

**Amtek Company**  
1244 Ritchie Highway, Suite 10  
Arnold, MD 21012  
800.926.8359 (Ph.)  
410.315.9249 (Fax)  
[info@amtekcompany.com](mailto:info@amtekcompany.com)

Drive & Control Academy

# DS4 Hydraulic Training System



The data specified above only serves to describe the product. No statements concerning the suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of use of their own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

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# Drive & Control Academy

Knowledge - the decisive competitive advantage



Bosch Rexroth is one of the leading global specialists in drive and control technology and has unique technology know-how. This knowledge is passed on by the Drive & Control Academy and supports customized training and further development as well as the qualification of technical experts.

### Knowledge is everything

Technical knowledge and competence of its employees provides a company with a decisive advantage in global competition. Under the umbrella of the Drive & Control Academy, Rexroth offers an extensive portfolio of products in the area of drive and control technologies knowledge transfer. These products are continuously updated to follow industry standards and best practices. The Drive & Control Academy are specialists in the transfer of specialized and integrated know-how for customers and employees and are able to provide training hardware for all levels of learning. With regards to this, our product portfolio has been developed with the following points in mind:

- ▶ Practical equipment focusing on the latest state of the art technology
- ▶ Training targeted towards specific user requirements
- ▶ Training utilizing the most up to date methods

### Training

New training offerings and continuous improvement of the training seminars guarantee that the conveyed knowledge is always state of the art. The methodical scope of supply comprises instructor led training, eLearning, practical training and blended learning. Additionally the advantages of both instructor led training and eLearning can be combined for an extremely effective training solution. When training customers we believe that the customer proximity principle is paramount.

### Training systems

The training systems provide newcomers and advanced users with practice-oriented knowledge in the areas hydraulics, pneumatics, electric drive and control technology, mechatronics and automation. These systems are comprised of standard industrial components and internationally standardized programming languages with open interfaces.

### Media

Rexroth's software-based teaching and studying media are distinguished by their high practical reference and are exactly adjusted to the trainings and training systems. They comprise eLearning modules, technology and application trainers, animations of components and systems as well as simulation-supported training units. This is completed by dictionaries, specialist books, manuals for trainers and trainees as well as work equipment.

### Knowledge Portal

The Knowledge Portal will develop into the multimedia contact point for all drive, control and movement technology topics in the industrial and academic training and further education as well as qualification. This unique contact point in the Internet will give the users access to high-quality information and allow for a structured exchange of knowledge and experience.





# DS4 Hydraulic Training System

Rexroth's technical know-how and solution competence in the area of industrial applications are smoothly integrated into the modularly structured training systems - in this way, they perfectly satisfy the quality levels demanded by industry.

## **Rexroth training systems**

Bosch Rexroth training systems are based on standard components from the various Bosch Rexroth product areas.

A complete training system consists of the hardware and the training and project manuals for trainers and trainees. By means of the training systems, both newcomers and advanced users work out practical exercises and gain technical specialized knowledge step-by-step. The trainees will recognize the industry standard components used in the training system in machines and systems again in their professional career.

Apart from the hydraulic training system described here in the catalog, Bosch Rexroth also offers training systems in the technology areas of Pneumatics, Sensors, PLC control and Mechantronics.

Information on suitable training aides and all other offers of the Drive & Control Academy is available on the Bosch Rexroth website at the address: <http://www.boschrexroth.com>

## **DS4 Hydraulic Training System**

The DS4 hydraulic training system allows for teaching in both industrial and mobile hydraulics, and in addition, it can also be used for pneumatic systems training. It offers a complete solution for teaching and demonstration of the operation of modern hydraulic circuits and prepares the trainees for their work in the industry.

Thanks to the configuration options, the training system can be perfectly adapted to the relevant topic and extended for the use in further trainings on more advanced technologies. Due to the use of a load sensing power unit, the DS4

is also perfectly suited for mobile hydraulics training and is capable of demonstrating the concepts particular to mobile hydraulics using a hands-on practical approach.

The device sets and the associated training manuals for the various study topics prepare the trainees for the tasks and requirements of their later professional life.

## **Equipment**

The DS4 hydraulic training system can be configured and extended and can grow with changes and additions to your curriculum. Its essential components are:

- ▶ Hydraulic power unit
- ▶ TÜV-tested safety valves
- ▶ Industry standard size 6 valving
- ▶ Control blocks for the mobile application area
- ▶ Cylinders with special protective covers to ensure student safety
- ▶ Storage and mounting rack for electrical components
- ▶ Toolbox for equipment storage
- ▶ Grooved plate and grid for mounting components and circuits
- ▶ Measuring glass
- ▶ Load unit
- ▶ Hose rack

The DS4 is delivered as a completely assembled system.

## **Configured to match your training requirement**

Based on your requirement you can choose between the following configurations:



- **Hydraulics:**  
Two independent work stations are possible by mounting a grid on each side
- **Pneumatics:**  
Two independent work stations are possible via a central grooved plate or one grooved plate on each side
- **Hydraulics / pneumatics combined:**  
Two independent work stations are possible by mounting a central grooved plate and one grid or via grooved plate on one side and a grid on one side.

#### Expandable for additional study topics

In order to achieve your training targets, you can tailor your training system to your requirements.

- On/off hydraulics
- Proportional valve technology
- Mobile hydraulics

#### Practical exercises with suitable training aids

Lab experiments and project books are specifically developed to assist the trainees in gaining technical knowledge and understanding.

- Trainer's/trainee's project manuals
- Specialist books
- Teaching media

#### Safety

The DS4 hydraulic training system has been developed and tested according to the Machinery Directive 2006/42/EC. A CE certificate is contained in the operating instructions.

#### Configuring your training system

Adapt your DS4 hydraulic training system to exactly meet to your requirements. We will support you in equipping your DS4 hydraulic training system to meet your specific needs. Contact us!





## Work stations



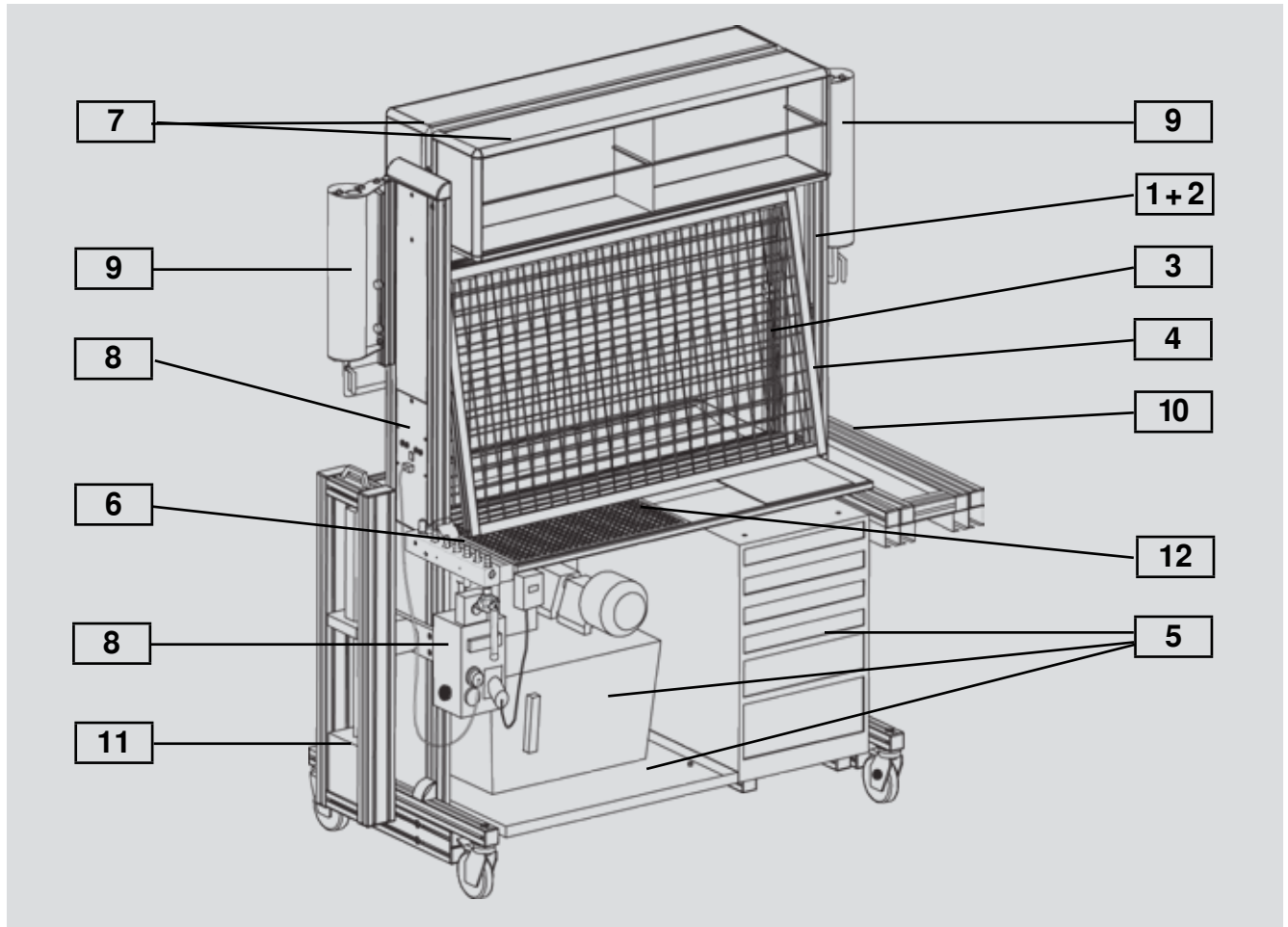
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## Work stations / DS4 configuration

We configure your work station according to your requirements



Assemblies of the DS4 work station according to the type key fields

☐ Type key field

**1+2** Product: Range, Group, Series code

**3** Frame

**4** Grid

**5** Substructure kit

- Fixed storage unit

- Power unit

- Oil tray

**6** Connection block hydraulics

**7** Electrical device racks

**8** Electrical supply

**9** Measuring glass

**10** Hose rack

**11** Load simulator

**12** Oil drip pan / writing surface

## Work stations / DS4 configuration - Examples

### DS4 training system for hydraulics, double-sided

Type: TS-DS4-1X/RG2U14V6A4E14M2S3L3T2-W

Material no. **R961006444**

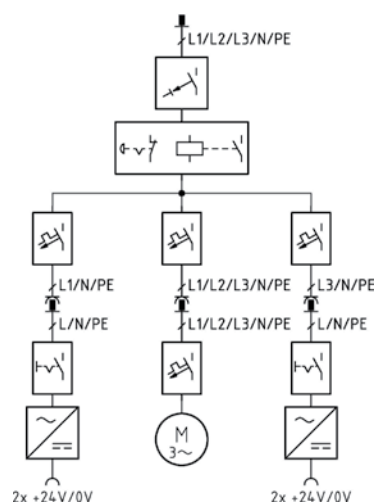
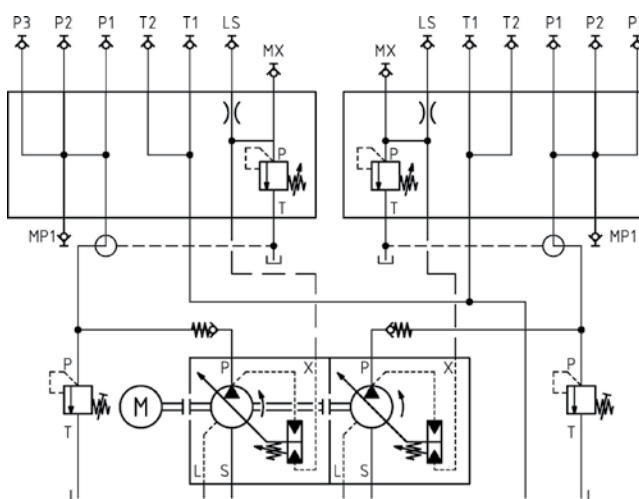
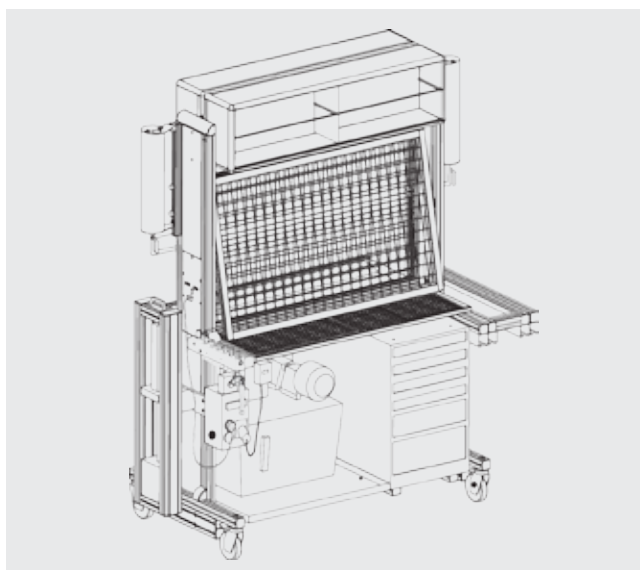
This example configuration is suitable for training on industrial and mobile hydraulics. Both working sides are prepared for mounting hydraulic components.

The power unit used has two pumps with variable displacement pressure compensated (load sensing) controllers, for completing independent exercises.

The system includes:

TS-DS4-1X/	Movable component support DS4 ProLine
R	Mounting frame for DS4 with mounting kit
G2	Two grids with reinforcement for mounting to the DS4
U14	Load sensing power unit, 400 V/50 Hz; 2.2 kW; with double pump, oil tray and fixed storage unit
V6	Two P/T/X distributors for load sensing power unit
A4	Two electrical component racks for DS4, double-row
E14	Control box 400 V/50 Hz with FI, with 2 mains adapters 24 VDC, 4.5 A, 230 V/50 Hz
M2	Two measuring glass 2.5 l
S3	Hose rack for 50 hoses
L3	Load simulator 15 kg rotatable
T2	Four oil drip pans for DS4
W	Low leakage quick disconnect

Dimensions	mm	L1810 x W800 x H1950
Weight	kg	415
Mains connection;	CEE 16 A	L1, L2, L3, N, PE
Fuse on the mains side, max.	A	16 (type C)
Connection voltage 3 phase AC	V	400
Mains frequency	Hz	50
Current consumption (power unit + mains adapter)	A	6.4
Safety pressure limitation	bar	70
Operating pressure controlled	bar	50
Standby pressure	bar	15
Flow	l/min	2x 8



## Work stations / DS4 configuration - Examples

### DS4 training system for hydraulics and pneumatics

Type: TS-DS4-1X/NG1U06V3A1E11M1S3L3T5-W

Material no. **R961006445**

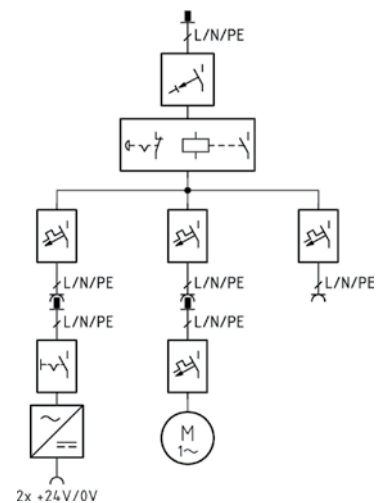
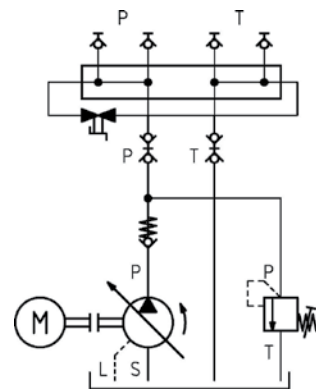
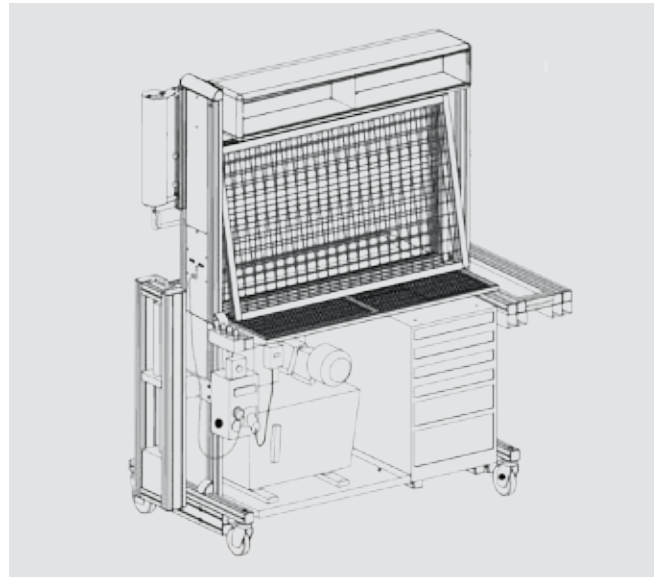
This example configuration is suitable for training on hydraulics and pneumatics. One working side is prepared for mounting hydraulic components and the other is prepared for mounting pneumatic components.

The power unit used has one variable displacement pressure compensated pump.

The system includes:

TS-DS4-1X/	Movable component support DS4 ProLine
N	Central grooved plate for DS4 with mounting kit
G1	Grid with reinforcement for mounting onto the DS4
U06	Hydraulic power unit 230 V/50 Hz with single pump, oil tray and fixed storage unit
V3	P/T distributor with zero pressure circulation
A1	Electrical rack for DS4, single-row
E11	Control box 230 V/50 Hz with FI, with mains adapter 24 VDC, 4.5 A, 230 V/50 Hz
M1	Measuring glass 2.5 l
S3	Hose rack for 50 hoses
L3	Load simulator 15 kg rotatable
T5	Oil drip pan for one side, writing surface for one side
W	Low leakage quick disconnect

Dimensions	mm	L1810 x W800 x H1890
Weight	kg	315
Mains connection;	CEE 16 A	L1, N, PE
Fuse on the mains side, max.	A	16 (type C)
Connection voltage 1 phase AC	V	230
Mains frequency	Hz	50
Current consumption (power unit + mains adapter)	A	9.5
Safety pressure limitation	bar	70
Operating pressure controlled	bar	50
Flow	l/min	8





## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Product range - Product group" (type key field 1)

Movable component support DS4	
Material no.	<b>R961000160</b>
Basis for all DS4 Work stations. Frame with two oil drip trays attached.	
Dimensions	mm L1350 x W790 x H1890
Weight	kg 67
Transport rollers	4 units; steerable
Coating	Tray; light gray RAL 7035 Side panels, blue RAL 5010
Material	Aluminum profiles powder-coated sheet steel
Delivery form	If ordered seperately some assembly will be required

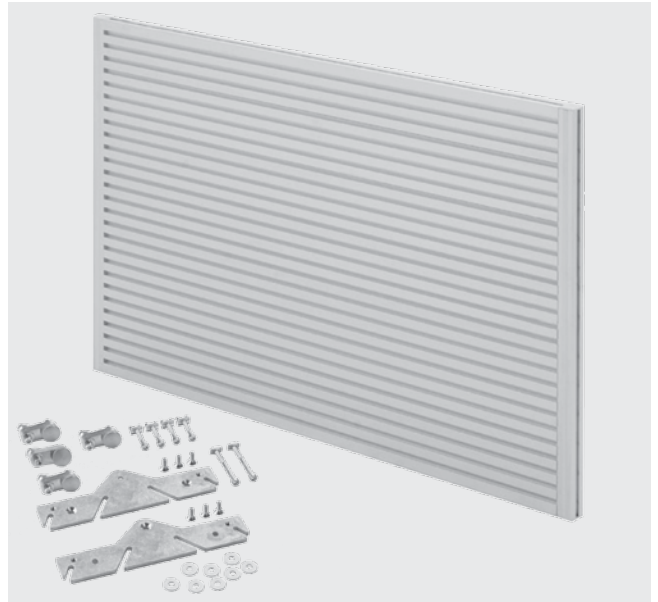


## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Frame" (type key field 3)

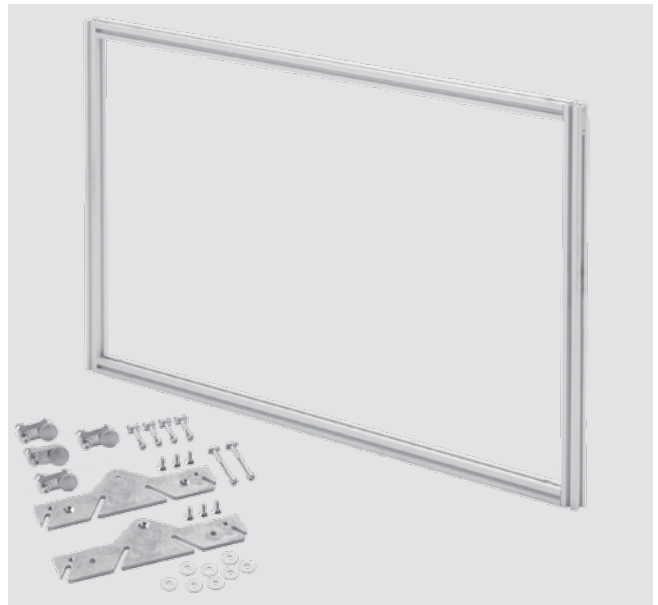
#### Central grooved plate for DS4 with mounting kit

Material no.	R961002216	
Can be used to allow pneumatic training with the DS4. The grids can still be mounted for hydraulic training.		
Dimensions	mm	L1130 x W700 x H30
Weight	kg	24.3
Material	Aluminum profile	
Delivery form	If ordered separately the mounting hardware is included	



#### Mounting frame for DS4 with mounting kit

Material no.	R961000226	
Facilitates the fastening of max. 2 grids or 2 grooved plates or a combination of grid and grooved plate.		
Dimensions	mm	L1130 x W700 x H30
Weight	kg	5.7
Material	Aluminum profile	
Delivery form	If ordered separately the mounting hardware is included	

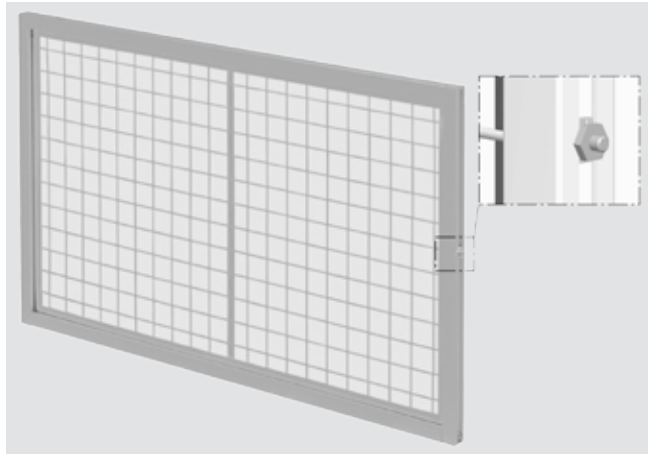


## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Grid" (type key field 4)

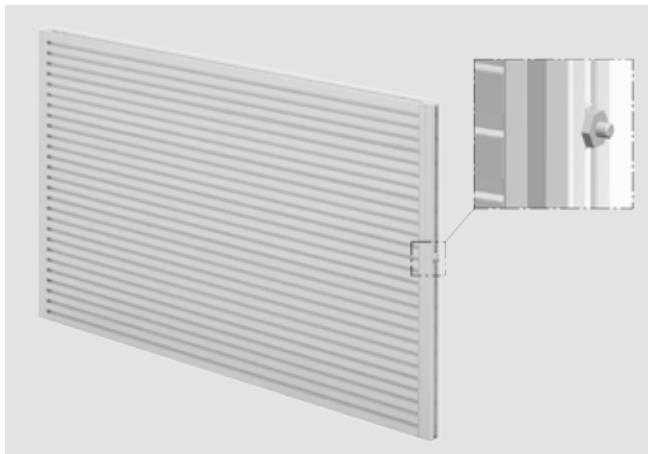
#### Reinforced grid for mounting onto the DS4

Material no.		<b>R961000210</b>
With reinforcement for hydraulic components with 50 mm grid sections		
Dimensions	mm	L1130 x W700 x H30
Weight	kg	11.75
Material		Steel, aluminum profile
Grid sections	mm	50 x 50



#### Grooved plate for mounting onto the DS4

Material no.		<b>R961000169</b>
With mounting bolts		
Dimensions	mm	L1130 x W700 x H30
Weight	kg	24
Material		Aluminum profile
Groove distance		25 mm



## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Substructure kit" (type key field 5)

Individual product	Code in the type key field 5																	
	U00	U01	U02	U03	U04	U05	U06	U07	U08	U09	U10	U11	U12	U14	U15	U16	U17	U18
without substructure	X																	
Power unit with single pump, 230 V/50 Hz R901134001			X				X											
Power unit with single pump, 400 V/50 Hz R901133999					X				X									
Power unit with double pump, 230 V/50 Hz R901134002				X				X										
Power unit with double pump, 400 V/50 Hz R901134000						X				X								
Power unit with double pump, 230 V/60 Hz R901141181															X			
LS power unit with double pump, 230 V/50 Hz R901168101 (not separately available)																X	X	
LS power unit with double pump, 230 V/60 Hz R901169108 (not separately available)													X					
LS power unit with double pump, 400 V/50 Hz R901171865 (not separately available)														X				X
Mounting kit power unit R961003735			X	X	X	X	X	X	X	X			X	X	X	X	X	X
Oil tray 737x725x30 R961003904		X	X	X	X	X	X	X	X	X	X				X			
Oil tray 737x725x80 R961004108													X	X		X	X	X
Oil tray 326x725x30 R961001269												X						
Mounting kit oil tray R961000761		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fixed storage unit R961000288							X	X	X	X	X	2X	X	X	X	X		
Mounting kit for fixed storage unit R961000835							X	X	X	X	X	2X	X	X	X	X		
Hose line 630 mm R961002474				2X		2X		2X		2X					2X			
Hose line 1000 mm R961002475			2X	2X	2X	2X	2X	2X	2X	2X					2X			
Installation kit LS pumps R961004063 (not separately available)													X	X		X	X	X

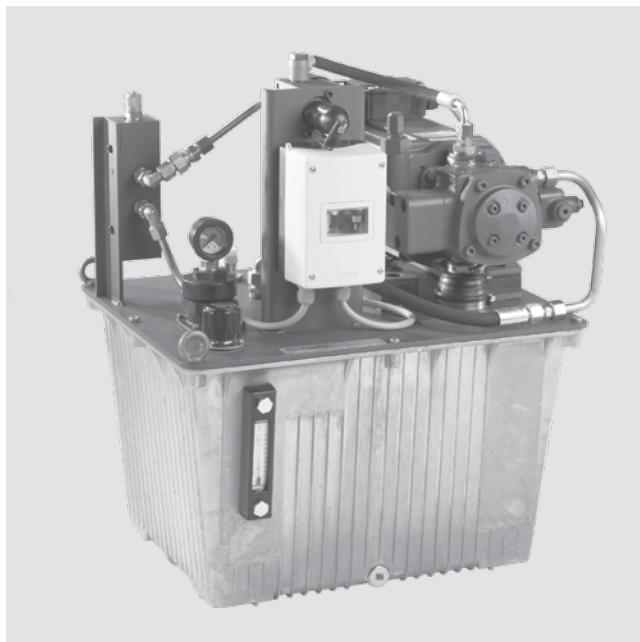
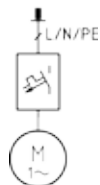
LS power units cannot be ordered separately. Construction kits with LS power unit and distributor, which are ready-for-operation are described on pages 36 and 37.

## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Substructure kit" (type key field 5)

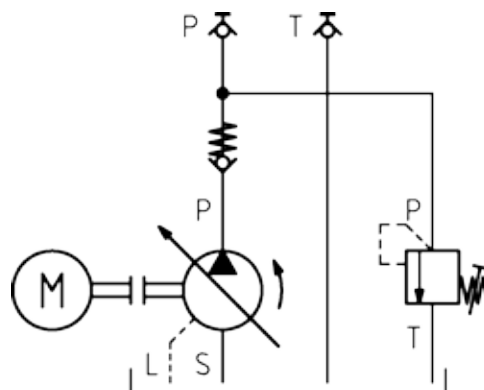
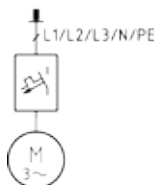
#### Hy power unit; 230 V/50 Hz; 1.5 kW; with single pump

Material no.		<b>R901134001</b>
Dimensions	mm	L540 x W440 x H650
Weight	kg	75
Coating		Blue RAL 5010
Pressure, controlled	bar	50
Safety pressure limitation	bar	70
Oil tank	l	40
Flow	l/min	8
Voltage	V	230
Frequency	Hz	50
Power	kW	1.5
Protective motor switch	A	9 - 12



#### Hy power unit; 400 V/50 Hz; 2.2 kW; with single pump

Material no.		<b>R901133999</b>
Dimensions	mm	L540 x W440 x H650
Weight	kg	87.5
Coating		Blue RAL 5010
Pressure	bar	50
Safety pressure limitation	bar	70
Oil tank	l	40
Flow	l/min	8
Voltage	V	400
Frequency	Hz	50
Power	kW	2.2
Protective motor switch	A	4.5 - 6.3





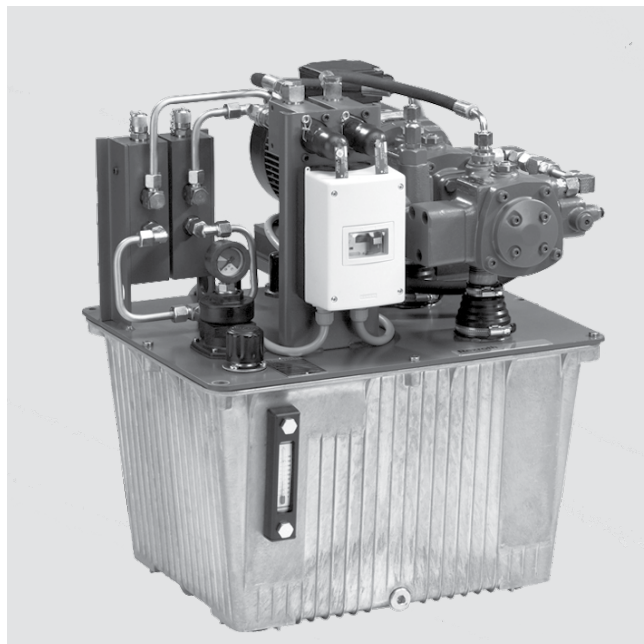
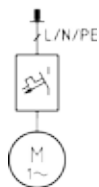
## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Substructure kit" (type key field 5)

#### Hy power unit; 230 V/50 Hz; 1.5 kW; with double pump

Material no.		<b>R901134002</b>
For supplying two Work stations		
Dimensions	mm	L540 x W625 x H650
Weight	kg	95
Coating		Blue RAL 5010
Pressure, controlled	bar	50
Safety pressure limitation	bar	70
Oil tank	l	40
Flow	l/min	2 x 8
Voltage	V	230
Frequency	Hz	50
Power	kW	1.5
Circuit breaker	A	9 -12

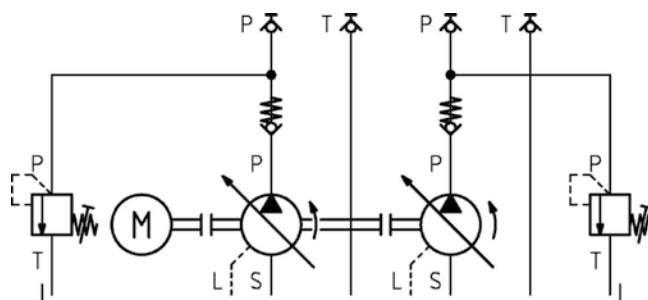
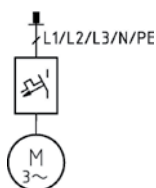
Diagram illustrating the connection of the pressure washer to the power source (M) and the spray lance (L/N/PE).



#### Hy power unit; 400 V/50 Hz; 2.2 kW; with double pump

Material no.	<b>R901134000</b>	
For supplying two Work stations		
Dimensions	mm	L540 x W625 x H650
Weight	kg	107.5
Coating		Blue RAL 5010
Safety pressure limitation	bar	70
Pressure	bar	50
Oil tank	l	40
Flow	l/min	2 x 8
Voltage	V	400
Frequency	Hz	50
Power	kW	2.2
Circuit breaker	A	4.5 - 6.3

The diagram illustrates a hydraulic circuit. At the top, a vertical line represents the main supply line, labeled 'L1/L2/L3/N/PE'. This line connects to a rectangular control valve symbol, which contains a diagonal line and a small triangle. Below the control valve, the line continues to a circular motor symbol. Inside the motor symbol, the letter 'M' is positioned above the number '3~', indicating a three-phase motor.

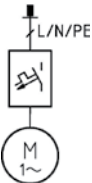


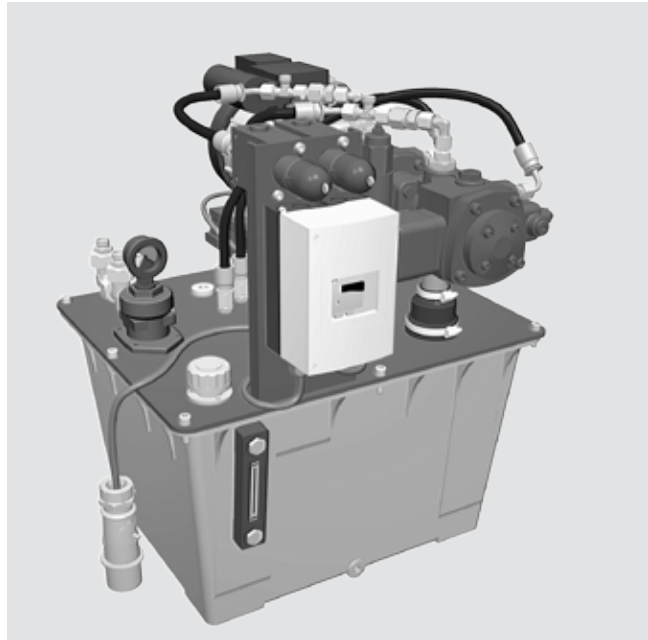
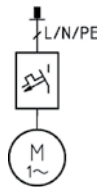
## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Substructure kit" (type key field 5)

#### LS Hy power unit 230 V/50 Hz; 1.5 kW; with double pump

Material no.	<b>R901168101</b>	
For supplying two Work stations, suitable for industrial and mobile hydraulics, with load sensing vane pump		
Dimensions	mm	L540 x W625 x H650
Weight	kg	95
Coating	Blue RAL 5010	
Max. operating pressure general hydraulics	bar	50
Safety pressure limitation	bar	70
Standby pressure	bar	15
Oil tank	l	40
Flow	l/min	2x 8
Voltage AC-single-phase	V	230
Frequency	Hz	50
Power	kW	1.5
Protective motor switch	A	9 -12

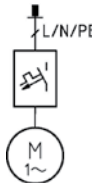


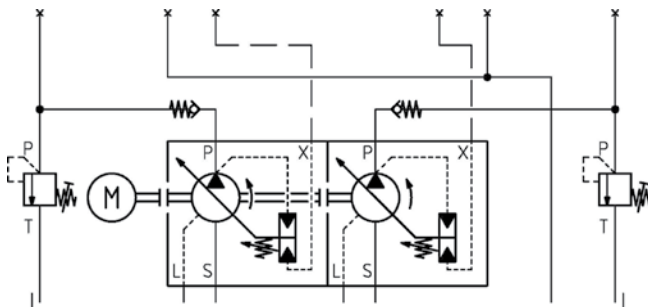
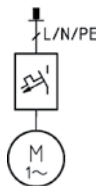


Important: Not available as a separate assembly

#### LS Hy power unit, 230 V/60 Hz; 1.5 kW; with double pump

Material no.	<b>R901169108</b>	
For supplying two Work stations, suitable for industrial and mobile hydraulics, with load sensing vane pump, with circuit breaker		
Dimensions	mm	L540 x W625 x H650
Weight	kg	95
Coating	Blue RAL 5010	
Max.operating pressure industrial hydraulics	bar	50
Safety pressure limitation	bar	70
Standby pressure	bar	15
Oil tank	l	40
Flow	l/min	2x 8
Voltage AC-single-phase	V	230
Frequency	Hz	60
Power	kW	1.5
Protective motor switch	A	9 - 12





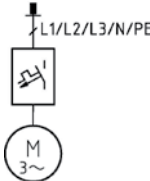
Important: Not available as a separate assembly

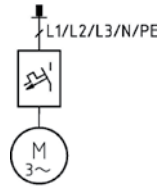
## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Substructure kit" (type key field 5)

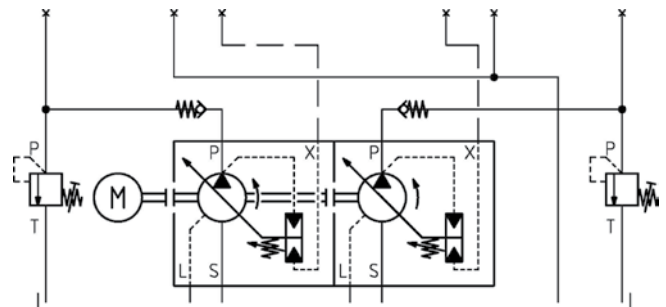
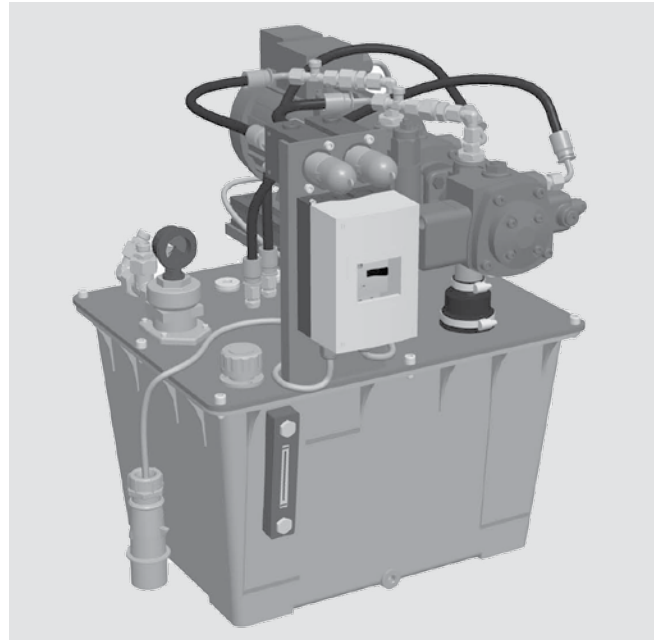
#### LS Hy power unit 400 V/50 Hz; 2.2 kW; with double pump

Material no.	<b>R901171865</b>	
For supplying two Work stations, suitable for industrial and mobile hydraulics, with load sensing vane pump		
Dimensions	mm	L540 x W625 x H650
Weight	kg	107.5
Coating		Blue RAL 5010
Max. operating pressure industrial hydraulics	bar	50
Safety pressure limitation	bar	70
Standby pressure	bar	15
Oil tank	l	40
Flow	l/min	2x 8
Voltage	V	3*400
Frequency	Hz	50
Power	kW	2.2
Protective motor switch	A	4.5-6.3





Important: Not available as a separate assembly



#### Mounting kit for power unit

Material no.	R961003735	
For mounting the power unit on the DS4		
Weight	kg	0.5



## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Substructure kit" (type key field 5)

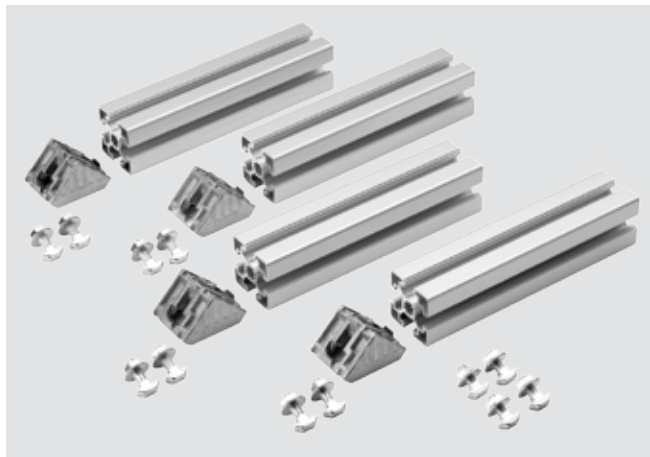
#### Fixed storage unit

Material no.		<b>R961000288</b>
Lock front-side, smoothly running drawers		
Dimensions	mm	L411 x W725 x H710
Weight	kg	82
Material		Sheet steel powder-coated
Drawers	mm	4x 100 high 1x 150 high
Load carrying capacity per drawer	N	500
Color		Light gray RAL 7035



#### Mounting kit for fixed storage unit

Material no.	R961000835	
Dimensions	mm	L230 x W130 x H90
Weight	kg	1.9



#### Hose line 630 mm

Material no.	<b>R961002474</b>
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#### Hose line 1000 mm

Material no.	<b>R961002475</b>
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Description of the hose lines see chapter "Components/hydraulic accessories"



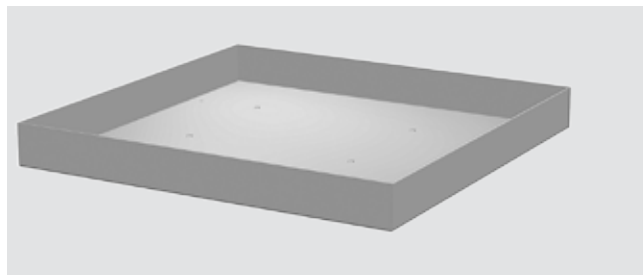
## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Substructure kit" (type key field 5)

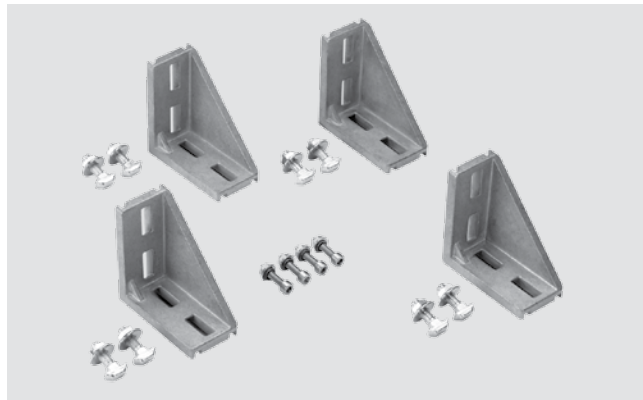
Oil tray	
Material no.	<b>R961003904</b>
For substructure DS4	
Dimensions	mm L737 x W725 x H30
Weight	kg 9.6
Material	Powder-coated sheet steel
Oil tray	
Material no.	<b>R961001269</b>
For substructure DS4; use in case of equipment with 2 installation containers	
Dimensions	mm L326 x W725 x H30
Weight	kg 4.6
Material	Powder-coated sheet steel



Oil tray	
Material no.	<b>R961004108</b>
For substructure DS4; edge height 80 mm for load sensing power unit	
Dimensions	mm L737 x W725 x H80
Weight	kg 11.9
Material	Powder-coated sheet steel



Mounting kit for oil tray	
Material no.	<b>R961000761</b>
Dimensions	mm L120 x W100 x H100
Weight	kg 0.450



Installation kit LS pumps	
Material no.	<b>R961004063</b>
Hydraulic hoses and fittings for the connection of the LS pumps to the tank and the hydraulic distributor	
Quantity	12 hydraulic hoses 30 fittings
Important: Not available as a separate assembly	

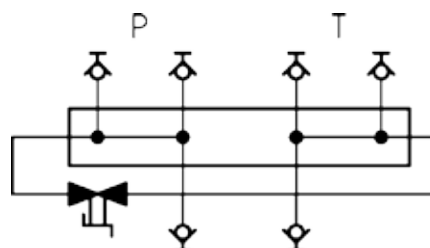
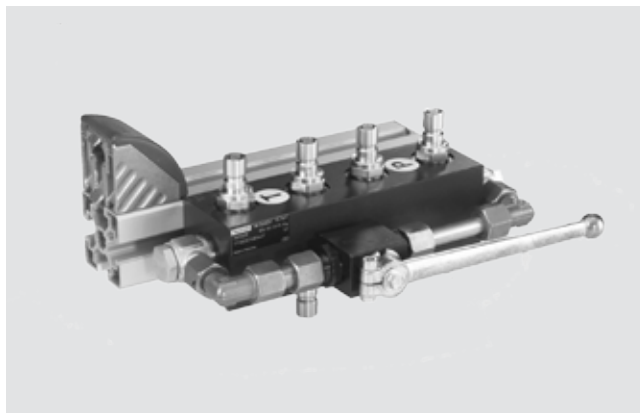


## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Connection block hydraulics" (type key field 6)

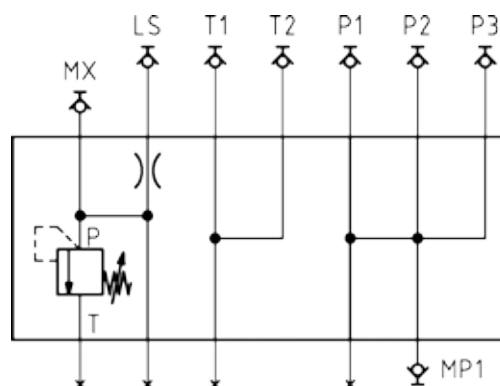
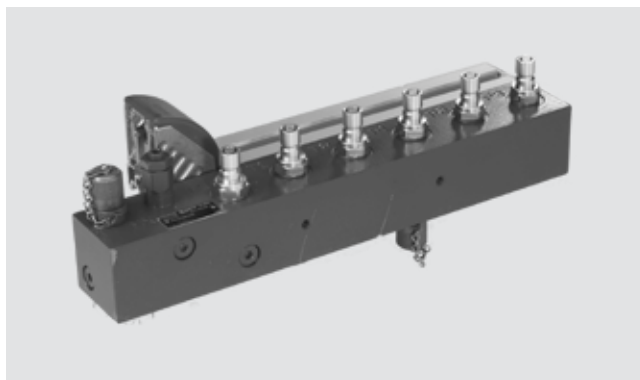
#### P/T distributor with circulation at zero pressure

Material no.	R961002567	
For attaching to the DS4 frame using angle brackets		
Dimensions	mm	L259 x W150 x H122
Weight	kg	4.62
Material	Aluminum profile Steel	



#### P/T/X distributor with 3-way ball valve for LS power unit

Material no.	R961004178	
For attaching to the DS4 frame using angle brackets		
Dimensions	mm	L339 x W133 x H95
Weight	kg	7.1
Important: Not available as a separate assembly		

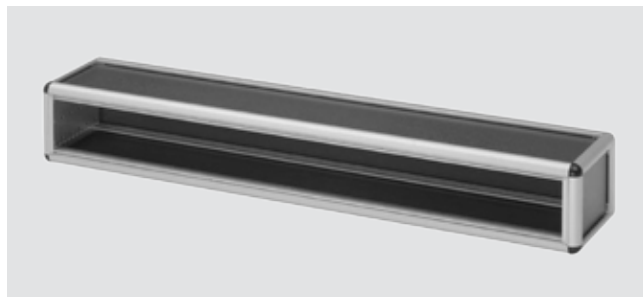


## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: “Electrical Rack” (type key field 7)

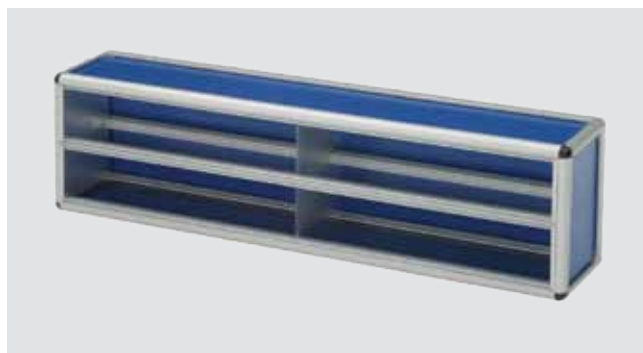
#### Rack single-row

Material no.		<b>R961000167</b>
210TE; 3HE for DS4, for holding the 19" electronics		
Dimensions	mm	L1130 x W200 x H173
Weight	kg	7.9
Material	Aluminum profile Sheet steel, powder-coated	



#### Rack double-row

Material no.		<b>R961000166</b>
210TE; 2 x 3HE for DS4, for holding the 19" electronics		
Dimensions	mm	L1130 x W200 x H306
Weight	kg	11.6
Material	Aluminum profile Sheet steel, powder-coated	



## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Electrical power supply" (type key field 8)

#### Power Supply

Material no. **R961000170**

Power supply for providing the control and measuring electronics, for operating the electric components.

Space saving design can be integrated into each side of the rack, also as an upgrade.

- Housing made of coated metal
- Short-circuit-proof with switch and control lamp
- 2 connection sockets for DC output
- Power supply according to EN60320-1 /DIN VDE 0625-1
- Connector to the power supply according to DIN 49441-R2 / CEE7
- Generates safe extra-low voltage

Dimensions	mm	L360 x W162 x H47
Weight	kg	2.52
Mounting type		Plugged
Input voltage	V	230
Frequency	Hz	50 - 60
Output voltage	VDC	2x 24
Protection class	IEC 60529	IP20
Current max.	A	4.5

Accessories:

Connection cable Mat. no. 1827003724

#### Power Supply

Material no. **1827003740**

Power supply for providing the control and measuring electronics, for operating the electric components.

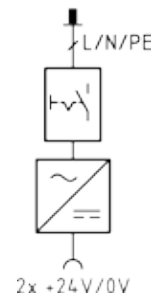
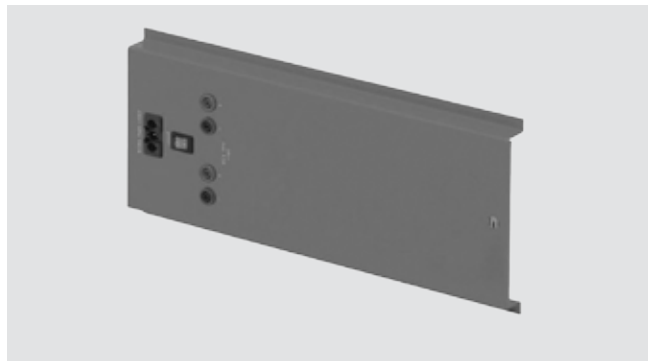
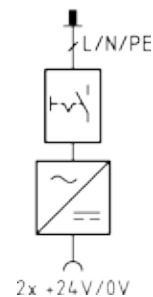
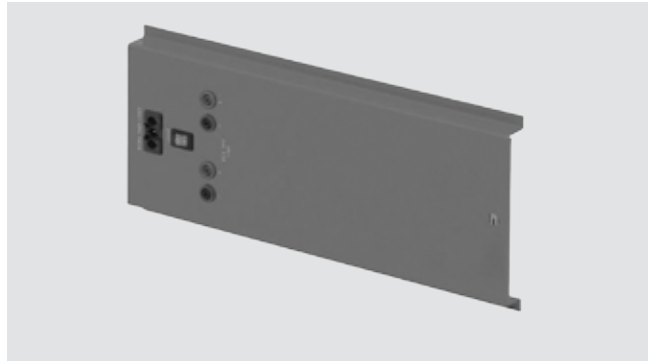
Space saving design can be integrated into each side of the rack, also as an upgrade.

- Housing made of coated metal
- Short-circuit-proof with switch and control lamp
- 2 connection sockets for DC output
- Power supply according to EN60320-1 /DIN VDE 0625-1
- Connector to the power supply according to DIN 49441-R2 / CEE7
- Generates safe extra-low voltage

Dimensions	mm	L360 x W162 x H47
Weight	kg	2.52
Mounting type		Plugged
Input voltage	V	115
Frequency	Hz	50 - 60
Output voltage	VDC	2x 24
Protection class	IEC 60529	IP20
Current max.	A	4.5

Accessories:

Connection cable Mat. no. 1827003742



## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Electrical power supply" (type key field 8)

Connection cable D; 3 m		
Material no.		<b>1827003724</b>
For connecting a mains adapter or a multiple socket outlet. Connection cable, three-wire, design according to EN60320-1 / DIN VDE 0625-1		
Dimensions	mm	L200 x W200 x H60
Weight	kg	0.9
Mounting type		Plugged
Cable length	m	3
Voltage	V	230
Temperature max.	°C	70
Protection class	IEC 60529	IP20
Connection cable US; 2 m		
Material no.		<b>1827003742</b>
For connecting a mains adapter or a multiple socket outlet. Connection cable, three-wire, design according to EN60320-1 / DIN VDE 0625-1		
Dimensions	mm	L200 x W200 x H60
Weight	kg	0.9
Mounting type		Plugged
Cable length	m	2
Voltage	V	115
Temperature max.	°C	70
Protection class	IEC 60529	IP20



## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Electrical power supply" (type key field 8)

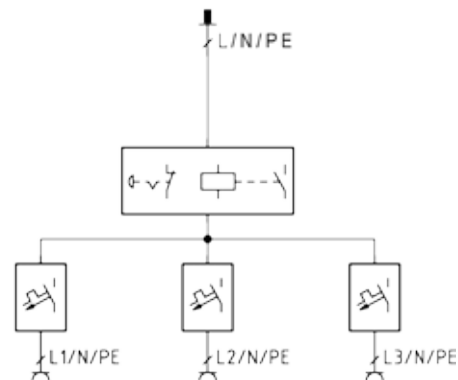
**Control box; 230 V/50 Hz; 2x emergency stop;  
3 sockets; without FI**

Material no. **1827008412**

With 2x emergency stop button; one coded socket

AC 230 V, two safety sockets AC 230 V; internal fuses 16 A;  
without earth leakage breaker

Weight	kg	6.5
Output voltage	VAC	230
Input voltage	VAC	230
Frequency	Hz	50 - 60
Input fuse	A	16, time-lag



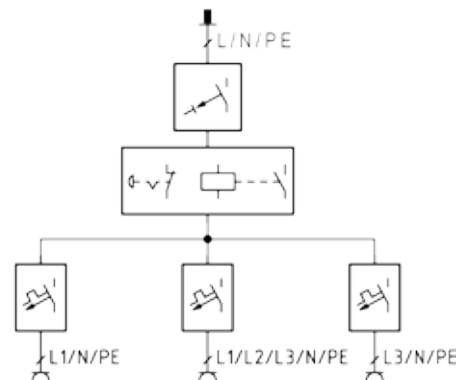
**Control box 230 V/50 Hz; 2x emergency stop;  
3 sockets; with FI**

Material no. **R961000963**

With 2x emergency stop button; one coded socket

AC 230 V, two safety sockets AC 230 V; internal fuses 16 A;  
with earth leakage breaker

Weight	kg	6.5
Output voltage	VAC	230
Input voltage	VAC	230
Frequency	Hz	50 - 60
Input fuse	A	16, time-lag





## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Electrical power supply" (type key field 8)

#### Control box 400 V/50 Hz; 2x emergency stop; three sockets; without FI

Material no. **R961000289**

With 2x emergency stop button; one coded socket  
3\*AC 400 V, two safety sockets AC 230 V; internal fuses  
16 A; without earth leakage breaker

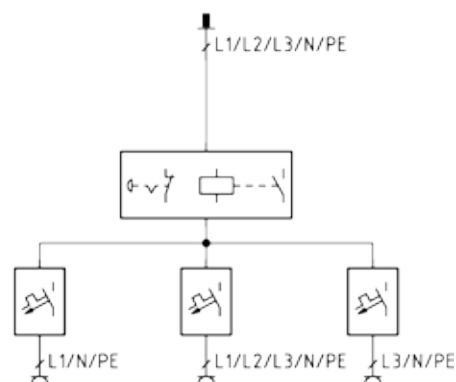
Weight kg 6.5

Output voltage VAC 230; 400

Input voltage VAC 400

Frequency Hz 50 - 60

Input fuse A 16, time-lag



#### Control box 400 V/50 Hz; 2x emergency stop; three sockets; with FI

Material no. **R961000962**

With 2x emergency stop button; one coded socket  
3\*AC 400 V, two safety sockets AC 230 V; internal fuses  
16 A; with earth leakage breaker

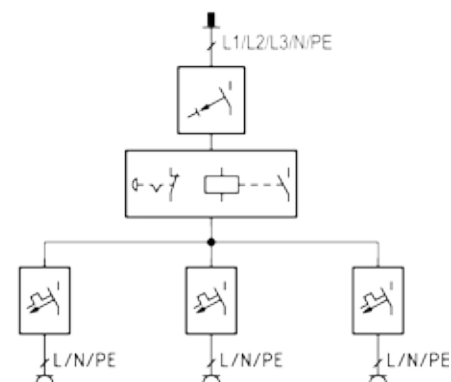
Weight kg 6.5

Output voltage VAC 230; 400

Input voltage VAC 400

Frequency Hz 50 - 60

Input fuse A 16, time-lag



## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Measuring glass" (type key field 9)

Measuring glass 2.5 l		
Material no.		<b>R961002564</b>
With scale, bleed valve, overflow protection and ball valve, note: NOT a pressure vessel		
Dimensions	mm	L160 x W200 x H700
Weight	kg	6.5
Volume	l	2.5
Material	Acrylic glass Aluminum profile Copper tube PVC hose with nylon insert Length 1.5 m	



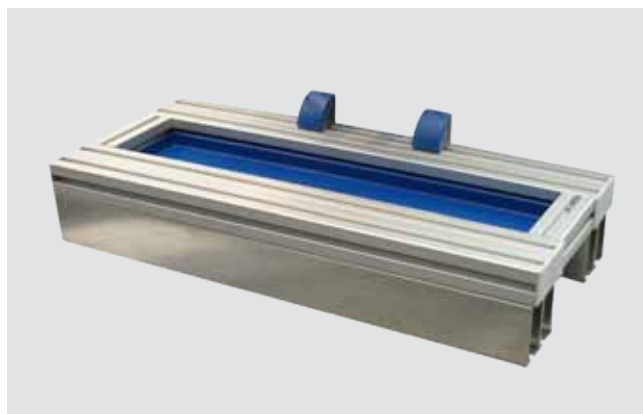
## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Hose rack" (type key field 10)

Hose rack for 9 hoses		
Material no.		<b>R961000188</b>
Intended for attachment to the side of the DS4		
Dimensions	mm	L230 x W244 x H191
Weight	kg	2.54
Material		Aluminum profile Steel



Hose rack for 50 hoses		
Material no.		<b>R961002634</b>
With oil tray for storing small parts.		
Intended for attachment to the side of the DS4. Space for 50 hoses (cannot be combined with load simulator at one side)		
Dimensions	mm	L708 x W320 x H191
Weight	kg	11
Material		Aluminum profile Sheet steel powder-coated
Color		Blue RAL 5010



## Work stations / DS4 configuration - Description of the individual components

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### Assembly of the DS4: "Load simulator" (type key field 11)

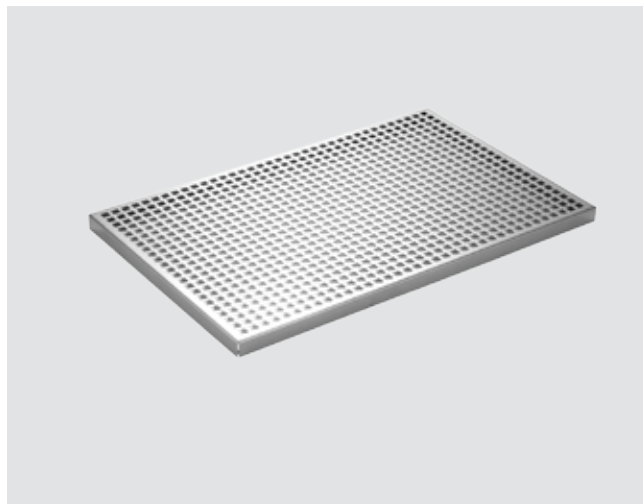
Load simulator 15 kg rotatable	
Material no.	R961000187
Description of the component see chapter "Components/ actuators"	



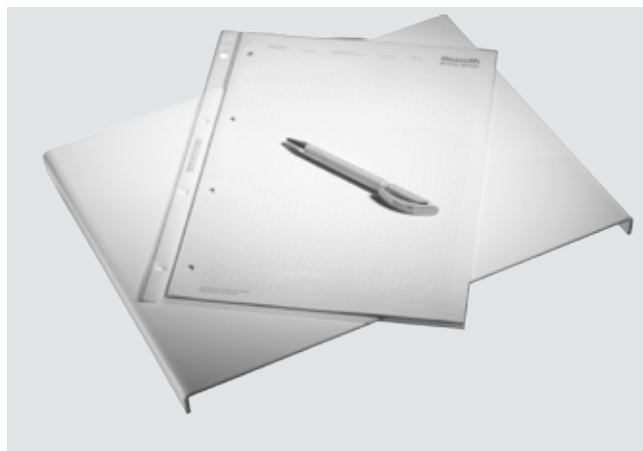
## Work stations / DS4 configuration - Description of the individual components

### Assembly of the DS4: "Oil drip pan / writing surface" (type key field 12)

Oil drip pan for DS4		
Material no.		<b>R961000192</b>
For DS4 oil pan (for one oil tray, 4 drip pans are necessary)		
Dimensions	mm	L560 x W361 x H22
Weight	kg	2.6
Material		Sheet steel
Delivery unit		1



Writing surface for DS3 and DS4		
Material no.		<b>1827003705</b>
For preparing notes on the exercise set-up and procedure at the workplace.		
Plates chamfered on both sides for insertion into the component support trays.		
Dimensions	mm	L275 x W360 x H25
Weight	kg	0.53
Mounting type		Loosely inserted, movable
Material		PMMA, white
Delivery unit	Pcs	2





## Work stations / DS4 configuration - Type key

		Fields:					
		8	9	10	11	12	13
Details in the fields:							
<b>Energy supply</b>							
(Control box with 2x emergency stop)							
without control box, without mains adapter	= E00						
Mains adapter 115 V, 50-60 Hz, DC 24 V, 4.5 A	1827003740 = E01						
Mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170 = E02						
Control box 230 V, 50-60 Hz	1827008412 +						
Mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170 = E05						
Control box 230 V, 50-60 Hz	1827008412 +						
2x mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170 2x = E06						
Control box 400 V, 50-60 Hz	R961000289 +						
Mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170 = E07						
Control box 400 V, 50-60 Hz	R961000289 +						
2x mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170 2x = E08						
Control box 230 V, 50-60 Hz, with FI	R961000963 +						
Mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170 = E11						
Control box 230 V, 50-60 Hz, with FI	R961000963 +						
2x mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170 2x = E12						
Control box 400 V, 50-60 Hz, with FI	R961000962 +						
Mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170 = E13						
Control box 400 V, 50-60 Hz, with FI	R961000962 +						
2x mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170 2x = E14						
Control box 230 V, 50-60 Hz, with FI	R961000963 = E15						
Control box 400 V, 50-60 Hz, with FI	R961000962 = E16						
<b>Measuring glass</b>							
without measuring glass	= M0						
Measuring glass 2.5 l	R961002564 = M1						
2x measuring glass' 2.5 l	R961002564 2x = M2						
<b>Hose rack (cannot be combined with load simulator on one side)</b>							
without hose rack	= S0						
Hose rack for 9 hoses	R961000188 = S1						
2x hose rack for 9 hoses	R961000188 2x = S2						
Hose rack for 50 hoses	R961002634 = S3						
<b>Load simulator (cannot be combined with hose deposit on one side)</b>							
without load simulator	= L0						
Load simulator 15 kg rotatable	R961000187 = L3						
2x load simulator 15 kg rotatable	R961000187 2x = L4						
<b>Oil drip pan / writing surface</b>							
without oil drip pan / without writing surface	= T0						
Oil drip pan for DS4 for 1 workplace	R961000192 2x = T1						
Oil drip pan for DS4 for 2 Work stations	R961000192 4x = T2						
Oil drip pan for one side + writing surface for one side	2x R961000192 + 4x 1827003705 = T5						
<b>Coupling type</b>							
Low leakage quick disconnect	= W						



## Work stations / Hydraulic power unit with variable displacement control for DS4, ready-for-operation

### Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 1\*230 V/50 Hz

The power unit has two pumps with variable displacement pressure controller (load sensing), for the independent hydraulic oil supply of the double sided DS4 training system. Suitable for exercises on on/off hydraulics, proportional valve technology and mobile hydraulics the hydraulic unit is supplied ready for operation and the operating pressure, standby pressure and displacement are set and sealed. The two safety pressure relief valves are sealed. The kit corresponds to the type key U16 or U17 together with V6.

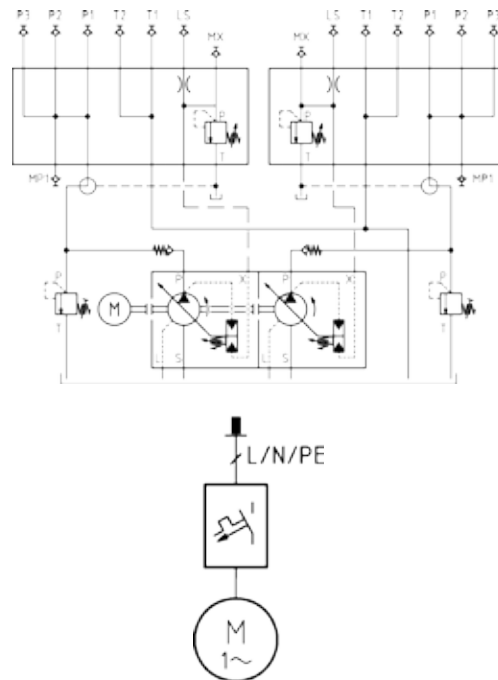
Material no.		<b>R961005986</b>
Dimensions	mm	L885 x W805 x H796
Weight	kg	129
Operating pressure controlled	bar	50
Safety pressure limitation	bar	70
Standby pressure	bar	15
Oil tank	l	40
Displacement	l/min	2x 8
Voltage, single-phase	V	230
Frequency	Hz	50
Power	kW	1.5
Protective motor switch	A	8.9

### Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 1\*230 V/60 Hz

Features and more data see Mat. no. R961005986

The kit corresponds to the type key U12 together with V6.

Material no.		<b>R961005987</b>
Voltage, single-phase	V	230
Frequency	Hz	60
Power	kW	1.5
Protective motor switch	A	8.7



## Work stations / Hydraulic power unit with variable displacement control for DS4, ready-for-operation

### Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 3\*400 V/50 Hz

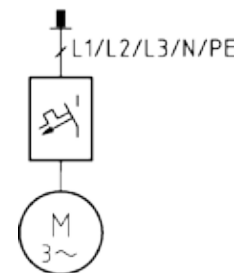
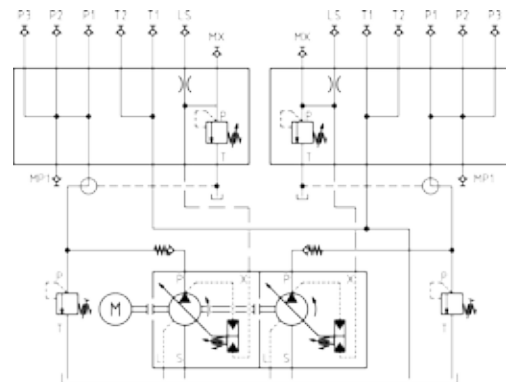
The power unit has two pumps with variable displacement pressure controller (load sensing), for the hydraulic oil supply of the double sided DS4 training system. Suitable for exercises on on/off hydraulics, proportional valve technology and mobile hydraulics. The hydraulic unit is supplied ready for operation and the operating pressure, standby pressure and displacement are set and sealed. The two safety pressure relief valves are sealed. The kit corresponds to the type key U14 or U19 together with V6.

Material no.		<b>R961005988</b>
Dimensions	mm	L885 x W805 x H796
Weight	kg	142
Operating pressure controlled	bar	50
Safety pressure limitation	bar	70
Standby pressure	bar	15
Oil tank	l	40
Displacement	l/min	2x 8
Voltage, three-phase	V	400
Frequency	Hz	50
Power	kW	2.2
Protective motor switch	A	5.4

### Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 3\*400 V/60 Hz

Features and more data see Mat. no. R961005989

Material no.		<b>R961005989</b>
Voltage, three-phase	V	460
Frequency	Hz	60
Power	kW	2.2
Rated current	A	4.6



## Work stations / component carrier

### Component carrier with grid and oil tray

Material no.	<b>R961003176</b>	
For storing hydraulic components;		
Options:		
A small hose rack (R961000188) or a large hose rack (R961002634) can be attached on each side.		
The desired hose rack must be ordered as separate item and will be supplied loose.		
Dimensions	mm	L820 x W790 x H1563
Weight	kg	35
Material	Aluminum profiles powder-coated sheet steel	
Transport rollers	4 units; steerable; fixable	
Coating	Side panels, blue RAL 5010	



### Component carrier with two grids and oil tray

Material no.	<b>R961003128</b>	
For storing hydraulic components;		
Options:		
A small hose rack (R961000188) or a large hose rack (R961002634) can be attached on each side.		
The desired hose rack must be ordered as separate item and will be supplied loose.		
Dimensions	mm	L820 x W790 x H1563
Weight	kg	42
Material	Aluminum profiles powder-coated sheet steel	
Transport rollers	4 units; steerable; fixable	
Coating	Side panels, blue RAL 5010	



## Work stations / control trolley

### Control trolley

Material no.		R961000190
Movable control trolley; grooved plate 25 mm grid for holding components with snap-in mounting system; 4 steering rollers with fixing brake		
Dimensions	mm	L972 x W790 x H1605
Weight	kg	70
2 work surfaces	mm	850 x 700
2 storage areas	mm	850 x 380
Material	Aluminum Sheet steel	anodized coated
Accessories:		
Electric attachment	Mat. no.	R961000279



### Electric attachment for control trolley

Material no.		<b>R961000279</b>
Electric attachment for control trolley; for holding components with tandem snap-in mounting system		
Dimensions	mm	L850 x W165 x H130
Weight	kg	2.8
2 work surfaces	mm	850 x 130
Material	Aluminum Sheet steel	anodized coated



## Work stations / accessories

### Portable storage unit PN

Material no. **R961000287**

Portable storage unit for use with the component carrier, for storing tools, measuring equipment, components and incidentals.

This is a prerequisite for the efficient, ordered storage of components at the workplace.

Design details:

- Smoothly running drawers
- Central lock
- Exterior and drawers made of coated sheet steel
- Two lockable steering rollers, two fixed rollers
- Frame and rubber mat on top
- Push handle on front

Dimensions	mm	L411 x W725 x H825
Weight	kg	78
Mounting type		Mobile, fixable rollers
Load per drawer	N	500
Number of drawers	mm	4x 100 high 1x 150 high
Material	Sheet steel	coated
Recommended accessories:		Mat. no.
Compartment division, H = 100 mm		R961000563
Compartment division, H = 150 mm		R961000564
Anti-slip mat		R961000568
Perforated plates for container		R961001666



### Drawer organization set 100 mm

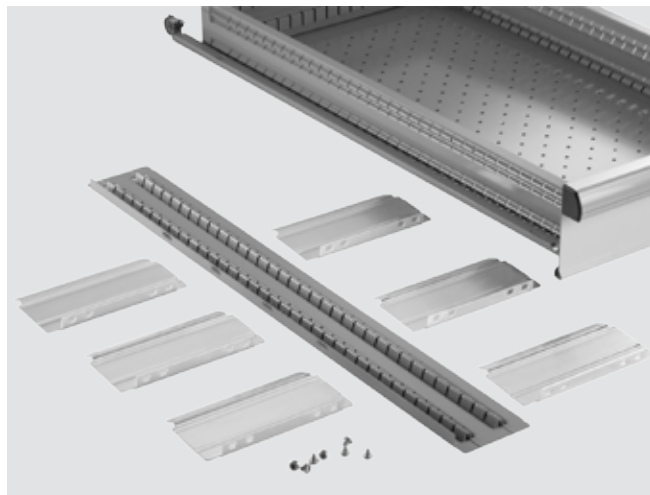
Material no. **R961000563**

Organization of the space in the storage unit drawers in order to separate the stored components. This prevents the shifting of the parts when opening and closing the drawers.

Design:

- Divider profiles of galvanized sheet steel
- Adjustable storage areas by means of the stepped slots in the central rail
- Six cross dividers for mounting in the central rail

Dimensions	mm	L620 x W100 x H40
Weight	kg	0.9
Mounting type		Plugged / optionally screwed
Individual fields	Pcs	8



## Work stations / accessories

### Drawer organization set 150 mm

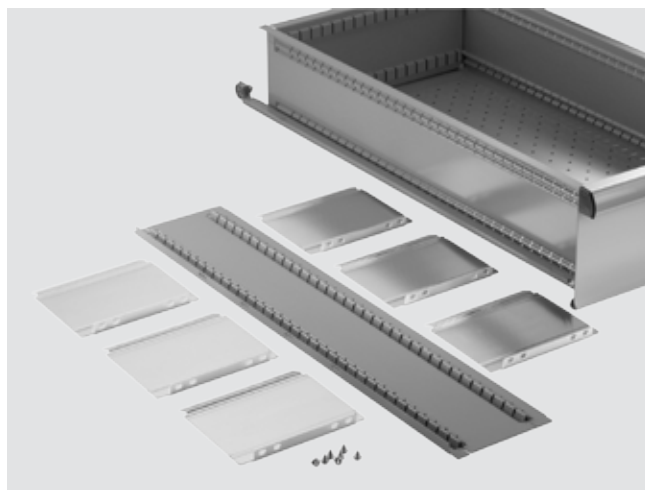
Material no. **R961000564**

Organization of the space in the storage unit drawers in order to separate the stored components. This prevents the shifting of the parts when opening and closing the drawers.

Design:

- Divider profiles of galvanized sheet steel
- Adjustable storage areas by means of the stepped slots in the central rail
- Six cross dividers for mounting in the central rail

Dimensions	mm	L620 x W150 x H40
Weight	kg	1.3
Mounting type		Plugged / optionally screwed
Individual fields	Pcs	8

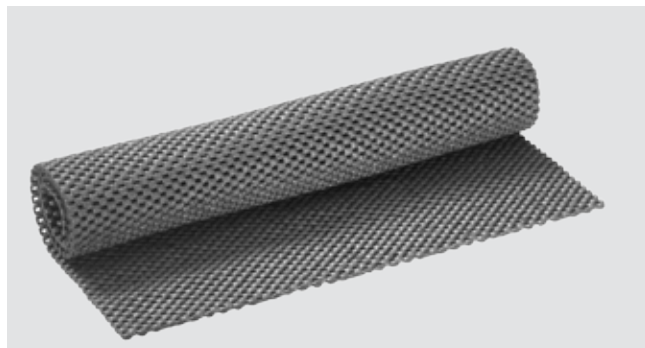


### Anti-slip mat

Material no. **R961000568**

Prevents the parts stored in the drawers from sliding and reduces the possibility of damage to tools and components. Made of black soft rubber, cut to the size of drawers in the portable storage unit with Mat. no.: R961000287 and fixed storage unit with Mat. no.: R961000288. Can also be used with the drawer organization set 100 mm or 150 mm

Dimensions	mm	L600 x W300 x H5
Weight	kg	0.09
Mounting type		Loose
Material	Neoprene	Black



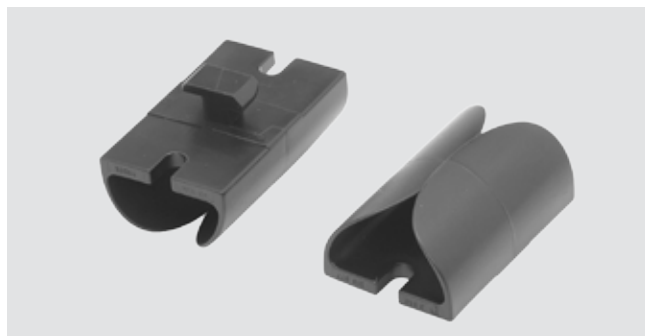
### Cloth holder set; LE2

Material no. **1827003722**

Can be used as easy-to-access holder for cleaning cloths and as cable and hose guide. Increases the tidiness at the workplace.

Is made of plastic, is clamped into the aluminum groove profiles of the component support in an easily fixable and releaseable form.

Dimensions	mm	L80 x W75 x H40
Weight	kg	0.05
Mounting type		Clamped in groove
Material	Plastic	Black
For groove width	mm	10
Delivery unit	Pcs	2



## Work stations / accessories

### Cable holder for 50 measuring lines

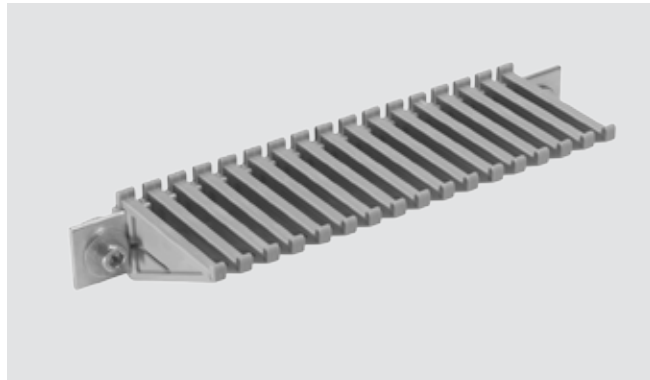
Material no. **R961004144**

Cable holder provides easy storage and access of measuring cables for the training exercises. The holder itself is mounted on the side of the component support or in the groove of the grooved plate.

Scope of delivery includes:

- Anodized aluminum sheet
- Plastic holder for holding the measuring cables
- Mounting kit (screws with nut)

Delivery form		Pre-assembled assemblies
Dimensions	mm	L210 x W65 x H35
Weight	kg	0.14
Mounting type		Screwed
Holding capacity	Pcs	50
Material	Aluminum Plastic	anodized PVC



### Monitor support arm

Material no. **1827003725**

The articulating support arm allows positioning of the monitor/laptop and keyboard. The support arm consists of a support profile with 2 joints and holding plate and a mounting plate for the height-adjustable attachment on the side of the component support.

The assemblies:

- Support arm consisting of anodized aluminum profiles
- Holding fixture made of sheet steel, pivot-mounted
- Holding bracket for keyboard, chrome plated steel rod
- Mounting kit

Monitor and keyboard are not included in the scope of delivery.

Dimensions	mm	L710 x W415 x H350
Weight	kg	8.3
Mounting type		Screwed with slot nuts
Load bearing capacity	N	250
Material	Aluminum Sheet steel	anodized coated
Table area (L x W)	mm	400 x 400





## Work stations / accessories

### Information board

Material no. **1827003721**

For holding and displaying information at the workplace, e.g. circuit diagrams, device descriptions, work instructions. This helps avoid clutter.

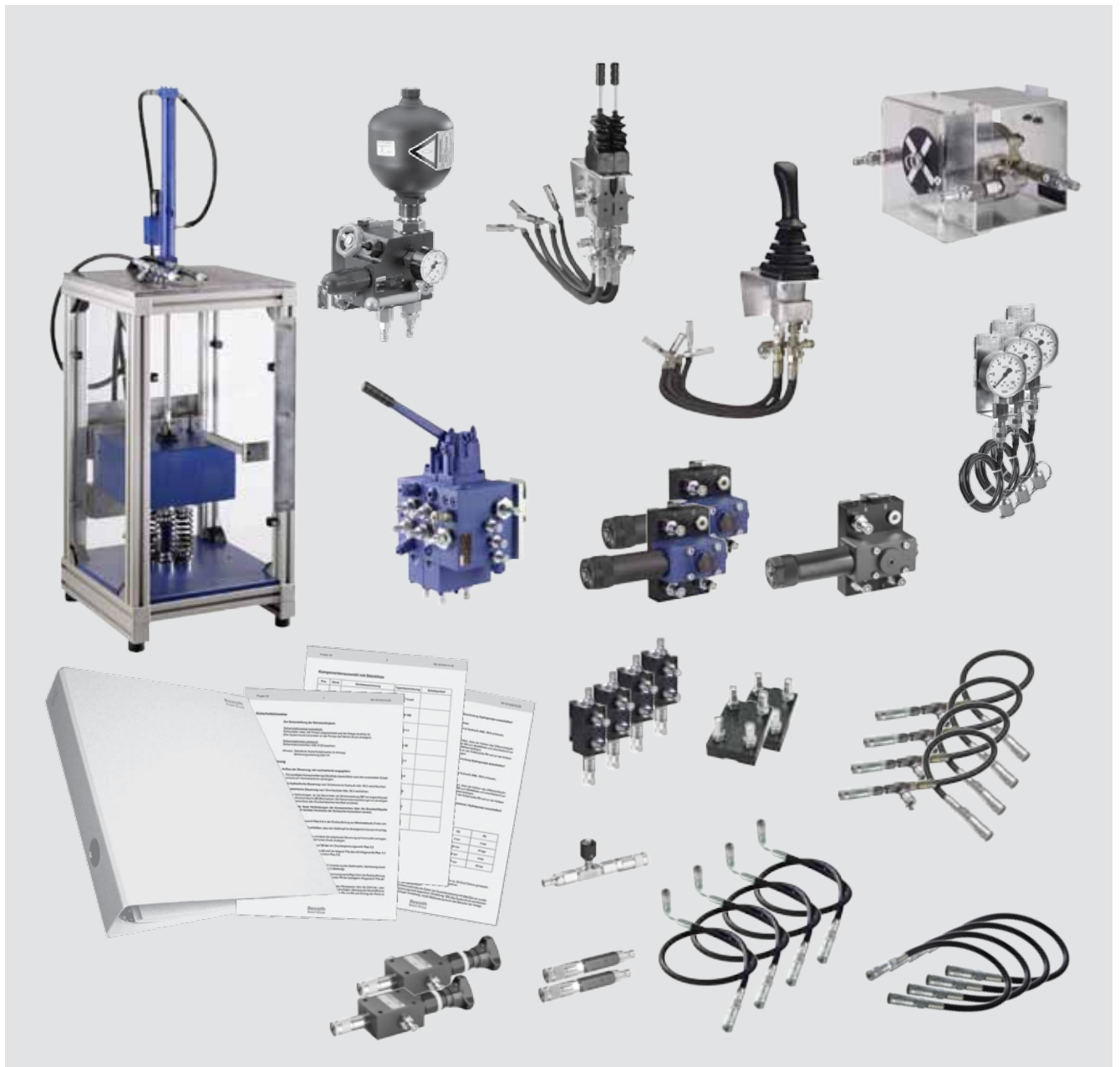
Support profile with 2 joints, with mounting kit for mounting at the side of the component support by means of nuts in the aluminum groove profile or the grooved plate, height-adjustable, cover with movable acrylic safety screen.

Dimensions	mm	L 370 x W280 x H80
Weight	kg	4.11
Mounting type		Screwed with slot nuts
Load bearing capacity	N	250
Material	Aluminum Sheet steel	anodized coated
Board size	Format	DIN A4





# Study topics



**Study topics**

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## Table of Contents: Study topics

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## Study topics / on/off hydraulics

### Hydraulic basics, manual operation, according to BiBB

The learning objectives are based on the topics proposed by BiBB and offer practical training on various levels of hydraulics. The experiments are supplemented by detailed information for both the trainer and the students and are structured according to the learning objectives through a method of step-by-step progression. The student manual contains all of the chart and graph information recording the results. Questions at the end of the sections ensure proper understanding of the material, which has been covered. All experiments utilize the DS4 training system.

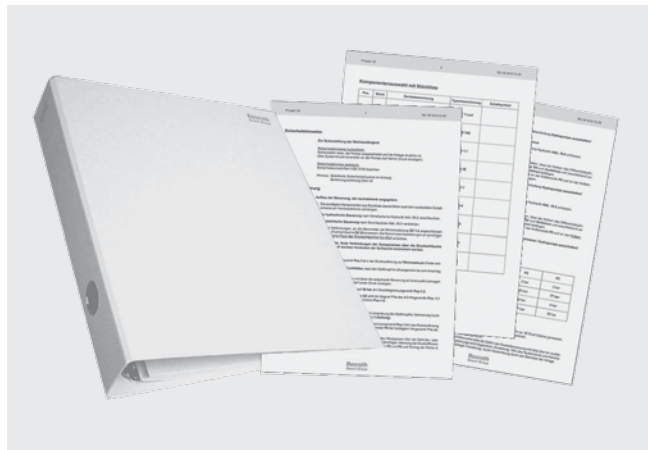
Scope of delivery:

- Training manuals for trainers and trainees
- Device set with the required components

### Training manuals for trainers and trainees:

The trainer's manual is intended as a tool for hydraulic trainers and instructors to aid in the implementation of the exercises using the DS4 training system. The book includes a description of the exercises based on practical examples and includes the following topics:

- Exercise A: Hydraulic power unit/pump
- Exercise B: Directional valves and actuators
- Exercise C: Check valves
- Exercise D: Flow control valves
- Exercise E: Pressure valves and pressure switches
- Exercise F: Hydraulic accumulators
- Exercise G: Circuit application
- Exercise H: Commissioning and maintenance



Trainer's manuals	Language	Mat. no.	Book title	Publication no.
Trainer's manual Hydraulic basics (BiBB, A-H) de	German	R900209841	Hydraulik-Grundlagen (in Anlehnung an BiBB) Lehrerhandbuch, Übung A - H	RD 00216
Trainer's manual Hydraulic basics (BiBB, A-H) en	English	R900215921	Trainer's manual Hydraulics, Exercises A-H	RE 00216
Trainer's manual Hydraulic basics (BiBB, A-H) es	Spanish	R900215922	Manual para el docente Hidráulica, Ejercicios A-H	RS 00216

Trainee's manuals	Language	Mat. no.	Book title	Publication no.
Trainee's manual Hydraulic basics (BiBB, A-H) de	German	R900209840	Hydraulik-Grundlagen (in Anlehnung an BiBB), Schülerhandbuch, Übung A - H	RD 00217
Trainee's manual Hydraulic basics (BiBB, A-H) en	English	R900215919	Trainee's manual Hydraulics, Exercises A-H	RE 00217
Trainee's manual Hydraulic basics (BiBB, A-H) es	Spanish	R900215920	Manual para el alumno Hidráulica, Ejercicios A-H	RS 00217

## Study topics / on/off hydraulics

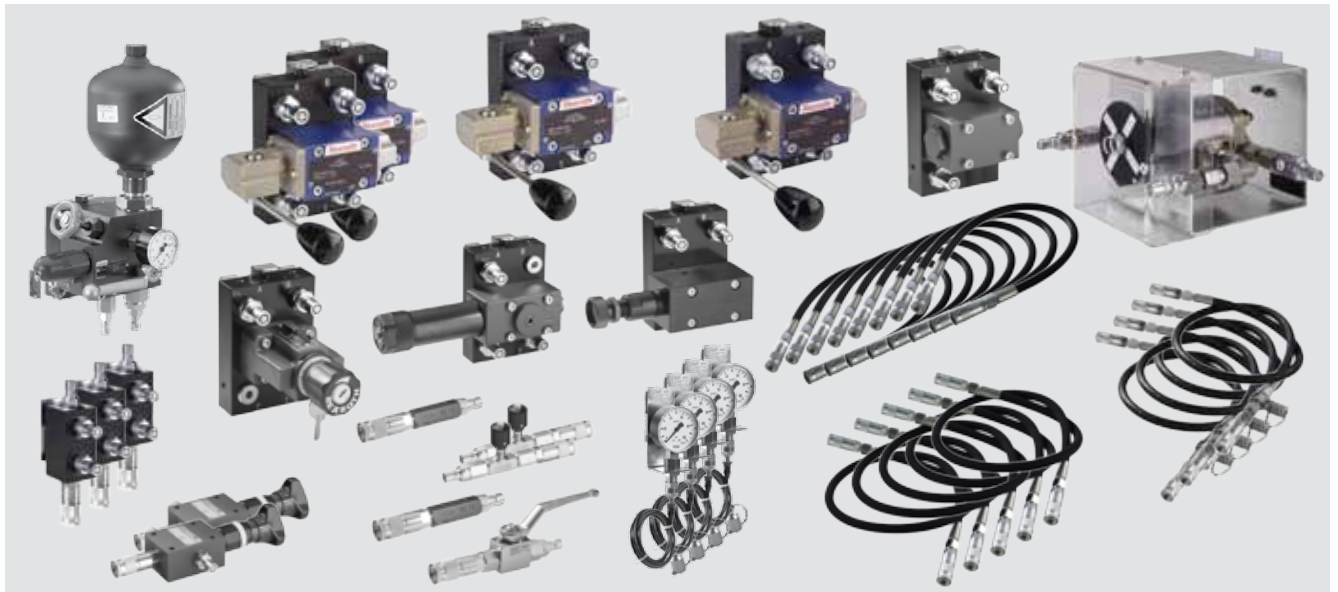
### Hydraulic basics, manual operation, according to BIBB

#### Hydraulic device set A-H for manually operated valves







Material no. **R961002888**

This component set can be used to teach all of the basic hydraulic principles and satisfies the requirements of the (BIBB A-H) hydraulic training manual. All of the components utilized are industry standard size 6 from the industrial hydraulic program and have been prepared for the use in the field of training.

Weight kg 51

















#### Set consisting of:

Item	Component	Mat. no.	Quantity	Figure	Page
1	Hose line 630 mm	R961002474	9		110
2	Hose line 1000 mm	R961002475	5		110
3	Hose line 1000 mm with minimess connection	R961002476	4		111
4	Pressure gauge 0 to 100 bar with measuring hose	R961002715	4		108
5	AB 21-20/G1/4-500 ball valve	R961002491	1		97
6	Hydraulic diaphragm-type accumulator with isolation valving for grid mounting	R961002503	1		105



## Study topics / switching hydraulics

### Hydraulic basics, manual operation, according to BiBB

Item	Component	Mat. no.	Quantity	Figure	Page
7	Hydraulic distributor for line mounting	R961002485	3		106
8	DBDH6G1X/100 direct operated pressure relief valve	R961002520	2		91
9	DR6DP1-5X/75YM direct operated pressure reducing valve	R961002544	1		91
10	DB6K1-4X/50YV pilot operated pressure relief valve	R961002545	1		92
11	DV06-1-1X/V throttle valve	R961002539	1		95
12	DRV06-1-1X/V throttle check valve	R961002495	1		95
13	2FRM6B36-3X/10QRV 2-way flow control valve	R961002546	1		96
14	SV 6 PB1-6X/ check valve, pilot operated	R961002513	1		100
15	S6A1.X check valve	R961002489	1		98
16	S6A3.X check valve	R961002522	1		99
17	4WMM6C5X 4/2 directional control valve	R961002552	2		84
18	4WMM6G5X 4/3 directional control valve	R961002550	1		84
19	4WMM6E5X/F 4/3 directional control valve	R961002551	1		85
20	Gear motor	R961004259	1		104

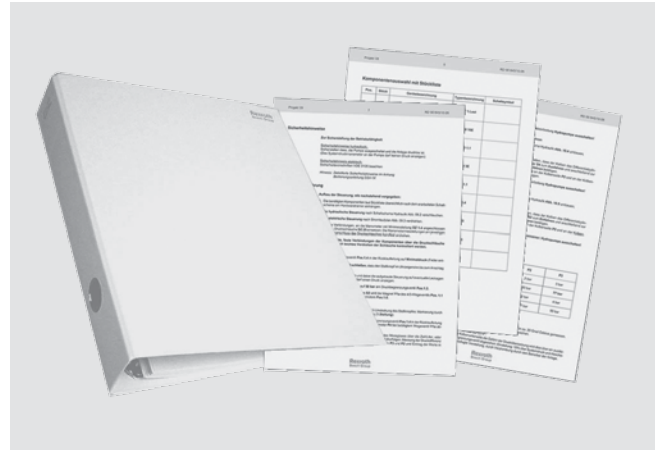
## Study topics / on/off hydraulics

### Project exercises on industrial hydraulics, (based on BiBB)

The learning objectives are based on the topics proposed by BIBB and the manual contains a matrix showing which BIBB topics which are covered in the various exercises. The exercises themselves are arranged as project tasks and ensure that each student gains the required knowledge in independent project planning, execution and analysis.

#### Training manuals for trainers and trainees:

The industrial hydraulics project manual can be used by trainers and instructors for teaching in the area of hydraulic control technology. The structure of the project exercises is such that the student begins with a defined requirement and must work through a problem and achieve a solution via an application. The student manual contains all of the chart and graph information for entering the recorded data. Each section contains questions to confirm the correct understanding of the material presented. Each exercise deals with one topic and is related directly to an example which would typically be found in industry.



Numbers of the project exercises and the relevant topic			
01	Hydraulic power unit	12	Pressure relief valve, direct operated
02	Characteristic curve of a variable displacement pump	13	Pressure control
03	Single-rod cylinder/pressure intensification	14	Pressure reducing valve
04	Single-rod cylinder/flow	15	Pressure switches
05	Cylinders, load pressure	16	Pressure switches / hysteresis
06	Setting the cylinder velocity	17	Hydraulic accumulators
07	Check valve	18	Differential circuit
08	Check valve, pilot operated	19	Fast advance - working speed motion control
09	Throttle valve, adjustable	20	Valve circulation control
10	Throttle check valve	21	Commissioning, inspection, maintenance, troubleshooting, repair
11	Flow control valve		

## Study topics / on/off hydraulics

### Project exercises for industrial hydraulics, (based on BiBB)

Trainer's manuals	Language	Mat. no.	Book title	Publication no.
Trainer's manual project manual industrial hydraulics de	German	R961002427	Projekthandbuch Industriehydraulik, Lehrerhandbuch	RD 00845
Trainer's manual project manual industrial hydraulics en	English	R961003790	Project Manual Industrial Hydraulics, Trainer's manual	RE 00845
Trainer's manual project manual industrial hydraulics es	Spanish	R961003791	Manual de proyecto Hidráulica industrial, Manual del profesor	RS 00845

Trainee's manuals	Language	Mat. no.	Book title	Publication no.
Trainee's manual project manual industrial hydraulics de	German	R961002429	Projekthandbuch Industriehydraulik, Schülerhandbuch	RD 00846
Trainee's manual project manual industrial hydraulics en	English	R961003751	Project Manual Industrial Hydraulics, Trainee's manual	RE 00846
Trainee's manual project manual industrial hydraulics es	Spanish	R961003765	Manual de proyecto Hidráulica industrial, Manual del alumno	RS 00846













All of the valves which are used are standard industrial size 6 valves and the maximum number of valves utilized in any experiment can be found in the associated table. The hydraulic components are intended for use with the DS4 training system that has the following equipment: Measuring glass, rack for electronic operating modules, power unit with 50 bar pressure and flow rate of 8 l/min and type W (low leakage couplings) and a rotatable loading unit.



## Study topics / on/off hydraulics

### Project exercises on industrial hydraulics, (based on BiBB)

Set consisting of:

Item	Component	Mat. no.	Quantity	Figure	Page
1	Hose line 630 mm	R961002474	9		110
2	Hose line 1500 mm	R961002473	5		110
3	Hose line 1000 mm with minimess connection	R961002476	4		111
4	Pressure gauge 0 to 100 bar with measuring hose	R961002715	4		108
5	AB 21-20/G1/4-500 ball valve	R961002491	1		97
6	Hydraulic diaphragm-type accumulator with isolation valving for grid mounting	R961002503	1		105
7	Hydraulic distributor, for grid mounting	R961002563	3		106
8	DBDH6G1X/100 pressure relief valve	R961002520	2		91
9	DR6DP1-5X/75YM direct operated pressure reducing valve	R961002544	1		91
10	DV06-1-1X/V throttle valve	R961002539	1		95
11	DRV06-1-1X/V throttle check valve	R961002495	1		95
12	2FRM6B36-3X/10QRV 2-way flow control valve	R961002546	1		96

## Study topics / switching hydraulics

### Project exercises on industrial hydraulics, (based on BiBB)

Item	Component	Mat. no.	Quantity	Figure	Page
13	SV 6 PB1-6X/ check valve, pilot operated	R961002513	1		100
14	S6A1.X check valve	R961002489	1		98
15	Pressure switch electric	R961003488	1		133
16	4WE6C6X/ 4/2 directional control valve	R961002547	2		87
17	4WE6G6X/ 4/3 directional control valve	R961002548	1		87
18	4WE6J6X/ 4/3 directional control valve	R961002554	1		88
19	4WE6E6X/ 4/3 directional control valve	R961002549	1		88
20	Axial piston motor	R961002811	1		104
21	CD70F25/16-200 single-rod cylinder with protective housing	R961003494	1		101

## Study topics / on/off hydraulics









### Project exercises on industrial hydraulics, (based on BiBB)

#### The necessary electric components:

The operating modules are designed for installation into the 19" rack.

The components must be ordered separately.



Item	Component	Mat. no.	Quantity	Figure	Page
1	BPS7.4 operating module, switches, buttons, 42TE	R900719908	1		117
2	BRS1.2 operating module, 3x relay, 42TE	R900897337	1		119
3	BPS8.1 operating module, light, buzzer, 21TE	R900897341	1		118
4	BPS 13.1 operating module, distributor 14-pole, 21TE	R900897345	1		116
5	Solenoid cable with LED, form A black	R900846807	1		131
6	Solenoid cable with LED, form A, gray	R900846808	2		131
7	Proximity switch inductive	R961003106	2		133
8	Connection cables - small set	R900029597	1		132





## Study topics / on/off hydraulics

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### Project exercises on industrial hydraulics, (based on BiBB)

#### The necessary measuring devices:

In addition to measuring the pressure via the gauges it is also possible to measure the flow and speed throughout the various exercises. In order to accomplish this the following measuring technology set is required.

Item	Component	Mat. no.	Quantity	Figure	Page
1	Stop watch, digital	R900061256	1		136
2	Flow meter DZ 30.N	R961002508	1		137
3	Tachometer	R900065201	1		136
4	Data acquisition set 3020	R913002273	1		135



## Study topics / on/off hydraulics

### Troubleshooting hydraulic systems

Troubleshooting can be introduced when training with either manual or electrically operated valving. The components of this device set have integrated faults and are meant to be used in conjunction with the contents of the BiBB exercises. The objective of the troubleshooting topic is to address the subjects of commissioning and troubleshooting in more detail and build the skills and abilities required for the systematic troubleshooting of the hydraulic system.

Scope of delivery:

- Training manual with part 1 for trainers and part 2 for trainees
- Device set with modified components for manually operated directional valves
- Device set with modified components for electrically operated directional valves

### Training manual:

The manual contains 3 tests that can be implemented using the following sets:

“Troubleshooting manually operated directional valve

- DW4N, Mat. no: R961006619” -or-

“Troubleshooting electrically operated directional valve

- DW4N, Mat. no: R961006620”

Test 1: Introduction into the systematic troubleshooting, maintenance schedule

Test 2: Different types of errors, adjustment errors, design errors

Test 3: Different errors in combination, adjustment errors, design errors



Trainer's manuals	Language	Mat. no.	Book title	Publication no.
Troubleshooting trainer's and trainee's manual de	German	R900054511	Fehlersuche in Hydraulikanlagen	RD 00261
Troubleshooting trainer's and trainee's manual en	English	R961003805	Fault detection in hydraulic systems	RE 00261
Troubleshooting trainer's and trainee's manual es	Spanish	R961003954	Búsqueda de fallos en instalaciones hidráulicas	RS 00261





Study topics / on/off hydraulics

Troubleshooting the hydraulic system

Device set troubleshooting DW4.N	
Material no.	R961006619
The device set contains components with integrated faults, which are then installed in circuits.	



List of individual components in the device set

Item	Component	Mat. no.	Quantity	Figure	Page
1	DBDH6G1X/100 direct operated pressure relief valve	R961006549	1		91
2	DB6K1-4X/50YV pilot operated pressure relief valve	R961006550	1		92
3	S6A1.X check valve with hose 630 mm	R961006552	1		98
4	4WMM6G5X 4/3 directional control valve	R961006553	1		84

Necessary accessories:  
Tachometer for hydraulic motor

## Study topics / on/off hydraulics

### Troubleshooting the hydraulic system







#### Device set troubleshooting DW4.E

Material no. **R961006620**

This device set is identical with the device set R961006619 with the exception of the electrically operated 4WE6G6X directional valve and related cables. The electrical control is not described in the manual however the exercise set-ups from the standard electrical manual can be used.



#### List of individual components in the device set

Item	Component	Mat. no.	Quantity	Figure	Page
1	DBDH6G1X/100 direct operated pressure relief valve	R961006549	1		91
2	DB6K1-4X/50YV pilot operated pressure relief valve	R961006550	1		92
3	S6A1.X check valve with hose 630 mm	R961006552	1		98
4	4WE6G6X 4/3 directional control valve	R961006551	1		87
5	Solenoid cable with LED, form A, black	R900846807	1		131
6	Solenoid cable with LED, form A, gray	R900846808	1		131

#### Necessary accessories:

Tachometer for hydraulic motor

## Study topics / proportional valve technology

### Proportional control

The exercises are designed so that the trainees work independently and hands-on in order to learn and understand the overall operation of this technology. To encourage this the relevant information is imparted via independent planning, implementing and control, all via practical project tasks.

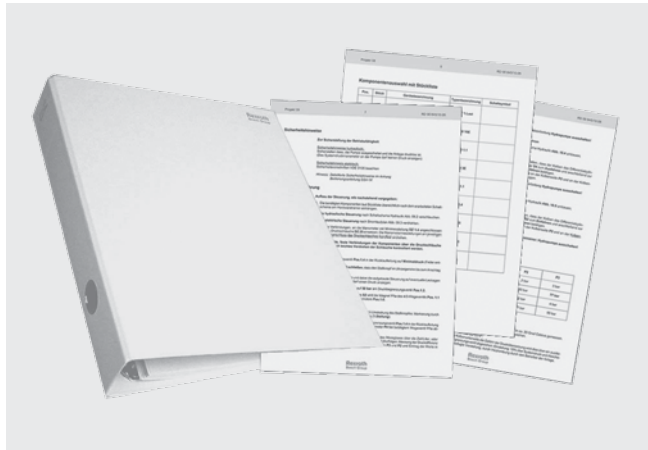
Scope of delivery:

“Proportional valve technology” project manual for trainers and trainees

- List of the necessary hydraulic components
- List of the necessary electric components
- List of the necessary measuring devices

### Training manuals for trainers and trainees:

The trainer's manual is intended for trainers and instructors in the field of proportional valve technology. It contains descriptions of how the various project exercises are carried out via the DS4 training system. The projects are based on practical application examples of electrohydraulic control technology however a prerequisite is that the trainee has basic hydraulic and electrical knowledge. The project results documented in this manual are generally to be regarded as orientation for the instructor and trainer. Before the projects are undertaken, the experiments relating to basic principles of hydraulics and switching hydraulics should have been carried out. General explanations regarding proportional valve technology are required as an introduction to this topic. General safety aspects and safety instructions precede the experiments and refer to the risks in the implementation of the exercises.



Numbers of the project exercises and the relevant topic			
01	Moving a cylinder with the help of an external potentiometer as a command value	07	Adjusting a motion sequence with 4-quadrant ramps
02	Moving a cylinder with command value module SWMA1	08	Adjusting a sequence with 2 proximity switches
03	Adjusting command value module SWMA1 with 4 command values	09	Adjustment of an automatic sequence with 3 proximity switches
04	Adjusting command value module SWMA1 with 4 command values and ramps	10	Adjusting the system pressure with the help of an external potentiometer
05	Adjusting a braking distance following a proximity switch signal	11	Moving a cylinder with two different pressures
06	The influence of pressure on velocity and braking distance	12	Automatic sequence with proportional pressure valve

Trainer's manuals	Language	Mat. no.	Book title	Publication no.
Trainer's manual project manual proportional valve technology de	German	R961003779	Projekthandbuch Stetigventiltechnik (Proportionaltechnik), Lehrerhandbuch	RD 00847
Trainer's manual project manual proportional valve technology en	English	R961003873	Project manual Proportional valve technology, Trainer's manual	RE 00847
Trainer's manual project manual proportional valve technology es	Spanish	R961003872	Manual de proyecto Técnica de válvulas continuas, (técnica proporcional), Manual del profesor	RS 00847

## Study topics / proportional valve technology

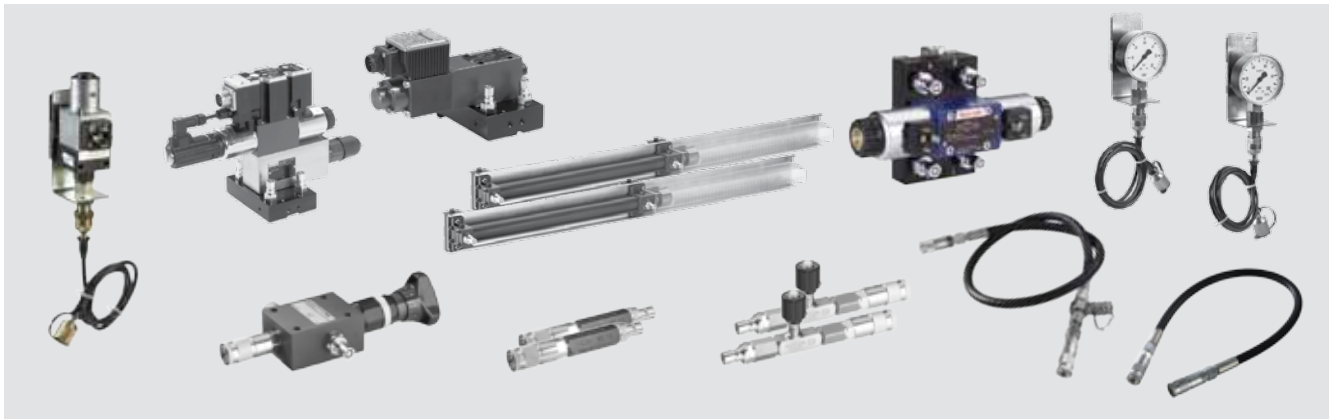
### Proportional control

Trainee's manuals	Language	Mat. no.	Book title	Publication no.
Trainee's manual project manual proportional valve technology de	German	R961003780	Projekthandbuch Stetigventiltechnik (Proportionaltechnik), Schülerhandbuch	RD 00848
Trainee's manual project manual proportional valve technology en	English	R961003875	Project manual Proportional valve technology, Trainee's manual	RE 00848
Trainee's manual project manual proportional valve technology es	Spanish	R961003874	Manual de proyecto Técnica de válvulas continuas (técnica proporcional), Manual del alumno	RS 00848

#### The necessary hydraulic components:

All of the components are standard size 6 from the industrial hydraulic program and have been prepared for the use in the field of training. The listed components are intended for the use with the DS4 training system. Required equipment features of the training system are: Measuring glass, rack for electronic operating modules, electrical power supply, hydraulic power unit with 50 bar and 8 l/min, hydraulic quick-disconnect couplings type "W".








The components must be ordered separately.



Item	Component	Mat. no.	Quantity	Figure	Page
1	4WREE6E08-2X/ 4/3 proportional directional valve with integrated electronics (OBE)	R961003533	1		89
2	4WE6E6X/ 4/3 directional control valve	R961002549	1		88
3	CD70F25/16-400 single-rod cylinder with protective housing	R961003495	2		101
4	DRV06-1-1X/V throttle check valve	R961002495	2		95
5	DBDH6G1X/100 direct operated pressure relief valve	R961002520	1		91

## Study topics / proportional valve technology

### Proportional control

Item	Component	Mat. no.	Quantity	Figure	Page
6	Pressure switch, electric	R961003488	1		133
7	Pressure gauge 0 to 100 bar with measuring hose	R961002715	1		108
8	Pressure gauge 0 to 60 bar with measuring hose	R961003403	1		108
9	DBEE6-1X/50 proportional pressure relief valve	R961003924	1		93
10	S6A1.X check valve	R961002489	2		98
11	Hose line 1000 mm with minimess connection	R961002476	1		111
12	Hose line 630 mm	R961002474	1		110

### The necessary electric components:

The operating modules are designed for installation into the 19" rack.



## Study topics / proportional valve technology

### Proportional control

Item	Component	Mat. no.	Quantity	Figure	Page
1	BPS 13.1 operating module, distributor, 21TE	R900897345	1		116
2	BPS 20.0 operating module for the command value generation, 21TE	R961000107	1		123
3	BPS 21.0 operating module, 14TE Adapter 4 mm sockets to 7-pole connecting plug	R961001630	1		124
4	BPS 7.4 operating module, switches, buttons, 42TE	R900719908	1		117
5	BRS 1.2 operating module, 3x relay, 42TE	R900897337	2		119
6	BPS 5.2 operating module with 1 potentiometer +/-10 Volt output, 21TE	R961001957	1		121
7	BPS 6.1 operating module, command/actual value display, 21TE	R900711665	1		122
8	BRS 2.1 operating module timer relay, 15TE	R961004561	1		120
9	Proximity switch, inductive	R961003106	3		133
10	7-pole cable for integrated electronics	R961003550	1		132





## Study topics / proportional valve technology

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### Proportional control

#### The necessary measuring devices:

For carrying out the exercises themselves, no additional measuring devices are necessary. In practice however, the incorrect set-up of the exercises sometimes results in faulty circuits. The equipment of this set is typical to instrumentation that is used in industry for carrying out measurements and is recommended to assist in troubleshooting of faulty circuits.

Item	Component	Mat. no.	Quantity	Figure	Page
1	Data acquisition set 5060	R913002274	1		136
2	Flow meter DZ30 N	R961002508	1		137
3	Multi-meter	R900897502	1		135
4	Stop watch, digital	R900061256	1		136



## Study topics / proportional valve technology

### Position control

The exercises are designed so that the trainees work hands-on in a largely independently way in order to learn and understand the overall operation of this technology. To encourage this, the information is imparted via independent planning, implementing and control, via practical project tasks.

Scope of delivery:

“Analog position control loop” project manual for trainers and trainees

- List of the necessary hydraulic components
- List of the necessary electric components
- List of the necessary measuring devices

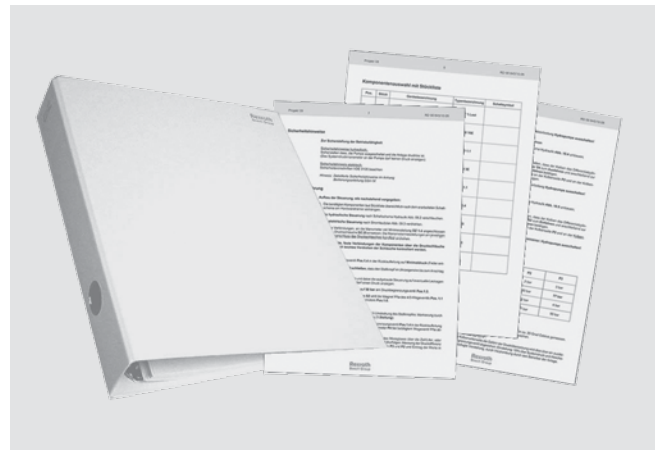
### Training manuals for trainers and trainees:

The “Analog position control loop” project manual provides practical exercises to develop an understanding of hydraulic closed loop and open loop control technology. These exercises provide the introduction into the practical element of axis control technology however it is not intended as a detailed transfer of theoretical control technology basics. The information covered gives an overview of the practical application of a simple electrohydraulic position control loop.

The topics are addressed such that the student first deals with the problem of keeping actuator position with different loads with an open loop control system. As a result of their findings the advantages of closed control loop are identified. Once this requirement is identified, the components of the electrohydraulic closed loop control are presented. The set-up and function of the closed loop is explained and basic safety information for implementing the exercises is provided.

Project exercises and the relevant topic:

- 01 Controlling the position by means of a 4/3 directional valve
- 02 Controlling the position by means of a proportional valve
- 03 Closed loop position control



Trainer's manuals	Language	Mat. no.	Book title	Publication no.
Project manual Analog position control, trainer's manual, de	German	R961005011	Projekthandbuch, Analoges Position-sregelkreis, Lehrerhandbuch	RD 09979
Project manual Analog position control, trainer's manual, en	English	R961005091	Project Manual, Analog position control loop, Trainer's manual	RE 09979
Trainee's manuals	Language	Mat. no.	Book title	Publication no.
Project manual Analog position control, trainee's manual, de	German	R961005010	Projekthandbuch Analoges Position-sregelkreis, Schülerhandbuch	RD 09980
Project manual Analog position control, trainee's manual, en	English	R961005092	Project Manual, Analog position control loop, Trainee's manual	RE 09980











### The necessary hydraulic components:

All of the exercises are performed using standard industrial hydraulic valves and are designed for use with the DS4 training system. Required equipment features of the training system are: Measuring glass, rack for electronic operating modules, power unit with 50 bar and 8 l/min, rotatable load unit, hydraulic quick-disconnect couplings type “W”.

## Study topics / proportional valve technology

### Position Control



Item	Component	Mat. no.	Quantity	Figure	Page
1	Horizontal loading unit	R961004486	1		103
2	Control valve size 6 OBE	R961002509	1		90
3	DBDH6G1X/100 direct operated pressure relief valve	R961002520	1		91
4	S6A1.X check valve	R961002489	1		98
5	4WE6C6X/ 4/2 directional control valve	R961002547	1		87
6	4WE6E6X/ 4/3 directional control valve	R961002549	1		88
7	DR6DP1-5X/ direct operated pressure reducing valve	R961002544	1		91
8	Pressure gauge 0 to 100 bar with measuring hose	R961002715	4		108
9	Hose line 1000 mm with minimess connection	R961002476	3		111
10	Hose line 630 mm	R961002474	5		110











## Study topics / proportional valve technology

### Position Control

#### The necessary electric components:

The operating modules are suitable for installation into the 19" rack.



Item	Component	Mat. no.	Quantity	Figure	Page
1	BPS 20.0 operating module for the command value generation, 21TE	R961000107	1		123
2	BPS 5.2 operating module with 1 potentiometer +/-10 Volt output, 21TE	R961001957	1		121
3	BPS 21.0 operating module, Adapter 4 mm sockets to 7-pole connecting plug, 14TE	R961001630	1		124
4	BPS 6.1 operating module, command/actual value display, 21TE	R900711665	1		122
5	BPS 13.1 operating module, distributor, 21TE	R900897345	2		116
6	BPS 7.4 operating module, switches, buttons, 42TE	R900719908	1		117
7	BRS 1.2 operating module, 3x relay, 42TE	R900897337	2		119
8	Proximity switch inductive	R961003106	1		133
9	Control panel for DS4 training system with MACAS controller module, 30TE	R961004782	1		125
10	7-pole cable for integrated electronics	R961003550	1		132





## Study topics / proportional valve technology

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### Position Control

#### The necessary measuring devices:

For carrying out the exercises themselves, no additional measuring devices are necessary. In practice however, the incorrect set-up of the exercises sometimes results in faulty circuits. The equipment of this set is typical to instrumentation that is used in industry for carrying out measurements and is recommended to assist in troubleshooting of faulty circuits.

Item	Component	Mat. no.	Quantity	Figure	Page
1	Data acquisition set 3020	R913002273	1		135
2	Flow meter DZ30 N	R961002508	1		137
3	Multi-meter	R900897502	1		135
4	Stop watch, digital	R900061256	1		136

## Study topics / mobile hydraulics

### Throttle control

The exercises are designed so that the trainees work in a hands-on and largely independently way in order to learn and understand the overall operation of open centre technology. To encourage this the information is imparted via independent planning, implementing and control, all via practical project tasks.

Scope of delivery:

“Mobile hydraulics-3SM-12 Throttle control” project manual for trainers and trainees

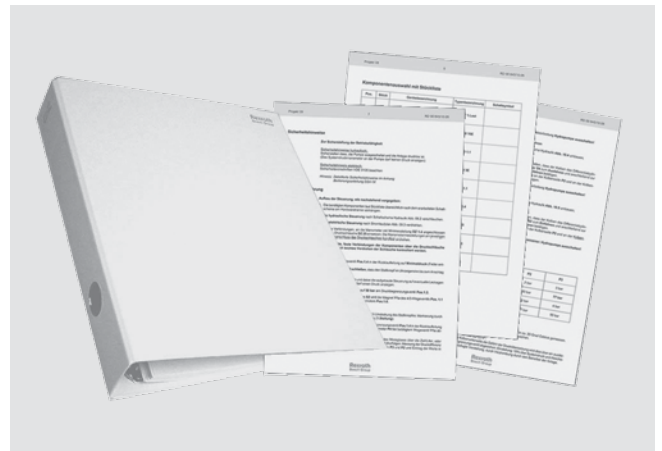
- List of the necessary hydraulic components
- List of the necessary measuring devices

### Training manuals for trainers and trainees:

The focus of the projects are on practical examples from mobile control technology and it is assumed that the trainees have basic hydraulic knowledge prior to beginning the project exercises. Because of this the experiments covering the basics of hydraulics should be completed prior to beginning work in this area of technology. It must be noted that the project results documented in this manual are to provide orientation for the instructor and student and it is recommended that the projects be performed beginning with No. 01.

The trainers manual provides the respective project/instructor information at the end of each project exercise.

The progression of information is such that an initial overview is given to the historical development of mobile hydraulics in order to classify throttle control and its areas of application within different machines. Following this the topics of the history of hydraulics in mobile machines, throttle control and its operation and also an explanation of special symbols to help to introduce this technology. The information then progresses to the particular components found in mobile hydraulic systems. The set-up and function of the following technology is presented and explained (6/3 directional valve, load holding valve, primary and secondary pressure valves, pilot control unit). The basic safety information for carrying out the exercises is also covered.



Numbers of the project exercises and the relevant topic			
01	Flow control and velocity control	06	Secondary valve
02	Pressure control and force control	07	Parallel operation
03	Hydraulic pilot control	08	Control characteristic
04	Speed with different loads	09	Lowering the boom and force build-up
05	Load holding valve		

## Study topics / mobile hydraulics

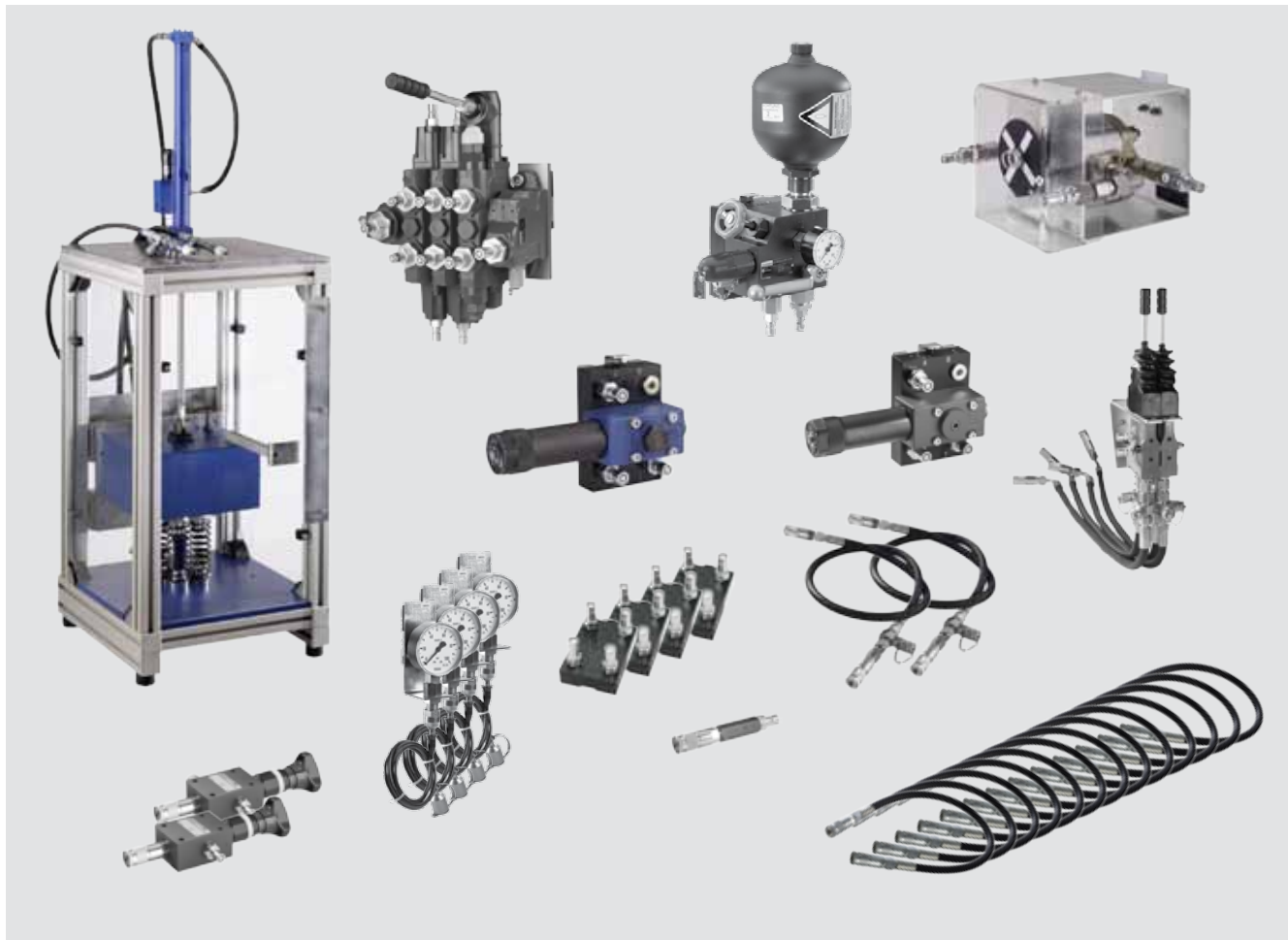
### Throttle control

Trainer's manuals	Language	Mat. no.	Book title	Publication no.
Trainer's manual Project manual Mobile hydraulics throttle control 3SM-12, de	German	R961004608	Projekthandbuch, Mobilhydraulik, Drosselsteuerung 3SM-12, Lehrerhandbuch	RD 09968
Trainer's manual Project manual Mobile hydraulics throttle control 3SM-12, en	English	R961005094	Project manual, Mobile hydraulics, 3SM-12 throttle control, Trainer's manual	RE 09968
Trainee's manuals	Language	Mat. no.	Book title	Publication no.
Trainee's manual Project manual Mobile hydraulics throttle control 3SM-12, de	German	R961004614	Projekthandbuch, Mobilhydraulik, Drosselsteuerung 3SM-12, Schülerhandbuch	RD 09969
Trainee's manual Project manual Mobile hydraulics throttle control 3SM-12, en	English	R961005093	Project manual, Mobile hydraulics; 3SM-12 throttle control, Trainee's manual	RE 09969

### The necessary hydraulic components:














All of the components used in the exercises are standard equipment from the Rexroth mobile hydraulic product range and are optimized for the use with the DS4 training system that has the following equipment:

Measuring glass, power unit with load sensing function, operating pressure 50 bar, standby pressure 15 bar, flow 8 l/min, hydraulic quick-disconnect couplings type "W".



## Study topics / mobile hydraulics

### Throttle control

Item	Component	Mat. no.	Quantity	Figure	Page
1	Control block 3SM-12, throttle control	R961004198	1		141
2	DBDH6G1X/100 direct operated pressure relief valve	R961002520	2		91
3	Pressure gauge 0 to 100 bar with measuring hose	R961002715	4		108
4	Hydraulic distributor, for grid mounting	R961002563	4		106
5	Gear motor	R961004259	1		104
6	Vertical loading unit	R961004005	1		102
7	2-2TH6-L70 pilot control unit	R961004190	1		139
8	Hydraulic diaphragm-type accumulator with isolation valving for grid mounting	R961002503	1		105
9	S6A1.X check valve	R961002489	1		98
10	DR6DP1-5X/75YM direct operated pressure reducing valve	R961002544	1		91
11	DZ6DP1-5X pressure sequence valve direct operated	R961002558	1		92
12	Hose line 1000 mm with minimess connection	R961002476	2		111
13	Hose line 630 mm	R961002474	13		110




## Study topics / mobile hydraulics

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### Throttle control

#### The necessary measuring devices:

For carrying out the exercises themselves, no additional measuring devices are necessary. In practice however, the incorrect set-up of the exercises sometimes results in faulty circuits. The equipment of this set is typical to instrumentation that is used in industry for carrying out measurements and is recommended to assist in troubleshooting of faulty circuits.

Item	Component	Mat. no.	Quantity	Figure	Page
1	Gear flow sensor 0.2 to 30 l/min with ISDS	R961002508	1		137
2	Data acquisition set 5060	R913002274	1		136
3	Speed sensor	R900892375	1		137
4	Pressure line segment with inspection glass	On request	1	-	



## Study topics / mobile hydraulics

### Load sensing control

The exercises are designed so that the trainees work in a hands-on and largely independently way in order to learn and understand the overall operation of load sensing technology. To encourage this the information is imparted via independent planning, implementing and control, all via practical project tasks.

Scope of delivery:

"Mobile hydraulics 2M4-12 load sensing control" project manual for trainers and trainees

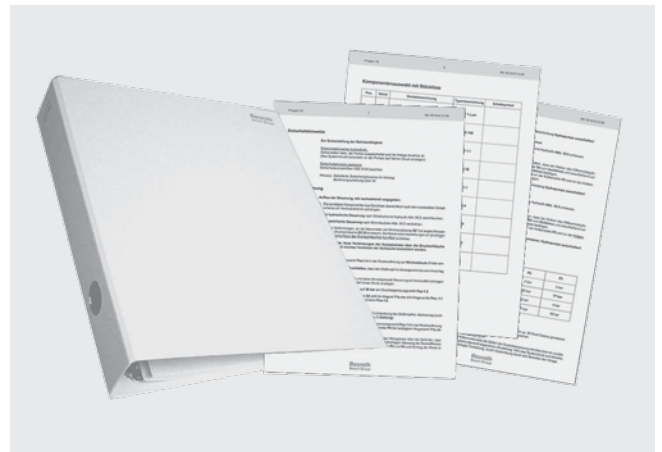
- List of the necessary hydraulic components
- List of the necessary measuring devices

### Training manuals for trainers and trainees:

Project focus is on practical examples from mobile control technology and it is assumed that the trainees have basic hydraulic knowledge prior to beginning the project exercises. Because of this the experiments covering the basics of hydraulics should be completed prior to beginning work in this area of technology. It must be noted that the project results documented in this manual are to provide orientation for the instructor and student and it is recommended that the projects be performed beginning with No. 01.

The trainer's manual provides the respective instructor information at the end of each project exercise.

The progression of information is such that an initial overview is given to the historical development of mobile hydraulics in order to classify load sensing control and its areas of application within different machines. Following this, the topics of the history of hydraulics in mobile machines, load sense control and its operation and also an explanation of special symbols to help to introduce this technology. The information then progresses to the particular components found in mobile hydraulic systems. The set-up and function of the following technology is presented and explained (2M4-12 LS control block, spool stroke limitation, LS limitation, pressure compensator, primary and secondary pressure valve, 2-2TH6 hydraulic pilot control). The basic safety information for carrying out the exercises is also covered.

















Numbers of the project exercises and the relevant topic			
01	Primary pressure limitation	07	Secondary valves
02	Actuator flows with stroke limitations	08	Load sensing pressure limitation
03	Load pressure compensation	09	Parallel operation with sufficient displacement
04	Pressure losses in P line	10	Parallel operation with insufficient displacement
05	Hydraulic pilot control	11	Stroke cylinders with alternating direction of force
06	Action of external forces		






## Study topics / mobile hydraulics

### Load sensing control




Item	Component	Mat. no.	Quantity	Figure	Page
1	Load sensing control block 2M4-12	R961004192	1		143
2	DBDH6G1X/100 direct operated pressure relief valve	R961002520	2		91
3	DZ6DP1-5X pressure sequence valve direct operated	R961002558	2		92
4	DR6DP1-5X/75YM direct operated pressure reducing valve	R961002544	1		91
5	DV06-1-1X/V throttle valve	R961002539	1		95
6	S6A1.X check valve	R961002489	2		98
7	Hydraulic diaphragm-type accumulator with isolation valving for grid mounting	R961002503	1		105
8	Hydraulic distributor, for grid mounting	R961002563	2		106
9	Hydraulic distributor, for line mounting	R961002485	4		106
10	2-2TH6-L70 pilot control unit	R961004190	1		139
11	Pilot control unit for arm rest installation 4TH6-97 (as alternative to item 10, R961004190)	R961004191	1		140
12	Vertical loading unit	R961004005	1		102
13	Gear motor	R961004259	1		104
14	Hose line 630 mm	R961002474	4		110

## Study topics / mobile hydraulics

### Load sensing control

Item	Component	Mat. no.	Quantity	Figure	Page
15	Hose line 630 mm with minimess connection	R961002481	4		111
16	Hose line 2000 mm with 90° fitting	R961002477	4		112
17	Pressure gauge 0 to 100 bar with measuring hose	R961002715	3		108

### The necessary measuring devices:

Item	Component	Mat. no.	Quantity	Figure	Page
1	Gear flow sensor 0.2 to 30 l/min with ISDS	R961002508	1		137
2	Data acquisition set 5060	R913002274	1		136
3	Speed sensor	R900892375	1		137
4	Pressure line segment with inspection glass	On request	1	-	

## Study topics / mobile hydraulics

### LUDV (anti-saturation) control

The exercises are designed so that the trainees work in a hands-on and largely independently way in order to learn and understand the overall operation of this technology. To encourage this the information is imparted via independent planning, implementing and control all via practical project tasks.

Scope of delivery:

"Mobile hydraulics LUDV 2SX-12" project manual for trainers and trainees

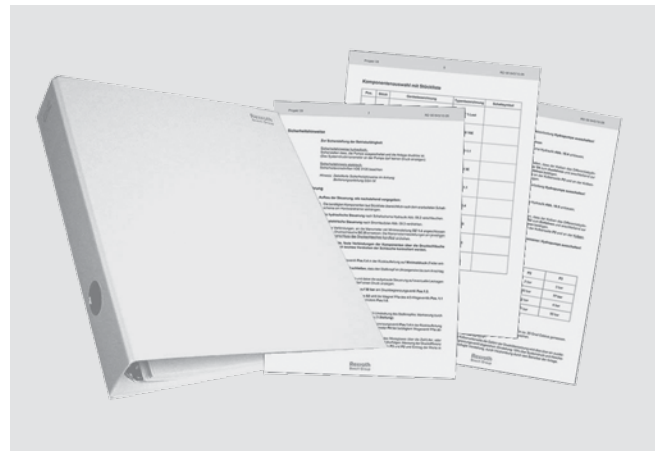
- List of the necessary hydraulic components
- List of the necessary measuring devices

### Training manuals for trainers and trainees:

Project focus is on practical examples from mobile control technology and it is assumed that the students have basic hydraulic knowledge prior to beginning the project exercises. Because of this the experiments covering the basics of hydraulics should be completed prior to beginning work in this area of technology. It must be noted that the project results documented in this manual are to provide orientation for the instructor and student and it is recommended that the projects be performed beginning with No. 01.

The trainer's manual provides the respective instructor information at the end of each project exercise.

The progression of information is such that an initial overview is given to the historical development of mobile hydraulics in order to classify LUDV (anti-saturation) control and its areas of application within different machines. Following this, the topics of the history of hydraulics in mobile machines, the LUDV (anti-saturation) control and its operation and also an explanation of special symbols help to introduce this technology. The information then progresses to the particular components found in mobile hydraulic systems. The set-up and function of the following technology is presented and explained (LUDV (anti-saturation) control block 2SX-12, load pressure signal, pressure compensators, actuator flow and spool stroke limitation, primary and secondary pressure valves, hydraulic pilot control). The basic safety information for carrying out the exercises is also covered.



Numbers of the project exercises and the relevant topic			
01	Pressure setting and hydraulic pilot control	05	Cylinders with alternating direction of force
02	Setting actuator speeds by means of stroke limiters	06	Boom cylinder with action of external forces
03	The effects of pipelines	07	Operating principle of an LUDV (anti-saturation) system
04	The effects of loads		

## Study topics / mobile hydraulics

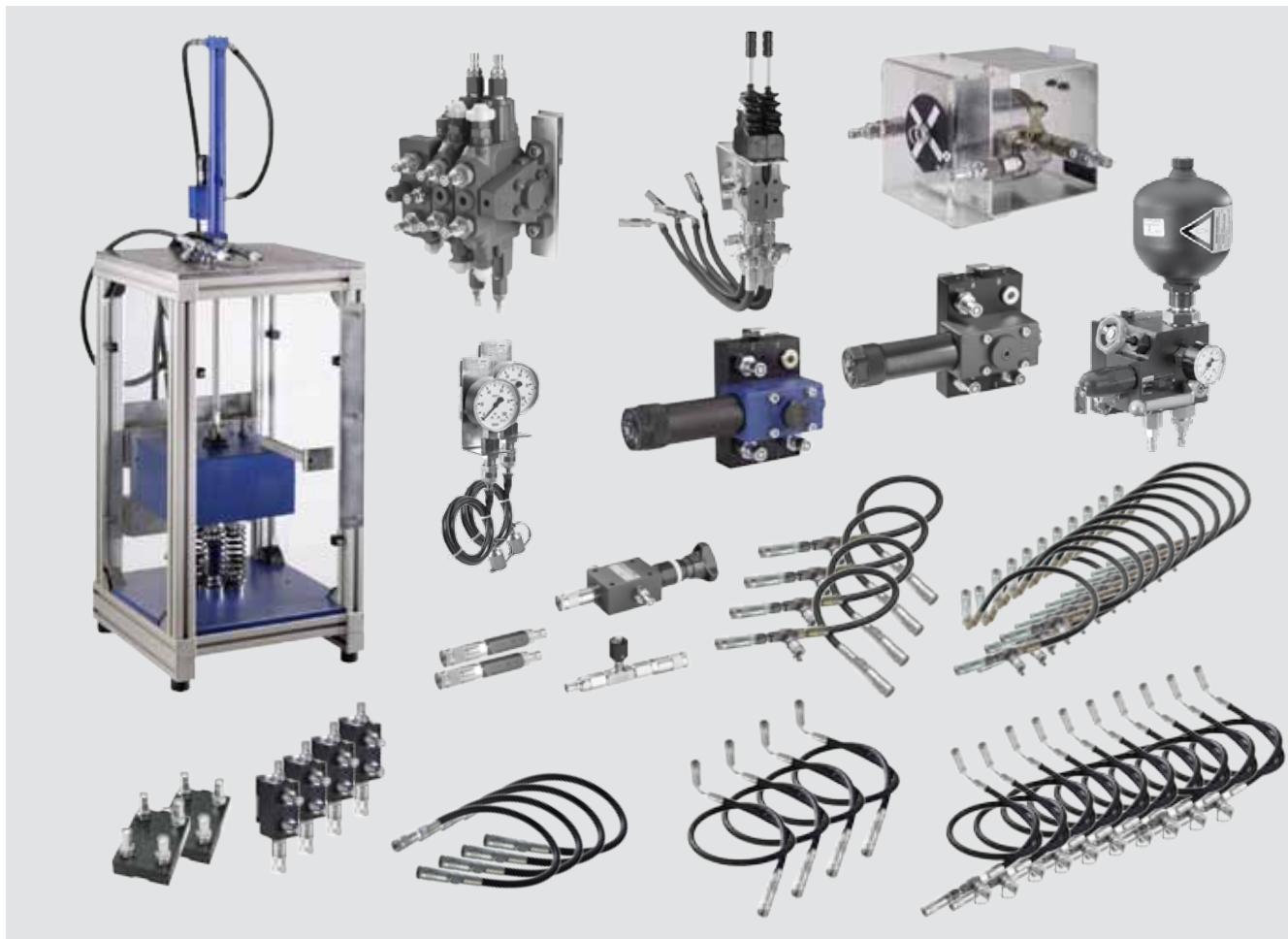
### LUDV control

Trainer's manuals	Language	Mat. no.	Book title	Publication no.
Trainer's manual Project manual Mobile hydraulics LUDV 2SX-12, de	German	R961004654	Projekthandbuch, Mobilhydraulik LUDV 2SX-12, Lehrerhandbuch	RD 09972
Trainer's manual Project manual Mobile hydraulics LUDV 2SX-12, en	English	R961005149	Project manual Mobile hydraulics, LUDV 2SX-12, Trainer's manual	RE 09972
Trainee's manuals	Language	Mat. no.	Book title	Publication no.
Trainee's manual Project manual Mobile hydraulics LUDV 2SX-12, de	German	R961004749	Projekthandbuch, Mobilhydraulik, LUDV 2SX-12, Schülerhandbuch	RD 09973
Trainee's manual Project manual Mobile hydraulics LUDV 2SX-12, en	English	R961005148	Project manual Mobile hydraulics, LUDV 2SX-12, Trainee's manual	RE 09973

### The necessary hydraulic components:















All of the components used in the exercises are standard equipment from the Rexroth mobile hydraulic product range and are optimized for the use with the DS4 training system that has the following equipment:

Measuring glass, power unit with load sensing function, operating pressure 50 bar, standby pressure 15 bar, flow 8 l/min, hydraulic quick-disconnect couplings type "W".



## Study topics / mobile hydraulics





### LUDV control

Item	Component	Mat. no.	Quantity	Figure	Page
1	LUDV 2SX-12 control block	R961004189	1		142
2	DR6DP1-5X/75YM direct operated pressure reducing valve	R961002544	1		91
3	DBDH6G1X/100 direct operated pressure relief valve	R961002520	1		91
4	DZ6DP1-5X pressure sequence valve direct operated	R961002558	1		92
5	S6A1.X check valve	R961002489	2		98
6	DV06-1-1X/V throttle valve	R961002539	1		95
7	Hydraulic diaphragm-type accumulator with isolation valving for grid mounting	R961002503	1		105
8	Hydraulic distributor, for grid mounting	R961002563	2		106
9	Hydraulic distributor, for line mounting	R961002485	4		106
10	2-2TH6-L70 pilot control unit	R961004190	1		139
11	Vertical loading unit	R961004005	1		102
12	Gear motor	R961004259	1		104
14	Hose line 630 mm	R961002474	4		110
15	Hose line 630 mm with minimess connection	R961002481	4		111






## Study topics / mobile hydraulics

### LUDV control

Item	Component	Mat. no.	Quantity	Figure	Page
15	Hose line 2000 mm with 90° fitting	R961002477	4		112
16	Hose line 700 mm with 90° fitting and minimess connection	R961004329	11		112
17	Hose line 1000 mm with 90° fitting and minimess connection	R961004330	10		112
18	Pressure gauge 0 to 100 bar with measuring hose	R961002715	2		108

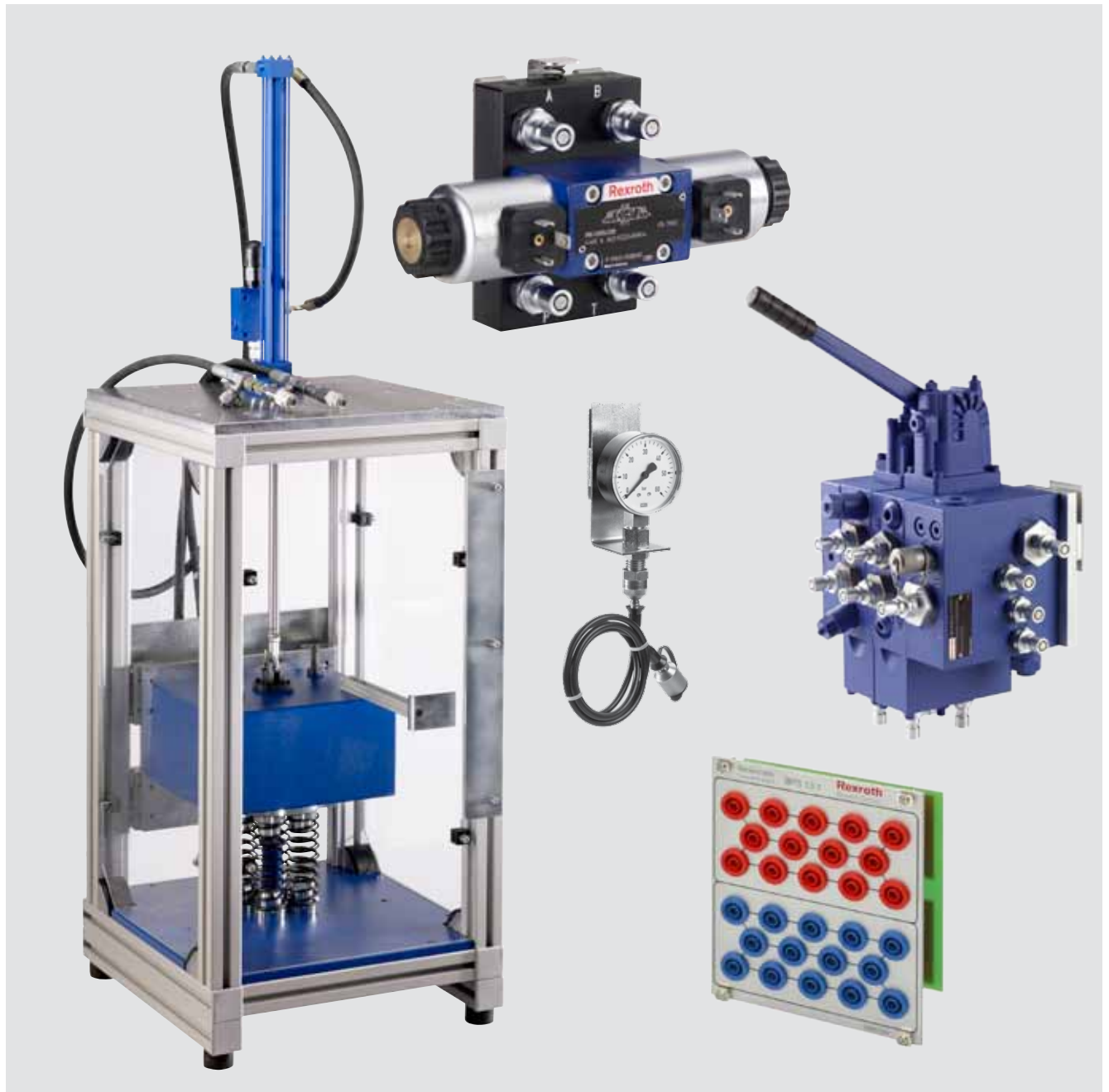
### The necessary measuring devices:

The connection couplings and mounting types are suitable for the DS4 training system

Item	Component	Mat. no.	Quantity	Figure	Page
1	Gear flow meter 0.2 to 30 l/min with ISDS	R961002508	1		137
2	Data acquisition set 5060	R913002274	1		136
3	Speed sensor	R900892375	1		137
4	Pressure line segment with inspection glass	On request	1	-	



# Components





## Table of Contents: Components

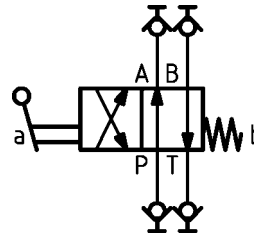
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▶ Hose lines	110		
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## Components / valves

### Directional control valves - manual operation

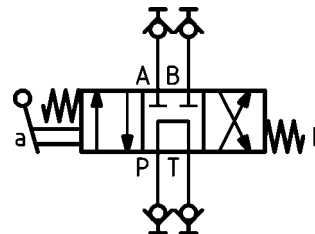
#### 4WMM6C5X 4/2 directional valve

Material no.	<b>R961002552</b>
4 port, 2 spool position, lever operated, spring return directional control valve.	
Control spool type "C"; in normal condition, P-A open, B-T open; sub-plate mounted; connections via quick disconnects.	
Didactic designation	DW3.NV-W
Industrial type	4WMM6C5X
Industrial type information	RE 22280
Dimensions	mm L137 x W125 x H182
Weight	kg 2
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W



#### 4WMM6G5X 4/3 directional valve

Material no.	<b>R961002550</b>
4 port, 3 spool position, lever operated, spring centred directional control valve.	
Control spool type "G"; in normal condition, P-T open, A,B blocked; sub-plate mounted; connections via quick disconnects.	
Didactic designation	DW4.NV-W
Industrial type	4WMM6G5X
Industrial type information	RE 22280
Dimensions	mm L137 x W125 x H182
Weight	kg 2
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W



#### 4WMM6G5X 4/3 directional valve - modified

Material no.	<b>R961006553</b>
Modified 4/3 directional valve 4WMM6G5X/; the typical features of aging and wear have been simulated.	

## Components / valves

### Directional control valves - manual operation

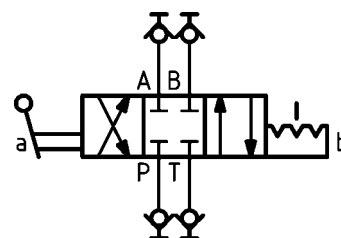
#### 4WMM6E5X/ 4/3 directional valve

Material no. **R961002551**

4 port, 3 spool position, lever operated, detented directional control valve.

Control spool type "E"; in normal condition, P,T, A,B blocked; sub-plate mounted; connections via quick disconnects.

Didactic designation	DW5.NV-W
Industrial type	4WMM6E5X/F
Industrial type information	RE 22280
Dimensions	mm L137 x W125 x H182
Weight	kg 2
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W



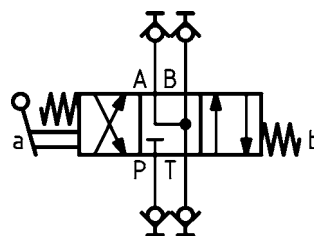
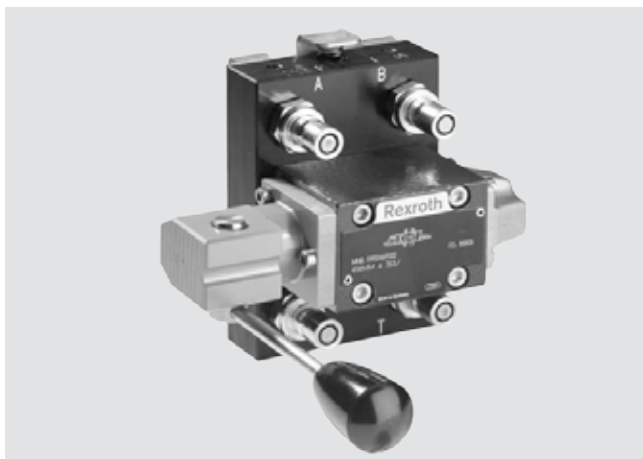
#### 4WMM6J5X 4/3 directional valve

Material no. **R961002510**

4 port, 3 spool position, lever operated, spring centred directional control valve.

Control spool type "J"; in normal condition, P blocked, A-B-T open; sub-plate mounted; connections via quick disconnects.

Didactic designation	DW14.NV-W
Industrial type	4WMM6J5X/F
Industrial type information	RE 22280
Dimensions	mm L137 x W125 x H182
Weight	kg 2
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W



## Components / valves

### Directional control valves - manual operation

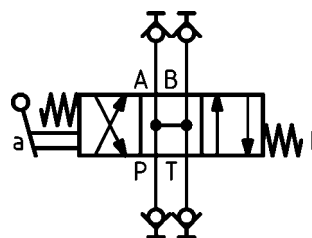
#### 4WMM6H5X 4/3 directional valve

Material no. **R961002511**

4 port, 3 spool position, lever operated, spring centred directional control valve.

Control spool type "H"; in normal condition, P-T-A-B open; sub-plate mounted; connections via quick disconnects.

Didactic designation	DW18.NV-W
Industrial type	4WMM6H5X
Industrial type information	RE 22280
Dimensions	mm L137 x W125 x H182
Weight	kg 2
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W

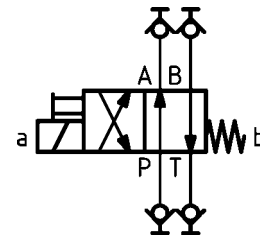


## Components / valves

### Directional control valves - electric operation

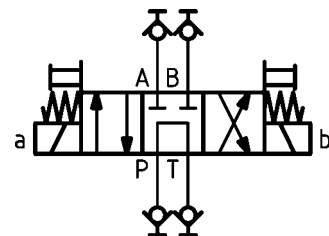
#### 4WE6C6X/ 4/2 directional valve

Material no.	<b>R961002547</b>
4 port, 2 spool position, solenoid operated, spring return directional control valve with concealed manual override	
Control spool type "C"; in normal condition, P-A open, B-T open; sub-plate mounted; connections via quick disconnects.	
Didactic designation	DW3E.NV-W
Industrial type	4WE6C6X/EG24N9K4
Industrial type information	RE 23178
Dimensions	mm L146 x W125 x H98
Weight	kg 2.35
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W
Voltage (DC) V	24
Power consumption	W 30
Switching time (on / off)	ms 25 - 45 / 10 - 25
Recommended accessories:	Mat. no.
Cable (gray connector, for solenoid A)	R900846808



#### 4WE6G6X/ 4/3 directional valve

Material no.	<b>R961002548</b>
4 port, 3 spool position, solenoid operated, spring centred directional control valve with concealed manual override.	
Control spool type "G"; in normal condition, P-T open, A,B blocked; sub-plate mounted; connections via quick disconnects.	
Didactic designation	DW4E.NV-W
Industrial type	4WE6G6X/EG24N9K4
Industrial type information	RE 23178
Dimensions	mm L206 x W125 x H98
Weight	2.9
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W
Voltage (DC) V	24
Power consumption	W 30
Switching time (on / off)	ms 25 - 45 / 10 - 25
Recommended accessories:	Mat. no.
Cable (gray connector, for solenoid A)	R900846808
Cable (black connector, solenoid B)	R900846807



#### 4WE6G6X/ 4/3 directional valve - modified

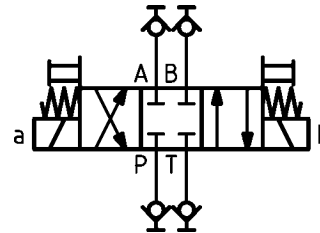
Material no.	<b>R961006551</b>
Modified 4/3 directional valve 4WE6G6X/; the typical features of aging and wear have been simulated.	

## Components / valves

### Directional control valves - electric operation

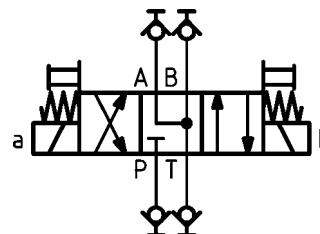
#### 4WE6E6X/ 4/3 directional valve

Material no.	<b>R961002549</b>
4 port, 3 spool position, solenoid operated, spring centred directional control valve with concealed manual override.	
Control spool type "E"; in normal condition, P,T, A,B blocked; sub-plate mounted; connections via quick disconnects.	
Didactic designation	DW13E.NV-W
Industrial type	4WE6E6X/EG24N9K4
Industrial type information	RE 23178
Dimensions	mm L206 x W125 x H98
Weight	kg 2.9
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W
Voltage (DC) V	24
Power consumption	W 30
Switching time (on / off)	ms 25 - 45 / 10 - 25
Recommended accessories:	Mat. no.
Cable (gray connector, for solenoid A)	R900846808
Cable (black connector, solenoid B)	R900846807



#### 4WE6J6X/ 4/3 directional valve

Material no.	<b>R961002554</b>
4 port, 3 spool position, lever operated, spring centred directional control valve.	
Control spool type "J"; in normal condition, P blocked, A-B-T open; sub-plate mounted; connections via quick disconnects.	
Didactic designation	DW10E.NV-W
Industrial type	4WE6J6X/EG24N9K4
Industrial type information	RE 23178
Dimensions	mm L206 x W125 x H98
Weight	kg 2.9
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W
Voltage (DC) V	24
Power consumption	W 30
Switching time (on / off)	ms 25 - 45 / 10 - 25
Recommended accessories:	Mat. no.
Cable (gray connector, for solenoid A)	R900846808
Cable (black connector, solenoid B)	R900846807





## Components / valves

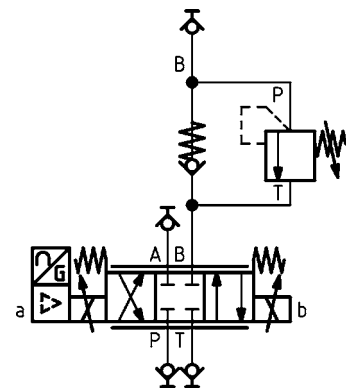
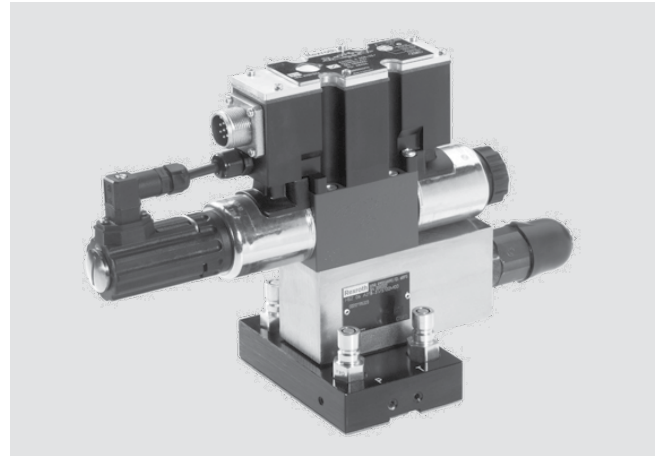
### Directional control valves - Proportional valves with feedback

#### 4WREE6E08-2X/ 4/3 proportional directional valve with integrated electronics and load simulation

Material no. **R961003533**

Direct operated proportional directional valve with electric position feedback and integrated electronics (OBE); control of flow direction and quantity via voltage command input; operation by means of proportional solenoids with central connector and detachable coil; spring-centered spool; load simulation via manually adjustable pressure relief valve affecting the oil returning to port B with reverse bypass check valve; sub-plate mounted; connections via quick disconnects

Didactic designation	DW40-E-D.NV-W
Industrial type	4WREE6E08-2X/G24K31/A1V + HSZ 06 A218
Industrial type information	RE 290618
Dimensions	mm L350 x W125 x H210
Weight	kg 5.9
Mounting type.	Snap-in, grid 50 x 50
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W
Supply voltage (DC) V	24 V
Current consumption max. A	2
Command value input (DC) V	±10 V
Recommended accessories:	Mat. no.
Cable for K31 connector	R961003550

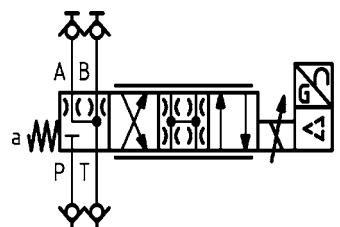


## Components / valves

### Directional control valves - Proportional valves with feedback

#### 4WRPEH6 4/4 directional high-response valve with integrated electronics

Material no.	<b>R961002509</b>
Direct operated high response directional control valve, with control spool and bushing in servo quality; with differential voltage input and fail-safe position in deactivated condition (P blocked, A-B-T open); electric position feedback and integrated electronics (OBE); factory calibrated; subplate mounted; connections via quick disconnects	
Didactic designation	DW38E.NV-W
Industrial type	4WRPEH6C3B04L-2X/G24K0/A1M
Industrial type information	RE 29035
Dimensions	mm L199 x W125 x H150
Weight	kg 4
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W
Supply voltage (DC) V	24
Power consumption max.	W 40
Command value input (DC) V	±10
Connecting plug	6P+P According to E DIN 43563-AM6
Recommended accessories:	Mat. no.
Cable for K31 connector	R961003550

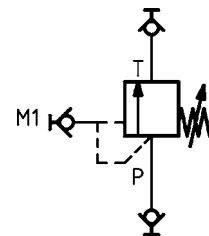
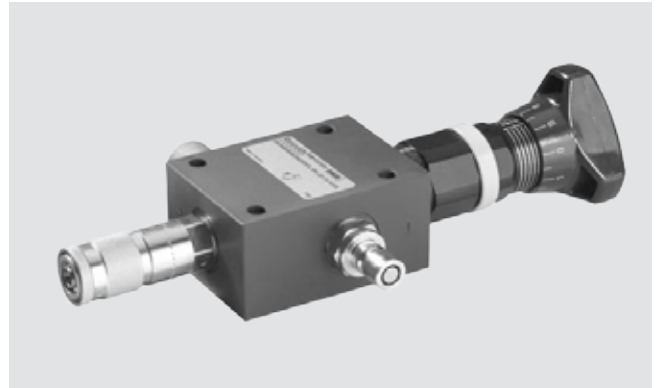


## Components / valves

### Pressure control valves - manual operation

#### DBDH6G1X/100 pressure relief valve

Material no.	<b>R961002520</b>	
Manual adjustment via control knob, subplate mounted; connections via quick disconnects		
Didactic designation	DD1.1N-W	
Industrial type	DBDH6G1X/100	
Industrial type information	RE 25402	
Dimensions	mm	L233 x W126 x H52
Weight	kg	1.8
Operating pressure max.	bar	120
Set pressure	bar	Up to 100
Flow max.	l/min	Approx. 15
Zero leak quick disconnect	Type W	
Type of operation	Manual	

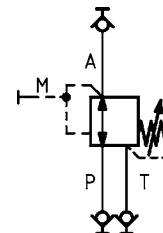
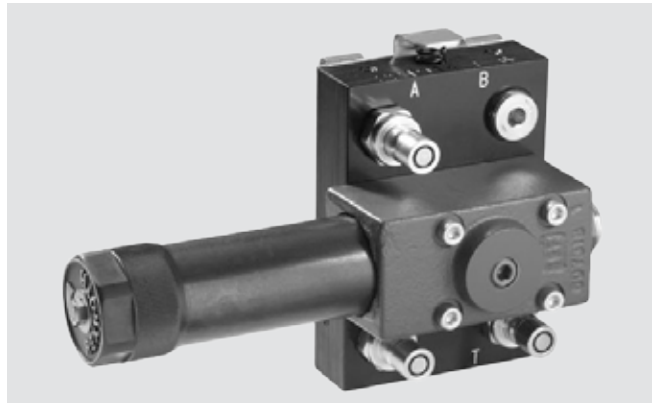


#### DBDH6G1X/100 pressure relief valve - modified

Material no.	<b>R961006549</b>
Modified DBDH6G1X/100 pressure relief valve; the typical features of aging and wear have been simulated.	

#### DR6DP1-5X/75 pressure reducing valve direct operated

Material no.	<b>R961002544</b>	
3-way design with manual adjustment via control knob, without bypass check valve; subplate mounted; connections via quick disconnects		
Didactic designation	DD2.NV-W	
Industrial type	DR6DP1-5X/75YM	
Industrial type information	RE 26564	
Dimensions	mm	L194 x W125 x H84
Weight	kg	2.45
Operating pressure max.	bar	120
Secondary pressure max.	bar	75
Flow max.	l/min	15
Zero leak quick disconnect	Type W	
Type of operation	Manual	

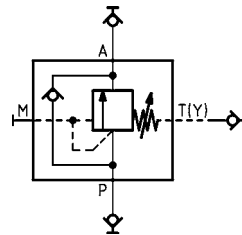


## Components / valves

### Pressure control valves - manual operation

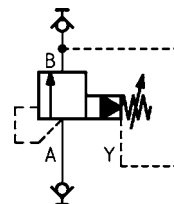
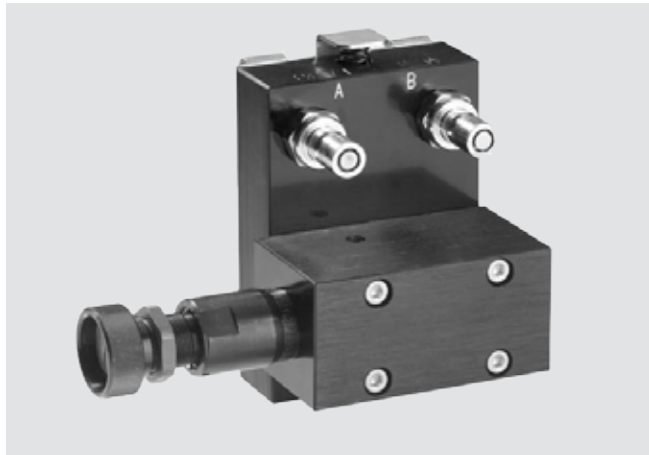
#### DZ6DP1-5X/75 pressure sequence valve direct operated

Material no.	<b>R961002558</b>	
Manual adjustment via control knob, pilot oil supply internal, leakage oil return external, with bypass check valve, sub-plate mounted; connections via quick disconnects		
Didactic designation	DD3.NV-W	
Industrial type	DZ6DP1-5X/75Y	
Industrial type information	RE 26076	
Dimensions	mm	L 197 x W125 x H86
Weight	kg	2.47
Operating pressure max.	bar	120
Sequencing pressure max.	bar	75
Flow max.	l/min	15
Zero leak quick disconnect	Type W	
Type of operation	Manual	



#### DB6K1-4X/50 pressure relief valve pilot operated

Material no.	<b>R961002545</b>	
Manual adjustment via control knob, pilot oil supply internal, pilot oil return internal, subplate mounted; connections via quick disconnects		
Didactic designation	DD4.1NV-W	
Industrial type	DB6K1-4X/50YV	
Industrial type information	RE 25731	
Dimensions	mm	L155 x W125 x H79
Weight	kg	1.5
Operating pressure max.	bar	120
Setting pressure max.	bar	50
Flow max.	l/min	15
Zero leak quick disconnect	Type W	
Type of operation	Manual	



#### DB6K1-4X/50 pressure relief valve pilot operated - modified

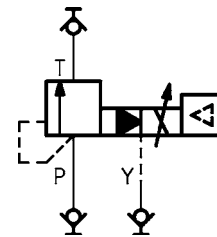
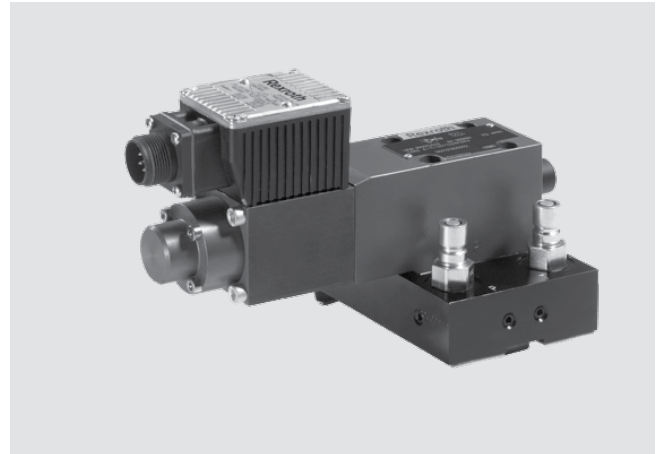
Material no.	<b>R961006550</b>
Modified DBDH6G1X/50 pressure relief valve pilot operated; the typical features of aging and wear have been simulated.	

## Components / valves

### Pressure control valves - Solenoid operation

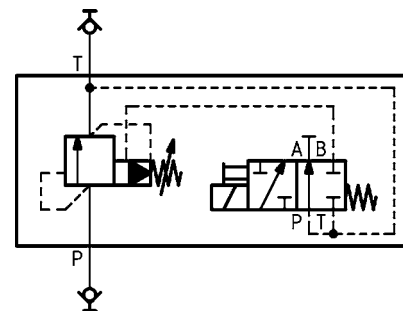
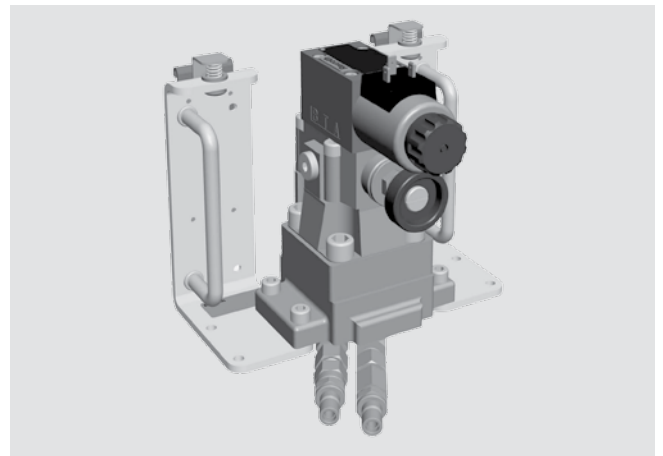
#### DBEE6-1X/50 proportional pressure relief valve

Material no.		<b>R961003924</b>
Pilot operated proportional pressure relief valve, pilot oil supply internal, pilot oil return external; integrated control electronics (OBE) with voltage command value; subplate mounted; connections via quick disconnects		
Didactic designation		DD18E.NV-W
Industrial type		DBEE6-1X/50
Industrial type information		RE 29158
Dimensions	mm	L213 x W125 x H123
Weight	kg	3.45
Operating pressure max.	bar	120
Setting range	bar	50
Hysteresis	%	1.5
Zero leak quick disconnect		Type W
Electrical connection		K31
Contact load max.	mA	1600
Necessary accessories:		Mat. no.                      Length
Connection cable		R961003550              1500 mm



#### DBW10A1-5X/50 pressure relief valve pilot operated

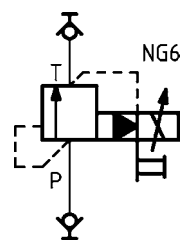
Material no.	<b>R961002553</b>	
Pilot operated pressure relief valve with manual adjustment via control knob and normally closed solenoid venting; with concealed emergency operation; without mating connector; subplate mounted; connections via quick disconnects		
Didactic designation	DD15E.NV-W	
Industrial type	DBW10A1-5X/ 50-6EG24N9K4	
Industrial type information	RE 2802 and RE 23178	
Dimensions	mm	L182 x W190 x H230
Weight	kg	7.45
Operating pressure max.	bar	120
Setting pressure max.	bar	50
Flow max.	l/min	15
Zero leak quick disconnect	Type W	
Voltage type	(DC) V	24
Necessary accessories:	Mat. no.	Length
Connection cable	R900846808	3000 mm



## Components / valves

### Pressure control valves - electric operation

DBE6-1X/50 proportional pressure relief valve			
Material no.		R961002555	
Pilot operated proportional pressure relief valve, pilot oil supply internal, pilot oil return internal for external control electronics; subplate mounted; connections via quick disconnects			
Didactic designation		DD12E.NV-W	
Industrial type		DBE6-1X/50G24NK4M	
Industrial type information		RE 29158	
Dimensions	mm	L222 x W125 x H103	
Weight	kg	3.26	
Operating pressure max.	bar	120	
Setting pressure max.	bar	50	
Pilot flow	l/min	0.6 - 1.2	
Flow max.	l/min	15	
Zero leak quick disconnect		Type W	
Voltage type		Direct voltage	
Control current min.	mA	100	
Control current max.	mA	1600	
Type of operation		Via proportional solenoid	
Necessary accessories:		Mat. no.	Length
Connection cable		R900846808	3000 mm



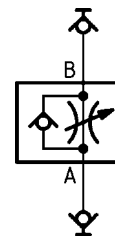
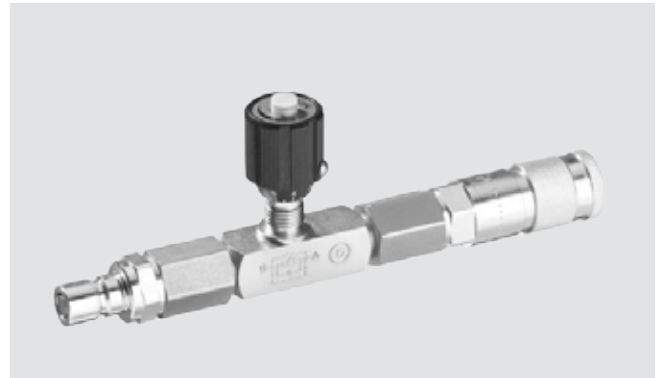
## Components / valves

### Flow control valves - manual operation

DV06-1-1X/V throttle valve	
Material no.	<b>R961002539</b>
With color scale	
Didactic designation	DF1.2N-W
Industrial type	DV06-1-1X/V
Industrial type information	RE 32502
Dimensions	mm L174 x W65 x H24
Weight	kg 0.33
Operating pressure max.	bar 120
Flow max.	l/min 15
Control range	l/min 0 - 15
Zero leak quick disconnect	Type W
Type of operation	Manual



DRV06-1-1X/V throttle check valve	
Material no.	<b>R961002495</b>
With color scale	
Didactic designation	DF2.2N-W
Industrial type	DRV06-1-1X/V
Industrial type information	RE 32502
Dimensions	mm L180 x W65 x H24
Weight	kg 0.35
Operating pressure max.	bar 120
Flow max.	l/min 15
Cracking pressure check valve	bar 0.5
Control range	l/min 0 - 15
Zero leak quick disconnect	Type W
Type of operation	Manual



## Components / valves

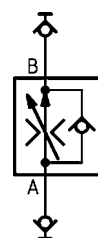
### Flow control valves - manual operation

#### 2FRM6B36-3X/ 2-way flow control valve

Material no. **R961002546**

With lockable rotary knob with scale, without external closing of the pressure compensator; subplate mounted; connections via quick disconnects

Didactic designation	DF3.NV-W
Industrial type	2FRM6B36-3X/10QRV
Industrial type information	RE 28163
Dimensions	mm L80 x W125 x H145
Weight	kg 1.86
Operating pressure max.	bar 120
Cracking pressure check valve	bar 0.7
Zero leak quick disconnect	Type W
Type of operation	Manual

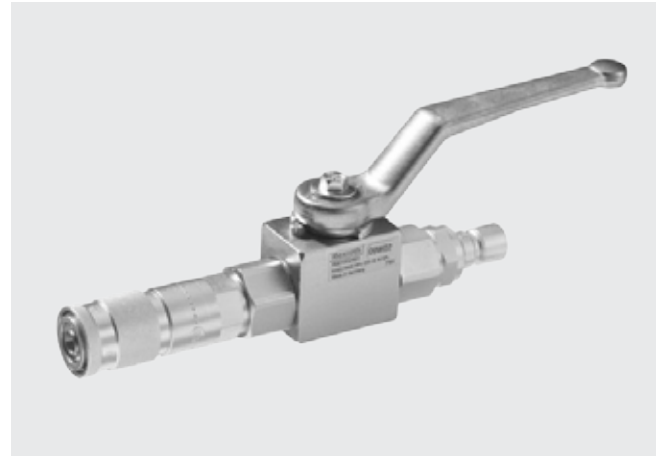




## Components / valves

### Isolator valves - manual operation

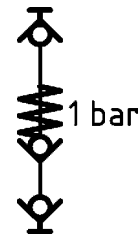
Ball valve		
Material no.		<b>R961002491</b>
Didactic designation		DZ2.1N-W
Industrial type		AB 21-20/G1/4-500
Industrial type information		AB 21-20
Dimensions	mm	L202 x W26 x H76
Weight	kg	0.53
Operating pressure max.	bar	120
Zero leak quick disconnect		Type W



## Components / valves

### Isolator valves - hydraulic operation

S6A1.X check valve		
Material no.	R961002489	
Didactic designation	DS2.1N-W	
Industrial type	S6A1.0/	
Industrial type information	RE 20375	
Dimensions	mm	L150 x D 22
Weight	kg	0.25
Operating pressure max.	bar	120
Cracking pressure	bar	1.0
Flow max.	l/min	approx. 18 l/min with $\Delta p = 7$ bar
Zero leak quick disconnect	Type W	



S6A1.X check valve with hose 630 mm		
Material no.	R961002471	
Didactic designation	DS2.N-W	
Industrial type	S6A1.0/	
Industrial type information	RE 20375	
Dimensions	mm	L1000 x D 22
Weight	kg	0.83
Operating pressure max.	bar	120
Cracking pressure	bar	1.0
Flow max.	l/min	approx. 18 l/min with $\Delta p = 7$ bar
Zero leak quick disconnect	Type W	

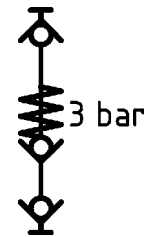


S6A1.X check valve with hose 630 mm - modified	
Material no.	R961006552
Modified S6A1.X check valve with hose 630 mm; the typical features of aging and wear have been simulated.	

## Components / valves

### Isolator valves - hydraulic operation

S6A3.X check valve		
Material no.	R961002522	
Didactic designation	DS3.1N-W	
Industrial type	S6A3.0/	
Industrial type information	RE 20375	
Dimensions	mm	L150 x D 22
Weight	kg	0.26
Operating pressure max.	bar	120
Cracking pressure	bar	3.0
Flow max.	l/min	approx. 18 l/min with $\Delta p = 9$ bar
Zero leak quick disconnect	Type W	



S6A3.X check valve with hose 630 mm		
Material no.	R961002472	
Didactic designation	DS3.N-W	
Industrial type	S6A3.0/	
Industrial type information	RE 20375	
Dimensions	mm	L1000 x D 22
Weight	kg	0.83
Operating pressure max.	bar	120
Cracking pressure	bar	3.0
Flow max.	l/min	approx. 18 l/min with $\Delta p = 9$ bar
Zero leak quick disconnect	Type W	

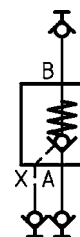


## Components / valves

### Isolator valves - hydraulic operation

#### S 6 PB1-6X/ check valve pilot operated

Material no.	<b>R961002513</b>	
Without external drain		
Didactic designation	DS1.1NV-W	
Industrial type	SV6PB1-6X/	
Industrial type information	RE 21460	
Dimensions	mm	L85 x W125 x H81
Weight	kg	1.73
Operating pressure max.	bar	120
Cracking pressure	bar	1.5
Flow max.	l/min	15
Zero leak quick disconnect	Type W	
Type of operation	Hydraulic	



## Components / actuators

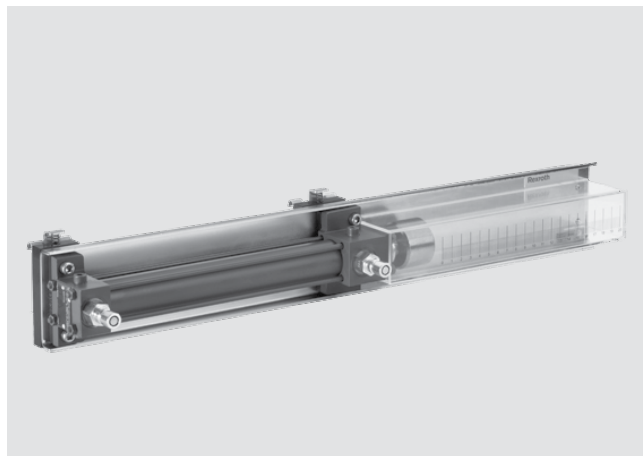
### Cylinders

#### CD70F25/16-200 single-rod cylinder with protective housing

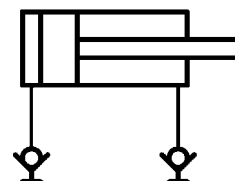
Material no. **R961003494**

Tie rod design with foot mounting and cam on the piston rod, complete with protective cover and provision for mounting proximity switches, without end position cushioning; connections via quick disconnects

Didactic designation	ZY1.6N-W
Industrial type	CD70F25/16-200Z11/01HCUM11T
Industrial type information	RE 17016
Dimensions	mm L560 x W90 x H100
Weight	kg 3.9
Mounting type.	Snap-in, grid 50 x 50
Operating pressure, max.	bar 105
Zero leak quick disconnect	Type W
Piston diameter	mm 25
Piston rod diameter	mm 16
Piston ratio	1.6:1
Stroke	mm 200



ø25/16x200



#### CD70F25/16-400 single-rod cylinder with protective housing

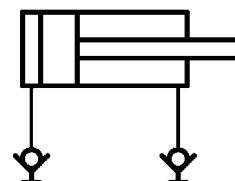
Material no. **R961003495**

Tie rod design with foot mounting and cam on the piston rod, complete with protective cover and provision for mounting proximity switches, without end position cushioning; connections via quick disconnects

Didactic designation	ZY1.7N-W
Industrial type	CD70F25/16-400Z11/01HCUM11T
Industrial type information	RE 17016
Dimensions	mm L960 x W90 x H100
Weight	kg 5.55
Mounting type.	Snap-in, grid 50 x 50
Operating pressure, max.	bar 105
Zero leak quick disconnect	Type W
Piston diameter	mm 25
Piston rod diameter	mm 16
Piston ratio	1.6:1
Stroke	mm 400



ø25/16x400

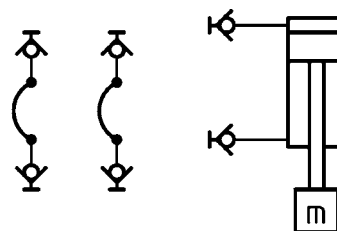


## Components / actuators

### Cylinders

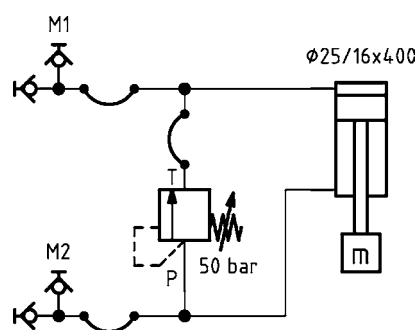
#### Load simulator, 15 kg, rotatable 180°

Material no.	<b>R961000187</b>	
Intended for attachment to side of DS4 trainer; including 2 hose lines with 90° fitting 2 m long; complete with safety mounting, protective cover and provision for mounting proximity switches, without end position cushioning; connections via quick disconnects		
Didactic designation	-	
Industrial type	CD70P25/16-200Z11	
Industrial type information	RE 17016	
Dimensions	mm	L1000 x W250 x H250
Weight	kg	31
Mounting type	Fixed via bolts	
Operating pressure, max.	bar	105
Zero leak quick disconnect	Type	W
Piston diameter	mm	25
Piston rod diameter	mm	16
Stroke	mm	200
Load weight	kg	15



#### Vertical loading unit, 80 kg

Material no.	R961004005	
For simulating the dynamic features of hydraulic systems with positive and negative inertial forces.		
Stand alone heavy vertical load unit with weight attached to the cylinder as an overrunning load and external load via a spring. Four-quadrant operation is therefore possible. Complete with protective cover, Mounting rail for proximity switches and linear rail to accept radial forces; connections via quick disconnects		
Didactic designation	-	
Industrial type	CD70H25/16 + DBDS6G1X/50	
Industrial type information	RE 17016 + RE 25402	
Dimensions	mm	L445 x W445 x H1400
Weight	kg	150
Mounting type.	Stand-alone	
Operating pressure, max.	bar	105
Zero leak quick disconnect	Type	W
Cylinder stroke	mm	400
Load weight	kg	80
Load spring	kN	2.5
Load stroke against load spring	mm	80
Loading force at 50 bar	kN	2.45
Cylinder, low-friction, ports G3/8"	25/16/400	



## Components / actuators

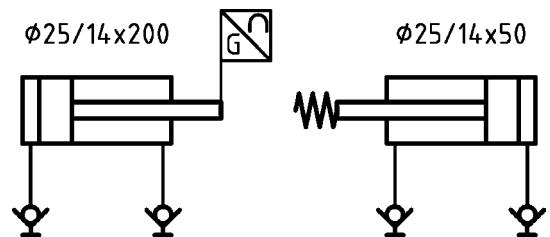
### Cylinders

#### Horizontal loading unit

Material no. **R961004486**

For simulating the principle features of open and closed loop positioning systems. The axis contains a cylinder with position feedback which may be moved against an opposing force cylinder and a damper. The force exerted by the loading cylinder can be varied by means of a pressure reducing valve while the damper prevents a metallic impact. A standardized measuring cable transducer provides analog position feedback. A ruler for visual indication of position, a protective cover, provision for mounting proximity switches and a guide for accepting radial forces are also included

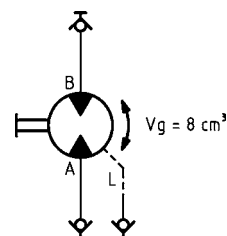
Didactic designation	-	
Industrial type	CYL1MF3/25/14/200 + CYL1MF3/25/14/50	
Dimensions	mm	L703 x W120 x H120
Weight	kg	6.3
Mounting type.	Grid mounting (50x50)	
Operating pressure, max.	bar	120
Zero leak quick disconnect	Type W	
Controlled stroke	mm	200
Load stroke	mm	50
Loading force at 50 bar, max.	kN	2.45 (hydr. adjustable)
Position-controlled cylinder	25/14/200	
Load cylinder	25/14/50	
Measuring travel	Standardized	600 mm = 10 V
transducer, output		



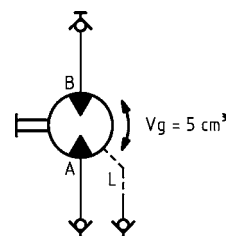
## Components / actuators

### Hydraulic motors

Gear motor		
Material no.		R961004259
Bi-directional with external drain connection and safety guard		
Didactic designation		DM8
Industrial type		AZMF-12-008
Industrial type information		RE 14026
Dimensions	mm	L250 x W220 x H160
Weight	kg	5.9
Mounting type		Snap-in, grid 50 x 50
Operating pressure max.	bar	120
Zero leak quick dis-connect	Type	W
Max. speed	1/min	1000
Displacement	cm <sup>3</sup>	8
Oil flow max.	l/min	8



Axial piston unit		
Material no.		R961002811
Bi-directional axial piston motor with safety guard		
Didactic designation		DM2.1N-W
Industrial type		A2F5/60W-C3
Industrial type information		RE 91001
Dimensions	mm	L130 x W230 x H205
Weight	kg	5.2
Mounting type		Snap-in, grid 50 x 50
Operating pressure max.	bar	120
Zero leak quick disconnect	Type	W
Max. speed	1/min	10 000
Displacement	cm <sup>3</sup>	4.93
Oil flow max.	l/min	49



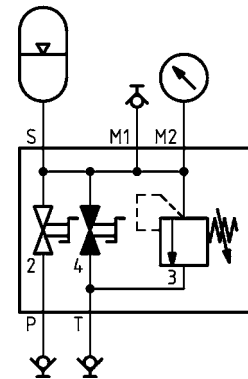


## Components / hydraulic accessories

### Hydraulic accumulators, pressure filters

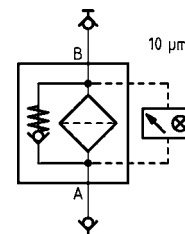
#### Hydraulic diaphragm-type accumulator with isolation valving for grid mounting

Material no.	<b>R961002503</b>
Diaphragm design, manual unloading, with pre-set/locked pressure relief valve	
Didactic designation	DZ3.2N-W
Industrial type: Accumulator	HAD 0,7-350-1X
Industrial type: Safety block	ABZSS10M-2X/100B/S30V
Industrial type information	Accumulator: AB 42-01
Industrial type information	Safety block: RE 50131
Dimensions	mm L225 x W165 x H350
Weight	kg 9.9
Nominal pressure	bar 100
Pressure rating	bar 100
Nominal volume	l 0.75
Zero leak quick disconnect	Type W



#### Line mounted filter

Material no.	<b>R961004334</b>
For installation in pressure lines, with bypass valve and visual clogging indicator	
Didactic designation	DZ8.N-W
Industrial type	ABZFD-S0040-10N-100-1X/M-A
Industrial type information	RE 50076
Dimensions	mm L167 x W108 x H218
Weight	kg 2.1
Nominal pressure	bar 100
Series	40
Filter rating	$\mu$ 10
Displacement	l/min 350
Zero leak quick disconnect	Type W



## Components / hydraulic accessories

### Manifolds

#### Hydraulic distributor for grid mounting

Material no. **R961002563**

Four connections for grid mounting

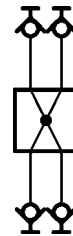
Didactic designation **DZ4.NV-W**

Dimensions mm L80 x W125 x H64

Weight kg 0.97

Operating pressure max. bar 120

Zero leak quick disconnect Type W



#### Hydraulic distributor for line mounting

Material no. **R961002485**

Four connections for line mounting

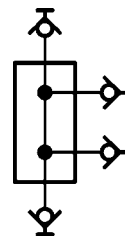
Didactic designation **DZ4.2N-W**

Dimensions mm L168 x W45 x H80

Weight kg 0.63

Operating pressure max. bar 120

Zero leak quick disconnect Type W

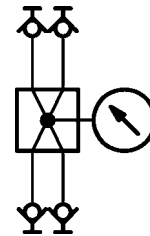


## Components / hydraulic accessories

### Manifolds

**Pressure gauge 0 to 100 bar with distributor, for grid mounting**

Material no.	<b>R961002530</b>
Four connections with pressure gauge	
Didactic designation	DZ1.N-W
Dimensions	mm L80 x B 125 x H91
Weight	kg 1.15
Operating pressure max.	bar 120
Zero leak quick disconnect	Type W



## Components / hydraulic accessories

### Pressure gauges

#### Pressure gauge 0 to 60 bar with measuring hose

Material no.	<b>R961003403</b>		
With mounting clip, 63 mm diameter, 5 bar scaling			
Didactic designation	DZ1.6		
Dimensions <sup>1)</sup>	mm	L63 x W56 x H147	
Weight	kg	0.45	
Pressure range	bar	0 - 60	
Included in the scope of delivery:	Mat. no.	Length	
Measuring hose	R900083425	1000 mm	

#### Pressure gauge 0 to 100 bar with measuring hose

Material no.	R961002715		
With mounting clip, 63 mm diameter, 5 bar scaling			
Didactic designation	DZ1.4		
Dimensions <sup>1</sup>	mm	L63 x W56 x H147	
Weight	kg	0.45	
Pressure range	bar	0 - 100	
Included in the scope of delivery:	Mat. no.	Length	
Measuring hose	R900083425	1000 mm	

#### Pressure gauge 0 to 160 bar with measuring hose

Material no.	<b>R961002720</b>	
With mounting clip, 63 mm diameter, 5 bar scaling		
Didactic designation	DZ1.5	
Dimensions <sup>1</sup>	mm	L63 x W56 x H147
Weight	kg	0.45
Pressure range	bar	0 - 160
Included in the scope of delivery:	Mat. no.	Length
Measuring hose	R900083425	1000 mm

<sup>1)</sup> without measuring hose



## Components / hydraulic accessories

### Pressure gauges

Measuring hose 1000 mm		
Material no.		<b>R900083425</b>
Didactic designation		MSK
Weight	kg	0.1
Hose length	mm	1000
Max. pressure	bar	630
Measuring hose 2000 mm		
Material no.		<b>R900054614</b>
Didactic designation		MSL
Weight	kg	0.2
Hose length	mm	2000
Max. pressure	bar	630



Clamp holder for grid system		
Material no.		<b>R961003498</b>
For mounting the pressure gauge at the grid		
Dimensions	mm	L55 x W44 x H110
Weight	kg	0.130



## Components / hydraulic accessories

### Hose lines with quick disconnect couplings

Hose line 630 mm		
Material no.	<b>R961002474</b>	
Didactic designation	VSK1.N-W	
Dimensions	mm	L760 x D 22
Min. bending radius	mm	85
Hose length	mm	630
Weight	kg	0.64
Operating pressure, max.	bar	120
Zero leak quick disconnect	R96100481	Socket M16x1.5

Hose line 1000 mm		
Material no.	<b>R961002475</b>	
Didactic designation	VSL1.N-W	
Dimensions	mm	L1130 x D 22
Min. bending radius	mm	85
Hose length	mm	1000
Weight	kg	0.74
Operating pressure, max.	bar	120
Zero leak quick disconnect	R96100481	Socket M16x1.5

Hose line 1500 mm		
Material no.	<b>R961002473</b>	
Didactic designation	VSL2.N-W	
Dimensions	mm	L1630 x D 22
Min. bending radius	mm	85
Hose length	mm	1500
Weight	kg	0.86
Operating pressure, max.	bar	120
Zero leak quick disconnect	R96100481	Socket M16x1.5

Hose line 2000 mm		
Material no.	<b>R961002480</b>	
Didactic designation	VSL3.N-W	
Dimensions	mm	L2130 x D 22
Min. bending radius	mm	85
Hose length	mm	2000
Weight	kg	0.95
Operating pressure, max.	bar	120
Zero leak quick disconnect	R96100481	Socket M16x1.5

Hose line 2500 mm		
Material no.	<b>R961002479</b>	
Didactic designation	VSL4.N-W	
Dimensions	mm	L2630 x D 22
Min. bending radius	mm	85
Hose length	mm	2500
Weight	kg	1.12
Operating pressure, max.	bar	120
Zero leak quick disconnect	R96100481	Socket M16x1.5



## Components / hydraulic accessories

### Hose lines with quick disconnect couplings

Hose line 630 mm with minimess connection	
Material no.	<b>R961002481</b>
Didactic designation	DZ25.3N-W
Min. bending radius	mm 85
Hose length	mm 630
Weight	kg 0.83
Operating pressure, max.	bar 120
Minimess connection	AB20-11/K1 G1/4 hose coupling
Zero leak quick disconnect	R96100481 Socket M16x1.5
Hose line 1000 mm with minimess connection	
Material no.	<b>R961002476</b>
Didactic designation	DZ25.1N-W
Min. bending radius	mm 85
Hose length	mm 1000
Weight	kg 0.93
Operating pressure, max.	bar 120
Minimess connection	AB20-11/K1 G1/4 hose coupling
Zero leak quick disconnect	R96100481 Socket M16x1.5
Hose line 1500 mm with minimess connection	
Material no.	<b>R961002482</b>
Didactic designation	DZ25.4N-W
Min. bending radius	mm 85
Hose length	mm 1500
Weight	kg 1.05
Operating pressure, max.	bar 120
Minimess connection	AB20-11/K1 G1/4 hose coupling
Zero leak quick disconnect	R96100481 Socket M16x1.5
Hose line 2000 mm with minimess connection	
Material no.	<b>R961002478</b>
Didactic designation	DZ25.2N-W
Min. bending radius	mm 85
Hose length	mm 2000
Weight	kg 1.18
Operating pressure, max.	bar 120
Minimess connection	AB20-11/K1 G1/4 hose coupling
Zero leak quick disconnect	R96100481 Socket M16x1.5



## Components / hydraulic accessories

### Hose lines with quick disconnect couplings

Hose line 700 mm with 90° fitting		
Material no.	<b>R961004332</b>	
Didactic designation	VSK1.N-W	
Min. bending radius	mm	85
Hose length	mm	700
Weight	kg	0.68
Operating pressure, max.	bar	120
Zero leak quick disconnect	R961000481 Socket M16x1.5	

Hose line 1000 mm with 90° fitting		
Material no.	<b>R961004331</b>	
Didactic designation	VSL1.1N-W	
Min. bending radius	mm	85
Hose length	mm	1000
Weight	kg	0.75
Operating pressure, max.	bar	120
Zero leak quick disconnect	R961000481 Socket M16x1.5	

Hose line 2000 mm with 90° fitting		
Material no.	<b>R961002477</b>	
Didactic designation	VSL3.1N-W	
Min. bending radius	mm	85
Hose length	mm	2000
Weight	kg	1.08
Operating pressure, max.	bar	120
Zero leak quick disconnect	R961000481 Socket M16x1.5	



Hose line 700 mm with 90° fitting and minimes connection		
Material no.	<b>R961004329</b>	
Didactic designation	DZ-W	
Min. bending radius	mm	85
Hose length	mm	700
Weight	kg	0.68
Operating pressure, max.	bar	120
Minimes connection	AB20-11/K1 G1/4 hose coupling	
Zero leak quick disconnect	R961000481 Socket M16x1.5	

Hose line 1000 mm with 90° fitting and minimes connection		
Material no.	<b>R961004330</b>	
Didactic designation	DZ-W	
Min. bending radius	mm	85
Hose length	mm	1000
Weight	kg	0.75
Operating pressure, max.	bar	120
Minimes connection	AB20-11/K1 G1/4 hose coupling	
Zero leak quick disconnect	R961000481 Socket M16x1.5	





## Components / hydraulic accessories

### Working equipment, spare parts

#### Tool set for hydraulics

Material no.	<b>R900865138</b>
Consisting of:	
Double open-ended wrench 10 x 11; 12 x 13; 14 x 17; 18 x 19	
Screwdriver 0.7 x 4.0; 0.95 x 5.5	
Phillips screwdriver	
Allen wrench 2.5; 3.0; 4.0; 6.0	
Didactic designation	Z2
Dimensions	L300 x W90 x H90
Weight	kg 1.0



#### Cleaning roll trolley

Material no.	<b>R900833872</b>
Consisting of:	
Moveable cleaning roll trolley	
Litter bin with cover 40 L	
Binding agent	
Wipes	
Rubbish sacks	
Dimensions	L700 x W500 x H450
Didactic designation	Z3
Weight	kg 35.0



#### Mininess threaded coupling G1/4

Material no.	<b>R900009090</b>
With screw-in stud G 1/4 A	
Didactic designation	AB 20-11/K1
Dimensions	L46 x D 22
Weight	kg 0.1
Max. pressure	bar 630



## Components / hydraulic accessories

### Working equipment, spare parts

#### Pressure relief socket

Material no.	R961002927	
For relieving trapped pressures		
Didactic designation	DRK	
Dimensions	mm	L79 x D 50
Weight	kg	0.19



#### Coupling connector G1/4"

Material no.	<b>R961000482</b>	
Dimensions	mm	L41 x D 21
Wrench size	mm	19
Weight	kg	0.036
Connection thread	G 1/4 A	
Operating pressure, max.	bar	120



#### Zero leak quick disconnect G 1/4"

Material no.	<b>R961000480</b>	
Dimensions	mm	L68 x D 22
Wrench size	mm	19
Weight	kg	0.17
Connection thread	G 1/4 A	
Operating pressure, max.	bar	120



#### Zero leak quick disconnect M16 x 1.5

Material no.	<b>R961000481</b>	
Dimensions	mm	L66 x D 22
Wrench size	mm	19
Weight	kg	0.17
Connection thread	M16 x 1.5	
Operating pressure, max.	bar	120



#### Hydraulic oil RSL22 1 kg

Material no.	<b>R900019287</b>	
The material number corresponds to 1 kg oil. One delivery unit comprises 18 kg oil in a can with a volume of 20 l. Information on safety certificate regarding the oil see: <a href="#">www.avi</a> Product trade name: AVIA Fluid RSL22		
Dimensions	mm	L250 x W250 x H400
Weight	kg	19
Contents	l	20



## Components / hydraulic accessories

### Working equipment, spare parts

Filling and testing device for hydraulic accumulators		
Material no.		<b>R900001439</b>
For filling and testing the hydraulic accumulator		
Didactic designation		FPU
Dimensions	mm	L450 x W350 x H100
Weight	kg	3.15
Pressure gauge display range	bar	0 - 250

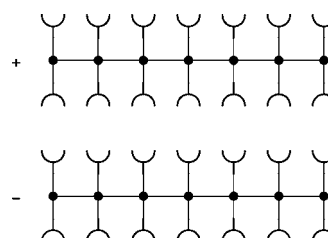


## Components / electrical components

### Operating modules in 19 inch installation technology

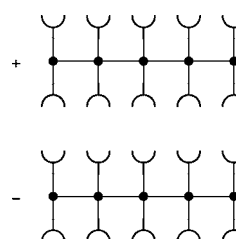
#### BPS13.1 operating module, distributor 1:13, 21TE

Material no.	R900897345	
Distribution terminals for 0 VDC and 24 VDC, red sockets for 24 V are interconnected and the blue sockets for 0 V are interconnected.		
For installation into 19" frame rack; contact safe 4 mm laboratory sockets.		
Didactic designation		BPS 13.1
Dimensions	mm	L107 x W41 x H129
Weight	kg	0.28
Mounting type		Screwed
Division grid, rack		3HE, 21TE
Operating voltage	(DC) V	24
Current per socket, max.	(DC) A	8
Connected sockets red (+)	Pcs	14
Connected sockets blue (+)	Pcs	14
Protection class	IEC 60529	IP50



#### TS-BPS13.1 operating module, distributor 1:9, 15TE

Material no.	<b>R961004910</b>	
Distribution terminals for 0 VDC and 24 VDC, red sockets for 24 V are interconnected and the blue sockets for 0 V are interconnected.		
For installation into 19" frame rack; contact safe 4 mm laboratory sockets.		
Didactic designation		BPS13.1
Dimensions	mm	L76 x W36 x H129
Weight	kg	0.136
Mounting type		Screwed
Division grid, rack		3HE, 15TE
Operating voltage	(DC) V	24
Current per socket, max.	(DC) A	8
Connected sockets red (+)	Pcs	10
Connected sockets blue (+)	Pcs	10
Protection class	IEC 60529	IP50



## Components / electrical components

### Operating modules in 19 inch installation technology

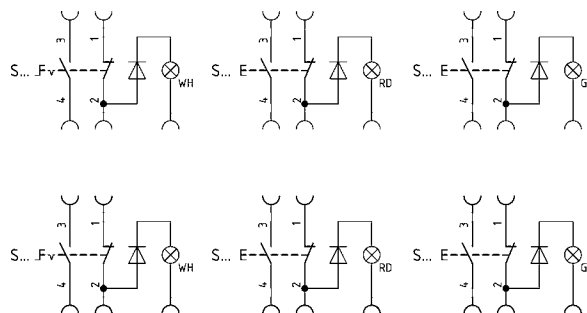
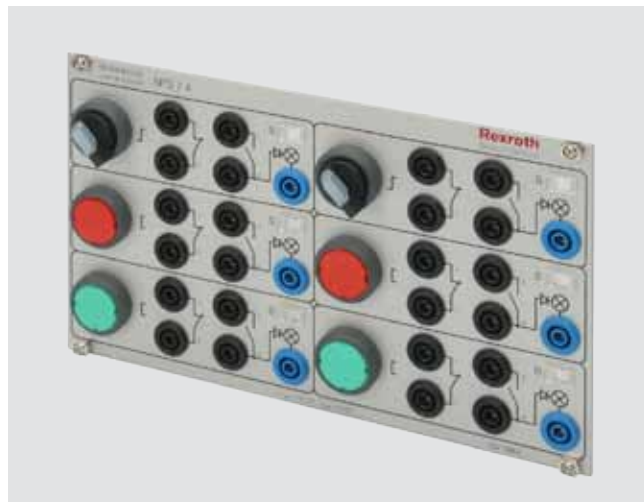
#### BPS7.4 operating module, switch-button, 42TE

Material no. **R900719908**

2x "switch-button group", contains two sets of the following:  
1 detented rotary switch with 1 NC and NO contact; 2 light-  
ed pushbuttons with spring return and 1 NC and 1 NO con-  
tact each.

For installation into 19" frame rack; contact safe 4 mm labo-  
ratory sockets.

Didactic designation	BPS7.4
Dimensions	mm L212 x W67 x H129
Weight	kg 0.43
Mounting type	Screwed
Division grid, rack	3HE, 42TE
Operating voltage (DC) V	24
Switching current, max. (DC) A	5
Protection class IEC 60529	IP50



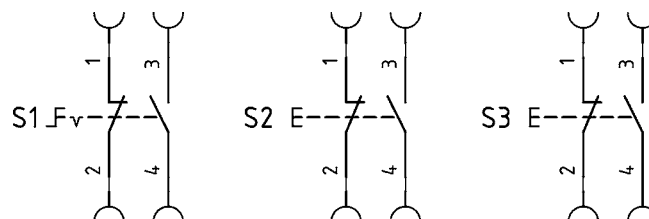
#### TS-BPS7.4 operating module, switch-button, 15TE

Material no. **R961004909**

1 detented rotary switch with 1 NC and NO contact; 2 light-  
ed pushbuttons with spring return and 1 NC and 1 NO con-  
tact each.

For installation into 19" frame rack; contact safe 4 mm labo-  
ratory sockets.

Didactic designation	BPS7.4
Dimensions	mm L76 x W36 x H129
Weight	kg 0.136
Mounting type	Screwed
Division grid, rack	3HE, 15TE
Operating voltage (DC) V	24
Contact load. (DC) A	4
Protection class IEC 60529	IP50



## Components / electrical components

### Operating modules in 19 inch installation technology

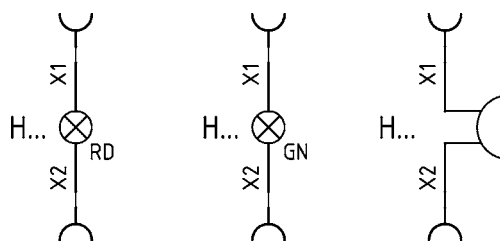
#### BPS8.1 operating module, signal display, visual/audible 21TE

Material no. **R900897341**

Visual and audible signal unit; display module with 1 x green LED, 1 x red LED; 1 x buzzer.

For installation into 19" frame rack; contact safe 4 mm laboratory sockets.

Didactic designation	BPS8.1
Dimensions	mm L107 x W55 x H129
Weight	kg 0.162
Mounting type	Screwed
Division grid, rack	3HE, 21TE
Operating voltage	(DC) V 24
Current consumption LED	mA 20
Current consumption buzzer	mA 10
Protection class	IEC 60529 IP50



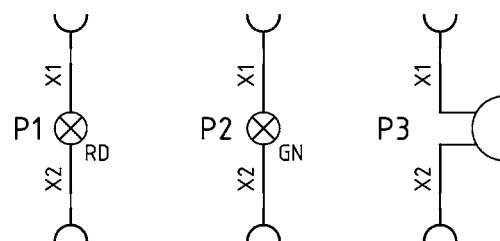
#### TS-BPS8.1 operating module, signal display, visual/audible 15TE

Material no. **R961004911**

Visual and audible signal unit; display module with 1 x green LED, 1 x red LED; 1 x buzzer.

For installation into 19" frame rack; contact safe 4 mm laboratory sockets.

Didactic designation	BPS8.1
Dimensions	mm L76 x W36 x H129
Weight	kg 0.136
Mounting type	Screwed
Division grid, rack	3HE, 15TE
Operating voltage	(DC) V 24
Current consumption LED	mA 20
Current consumption buzzer	mA 10
Protection class	IEC 60529 IP50



## Components / electrical components

### Operating modules in 19 inch installation technology

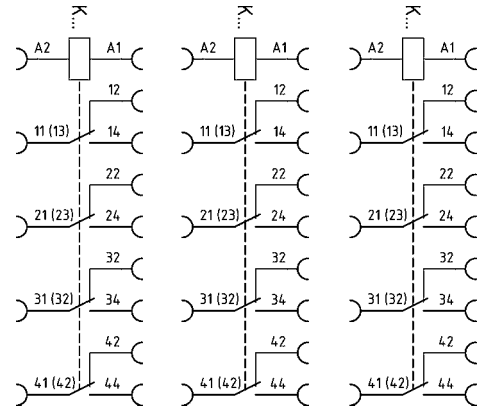
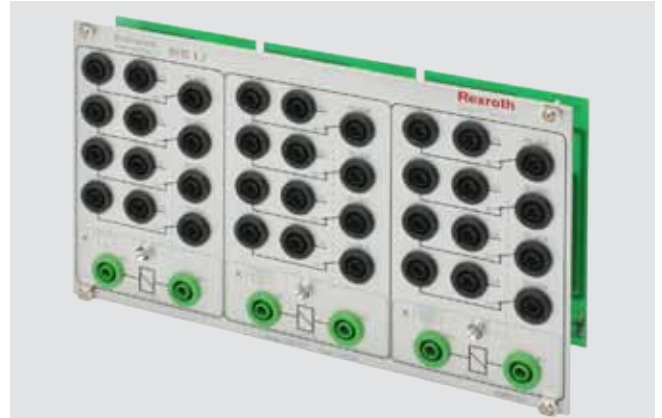
#### BRS1.2 operating module, 3 x relay, 42TE

Material no. **R900897337**

Relay group with 3 relays, with 4 changeover contacts each; control light is illuminated in switched condition.

For installation into 19" frame rack; contact safe 4 mm laboratory sockets.

Didactic designation	BRS1.2
Dimensions	mm L214 x W82 x H129
Weight	kg 0.63
Mounting type	Screwed
Division grid, rack	3HE, 42TE
Operating voltage (DC) V	24
Response voltage (DC) V	18
Dropout voltage (DC) V	1.2
Continuous current A	5
Protection class IEC 60529	IP50



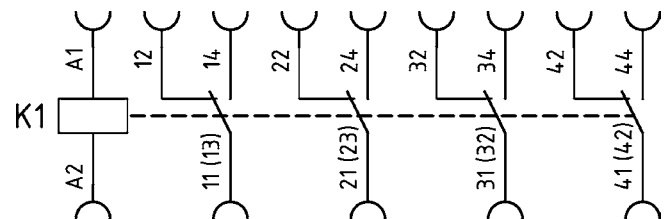
#### TS-BRS1.2 operating module, 1 x relay, 15TE

Material no. **R961004908**

Relay module relay, with 4 changeover contacts each; control light is illuminated in switched condition.

For installation into 19" frame rack; contact safe 4 mm laboratory sockets.

Didactic designation	BRS1.2
Dimensions	mm L76 x W42 x H129
Weight	kg 0.145
Mounting type	Screwed
Division grid, rack	3HE, 15TE
Operating voltage (DC) V	24
Response voltage (DC) V	18
Dropout voltage (DC) V	1.2
Continuous current (DC) V	4
Protection class IEC 60529	IP50





## Components / electrical components

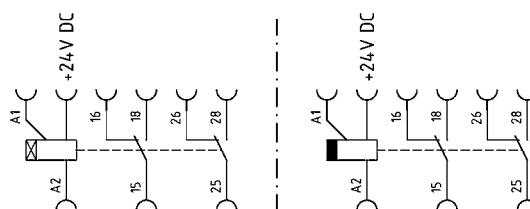
### Operating modules in 19 inch installation technology

#### BRS2.1 operating module, time relay, 21TE

Material no.	R900897346		
Relay with 1 NO contact and 1 NC contact; optionally switching for delay on or delay off; delay time can be steplessly adjusted, control light is illuminated in switched condition.			
For installation into 19" frame rack; contact safe 4 mm laboratory sockets.			
Didactic designation		BRS 2.1	
Dimensions	mm	L107 x W72 x H129	
Weight	kg	0.250	
Mounting type		Screwed	
Division grid, rack		3HE, 21TE	
Operating voltage	(DC) V	24	
Switching voltage	(DC) V	24	
Delay time	s	0 - 10	
Switching current max.	(DC) A	5	
Protection class	IEC 60529	IP50	



umschaltbar  
switchable

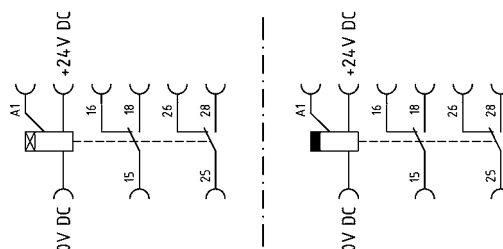


#### TS-BRS2.1 operating module, time relay, 15TE

Material no.	R961004561		
Relay with 1 NO contact and 1 NC contact; optionally switching for delay on or delay off; delay time can be steplessly adjusted, control light is illuminated in switched condition.			
For installation into 19" frame rack; contact safe 4 mm laboratory sockets.			
Didactic designation		BRS2.1	
Dimensions	mm	L76 x W50 x H129	
Weight	kg	0.156	
Mounting type		Screwed	
Division grid, rack		3HE, 15TE	
Operating voltage	(DC) V	24	
Current consumption relay	mA	80	
Switching voltage	(DC) V	24	
Delay time	s	0 - 10	
Switching current with DC 24 V max.	(DC) A	2	
Protection class	IEC 60529	IP50	



umschaltbar  
switchable





## Components / electrical components

### Operating modules in 19 inch installation technology

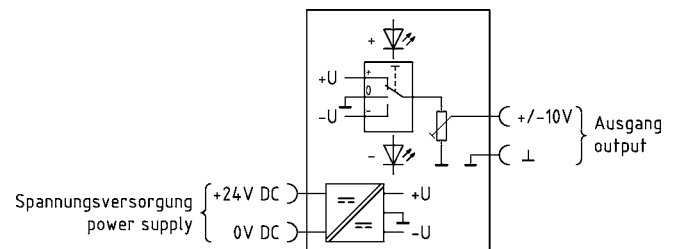
#### BPS5.2 operating module, command value $\pm 10$ V, 21TE

Material no. **R961001957**

With 3 position rotary switch and 10 turn potentiometer with scale; visual signal for selected polarity.

For installation into 19" frame rack; contact safe 4 mm laboratory sockets.

Didactic designation	BPS5.2
Dimensions	mm L107 x W60 x H129
Weight	kg 0.190
Mounting type	Screwed
Division grid, rack	3HE, 21TE
Operating voltage (DC) V	24
Output voltage (zero-potential) V	$\pm 10$
Protection class IEC 60529	IP50



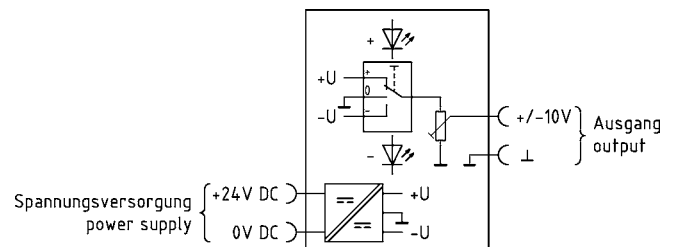
#### TS-BPS5.2 operating module, command value $\pm 10$ V, 30TE

Material no. **R961004898**

With 3 position rotary switch and 10 turn potentiometer with scale; visual signal for selected polarity.

For installation into 19" frame rack; contact safe 4 mm laboratory sockets.

Didactic designation	BPS5.2
Dimensions	mm L153 x W55 x H129
Weight	kg 0.221
Mounting type	Screwed
Division grid, rack	3HE, 30TE
Operating voltage (DC) V	24
Output voltage (zero-potential) V	$\pm 10$
Protection class IEC 60529	IP50



## Components / electrical components

### Operating modules in 19 inch installation technology

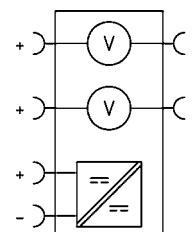
#### BPS6.1 operating module, command/actual value display, 21TE

Material no. **R900711665**

2x isolated input digital voltmeters with 3 ½ display figures; figure height 13 mm.

For installation into 19" frame rack; contact safe 4 mm laboratory sockets.

Didactic designation	BPS6.1
Dimensions	mm L107 x W103 x H129
Weight	kg 0.255
Mounting type	Screwed
Division grid, rack	3HE, 21TE
Operating voltage	(DC) V 24
Measuring voltage max.	(DC) V +/-20
Internal resistance	M Ω 1
Protection class	IEC 60529 IP50



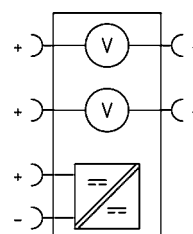
#### TS-BPS6.1 operating module, command/actual value display, 30TE

Material no. **R961004913**

2x isolated input digital voltmeters with 3 ½ display figures; figure height 13 mm.

For installation into 19" frame rack; contact safe 4 mm laboratory sockets.

Didactic designation	BPS6.1
Dimensions	mm L153 x W82 x H129
Weight	kg 0.325
Mounting type	Screwed
Division grid, rack	3HE, 30TE
Operating voltage	(DC) V 24
Measuring voltage max.	(DC) V +/-20
Internal resistance	M Ω 1
Protection class	IEC 60529 IP50

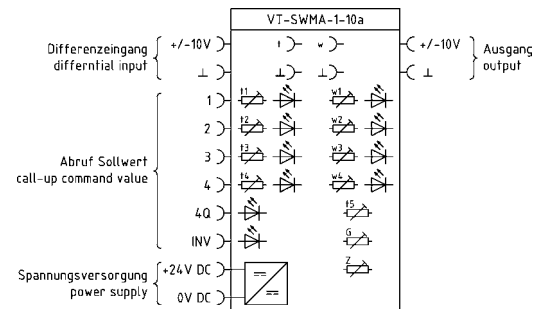


## Components / electrical components

### Operating modules in 19 inch installation technology

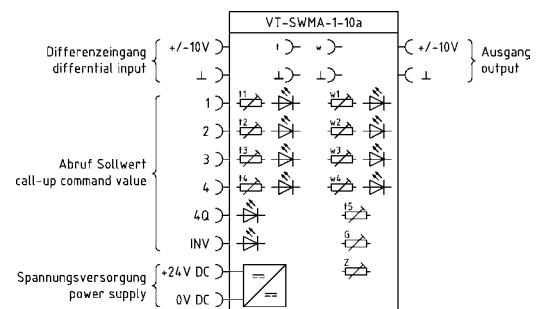
#### BPS20 operating module, command value generation, 21TE

Material no.	<b>R961000107</b>
Command value module for 4 preset command values and 5 ramps per command value.	
For installation into 19" frame rack; contact safe 4 mm laboratory sockets.	
Didactic designation	BPS20
Dimensions	mm L107 x W92 x H129
Weight	kg 0.355
Mounting type	Screwed
Division grid, rack	3HE, 21TE
Operating voltage	(DC) V 24
Output voltage	(DC) V $\pm 10$
Current consumption	mA 500
Protection class	IEC 60529 IP50



#### TS-BPS20 operating module, command value generation, 30TE

Material no.	<b>R961004897</b>
Command value module for 4 preset command values and 5 ramps per command value.	
For installation into 19" frame rack; contact safe 4 mm laboratory sockets.	
Didactic designation	BPS20
Dimensions	mm L153 x W90 x H129
Weight	kg 0.350
Mounting type	Screwed
Division grid, rack	3HE, 30TE
Operating voltage	(DC) V 24
Output voltage	V $\pm 10$
Current consumption	mA 500
Protection class	IEC 60529 IP50





## Components / electrical components

### Operating modules in 19 inch installation technology

#### TS-BPS30.0 operating module, analog controller module, 30TE

Material no. **R961004782**

For setting up simple position controls with an analog position measurement system utilizing valves with integrated control electronics. The control signal processing is completely analog and the controller is only equipped with the features necessary for setting up a hydraulic closed loop control. Analog command and actual values are compared and the resulting control signal with the closed loop control parameters is forwarded to the output. Cable break detection for actual value cable; interfaces short-circuit protection; test points on the front faceplate; overlap compensation step can be switched off. Position control via: PT1 control; area matching of cylinders.

For installation into 19" frame rack; contact safe 4 mm laboratory sockets.

- Command value (2 x 2 mm socket, yellow)
- Output, actuating signal (2 x 2 mm socket, yellow)
- Actual value (5-pole socket M12)
- Release signal (4 mm socket black)
- Inposition signal (4 mm socket black)
- Actual value adjustment "zero gain",
- Zero point valve "zero valve"

Didactic designation	BPS30.0
Industrial type information	RE 30050
Dimensions	mm L153 x W82 x H129
Weight	kg 0.492
Mounting type	Screwed
Division grid, rack	3HE, 30TE
Operating voltage	(DC) V 24
Current consumption	mA 500
Command value external	(DC) V 0 - 10
Ramp time	s 0.1 - 10
Controller (proportional share)	$K_p$ 1 - 16
Controller (reset time)	$K_{T1}$ 1 - 16
Controller (integral share)	$K_i$ 1 - 16
Area matching	Cylinders 1 - 16
Output signal (actuating variable)	V $\pm 10$
Protection class	IEC 60529 IP50



## Components / electrical components

### Operating modules in 19 inch installation technology

#### BPS3.1 operating module, adapter for analog amplifier VT-VSPA1, 34TE

Material no. **R900711662**

Adapter to facilitate interconnection of VT-VSPA1 amplifier to valve and signal values; connection of the plug-in connector via 4 mm laboratory sockets; setting of command value signal via potentiometer

Connection designations:

- Voltage supply (1 x red/1 x black)
- 10-turn potentiometer for the external command value (3 x yellow)
- Output to the solenoid (2 x black)
- Switch on and off of the "up/down" ramp (3 x yellow)
- +/-9 V supply for the command value specification (2 x blue for neg, 2 x red for pos)
- Measurement of the set ramp (2 x white)
- Command value specification (1 x yellow)
- External command value via PLC or CNC (2 x yellow)

Didactic designation	BPS3.1
Dimensions	mm L172 x W200 x H129
Weight	kg 0.420
Mounting type	Screwed
Division grid, rack	3HE, 34TE
Protection class	IEC 60529 IP50



#### Operating module; VT-VSPA1 proportional amplifier, 4TE

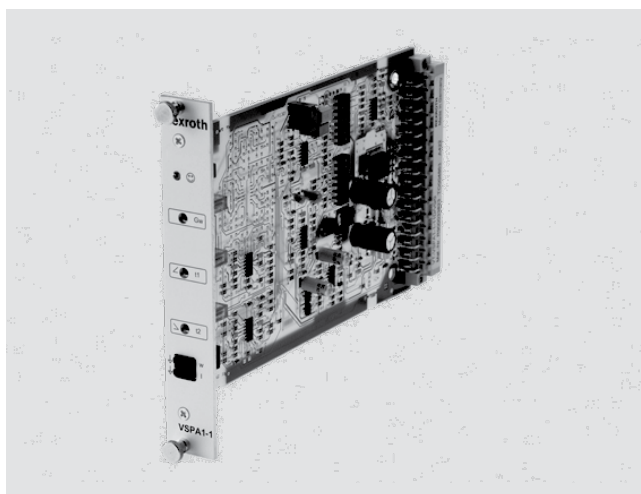
Material no. **R900033823**

For controlling direct operated proportional valves without electrical position feedback; suitable for directional, pressure and flow control valves.

- Differential input, switchable from voltage to current input
- Additional command value input 0 to +9 V
- Ramp generator, can be separately set for up and down direction
- Pulse width modulated power output stage
- Fault monitoring and "Ready for operation" message
- Protection against reverse polarity for the voltage supply
- Cable break detection for current input 4 to 20 mA
- Protection against short-circuit for the solenoid line
- Cable break detection for the solenoid line

For installation into 19" frame rack;

Didactic designation	VSPA1
Industrial type	VT-VSPA1-1-1X
Industrial type information	RE 30111
Dimensions	mm L20 x W180 x H129
Weight	kg 0.108
Mounting type	Screwed
Division grid, rack	3HE, 4TE
Operating voltage	(DC) V 24
Current consumption max.	A 1.8





## Components / electrical components

### Operating modules in 19 inch installation technology

#### BPS3.1 operating module + VT-VSPA1 with 49 TE electronic box

Material no. **1827008065**

BPS3.1 operating module and VSPA1 amplifier contained within a box with snap-in mounting for installation on a grooved plate.

Contact safe 4 mm laboratory sockets.

Didactic designation	BPS3.1 + VSPA1
Industrial type	VT-VSPA1-1-1X
Industrial type information	RE 30111
Dimensions	mm L280 x W210 x H140
Weight	kg 1.88
Mounting type	Snap-in
Operating voltage	(DC) V 24



#### BPS2.1 operating module, adapter for analog control amplifier VT-VRPA1, 34TE

Material no. **R900711658**

Adapter to facilitate interconnection of VT-VRPA1 amplifier to a proportional valve and signal values; connection of the plug-in connector via 4 mm laboratory sockets; setting of command value signal via potentiometer

Connection designations:

- Voltage supply (red/black)
- 10-turn potentiometer for the external command value (3 x yellow)
- Output to the solenoid (2 x black)
- Connection for valve position transducer (3-pole connector)
- +/-9 V supply for the command value specification (2 x blue for neg, 2 x red for pos)
- Measurement of the set ramp (2 x white)
- Command value specification (2 x yellow)
- External command value entry via PLC or CNC (2 x yellow)
- Switching input "Ramp off" (1 x green)

Didactic designation	BPS2.1
Dimensions	mm L172 x W200 x H129
Weight	kg 0.420
Mounting type	Screwed
Division grid, rack	3HE, 34TE
Protection class	IEC 60529 IP50



## Components / electrical components

### Operating modules in 19 inch installation technology

#### Operating module VT-VRPA1 proportional amplifier, 4TE

Material no. **R901057058**

- For controlling direct operated proportional valves with electrical position feedback, suitable for directional, pressure and flow control valves
- Command value signal inputs: 0 to +6 V; 0 to +9 V; 0 to +10 V; 0 to 20 mA; 4 to 20 mA (settable via jumpers)
- Potentiometer setting on the front plate for zero point and maximum limitation
- Measuring sockets for the ramp time
- Enable and “Ramp off” inputs
- Jumpers for switching the maximum ramp time between 0.02 to 5 s or 0.2 to 50 s
- Measuring sockets for command value (0 to +6 V) and actual value (0 to –6 V)
- LED display “Ready for operation”
- Protection against reverse polarity
- For installation in 19” frame

Didactic designation	VRPA1
Industrial type	VT-VRPA1-150-1X/V0/0
Industrial type information	RE 30118
Dimensions	mm L20 x W180 x H129
Weight	kg 0.115
Mounting type	Screwed
Division grid, rack	3HE, 4TE
Operating voltage	(DC) V 24
Current consumption max.	A 1.5
Protection class	IEC 60529 IP50



#### Operating module BRS 2.1 + VT-VRPA1-150-1X/V0/0 with electronic box 49 TE

Material no. **1827008088**

BPS2.1 operating module and VRPA1 amplifier contained within a box with snap-in mounting for installation on a grooved plate.

Contact safe 4 mm laboratory sockets.

Didactic designation	BPS2.1 + VRPA1
Dimensions	mm L280 x W210 x H140
Weight	kg 1.88
Mounting type	Screwed
Operating voltage	(DC) V 24
Protection class	IEC 60529 IP50

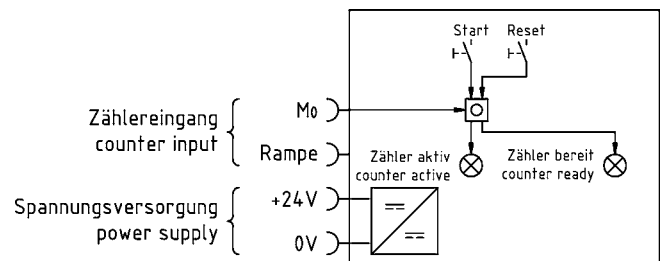




## Components / electrical components

### Operating modules in 19 inch installation technology

BPS 11.1 operating module		
Material no.		<b>R900711666</b>
Didactic designation		BPS11.1
Dimensions	mm	L107 x W92 x H129
Weight	kg	0.230
Mounting type		Screwed
Division grid, rack		3HE, 21TE
Operating voltage	(DC) V	24
Protection class	IEC 60529	IP50



Operating module, mains adapter, 230 V/50 Hz, 42TE		
Material no.		<b>R900703147</b>
Stabilized, short circuit proof power supply; spring return key switch and operation light, stop button and emergency stop button with detent; complete with supply cable, DC output via 2 contact safe 4 mm laboratory sockets.		
Didactic designation		N3
Dimensions	mm	L214 x W170 x H129
Weight	kg	2.5
Mounting type		Screwed
Division grid, rack		3HE, 42TE
Input voltage	(AC) V	230
Output voltage	(DC) V	24
Output current	A	5
Microfuse		1.6, type C (slow-blow)
Length, mains cable	mm	2000
Protection class	IEC 60529	IP50



## Components / electrical components

### Operating modules in 19 inch installation technology

#### Blanking plate, 3HE, 21TE

Material no. **R900309347**

Front plate for closing the installation areas at the 19" frame, which are not used. Aluminum; anodized without color; 2.5 mm thick; 4 captive screws.

Dimensions	mm	L107 x W14 x H129
Weight	kg	0.05
Mounting type		Screwed
Division grid		3HE, 21TE

#### Blanking plate, 3HE, 8TE

Material no. **1827008409**

Front plate for closing the installation areas at the 19" frame, which are not used. Aluminum; anodized without color; 2.5 mm thick; 4 captive screws.

Dimensions	mm	L40 x W14 x H129
Weight	kg	0.038
Mounting type		Screwed
Division grid		3HE, 8TE

#### Blanking plate, 3HE, 7TE

Material no. **1827008410**

Front plate for closing the installation areas at the 19" frame, which are not used. Aluminum; anodized without color; 2.5 mm thick; 2 captive screws.

Dimensions	mm	L36 x W14 x H129
Weight	kg	0.028
Mounting type		Screwed
Division grid		3HE, 7TE

#### Blanking plate, 3HE, 6TE

Material no. **R913004345**

Front plate for closing the installation areas at the 19" frame, which are not used. Aluminum; anodized without color; 2.5 mm thick; 2 captive screws.

Dimensions	mm	L30 x W12 x H129
Weight	kg	0.027
Mounting type		Screwed
Division grid		3HE, 6TE

#### Blanking plate, 3HE, 4TE

Material no. **R961001336**

Front plate for closing the installation areas at the 19" frame, which are not used. Aluminum; anodized without color; 2.5 mm thick; 2 captive screws.

Dimensions	mm	L21 x W14 x H129
Weight	kg	0.025
Mounting type		Screwed
Division grid		3HE, 4TE



## Components / electrical components

### Connection lines

#### Solenoid cable with LED form A black

Material no.	<b>R900846807</b>
With LED, form A DIN 43650, 2-wire, connector black	
Didactic designation	E1
Dimensions	mm L3000
Weight	kg 0.3



#### Solenoid cable with LED form A gray

Material no.	<b>R900846808</b>
With LED, form A DIN 43650, 2-wire, connector gray	
Didactic designation	E2
Dimensions	mm L3000
Weight	kg 0.3



#### Solenoid cable without LED form A gray

Material no.	<b>R900846809</b>
Without LED, form A DIN 43650, 2-wire, connector gray	
Didactic designation	E3
Dimensions	mm L3000
Weight	kg 0.3



#### Solenoid cable without LED form A black

Material no.	<b>R900846812</b>
Without LED, form A DIN 43650, 2-wire, connector black	
Didactic designation	E4
Dimensions	mm L3000
Weight	kg 0.3



#### Cable set for command value measurement

Material no.	<b>R900826555</b>
For the actual and command value measurement 2 adapter lines each, from 2 to 4 mm connector black and red	
Didactic designation	E5
Dimensions	mm L240
Weight	kg 0.27



#### Pressure switch cable

Material no.	<b>R900846817</b>
With connector, form A DIN 43650, 4-wire	
Didactic designation	E6
Dimensions	mm L3000
Weight	kg 0.3



## Components / electrical components

### Connection lines

#### Connection cable set - small

Material no.	<b>R900029597</b>	
Consisting of:	39 Contact safe connection cables; 10 pieces each 250 mm long red, and green 5 pieces each 500 mm long red, green and black 2 pieces each 1000 mm long red and black 1 piece each 2000 mm long red and blue	
Didactic designation	E16	
Weight	kg	1.1



#### Connection cable set - large

Material no.	<b>R900021502</b>	
Consisting of:	64 contact safeconnection cables 10 pieces each 250 mm long red, green and black 5 pieces each 500 mm long red, green and black 5 pieces each 750 mm long black 4 pieces each 750 mm long red and black 2 pieces each 1000 mm long red and black 1 piece each 2000 mm long red and blue 10 250 mm long red, green and blackin each case 5 units 500 mm long red, green and black5 units 750 mm long blackin each case 4 units 750 mm long red and blackin each case 2 units 1000 mm long red and blackin each case 1 unit 2000 mm long red and blue	
Didactic designation	E17	
Weight	kg	1.78



#### 7-pole cable for integrated electronics

Material no.	R961003550	
7-pole connection cable (6 + PE) for valves with integrated control electronics (OBE); to facilitate connection from valve connector K31 with mating connector according to DIN EN 175201-804 (OBE side) to measuring socket connection; Cable: LiYC 7 x 0.75 mm².		
Dimensions	mm	L1500
Weight	kg	0.450
Protection class	IEC 60529	IP50



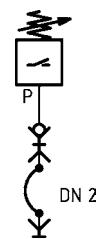
## Components / electrical components

### Proximity switch, pressure switch

Proximity switch inductive		
Material no.		R961003106
Adjustable inductive proximity switch with LED switching indication c/w mounting plate and thumb screw for mounting to the various actuators. 24 V signal generation by means of proximity with metallic objects.		
Supply voltage 24 V; signal 24 V; 4 mm laboratory connector; red 24 V; blue 0 V; black 24 V signal.		
Didactic designation		DE2
Dimensions	mm	L3000
Weight	kg	0.20
Max. recording range	mm	8



Pressure switch electric		
Material no.		R961003488
With mounting, including cable		
Didactic designation		DD6E.3
Industrial type		HED80A1X/100K14
Industrial type information		RE 50060
Dimensions <sup>1)</sup>	mm	L100 x W45 x H170
Operating pressure max.	bar	120
Setting range	bar	4 to 100
Switching accuracy	%	< ±1 of the setting range
Electrical connection		Plug-in connection according to DIN 43650 Design A, 3-pole + PE
Contact load max.		VAC: 250 V - 5 A (DC) V: 50 V - 1 A; 125 V - 0.03 A
Switching cycles admissible / h		4800
Included in the scope of delivery:		Mat. no.                      Length
Measuring hose		R900083425              1000 mm
Connection cable		R900846817              3000 mm



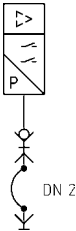
<sup>1)</sup> Dimensions without measuring hose and connection cable

Components / electrical components

Pressure switches

Pressure switch electronically programmable		
Material no.		R961003555
With mounting, including cable		
Didactic designation		DD6E.5
Industrial type		HEDE10
Industrial type information		RE 30278
Dimensions <sup>1)</sup>	mm	L72 x W44 x H157
Weight	kg	0.750
Operating pressure max.	bar	120
Setting range	bar	0 - 100
Switching accuracy	%	0.5
Electrical connection		K41 (M12)
Contact load max.	mA	250
Switching cycles	Hz	170
Included in the scope of delivery:		Mat. no.                      Length
Measuring hose		R900083425      1000 mm
Connection cable		R900846817      3000 mm

<sup>1)</sup> Dimensions without measuring hose and connection cable



## Components / measuring technology

### Measuring devices

Multi-meter		
Material no.		<b>R900897502</b>
With 12 mm high LED display, 3 1/2 digits, 19 measurement ranges, solar powered design		
Didactic designation		E24
Dimensions	mm	L180 x W90 x H40
Weight	kg	0.25
Current max.	A	10



Data acquisition set 2020		
Material no.		<b>R961002272</b>
Two analog measuring inputs, 128 kB measured value memory, graphical LCD display.		
The 2020 measuring device set consists of:		
- 1 measuring device multi-handy 2020		
- 1 power pack 6 VDC with country adapter EU, UK, US		
- 2 pressure sensors with cable, length 2.5 m, 2 x 0 to 200 bar		
- 2 minimess direct ports 1620		
- Plastic suitcase		
Measuring range	bar	0 - 200



Data acquisition set 3020		
Material no.		<b>R961002273</b>
Two analog measuring inputs, 1 frequency input memory for 1 million analog measured values, graphical LCD display.		
The 3020 measuring device set consists of:		
- Measuring device multi-handy 3020		
- 1 power pack 24 VDC with country adapter		
- USB data transfer cable		
- 2 minimess direct ports 1620		
- 1 HYDROcomsys software		
- 2 HAT-PD pressure sensors with freely selectable measuring ranges		
- 1 transport suitcase		
- 2 measuring cables		
Measuring range	bar	0 - 200





## Components / measuring technology

### Measuring devices

#### Data acquisition set 5060

Material no.	<b>R913002274</b>
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With 24 channels, up to 1 GB data memory; color display, CAN bus technology

The 5060 measuring device set consists of:

- 1 measuring device multi-handy 5060
- 1 power pack 24 VDC with country adapter
- 1 USB data transfer cable
- 2 minimess direct ports 1620
- 1 software CD
- 2 PR 15 pressure sensors with freely selectable measurement ranges
- 1 transport suitcase
- 2 measuring cables

Measuring range	bar	0 - 200
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#### Stop watch, digital

Material no.	<b>R900061256</b>
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Quartz design, 1/100 sec, time and date

Didactic designation	CLOCK
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Weight	kg	0.27
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#### Tachometer, visual / mechanical

Material no.	<b>R900065201</b>
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Visual - mechanical, 5-digit LCD display 10 mm high

Didactic designation	DREH/OM
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Dimensions	mm	L120 x W95 x H60
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Weight	kg	0.65
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## Components / measuring technology

### Sensors

#### Pressure transducer 0-200 bar with ISDS

Material no.	<b>R900738915</b>	
Didactic designation	DZ37.1	
Dimensions	mm	L180 x D 40
Weight	kg	0.17
Output current	mA	0 - 20
Measuring range	bar	0 - 200
Recommended accessories	Mat. no.	
ISDS measuring cable	R900733207	



#### Speed sensor

Material no.		<b>R900892375</b>
With visual reflection light barrier, with pulsating red light, with measuring cable		
Didactic designation		E19
Dimensions	mm	L3000
Weight	kg	0.43
Switching current max.	mA	200
Response time	ms	1
Signal sequence		
frequency max.	Hz	500
Supply voltage	(DC) V	7.5 - 30



#### Temperature sensor with ISDS

Material no.	<b>R900749653</b>	
Didactic designation	TEMP2	
Dimensions	mm	L100 x D 40
Weight	kg	0.46
Measuring signal output	mA	0 - 20
Measuring range	°C	-50 to +200
Supply voltage	(DC) V	10 - 30
Recommended accessories	Mat. no.	
ISDS measuring cable	R900733207	



## Components / measuring technology

### Sensors, measuring cables

#### Gear flow meter 0.2 to 30 l/min with ISDS

Material no.	R961002508	
Mounted on device plate		
Didactic designation	DZ30.2N-W	
Dimensions	mm	L230 x W180 x H115
Weight	kg	3.38
Measuring range	l/min	0.2 - 30
Impulse per	dm <sup>3</sup>	Approx. 1640
Recommended accessories		Mat. no.
ISDS measuring cable		R900733207



#### Flow meter 1.0 to 7.5 l/min

Material no.	R961002561	
FM-222-112		
Didactic designation	DZ35.1N-W	
Dimensions	mm	L160 x D 60
Weight	kg	0.66
Pressure max.	bar	100
Measuring range	l/min	1.0 - 7.5



#### Measuring cable for ISDS

Material no.	R900733207	
Didactic designation	MKS	
Dimensions	mm	L2500
Weight	kg	0.35



## Components / mobile hydraulics

### 2-2TH6-L70 pilot control unit

Material no. **R961004190**

Deflection of the lever adjusts the control pressure at the output. This hydraulic control pressure is typically used to operate directional valve spools. The pilot control unit consists of 2 elements with 2 hydraulic pressure reducing valves each. Two spring return control levers with control curve 70; 4 hoses with gauging point connections.

Didactic designation 2-2TH6

Industrial type information RE 64552

Dimensions mm L1060 x W140 x H230

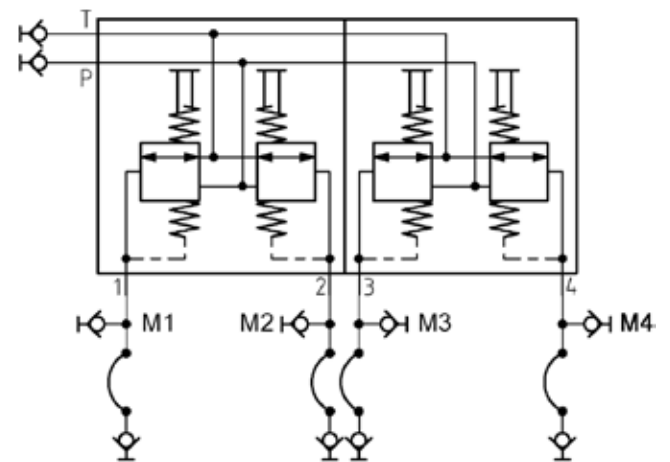
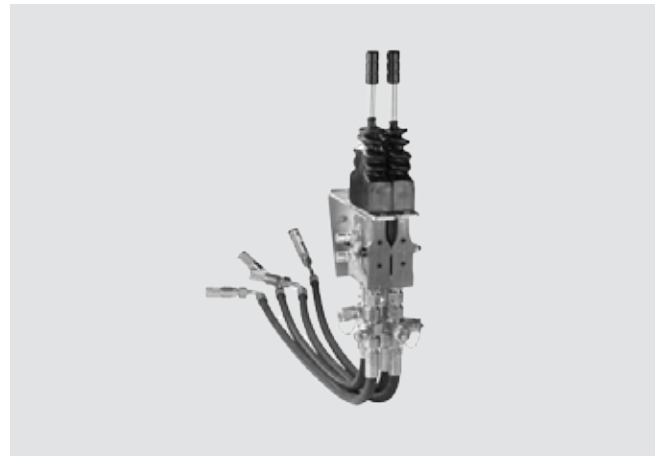
Weight kg 5.7

Mounting type Snap-in, grid 50 x 50

Inlet pressure max. bar 50

Control pressure max. bar 35

Pilot volume max. l/min 16



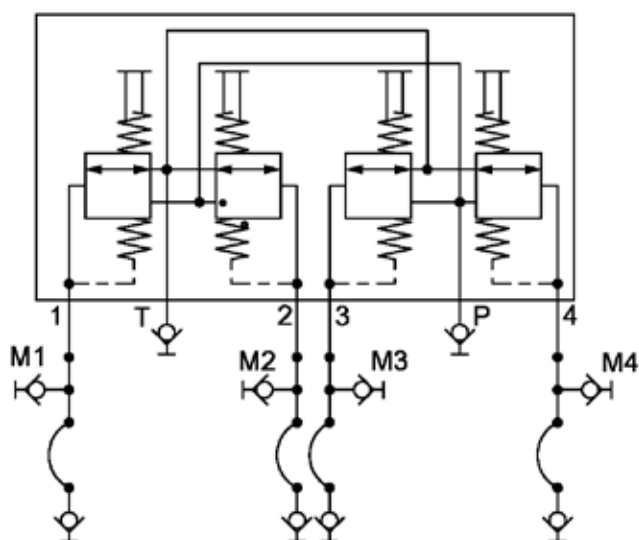
## Components / mobile hydraulics

### Pilot control unit for arm rest installation 4TH6-97

Material no. **R961004191**

Deflection of the lever adjusts the control pressure at the output. This hydraulic control pressure is typically used to operate directional valve spools. Allows the parallel control of two actuators by means of one hand lever. The pilot control unit consists of one element with 4 hydraulic pressure reducing valves. 1 hand lever with control curve 97; 4 hoses with gauging point connections.

Didactic designation	4TH6
Industrial type information	RE 64555
Dimensions	mm L1080 x W150 x H180
Weight	kg 6.1
Mounting type	Snap-in, grid 50 x 50
Inlet pressure max.	bar 50
Control pressure max.	bar 35
Pilot volume max.	l/min 16



## Components / mobile hydraulics

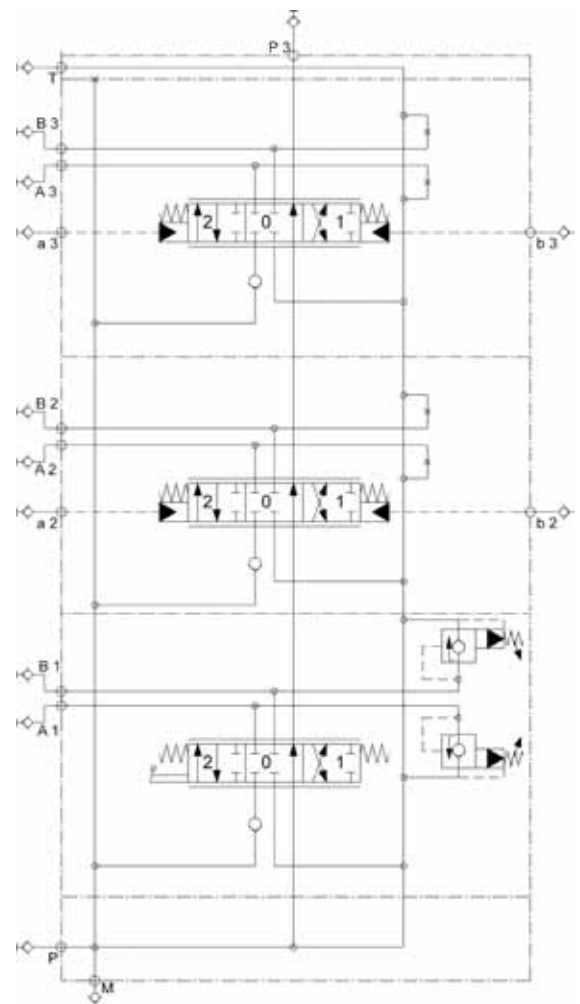
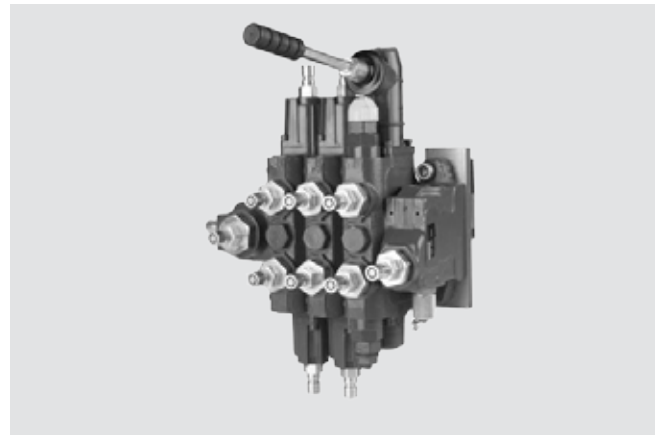
### Control block 3SM-12 throttle control

Material no. **R961004198**

Hydraulic pilot pressure or manual lever movements are used to operate the directional valve spools. The actuator is moved depending on the load pressure and the differential pressure at the valve opening cross-section. The pressure differential is load pressure dependent and not compensated. The control block consists of an input and end element, 3 directional valve elements with 2 hydraulic pilot controls and one manual lever control.

Input element with P port; end element with T port and P3 for power beyond; 2 port reliefs.

Didactic designation	3SM-12
Industrial type information	RE 64122
Dimensions	mm L320 x W245 x H245
Weight	kg 14
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120



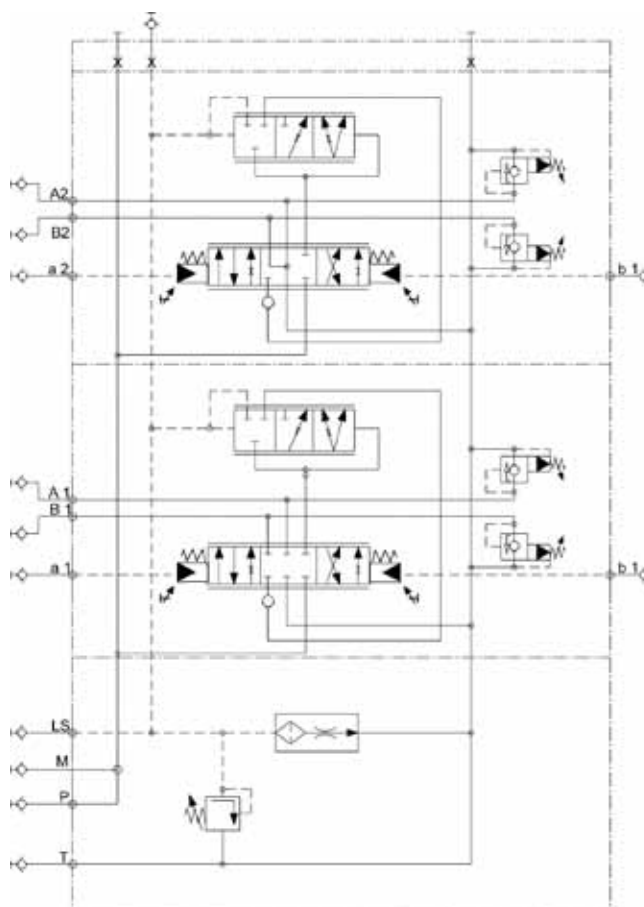
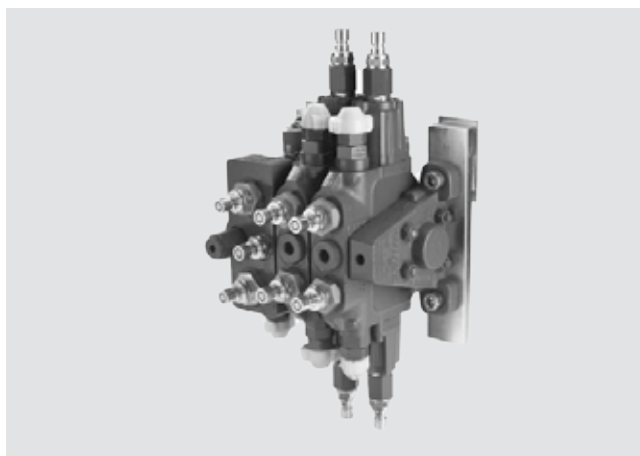
## Components / mobile hydraulics

### 2SX-12 LUDV (anti-saturation) control block

Material no. **R961004189**

Hydraulic pilot pressure is used to operate the directional valve spools. The actuator is moved depending on the pilot pressure and the differential pressure at the valve opening cross-section. The lowest differential pressure is controlled by the pump controller, the highest by the downstream pressure compensators. The highest load pressure is forwarded to the pump controller as the LS signal. In case of excessive consumption (re-quested flow is larger than the flow that can be delivered by the pump), the downstream pressure compensators begin to close. This guarantees that in case of excessive consumption, no actuator will stall. The control block consists of an inlet and end cover element and 2 directional valve elements with hydraulic pilot control. The inlet element accommodates the LS pressure limitation valve and the unloading. Each directional valve element is equipped with port relief valves. The flow quantity limited be set by means of stroke limiters.

Didactic designation	2SX-12
Industrial type information	RE 64128
Dimensions	mm L355 x W190 x H165
Weight	kg 17
Operating pressure max.	bar 120



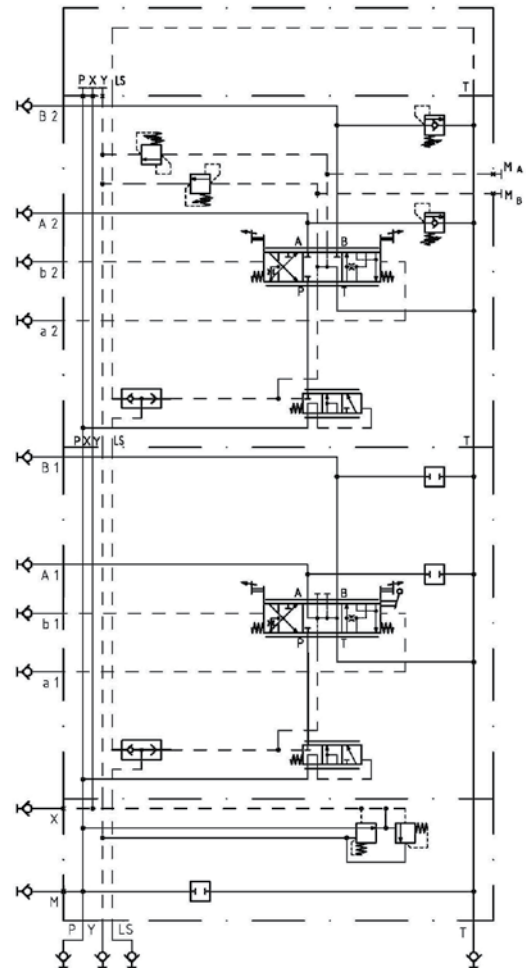
## Components / mobile hydraulics

### Load sensing control block 2M4-12

Material no. **R961004192**

Hydraulic pilot pressure or manual lever movements are used to operate the directional valve spools. The actuator is moved with a speed depending on the spool position and the differential pressure at the valve opening cross-section. The pressure differential is controlled by the upstream pressure compensators. The highest load pressure is forwarded to the pump controller as an LS signal via a shuttle valve network. The control block consists of an inlet and end cover element and 2 directional valve elements with hydraulic pilot control and one manual lever operator. The individual valve sections have 4 port relief valves, 2 of which can be adjusted. One directional valve element is equipped with LS pressure limiting valves. The flow quantity can be limited by means of stroke limiters.

Didactic designation	2M4-12
Industrial type information	RE 64276
Dimensions	mm L370 x W235 x H245
Weight	kg 19
Mounting type	Snap-in, grid 50 x 50
Operating pressure max.	bar 120







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**Bosch Rexroth AG**

Drive & Control Academy

Bahnhofplatz 2

97070 Würzburg

Phone: 09352/18-6372

Fax: 09352/18-6882

Email: [trainingsystems@boschrexroth.de](mailto:trainingsystems@boschrexroth.de)

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