

Drive & Control Academy

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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	4
<hr/>	
Hydraulic Training System	
DS4	6
<hr/>	
Workplaces	9
DS4 configuration	11
Hydraulic power unit	36
Component carrier	38
Control trolley	39
Accessories	40
<hr/>	
Study topics	45
On/off hydraulics	48
Proportional valve technology	60
Mobile hydraulics	69
<hr/>	
Components	81
Valves	84
Actuators	101
Hydraulic accessories	105
Electrical devices	116
Measurement technology	135
Mobile hydraulics	139

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 aides

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

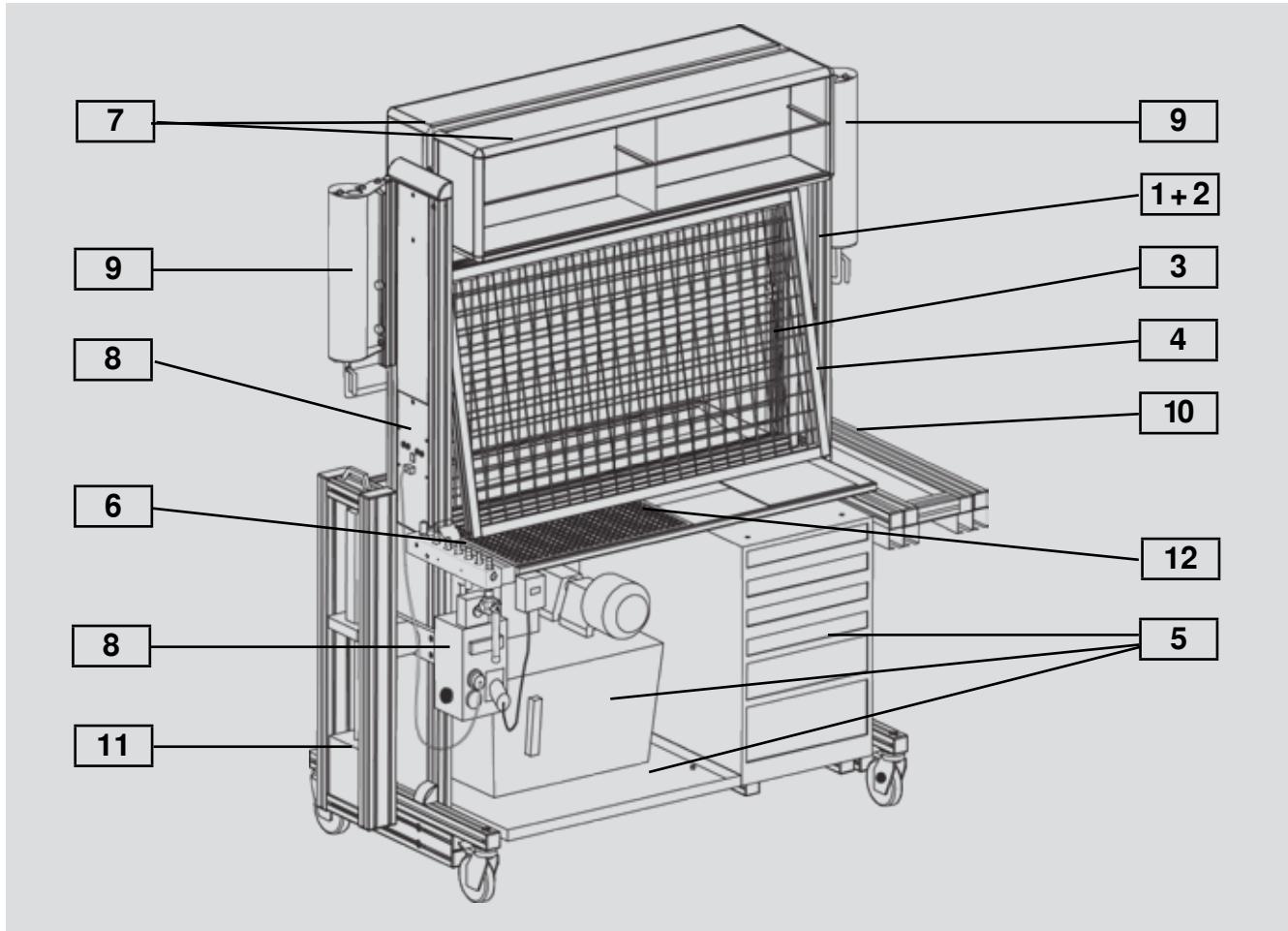


Table of Contents: Work stations

Contents	Page
DS4 configuration	11
DS4 configuration - Examples	
▶ DS4 training system for hydraulics, double-sided	12
▶ DS4 training system for hydraulic and pneumatic systems	13
DS4 configuration - Description of the individual components (type key field)	
▶ Product range - Product group + Series code (field1+2)	14
▶ Frame (field 3)	15
▶ Grid (field 4)	16
▶ Substructure kit (field 5)	17-23
▶ Connection block hydraulics (field 6)	24
▶ Electrical device rack (field 7)	25
▶ Electrical supply (field 8)	26-29
▶ Measuring glass (field 9)	30
▶ Hose storage (field 10)	31
▶ Load simulator (field 11)	32
▶ Oil drip pan/writing surface (field 12)	33
▶ Quick disconnect type (field 13)	33
DS4 configuration - Type key	34-35
Hydraulic power unit with variable displacement pump for DS4, ready-for-operation	
▶ Single phase 50 / 60 Hz	36
▶ Three-phase 50 / 60 Hz	37
Component carrier	
▶ Component carrier with grid and oil drip pan	38
▶ Component carrier with 2 grids and oil drip pan	38
Component trolley	
▶ Component trolley	39
▶ Electric attachment for component trolley	39
Accessories	
▶ Roller storage unit	40
▶ Drawer organizer set	40
▶ Anti-slip mat	41
▶ Cloth holder	41
▶ Cable holder	42
▶ Monitor support arm	42
▶ Information board	43

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**

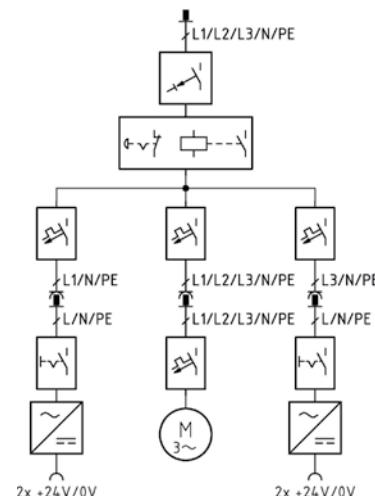
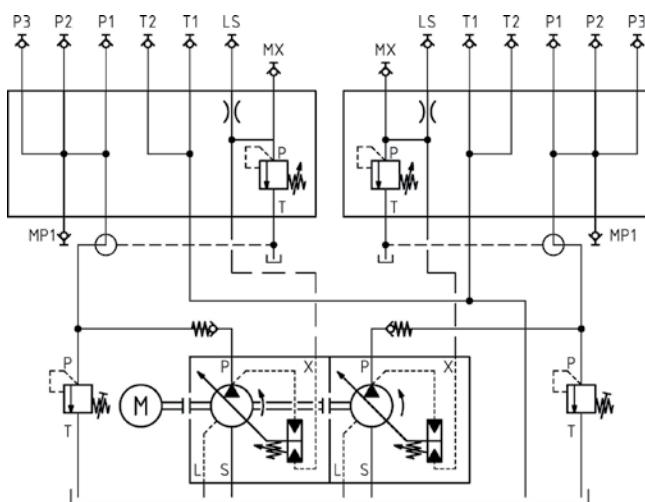
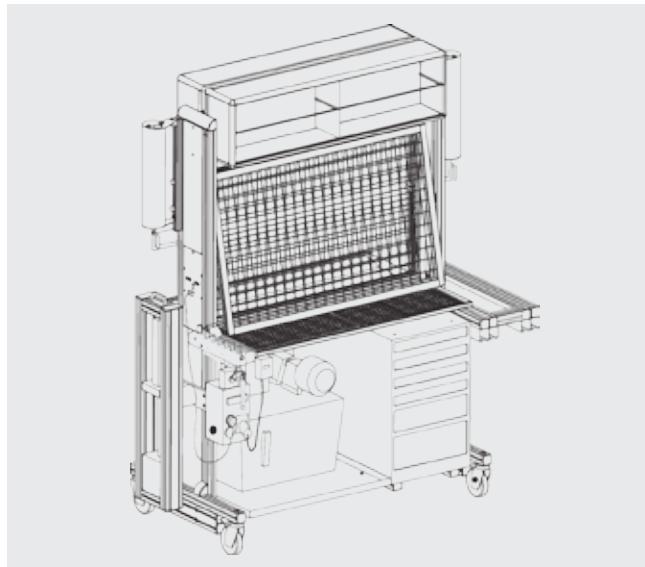
This example configuration is suitable for training on industrial and mobile hydraulics. Both working sides are prepared for mounting hydraulic components.

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

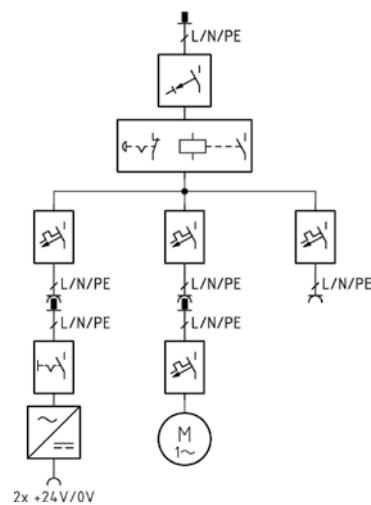
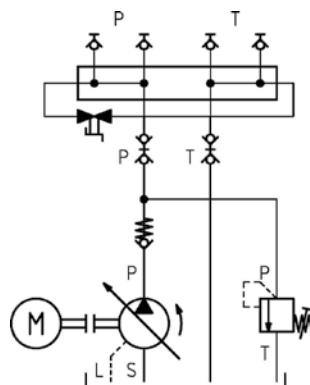
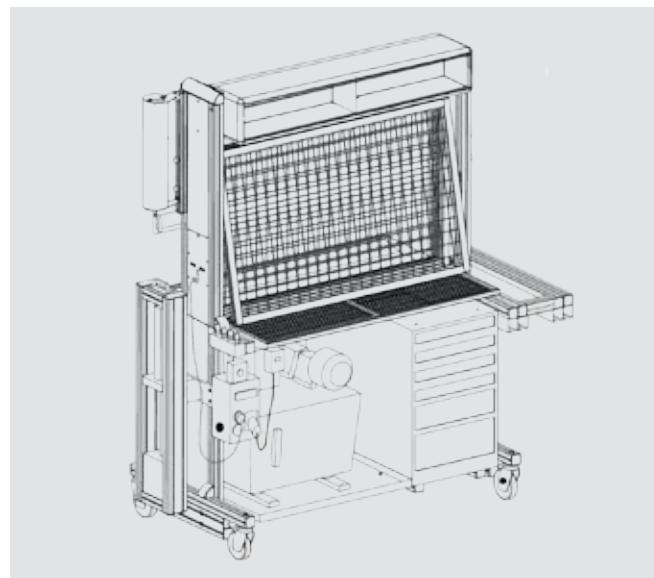
This example configuration is suitable for training on hydraulics and pneumatics. One working side is prepared for mounting hydraulic components and the other is prepared for mounting pneumatic components.

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.	R961000160
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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 separately some assembly will be required



Work stations / DS4 configuration - Description of the individual components

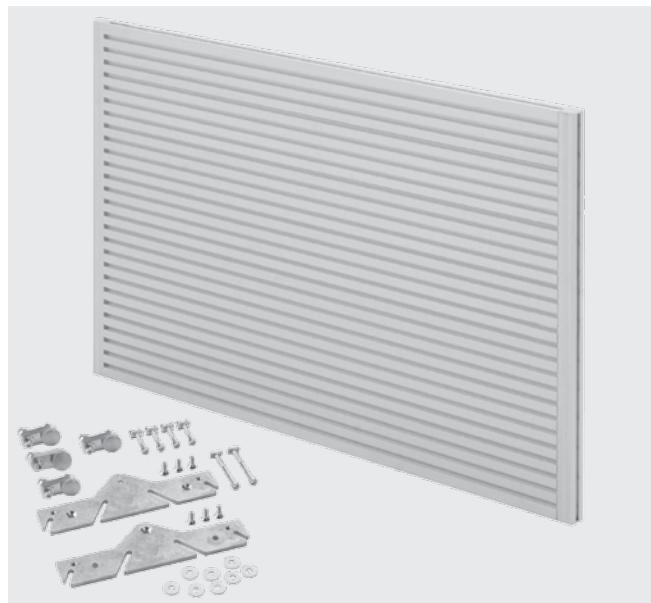
Assembly of the DS4: "Frame" (type key field 3)

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

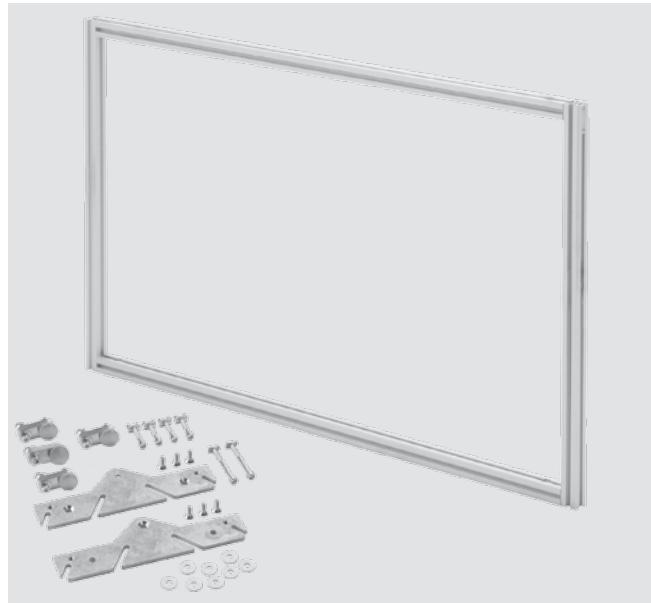


Mounting frame for DS4 with mounting kit

Material no.	R961000226
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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. **R961000210**

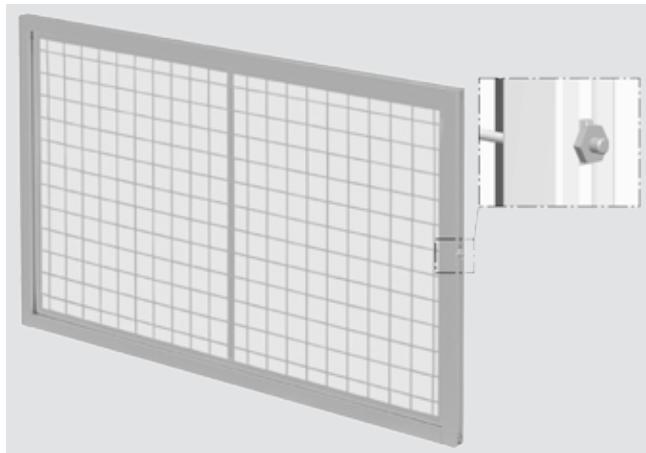
With reinforcement for hydraulic components with 50 mm grid sections

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. **R961000169**

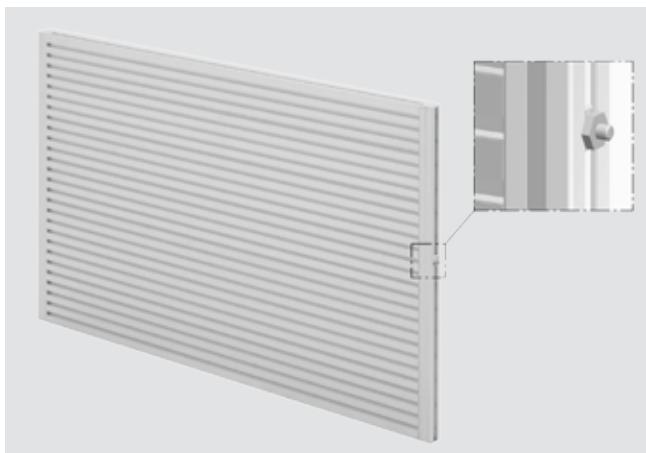
With mounting bolts

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
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	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									
Installation kit LS pumps R961004063 (not separately available)													X	X		X	X	X

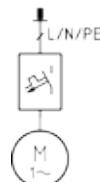
LS power units cannot be ordered separately. Construction kits with LS power unit and distributor, which are ready-for-operation are described on pages 36 and 37.

Work stations / DS4 configuration - Description of the individual components

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

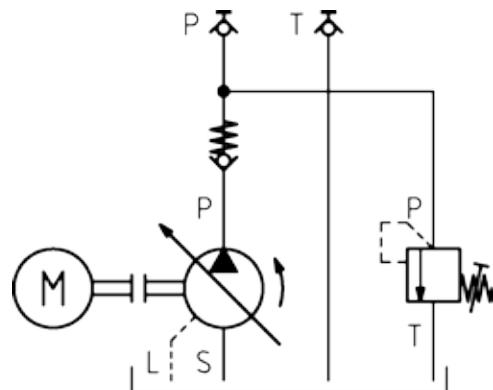
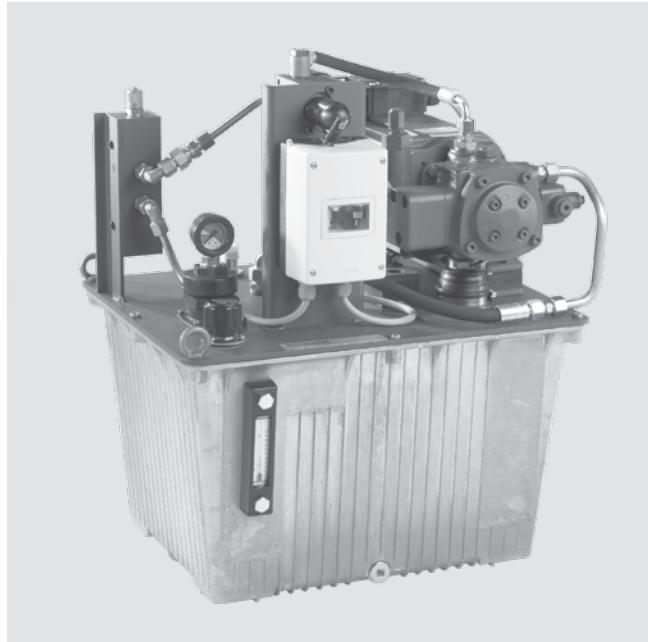
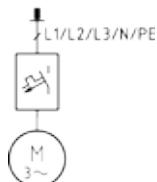
Hy power unit; 230 V/50 Hz; 1.5 kW; with single pump

Material no.	R901134001
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.	R901133999
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. **R901134002**

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

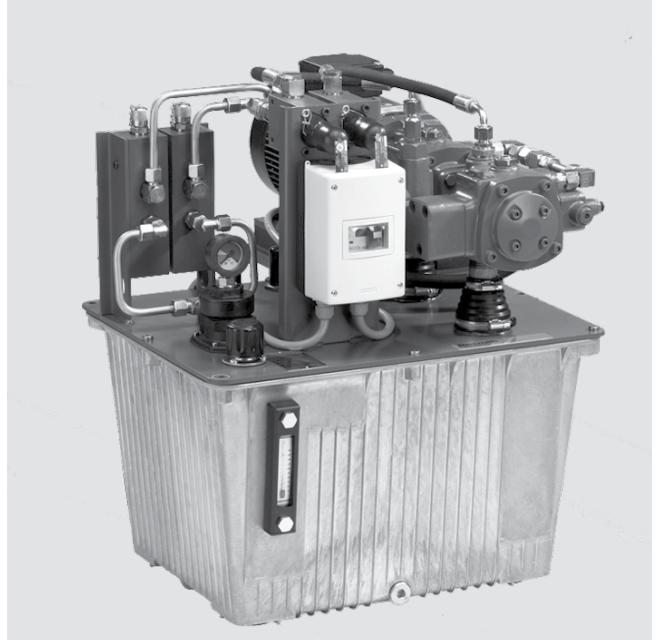
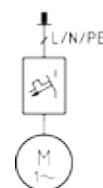
Flow l/min 2 x 8

Voltage V 230

Frequency Hz 50

Power kW 1.5

Circuit breaker A 9 -12



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

Material no. **R901134000**

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

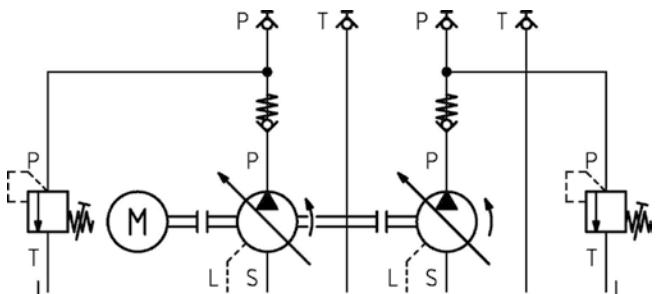
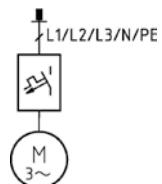
Flow l/min 2 x 8

Voltage V 400

Frequency Hz 50

Power kW 2.2

Circuit breaker A 4.5 - 6.3



Work stations / DS4 configuration - Description of the individual components

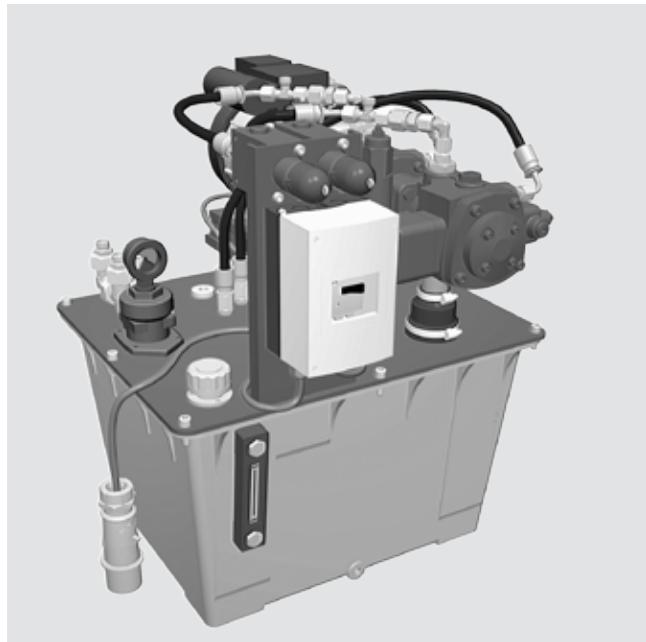
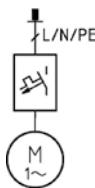
Assembly of the DS4: "Substructure kit" (type key field 5)

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

Material no. **R901168101**

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



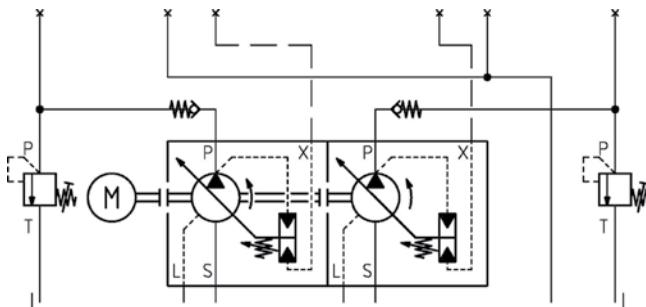
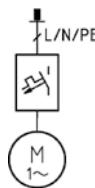
Important: Not available as a separate assembly

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

Material no. **R901169108**

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



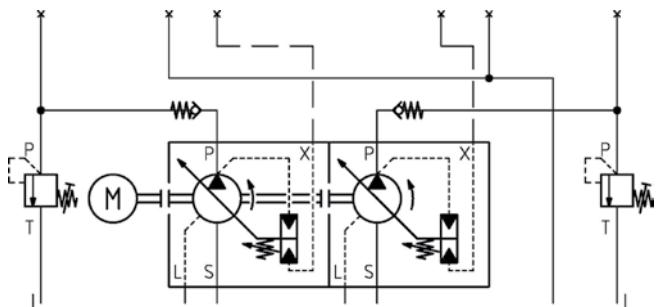
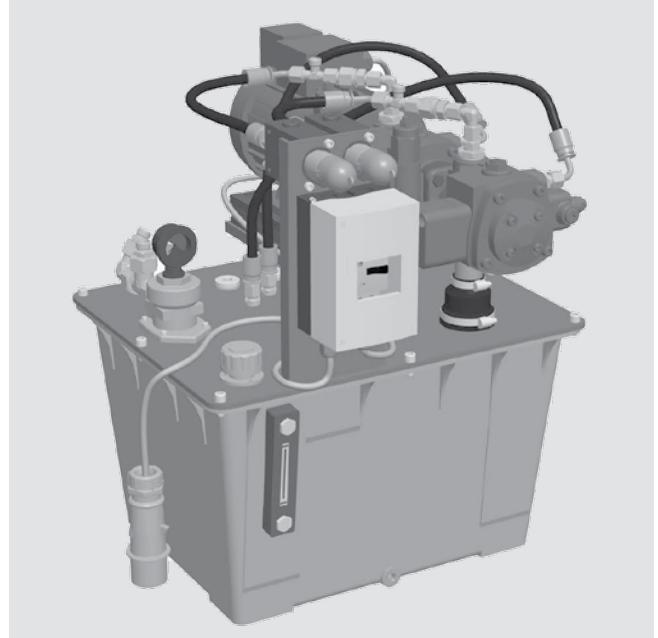
Important: Not available as a separate assembly

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.	R901171865
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 bar industrial hydraulics	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.	R961000288
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.	R961002474
Hose line 1000 mm	
Material no.	R961002475

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

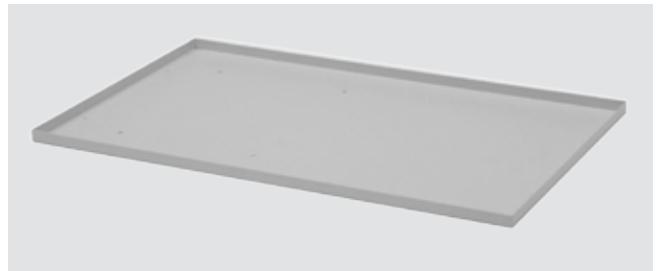
Material no.	R961003904
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For substructure DS4

Dimensions	mm	L737 x W725 x H30
------------	----	-------------------

Weight	kg	9.6
--------	----	-----

Material	Powder-coated sheet steel
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Oil tray

Material no.	R961001269
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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

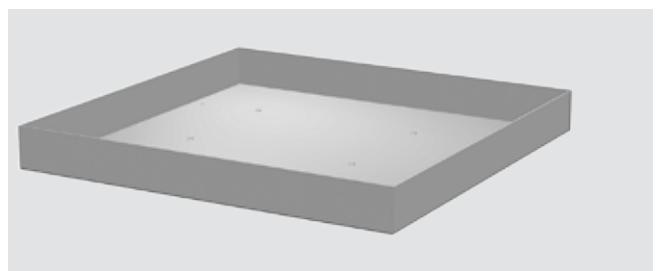
Material no.	R961004108
--------------	-------------------

For substructure DS4; edge height 80 mm for load sensing power unit

Dimensions	mm	L737 x W725 x H80
------------	----	-------------------

Weight	kg	11.9
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Material	Powder-coated sheet steel
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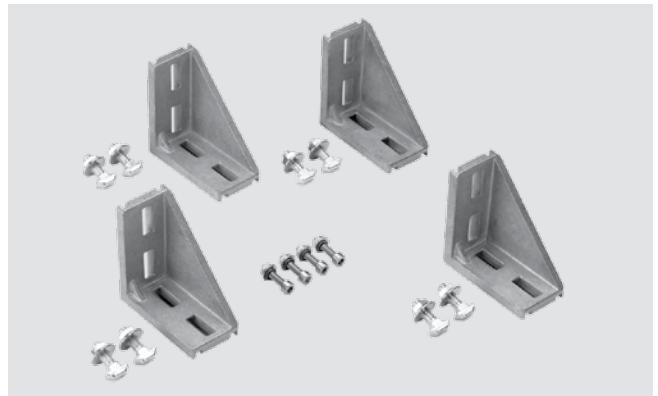


Mounting kit for oil tray

Material no.	R961000761
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Dimensions	mm	L120 x W100 x H100
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Weight	kg	0.450
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Installation kit LS pumps

Material no.	R961004063
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Hydraulic hoses and fittings for the connection of the LS pumps to the tank and the hydraulic distributor

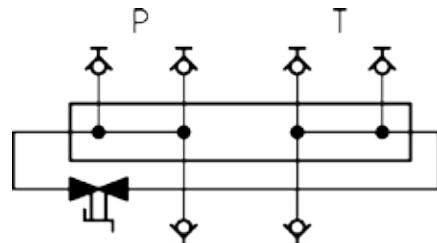
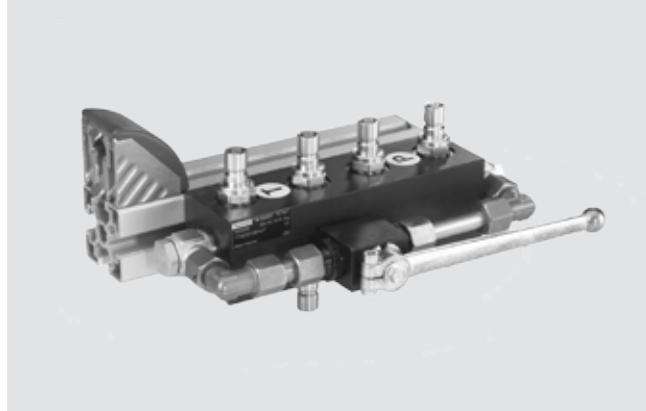
Quantity	12 hydraulic hoses 30 fittings
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Important: Not available as a separate assembly

Work stations / DS4 configuration - Description of the individual components

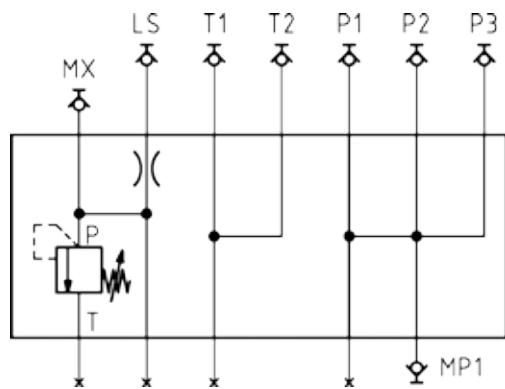
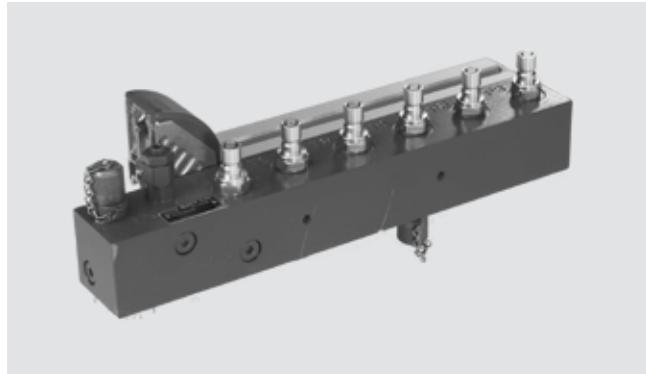
Assembly of the DS4: "Connection block hydraulics" (type key field 6)

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

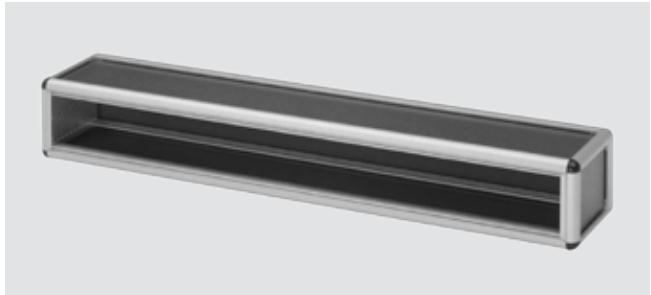


Work stations / DS4 configuration - Description of the individual components

Assembly of the DS4: "Electrical Rack" (type key field 7)

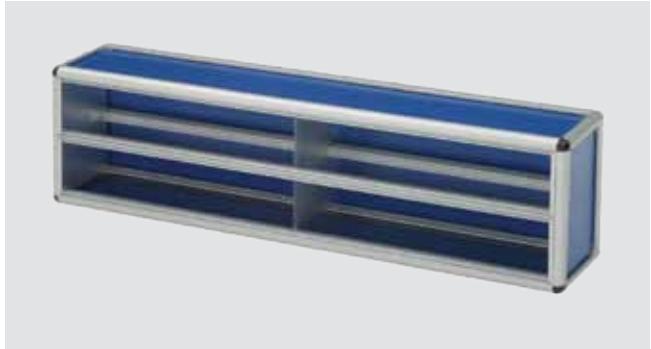
Rack single-row

Material no.	R961000167
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.	R961000166
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.

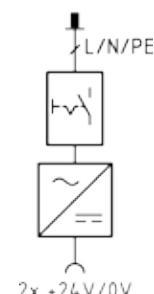
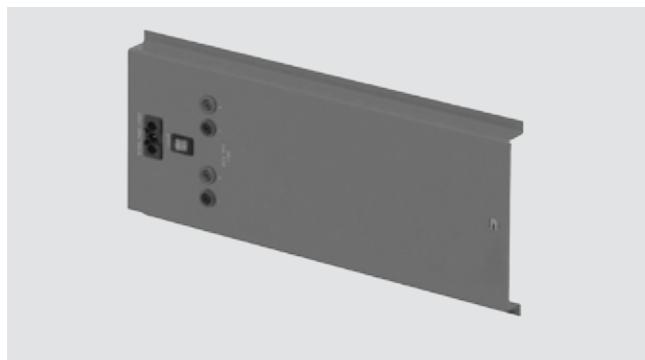
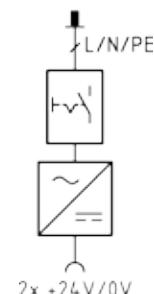
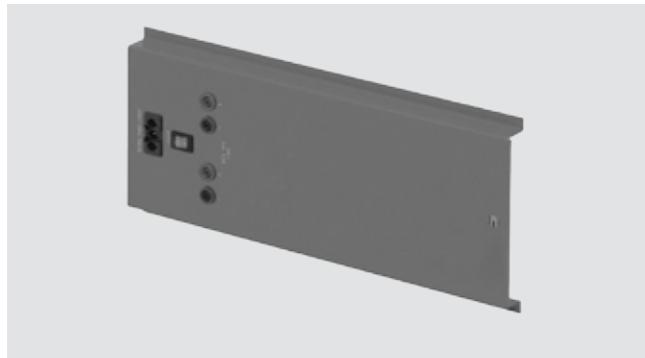
Space saving design can be integrated into each side of the rack, also as an upgrade.

- 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.	1827003724
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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
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Connection cable US; 2 m

Material no.	1827003742
--------------	-------------------

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
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Protection class IEC 60529	IP20
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Work stations / DS4 configuration - Description of the individual components

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

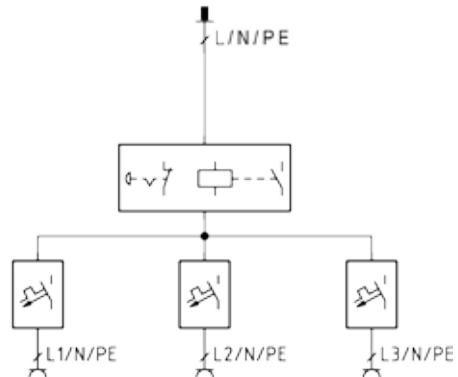
**Control box; 230 V/50 Hz; 2x emergency stop;
3 sockets; without FI**

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



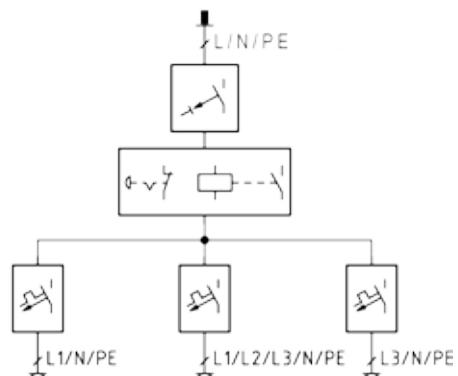
**Control box 230 V/50 Hz; 2x emergency stop;
3 sockets; with FI**

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

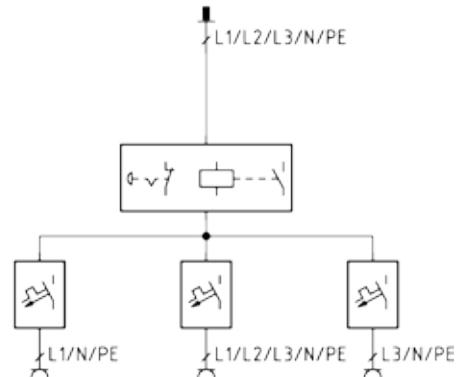
Weight kg 6.5

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

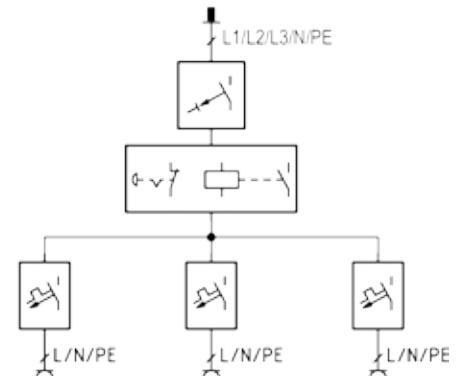
Weight kg 6.5

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.	R961002564
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



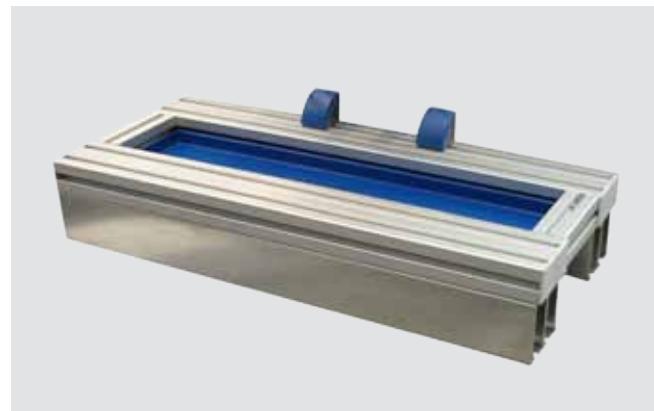
Work stations / DS4 configuration - Description of the individual components

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

Hose rack for 9 hoses	
Material no.	R961000188
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.	R961002634
With oil tray for storing small parts.	
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

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

Load simulator 15 kg rotatable

Material no. **R961000187**

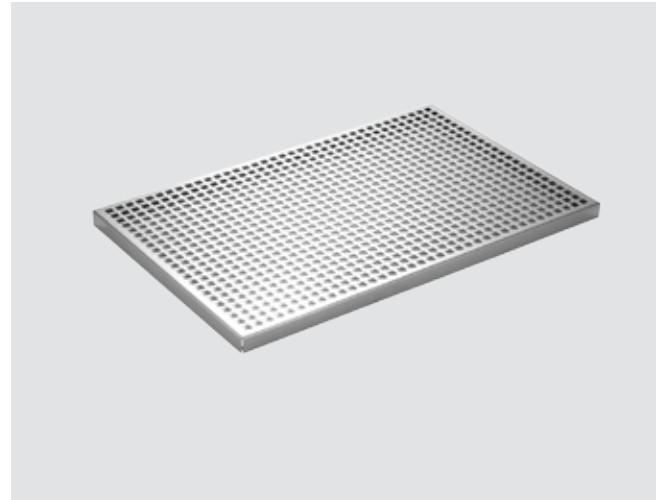
Description of the component see chapter
"Components/ actuators"



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.	R961000192
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.	1827003705
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

Type key

Fields:	1	2	3	4	5	6	7
Details in the fields:	TS	DS4	1X	/			

Product range - Product group

Movable component support DS4 ProLine R961000160 = TS-DS4

Series code

Series number = 1X

Frame

Central grooved plate for DS4 with mounting kit	R961002216	= N
Mounting frame for DS4 with mounting kit	R961000226	= R

Grid

without grid, without grooved plate	= G0
Grid on one side, with reinforcement for mounting onto the DS4	R961000210 = G1
Grooved plate on one side, for mounting onto the DS4	R961000169 = N1
Grid on two sides, with reinforcement for mounting onto the DS4	R961000210 2 x = G2
Grooved plate on two sides, for mounting onto the DS4	R961000169 2 x = N2
1 side grid + 1 side grooved plate	R961000210 + R961000169 = GN

Substructure kit

(Material number see "DS4 configuration - Description of the individual components", field 5)

without substructure kit	= U00
with oil tray	= U01
Hydraulic power unit 230 V/50 Hz; 1.5 kW; with single pump and oil tray	= U02
Hydraulic power unit 230 V/50 Hz; 1.5 kW; with double pump and oil tray	= U03
Hydraulic power unit 400 V/50 Hz; 2.2 kW; with single pump and oil tray	= U04
Hydraulic power unit 400 V/50 Hz; 2.2 kW; with double pump and oil tray	= U05
Hydraulic power unit 230 V/50 Hz; 1.5 kW; with single pump, oil tray and fixed storage unit	= U06
Hydraulic power unit 230 V/50 Hz; 1.5 kW; with double pump, oil tray and fixed storage unit	= U07
Hydraulic power unit 400 V/50 Hz; 2.2 kW; with single pump, oil tray and fixed storage unit	= U08
Hydraulic power unit 400 V/50 Hz; 2.2 kW; with double pump, oil tray and fixed storage unit	= U09
Oil tray and container for DS4 with mounting kit	= U10
Oil tray and 2 containers for DS4 with mounting kit	= U11
LS Hy power unit, 230 V/60 Hz; 1.5 kW; with double pump, oil tray and fixed storage unit	= U12
LS Hy power unit, 400 V/50 Hz; 2.2 kW; with double pump, oil tray and fixed storage unit	= U14
Hydraulic power unit, 230 V/60 Hz; 1.5 kW; with double pump, oil tray and fixed storage unit	= U15
LS Hy power unit, 230 V/50 Hz; 1.5 kW; with double pump, oil tray and fixed storage unit	= U16
LS Hy power unit, 230 V/50 Hz; 1.5 kW; with double pump and oil tray	= U17
LS Hy power unit, 400 V/50 Hz; 2.2 kW; with double pump and oil tray	= U18

Connection block hydraulics

without connection block hydraulics	= V0
P/T distributor with zero pressure circulation	R961002567 = V3
2 x P/T distributor with zero pressure circulation	R961002567 2x = V4
P/T/X distributor for load sensing power unit	R961004178 = V5
2 x P/T/X distributor for load sensing power unit	R961004178 2x = V6

Racks

without racks	= A0
Rack 210TE, 1x 3HE, single-sided	R961000167 = A1
Rack 210TE, 2x 3HE, single-sided	R961000166 = A2
Rack 210TE, 1x 3HE, double-sided	R961000167 2x = A3
Rack 210TE, 2x 3HE, double-sided	R961000166 2x = A4
Rack 210TE, 1x 3HE (R961000167) + 2x 3HE (2x R961000166)	= A5

Work stations / DS4 configuration - Type key

Fields:	8	9	10	11	12	13
Details in the fields:						
Energy supply						
(Control box with 2x emergency stop)						
without control box, without mains adapter						
Mains adapter 115 V, 50-60 Hz, DC 24 V, 4.5 A	1827003740					
Mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170					
Control box 230 V, 50-60 Hz	1827008412 +					
Mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170					
Control box 230 V, 50-60 Hz	1827008412 +					
2x mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170 2x					
Control box 400 V, 50-60 Hz	R961000289 +					
Mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170					
Control box 400 V, 50-60 Hz	R961000289 +					
2x mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170 2x					
Control box 230 V, 50-60 Hz, with FI	R961000963 +					
Mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170					
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					
Control box 400 V, 50-60 Hz, with FI	R961000962 +					
Mains adapter 230 V, 50-60 Hz, DC 24 V, 4.5 A	R961000170					
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					
Control box 230 V, 50-60 Hz, with FI	R961000963					
Control box 400 V, 50-60 Hz, with FI	R961000962					
Measuring glass						
without measuring glass						
Measuring glass 2.5 l	R961002564					
2x measuring glass' 2.5 l	R961002564 2x					
Hose rack (cannot be combined with load simulator on one side)						
without hose rack						
Hose rack for 9 hoses	R961000188					
2x hose rack for 9 hoses	R961000188 2x					
Hose rack for 50 hoses	R961002634					
Load simulator (cannot be combined with hose deposit on one side)						
without load simulator						
Load simulator 15 kg rotatable	R961000187					
2x load simulator 15 kg rotatable	R961000187 2x					
Oil drip pan / writing surface						
without oil drip pan / without writing surface						
Oil drip pan for DS4 for 1 workplace	R961000192 2x					
Oil drip pan for DS4 for 2 Work stations	R961000192 4x					
Oil drip pan for one side + writing surface for one side	2x R961000192 + 4x 1827003705					
Coupling type						
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.

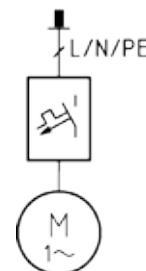
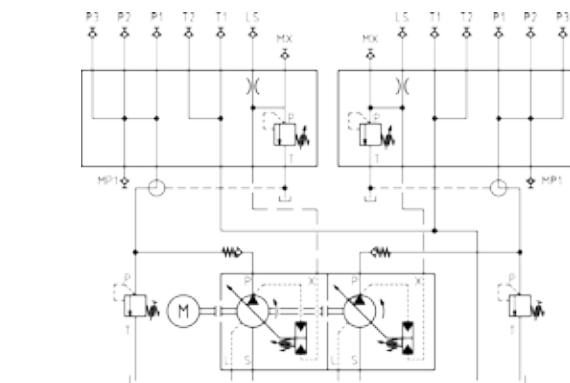
Material no.	R961005986	
Dimensions	mm L885 x W805 x H796	
Weight	kg 129	
Operating pressure controlled	bar 50	
Safety pressure limitation	bar 70	
Standby pressure	bar 15	
Oil tank	l 40	
Displacement	l/min 2x 8	
Voltage, single-phase	V 230	
Frequency	Hz 50	
Power	kW 1.5	
Protective motor switch	A 8.9	

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.	R961005987	
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

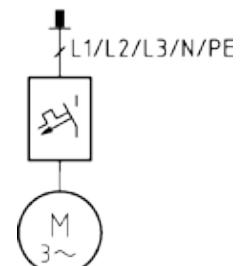
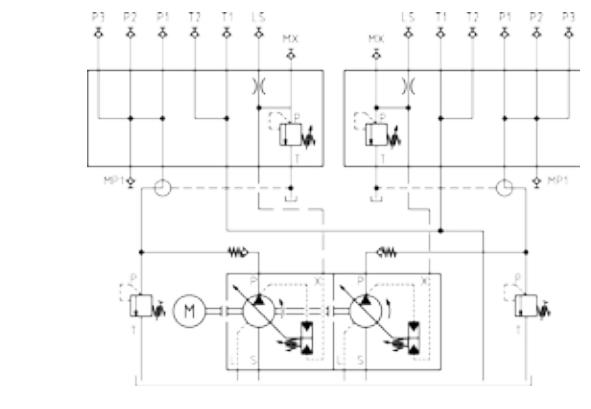
The power unit has two pumps with variable displacement pressure controller (load sensing), for the hydraulic oil supply of the double sided DS4 training system. Suitable for exercises on on/off hydraulics, proportional valve technology and mobile hydraulics. The hydraulic unit is supplied ready for 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.	R961005988
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.	R961005989
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.	R961003176
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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
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Weight	kg	35
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Material	Aluminum profiles powder-coated sheet steel
----------	--

Transport rollers	4 units; steerable; fixable
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Coating	Side panels, blue RAL 5010
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Component carrier with two grids and oil tray

Material no.	R961003128
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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.	R961000279	
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
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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

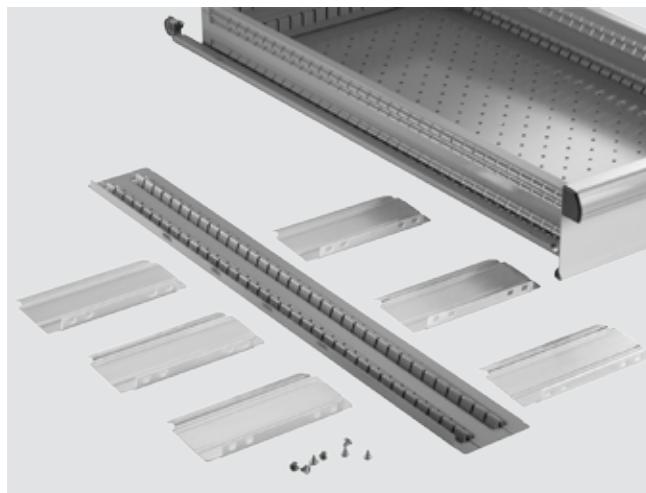
Material no.	R961000563
--------------	-------------------

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:

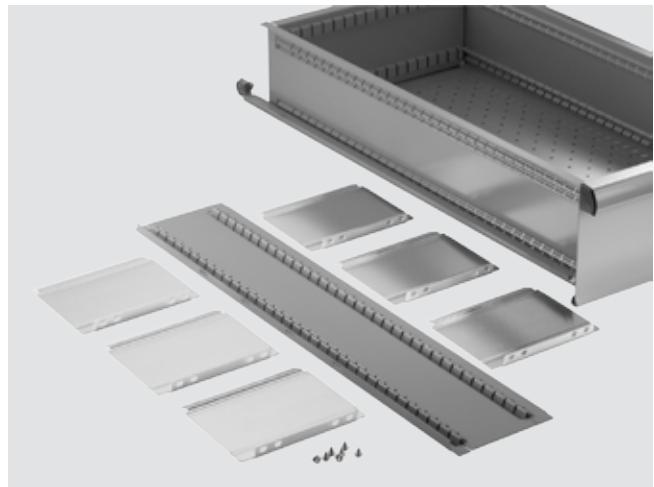
- Divider profiles of galvanized sheet steel
- Adjustable storage areas by means of the stepped slots in the central rail
- Six cross dividers for mounting in the central rail

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
--------------	-------------------

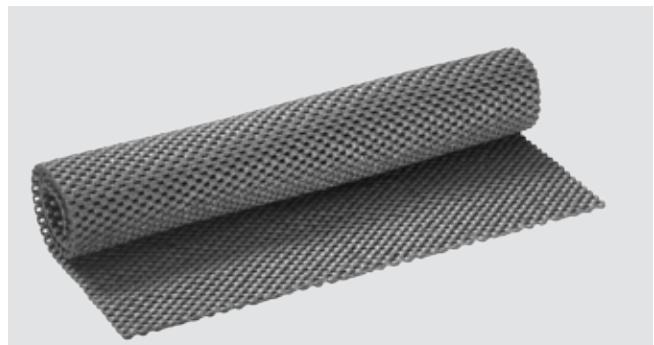
Prevents the parts stored in the drawers from sliding and reduces the possibility of damage to tools and components. Made of black soft rubber, cut to the size of drawers in the portable storage unit with Mat. no.: R961000287 and fixed storage unit with Mat. no.: R961000288. Can also be used with the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

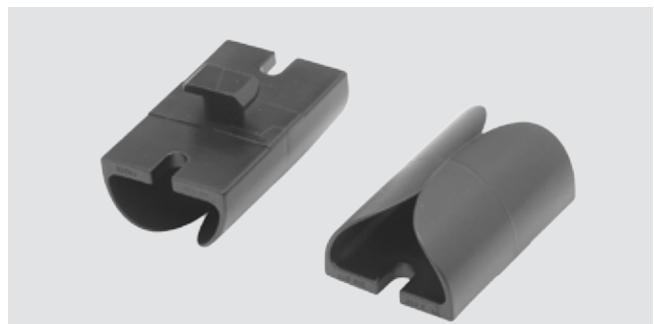
Weight	kg	0.05
--------	----	------

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
---------------	--------------------------

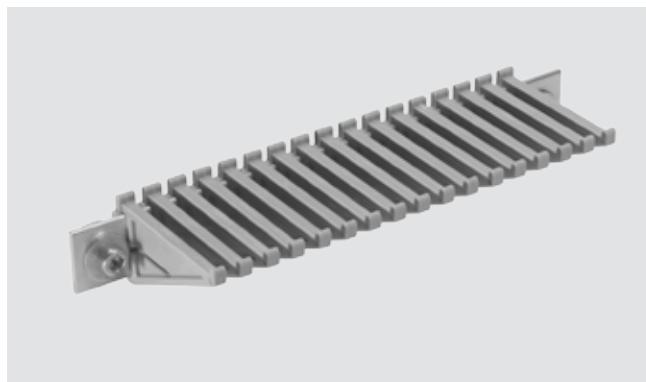
Dimensions	mm	L210 x W65 x H35
------------	----	------------------

Weight	kg	0.14
--------	----	------

Mounting type	Screwed
---------------	---------

Holding capacity	Pcs	50
------------------	-----	----

Material	Aluminum	anodized
	Plastic	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
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Material	Aluminum	anodized
	Sheet steel	coated

Table area (L x W)	mm	400 x 400
--------------------	----	-----------

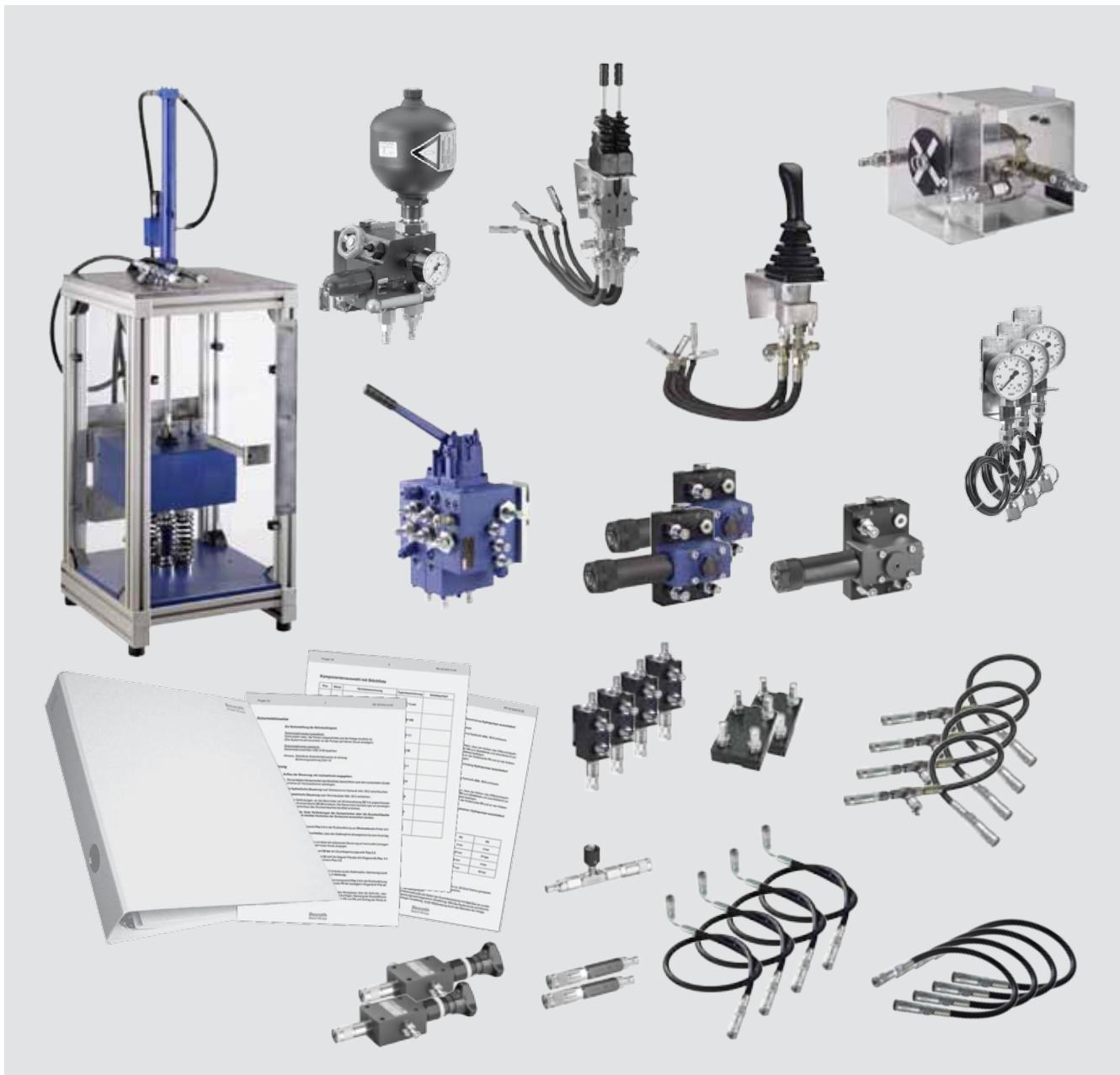


Work stations / accessories

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

Table of Contents: Study topics

Contents	Page	Contents	Page
On/off hydraulics		Proportional valve technology	
▶ Hydraulic basics, manual operation, according to BiBB	48	▶ Proportional control	60
▶ Project exercises for industrial hydraulics, (based on BiBB)	52	▶ Position control	65
▶ Troubleshooting hydraulic systems	57	Mobile hydraulics	
		▶ Throttle control	69
		▶ Load sensing control	73
		▶ LUDV (anti-saturation) control	77

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.

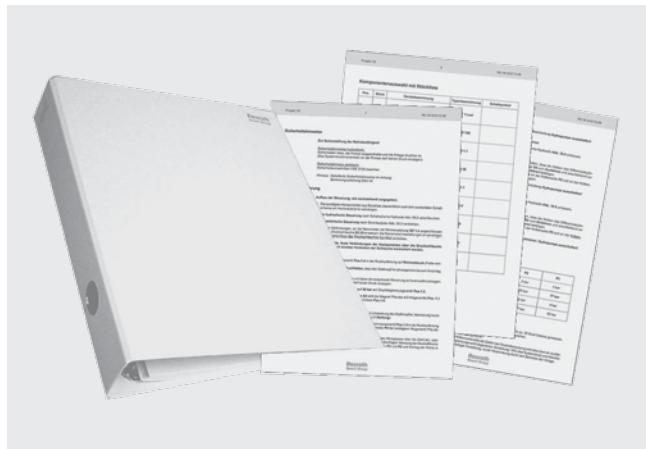
Scope of delivery:

- 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 aide 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	Publica-tion 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	Publica-tion 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

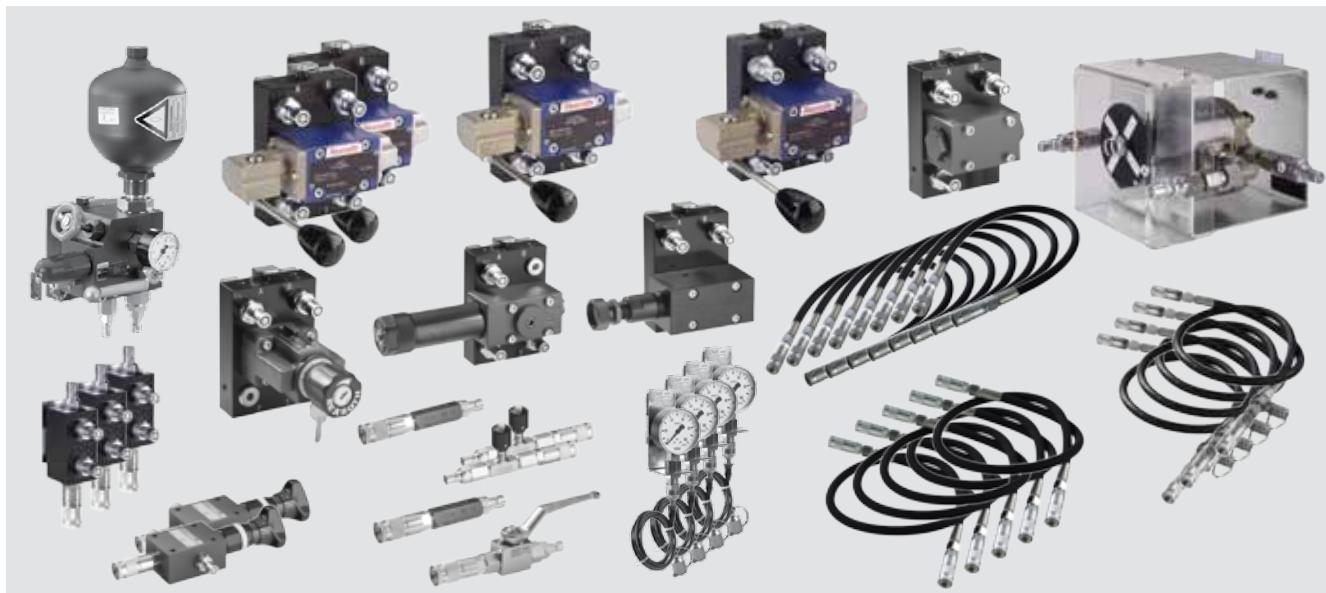
Hydraulic basics, manual operation, according to BiBB

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	Publica-tion 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	Publica-tion 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 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

Project exercises on industrial hydraulics, (based on BiBB)

The necessary measuring devices:

In addition to measuring the pressure via the guages 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	Publica-tion 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.

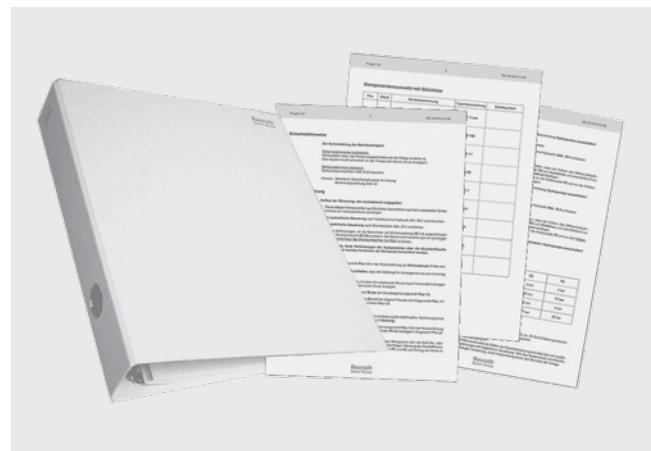
Scope of delivery:

“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

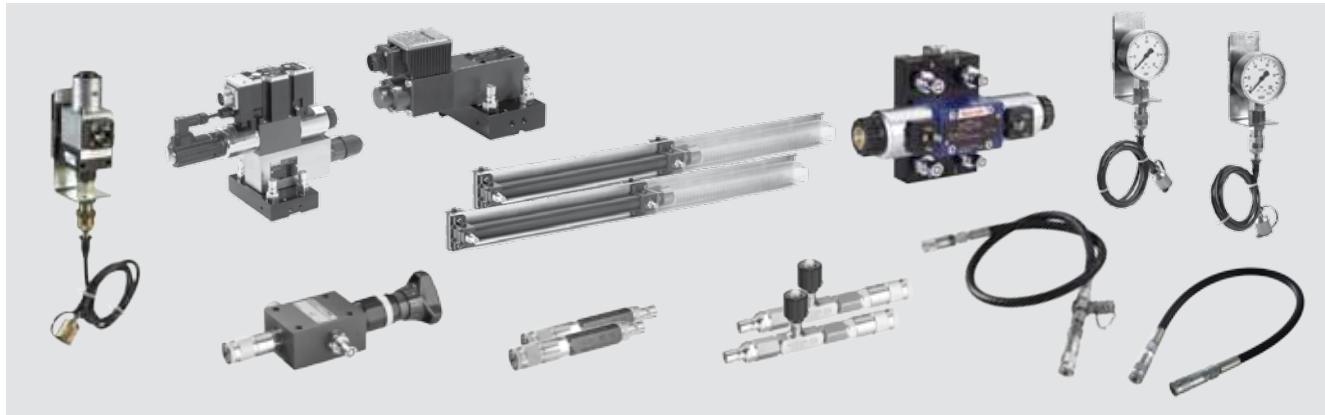
Proportional control

Trainee's manuals	Language	Mat. no.	Book title	Publica-tion 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

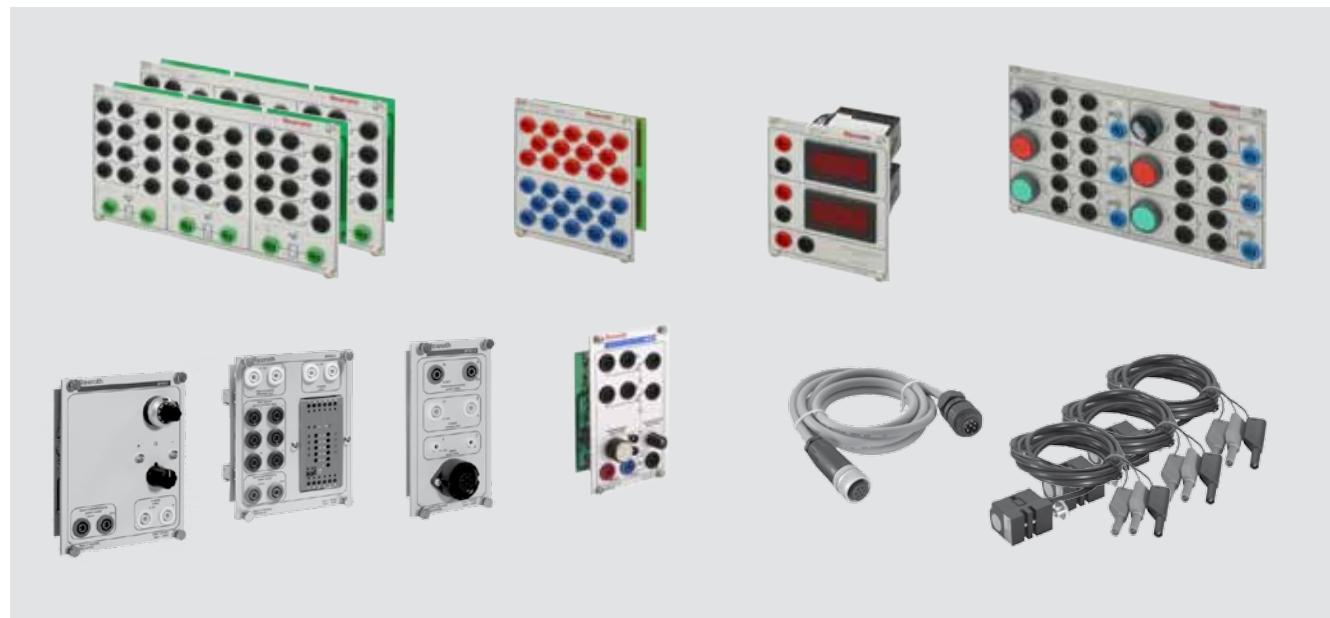
Study topics / proportional valve technology

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

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

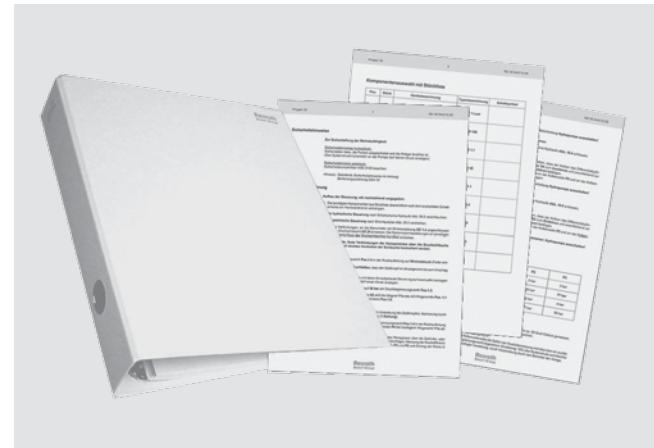
Training manuals for trainers and trainees:

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, Analog Position-s Regelkreis, 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 Analog Position-s Regelkreis, 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	A rectangular operating module with a digital display and several analog and digital input/output terminals.	123
2	BPS 5.2 operating module with 1 potentiometer +/-10 Volt output, 21TE	R961001957	1	A rectangular operating module with a single potentiometer and a digital display.	121
3	BPS 21.0 operating module, Adapter 4 mm sockets to 7-pole connecting plug, 14TE	R961001630	1	A rectangular operating module with a digital display and a large number of physical buttons and knobs.	124
4	BPS 6.1 operating module, command/actual value display, 21TE	R900711665	1	A small rectangular operating module with a digital display and a few buttons.	122
5	BPS 13.1 operating module, distributor, 21TE	R900897345	2	A rectangular operating module with a digital display and a large number of physical buttons and knobs, similar to item 3.	116
6	BPS 7.4 operating module, switches, buttons, 42TE	R900719908	1	A rectangular operating module with a digital display and a large number of physical buttons and knobs, similar to item 3.	117
7	BRS 1.2 operating module, 3x relay, 42TE	R900897337	2	A rectangular operating module with a digital display and a large number of physical buttons and knobs, similar to item 3.	119
8	Proximity switch inductive	R961003106	1	A proximity switch module with a cable and connectors.	133
9	Control panel for DS4 training system with MACAS controller module, 30TE	R961004782	1	A control panel with a digital display and a large number of physical buttons and knobs.	125
10	7-pole cable for integrated electronics	R961003550	1	A 7-pole cable with a connector and a cable length.	132

Study topics / proportional valve technology

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

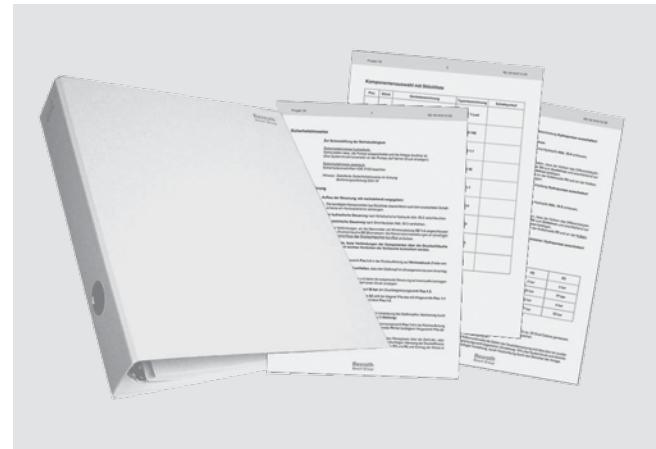
- List of the necessary hydraulic components
- List of the necessary measuring devices

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

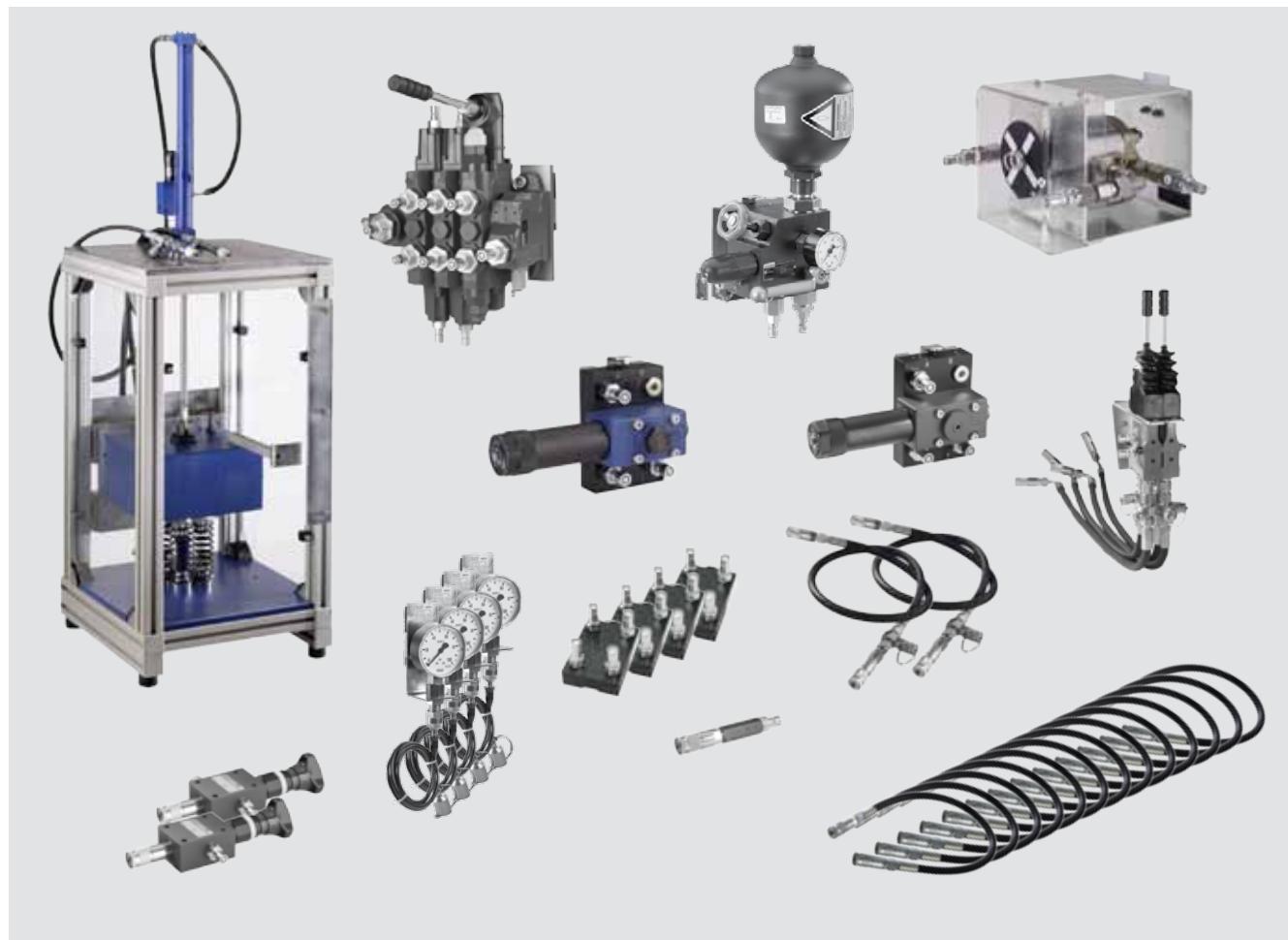
Throttle control

Trainer's manuals	Language	Mat. no.	Book title	Publica-tion 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	Publica-tion 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

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

Trainer's manuals	Language	Mat. no.	Book title	Publication no.
Trainer's manual Project manual Mobile hydraulics load sensing 2M4-12, de	German	R961004565	Projekthandbuch, Mobilhydraulik, Load Sensing 2M4-12, Lehrerhandbuch	RD 09970
Trainer's manual Project manual Mobile hydraulics load sensing 2M4-12, en	English	R961005147	Project manual, Mobile hydraulics, Load Sensing 2M4-12, Trainer's manual	RE 09970

Trainee's manuals	Language	Mat. no.	Book title	Publication no.
Trainee's manual Project manual Mobile hydraulics load sensing 2M4-12, de	German	R961004564	Projekthandbuch, Mobilhydraulik, Load Sensing 2M4-12, Schülerhandbuch	RD 09971
Trainee's manual Project manual Mobile hydraulics load sensing 2M4-12, en	English	R961005146	Project manual, Mobile hydraulics, Load Sensing 2M4-12, Trainee's manual	RE 09971

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

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

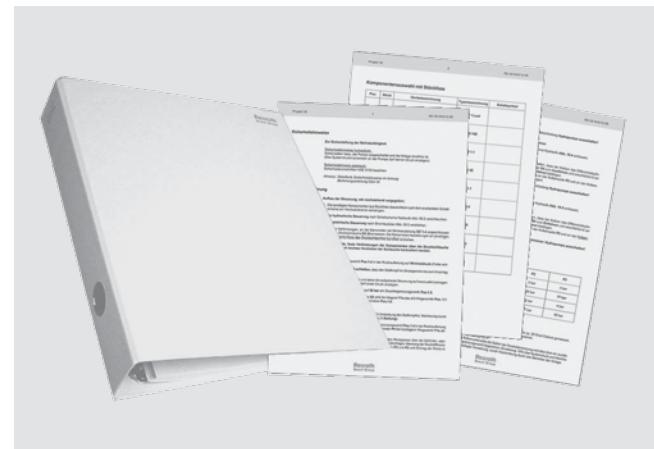
- List of the necessary hydraulic components
- List of the necessary measuring devices

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

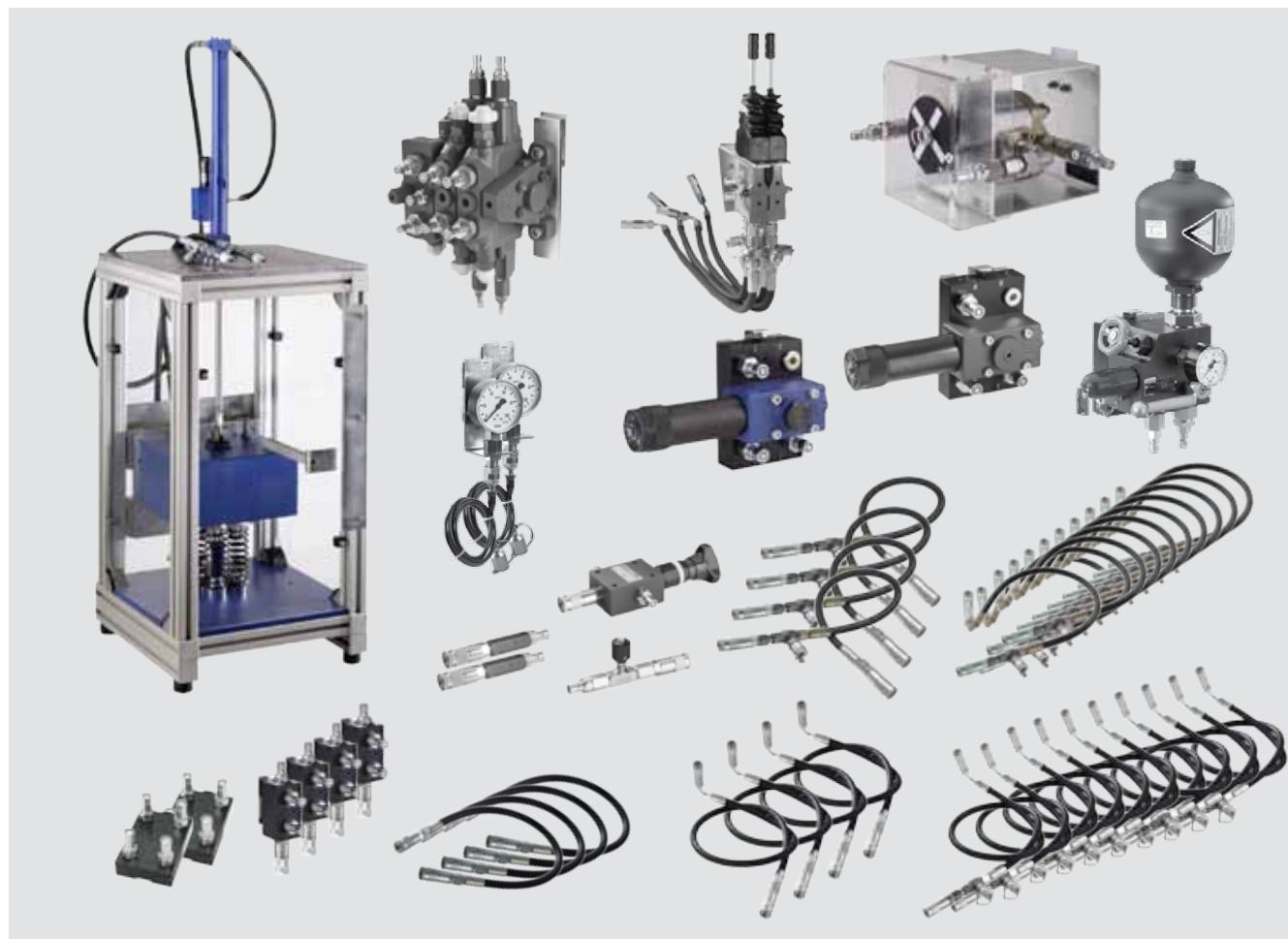
Trainer's manuals	Language	Mat. no.	Book title	Publica-tion no.
Trainer's manual Project manual Mobile hydraulics LUDV 2SX-12, de	German	R961004654	Projekthandbuch, Mobilhydraulik LUDV 2SX-12, Lehrerhandbuch	RD 09972
Trainer's manual Project manual Mobile hydraulics LUDV 2SX-12, en	English	R961005149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

Trainee's manuals	Language	Mat. no.	Book title	Publica-tion 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

Contents	Page	Contents	Page
Valves		Electrical components	
▶ Directional control valves		▶ Operating modules 19" installation technology	116
– Manual operation	84	▶ Connection lines	131
– Electric operation	87	▶ Proximity switches	133
– Proportional valves with feedback	89	▶ Pressure switches	133
▶ Pressure control valves		Measurement technology	
– Manual operation	91	▶ Measuring devices	135
– Solenoid operation	93	▶ Sensors	137
▶ Flow control valves		▶ Measuring cables	137
– Manual operation	95	Mobile hydraulics	
▶ Isolator valves		▶ Pilot control unit	
– Manual operation	97	– 2-2TH6 pilot control unit, hydraulic	139
– Hydraulic operation	98	– 4TH6 pilot control unit, hydraulic	140
Actuators		▶ Mobile control block	
▶ Cylinders	101	– 3SM12 mobile control block	141
▶ Hydraulic motors	104	– 2M4-12 mobile control block	142
Hydraulic accessories		– 2SX-12 mobile control block	143
▶ Hydraulic accumulators, pressure filters	105		
▶ Manifolds	106		
▶ Pressure gauges	108		
▶ Hose lines	110		
▶ Working equipment, spare parts	113		

Components / valves

Directional control valves - manual operation

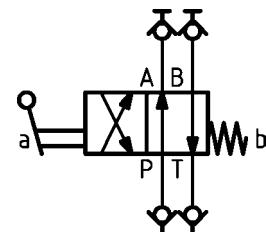
4WMM6C5X 4/2 directional valve

Material no.	R961002552
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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



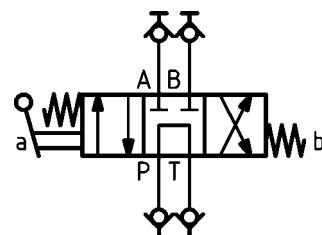
4WMM6G5X 4/3 directional valve

Material no.	R961002550
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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.	R961006553
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Modified 4/3 directional valve 4WMM6G5X/; the typical features of aging and wear have been simulated.

Components / valves

Directional control valves - manual operation

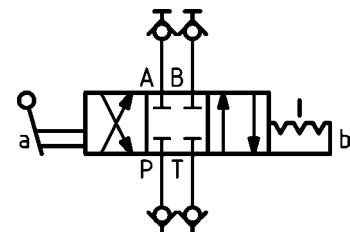
4WMM6E5X/ 4/3 directional valve

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



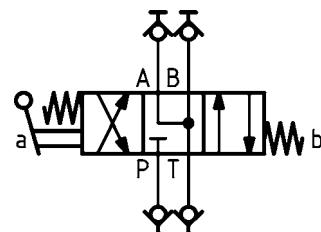
4WMM6J5X 4/3 directional valve

Material no.	R961002510
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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

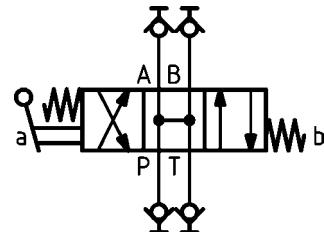
4WMM6H5X 4/3 directional valve

Material no.	R961002511
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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

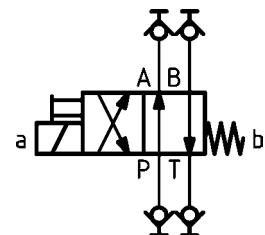
4WE6C6X/ 4/2 directional valve

Material no. **R961002547**

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



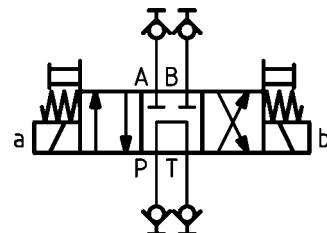
4WE6G6X/ 4/3 directional valve

Material no. **R961002548**

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. **R961006551**

Modified 4/3 directional valve 4WE6G6X/; the typical features of aging and wear have been simulated.

Components / valves

Directional control valves - electric operation

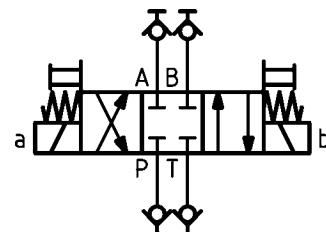
4WE6E6X/ 4/3 directional valve

Material no.	R961002549
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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



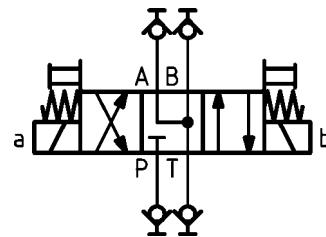
4WE6J6X/ 4/3 directional valve

Material no.	R961002554
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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

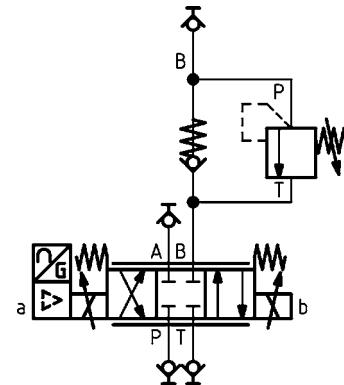
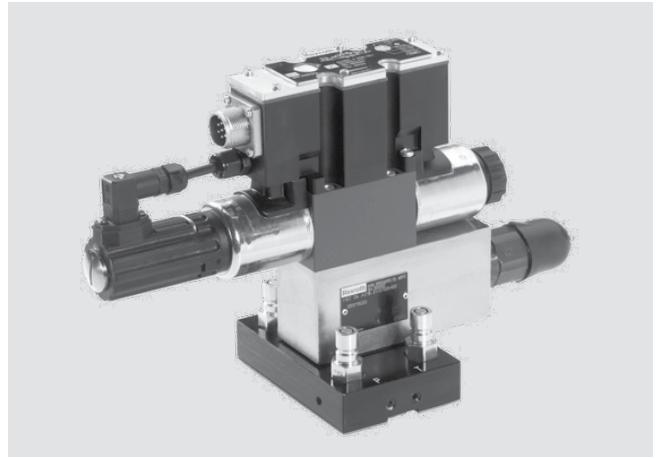
Directional control valves - Proportional valves with feedback

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

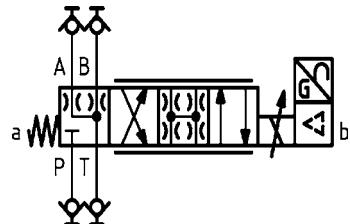
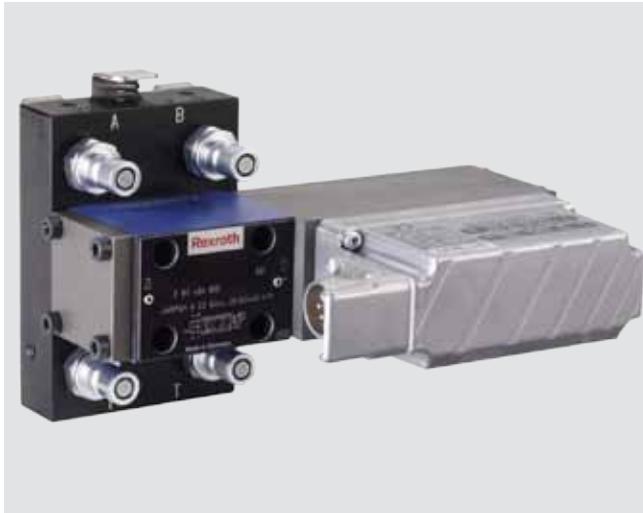
Material no. **R961002509**

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.	R961002520
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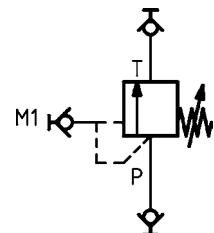
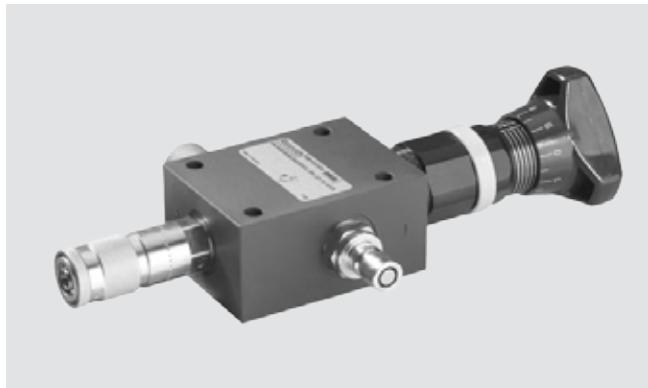
Manual adjustment via control knob, subplate mounted; connections via quick disconnects

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.	R961006549
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Modified DBDH6G1X/100 pressure relief valve; the typical features of aging and wear have been simulated.

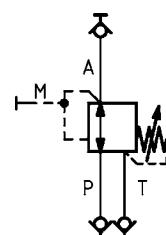
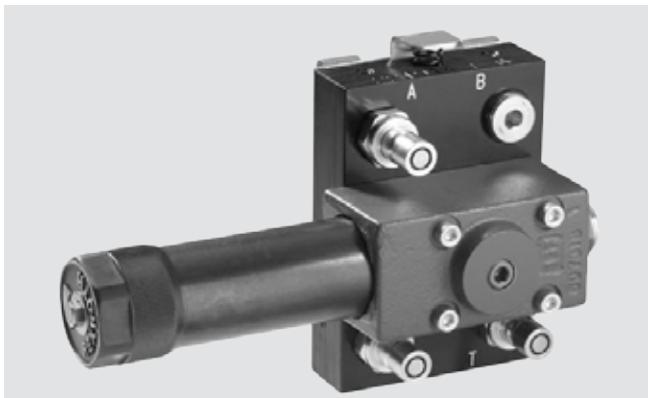


DR6DP1-5X/75 pressure reducing valve direct operated

Material no.	R961002544
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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

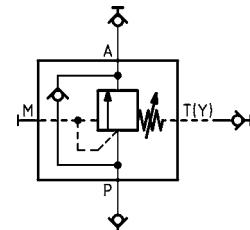
Pressure control valves - manual operation

DZ6DP1-5X/75 pressure sequence valve direct operated

Material no. **R961002558**

Manual adjustment via control knob, pilot oil supply internal, leakage oil return external, with bypass check valve, subplate mounted; connections via quick disconnects

Didactic designation	DD3.NV-W
Industrial type	DZ6DP1-5X/75Y
Industrial type information	RE 26076
Dimensions mm	L197 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

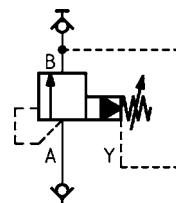
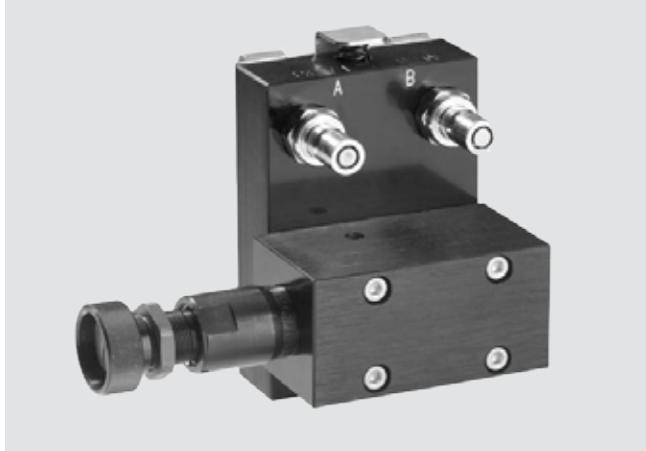


DB6K1-4X/50 pressure relief valve pilot operated

Material no. **R961002545**

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. **R961006550**

Modified DBDH6G1X/50 pressure relief valve pilot operated; the typical features of aging and wear have been simulated.

Components / valves

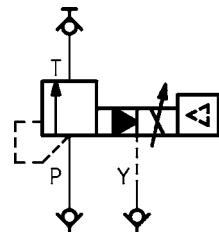
Pressure control valves - Solenoid operation

DBEE6-1X/50 proportional pressure relief valve

Material no.	R961003924
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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

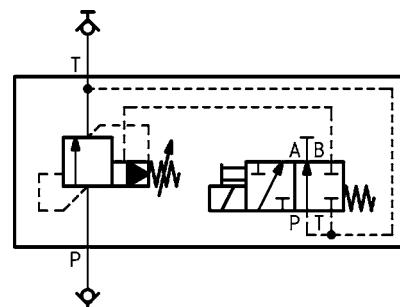
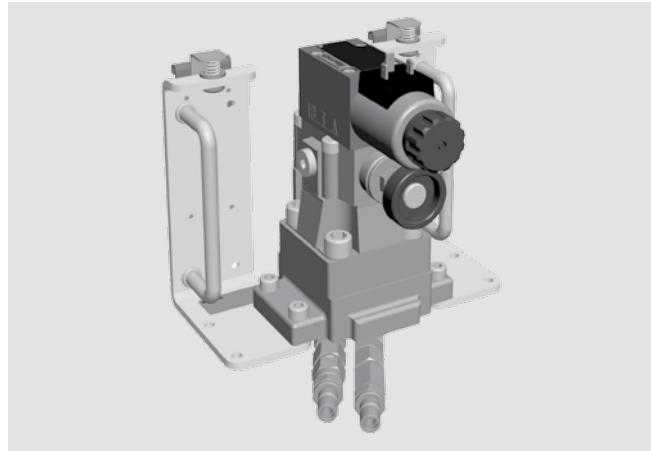


DBW10A1-5X/50 pressure relief valve pilot operated

Material no.	R961002553
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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

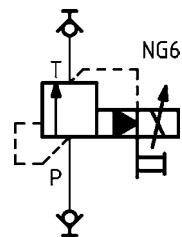
Pressure control valves - electric operation

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. **R961002539**

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

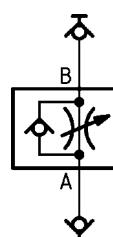
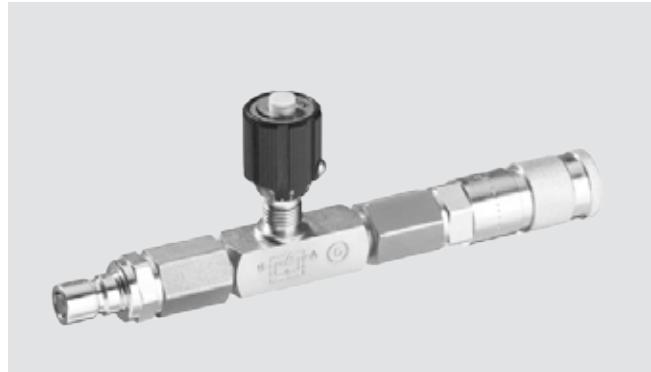


DRV06-1-1X/V throttle check valve

Material no. **R961002495**

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

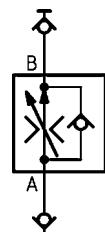
Flow control valves - manual operation

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. **R961002491**

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



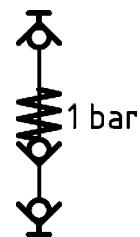
Components / valves

Isolator valves - hydraulic operation

S6A1.X check valve

Material no.	R961002489
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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
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Modified S6A1.X check valve with hose 630 mm; the typical features of aging and wear have been simulated.

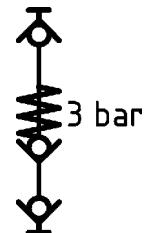
Components / valves

Isolator valves - hydraulic operation

S6A3.X check valve

Material no.	R961002522
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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. **R961002513**

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

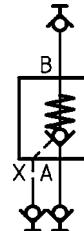
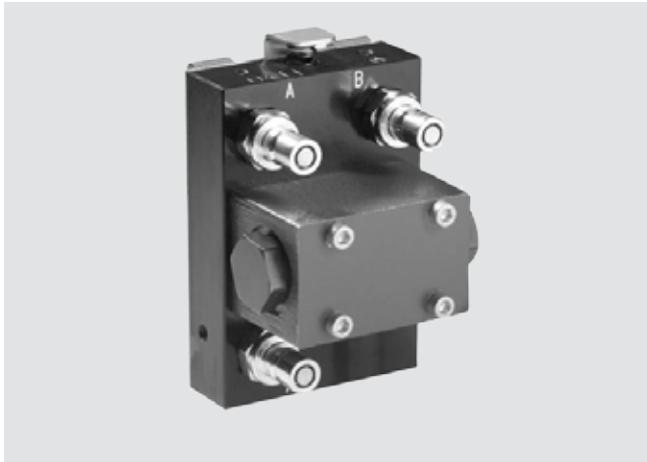
Operating pressure max. bar 120

Cracking pressure bar 1.5

Flow max. l/min 15

Zero leak quick disconnect Type W

Type of operation Hydraulic



Components / actuators

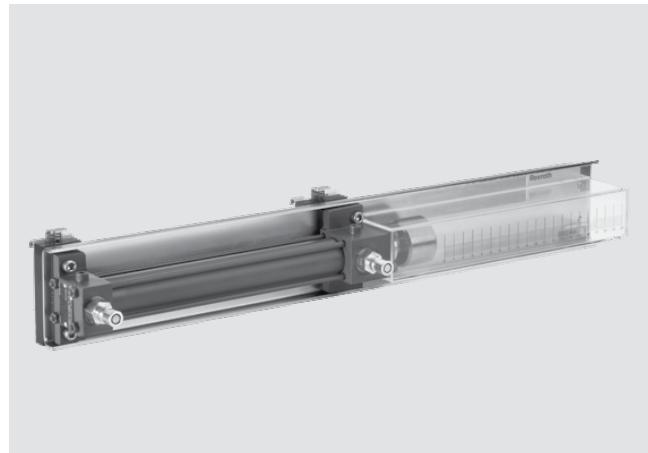
Cylinders

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

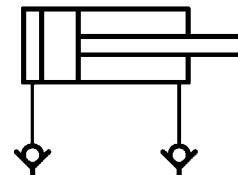
Material no. **R961003494**

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

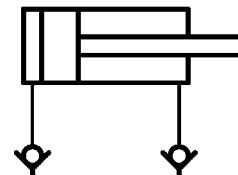
Material no. **R961003495**

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

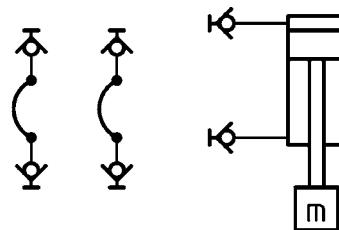
Cylinders

Load simulator, 15 kg, rotatable 180°

Material no.	R961000187
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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



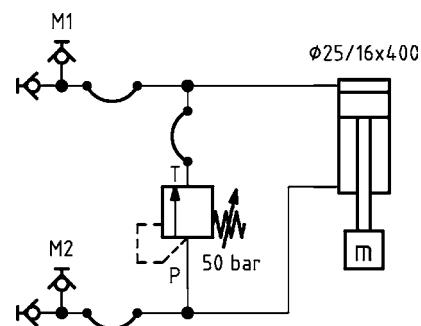
Vertical loading unit, 80 kg

Material no.	R961004005
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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

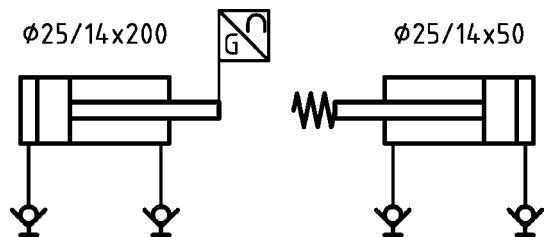
Cylinders

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 transducer, output	600 mm = 10 V



Components / actuators

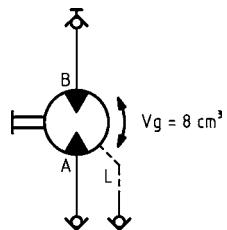
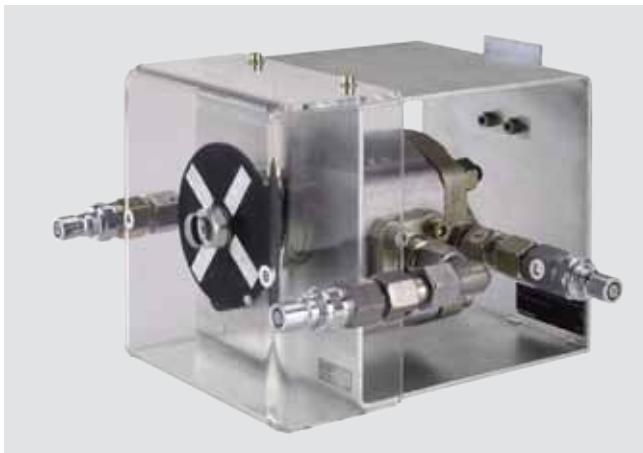
Hydraulic motors

Gear motor

Material no.	R961004259
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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 disconnect	Type W
Max. speed 1/min	1000
Displacement cm ³	8
Oil flow max. l/min	8

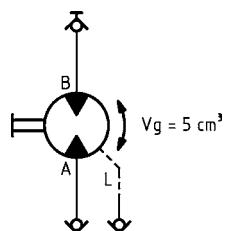


Axial piston unit

Material no.	R961002811
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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 ³	4.93
Oil flow max. l/min	49



Components / hydraulic accessories

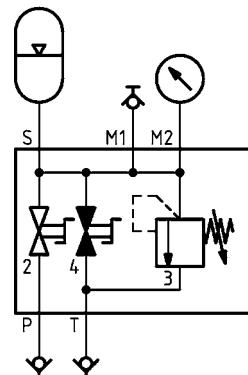
Hydraulic accumulators, pressure filters

Hydraulic diaphragm-type accumulator with isolation valving for grid mounting

Material no. **R961002503**

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

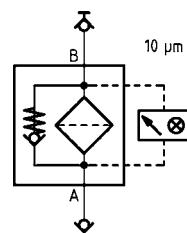


Line mounted filter

Material no. **R961004334**

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 μ	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

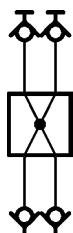
Didactic designation **DZ4.NV-W**

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

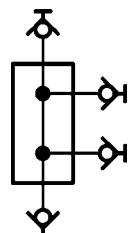
Didactic designation **DZ4.2N-W**

Dimensions mm **L168 x W45 x H80**

Weight kg **0.63**

Operating pressure max. bar **120**

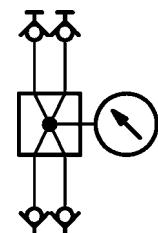
Zero leak quick disconnect **Type W**



Components / hydraulic accessories

Manifolds

Pressure gauge 0 to 100 bar with distributor, for grid mounting	
Material no.	R961002530
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.	R961003403	
With mounting clip, 63 mm diameter, 5 bar scaling		
Didactic designation	DZ1.6	
Dimensions ¹⁾	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 ¹	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.	R961002720	
With mounting clip, 63 mm diameter, 5 bar scaling		
Didactic designation	DZ1.5	
Dimensions ¹	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	



¹⁾ without measuring hose

Components / hydraulic accessories

Pressure gauges

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



Clamp holder for grid system	
Material no.	R961003498
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.	R961002474
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.	R961002475
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.	R961002473
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.	R961002480
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.	R961002479
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.	R961002481
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.	R961002476
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.	R961002482
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.	R961002478
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.	R961004332
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.	R961004331
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.	R961002477
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 minimess connection

Material no.	R961004329
Didactic designation	DZ-W
Min. bending radius mm	85
Hose length mm	700
Weight kg	0.68
Operating pressure, max. bar	120
Minimess connection	AB20-11/K1 G1/4 hose coupling
Zero leak quick disconnect	R961000481 Socket M16x1.5

Hose line 1000 mm with 90° fitting and minimess connection

Material no.	R961004330
Didactic designation	DZ-W
Min. bending radius mm	85
Hose length mm	1000
Weight kg	0.75
Operating pressure, max. bar	120
Minimess 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.	R900865138
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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
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Dimensions	L300 x W90 x H90
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Weight	kg
	1.0



Cleaning roll trolley

Material no.	R900833872
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Consisting of:

Moveable cleaning roll trolley

Litter bin with cover 40 L

Binding agent

Wipes

Rubbish sacks

Dimensions	L700 x W500 x H450
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Didactic designation	Z3
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Weight	kg
	35.0



Minimess threaded coupling G1/4

Material no.	R900009090
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With screw-in stud G 1/4 A

Didactic designation	AB 20-11/K1
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Dimensions	L46 x D 22
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Weight	kg
	0.1

Max. pressure	bar
	630



Components / hydraulic accessories

Working equipment, spare parts

Pressure relief socket

Material no.	R961002927
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For relieving trapped pressures

Didactic designation	DRK
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Dimensions	mm	L79 x D 50
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Weight	kg	0.19
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Coupling connector G1/4"

Material no.	R961000482
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Dimensions	mm	L41 x D 21
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Wrench size	mm	19
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Weight	kg	0.036
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Connection thread	G 1/4 A
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Operating pressure, max.	bar	120
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Zero leak quick disconnect G 1/4"

Material no.	R961000480
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Dimensions	mm	L68 x D 22
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Wrench size	mm	19
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Weight	kg	0.17
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Connection thread	G 1/4 A
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Operating pressure, max.	bar	120
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Zero leak quick disconnect M16 x 1.5

Material no.	R961000481
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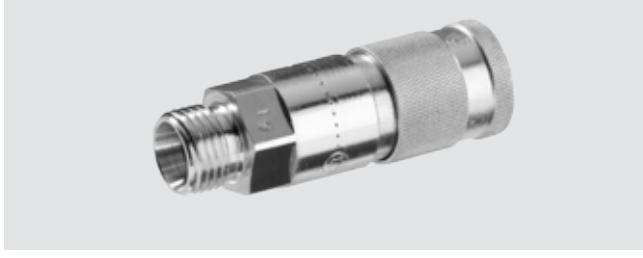
Dimensions	mm	L66 x D 22
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Wrench size	mm	19
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Weight	kg	0.17
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Connection thread	M16 x 1.5
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Operating pressure, max.	bar	120
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Hydraulic oil RSL22 1 kg

Material no.	R900019287
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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:

www.avi Product trade name: AVIA Fluid RSL22

Dimensions	mm	L250 x W250 x H400
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Weight	kg	19
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Contents	l	20
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Components / hydraulic accessories

Working equipment, spare parts

Filling and testing device for hydraulic accumulators	
Material no.	R900001439
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

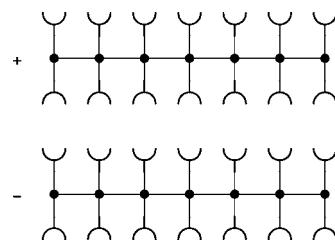
BPS13.1 operating module, distributor 1:13, 21TE

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



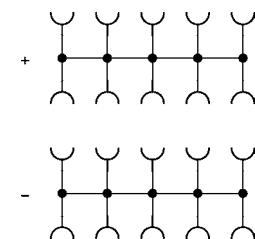
TS-BPS13.1 operating module, distributor 1:9, 15TE

Material no. **R961004910**

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

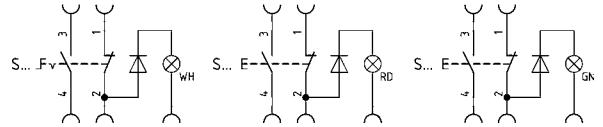
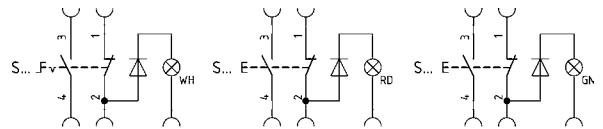
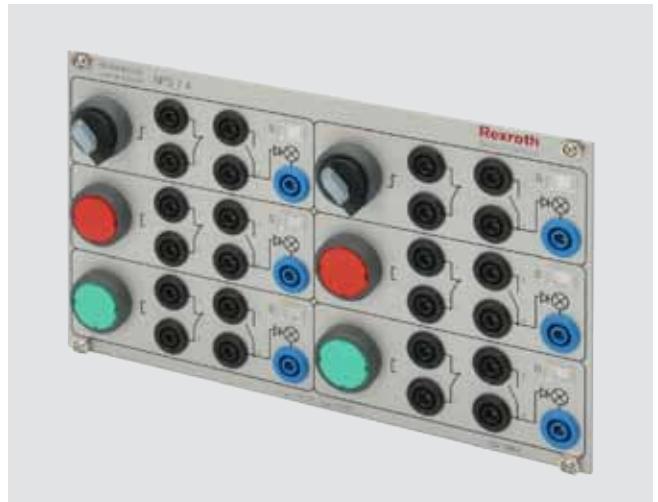
Material no. **R900719908**

2x "switch-button group", contains two sets of the following:

1 detented rotary switch with 1 NC and NO contact; 2 lighted pushbuttons with spring return and 1 NC and 1 NO contact each.

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



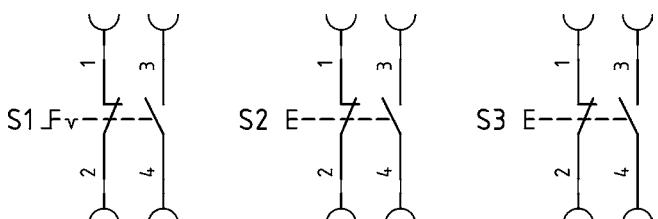
TS-BPS7.4 operating module, switch-button, 15TE

Material no. **R961004909**

1 detented rotary switch with 1 NC and NO contact; 2 lighted pushbuttons with spring return and 1 NC and 1 NO contact each.

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

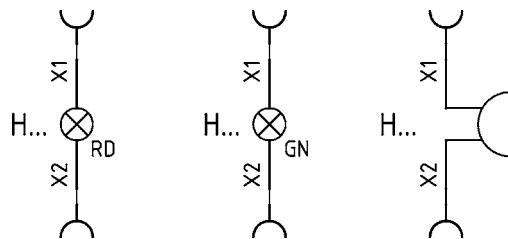
BPS8.1 operating module, signal display, visual/audible 21TE

Material no. **R900897341**

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



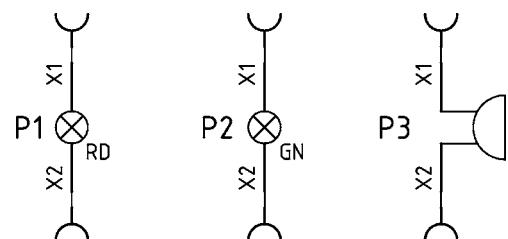
TS-BPS8.1 operating module, signal display, visual/audible 15TE

Material no. **R961004911**

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

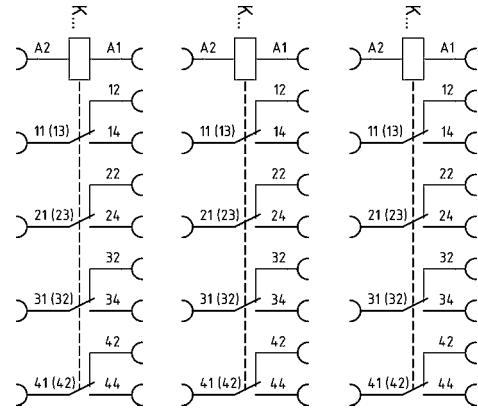
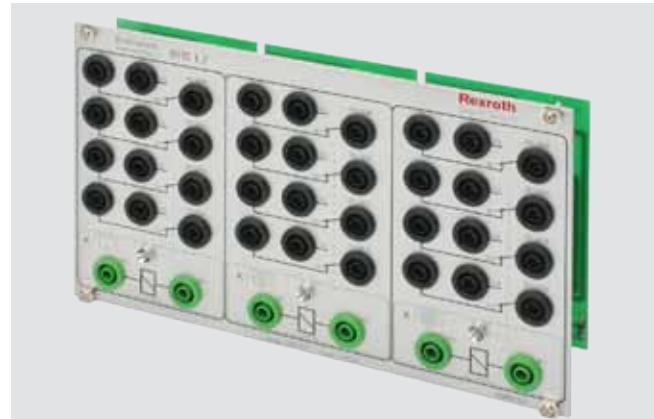
BRS1.2 operating module, 3 x relay, 42TE

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



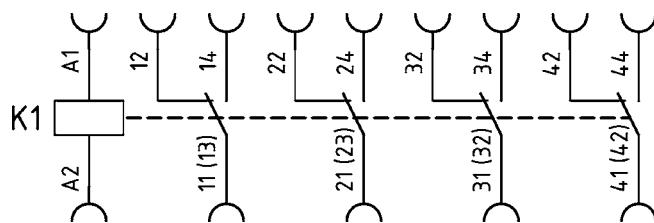
TS-BRS1.2 operating module, 1 x relay, 15TE

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**

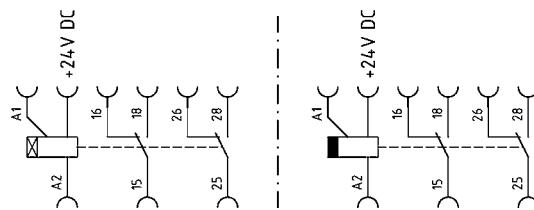
Relay with 1 NO contact and 1 NC contact; optionally switching for delay on or delay off; delay time can be steplessly adjusted, control light is illuminated in switched condition.

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**

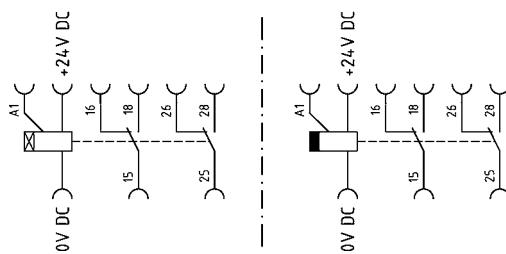
Relay with 1 NO contact and 1 NC contact; optionally switching for delay on or delay off; delay time can be steplessly adjusted, control light is illuminated in switched condition.

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 (DC) A with DC 24 V max.	2
Protection class IEC 60529	IP50



umschaltbar
switchable



Components / electrical components

Operating modules in 19 inch installation technology

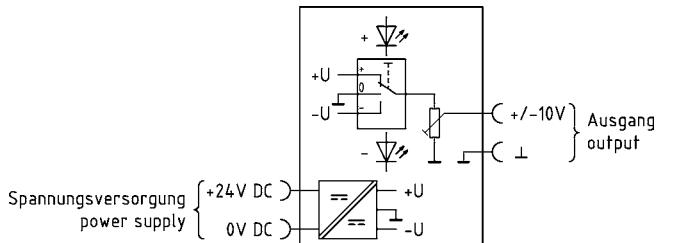
BPS5.2 operating module, command value +/-10 V, 21TE

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	V	+/-10
(zero-potential)		
Protection class	IEC 60529	IP50



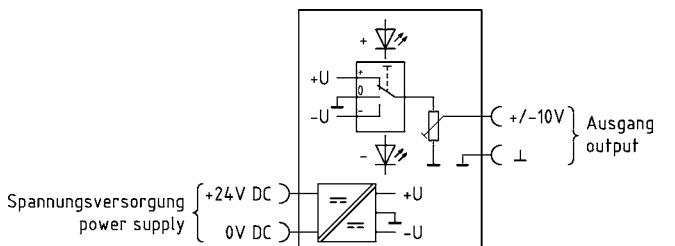
TS-BPS5.2 operating module, command value +/-10 V, 30TE

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	V	+/-10
(zero-potential)		
Protection class	IEC 60529	IP50



Components / electrical components

Operating modules in 19 inch installation technology

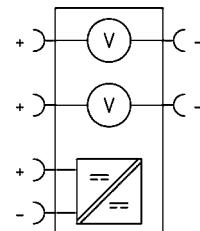
BPS6.1 operating module, command/actual value display, 21TE

Material no. **R900711665**

2x isolated input digital voltmeters with 3 1/2 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



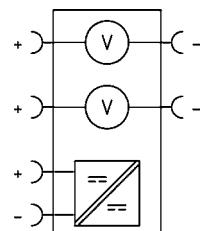
TS-BPS6.1 operating module, command/actual value display, 30TE

Material no. **R961004913**

2x isolated input digital voltmeters with 3 1/2 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

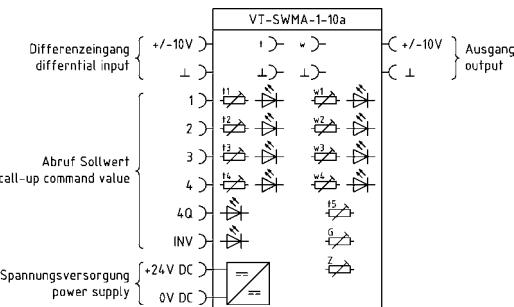
BPS20 operating module, command value generation, 21TE

Material no. **R961000107**

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	+/-10
Current consumption mA	500
Protection class IEC 60529	IP50



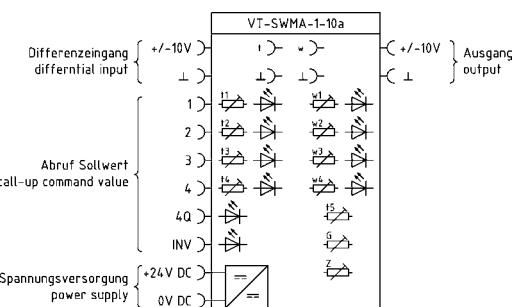
TS-BPS20 operating module, command value generation, 30TE

Material no. **R961004897**

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	+/-10
Current consumption mA	500
Protection class IEC 60529	IP50



Components / electrical components

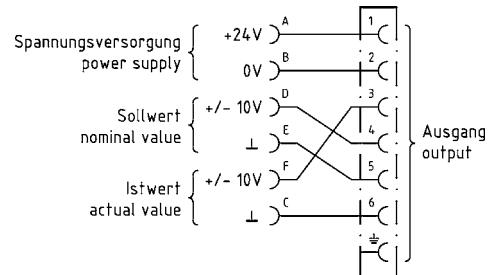
Operating modules in 19 inch installation technology

BPS21.0 operating module, adapter for connector to laboratory sockets, 14TE

Material no.	R961001630
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Adapter for 7-pole connecting plug to laboratory sockets. For installation into 19" frame rack; contact safe 4 mm laboratory sockets for DC 24 V lines and command value lines; contact safe; 2 mm laboratory sockets with gold plated contacts for actual values

Didactic designation	BPS21
Dimensions	mm L71 x W53 x H129
Weight	kg 0.120
Mounting type	Screwed
Division grid, rack	3HE, 14TE
Operating voltage (DC) V	24
Protection class	IEC 60529 IP50

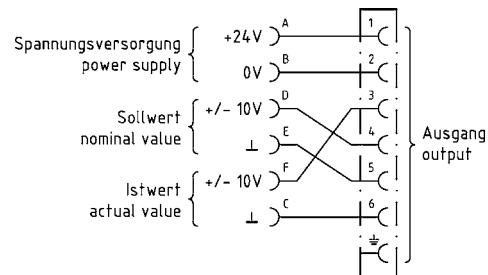


TS-BPS21.0 operating module, adapter for connector to laboratory sockets, 15TE

Material no.	R961004896
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Adapter for 7-pole connecting plug to laboratory sockets. For installation into 19" frame rack; contact safe 4 mm laboratory sockets for DC 24 V lines and command value lines; contact safe; 2 mm laboratory sockets with gold plated contacts for actual values

Didactic designation	BPS21.0
Dimensions	mm L76 x W53 x H129
Weight	kg 0.130
Mounting type	Screwed
Division grid, rack	3HE, 15TE
Operating voltage (DC) V	24
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_{T_1}	1 - 16
Controller (integral share) K_i	1 - 16
Area matching Cylinders	1 - 16
Output signal (actuating variable) V	+/-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

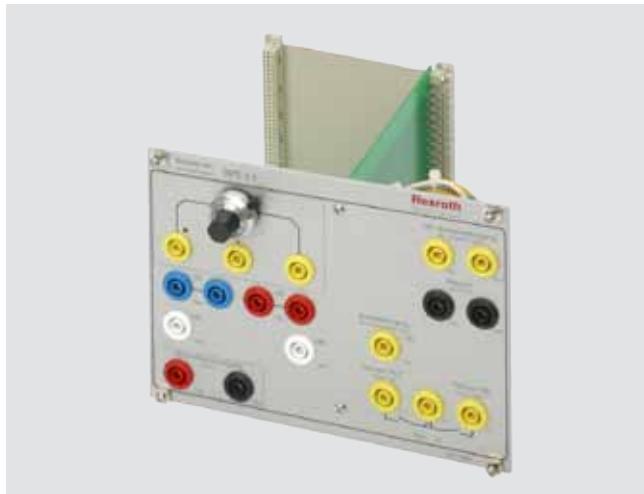
Material no.	R900711662
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Adapter to facilitate interconnection of VT-VSPA1 amplifier to valve and signal values; connection of the plug-in connector via 4 mm laboratory sockets; setting of command value signal via potentiometer

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

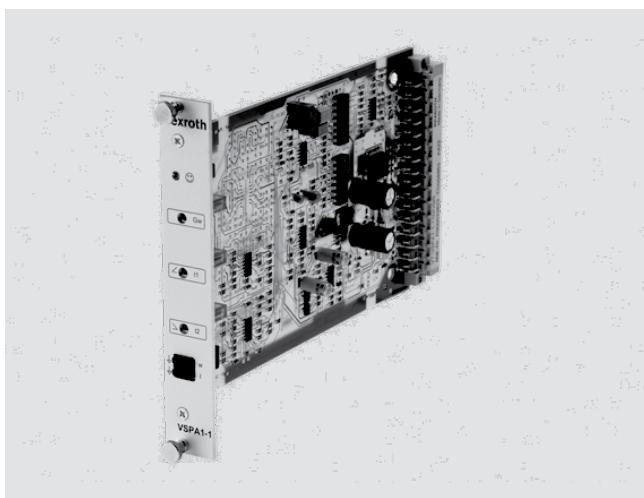
Material no.	R900033823
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For controlling direct operated proportional valves without electrical position feedback; suitable for directional, pressure and flow control valves.

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

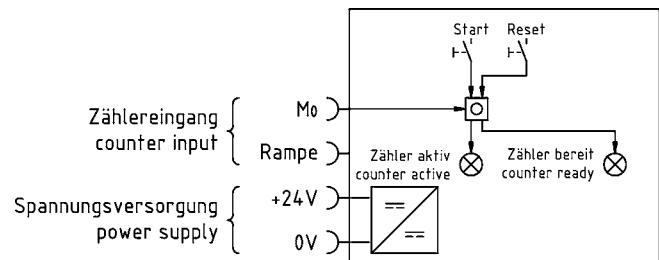
Didactic designation	BPS2.1 + VRPA1
Dimensions	mm L280 x W210 x H140
Weight	kg 1.88
Mounting type	Screwed
Operating voltage (DC) V	24
Protection class	IEC 60529 IP50



Components / electrical components

Operating modules in 19 inch installation technology

BPS 11.1 operating module	
Material no.	R900711666
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.	R900703147
--------------	------------

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
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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
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Weight	kg	0.05
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Mounting type	Screwed
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Division grid	3HE, 21TE
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Blanking plate, 3HE, 8TE

Material no.	1827008409
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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
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Weight	kg	0.038
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Mounting type	Screwed
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Division grid	3HE, 8TE
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Blanking plate, 3HE, 7TE

Material no.	1827008410
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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
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Weight	kg	0.028
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Mounting type	Screwed
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Division grid	3HE, 7TE
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Blanking plate, 3HE, 6TE

Material no.	R913004345
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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
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Weight	kg	0.027
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Mounting type	Screwed
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Division grid	3HE, 6TE
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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
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Weight	kg	0.025
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Mounting type	Screwed
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Division grid	3HE, 4TE
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Components / electrical components

Connection lines

Solenoid cable with LED form A black

Material no.	R900846807
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.	R900846808
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.	R900846809
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.	R900846812
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.	R900826555
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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.	R900846817
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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.	R900029597
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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
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Weight	kg	1.1
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Connection cable set - large

Material no.	R900021502
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Consisting of:

64 contact safe connection 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 black in each case 5 units
 500 mm long red, green and black 5 units 750 mm long
 black in each case 4 units 750 mm long red and black in each
 case 2 units 1000 mm long red and black in each case 1 unit
 2000 mm long red and blue

Didactic designation	E17
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Weight	kg	1.78
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7-pole cable for integrated electronics

Material no.	R961003550
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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
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Weight	kg	0.450
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Protection class	IEC 60529	IP50
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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

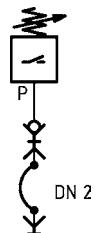


Pressure switch electric

Material no. **R961003488**

With mounting, including cable

Didactic designation	DD6E.3
Industrial type	HED8OA1X/100K14
Industrial type information	RE 50060
Dimensions ¹⁾ mm	L100 x W45 x H170
Operating pressure bar max.	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



¹⁾ 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 ¹⁾ 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)

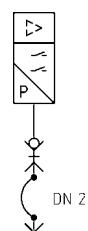
Contact load max. mA 250

Switching cycles Hz 170

Included in the scope of delivery: Mat. no. Length

Measuring hose R900083425 1000 mm

Connection cable R900846817 3000 mm



¹⁾ Dimensions without measuring hose and connection cable

Components / measuring technology

Measuring devices

Multi-meter

Material no. **R900897502**

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. **R961002272**

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. **R961002273**

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.	R913002274
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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.	R900061256
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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.	R900065201
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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.	R900738915
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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
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Speed sensor

Material no.	R900892375
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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.	R900749653
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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
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Components / measuring technology

Sensors, measuring cables

Gear flow meter 0.2 to 30 l/min with ISDS

Material no.	R961002508
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Mounted on device plate

Didactic designation	DZ30.2N-W
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Dimensions	mm	L230 x W180 x H115
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Weight	kg	3.38
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Measuring range	l/min	0.2 - 30
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Impulse per	dm ³	Approx. 1640
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Recommended accessories	Mat. no.
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ISDS measuring cable	R900733207
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Flow meter 1.0 to 7.5 l/min

Material no.	R961002561
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FM-222-112

Didactic designation	DZ35.1N-W
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Dimensions	mm	L160 x D 60
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Weight	kg	0.66
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Pressure max.	bar	100
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Measuring range	l/min	1.0 - 7.5
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Measuring cable for ISDS

Material no.	R900733207
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Didactic designation	MKS
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Dimensions	mm	L2500
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Weight	kg	0.35
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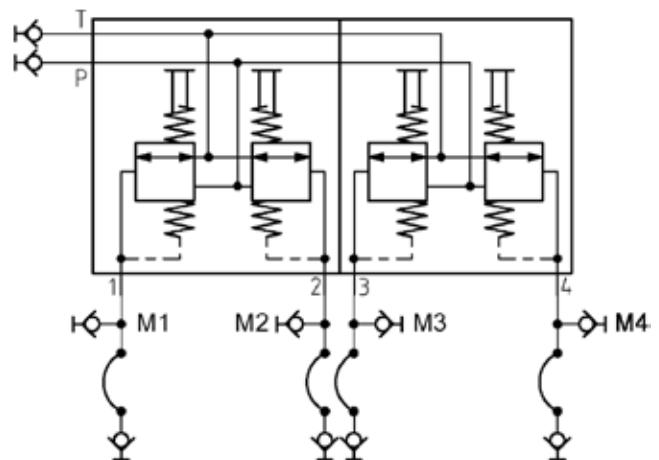
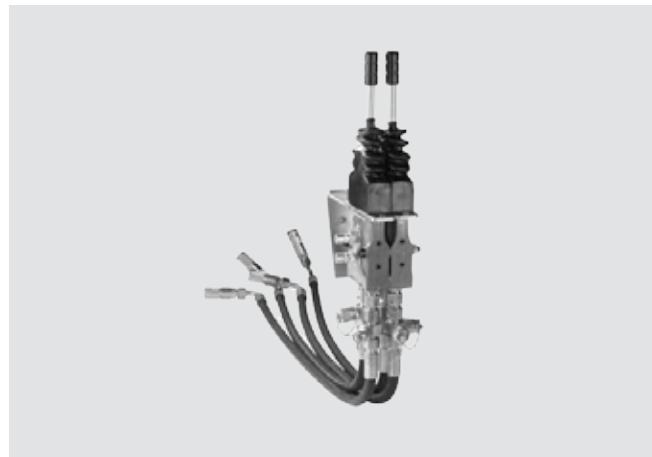
Components / mobile hydraulics

2-2TH6-L70 pilot control unit

Material no.	R961004190
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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



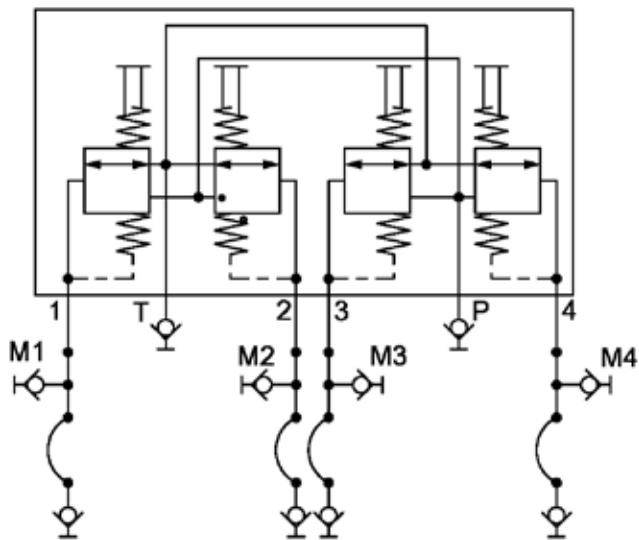
Components / mobile hydraulics

Pilot control unit for arm rest installation 4TH6-97

Material no.	R961004191
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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

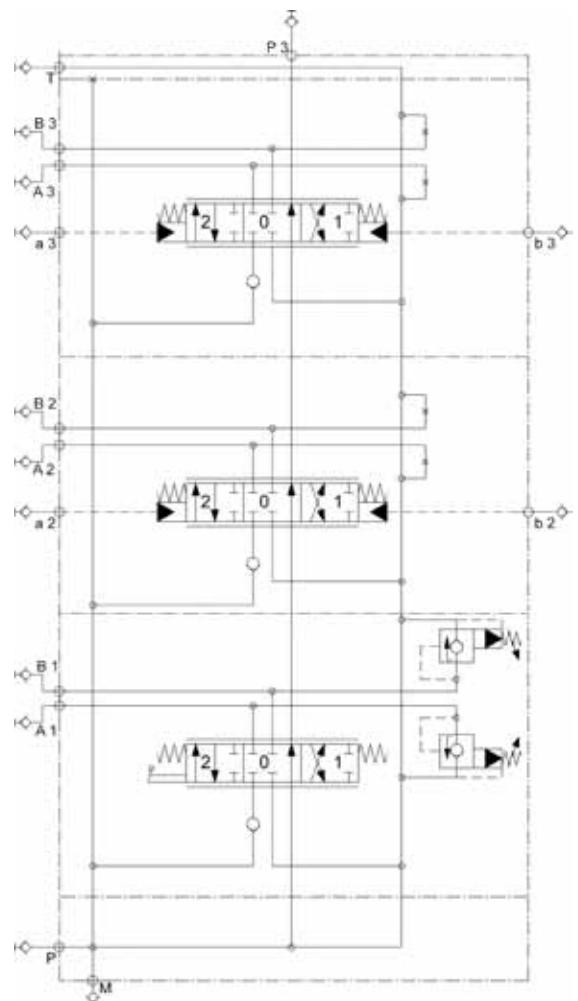
Control block 3SM-12 throttle control

Material no.	R961004198
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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



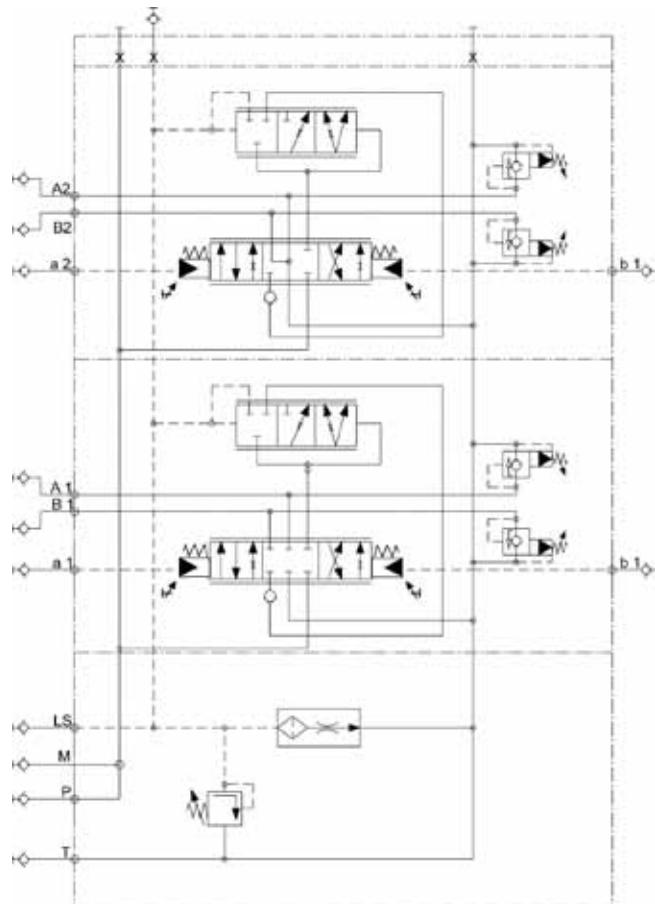
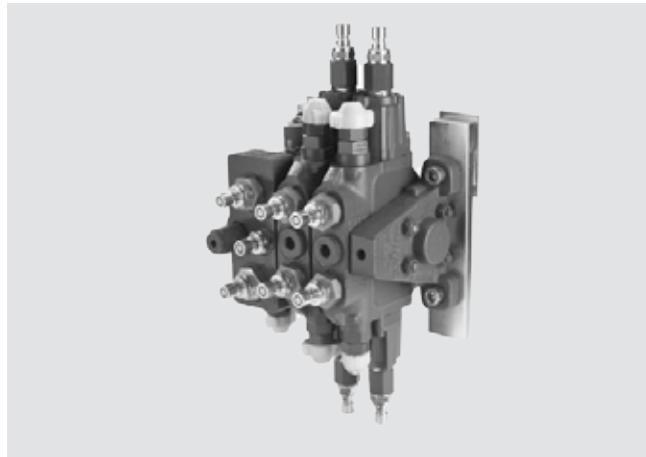
Components / mobile hydraulics

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 (requested 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



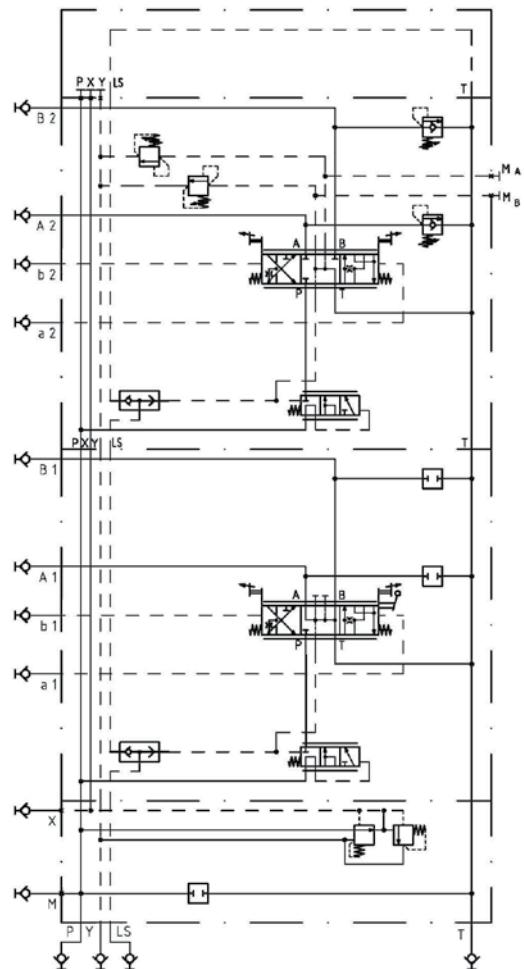
Components / mobile hydraulics

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



Material number overview

Material no.	Denomination	Page
1827003705	Writing surface for DS3 and DS4	33
1827003721	Information board	43
1827003722	Cloth holder set; LE2	41
1827003724	Connection cable D; 3 m	27
1827003725	Monitor support arm	42
1827003740	Power supply	26
1827003742	Connection cable US; 2 m	27
1827008065	BPS3.1 operating module + VT-VSPA1 with 49 TE electronic box	127
1827008088	Operating module BRS 2.1 + VT-VRPA1-150-1X/V0/0 with electronic box 49 TE	128
1827008409	Blanking plate, 3HE, 8TE	130
1827008410	Blanking plate, 3HE, 7TE	130
1827008412	Control box; 230 V/50 Hz; 2x emergency stop; 3 sockets; without FI	28
R900001439	Filling and testing device for hydraulic accumulators	115
R900009090	Minimess threaded coupling G1/4	113
R900019287	Hydraulic oil RSL22 1 kg	114
R900021502	Measuring line set large	132
R900029597	Measuring line set small	132
R900033823	Operating module; VT-VSPA1 proportional amplifier, 4TE	126
R900054511	Troubleshooting trainer's and trainee's manual de	57
R900054614	Measuring hose 2000 mm	109
R900061256	Stop watch, digital	136
R900065201	Tachometer, visual / mechanical	136
R900083425	Measuring hose 1000 mm	109
R900209840	Trainee's manual Hydraulic basics (BiBB, A-H) de	48
R900209841	Trainer's manual Hydraulic basics (BiBB, A-H) de	48
R900215919	Trainee's manual Hydraulic basics (BiBB, A-H) en	48
R900215920	Trainee's manual Hydraulic basics (BiBB, A-H) es	48
R900215921	Trainer's manual Hydraulic basics (BiBB, A-H) en	48
R900215922	Trainer's manual Hydraulic basics (BiBB, A-H) es	48
R900309347	Blanking plate, 3HE, 21TE	130
R900703147	Operating module, mains adapter, 230 V/50 Hz, 42TE	129
R900711658	BPS2.1 operating module, adapter for analog control amplifier VT-VRPA1, 34TE	127
R900711662	BPS3.1 operating module, adapter for analog amplifier VT-VSPA1, 34TE	126
R900711665	BPS6.1 operating module, command/actual value display, 21TE	122
R900711666	BPS 11.1 operating module	129
R900719908	BPS7.4 operating module, switch-button, 42TE	117
R900733207	Measuring cable for ISDS	138
R900738915	Pressure transducer 0-200 bar with ISDS	137
R900749653	Temperature sensor with ISDS	137
R900826555	Cable set for command value measurement	131

Material number overview

Material no.	Denomination	Page
R900833872	Cleaning roll trolley	113
R900846807	Solenoid cable with LED form A black	131
R900846808	Solenoid cable with LED form A gray	131
R900846809	Solenoid cable without LED form A gray	131
R900846812	Solenoid cable without LED form A black	131
R900846817	Pressure switch cable	131
R900865138	Tool set for hydraulics	113
R900892375	Speed sensor	137
R900897337	BRS1.2 operating module, 3 x relay, 42TE	119
R900897341	BPS8.1 operating module, signal display, visual / acoustic 21TE	118
R900897345	BPS13.1 operating module, distributor 1:13, 21TE	116
R900897346	BRS2.1 operating module, time relay, 21TE	120
R900897502	Multi meter	135
R901057058	Operating module VT-VRPA1 proportional amplifier, 4TE	128
R901133999	Hy power unit; 400 V/50 Hz; 2.2 kW; with single pump	18
R901134000	Hy power unit; 400 V/50 Hz; 2.2 kW; with double pump	19
R901134001	Hy power unit; 230 V/50 Hz; 1.5 kW; with single pump	18
R901134002	Hy power unit; 230 V/50 Hz; 1.5 kW; with double pump	19
R901168101	LS Hy power unit 230 V/50 Hz; 1.5 kW; with double pump	20
R901169108	LS Hy power unit 230 V/60 Hz; 1.5 kW; with double pump	20
R901171865	LS Hy power unit 400 V/50 Hz; 2.2 kW; with double pump	21
R913002274	Data acquisition set 5060	136
R913004345	Blanking plate, 3HE, 6TE	130
R961000107	BPS20 operating module, command value generation, 21TE	123
R961000160	Movable component support DS4	14
R961000166	Rack double-row	25
R961000167	Rack single-row	25
R961000169	Grooved plate for mounting onto the DS4	16
R961000170	Power supply	26
R961000187	Load simulator 15 kg rotatable	32
R961000187	Load simulator, 15 kg, rotatable 180°	102
R961000188	Hose rack for 9 hoses	31
R961000190	Control trolley	39
R961000192	Oil drip pan for DS4	33
R961000210	Reinforced grid for mounting onto the DS4	16
R961000226	Mounting frame for DS4 with mounting kit	15
R961000279	Electric attachment for control trolley	39
R961000287	Portable storage unit PN	40
R961000288	Fixed storage unit	22
R961000289	Control box 400V/50 Hz; 2x emergency stop; 3 sockets; without FI	29

Material number overview

Material no.	Denomination	Page
R961000480	Zero leak quick disconnect G 1/4"	114
R961000481	Zero leak quick disconnect M16 x 1.5	114
R961000482	Coupling connector G1/4"	114
R961000563	Drawer organization set 100 mm	40
R961000564	Drawer organization set 150 mm	41
R961000568	Anti-slip mat	41
R961000761	Mounting kit for oil tray	23
R961000835	Mounting kit for fixed storage unit	22
R961000962	Control box 400V/50 Hz; 2x emergency stop; 3 sockets; with FI	28
R961000963	Control box; 230V/50 Hz; 2x emergency stop; 3 sockets; with FI	28
R961001269	Oil tray	23
R961001336	Blanking plate, 3HE, 4TE	130
R961001630	BPS21.0 operating module, adapter for connector to laboratory sockets, 14TE	124
R961001957	BPS5.2 operating module, command value +/-10 V, 21TE	121
R961002216	Central grooved plate for DS4 with mounting kit	15
R961002272	Data acquisition set 2020	135
R961002273	Data acquisition set 3020	135
R961002427	Trainer's manual Project manual Industrial hydraulics de	52
R961002429	Trainee's manual Project manual Industrial hydraulics de	52
R961002471	S6A1.X check valve with hose 630 mm	98
R961002472	S6A3.X check valve with hose 630 mm	99
R961002473	Hose line 1500 mm	110
R961002474	Hose line 630 mm	22
R961002474	Hose line 630 mm	110
R961002475	Hose line 1000 mm	22
R961002475	Hose line 1000 mm	110
R961002476	Hose line 1000 mm with minimess connection	111
R961002477	Hose line 2000 mm with 90° fitting	112
R961002478	Hose line 2000 mm with minimess connection	111
R961002479	Hose line 2500 mm	110
R961002480	Hose line 2000 mm	110
R961002481	Hose line 630 mm with minimess connection	111
R961002482	Hose line 1500 mm with minimess connection	111
R961002485	Hydraulic distributor, for line mounting	106
R961002489	S6A1.X check valve	98
R961002491	Ball valve	97
R961002495	DRV06-1-1X/V throttle check valve	95
R961002503	Hydraulic diaphragm-type accumulator with isolation valving for grid mounting	105
R961002508	Gear flow meter 0.2 to 30 l/min with ISDS	137
R961002509	4WRPEH6 4/4 directional high-response valve with integrated electronics	90

Material number overview

Material no.	Denomination	Page
R961002510	4WMM6J5X 4/3 directional valve	85
R961002511	4WMM6H5X 4/3 directional valve	86
R961002513	S 6 PB1-6X/ check valve pilot operated	100
R961002520	DBDH6G1X/100 direct operated pressure relief valve	91
R961002522	S6A3.X check valve	99
R961002530	Pressure gauge 0 to 100 bar with distributor, for grid mounting	107
R961002539	DV06-1-1X/V throttle valve	95
R961002544	DR6DP1-5X/75 direct operated pressure reducing valve	91
R961002545	DB6K1-4X/50 pressure relief valve pilot operated	92
R961002546	2FRM6B36-3X/ 2-way flow control valve	96
R961002547	4WE6C6X/ 4/2 directional valve	87
R961002548	4WE6G6X/ 4/3 directional valve	87
R961002549	4WE6E6X/ 4/3 directional valve	88
R961002550	4WMM6G5X 4/3 directional valve	84
R961002551	4WMM6E5X/ 4/3 directional valve	85
R961002552	4WMM6C5X 4/2 directional valve	84
R961002553	DBW10A1-5X/50 pressure relief valve pilot operated	93
R961002554	4WE6J6X/ 4/3 directional valve	88
R961002555	DBE6-1X/50 proportional pressure relief valve	94
R961002558	DZ6DP1-5X/75 pressure sequence valve direct operated	92
R961002561	Flow meter 1.0 to 7.5 l/min	138
R961002563	Hydraulic distributor, for grid mounting	106
R961002564	Measuring glass 2.5 l	30
R961002567	P/T distributor with circulation at zero pressure	24
R961002634	Hose rack for 50 hoses	31
R961002715	Pressure gauge 0 to 100 bar with measuring hose	108
R961002720	Pressure gauge 0 to 160 bar with measuring hose	108
R961002811	Axial piston unit	104
R961002888	Hydraulic device set A-H for manually operated valves	49
R961002927	Pressure relief socket	114
R961003106	Proximity switch inductive	133
R961003128	Component carrier with two grids and oil tray	38
R961003176	Component carrier with grid and oil tray	38
R961003403	Pressure gauge 0 to 60 bar with measuring hose	108
R961003488	Pressure switch electric	133
R961003494	CD70F25/16-200 single-rod cylinder with protective housing	101
R961003495	CD70F25/16-400 single-rod cylinder with protective housing	101
R961003498	Clamp holder for grid system	109
R961003533	4WREE6E08-2X/ 4/3 proportional directional valve with integrated electronics and load simulation	89
R961003550	7-pole cable for integrated electronics	132

Material number overview

Material no.	Denomination	Page
R961003555	Pressure switch electronically programmable	134
R961003735	Mounting kit for power unit	21
R961003751	Trainee's manual Project manual Industrial hydraulics en	52
R961003765	Trainee's manual Project manual Industrial hydraulics es	52
R961003779	Trainer's manual Project manual Proportional valve technology de	61
R961003780	Trainee's manual Project manual Proportional valve technology de	65
R961003790	Trainer's manual Project manual Industrial hydraulics en	52
R961003791	Trainer's manual Project manual Industrial hydraulics es	52
R961003805	Troubleshooting trainer's and trainee's manual en	57
R961003872	Trainer's manual Project manual Proportional valve technology es	61
R961003873	Trainer's manual Project manual Proportional valve technology en	61
R961003874	Trainee's manual Project manual Proportional valve technology es	65
R961003875	Trainee's manual Project manual Proportional valve technology en	65
R961003904	Oil tray	23
R961003924	DBEE6-1X/50 proportional pressure relief valve	93
R961003954	Troubleshooting trainer's and trainee's manual es	57
R961004005	Vertical loading unit, 80 kg	102
R961004063	Installation kit LS pumps	23
R961004108	Oil tray	23
R961004144	Cable holder for 50 measuring lines	42
R961004178	P/T/X distributor with 3-way ball valve for LS power unit	24
R961004189	LUDV 2SX-12 control block	142
R961004190	2-2TH6-L70 pilot control unit	139
R961004191	Pilot control unit for arm rest installation 4TH6-97	140
R961004192	Load sensing control block 2M4-12	143
R961004198	Control block 3SM-12 throttle control	141
R961004259	Gear motor	104
R961004329	Hose line 700 mm with 90° fitting and minimess connection	112
R961004330	Hose line 1000 mm with 90° fitting and minimess connection	112
R961004331	Hose line 1000 mm with 90° fitting	112
R961004332	Hose line 700 mm with 90° fitting	112
R961004334	Line mounted filter	105
R961004486	Horizontal loading unit	103
R961004561	TS-BRS2.1 operating module, time relay, 15TE	120
R961004564	Trainee's manual Project manual Mobile hydraulics load sensing 2M4-12, de	74
R961004565	Trainer's manual Project manual Mobile hydraulics Load sensing 2M4-12, de	74
R961004608	Trainer's manual Project manual Mobile hydraulics Throttle control 3SM-12, de	70
R961004614	Trainee's manual Project manual Mobile hydraulics throttle control 3SM-12, de	70
R961004654	Trainer's manual Project manual Mobile hydraulics LUDV 2SX-12, de	78
R961004749	Trainee's manual Project manual Mobile hydraulics LUDV 2SX-12, de	78

Material number overview

Material no.	Denomination	Page
R961004782	TS-BPS30.0 operating module, analog controller module, 30TE	125
R961004896	TS-BPS21.0 operating module, adapter for connector to laboratory sockets, 15TE	124
R961004897	TS-BPS20 operating module, command value generation, 30TE	123
R961004898	TS-BPS5.2 operating module, command value +/-10 V, 30TE	121
R961004908	TS-BRS1.2 operating module, 1 x relay, 15TE	119
R961004909	TS-BPS7.4 operating module, switch-button, 15TE	117
R961004910	TS-BPS13.1 operating module, distributor 1:9, 15TE	116
R961004911	TS-BPS8.1 operating module, signal display, visual / acoustic 15TE	118
R961004913	TS-BPS6.1 operating module, command/actual value display, 30TE	122
R961005010	Project manual Analog position control loop, trainee's manual, de	60
R961005011	Project manual Analog position control loop, trainer's manual, de	60
R961005091	Project manual Analog position control loop, trainer's manual, en	60
R961005092	Project manual Analog position control loop, trainee's manual, en	60
R961005093	Trainee's manual Project manual Mobile hydraulics throttle control 3SM-12, en	70
R961005094	Trainer's manual Project manual Mobile hydraulics Throttle control 3SM-12, en	70
R961005146	Trainee's manual Project manual Mobile hydraulics load sensing 2M4-12, en	74
R961005147	Trainer's manual Project manual Mobile hydraulics Load sensing 2M4-12, en	74
R961005148	Trainee's manual Project manual Mobile hydraulics LUDV 2SX-12, en	78
R961005149	Trainer's manual Project manual Mobile hydraulics LUDV 2SX-12, en	78
R961005986	Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 1*230 V/60 Hz	36
R961005987	Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 1*230 V/50 Hz	36
R961005988	Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 3*400 V/50 Hz	37
R961005989	Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 3*400 V/60 Hz	37
R961006444	DS4 training system for hydraulics, double-sided type: TS-DS4-1X/RG2U14V6A4E14M2S3L3T2-W	12
R961006445	DS4 training system for hydraulics and pneumatics type: TS-DS4-1X/NG1U06V3A1E11M1S3L3T5-W	13
R961006549	DBDH6G1X/100 direct operated pressure relief valve - modified	91
R961006550	DB6K1-4X/50 pressure relief valve pilot operated - modified	92
R961006551	4WE6G6X/ 4/3 directional valve - modified	87
R961006553	4WMM6G5X 4/3 directional valve - modified	84
R961006619	Device set troubleshooting DW4.N	58
R961006620	Device set troubleshooting DW4.E	59

Index

Denomination	Material no.	Page
2-2TH6-L70 pilot control unit	R961004190	139
2FRM6B36-3X/ 2-way flow control valve	R961002546	96
4WE6C6X/ 4/2 directional valve	R961002547	87
4WE6E6X/ 4/3 directional valve	R961002549	88
4WE6G6X/ 4/3 directional valve	R961002548	87
4WE6G6X/ 4/3 directional valve - modified	R961006551	87
4WE6J6X/ 4/3 directional valve	R961002554	88
4WMM6C5X 4/2 directional valve	R961002552	84
4WMM6E5X/ 4/3 directional valve	R961002551	85
4WMM6G5X 4/3 directional valve	R961002550	84
4WMM6G5X 4/3 directional valve - modified	R961006553	84
4WMM6H5X 4/3 directional valve	R961002511	86
4WMM6J5X 4/3 directional valve	R961002510	85
4WREE6E08-2X/ 4/3 proportional directional valve with integrated electronics and load simulation	R961003533	89
4WRPEH6 4/4 directional high-response valve with integrated electronics	R961002509	90
7-pole cable for integrated electronics	R961003550	132
Anti-slip mat	R961000568	41
Axial piston unit	R961002811	104
Ball valve	R961002491	97
Blanking plate, 3HE, 21TE	R900309347	130
Blanking plate, 3HE, 4TE	R961001336	130
Blanking plate, 3HE, 6TE	R913004345	130
Blanking plate, 3HE, 7TE	1827008410	130
Blanking plate, 3HE, 8TE	1827008409	130
BPS 11.1 operating module	R900711666	129
BPS13.1 operating module, distributor 1:13, 21TE	R900897345	116
BPS2.1 operating module, adapter for analog control amplifier VT-VRPA1, 34TE	R900711658	127
BPS20 operating module, command value generation, 21TE	R961000107	123
BPS21.0 operating module, adapter for connector to laboratory sockets, 14TE	R961001630	124
BPS3.1 operating module + VT-VSPA1 with 49 TE electronic box	1827008065	127
BPS3.1 operating module, adapter for analog amplifier VT-VSPA1, 34TE	R900711662	126
BPS5.2 operating module, command value +/-10 V, 21TE	R961001957	121
BPS6.1 operating module, command/actual value display, 21TE	R900711665	122
BPS7.4 operating module, switch-button, 42TE	R900719908	117
BPS8.1 operating module, signal display, visual / acoustic 21TE	R900897341	118
BRS1.2 operating module, 3 x relay, 42TE	R900897337	119
BRS2.1 operating module, time relay, 21TE	R900897346	120
Cable holder for 50 measuring lines	R961004144	42
Cable set for command value measurement	R900826555	131
CD70F25/16-200 single-rod cylinder with protective housing	R961003494	101

Index

Denomination	Material no.	Page
CD70F25/16-400 single-rod cylinder with protective housing	R961003495	101
Central grooved plate for DS4 with mounting kit	R961002216	15
Clamp holder for grid system	R961003498	109
Cleaning roll trolley	R900833872	113
Cloth holder set; LE2	1827003722	41
Component carrier with grid and oil tray	R961003176	38
Component carrier with two grids and oil tray	R961003128	38
Connection cable D; 3 m	1827003724	27
Connection cable US; 2 m	1827003742	27
Control block 3SM-12 throttle control	R961004198	141
Control box 400V/50 Hz; 2x emergency stop; 3 sockets; with FI	R961000962	28
Control box 400V/50 Hz; 2x emergency stop; 3 sockets; without FI	R961000289	29
Control box; 230 V/50 Hz; 2x emergency stop; 3 sockets; without FI	1827008412	28
Control box; 230V/50 Hz; 2x emergency stop; 3 sockets; with FI	R961000963	28
Control trolley	R961000190	39
Coupling connector G1/4"	R961000482	114
Data acquisition set 2020	R961002272	135
Data acquisition set 3020	R961002273	135
Data acquisition set 5060	R913002274	136
DB6K1-4X/50 pressure relief valve pilot operated	R961002545	92
DB6K1-4X/50 pressure relief valve pilot operated - modified	R961006550	92
DBDH6G1X/100 direct operated pressure relief valve	R961002520	91
DBDH6G1X/100 direct operated pressure relief valve - modified	R961006549	91
DBE6-1X/50 proportional pressure relief valve	R961002555	94
DBEE6-1X/50 proportional pressure relief valve	R961003924	93
DBW10A1-5X/50 pressure relief valve pilot operated	R961002553	93
Device set troubleshooting DW4.E	R961006620	59
Device set troubleshooting DW4.N	R961006619	58
DR6DP1-5X/75 direct operated pressure reducing valve	R961002544	91
Drawer organization set 100 mm	R961000563	40
Drawer organization set 150 mm	R961000564	41
DRV06-1-1X/V throttle check valve	R961002495	95
DS4 training system for hydraulics and pneumatics type:	R961006445	13
TS-DS4-1X/NG1U06V3A1E11M1S3L3T5-W		
DS4 training system for hydraulics, double-sided type:	R961006444	12
TS-DS4-1X/RG2U14V6A4E14M2S3L3T2-W		
DV06-1-1X/V throttle valve	R961002539	95
DZ6DP1-5X/75 pressure sequence valve direct operated	R961002558	92
Electric attachment for control trolley	R961000279	39
Filling and testing device for hydraulic accumulators	R900001439	115

Index

Denomination	Material no.	Page
Fixed storage unit	R961000288	22
Flow meter 1.0 to 7.5 l/min	R961002561	138
Gear flow meter 0.2 to 30 l/min with ISDS	R961002508	137
Gear motor	R961004259	104
Grooved plate for mounting onto the DS4	R961000169	16
Horizontal loading unit	R961004486	103
Hose line 1000 mm	R961002475	22
Hose line 1000 mm	R961002475	110
Hose line 1000 mm with 90° fitting	R961004331	112
Hose line 1000 mm with 90° fitting and minimess connection	R961004330	112
Hose line 1000 mm with minimess connection	R961002476	111
Hose line 1500 mm	R961002473	110
Hose line 1500 mm with minimess connection	R961002482	111
Hose line 2000 mm	R961002480	110
Hose line 2000 mm with 90° fitting	R961002477	112
Hose line 2000 mm with minimess connection	R961002478	111
Hose line 2500 mm	R961002479	110
Hose line 630 mm	R961002474	22
Hose line 630 mm	R961002474	110
Hose line 630 mm with minimess connection	R961002481	111
Hose line 700 mm with 90° fitting	R961004332	112
Hose line 700 mm with 90° fitting and minimess connection	R961004329	112
Hose rack for 50 hoses	R961002634	31
Hose rack for 9 hoses	R961000188	31
Hy power unit; 230 V/50 Hz; 1.5 kW; with double pump	R901134002	19
Hy power unit; 230 V/50 Hz; 1.5 kW; with single pump	R901134001	18
Hy power unit; 400 V/50 Hz; 2.2 kW; with double pump	R901134000	19
Hy power unit; 400 V/50 Hz; 2.2 kW; with single pump	R901133999	18
Hydraulic device set A-H for manually operated valves	R961002888	49
Hydraulic diaphragm-type accumulator with isolation valving for grid mounting	R961002503	105
Hydraulic distributor, for grid mounting	R961002563	106
Hydraulic distributor, for line mounting	R961002485	106
Hydraulic oil RSL22 1 kg	R900019287	114
Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 1*230 V/50 Hz	R961005987	36
Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 1*230 V/60 Hz	R961005986	36
Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 3*400 V/50 Hz	R961005988	37
Hydraulic power unit with variable displacement control for DS4, ready-for-operation, 3*400 V/60 Hz	R961005989	37
Information board	1827003721	43

Index

Denomination	Material no.	Page
Installation kit LS pumps	R961004063	23
Line mounted filter	R961004334	105
Load sensing control block 2M4-12	R961004192	143
Load simulator 15 kg rotatable	R961000187	32
Load simulator, 15 kg, rotatable 180°	R961000187	102
LS Hy power unit 230 V/50 Hz; 1.5 kW; with double pump	R901168101	20
LS Hy power unit 230 V/60 Hz; 1.5 kW; with double pump	R901169108	20
LS Hy power unit 400 V/50 Hz; 2.2 kW; with double pump	R901171865	21
LUDV 2SX-12 control block	R961004189	142
Measuring cable for ISDS	R900733207	138
Measuring glass 2.5 l	R961002564	30
Measuring hose 1000 mm	R900083425	109
Measuring hose 2000 mm	R900054614	109
Measuring line set large	R900021502	132
Measuring line set small	R900029597	132
Minimess threaded coupling G1/4	R900009090	113
Monitor support arm	1827003725	42
Mounting frame for DS4 with mounting kit	R961000226	15
Mounting kit for fixed storage unit	R961000835	22
Mounting kit for oil tray	R961000761	23
Mounting kit for power unit	R961003735	21
Movable component support DS4	R961000160	14
Multi meter	R900897502	135
Oil drip pan for DS4	R961000192	33
Oil tray	R961001269	23
Oil tray	R961003904	23
Oil tray	R961004108	23
Operating module BRS 2.1 + VT-VRPA1-150-1X/V0/0 with electronic box 49 TE	1827008088	128
Operating module VT-VRPA1 proportional amplifier, 4TE	R901057058	128
Operating module, mains adapter, 230 V/50 Hz, 42TE	R900703147	129
Operating module; VT-VSPA1 proportional amplifier, 4TE	R900033823	126
P/T distributor with circulation at zero pressure	R961002567	24
P/T/X distributor with 3-way ball valve for LS power unit	R961004178	24
Pilot control unit for arm rest installation 4TH6-97	R961004191	140
Portable storage unit PN	R961000287	40
Power supply	1827003740	26
Power supply	R961000170	26
Pressure gauge 0 to 100 bar with distributor, for grid mounting	R961002530	107
Pressure gauge 0 to 100 bar with measuring hose	R961002715	108
Pressure gauge 0 to 160 bar with measuring hose	R961002720	108

Index

Denomination	Material no.	Page
Pressure gauge 0 to 60 bar with measuring hose	R961003403	108
Pressure relief socket	R961002927	114
Pressure switch cable	R900846817	131
Pressure switch electric	R961003488	133
Pressure switch electronically programmable	R961003555	134
Pressure transducer 0-200 bar with ISDS	R900738915	137
Project manual Analog position control loop, trainee's manual, de	R961005010	60
Project manual Analog position control loop, trainee's manual, en	R961005092	60
Project manual Analog position control loop, trainer's manual, de	R961005011	60
Project manual Analog position control loop, trainer's manual, en	R961005091	60
Proximity switch inductive	R961003106	133
Rack double-row	R961000166	25
Rack single-row	R961000167	25
Reinforced grid for mounting onto the DS4	R961000210	16
S 6 PB1-6X/ check valve pilot operated	R961002513	100
S6A1.X check valve	R961002489	98
S6A1.X check valve with hose 630 mm	R961002471	98
S6A3.X check valve	R961002522	99
S6A3.X check valve with hose 630 mm	R961002472	99
Solenoid cable with LED form A black	R900846807	131
Solenoid cable with LED form A gray	R900846808	131
Solenoid cable without LED form A black	R900846812	131
Solenoid cable without LED form A gray	R900846809	131
Speed sensor	R900892375	137
Stop watch, digital	R900061256	136
Tachometer, visual / mechanical	R900065201	136
Temperature sensor with ISDS	R900749653	137
Tool set for hydraulics	R900865138	113
Trainee's manual Hydraulic basics (BiBB, A-H) de	R900209840	48
Trainee's manual Hydraulic basics (BiBB, A-H) en	R900215919	48
Trainee's manual Hydraulic basics (BiBB, A-H) es	R900215920	48
Trainee's manual Project manual Industrial hydraulics de	R961002429	52
Trainee's manual Project manual Industrial hydraulics en	R961003751	52
Trainee's manual Project manual Industrial hydraulics es	R961003765	52
Trainee's manual Project manual Mobile hydraulics load sensing 2M4-12, de	R961004564	74
Trainee's manual Project manual Mobile hydraulics load sensing 2M4-12, en	R961005146	74
Trainee's manual Project manual Mobile hydraulics LUDV 2SX-12, de	R961004749	78
Trainee's manual Project manual Mobile hydraulics LUDV 2SX-12, en	R961005148	78
Trainee's manual Project manual Mobile hydraulics throttle control 3SM-12, de	R961004614	70
Trainee's manual Project manual Mobile hydraulics throttle control 3SM-12, en	R961005093	70

Index

Denomination	Material no.	Page
Trainee's manual Project manual Proportional valve technology de	R961003780	65
Trainee's manual Project manual Proportional valve technology en	R961003875	65
Trainee's manual Project manual Proportional valve technology es	R961003874	65
Trainer' manual Project manual Proportional valve technology en	R961003873	61
Trainer's manual Hydraulic basics (BiBB, A-H) de	R900209841	48
Trainer's manual Hydraulic basics (BiBB, A-H) en	R900215921	48
Trainer's manual Hydraulic basics (BiBB, A-H) es	R900215922	48
Trainer's manual Project manual Industrial hydraulics de	R961002427	52
Trainer's manual Project manual Industrial hydraulics en	R961003790	52
Trainer's manual Project manual Industrial hydraulics es	R961003791	52
Trainer's manual Project manual Mobile hydraulics Load sensing 2M4-12, de	R961004565	74
Trainer's manual Project manual Mobile hydraulics Load sensing 2M4-12, en	R961005147	74
Trainer's manual Project manual Mobile hydraulics LUDV 2SX-12, de	R961004654	78
Trainer's manual Project manual Mobile hydraulics LUDV 2SX-12, en	R961005149	78
Trainer's manual Project manual Mobile hydraulics Throttle control 3SM-12, de	R961004608	70
Trainer's manual Project manual Mobile hydraulics Throttle control 3SM-12, en	R961005094	70
Trainer's manual Project manual Proportional valve technology de	R961003779	61
Trainer's manual Project manual Proportional valve technology es	R961003872	61
Troubleshooting trainer's and trainee's manual de	R900054511	57
Troubleshooting trainer's and trainee's manual en	R961003805	57
Troubleshooting trainer's and trainee's manual es	R961003954	57
TS-BPS13.1 operating module, distributor 1:9, 15TE	R961004910	116
TS-BPS20 operating module, command value generation, 30TE	R961004897	123
TS-BPS21.0 operating module, adapter for connector to laboratory sockets, 15TE	R961004896	124
TS-BPS30.0 operating module, analog controller module, 30TE	R961004782	125
TS-BPS5.2 operating module, command value +/-10 V, 30TE	R961004898	121
TS-BPS6.1 operating module, command/actual value display, 30TE	R961004913	122
TS-BPS7.4 operating module, switch-button, 15TE	R961004909	117
TS-BPS8.1 operating module, signal display, visual / acoustic 15TE	R961004911	118
TS-BRS1.2 operating module, 1 x relay, 15TE	R961004908	119
TS-BRS2.1 operating module, time relay, 15TE	R961004561	120
Vertical loading unit, 80 kg	R961004005	102
Writing surface for DS3 and DS4	1827003705	33
Zero leak quick disconnect G 1/4"	R961000480	114
Zero leak quick disconnect M16 x 1.5	R961000481	114

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