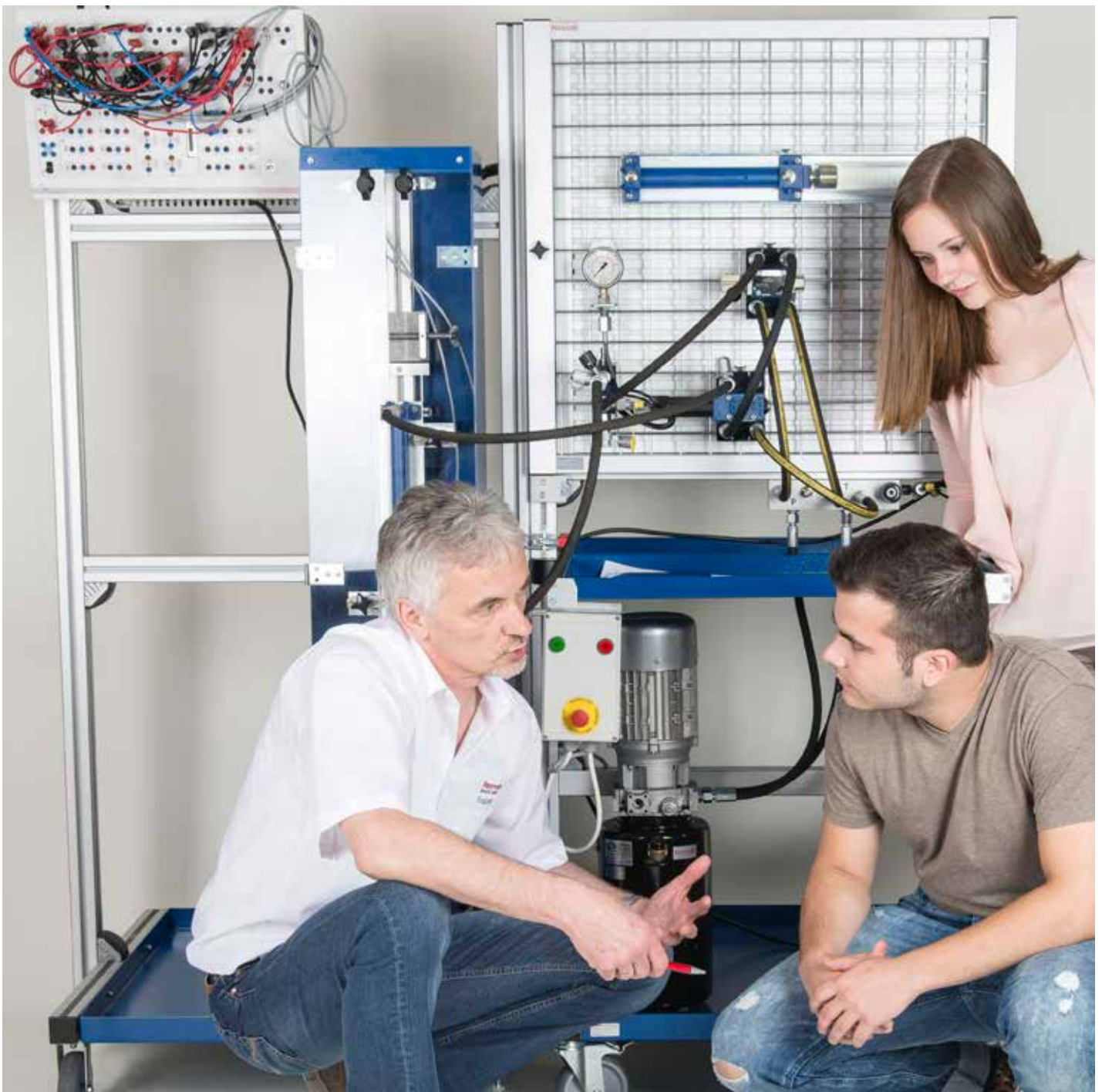


Training systems for hydraulics

Edition: 05.2017



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The Drive & Control Academy

Makes unique knowledge available.

www.boschrexroth.de/academy



As leading specialist in drive and control technology, Bosch Rexroth has unique technical know-how. We are willingly prepared to pass this knowledge onto trainees and students and to experts and employees. At the Drive & Control Academy, we support customized basic and advanced training as well as qualification of technical experts. Practice-oriented, target group-specific and with latest methods.

Knowledge is everything

Expert knowledge and competence of the employees creates a decisive advantage in global competition.

Under the roof of the Drive & Control Academy Rexroth offers a practice-oriented portfolio of knowledge products in the area of drive and control technologies. The Academy particularly sets benchmarks in the didactic preparation of specialized and integrated know-how. And it does so for customers, employees and institutes of basic and advanced training.

The offers are always compiled according to the identical principles:

1. Practice-oriented equipment complying with the state-of-the-art
2. Target group-specific training offers
3. Latest forms of teaching and media

The concept of the Drive & Control Academy is based on four columns of our knowledge transfer: Training, training systems, media and Knowledge Portal.

Training systems

The modular training systems developed by the Rexroth specialists provide beginners and advanced employees with hands-on technology know-how and solution competence. Founded practice-oriented knowledge can be experienced by means of industrial serial components - with internationally standardized programming languages and open interfaces.

For more information please visit:
www.boschrexroth.de/trainingsystems



Media

Our aspiration is to offer teaching and learning media which are technologically always up-to-date and have high practical relevance. Therefore they comprise latest eLearning and eTraining modules with numerous animations and simulation-based learning units. They also include printed reference books and handbooks, eBooks, apps, software and other useful work equipment.

For more information please visit:
www.boschrexroth.de/trainingmedia



Training

With Rexroth, the knowledge transfer is always up-to-date and uses latest methods and media. Whether face-to-face training, eLearning or eTraining with online access via the Rexroth LearnWorld, whether special practical training or also blended learning which combines the advantages of face-to-face training and eLearning in a perfect form - no matter which training method: The principle of being close to our customer is always in the foreground.

For more information please visit:
www.boschrexroth.de/training



Learning topics



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Term definition

Term definition:

Learning topic with material number for device set and catalog page

For one learning topic, there may be several device sets with corresponding exercise books. In this catalog, you can find the learning topics On/off hydraulics, Continuous control valve technology and Mobile hydraulics. One device set is an assembly of components for the completion of practical exercises.

Material number for extension device set and catalog page

An extension device set is the additional equipment required in order to get from one or more learning topics to the next.

Additional learning topics with material number for extension device set and catalog page

An additional learning topic may for example be the troubleshooting. These additional learning topics are offered for the deeper study of certain subjects. They can be taught by means of extension device sets and suitable exercise books.

Workstations

Workstations are used to assemble components from the device sets in order to complete the practical exercises from the exercise books.

Training systems

A training system combines workstations, device sets and exercise books.

Spare parts

Spare parts are individual components from the device sets or the workstations.

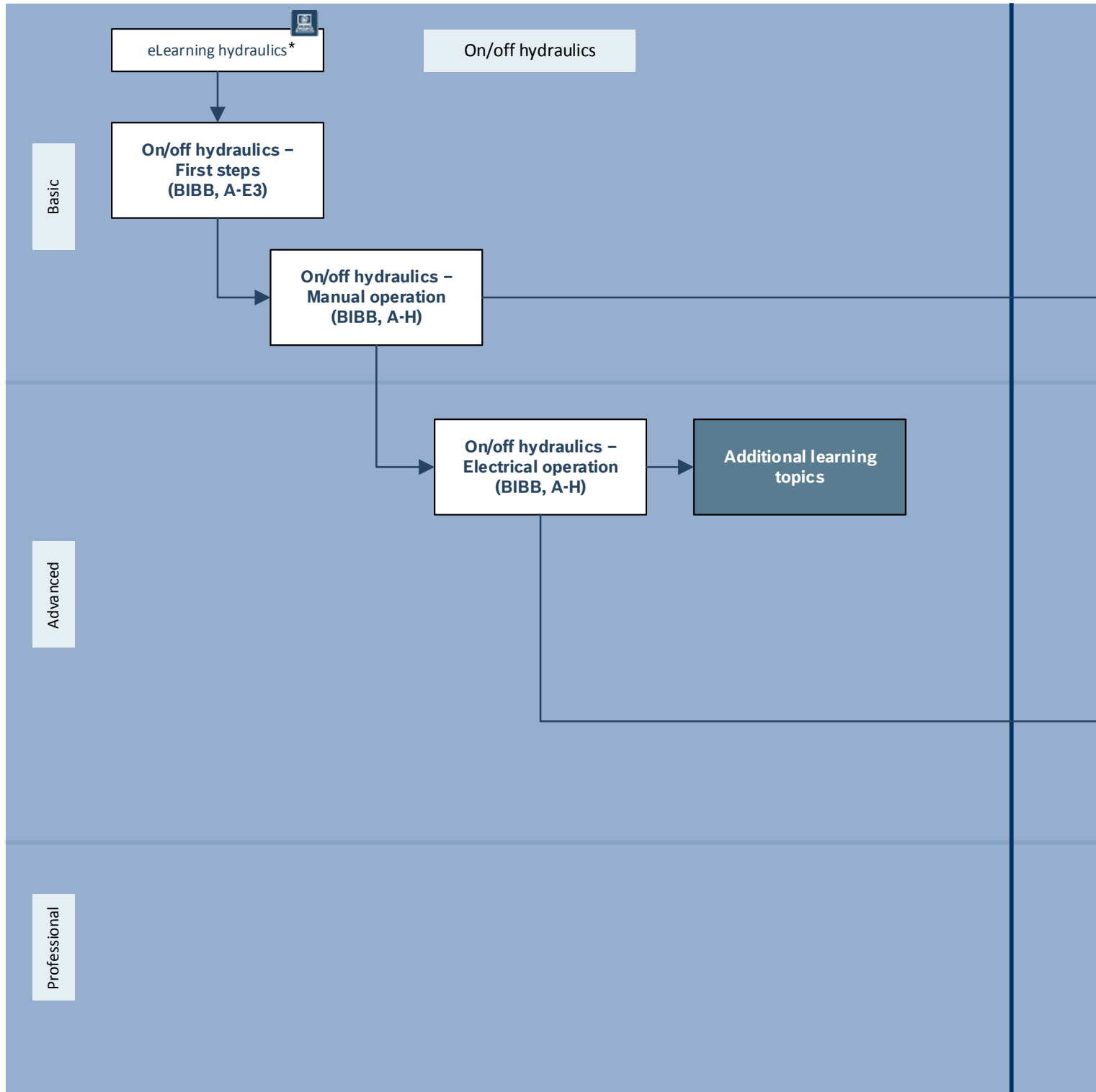
Accessories

Accessories are additional products which can be optionally used.

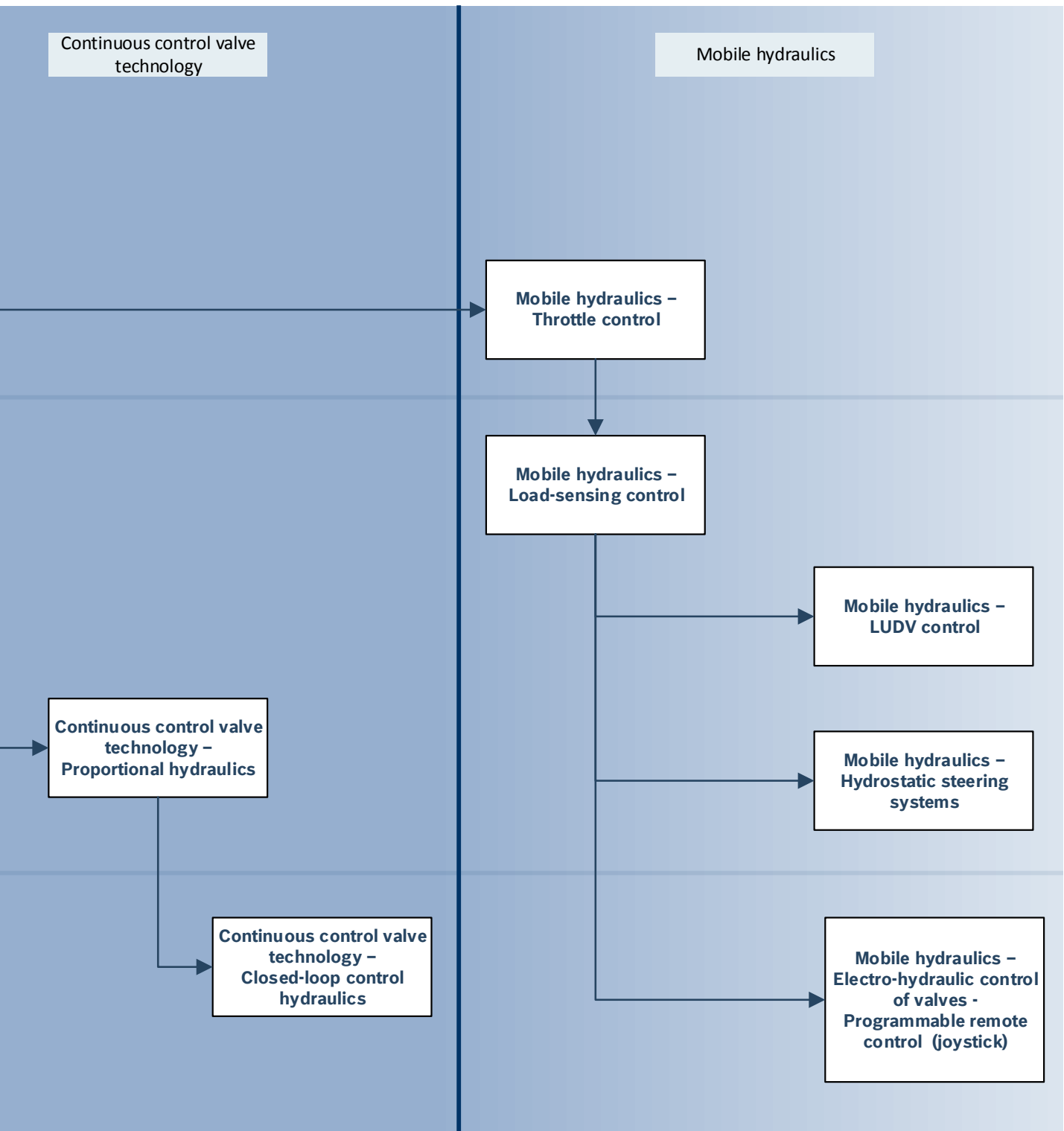
BIBB

Federal Institute for Vocational Education and Training (BIBB – Bundesinstitut für Berufsbildung)

Overview of the learning topics



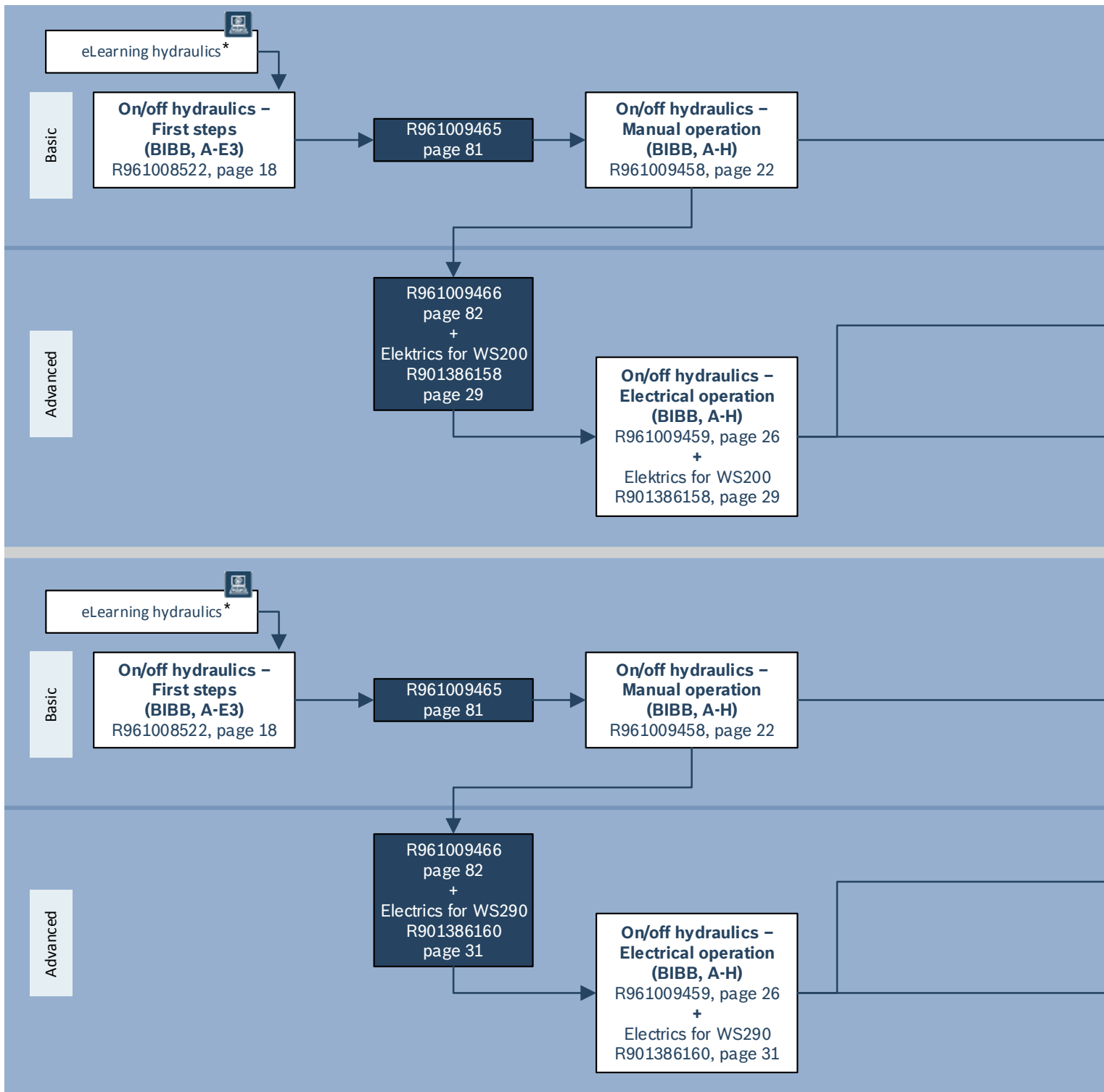
* see media catalog, R999000374 (DE)/R999000375 (EN)/ R999000492 (ES)



"Term definition" on page 11

Learning topics On/off hydraulics

Device sets On/off hydraulics



* see media catalog, R999000374 (DE)/R999000375 (EN)/ R999000492 (ES)

On/off hydraulics with workstation WS200

On/off hydraulics –
Troubleshooting,
manual operation
R961006619, page 36

On/off hydraulics –
Troubleshooting,
electrical operation
R961006620, page 37

On/off hydraulics –
Electrical operation
(BIBB, Z1-Z3)
R961009475, page 32

On/off hydraulics with workstation WS290

On/off hydraulics –
Troubleshooting,
manual operation
R961006619, page 36

On/off hydraulics –
Troubleshooting,
electrical operation
R961006620, page 37

On/off hydraulics –
Electrical operation
(BIBB, Z1-Z3)
R961009475, page 32

**Continuous control
valve technology
or
Mobile hydraulics
with workstation
WS290**

"Term definition" on page 11

On/off hydraulics – First steps (BIBB, A-E3)

The objectives of this learning topic correspond to the specifications of the Federal Institute for Vocational Education and Training (BIBB) and offer practice-based training in the different levels of on/off hydraulics.

Successful completion of the practical exercises provides hands on knowledge of the function and effect of the main components and basic circuits of on/off hydraulics .

Exercise books

The exercise books correspond to the device sets.

The exercises and tasks provide basic information and methods in a structured way with step-by-step instructions for the individual exercises.

Two versions – Teaching and learning document

- ▶ Exercises with solutions: more far-reaching trainer information and contents such as measured values, calculation results, etc.
- ▶ Exercises: independent completion of calculations and measured value tables, etc.

Learning contents

With the help of logically structured, practical exercises, the trainee should:

- ▶ understand physical laws of hydraulics such as pressure difference, opening cross-section and flow,
- ▶ get to know and apply the legal regulations and safety requirements,
- ▶ understand the function of basic hydraulic circuits,
- ▶ identify the typical behavior of hydraulic components in different operating situations,
- ▶ determine characteristic values and derive characteristic curves from them.



Example exercise book

The following exercises are included:

No.	Exercise	BIBB exercise
01	Identifying components	A
02	Commissioning	A
03	Function of pressure relief valves	–
04	Controlling a hydraulic cylinder by means of a directional control valve	B1
05	Simulating loads at the hydraulic cylinder by means of a throttle/non-return valve	D1/E1
06	Influence of the meter-in control on the motion velocity of a hydraulic cylinder	D3/E1
07	Influence of changing system pressures on the motion velocity of a hydraulic cylinder	E1
08	Influence of changing load pressures on the motion velocity of a hydraulic cylinder	E1
09	Effect of a meter-out control (pressure intensification)	–
10	Function of pressure reducing valves	E3

Exercise books "On/off hydraulics – First steps"			
	Language	Material number	Material short text
Exercises with solutions (trainer's manual)	DE	R961008759	UEBUNGSBUCH TW-HY-LH-1/X 101DE
Exercises with solutions (trainer's manual)	EN	R961008761	EXERCISE BOOK TW-HY-LH-1/X 101EN
Exercises (trainee's manual)	DE	R961008760	UEBUNGSBUCH TW-HY-SH-1/X 101DE
Exercises (trainee's manual)	EN	R961008762	EXERCISE BOOK TW-HY-SH-1/X 101EN

Device set for workstation WS200/WS290 "On/off hydraulics – First steps (BIBB, A-E3)"

Material number R961008522

Material short text EQUIPMENT SET TS-HS 101-1X

This device set is used to study basic hydraulics using practical exercises. Only industry standard components are used. These have been adapted for use on the training equipment.

The device set corresponds to the exercise book "On/off hydraulics – First steps" which deals with BIBB exercises A-E3. The exercises with the components listed below can be carried out on workstations WS200 and WS290.



The device set R961008522 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Differential cylinder CD70F25/16-200 with protective housing and connection possibility for load unit in workstation WS201	R961009526	1		155
2	4/3 directional control valve 4WMM6G5X	R961002550	1		138
3	Pressure reducing valve, direct-operated, DR6DP1-5X/	R961002544	1		145
4	Throttle/non-return (check) valve DRV06-1-1X/V	R961002495	2		149
5	Hydraulic distributor 4 ports	R961002485	1		169
6	Manometer 0-100 bar with measuring hose	R961002715	3		198
7	Hose line 630 mm	R961002474	5		170
8	Hose line 630 mm with Minimes port	R961002481	2		171

The recommended accessories are listed on page 38.

On/off hydraulics – Manual operation (BIBB, A-H)

The objectives of this learning topic correspond to the specifications of the Federal Institute for Vocational Education and Training (BIBB) and offer practice-based training in the different levels of on/off hydraulics.

Successful completion of the practical exercises provides hands on knowledge of the use of manually-operated on/off valves as well as the function and effect of the main components and basic circuits of on/off hydraulics is acquired.

Exercise books

The exercise books correspond to the device sets.

The exercises and tasks provide basic information and methods in a structured way with step-by-step instructions for the individual exercises.

Two versions – Teaching and learning document

- ▶ Exercises with solutions: more far-reaching trainer information and contents such as measured values, calculation results, etc.
- ▶ Exercises: independent completion of calculations and measured value tables, etc.

Learning contents

With the help of logically structured, practical exercises, the trainee should:

- ▶ understand physical laws of hydraulics such as pressure difference, opening cross-section and flow,
- ▶ get to know and apply the legal regulations and safety requirements,
- ▶ understand the function of basic hydraulic circuits,
- ▶ identify the typical behavior of hydraulic components in different operating situations,
- ▶ determine characteristic values and derive characteristic curves from them.



Example exercise book

The following exercises are included:

No.	Exercise	BIBB exercise
01	Hydraulic system	A1
02	Hydraulic pump	A1
03	Differential cylinder (pressure intensification)	B1
04	Differential cylinder (flow)	B1
05	Hydraulic motor	G2
06	4/3 directional control valve	B2
07	Non-return valve	C1
08	Non-return valve, pilot-operated	C1
09	Throttle valve, adjustable	D1
10	Throttle/non-return valve	D3
11	Flow control valve	D2
12	Pressure relief valve, direct-operated/pilot-operated	E1/E2
13	Control by means of pressure relief valves	E1
14	Pressure reducing valve	E3
15	Hydraulic accumulator	F1
16	Differential circuit	G1
17	Circulation circuit	B2/G4
18	Commissioning, troubleshooting	H1

Exercise books "On/off hydraulics – Manual operation (according to BIBB)"

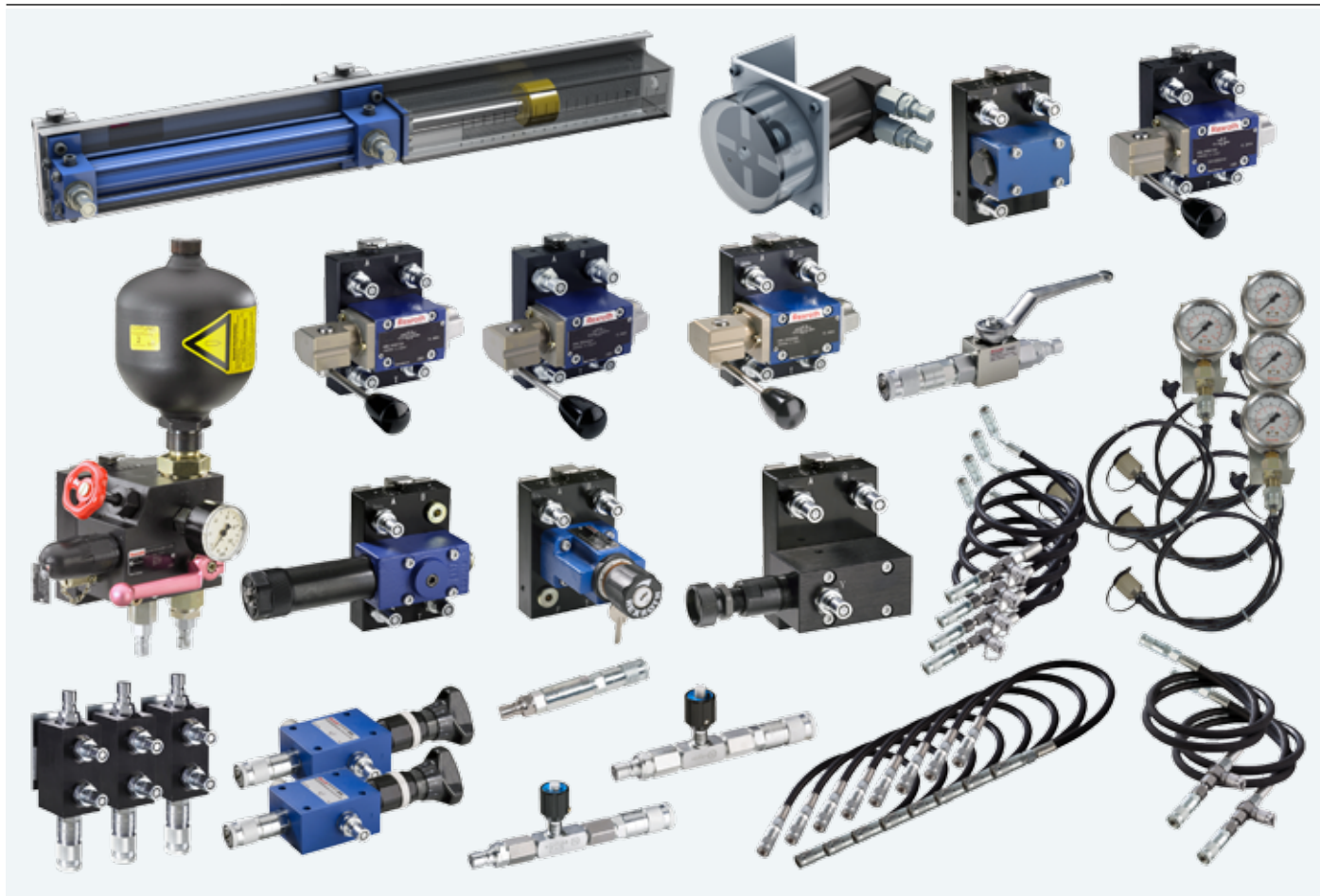
	Language	Material number	Material short text
Exercises with solutions (trainer's manual)	DE	R901385280	UEBUNGSBUCH TW-HY-LH-1/X 201DE
Exercises with solutions (trainer's manual)	EN	R901385282	EXERCISE BOOK TW-HY-LH-1/X 201EN
Exercises with solutions (trainer's manual)	ES	R901385286	LIBRO DE EJERCICIOS TW-HY-LH-1/X 201ES
Exercises with solutions (trainer's manual)	FR	R901424956	LIVRE D'EXERCICES TW-HY-LH-1/X 201FR
Exercises (trainee's manual)	DE	R901385281	UEBUNGSBUCH TW-HY-SH-1/X 201DE
Exercises (trainee's manual)	EN	R901385283	EXERCISE BOOK TW-HY-SH-1/X 201EN
Exercises (trainee's manual)	ES	R901385287	LIBRO DE EJERCICIOS TW-HY-SH-1/X 201ES
Exercises (trainee's manual)	FR	R901424966	LIVRE D'EXERCICES TW-HY-SH-1/X 201FR

Device set for workstation WS200/WS290 "On/off hydraulics – Manual operation (BIBB, A-H), complete"






Material number R961009458

Material short text EQUIPMENT SET TS-HS 201-1X




This device set is used to study basic hydraulics using practical exercises. Only industrial components are used. They have been adapted for use on the training equipment. The device set corresponds to the exercise book "On/off hydraulics – Manual operation (according to BIBB)" which deals with BIBB exercises A-H. The exercises with the components listed below can be carried out on workstations WS200 and WS290.



The device set R961009458 comprises the following components

Item	Individual components device set	Mat.-no. individual component	Quantity	Image	Page
1	Differential cylinder CD70F25/16-200 with protective housing and connection possibility for load unit in workstation WS201	R961009526	1		155
2	Planetary motor	R961008748	1		160
3	4/2 directional control valve 4WMM6C5X	R961002552	1		138
4	4/3 directional control valve 4WMM6G5X	R961002550	1		138
5	4/3 directional control valve 4WMM6J5X	R961002510	1		139

The device set R961009458 comprises the following components

Item	Individual components device set	Mat.-no. individual component	Quantity	Image	Page
6	4/3 directional control valve 4WMM6E5X/	R961002551	1		139
7	Pressure relief valve DBDH6G1X/	R961002520	2		145
8	Pressure relief valve, pilot-operated, DB6K1-4X/50	R901460846	1		146
9	Pressure reducing valve, direct-operated, DR6DP1-5X/	R961002544	1		145
10	2-way flow control valve 2FRM6B36-3X/	R961002546	1		150
11	Throttle valve DV06-1-1X/V	R961002539	1		149
12	Throttle/non-return (check) valve DRV06-1-1X/V	R961002495	1		149
13	Non-return (check) valve S6A05-1X	R901462818	1		153
14	Non-return (check) valve, pilot-operated, SV 6 PB1-6X/	R961002513	1		154
15	Accumulator module	R961002503	1		167
16	Hydraulic distributor 4 ports	R961002485	3		169
17	Shut-off valve	R961002491	1		152
18	Manometer 0-100 bar with measuring hose	R961002715	4		198
19	Hose line 630 mm	R961002474	8		170
20	Hose line 1000 mm with 90° fitting and Minimes port	R961004330	4		173
21	Hose line 1500 mm with Minimes port	R961002482	2		171

The recommended accessories are listed on page 38.

On/off hydraulics – Electrical operation (BIBB, A-H and Z1-Z3)

The objectives of this learning topic correspond to the specifications of the Federal Institute for Vocational Education and Training (BIBB) and offer practice-based training in the different levels of on/off hydraulics.

Successful completion of the practical exercises provides hands on, knowledge of the use of electrically-operated on/off valves as well as the function and effect of the main components and basic circuits of on/off hydraulics.

Exercise books

The exercise books correspond to the device sets.

The exercises and tasks provide basic information and methods in a structured way with step-by-step instructions for the individual exercises.

Two versions – Teaching and learning document

- ▶ Exercises with solutions: more far-reaching trainer information and contents such as measured values, calculation results, etc.
- ▶ Exercises: independent completion of calculations and measured value tables, etc.

Learning contents

With the help of logically structured, practical exercises, the trainee should:

- ▶ understand physical laws of hydraulics such as pressure difference, opening cross-section and flow,
- ▶ get to know and apply the legal regulations and safety requirements,
- ▶ understand the function of basic hydraulic circuits,
- ▶ identify the typical behavior of hydraulic components in different operating situations,
- ▶ determine characteristic values and derive characteristic curves from them.



Example exercise book

The following exercises are included:

No.	Exercise	BIBB exercise
01	Hydraulic system	A1
02	Hydraulic pump	A1
03	Differential cylinder (pressure intensification)	B1
04	Differential cylinder (flow)	B1
05	Hydraulic motor	G2
06	4/3 directional control valve	B2
07	Non-return valve	C1
08	Non-return valve, pilot-operated	C1
09	Throttle valve, adjustable	D1
10	Throttle/non-return valve	D3
11	Flow control valve	D2
12	Pressure relief valve, direct-operated/pilot-operated	E1/E2
13	Control by means of pressure relief valves	E1
14	Pressure reducing valve	E3
15	Hydraulic accumulator	F1
16	Differential circuit	G1
17	Circulation circuit	B2/G4
18	Commissioning, troubleshooting	H1
19	Pressure switch (hysteresis)	E4
20	Rapid motion/creep motion control	G3
21	Load-holding circuit with jerk-free lowering	Z1
22	Rectifier circuit	Z2
23	Circulation circuit for large flows	Z3
24	Accumulator charging circuit	Z3

Exercise books "On/off hydraulics – Electrical operation (according to BIBB)"

	Language	Material number	Material short text
Exercises with solutions (trainer's manual)	DE	R901385278	UEBUNGSBUCH TW-HY-LH-1/X 202DE
Exercises with solutions (trainer's manual)	EN	R901385284	EXERCISE BOOK TW-HY-LH-1/X 202EN
Exercises with solutions (trainer's manual)	ES	R901385288	LIBRO DE EJERCICIOS TW-HY-LH-1/X 202ES
Exercises with solutions (trainer's manual)	FR	R901425711	LIVRE D'EXERCICES TW-HY-LH-1/X 202FR
Exercises (trainee's manual)	DE	R901385279	UEBUNGSBUCH TW-HY-SH-1/X 202DE
Exercises (trainee's manual)	EN	R901385285	EXERCISE BOOK TW-HY-SH-1/X 202EN
Exercises (trainee's manual)	ES	R901385289	LIBRO DE EJERCICIOS TW-HY-SH-1/X 202ES
Exercises (trainee's manual)	FR	R901425712	LIVRE D'EXERCICES TW-HY-SH-1/X 202FR

Device set for workstation WS200/WS290 "On/off hydraulics – Electrical operation (BIBB, A-H), complete"





Material number R961009459

Material short text EQUIPMENT SET TS-HS 202-2X

This device set is used to study basic hydraulics using practical exercises. Only industry standard components are used. They have been adapted for use on the training equipment. The device set corresponds to the exercise book "On/off hydraulics – Electrical operation (according to BIBB)" which deals with BIBB exercises A-H and Z1-Z3. The exercises with the components listed below can be carried out on workstations WS200 and WS290.



The device set R961009459 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Differential cylinder CD70F25/16-200 with protective housing and connection possibility for load unit in workstation WS201	R961009526	1		155
2	Planetary motor	R961008748	1		160
3	4/2 directional control valve 4WE6C6X/	R961002547	2		141
4	4/3 directional control valve 4WE6G6X/	R961002548	1		141

The device set R961009459 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
5	4/3 directional control valve 4WE6J6X/	R961002554	1		142
6	4/3 directional control valve 4WE6E6X/	R961002549	1		142
7	Pressure relief valve DBDH6G1X/	R961002520	2		145
8	Pressure relief valve, pilot-operated, DB6K1-4X/50	R901460846	1		146
9	Pressure reducing valve, direct-operated, DR6DP1-5X/	R961002544	1		145
10	2-way flow control valve 2FRM6B36-3X/	R961002546	1		150
11	Throttle valve DV06-1-1X/V	R961002539	1		149
12	Throttle/non-return (check) valve DRV06-1-1X/V	R961002495	1		149
13	Non-return (check) valve S6A05-1X	R901462818	1		153
14	Non-return (check) valve, pilot-operated, SV 6 PB1-6X/	R961002513	1		154
15	Accumulator module	R961002503	1		167
16	Hydraulic distributor 4 ports	R961002485	3		169
17	Shut-off valve	R961002491	1		152
18	Manometer 0-100 bar with measuring hose	R961002715	4		198
19	Hose line 630 mm	R961002474	8		170
20	Hose line 1000 mm with 90° fitting and Minimes port	R961004330	4		173
21	Hose line 1500 mm with Minimes port	R961002482	2		171

The recommended accessories are listed on page 38.

Device set Electrics for workstation WS200 "On/off hydraulics – Electrical operation (BIBB, A-H), without I/O module"






Material number R901386157

Material short text EQUIPMENT SET TS-HS 501-1X

This device set includes all necessary electrical components for the BIBB exercises A-H and Z1-Z3. The electrical switches, push buttons, relays and displays are incorporated in one unit with plastic housing. This device set is required to carry out exercises from the exercise book "On/off hydraulics – Electrical operation (according to BIBB)" using a workstation WS200.



The device set R901386157 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Control unit housing variant – BIBB module	R961009678	1		185
2	Pressure switch, electrical	R961003488	1		192
3	Proximity switch, inductive	R961003106	2		191
4	Solenoid cable with connector form A, black, with LED, with protective circuit	R901457044	3		187
5	Measuring line set, small	R900029597	1		188






Device set Electrics for workstation WS200 "On/off hydraulics – Electrical operation (BIBB, A-H), with I/O module"

Material number	R901386158
Material short text	EQUIPMENT SET TS-HS 502-1X

This device set includes all necessary electrical components for the BIBB exercises A-H and Z1-Z3. The electrical switches, push buttons, relays and displays are incorporated in one unit with plastic housing. This device set is required to carry out exercises from the exercise book "On/off hydraulics – Electrical operation (according to BIBB)" using a workstation WS200. This unit also includes an I/O module with connections for sensors and valves. A simulation program can be connected to the hardware via the USB interface.



The device set R901386158 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Control unit housing variant – BIBB module + I/O module	R961009675	1		184
2	Pressure switch, electrical	R961003488	1		192
3	Proximity switch, inductive	R961003106	2		191
4	Solenoid cable with connector form A, black, with LED, with protective circuit	R901457044	3		187
5	Measuring line set, small	R900029597	1		188

Device set Electrics for workstation WS290 "On/off hydraulics – Electrical operation (BIBB, A-H), without I/O module"







Material number R901386159

Material short text EQUIPMENT SET TS-HS 503-1X

This device set includes all necessary electrical components for the BIBB exercises A-H and Z1-Z3. The electrical switches, push buttons, relays and displays are incorporated in one unit with plastic housing. This device set is required to carry out exercises from the exercise book "On/off hydraulics – Electrical operation (according to BIBB)" using a workstation WS290.



The device set R901386159 comprises the following components

Item	Individual components device set	Mat.-no. individual component	Quantity	Image	Page
1	Control unit 19" variant – BIBB module	R961009676	1		185
2	Adapter plate 19" variant – 1 switch, cold-device socket, mains cable	R901384795	1		186
3	Pressure switch, electrical	R961003488	1		192
4	Proximity switch, inductive	R961003106	2		191
5	Solenoid cable with connector form A, black, with LED, with protective circuit	R901457044	3		187
6	Measuring line set, small	R900029597	1		188

Device set Electrics for workstation WS290 "On/off hydraulics – Electrical operation (BIBB, A-H), with I/O module"

Material number R901386160
 Material short text EQUIPMENT SET TS-HS 504-1X

This device set includes all necessary electrical components for the BIBB exercises A-H and Z1-Z3. The electrical switches, push buttons, relays and displays are incorporated in one unit with plastic housing. This device set is required to carry out exercises from the exercise book "On/off hydraulics – Electrical operation (according to BIBB)" using a workstation WS290. This unit also includes an I/O module with connections for sensors and valves. A simulation program can be connected to the hardware via the USB interface.



The device set R901386160 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Control unit 19" variant – BIBB module	R961009676	1		185
2	Control unit 19" variant – I/O module	R961009677	1		147
3	Adapter plate 19" variant – 1 switch, cold-device socket, mains cable	R901384795	1		186
4	Pressure switch, electrical	R961003488	1		192
5	Proximity switch, inductive	R961003106	2		191
6	Solenoid cable with connector form A, black, with LED, with protective circuit	R901457044	3		187
7	Measuring line set, small	R900029597	1		188

Additional learning topic On/off hydraulics – Electrical operation (BIBB, Z1-Z3), extension




Extension device set for workstation WS200/WS290 "On/off hydraulics – Electrical operation (BIBB, Z1-Z3), to "On/off hydraulics – Electrical operation (BIBB, A-H)"

Material number R961009475

Material short text EQUIPMENT SET TS-HS 412-1X

The device set corresponds to the exercise book "On/off hydraulics – Electrical operation (according to BIBB)" which deals with BIBB exercises Z1-Z3. The exercises with the components listed below can be carried out on workstations WS200 and WS290.

The device set R961009475 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Pressure relief valve, pilot-operated, DBW10A1-5X/	R961002553	1		148
2	Non-return (check) valve S6A05-1X	R901462818	3		153
3	Pressure switch, electrical	R961003488	1		192

The recommended accessories are listed on page 38.

On/off hydraulics – Troubleshooting

The contents of this learning topic provide support on how systematic troubleshooting in hydraulic systems can be achieved in a targeted manner. The troubleshooting refers to hydraulic circuits with manually- or electrically-operated directional control valves, pressure control valves and non-return valves.

The successful completion of the practical exercises provides hands on training in the different levels of troubleshooting with on/off hydraulics.

Exercise books

The exercise books correspond to the device sets. They build on the learning topics "On/off hydraulics – Manual operation (BIBB, A-H)" and "On/off hydraulics – Electrical operation (BIBB, A-H and Z1-Z3)" with further training in the topics commissioning and troubleshooting.

The exercises and tasks provide basic information and methods in a structured way with step-by-step instructions for the individual exercises.

Teaching and learning document in one book

- ▶ Exercises with solutions: more far-reaching trainer information and contents such as measured values, calculation results, etc.
- ▶ Exercises: independent completion of calculations and measured value tables, etc.

Learning contents

With the help of logically structured, practical exercises, the trainee should:

- ▶ understand physical laws of hydraulics such as pressure difference, opening cross-section and flow,
- ▶ get to know and apply the legal regulations and safety requirements,
- ▶ understand the function of basic hydraulic circuits,
- ▶ get to know the systematic troubleshooting with different error types (adjustment errors, system errors).



Example exercise book

The following exercises are included:






No.	Exercise	Error type
01	Hydraulic clamping (non-return valve)	System error
02	Clamping equipment with hydraulic motor (pressure relief valve, directional control valve)	Adjustment error, system error
03	Clamping equipment with hydraulic motor (pressure relief valve, directional control valve)	Combination of adjustment and system error

Exercise books "Fault detection in hydraulic systems"			
	Language	Material number	Material short text
Exercises with solutions/exercises (trainer's/trainee's manual)	DE	R900054511	UEBUNGSBUCH TW-HY-AL-1/X 204DE
Exercises with solutions/exercises (trainer's/trainee's manual)	EN	R961003805	EXERCISE BOOK TW-HY-AL-1/X 204EN
Exercises with solutions/exercises (trainer's/trainee's manual)	ES	R961003954	LIBRO DE EJERCICIOS TW-HY-AL-1/X 204ES

Additional learning topic On/off hydraulics – Troubleshooting, manual operation

Extension device set for workstation WS200/WS290 "On/off hydraulics – Troubleshooting, manual operation"	
Material number	R961006619
Material short text	EQUIPMENT SET TS-HS 203-1X
The device set comprises components with installed defects to be used in exercise set-ups for the systematic troubleshooting in hydraulic systems.	
The device set corresponds to the exercise book "Fault detection in hydraulic systems". The exercises with the components listed below can be carried out with workstations WS200 and WS290.	



The device set R961006619 comprises the following components					
Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	4/3 directional control valve 4WMM6G5X manipulated	R961006553	1		138
2	Pressure relief valve DBDH6G1X/100 manipulated	R961006549	1		*
3	Pilot-operated pressure relief valve DB6K1-4X/50YV manipulated	R961006550	1		*
4	Non-return (check) valve S6A05-1X with hose 630 mm manipulated	R961006552	1		*
5	Sight glass	R961006596	1		168

* Items 2 to 4 are not separately available

The recommended accessories are listed on page 38.

Additional learning topic On/off hydraulics – Troubleshooting, electrical operation

Device set for workstation WS200/WS290 "On/off hydraulics – Troubleshooting, electrical operation"






Material number R961006620
 Material short text EQUIPMENT SET TS-HS 204-1X

Except for the electrically operated directional control valve 4WMM6G5X (R961006553), the device set is identical with the device set R961006619.

The electrical control is not specifically described in the exercise book "Fault detection in hydraulic systems".



The device set R961006620 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	4/3 directional control valve 4WE6G6X manipulated	R961006551	1		*
2	Pressure relief valve DBDH6G1X/100 manipulated	R961006549	1		*
3	Pilot-operated pressure relief valve DB6K1-4X/50YV manipulated	R961006550	1		*
4	Non-return (check) valve S6A05-1X with hose 630 mm manipulated	R961006552	1		*
5	Sight glass	R961006596	1		168

* Items 1 to 4 are not separately available








The recommended accessories are listed on page 38.

On/off hydraulics – Accessories

For the exercises in on/off hydraulics, you need measuring equipment for the flow, speed and pressure.

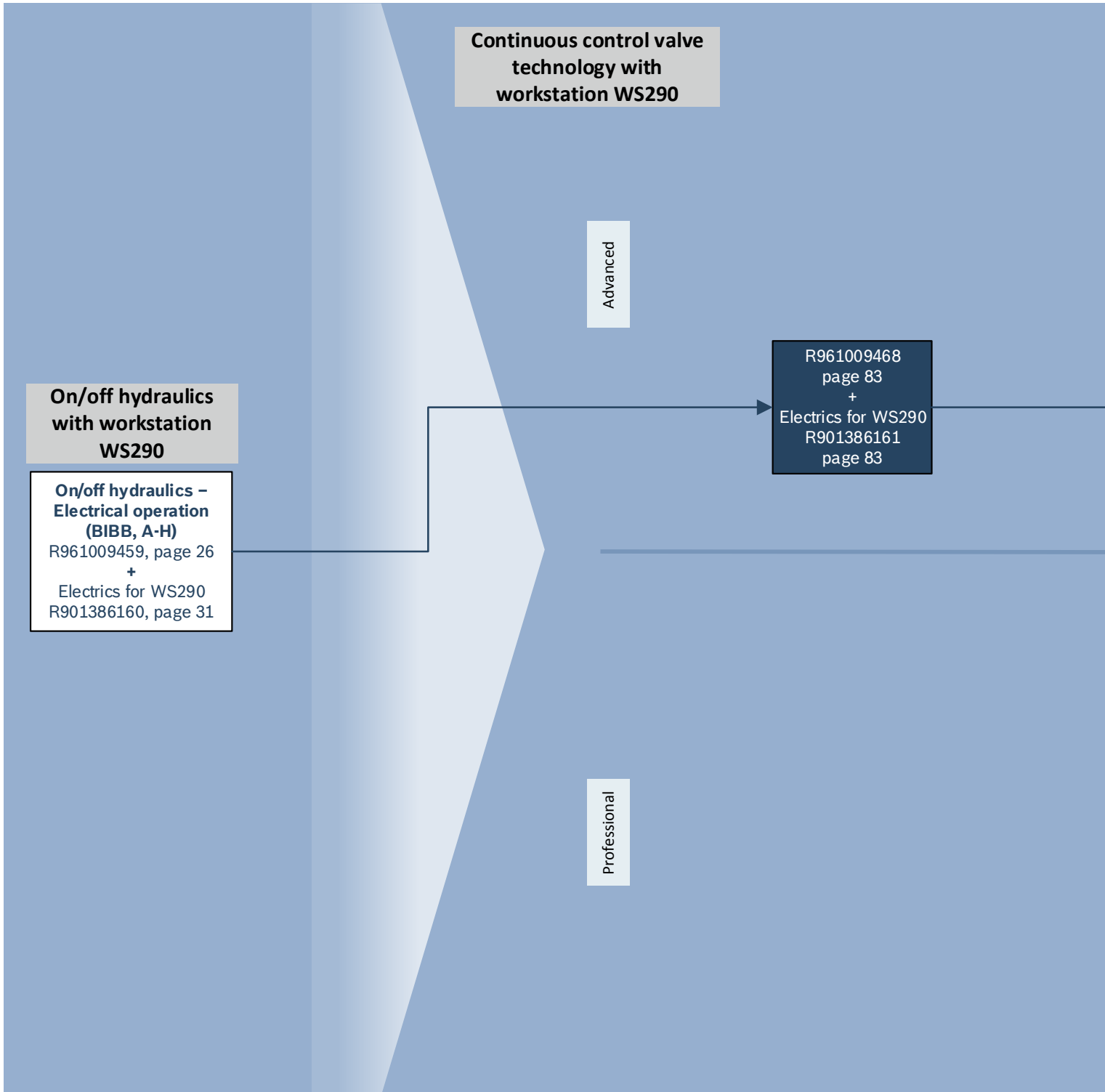
For more accessories, please refer to page 89.

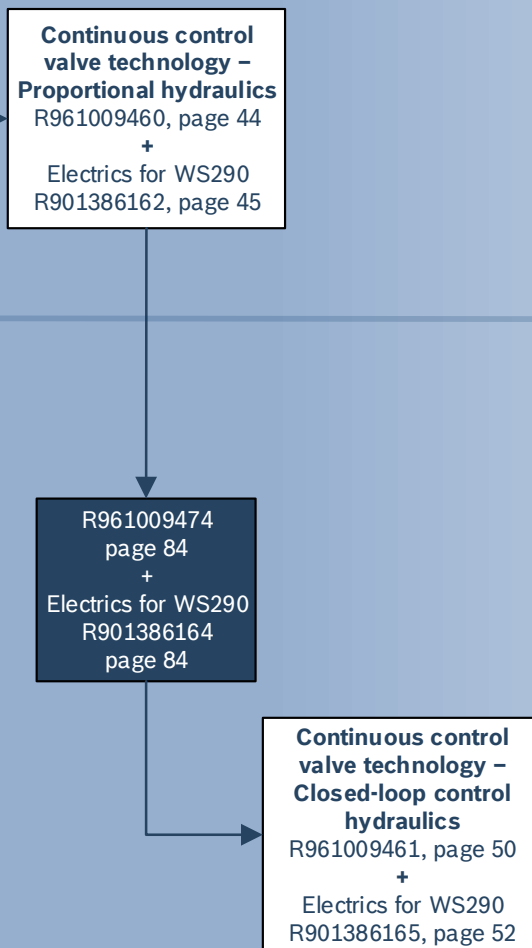
We recommend:

Item	Component	Mat.-no.	Quantity	Image	Page
1	Basic measuring instrument set	R961009563	1		194
2	Measuring glass for workstation WS201	R961009485	1		200
or	Measuring glass 2.5l for workstation WS290 (included in the workstation WS290)	R961002564	1		205
3	Test and filling device for hydraulic accumulator	0538103012	1		167
4	Pressure release sleeve	R961002927	1		173
5	Stop watch, digital	R900061256	1		194
6	Tachometer, visual	R961008893	1		195

Learning topics Continuous control valve technology

Device sets Continuous control valve technology





"Term definition" on page 11

Continuous control valve technology – Proportional hydraulics

The objectives of this learning topic are the familiarization and the use of a proportional directional control valve and a proportional pressure control valve and the corresponding set-point adjustments.

Successful completion of the practical exercises provides hands on knowledge of the function and effect of the main components and basic circuits of continuous control valve technology.

Exercise books

The exercise books correspond to the device sets. These device sets build on the contents and knowledge from the learning topic "On/off hydraulics – Manual and electrical operation (according to BIBB)". The exercises and tasks provide basic information and methods in a structured way with step-by-step instructions for the individual exercises.

Two versions – Teaching and learning document

- ▶ Exercises with solutions: more far-reaching trainer information and contents such as measured values, calculation results, etc.
- ▶ Exercises: independent completion of calculations and measured value tables, etc.

Learning contents

With the help of logically structured, practical exercises, the trainee should:

- ▶ understand physical laws of proportional control valves such as pressure difference, opening cross-section and flow,
- ▶ get to know and apply the legal regulations and safety provisions,
- ▶ apply the most important symbols of proportional hydraulics, read circuit diagrams,
- ▶ get to know and understand the meaning and mode of operation of command value presetting, ramp function and signal sequences,
- ▶ practice the setting, commissioning and optimization of an electro-hydraulic system,
- ▶ determine characteristic values and derive characteristic curves from them.



Example exercise book

The following exercises are included:

Number	Exercise
01	Moving cylinders with external potentiometer as command value presetting
02	Moving cylinders with SWMA1 command value module as command value presetting
03	Setting the SWMA1 command value module with 4 command values
04	Setting the SWMA1 command value module with 4 command values and ramp
05	Setting the braking distance according to the proximity switch signal
06	Pressure ratios at the continuous control valve and influence on velocity and braking distance
07	Setting a motion sequence with 4 quadrants
08	Setting a sequence with 2 proximity switches
09	Setting an automatic sequence with 3 proximity switches
10	Setting the system pressure by means of an external potentiometer
11	Moving a cylinder with two different pressures
12	Automatic sequence with continuous pressure control valve

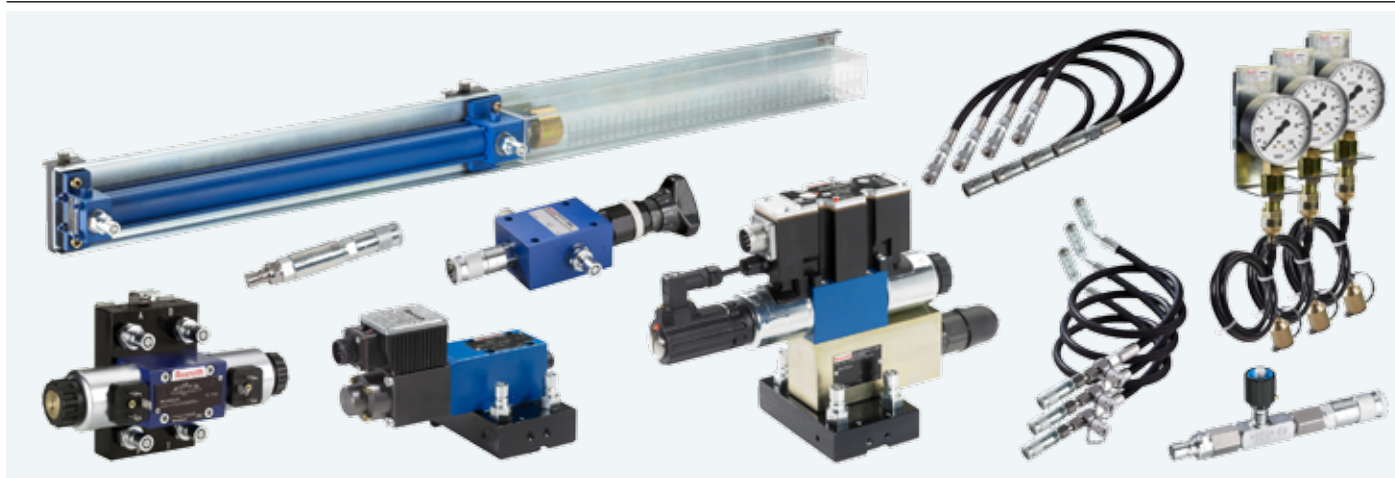
Exercise books "Proportional valve technology"			
	Language	Mat.-no.	Material short text
Exercises with solutions (trainer's manual)	DE	R961003779	UEBUNGSBUCH TW-HY-LH-2/X 301DE
Exercises with solutions (trainer's manual)	EN	R961003873	EXERCISE BOOK TW-HY-LH-1/X 301EN
Exercises with solutions (trainer's manual)	ES	R961003872	LIBRO DE EJERCICIOS TW-HY-LH-1/X 301ES
Exercises (trainee's manual)	DE	R961003780	UEBUNGSBUCH TW-HY-SH-2/X 301DE
Exercises (trainee's manual)	EN	R961003875	EXERCISE BOOK TW-HY-SH-1/X 301EN
Exercises (trainee's manual)	ES	R961003874	LIBRO DE EJERCICIOS TW-HY-SH-1/X 301ES

Device set for workstation WS290 "Continuous control valve technology – Proportional hydraulics, complete"











Material number R961009460

Material short text EQUIPMENT SET TS-HS 301-2X

This device set is used to study electro-hydraulic control technology using practical exercises. Only industry standard components are used. These have been adapted for use on the training equipment. The device set corresponds to the exercise book "Proportional valve technology". The exercises with the components listed below can be carried out on workstation WS290.



The device set R961009460 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Differential cylinder CD70F25/16-400 with protective housing	R961003495	1		156
2	4/3 directional control valve 4WE6E6X/	R961002549	1		142
3	4/3 proportional directional control valve 4WREE6E08-2X/ with int. elec. and load sim.	R961003533	1		143
4	Pressure relief valve DBDH6G1X/	R961002520	1		145
5	Prop. pressure relief valve DBEE6-2X/50	R961003924	1		148
6	Throttle/non-return (check) valve DRV06-1-1X/V	R961002495	1		149
7	Non-return (check) valve S6A05-1X	R901462818	1		153
8	Manometer 0-100 bar with measuring hose	R961002715	3		198
9	Hose line 630 mm	R961002474	4		170
10	Hose line 1000 mm with 90° fitting and Minimes port	R961004330	3		173

The recommended accessories are listed on page 54.







Device set Electrics for workstation WS290 "Continuous control valve technology – Proportional hydraulics, complete"








Material number R901386162
 Material short text EQUIPMENT SET TS-HS 506-2X

This device set includes all necessary electrical components for the proportional hydraulics exercises. The electrical switches, push buttons, relays and displays are incorporated in one operating unit – 19" rack variant. All other components such as display unit or set-point adjuster are also designed in 19" rack variant. This device set is required to carry out the exercises from the exercise book "Proportional valve technology" on a workstation WS290.



The device set R901386162 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Control unit 19" variant – BIBB module	R961009676	1		185
2	Switching element 19" variant – 1 switch + 2 push buttons, 3 NO contacts, 3 NC contacts	R961009617	1		174
3	Display unit 19" variant – 2 displays, max. display range 0-20 V	R961009623	1		177
4	Adapter plate 19" variant – round connector laboratory socket	R961009630	1		178
5	Set-point adjuster 19" variant – with ramp	R961009631	1		178
6	Set-point adjuster 19" variant – +/- 10 V	R961009632	1		177

The device set R901386162 comprises the following components					
Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
7	Adapter plate 19" variant – 1 switch, cold-device socket, connecting cable 0.5m	R901384795	1		186
8	Pressure switch, electrical	R961003488	1		192
9	Proximity switch, inductive	R961003106	3		191
10	Cable 7-pole for integrated electronics	R961003550	1		189
11	Cable set for command value/actual value measurement, 2 mm/2 mm and 2mm/4 mm	R901461031	1		189
12	Measuring line set, large	R900021502	1		188
13	Solenoid cable with connector form A, black, with LED, with protective circuit	R901457044	2		187

Continuous control valve technology – Closed-loop control hydraulics

The objectives of this learning topic are the familiarization and the use of a valve for closed-loop control with on-board electronics, a hydraulic cylinder with load unit and position transducer, and the corresponding set-point adjustments.

Successful completion of the practical exercises provides hands on knowledge of the practical application of a simple electro-hydraulic position control circuit.

Exercise books

The exercise books correspond to the device sets. These device sets build on the contents and knowledge from the learning topics "On/off hydraulics – Manual and electrical operation (according to BIBB)" and "Continuous control valve technology – Proportional hydraulics".

The exercises and tasks provide basic information and methods in a structured way with step-by-step instructions for the individual exercises.

Two versions – Teaching and learning document

- ▶ Exercises with solutions: more far-reaching trainer information and contents such as measured values, calculation results, etc.
- ▶ Exercises: independent completion of calculations and measured value tables, etc.

Learning contents

With the help of logically structured, practical exercises, the trainee should:

- ▶ understand physical laws of continuous control valves such as pressure difference, opening cross-section and flow,
- ▶ get to know and apply the legal regulations and safety requirements,
- ▶ apply the most important symbols of closed-loop control hydraulics, read circuit diagrams,
- ▶ Understand the meaning and mode of operation of command value presetting, ramp function and signal sequences,
- ▶ practice the setting, commissioning and optimization of an electro-hydraulic system,
- ▶ determine characteristic values and derive characteristic curves from them,
- ▶ identify disadvantages of an open loop control,
- ▶ understand function and importance of the setting of a controller,
- ▶ identify the advantages of a control,
- ▶ practice the commissioning and optimization of an electro-hydraulic position control circuit with variable loads.



Example exercise book

The following exercises are included:

No.	Exercise
01	Setting a position with a 4/3 directional control valve
02	Setting a position with a continuous control valve
03	Position control

Exercise books "Analog position control loop"			
	Language	Material number	Material short text
Exercises with solutions (trainer's manual)	DE	R961005011	UEBUNGSBUCH TW-HY-LH-1/X 302DE
Exercises with solutions (trainer's manual)	EN	R961005091	EXERCISE BOOK TW-HY-LH-1/X 302EN
Exercises (trainee's manual)	DE	R961005010	UEBUNGSBUCH TW-HY-SH-1/X 302DE
Exercises (trainee's manual)	EN	R961005092	EXERCISE BOOK TW-HY-SH-1/X 302EN

Device set for workstation WS290 "Continuous control valve technology – Closed-loop control hydraulics, complete"






Material number R961009461

Material short text EQUIPMENT SET TS-HS 302-2X







This device set is used to study practical applications of a simple electro-hydraulic position control loop. Only industry standard components are used which have been adapted for use on the training equipment. The device set corresponds to the exercise book "Analog position control loop". The exercises with the components listed below can be carried out on workstation WS290.



The device set R961009461 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Load unit, controlled, for dynamic load simulation	R961004486	1		157
2	4/4 valve for closed-loop control 4WRPEH6 with integrated electronics	R961002509	1		144
3	4/2 directional control valve 4WE6C6X/	R961002547	1		141
4	4/3 directional control valve 4WE6E6X/	R961002549	1		142
5	Pressure relief valve DBDH6G1X/	R961002520	1		145

The device set R961009461 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
6	Pressure reducing valve, direct-operated, DR6DP1-5X/	R961002544	1		145
7	Non-return (check) valve S6A05-1X	R901462818	1		153
8	Hydraulic distributor 4 ports	R961002485	2		169
9	Manometer 0-100 bar with measuring hose	R961002715	4		198
10	Hose line 630 mm	R961002474	7		170
11	Hose line 1000 mm with 90° fitting and Minimes port	R961004330	5		173

The recommended accessories are listed on page 54.

Device set Electrics for workstation WS290 "Continuous control valve technology – Closed-loop control hydraulics, complete"







Material number R901386165

Material short text EQUIPMENT SET TS-HS 509-2X








In this device set, all necessary electrical components for the Closed-loop control hydraulics exercises are summarized. The electrical functions switch, push button, relay and display are summarized in an operating element in 19" technology. All other components such as display unit or set-point adjuster are also designed in 19" technology. This device set is required to carry out the exercises from the exercise book "Analog position control loop" at a workstation WS290.



The device set R901386165 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Control unit 19" variant – BIBB module	R961009676	1		185
2	Control module TS-BPS 30.0, analog controller module, 30TE	R961004782	1		179
3	Switching element 19" variant – 1 switch + 2 push buttons, 3 NO contacts, 3 NC contacts	R961009617	1		174
4	Display unit 19" variant – 2 displays, max. display range 0-20 V	R961009623	1		177
5	Adapter plate 19" variant – round connector laboratory socket	R961009630	1		178
6	Set-point adjuster 19" variant – with ramp	R961009631	1		178








The device set R901386165 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
7	Set-point adjuster 19" variant – +/- 10 V	R961009632	1		177
8	Adapter plate 19" variant – 1 switch, cold-device socket, mains cable	R901384795	1		186
9	Proximity switch, inductive	R961003106	1		191
10	Cable 7-pole for integrated electronics	R961003550	1		189
11	Cable set for command value/actual value measurement, 2 mm/2 mm and 2mm/4 mm	R901461031	1		189
12	Measuring line set, large	R900021502	1		188
13	Solenoid cable with connector form A, black, with LED, with protective circuit	R901457044	3		187

Continuous control valve technology – Accessories

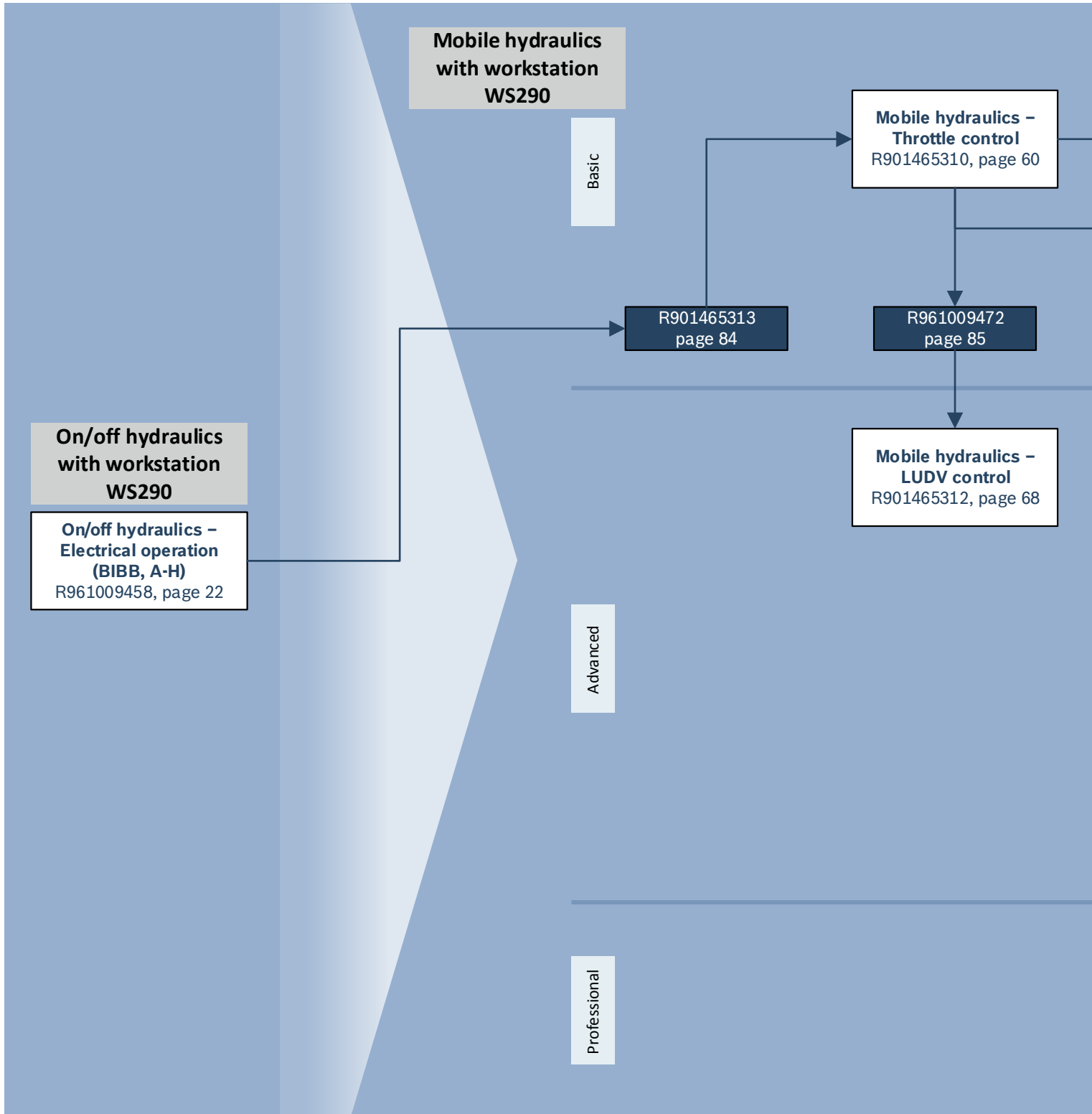
For the exercises in the continuous control valve technology, you need measuring equipment for the flow and pressure measurement as well as a multimeter. More accessories are listed on page 89.

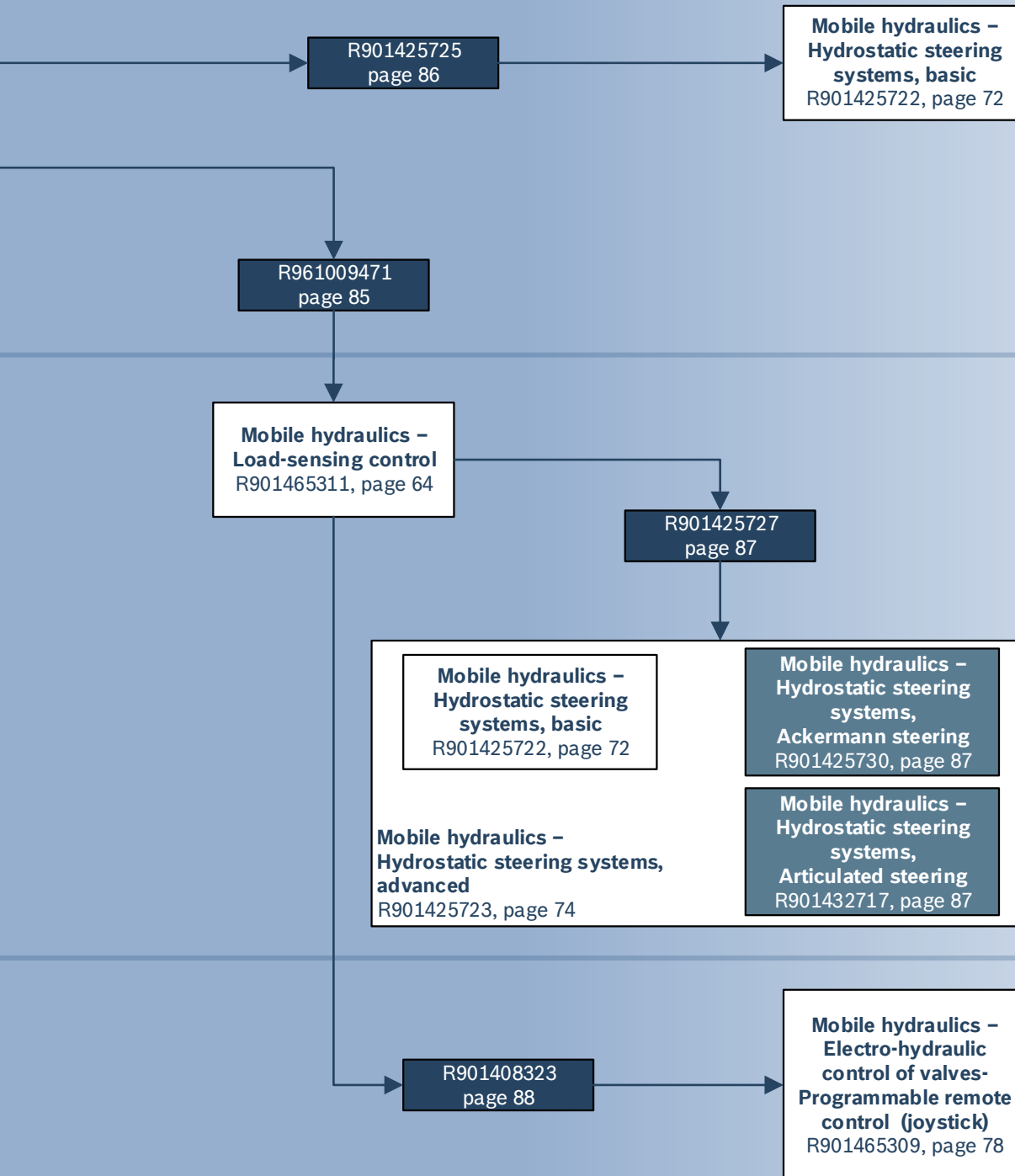
We recommend:

Item	Component	Mat.-no.	Quantity	Image	Page
1	Basic measuring instrument set	R961009563	1		194
and	Measuring glass 2.5l for workstation WS290 (included in the workstation WS290)	R961002564	1		205
2	Gear wheel flow rate sensor	R961002508	1		196
and	Measuring cable for ISDS	R900733207	1		196
and	Measuring instrument set 3020	R913038909	1		193
3	Multimeter VC175	R913038027	1		193
4	Pressure release sleeve	R961002927	1		173

Learning topics Mobile hydraulics

Device sets Mobile hydraulics





"Term definition" on page 11

Mobile hydraulics – Throttle control

The objectives of this learning topic are the familiarization with the use of a mobile control block with throttle control.

Successful completion of the practical exercises provides hands on knowledge of function and effect of the main components and basic circuits of mobile hydraulics.

Exercise books

The exercise books correspond to the device sets. These device sets build on the contents and knowledge from the learning topic "On/off hydraulics – Manual operation (BIBB, A-H)".

The exercises and tasks provide basic information and methods in a structured way with step-by-step instructions for the individual exercises.

Two versions – Teaching and learning document

- ▶ Exercises with solutions: more far-reaching trainer information and contents such as measured values, calculation results, etc.
- ▶ Exercises: independent completion of calculations and measured value tables, etc.

Learning contents

With the help of logically structured, practical exercises, the trainee should:

- ▶ understand physical laws of hydraulics such as pressure difference, opening cross-section and flow,
- ▶ read specific switching symbols,
- ▶ identify the function of the throttle control,
- ▶ get to know components such as 6/3 directional control valve, load holding valve, primary and outlet pressure valve, hydraulic pilot control,
- ▶ understand the connection between control and velocity,
- ▶ get to know the function of the throttle control in parallel operation,
- ▶ work out the function and application of the hydraulic control,
- ▶ determine characteristic values and derive characteristic curves from them.



Example exercise book

The following exercises are included:

Number	Exercise
01	Flow distribution
02	Pressure control and force control
03	Hydraulic pilot control
04	Speed with different loads
05	Load holding valve
06	Secondary valve
07	Parallel operation
08	Control characteristic
09	Lower boom and force build-up

Exercise books "Mobile hydraulics - Throttle control 3SM-12"			
	Language	Mat.-no.	Material short text
Exercises with solutions (trainer's manual)	DE	R961004608	UEBUNGSBUCH TW-HY-LH-1/X 303DE
Exercises with solutions (trainer's manual)	EN	R961005094	EXERCISE BOOK TW-HY-LH-1/X 303EN
Exercises (trainee's manual)	DE	R961004614	UEBUNGSBUCH TW-HY-SH-1/X 303DE
Exercises (trainee's manual)	EN	R961005093	EXERCISE BOOK TW-HY-SH-1/X 303EN

Device set for workstation WS290 "Mobile hydraulics – Throttle control, complete"

Material number R901465310

Material short text EQUIPMENT SET TS-HS 303-3X





This device set is used to study practical applications from the mobile control technology. Only industry standard components are used. These have been adapted for use on the training equipment.

The device set corresponds to the exercise book "Mobile hydraulics – Throttle control 3SM-12".










The exercises with the components listed below can be carried out on workstation WS290.



The device set R901465310 comprises the following components


Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Mobile control block Throttle control 3 SM12	R961005970	1		162
2	Hydraulic pilot control unit 2 levers 2-2TH6	R961005967	1		161
3	Planetary motor	R961008748	1		160
4	Pressure relief valve DBDH6G1X/	R961002520	1		145

The device set R901465310 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
5	Pressure reducing valve, direct-operated, DR6DP1-5X/	R961002544	1		145
6	Pressure sequence valve, direct-operated, DZ6DP1-5X/	R961002558	1		146
7	Non-return (check) valve S6A05-1X	R901462818	1		153
8	Accumulator module	R961002503	1		167
9	Hydraulic distributor 4 ports	R961002485	6		169
10	Manometer 0-100 bar with measuring hose	R961002715	3		198
11	Hose line 630 mm	R961002474	11		170
12	Hose line 700 mm with 90° fitting and Minimes port	R961004329	3		173
13	Hose line 1000 mm with 90° fitting	R961004331	6		172

The recommended accessories are listed on page 80.

Necessary accessories (for exercises 2, 5, 6, 9):

1	Load unit 80 kg, stationary	R961004005	1		120
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Mobile hydraulics – Load-sensing control

The objectives of this learning topic are the familiarization with the use of a mobile control block with load-sensing control.

Successful completion of the practical exercises provides hands on knowledge of the function and effect of the main components and basic circuits of mobile hydraulics.

Exercise books

The exercise books correspond to the device sets. These device sets build on the contents and knowledge from the learning topics "On/off hydraulics – Manual operation (BIBB, A-H)" and "Mobile hydraulics – Throttle control".

The exercises and tasks provide basic information and methods in a structured way with step-by-step instructions for the individual exercises.

Two versions – Teaching and learning document

- ▶ Exercises with solutions: more far-reaching trainer information and contents such as measured values, calculation results, etc.
- ▶ Exercises: independent completion of calculations and measured value tables, etc.

Learning contents

With the help of logically structured, practical exercises, the trainee should:

- ▶ understand physical laws of hydraulics such as pressure difference, opening cross-section and flow,
- ▶ get to know and use specific switching symbols,
- ▶ understand the function of the load-sensing control,
- ▶ get to know components such as 4/3 directional control valve, load holding valve, primary and secondary valve, pressure compensator, hydraulic pilot control,
- ▶ understand the connection between control and velocity,
- ▶ get to know the function of the load-sensing control in parallel operation,
- ▶ work out the function and application of the hydraulic pilot control,
- ▶ determine characteristic values and derive characteristic curves from them, if required.



Example exercise book

The following exercises are included:

Number	Exercise
01	Primary pressure limitation
02	Actuator flow
03	Load pressure compensation
04	Pressure losses in p line
05	Hydraulic pilot control
06	External force
07	Outlet pressure limitation
08	LS pressure limitation
09	Parallel operation with sufficient delivery volume
10	Parallel operation with too little delivery volume
11	Load change

Exercise books "Mobile hydraulics – Load sensing control 2M4-12"			
	Language	Mat.-no.	Material short text
Exercises with solutions (trainer's manual)	DE	R961004565	UEBUNGSBUCH TW-HY-LH-1/X 304DE
Exercises with solutions (trainer's manual)	EN	R961005147	EXERCISE BOOK TW-HY-LH-1/X 304EN
Exercises with solutions (trainer's manual)	ES	R901206091	LIBRO DE EJERCICIOS TW-HY-LH-1/X 304ES
Exercises (trainee's manual)	DE	R961004564	UEBUNGSBUCH TW-HY-SH-1/X 304DE
Exercises (trainee's manual)	EN	R961005146	EXERCISE BOOK TW-HY-SH-1/X 304EN
Exercises (trainee's manual)	ES	R901206157	LIBRO DE EJERCICIOS TW-HY-SH-1/X 304ES

Device set for workstation WS290 "Mobile hydraulics – Load-sensing control, complete"

Material number R901465311

Material short text EQUIPMENT SET TS-HS 304-3X





This device set is used to study practical applications from the mobile control technology. Only industry standard components are used. These have been adapted for use on the training equipment.

The device set corresponds to the exercise book "Mobile hydraulics – Load-sensing control 2M4-12".











The exercises with the components listed below can be carried out on workstation WS290.



The device set R901465311 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Mobile control block Load-sensing 2M4-12	R961005969	1		163
2	Hydraulic pilot control unit 2 levers 2-2TH6	R961005967	1		161
3	Planetary motor	R961008748	1		160
4	Pressure relief valve DBDH6G1X/	R961002520	1		145

The device set R901465311 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
5	Pressure reducing valve, direct-operated, DR6DP1-5X/	R961002544	1		145
6	Pressure sequence valve, direct-operated, DZ6DP1-5X/	R961002558	1		146
7	Throttle valve DV06-1-1X/V	R961002539	1		149
8	Non-return (check) valve S6A05-1X	R901462818	1		153
9	Accumulator module	R961002503	1		167
10	Hydraulic distributor 4 ports	R961002485	5		169
11	Manometer 0-100 bar with measuring hose	R961002715	3		198
12	Hose line 630 mm	R961002474	10		170
13	Hose line 700 mm with 90° fitting and Minimes port	R961004329	3		173
14	Hose line 1000 mm with 90° fitting	R961004331	8		172

The recommended accessories are listed on page 80.

Necessary accessories (for exercises 6, 7, 8, 9, 10, 11):

1	Load unit 80 kg, stationary	R961004005	1		120
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Mobile hydraulics – LUDV control

The objectives of this learning topic are the familiarization with the use of a mobile control block with LUDV control (load pressure-independent flow distribution).

Successful completion of the practical exercises provides hands on knowledge of the function and effect of the main components and basic circuits of mobile hydraulics.

Exercise books

The exercise books correspond to the device sets. These device sets build on the contents and knowledge from the learning topics "On/off hydraulics – Manual operation (BIBB, A-H)" and "Mobile hydraulics – Throttle and Load-sensing control".

The exercises and tasks provide basic information and methods in a structured way with step-by-step instructions for the individual exercises.

Two versions – Teaching and learning document

- ▶ Exercises with solutions: more far-reaching trainer information and contents such as measured values, calculation results, etc.
- ▶ Exercises: independent completion of calculations and measured value tables, etc.

Learning contents

With the help of logically structured, practical exercises, the trainee should:

- ▶ understand physical laws of hydraulics such as pressure difference, opening cross-section and flow,
- ▶ get to know and use specific switching symbols,
- ▶ understand the function of the LUDV control,
- ▶ get to know components such as 4/3 directional control valve, load holding valve, primary and outlet pressure valve, pressure compensator, hydraulic pilot control,
- ▶ understand the connection between control and velocity,
- ▶ get to know the function of the LUDV control in parallel operation,
- ▶ work out the function and application of the hydraulic pilot control,
- ▶ determine characteristic values and derive characteristic curves from them.



Example exercise book

The following exercises are included:

Number	Exercise
01	Pressure setting and hydraulic pilot control
02	Setting actuator quantities by means of stroke limitations
03	Influence of pipelines
04	Influence of loads
05	Stroke limitation with changing direction of force
06	Boom cylinder with external force effect
07	LUDV system

Exercise books "Mobile hydraulics - LUDV"			
	Language	Mat.-no.	Material short text
Exercises with solutions (trainer's manual)	DE	R961004654	UEBUNGSBUCH TW-HY-LH-1/X 305DE
Exercises with solutions (trainer's manual)	EN	R961005149	EXERCISE BOOK TW-HY-LH-1/X 305EN
Exercises (trainee's manual)	DE	R961004749	UEBUNGSBUCH TW-HY-SH-1/X 305DE
Exercises (trainee's manual)	EN	R961005148	EXERCISE BOOK TW-HY-SH-1/X 305EN

Device set for workstation WS290 "Mobile hydraulics – LUDV control, complete"

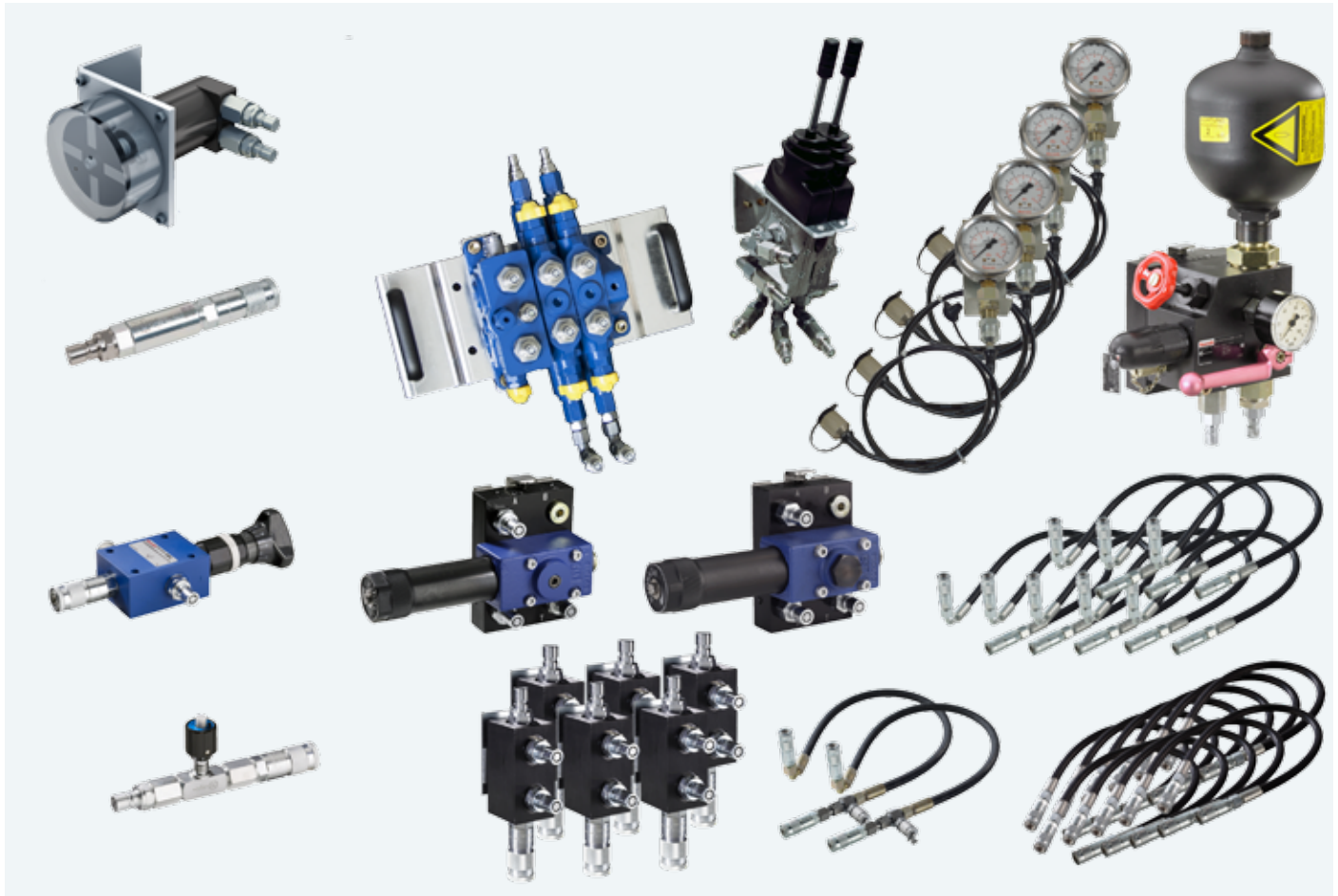
Material number R901465312

Material short text EQUIPMENT SET TS-HS 305-3X




This device set is used to study practical applications from the mobile control technology. Only industry standard components are used. These have been adapted for use on the training equipment.

The device set corresponds to the exercise book "Mobile hydraulics – LUDV".

The exercises with the components listed below can be carried out on workstation WS290.



The device set R901465312 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Mobile control block LUDV 2SX-12	R961005966	1		162
2	Hydraulic pilot control unit 2 levers 2-2TH6	R961005967	1		161
3	Planetary motor	R961008748	1		160

The device set R901465312 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
4	Pressure relief valve DBDH6G1X/	R961002520	1		145
5	Pressure reducing valve, direct-operated, DR6DP1-5X/	R961002544	1		145
6	Pressure sequence valve, direct-operated, DZ6DP1-5X/	R961002558	1		146
7	Throttle valve DV06-1-1X/V	R961002539	1		149
8	Non-return (check) valve S6A05-1X	R901462818	1		153
9	Accumulator module	R961002503	1		167
10	Hydraulic distributor 4 ports	R961002485	6		169
11	Manometer 0-100 bar with measuring hose	R961002715	4		198
12	Hose line 630 mm	R961002474	11		170
13	Hose line 700 mm with 90° fitting and Minimes port	R961004329	2		173
14	Hose line 1000 mm with 90° fitting	R961004331	8		172

The recommended accessories are listed on page 80.

Necessary accessories (for exercises 5, 6, 7):

1	Load unit 80 kg, stationary	R961004005	1		120
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Mobile hydraulics – Hydrostatic steering systems

The objectives of this learning topic are the familiarization with the use of hydrostatic steering systems.

Successful completion of the practical exercises provides hands on knowledge of the function and effect of the main components and basic circuits of mobile hydraulics.

Exercise books

The exercise books correspond to the device sets. These device sets build on the contents and knowledge from the learning topics "On/off hydraulics – Manual operation (BIBB, A-H)" and "Mobile hydraulics – Load-sensing control".

The exercises and tasks provide basic information and methods in a structured way with step-by-step instructions for the individual exercises.

Two versions – Teaching and learning document

- ▶ Exercises with solutions: more far-reaching trainer information and contents such as measured values, calculation results, etc.
- ▶ Exercises: independent completion of calculations and measured value tables, etc.

Learning contents

With the help of logically structured, practical exercises, the trainee should:

- ▶ understand physical laws of hydraulics such as pressure difference, opening cross-section and flow,
- ▶ get to know and apply the legal regulations and safety provisions,
- ▶ get to know and use specific switching symbols for steering systems,
- ▶ understand the function of hydrostatic steering systems,
- ▶ understand the connection between control (steering wheel) and steering velocity,
- ▶ get to know the behavior of hydrostatic steering systems in parallel operation to the work hydraulics (prioritization),
- ▶ work out the function and application of the hydraulic pilot control,
- ▶ determine characteristic values and derive characteristic curves from them, if required.



Example exercise book

The following exercises are included:

Number	Exercise
01	Getting to know the steering system
02	Flow/steering speed characteristic curve
03	Frame size of a steering unit
04	Operation force at the steering wheel (incl. emergency steering function)
05	Priority valve
06	Ackermann steering
07	Articulated steering
08	Wheel loader with articulated steering (application circuit)

Exercise books "Mobile hydraulics - Hydrostatic steering systems"			
	Language	Mat.-no.	Material short text
Exercises with solutions (trainer's manual)	DE	R961009559	UEBUNGSBUCH TW-HY-LH-1/X 306DE
Exercises with solutions (trainer's manual)	EN	R961009561	EXERCISE BOOK TW-HY-LH-1/X 306EN
Exercises with solutions (trainer's manual)	ES	R901440313	LIBRO DE EJERCICIOS TW-HY-LH-1/X 306ES
Exercises with solutions (trainer's manual)	FR	R901440315	LIVRE D'EXERCICES TW-HY-LH-1/X 306FR
Exercises (trainee's manual)	DE	R961009560	UEBUNGSBUCH TW-HY-SH-1/X 306DE
Exercises (trainee's manual)	EN	R961009562	EXERCISE BOOK TW-HY-SH-1/X 306EN
Exercises (trainee's manual)	ES	R901440314	LIBRO DE EJERCICIOS TW-HY-SH-1/X 301ES
Exercises (trainee's manual)	FR	R901440316	LIVRE D'EXERCICES TW-HY-SH-1/X 306FR

Device set for workstation WS290 "Mobile hydraulics – Steering systems, basic, complete"

Material number R901425722




Material short text EQUIPMENT SET TS-HS 102-1X

This device set is used to study practical exercises from the mobile control technology. Only industry standard components are used. These have been adapted for use on the training equipment. The device set corresponds to the exercises 1 to 5 from the exercise book "Mobile hydraulics – Hydrostatic steering systems".











The exercises with the components listed below can be carried out on workstation WS290.



The device set R901425722 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Steering system with steering unit, steering assembly and steering wheel	R901403830	1		165
2	Pressure relief valve DBDH6G1X/	R961002520	2		145
3	Hydraulic distributor 4 ports	R961002485	4		169

The device set R901425722 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
4	Manometer 0 To 100 bar with measuring hose	R961002715	2		198
5	Hose line 1000 mm with 90° fitting and Minimes port	R961004330	1		173
6	Hose line 1000 mm	R961002475	4		170
7	Hose line 630 mm	R961002474	6		170
8	Differential cylinder CD70F25/16-200 with protective housing and connection possibility for load unit in workstation WS201	R961009526	1		155
9	Shut-off valve	R961002491	1		152
10	Non-return (check) valve S6A05-1X	R901462818	1		153
11	Spring scale, 0 - 12.5 kg	R913048952	1		*
12	Priority valve, 3-way flow control valve in Closed Center Load-sensing version	R901403832	1		165
* Item 11 is not separately available					
Necessary accessories (for exercise 8):					
1	Load unit 80 kg, stationary	R961004005	1		120

Device set for workstation WS290 "Mobile hydraulics – Steering system, advanced, complete"

Material number R901425723




Material short text EQUIPMENT SET TS-HS 205-1X

This device set is used to study practical exercises from the mobile control technology. Only industry standard components are used. These have been adapted for use on the training equipment. The device set corresponds to the exercise book "Mobile hydraulics – Hydrostatic steering systems".












The exercises with the components listed below can be carried out on workstation WS290.



The device set R901425723 comprises the following components


Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Steering system with steering unit, steering assembly and steering wheel	R901403830	1		165
2	Pressure relief valve DBDH6G1X/	R961002520	2		145
3	Hydraulic distributor 4 ports	R961002485	4		169

The device set R901425723 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
4	Manometer 0 to 100 bar with measuring hose	R961002715	2		198
5	Hose line 1000 mm with 90° fitting and Minimes port	R961004330	1		173
6	Hose line 1000 mm	R961002475	4		170
7	Hose line 630 mm	R961002474	6		170
8	Differential cylinder CD70F25/16-200 with protective housing and connection possibility for load unit in workstation WS201	R961009526	1		155
9	Shut-off valve	R961002491	1		152
10	Non-return (check) valve S6A05-1X	R901462818	1		153
11	Spring scale, 0 - 12.5 kg	R913048952	1		*
12	Priority valve, 3-way flow control valve in Closed Center Load-sensing version	R901403832	1		165
13	Ackermann steering functional module with one double-acting cylinder, 2 displays for steering angle (1 per wheel) and steering stroke, protective housing	R901419580	1		166
14	Articulated steering functional module with 2 differential cylinders, display for kinking angle and steering stroke, protective housing	R901419587	1		166

* Item 11 is not separately available

Necessary accessories (for exercise 8):

1	Load unit 80 kg, stationary	R961004005	1		120
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Mobile hydraulics – Electrohydraulic control of valves – Programmable remote control (joystick) with integrated power electronics

The objectives of this learning topic are the familiarization with the use and the properties of the programming of pilot control systems for mobile hydraulics controls.

Successful completion of the practical exercises provides hands on knowledge of the function and effect of the main components and basic circuits of mobile hydraulics.

Exercise books

The exercise books correspond to the device sets. These device sets build on the contents and knowledge from the learning topics "On/off hydraulics – Manual operation (BIBB, A-H)" and "Mobile hydraulics – Load-sensing control".

The exercises and tasks provide basic information and methods in a structured way with step-by-step instructions for the individual exercises.

Two versions – Teaching and learning document

- ▶ Exercises with solutions: more far-reaching trainer information and contents such as measured values, calculation results, etc.
- ▶ Exercises: independent completion of calculations and measured value tables, etc.

Learning contents

With the help of logically structured, practical exercises, the trainee should:

- ▶ get to know differences, types and function of the electro-hydraulic control,
- ▶ understand the functional scope and programming of the "EMToolBox" software,
- ▶ understand function and setup of proportional pressure reducing valves,
- ▶ determine characteristic curves,
- ▶ test programmed cams by means of a practical example (e.g. load-sensing mobile control block).



Example exercise book

The following exercises are included:

Number	Exercise
01	Getting to know a proportional pressure reducing valve
02	Time ramps
03	Programming the cam with 10% and 90% step jump for rope winch
04	Programming a progressive cam for controlling the working cylinder of an excavator
05	Switchover to second cam by activating a digital input
06	Parallel operation with too little delivery volume – Optimization by means of cam

Exercise books "Mobile hydraulics – Electrohydraulic operation of valves – Programmable remote control (joystick) with integrated power electronics"

	Language	Mat.-no.	Material short text
Exercises with solutions (trainer's manual)	DE	R901407781	UEBUNGSBUCH TW-HY-LH-1/X 413DE
Exercises with solutions (trainer's manual)	EN	R901407785	EXERCISE BOOK TW-HY-LH-1/X 413EN
Exercises with solutions (trainer's manual)	ES	R901407790	LIBRO DE EJERCICIOS TW-HY-LH-1/X 413ES
Exercises (trainee's manual)	DE	R901407784	UEBUNGSBUCH TW-HY-SH-1/X 413DE
Exercises (trainee's manual)	EN	R901407788	EXERCISE BOOK TW-HY-SH-1/X 413EN
Exercises (trainee's manual)	ES	R901407791	LIBRO DE EJERCICIOS TW-HY-SH-1/X 413ES

Device set for workstation WS290 "Mobile hydraulics – Programmable remote control (joystick), complete"




Material number R901465309

Material short text EQUIPMENT SET TS-HS 306-1X













This device set is used to study practical exercises from the mobile control technology. Only industry standard components are used. These have been adapted for use on the training equipment. The device set corresponds to the exercises from the exercise book "Mobile hydraulics – Electrohydraulic operation of valves – Programmable remote control (joystick) with integrated power electronics". The exercises with the components listed below can be carried out on workstation WS290.



The device set R901465309 comprises the following components


Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
1	Remote control plate with 4 proportional pressure reducing valves	R901408448	1		164
2	Pressure relief valve DBDH6G1X/	R961002520	1		145
3	Hydraulic distributor 4 ports	R961002485	4		169

The device set R901465309 comprises the following components

Item	Description of the individual components	Mat.-no. individual component	Quantity	Image	Page
4	Mobile hydraulics load-sensing 2M4-12	R961005969	1		163
5	Planetary motor	R961008748	1		160
6	Non-return (check) valve S6A05-1X	R901462818	1		
7	Accumulator module	R961002503	1		167
8	Manometer 0 to 100 bar with measuring hose	R961002715	3		198
9	Hose line 1000 mm with 90° fitting	R961004331	8		172
10	Hose line 700 mm with 90° fitting and Minimes port	R961004329	3		173
11	Hose line 630 mm	R961002474	7		170
12	Electronic 2-axis joystick (with power outputs) with connection unit and programming interface	R901407766	1		164
13	Connecting cable to control the valves of the remote control plate	R901411277	4		*
14	Measuring line 1500 mm, red	1827003464	2		*
15	Measuring line 1500 mm, blue	1827003465	2		*

* Items 14-16 are not separately available









Necessary accessories (for exercises 4, 6):

1	Load unit 80 kg, stationary	R961004005	1		120
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Mobile hydraulics – Accessories

For the exercises in mobile hydraulics, you need measuring equipment for the flow, speed and pressure measurement. More accessories are listed on page 89.

We recommend:













Item	Component	Mat.-no.	Quantity	Image	Page
1	Basic measuring instrument set	R961009563	1		194
and	Measuring glass 2.5l for workstation WS290 (included in the workstation WS290)	R961002564	1		205
2	Gear wheel flow rate sensor	R961002508	1		196
and	Measuring cable for ISDS	R900733207	1		196
and	Measuring instrument set 3020	R913038909	1		193
3	Test and filling device for hydraulic accumulator	0538103012	1		167
4	Pressure release sleeve	R961002927	1		173
5	Multimeter VC175	R913038027	1		193

Extension device sets

For a favorably priced extension of learning topics, Bosch Rexroth offers corresponding extension device sets (overviews on p. 12, 14, 40 and 56) Based on a device set, you can reach the next learning topic by means of an extension device set.

Extension device set for workstation WS200/WS290 from "On/off hydraulics – First steps (BIBB A-E3)" to "On/off hydraulics – Manual operation (BIBB, A-H)"





Material number	R961009465
Material short text	EQUIPMENT SET TS-HS 402-1X

Item	Components extension device set R961009465	Mat.-no.	Quantity	Image	Page
1	Planetary motor	R961008748	1		160
2	4/2 directional control valve 4WMM6C5X	R961002552	1		138
3	4/3 directional control valve 4WMM6J5X	R961002510	1		139
4	4/3 directional control valve 4WMM6E5X/	R961002551	1		139
5	Pressure relief valve DBDH6G1X/	R961002520	2		145
6	Pressure relief valve, pilot-operated, DB6K1-4X/50	R901460846	1		146
7	2-way flow control valve 2FRM6B36-3X/	R961002546	1		150
8	Throttle valve DV06-1-1X/V	R961002539	1		149
9	Non-return (check) valve S6A05-1X	R901462818	1		153
10	Non-return (check) valve, pilot-operated, SV 6 PB1-6X/	R961002513	1		154
11	Accumulator module	R961002503	1		167
12	Hydraulic distributor 4 ports	R961002485	2		169

Item	Components extension device set R961009465	Mat.-no.	Quantity	Image	Page
13	Shut-off valve	R961002491	1		152
14	Manometer 0-100 bar with measuring hose	R961002715	1		198
15	Hose line 630 mm	R961002474	3		170
16	Hose line 1000 mm with 90° fitting and Minimes port	R961004330	4		173
17	Hose line 1500 mm with Minimes port	R961002482	2		171




Extension device set for workstation WS200/WS290 from "On/off hydraulics – Manual operation (BIBB A-H)" to "On/off hydraulics – Electrical operation (BIBB, A-H)"

Material number R961009466
Material short text EQUIPMENT SET TS-HS 404-1X

Item	Components extension device set R961009466	Mat.-no.	Quantity	Image	Page
1	4/2 directional control valve 4WE6C6X/	R961002547	2		141
2	4/3 directional control valve 4WE6G6X/	R961002548	1		141
3	4/3 directional control valve 4WE6J6X/	R961002554	1		142
4	4/3 directional control valve 4WE6E6X/	R961002549	1		142










Extension device set for workstation WS290 from "On/off hydraulics – Electrical operation (BIBB A-H)" to "Continuous control valve technology – Proportional hydraulics"












Material number	R961009468
Material short text	EQUIPMENT SET TS-HS 406-1X

Item	Components extension device set R961009468	Mat.-no.	Quantity	Image	Page
1	Differential cylinder CD70F25/16-400 with protective housing	R961003495	1		156
2	4/3 proportional directional control valve 4WREE6E08-2X/ with int. elec. and load sim.	R961003533	1		143
3	Prop. pressure relief valve DBEE6-1X/50	R961003924	1		148

Extension device set Electrics for workstation WS290 from "On/off hydraulics – Electrical operation (BIBB, A-H)" to "Continuous control valve technology – Proportional hydraulics"

Material number	R901386161
Material short text	EQUIPMENT SET TS-HS 505-1X

Item	Components extension device set Electrics R901386161	Mat.-no.	Quantity	Image	Page
1	Switching element 19" variant – 1 switch + 2 push buttons, 3 NO contacts, 3 NC contacts	R961009617	1		174
2	Display unit 19" variant – 2 displays, max. display range 0-20 V	R961009623	1		177
3	Adapter plate 19" variant – round connector laboratory socket	R961009630	1		178
4	Set-point adjuster 19" variant – with ramp	R961009631	1		178
5	Set-point adjuster 19" variant – +/- 10 V	R961009632	1		177
6	Cable 7-pole for integrated electronics	R961003550	1		189
7	Cable set for command value/actual value measurement, 2 mm/2 mm and 2mm/4 mm	R901461031	1		189
8	Proximity switch, inductive	R961003106	1		191
9	Measuring line set, small	R900029597	1		188

Extension device set for workstation WS290 from "On/off hydraulics – Electrical operation (BIBB, A-H)" + "Continuous control valve technology – Proportional hydraulics" to "Continuous control valve technology – Closed-loop control hydraulics"					
Material number		R961009474			
Material short text		EQUIPMENT SET TS-HS 411-1X			
Item	Components extension device set R961009474	Mat.-no.	Quantity	Image	Page
1	Load unit, controlled, for dynamic load simulation	R961004486	1		157
2	4/4 valve for closed-loop control 4WRPEH6 with integrated electronics	R961002509	1		144
Extension device set Electrics for workstation WS290 from "Continuous control valve technology – Proportional hydraulics" to "Continuous control valve technology – Closed-loop control hydraulics"					
Material number		R901386164			
Material short text		EQUIPMENT SET TS-HS 508-1X			
Item	Components extension device set Electrics R901386164	Mat.-no.	Quantity	Image	Page
1	Control module TS-BPS 30.0, analog controller module, 30TE	R961004782	1		179
2	Cable set for command value/actual value measurement, 2 mm/2 mm and 2mm/4 mm	R901461031	1		189
Extension device set from "On/off hydraulics – Manual operation (BIBB)" to "Mobile hydraulics – Throttle control"					
Material number		R901465313			
Material short text		EQUIPMENT SET TS-HS 405-2X			
Item	Components extension device set R901465313	Mat.-no.	Quantity	Image	Page
1	Mobile hydraulics Throttle control 3 SM12	R961005970	1		162
2	Hydraulic pilot control unit 2 levers 2-2TH6	R961005967	1		161
3	Pressure sequence valve, direct-operated, DZ6DP1-5X/	R961002558	1		146
4	Hydraulic distributor 4 ports	R961002485	3		169
5	Hose line 630 mm	R961002474	3		170
6	Hose line 700 mm with 90° fitting and Minimes port	R961004329	3		173
7	Hose line 1000 mm with 90° fitting	R961004331	2		172

Extension device set for workstation WS290 from "Mobile hydraulics – Throttle control" to "Mobile hydraulics – LUDV control"

Material number R961009472




Material short text EQUIPMENT SET TS-HS 410-1X

Item	Components extension device set R961009472	Mat.-no.	Quantity	Image	Page
1	Mobile hydraulics LUDV 2SX-12	R961005966	1		162
2	Throttle valve DV06-1-1X/V	R961002539	1		149
3	Manometer 0-100 bar with measuring hose	R961002715	1		198
4	Hose line 1000 mm with 90° fitting	R961004331	2		172

Extension device set for workstation WS290 from "Mobile hydraulics – Load-sensing control" to "Mobile hydraulics – Throttle control"

Material number R961009471





Material short text EQUIPMENT SET TS-HS 409-1X

Item	Components extension device set R961009471	Mat.-no.	Quantity	Image	Page
1	Mobile hydraulics Load-sensing 2M4-12	R961005969	1		163
2	Throttle valve DV06-1-1X/V	R961002539	1		149
3	Hose line 1000 mm with 90° fitting	R961004331	2		172

Extension device set for workstation WS290 from "On/off hydraulics – Manual operation (BIBB, A-H)" + "Mobile hydraulics – Throttle control" to "Mobile hydraulics – Steering systems, basic"

Material number R901425725







Material short text EQUIPMENT SET TS-HS 414-1X

Item	Components extension device set R901425725	Mat.-no.	Quantity	Image	Page
1	Steering system with steering unit, steering assembly and steering wheel	R901403830	1		165
2	Hose line 1000 mm	R961002475	4		170
3	Spring scale, 0 - 12.5 kg	R913048952	1		*
4	Priority valve, 3-way flow control valve in Closed Center Load-sensing version	R901403832	1		165

* Item 3 is not separately available

Extension device set for workstation WS290 from "On/off hydraulics – Manual operation (BIBB, A-H)" + "Mobile hydraulics – Throttle control" + "Mobile hydraulics – Load-sensing control" to "Mobile hydraulics – Steering systems, advanced"



Material number R901425727
 Material short text EQUIPMENT SET TS-HS 415-1X

Item	Components extension device set R901425727	Mat.-no.	Quantity	Image	Page
1	Steering system with steering unit, steering assembly and steering wheel	R901403830	1		165
2	Hose line 1000 mm	R961002475	4		170
3	Spring scale, 0 - 12.5 kg	R913048952	1		*
4	Priority valve, 3-way flow control valve in Closed Center Load-sensing version	R901403832	1		165
5	Ackermann steering functional module with one double-acting cylinder, 2 displays for steering angle (1 per wheel) and steering stroke, protective housing	R901419580	1		166
6	Articulated steering functional module with 2 differential cylinders, display for kinking angle and steering stroke, protective housing	R901419587	1		166

* Item 3 is not separately available



Device set for workstation WS290 "Mobile hydraulics – Steering systems, Ackermann steering"






Material number R901425730
 Material short text EQUIPMENT SET TS-HS 206-1X

Item	Components extension device set R901425730	Mat.-no.	Quantity	Image	Page
1	Ackermann steering functional module with one double-acting cylinder, 2 displays for steering angle (1 per wheel) and steering stroke, protective housing	R901419580	1		166
2	Hose line 1000 mm	R961002475	2		170

Device set for workstation WS290 "Mobile hydraulics – Steering systems, articulated steering"

Material number R901432717
 Material short text EQUIPMENT SET TS-HS 207-1X










Item	Components extension device set R901432717	Mat.-no.	Quantity	Image	Page
1	Articulated steering functional module with 2 differential cylinders, display for kinking angle and steering stroke, protective housing	R901419587	1		166
2	Hose line 1000 mm	R961002475	2		170

Extension device set for workstation WS290 from "Mobile hydraulics – Load-sensing control" to "Mobile hydraulics – Programmable remote control (joystick)"					
Material number		R901408323			
Material short text		EQUIPMENT SET TS-HS 413-1X			
Item	Components extension device set R901408323	Mat.-no.	Quantity	Image	Page
1	Electronic 2-axis joystick (with power outputs) with connection unit and programming interface	R901407766	1		164
2	Remote control plate with 4 proportional pressure reducing valves	R901408448	1		164
3	Connecting cable to control the valves of the remote control plate	R901411277	4		*
4	Measuring line 1500 mm, red	1827003464	2		*
5	Measuring line 1500 mm, blue	1827003465	2		*





* Items 3-5 are not separately available

Accessories





Flow measurement/temperature measurement

Item	Component	Mat.-no.	Quantity	Image	Page
1	Stop watch, digital	R900061256	1		194
and	Measuring glass for workstation WS201	R961009485	1		200
or	Measuring glass 2.5l for workstation WS290 (included in the workstation WS290)	R961002564	1		205
2	Flow meter 1.0 to 7.5 l/min	R961002561	1		197
3	Gear wheel flow rate sensor	R961002508	1		196
and	Temperature sensor with ISDS	R900749653	1		196
and	Measuring cable for ISDS	R900733207	1		196
and	Measuring instrument set 3020	R913038909	1		193
or	Measuring instrument set 5060	R913038907	1		194


Speed measurement

Item	Component	Mat.-no.	Quantity	Image	Page
1	Tachometer, visual	R961008893	1		195
2	Speed sensor	R900892375	1		195
and	Measuring instrument set 3020	R913038909	1		193
or	Measuring instrument set 5060	R913038907	1		194


Pressure measurement

Item	Component	Mat.-no.	Quantity	Image	Page
1	Digital manometer	R961009534	1		197
2	Pressure transducer 0-200 bar with ISDS	R901465414	1		195
and	Measuring instrument set 3020	R913038909	1		193
or	Measuring instrument set 5060	R913038907	1		194




Current/voltage measurement

Item	Component	Mat.-no.	Quantity	Image	Page
1	Multimeter VC175	R913038027	1		193

Filling/checking the hydraulic accumulator

Item	Component	Mat.-no.	Quantity	Image	Page
1	Test and filling device for hydraulic accumulator	0538103012	1		167

Measuring instrument sets

Item	Component	Mat.-no.	Quantity	Image	Page
1	Basic measuring instrument set	R961009563	1		194
2	Measuring instrument set 3020	R913038909	1		193
3	Measuring instrument set 5060	R913038907	1		194

Workstations



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Workstation WS200

Your perfect entry into the world of knowledge.

The workstation WS200 convinces by modularity, practical compactness as practice-related equipment. The user benefits from the low entry price with large extension options depending on the intended application.

The new entry-level system workstation WS200

With the WS200 workstation, Bosch Rexroth offers you a perfect but still cost-efficient entry into the extensive world of Rexroth's knowledge. The WS200 workstation is a compact basic solution in the technology fields hydraulics, pneumatics and automatic control engineering and can thus be used in versatile applications.

By means of extensive accessories, the WS200 workstation can be perfectly adjusted to individual requirements of companies and teaching facilities as well as to most different learning topics. In connection with the teaching and learning media, the workstation allows for customized training and qualification - from the beginner to the professional.

Modular

The WS200 workstation can be used in versatile applications. The modular setup allows for customized qualification of experts in the areas hydraulics, pneumatics and automation. Of the WS200 workstation, a total of six preferred types are available.

Robust, compact and expandable

The stable and durable construction is designed in industrial quality (CE mark) and designed for heavy industrial components. However thanks to the compact dimensions which are adjusted to standard doors as well as the transportability on rollers, the WS200 workstation still remains very flexible and can be used wherever it is

needed. The WS200 workstation can be individually and easily extended. Due to the easy connection technology, all modules can be seamlessly connected with each other.

Practice-based equipment

The WS200 workstation is equipped with industry-tested products and standard components which the trainees will find again later in their professional career in machines and systems.

One example: the basic device set "On/off hydraulics – First steps":

- ▶ Differential cylinder with protective housing
- ▶ Pressure reducing valve, direct-operated
- ▶ 4/3 directional control valve
- ▶ Throttle/non-return (check) valve
- ▶ Manometer with measuring hose
- ▶ Hydraulic distributor
- ▶ Hose lines
- ▶ Hose lines with Minimes port

One-sided or two-sided operation

The clear setup of the WS200 workstation simplifies the entry into the world of knowledge. The trainees can gather own experience regarding the handling of industry-tested components step-by-step. The workstation allows for both, one-sided and two-sided operation. It consists of a base frame and grates for industrial components as well as grooved plates for the pneumatics and automation elements.



Variants of the workstation WS200 (examples)

The extensive accessories range from hose holders to drive units and control units and can thus be exactly adjusted to your requirements. Apart from the different device sets and components, the complete training system also comprises corresponding exercises with solutions for trainers and exercises for trainees regarding technologies such as on/off hydraulics, pneumatics, sensor technology, etc. In this way, the trainees are perfectly prepared for the future professional tasks and requirements.



Hose holder



Mounting kit



Example of an device set

Workstation WS201

The mobile extension for the WS200 workstation.

The WS201 workstation convinces by its mobility as well as the well thought out dimensions. Many extension options suitable for your application.

The extension system workstation WS201

The mobile unit with one or two measuring glasses and one or two load units can be mechanically connected to a workstation.

Load units for workstation WS201

The load units can be moved by means of hydraulics. The cylinders required in the load units are not part of the load units but contained in a device set for the learning topics. The load units have been designed for pulling and pushing loads. Scalable loads for 4, 8, 12 or 16 kg are available. All moved parts are safely accommodated in a protective housing.

Measuring glasses for workstation WS201

The measuring glasses for measuring and visualizing the flow are attached to the mobile unit in an ergonomically favorable position. A measuring scale, overflow protection, an air valve and a runner which has to be opened manually are available. The measurement range is 0 - 1.6 liters.

Modular

The WS201 workstation can be used in versatile applications. The modular setup allows for customized qualification of experts in the areas hydraulics and pneumatics. Of the WS201 workstation, a total of four preferred types are available.

Robust, compact and expandable

The stable and durable construction is designed in industrial quality. However thanks to the compact dimensions which are adjusted to standard doors as well as the transportability on rollers, the WS201 workstation still remains very flexible and can be used wherever it is needed. The WS201 workstation can be individually and easily extended. Due to the easy connection technology, it can be seamlessly connected to other workstations.

One-sided or two-sided operation

The clear setup of the WS201 workstation simplifies the entry into the world of knowledge. The trainees can gather own experience regarding the handling of industry-tested components step-by-step. The workstation allows for both, one-sided and two-sided operation.



Variants of the workstation WS201 (examples)

Workstation WS290

The extensive package for your ideas.

The WS290 workstation offers unlimited possibilities for the creation of practice-related and demanding tasks in the areas on/off hydraulics, continuous control valve technology, mobile hydraulics and pneumatics.

Rexroth training systems

Bosch Rexroth's training systems are based on standard components from the different Rexroth product areas. One training system consists of the workstation, the components contained in the device sets and the exercise books. Using the exercises with solutions and exercises, topics building on each other can be dealt with. By means of the training systems, newcomers and experts acquire practice-oriented and technical specialist knowledge step-by-step. The trainees will find the standard components used at the workstation again later in their professional career in machines and systems. Apart from the training systems for hydraulics described here in the catalog, Bosch Rexroth offers training systems also in the technology fields pneumatics, sensor technology, PLC and mechatronics. Information on suitable teachware and all other offers of the Drive & Control Academy is available on the Bosch Rexroth website at: www.boschrexroth.com

Workstation WS290

The WS290 workstation is used to impart knowledge of industrial and mobile hydraulics. By upgrading it with a grooved plate, it can moreover be used for pneumatics and automatic control engineering. It offers the basis for clearly imparting the operating behavior of modern hydraulic circuits and perfectly prepares the trainees for their work in the company. For use in training sessions, the preferred types of the WS290 workstation offer equipment adjusted to the relevant topic and can be extended, if necessary. Due to the use of a load-sensing power unit, the WS290 workstation is perfectly suited for mobile hydraulics

training sessions. In this way, the particularities in the area of mobile applications are illustrated in a practice-related manner. The device sets which are available for the different topics together with the exercise books perfectly prepare the trainees for their future professional tasks and requirements.

Equipment

The WS290 workstation is divided into 10 preferred types which are technically based on the tried and tested DS4 workstations. The material components are:

- ▶ Base frame with grate for holding components
- ▶ Hydraulic power unit with TÜV-tested safety valves and control cabinet
- ▶ Assembly carrier for holding electronic components
- ▶ Installation container for storing components and accessories
- ▶ Measuring glass with scale
- ▶ Hose deposit for holding up to 50 hoses
- ▶ Load simulator, 15 kg, swivel-mounted

The WS290 workstation is supplied in completely assembled form.

Training environment

The WS290 workstation is equipped according to the planned purpose.

- ▶ Hydraulics: Choose from our 10 preferred types the one- or double-sided version suitable for your purposes, for up to 6 trainees with independent workplaces thanks to one grate on each side.



Variants of the workstation WS290 (examples)

- ▶ Pneumatics: If you replace both grates by grooved plates, independent workplaces for up to 6 trainees will result.
- ▶ Hydraulics/pneumatics combined: If you replace one of the grates by a grooved plate, independent workplaces for up to 6 trainees will result; grate for hydraulics on the one and grooved plate for pneumatics on the other side (grooved plates are not included in the preferred types; they are, however, available as accessories).

Customized to learning topics thanks to extensions

In order to achieve your learning targets, you can individually adjust your training system to the requirements of your company.

- ▶ On/off hydraulics
- ▶ Continuous control valve technology
- ▶ Mobile hydraulics



Directional control valves



Directional control valves



Hydraulic pilot control unit

Practical exercises with suitable teachware

Expert knowledge and competence of the employees create a decisive advantage for the company in global competition.

- ▶ *Exercises with solutions* and *exercises*
- ▶ Technical books
- ▶ Teaching media

Safety

The WS290 workstation has been developed and tested according to the directives of the Machinery Directive 2006/42/EC.

The operating instructions contain a CE certificate.

Selection of the correct preferred type

Select the preferred type of the WS290 workstation satisfying your requirements. We are willingly prepared to support you making the correct selection. Contact us!

Fields of application of the workstations

Bosch Rexroth's technical know-how and the solution competence in the area of industrial applications are directly integrated into the modularly set-up workstations - thus, they exactly satisfy the quality levels demanded by the industry.

Approved quality

All Bosch Rexroth workstations are based on standard components from the different product areas of the drive and control specialist. Particularly the core competences in hydraulics have been considered in the workstations. The safe, robust, durable and easy-to-operate serial components offer trainees a seamless transition to the requirements of industrial everyday life as they will find these elements again in their future professional career in machines and systems. Due to their large number of variants, the workstations can always be exactly adjusted to the relevant training topic. Suitable teaching and learning media including *Exercises with solutions* and *Exercises* complete the overall package.

With the WS200 workstation, a particularly cost-efficient system for the practice-related basic and advanced training has been developed. With the modularly set-up workstation, basic knowledge in hydraulics, pneumatics and automation can be imparted in an illustrative and realistic manner.

The WS200 workstation amends the existing offer of entry-level systems while the WS290 workstation still brings along all components for the focused training of already advanced trainees.

The larger working surface with perfect space utilization offers sufficient space for more complex tasks and demanding examples in the areas on/off hydraulics, continuous control valve technology and mobile hydraulics.

Which workstation do I need?

The WS200 workstation benefits from the low entry price and practical compactness. The on/off hydraulics learning topics as well as the pneumatics and automatic control engineering learning topics can be dealt with at the easy-to-extend WS200 workstation. Learning topics such as continuous control valve technology and mobile hydraulics are taught at our tried and tested WS290 workstation. The following table offers an overview of the possible learning topics:

Learning topics	WS200	WS290
On/off hydraulics – First steps (BIBB, A-E3)	X	X
On/off hydraulics – Manual operation (BIBB, A-H)	X	X
On/off hydraulics – Electrical operation (BIBB, A-H and Z1-Z3)	X	X
Continuous control valve technology – Proportional hydraulics		X
Continuous control valve technology – Closed-loop control hydraulics		X
Mobile hydraulics – Throttle control		X
Mobile hydraulics – Load-sensing control		X
Mobile hydraulics – LUDV control		X
Mobile hydraulics – Hydrostatic steering systems		X
Mobile hydraulics – Electrohydraulic control of valves – Programmable remote control (joystick) with integrated power electronics		X

Drive & Control Academy

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Workstation WS200

Workstation WS200 hydraulics, 230 VAC/50 Hz, one-sided for 1 - 2 trainees – assembled, incl. packaging

Material number	R961008850
Material short text	WORKSTATION TS-WS200-1X/ NOG1A1T1&

This workstation is perfectly suited for the training of Hydraulics – Basic principles.

The mobile workstation WS200 has a grate at which the hydraulic components can be safely attached. It can be operated on one side and can be simultaneously used by up to two trainees.

The installed hydraulic power unit is equipped with a noise-reduced external gear pump and a one-phase asynchronous motor. The control box has one ON and one OFF push button as well as an emergency off pushbutton. The voltage supply of the workstation is effected by means of a mains cable (length approx. 1.8 m) with safety plug.

The easy and safe supply with hydraulic fluid is ensured by means of low leakage oil, self-sealing coupling plugs at the P/T distributor. The supplied storage trays can be converted from an oil tank into a practical writing pad by just turning them.

Scope of delivery	<ul style="list-style-type: none"> ▶ Base frame ▶ 1 grate ▶ 1 hydraulic power unit, 230 VAC/50 Hz with pump, hose set, control box and P/T distributor ▶ Storage set
-------------------	--

Dimensions	mm (L x W x H)	800 x 806 x 1772
Number of workplaces		1 - 2
Weight	kg	59
Supply voltage	VAC	230
Rated current	A	1.6
Mains frequency	Hz	50
Power	kW	0.37
Max. working pressure	bar	50
Max. flow	l/min	3.2
Tank	l	6.2

Workstation WS200 hydraulics, 230 VAC/60 Hz, one-sided for 1 - 2 trainees – assembled, incl. packaging

Material number	R901465883	
Material short text	WORKSTATION TS-WS200-1X/ NOG1A3T1&	
Mains frequency	Hz	60
Max. flow	l/min	3.0



Workstation WS200 hydraulics, 230 VAC/50 Hz, double-sided for 2 - 4 trainees – assembled, incl. packaging

Material number	R961008852
Material short text	WORKSTATION TS-WS200-1X/ NOG2A2T1&

This workstation corresponds to the previous station (R961008850) in double-sided version. In this way, two to four trainees in two groups can work at the station simultaneously.

Scope of delivery	<ul style="list-style-type: none"> ▶ Base frame ▶ 2 grates ▶ 2 hydraulic power units, 230V/50Hz with pump, hose set, control box and P/T distributor ▶ Storage set
-------------------	--

Dimensions	mm (L x W x H)	800 x 806 x 1772
Number of workplaces		2 - 4
Weight	kg	85
Supply voltage	VAC	230
Rated current	A	2 x 1.6
Mains frequency	Hz	50
Power	kW	2 x 0.37
Max. working pressure	bar	50
Max. flow	l/min	2 x 3.2
Tank	l	2 x 6.2

Workstation WS200 hydraulics, 230 VAC/60 Hz, double-sided for 2 - 4 trainees – assembled, incl. packaging

Material number	R901465886
Material short text	WORKSTATION TS-WS200-1X/ NOG2A4T1&

Mains frequency	Hz	60
Max. flow	l/min	3.0



Workstation WS200 hydraulics, 230 VAC/50 Hz, one-sided and pneumatics double-sided for 1 - 2 trainees – assembled, incl. packaging

Material number	R961009258
Material short text	WORKSTATION TS-WS200-1X/ N1G1A1T1&

This workstation is perfectly suited for the training of Hydraulics – Basic principles and moreover of pneumatics and automatic control engineering.

The mobile workstation has a grooved plate at which the components of pneumatics and automatic control engineering can be fastened. The Snap-In quick fastening system provides for easy attachment and secure hold.

The mobile workstation has a grate at which the necessary hydraulic components can be safely attached. It can be operated on one side and can be simultaneously used by up to two trainees.

The installed hydraulic power unit is equipped with a noise-reduced external gear pump and a one-phase asynchronous motor.

The control box has one ON and one OFF push button as well as an emergency off pushbutton. The voltage supply of the workstation is effected by means of a mains cable (length approx. 1.8 m) with safety plug.

The easy and safe supply with hydraulic fluid is ensured by means of a self-sealing coupling plug at the P/T distributor.

The supplied storage trays can be converted from an oil tank into a practical writing pad by just turning them.

Scope of delivery	<ul style="list-style-type: none"> ▶ Base frame ▶ 1 grooved plate, double-sided ▶ 1 grate ▶ 1 hydraulic power unit, 230 VAC/50 Hz with pump, hose set, control box and P/T distributor ▶ Storage set
-------------------	---

Dimensions	mm (L x W x H)	800 x 806 x 1772
Number of workplaces		1 - 2
Weight	kg	72
Supply voltage	VAC	230
Rated current	A	1.6
Mains frequency	Hz	50
Power	kW	0.37
Max. working pressure (hydraulics)	bar	50
Maximum flow	l/min	3.2
Tank	l	6.2

Workstation WS200 hydraulics, 230 VAC/60 Hz, one-sided and pneumatics double-sided for 1 - 2 trainees – assembled, incl. packaging

Material number	R901465889
Material short text	WORKSTATION TS-WS200-1X/ N1G1A3T1&

Mains frequency	Hz	60
Max. flow	l/min	3.0



Accessories

Designation	Material number	Quantity
Compressor*	1827008426	1

* Accessories for pneumatics, see sales catalog Training system Pneumatics R999000217

Workstation WS200 hydraulics and pneumatics, 230 VAC/60 Hz, double-sided for 2 - 4 trainees – assembled, incl. packaging

Material number	R901392535
Material short text	WORKSTATION TS-WS200-1X/ N1G2A2T1&

This workstation corresponds to the previous station (R961009258) in double-sided version. In this way, two to four trainees in two groups can work at the station simultaneously.

Scope of delivery	<ul style="list-style-type: none"> ▶ Base frame ▶ 1 grooved plate, double-sided ▶ 2 grates ▶ 2 hydraulic power units, 230V/50Hz with pump, hose set, control box and P/T distributor ▶ Storage set
-------------------	---

Dimensions	mm (L x W x H)	800 x 806 x 1772
Number of workplaces		2 - 4
Weight	kg	98
Supply voltage	VAC	230
Rated current	A	2 x 1.6
Mains frequency	Hz	50
Power	kW	2 x 0.37
Max. working pressure (hydraulics)	bar	50
Maximum flow	l/min	3.2
Tank	l	2x 6.2

Workstation WS200 hydraulics and pneumatics, 230 VAC/60 Hz, double-sided for 2 - 4 trainees – assembled, incl. packaging

Material number	R901465891
Material short text	WORKSTATION TS-WS200-1X/ N1G2A4T1&

Mains frequency	Hz	60
Max. flow	l/min	3.0

Accessories

Designation	Material number	Quantity
Compressor*	1827008426	1

* Accessories for pneumatics, see sales catalog Training system Pneumatics R999000217



**Workstation WS200 pneumatics, double-sided for 2 - 4 trainees
- assembled, incl. packaging**

Material number	R961008854
Material short text	WORKSTATION TS-WS200-1X/ N1G0A0T1&

This workstation is perfectly suited for the training of pneumatics and automatic control engineering.

The mobile workstation has a grooved plate at which the components of pneumatics and automatic control engineering can be fastened. The Snap-In quick fastening system provides for easy attachment and secure hold.

The double-sided version has been designed so that two to four trainees in two groups can work at the workstation simultaneously. The supplied storage trays can be converted from an oil tank into a practical writing pad by just turning them.

Scope of delivery	<ul style="list-style-type: none"> ▶ Base frame ▶ 1 grooved plate, double-sided ▶ Storage set
-------------------	--

Dimensions	mm (L x W x H)	800 x 806 x 1772
Number of workplaces		2 - 4
Weight	kg	45

Accessories

Designation	Material number	Quantity
Compressor*	1827008426	1

* Accessories for pneumatics, see sales catalog Training system Pneumatics R999000217



**Workstation WS200, component carrier double-sided
 – assembled, incl. packaging**

Material number	R961008856
Material short text	WORKSTATION TS-WS200-1X/ NOG6A0T0&

At the component carrier, you can store all hydraulic components which are currently not needed in a space-saving and well-arranged manner. It has a total of four grates in a 50 mm grid and an oil tank, is movable and can be equipped on both sides.

Scope of delivery	<ul style="list-style-type: none"> ▶ Base frame WS200 ▶ 4 grates
Dimensions	mm (L x W x H) 800 x 758 x 1772
Weight	kg 47



Workstation WS201 – Extensions for workstation WS200

Workstation WS201 hydraulics, load unit measuring glass, one-sided for 1 - 2 trainees – assembled, incl. packaging

Material number	R961009584
Material short text	WORKSTATION TS-WS201-1X/M1L1B0

Separate and mobile unit with measuring glass and load unit.

Steering rollers with brakes for moving the mobile unit are available. Easy transport due to well thought out dimensions (standard door, lift, vehicle).

The mobile unit with measuring glass and load unit can be mechanically connected to a workstation.

Load unit for workstation WS201

The load unit can be moved by means of hydraulics. The cylinder required in the load unit is not part of the load unit but contained in the device sets for the learning topics.

The load unit has been designed for pulling and pushing loads. Scalable loads for 4, 8, 12 or 16 kg are available.

All moved parts are safely accommodated in a protective housing.

Measuring glass for workstation WS201

The measuring glass for measuring and visualizing the flow is attached to the mobile unit in an ergonomically favorable position. A measuring scale, overflow protection, an air valve and a runner which has to be opened manually are available. The measurement range is 0 - 1.6 liters.

Scope of delivery	<ul style="list-style-type: none">▶ Base frame▶ 1 load unit▶ 1 measuring glass
-------------------	--

Dimensions	mm (L x W x H)	800 x 758 x 1772
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Weight	kg	66
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Workstation WS201 hydraulics, load unit measuring glass, double-sided for 2 - 4 trainees – assembled, incl. packaging

Material number	R961009585
Material short text	WORKSTATION TS-WS201-1X/M2L2B0

Separate and mobile unit with two measuring glasses and two load units. The unit has a double-sided design with one measuring glass and one load unit per side.

Steering rollers with brakes for moving the unit are available. Easy transport due to well thought out dimensions (standard door, lift, vehicle). The mobile unit with two measuring glasses and two load units can be mechanically connected to a workstation.

Load units for workstation WS201

The two load units can be moved by means of hydraulics. The cylinders required in the two load units are not part of the load units but contained in the device sets for the learning topics. The load units have been designed for pulling and pushing loads. Scalable loads for 4, 8, 12 or 16 kg are available.

All moved parts are safely accommodated in a protective housing.

Measuring glasses for workstation WS201

The measuring glasses for measuring and visualizing the flow are attached to the mobile unit in an ergonomically favorable position. A measuring scale, overflow protection, an air valve and a runner which has to be opened manually are available. The measurement range is 0 - 1.6 liters.

Scope of delivery	<ul style="list-style-type: none"> ▶ Base frame ▶ 2 load units ▶ 2 measuring glasses
Dimensions	mm (L x W x H) 800 x 758 x 1772
Weight	kg 110



**Workstation WS201 hydraulics, load unit, one-sided for
1 - 2 trainees – assembled, incl. packaging**

Material number	R961009588
Material short text	WORKSTATION TS-WS201-1X/M0L1B0

Separate and mobile unit with measuring glass and load unit.

Steering rollers with brakes for moving the mobile unit are available.
Easy transport due to well thought out dimensions (standard door,
lift, vehicle).

The mobile unit with measuring glass and load unit can be
mechanically connected to a workstation.

Load unit for workstation WS201

The load unit can be moved by means of hydraulics. The cylinder
required in the load unit is not part of the load unit but contained in
the device sets for the learning topics.

The load unit has been designed for pulling and pushing loads.

Scalable loads for 4, 8, 12, or 16 kg are available.

All moved parts are safely accommodated in a protective housing.

Scope of delivery	▶ Base frame
	▶ 1 load unit

Dimensions	mm (L x W x H)	800 x 758 x 1772
Weight	kg	58



Workstation WS201 hydraulics, load unit, double-sided for 2 - 4 trainees – assembled, incl. packaging

Material number	R961009589
Material short text	WORKSTATION TS-WS201-1X/MOL2B0

Separate and mobile unit with two measuring glasses and two load units. The unit has a double-sided design with one measuring glass and one load unit per side.

Steering rollers with brakes for moving the unit are available. Easy transport due to well thought out dimensions (standard door, lift, vehicle).

The mobile unit with two measuring glasses and two load units can be mechanically connected to a workstation.

Load units for workstation WS201

The two load units can be moved by means of hydraulics. The cylinders required in the two load units are not part of the load units but contained in the device sets for the learning topics. The load units have been designed for pulling and pushing loads. Scalable loads for 4, 8, 12 or 16 kg are available. All moved parts are safely accommodated in a protective housing.

Scope of delivery	<ul style="list-style-type: none"> ▶ Base frame ▶ 2 load units
Dimensions	mm (L x W x H) 800 x 758 x 1772
Weight	kg 94



Workstation WS290

Workstation WS290, hydraulics, hydraulic power unit with single pump and pressure controller, one-sided for 1 - 3 trainees – assembled, incl. packaging

The workstation WS290 is perfectly suitable to carry out training sessions regarding the topics on/off, proportional and closed-loop control hydraulics.

On one side of the mobile workstation WS290, there is a grate at which the hydraulic components can be safely attached. The one-sided workstation WS290 is designed for 1 - 3 trainees.

The hydraulic power unit used has a vane pump with pressure controller. With workstation WS290, a control box with ON push button, circuit breaker and 2 sockets is installed. The voltage supply of the workstation is effected by means of a mains cable. On the workplace side, an emergency off pushbutton is provided. Self-sealing coupling plugs at the P/T distributor allow for the supply of the workplace with hydraulic fluid thanks to easy, low leakage oil handling.

The installation container made of powder-coated sheet steel is equipped with 5 fully extending drawers. A measuring glass made of Plexiglas with scale is equipped with an air and air relief valve, an overflow conduit and a shut-off valve. This allows for safe use and provide protection against overflow and overpressure. In the hose deposit, up to 50 hydraulic hoses can be stored. The arrangement of the hoses prevents leakage of the hydraulic fluid. The integrated oil tank is suitable for storing small parts or tools. The swivel-mounted load unit mounted on the side is equipped with a weight of 15 kg. With this load unit, exercises for pulling and pushing loads on cylinders can be carried out. All moved parts are safely accommodated in a protective housing.

Scope of delivery	<ul style="list-style-type: none"> ▶ Base frame WS290 ▶ 1 grate with reinforcement ▶ 1 installation container ▶ 1 measuring glass ▶ 1 hose deposit for 50 hoses ▶ 1 load unit 15 kg, swivel-mounted ▶ 4 oil drip trays ▶ completely assembled
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Dimensions	mm (L x W x H)	1810 x 800 x 1950
Number of workplaces		1 - 3
Weight	kg	310
Max. working pressure	bar	55
Max. flow per pump	l/min	8
Tank	l	40

	with assembly carrier	without assembly carrier
Supply voltage 230 V, one-phase Mains frequency 50 Hz Power 1.5 kW Circuit breaker 9 - 12 A	Material number R961009454 Material short text WORKSTATION TS-WS290-1X/G1A4B1C1&	Material number R961009862 Material short text WORKSTATION TS-WS290-1X/G1A4B0C1&
Supply voltage 400 V, three-phase Mains frequency 50 Hz Power 2.2 kW Circuit breaker 4.5 - 6.3 A	Material number R961009453 Material short text WORKSTATION TS-WS290-1X/G1A5B1C1&	Material number R961009863 Material short text WORKSTATION TS-WS290-1X/G1A5B0C1&

Workstation WS290, hydraulics, hydraulic power unit with double pump and flow controller, double-sided for 2 - 6 trainees – assembled, incl. packaging

The workstation WS290 is perfectly suitable to carry out training sessions regarding the topics on/off, proportional, control and mobile hydraulics.

On both sides of the mobile workstation WS290, there is a grate at which the hydraulic components can be safely attached.

The double-sided WS290 is designed for 2 - 6 trainees. The hydraulic power unit used has two pumps with flow pressure controller (load-sensing); thus, independent exercises can be carried out on both sides. With workstation WS290, a control box with ON push button, circuit breaker and 2 sockets is installed. The voltage supply of the workstation is effected by means of a mains cable. In addition, every workplace side is equipped with an emergency off pushbutton. Self-sealing coupling plugs at the P/T/X distributor allow for the supply of the workplaces with hydraulic fluid thanks to easy, low leakage oil handling.

The installation container made of powder-coated sheet steel is equipped with 5 fully extending drawers.

The measuring glasses made of Plexiglas with scale are equipped with an air and air relief valve, an overflow conduit and a shut-off valve. This allows for safe use and provide protection against overflow and overpressure. In the hose deposit, up to 50 hydraulic hoses can be stored. The arrangement of the hoses prevents leakage of the hydraulic fluid. The integrated oil tank is suitable for storing small parts or tools.

The swivel-mounted load unit mounted on the side is equipped with a weight of 15 kg. With this load unit, exercises for pulling and pushing loads on cylinders can be carried out. All moved parts are safely accommodated in a protective housing.

Scope of delivery	<ul style="list-style-type: none"> ▶ Base frame WS290 ▶ 2 grates with reinforcement ▶ 1 installation container ▶ 2 measuring glasses ▶ 1 hose deposit for 50 hoses ▶ 1 load unit 15 kg, swivel-mounted ▶ 4 oil drip trays ▶ completely assembled
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Dimensions	mm (L x W x H)	1810 x 800 x 1950
Number of workplaces		2 - 6
Weight	kg	370
Max. working pressure	bar	55
Max. flow per pump	l/min	8
Tank	l	40

	with assembly carrier	without assembly carrier
Supply voltage 230 V, single-phase Mains frequency 50 Hz Power 1.5 kW Circuit breaker 9 - 12 A	Material number R961009457 Material short text WORKSTATION TS-WS290-1X/G2A1B2C1&	Material number R961009864 Material short text WORKSTATION TS-WS290-1X/G2A1B0C1&
Supply voltage 230 V, one-phase Mains frequency 60 Hz Power 1.5 kW Circuit breaker 9 - 12 A	Material number R961009456 Material short text WORKSTATION TS-WS290-1X/G2A2B2C1&	Material number R961009865 Material short text WORKSTATION TS-WS290-1X/G2A2B0C1&
Supply voltage 3x400 V, three-phase Mains frequency 50 Hz Power 2.2 kW Circuit breaker 4.5 - 6.3 A	Material number R961009455 Material short text WORKSTATION TS-WS290-1X/G2A3B2C1&	Material number R961009866 Material short text WORKSTATION TS-WS290-1X/G2A3B0C1&

Accessories for workstation WS290

Rolling drawer unit		
Material number	R961000287	
Material short text	CABINET TS-MC-5S-ROLL	
Rolling drawer unit for holding tools, measuring tools, components and incidentals. It enables fast, ordered availability of parts at the workplace.		
Design details	<ul style="list-style-type: none"> ▶ Drawers with easy running tracks ▶ Central cylinder lock ▶ Every drawer individually locked ▶ Housing and drawers made of coated sheet steel ▶ 2 lockable steering rollers, 2 fixed rollers ▶ Upper surface with frame and rubber mat ▶ Front side with pushing rods 	
Dimensions	mm (L x W x H)	800 x 425 x 840
	Design details	4 drawers, 100 high 1 drawer, 150 high
Weight	kg	75
Material	Sheet steel, coated	
Accessories		
Designation	Material number	Quantity
Drawer division assortment H=100 mm	R961000563	4
Drawer division assortment H=150 mm	R961000564	1
Anti-slip mat	R961000568	5



Drawer division assortment 100 mm		
Material number	R961000563	
Material short text	DRAWER COMPONENT TS-MC-DS100	
Flexible division of the drawers with 100 mm height of the container, for the systematic ordering of the stored parts. Version for drawers of the installation container of the WS290 workstation and the rolling drawer unit (R961000287).		
<ul style="list-style-type: none"> ▶ Division profiles made of zinc-plated sheet steel ▶ Fine division by stepped grid slots of the central rail ▶ 6 transversal dividers for hanging into the central rail 		
Type of mounting	plugged / optionally screwed	
Individual fields	Quantity	8



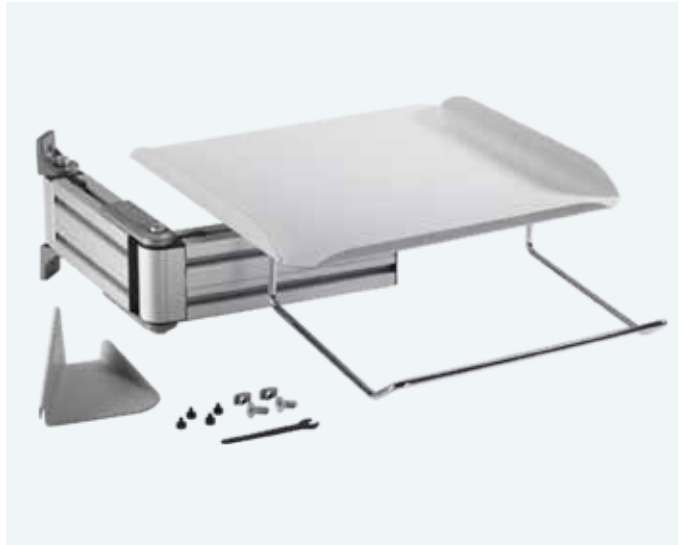
Drawer division assortment 150 mm		
Material number	R961000564	
Material short text	DRAWER COMPONENT TS-MC-DS150	
Flexible division of the drawers with 150 mm height of the container, for the systematic ordering of the stored parts. Version for drawers of the installation container of the WS290 workstation and the rolling drawer unit (R961000287).		
<ul style="list-style-type: none"> ▶ Division profiles made of zinc-plated sheet steel ▶ Fine division by stepped grid slots of the central rail ▶ 6 transversal dividers for hanging into the central rail 		
Type of mounting	plugged / optionally screwed	
Individual fields	Quantity	8



Anti-slip mat		
Material number	R961000568	
Material short text	LINING MAT TS-MC-ANTIRUTSCH-18X&	
Prevents the slipping of the parts such as tools and components stored in the drawer of the installation container of the WS290 workstation and the rolling drawer unit (R961000287). Can also be used with drawer division assortment 100 mm and/or 150 mm.		
Dimensions	mm (L x W x H)	600 x 300 x 5
Weight	kg	0.086
Material	Chloroprene rubber, black	



Monitor support arm		
Material number	1827003725	
Material short text	SUPPORTING ARM TS-MC-DS3/DS4	
The pivoted support arm with rotatable holder promotes the ergonomic setup of the workplace with monitor/laptop and keyboard. The support arm consists of a 2-times pivoted support profile with holding plate and one fastening plate for the height-adjustable attachment at the lateral part of the base frame.		
Dimensions	mm (L x W x H)	710 x 415 x 350
Weight	kg	8.3
Load carry capacity	N	250
Delivery form	pre-assembled assembly	
Type of mounting	screwed with slot nuts	
Table area	mm (L x W)	400 x 400



Cloth holder		
Material number	1827003722	
Material short text	CLOTH HOLDER TS-MC-2ST	
Cloth holder for handy cleaning cloths at the workplace; can also be used as cable and hose guide. Easily fixable in the groove profiles of the workstations.		
Type of mounting	clamped in 10 mm groove	
Material	Plastics, black	
Delivery unit	Qty	2



Cable holder for 50 measuring lines		
Material number	R961004144	
Material short text	CABLE CLAMP TS-MC-50F-MITBEF	
Cable holder for holding measuring lines, ergonomic workplace with availability of the necessary measuring lines for the exercises to be completed. The measuring line is hanged into the cable holder.		
Dimensions	mm (L x W x H)	210 x 65 x 35
Weight	kg	0.14
Delivery form	pre-assembled assembly	
Type of mounting	screwed	
Intake capacity	Qty	50



Info board

Material number	1827003721
Material short text	INFORMATION PANEL TS-MC-DINA4-GELENK

For displaying information at the workplace in an ergonomic form as it is necessary to complete the exercises, e.g. circuit diagrams, device description, work instructions. Direct access at the workplace is thus ensured. 2-times pivoted support profile, with mounting kit for attachment at the base frame by means of T-slot nuts in the aluminum groove profile or grooved plate, height-adjustable, cover with acrylic protective screen.

Dimensions	mm (L x W x H)	370 x 280 x 80
Weight	kg	4.11
Load carry capacity	N	250
Type of mounting	screwed with slot nuts	
Board size	Format	A4



10 l hydraulic oil RSL22

Material number	R913035362
Material short text	HYDRAULICS OIL AVIA FLUID RSL 22 (C&

10 liters hydraulic fluid, suitable for all WS200/WS290 power units, safety data sheet see: www.avia.de

Product name	AVIA Fluid RSL 22
Contents	l 10

20 l hydraulic oil RSL22

Material number	R913046494
Material short text	HYDRAULICS OIL AVIA FLUID RSL 22-20L

20 liters hydraulic fluid, suitable for all WS200/WS290 power units, safety data sheet see: www.avia.de

Product name	AVIA Fluid RSL 22
Contents	l 20



Filling funnel with hose

Material number	R961009591
Material short text	FUNNEL 160 + SCHLAUCH

Filling funnel for filling the power units of the WS200 and WS290 workstations with hydraulic fluid



Tool bag for hydraulics		
Material number	R900865138	
Material short text	SET OF TOOLS TS-MC-HY-TASCHE	
Consisting of:		
▶ Open-end wrench 10 x 11; 12 x 13; 14 x 17; 18 x 19		
▶ Screwdriver 0.7 x 4.0; 0.95 x 5.5		
▶ Slotted screwdriver		
▶ Internal hexagon wrench 2.5; 3.0; 4.0; 6.0		
Dimensions	mm (L x W x H)	300 x 90 x 90
Weight	kg	1



Cleaning roll rack		
Material number	R900833872	
Material short text	DISPOSAL TS-HC-OEL_PAPROL-SACK_GESTELL	
Consisting of:		
▶ movable cleaning roll rack		
▶ Trash can with cover 40 l		
▶ Binding agent		
▶ Wipes		
▶ Trash bags		
Dimensions	mm (L x W x H)	700 x 500 x 450
Weight	kg	35



Accessories for workstation WS200

Mounting kit for connecting the WS200 workstations

Material number	R961008677
Material short text	CONNECTING KIT TS-MC-GN851-160-T2

The mounting kit can be easily attached at the WS200/WS201 workstations. The stainless steel closing bracket safely connects the workstations with each other.

Hose holder for 9 hoses

Material number	R961008698
Material short text	HOSE HOLDER TS-MC-9F

The hose holder can be optionally attached to the WS200 workstation. The hose holder is used to hold up to 9 hydraulic hose lines. The hose lines are hung up between the two racks.

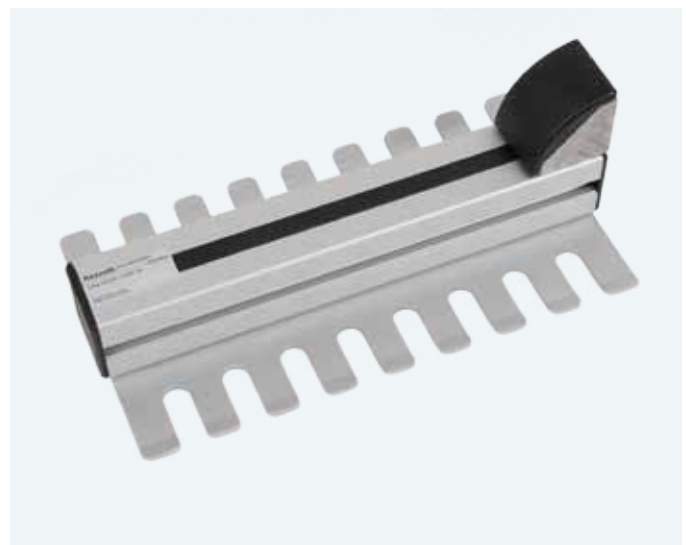
Dimensions	mm (L x W x H)	280 x 210 x 105
Weight	kg	1.0

Hose holder for 16 hoses

Material number	R901448893
Material short text	HOSE HOLDER TS-MC-16F

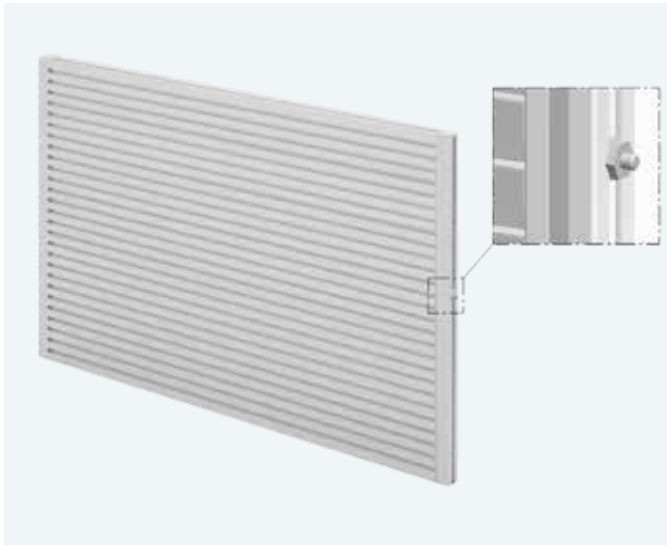
The hose holder can be optionally attached to the WS200 workstation. The hose holder is used to hold up to 16 hydraulic hose lines. The hose lines are hung up between the two racks.

Dimensions	mm (L x W x H)	280 x 150 x 105
Weight	kg	825g



Accessories for workstation WS290

Grooved plate for hanging up		
Material number	R961000169	
Material short text	GROOVED PLATE TS-MC-DS4-1130X700X3&	
Grooved plate with 25 mm groove distance. For mounting components with Snap-In quick fastening system from the areas pneumatics and automation control engineering. The grooved plate can be quickly and easily hanged in and securely fastened on both sides of the WS290 workstation.		
Dimensions	mm (L x W x H)	1130 x 700 x 30
Weight	kg	24
Material	Aluminum profile	
Groove distance	mm	25



Load unit 80 kg, stationary		
Material number	R961004005	
Material short text	LOAD UNIT TS-HC-CD 70H 25/ 16-&	
For imparting the dynamic properties of hydraulic systems with positive and negative mass forces. Heavy, vertical load unit, freestanding, mass is suspended from the cylinder. It can be moved against a load spring.		
4-quadrant operation is possible. When putting the mass onto the load spring, a load change takes place. Mounting rail for proximity switch, protective screens, roller guides for absorbing radial forces. Connections via self-sealing coupling plugs.		
Dimensions	mm (L x W x H)	445 x 445 x 1400
Weight	kg	148
Load mass	kg	80
Working pressure max.	bar	105
Industrial type	CD70H25/16+DBDS6G1X/50	
Cylinder stroke	mm	400
Load force 50 bar	kN	2.45
Load spring	kN	2.5
Load stroke against load spring	mm	80
Piston diameter	mm	25
Piston rod diameter	mm	16
Piston ratio	1.6 : 1	



Order examples



Drive & Control Academy

Learning topics

Workstations

Order examples

Components and spare parts

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On/off hydraulics

If you want to teach hydraulics from the basic knowledge to the on/off hydraulics, manual and electrical operation plus troubleshooting topics, we recommend the following equipment:

Selection of device sets suitable for the learning topics:

Mat.-no.	Material short text	Description	Quantity
R961009458	EQUIPMENT SET TS-HS 201-1X	Device set for workstation WS200/WS290 "On/off hydraulics – Manual operation (BIBB, A-H), complete"	2
R961009466	EQUIPMENT SET TS-HS 404-1X	Extension device set for workstation WS200/WS290 from "On/off hydraulics – Manual operation" to "On/off hydraulics – Electrical operation (BIBB)"	2
R901386157	EQUIPMENT SET TS-HS 501-1X	Device set Electrics for workstation WS200 "On/off hydraulics – Electrical operation (BIBB, A-H), without I/O module"	2
R961006620	EQUIPMENT SET TS-HS 204-1X	Device set for workstation WS200/WS290 "On/off hydraulics – Troubleshooting, electrical operation"	2

Workstations suitable for the learning topics:

Mat.-no.	Material short text	Description	Quantity
R961008852	WORKSTATION TS-WS200-1X/N0G2A2T1&	Workstation WS200 hydraulics, 230 VAC/50 Hz, double-sided for 2 - 4 trainees – assembled, incl. packaging	1
R961009585	WORKSTATION TS-WS201-1X/M2L2B0	Workstation WS201 hydraulics, load unit measuring glass, double-sided for 2 - 4 trainees – assembled, incl. packaging	1
R961008856	WORKSTATION TS-WS200-1X/N0G6A0T0&	Workstation WS200, component carrier double-sided – assembled, incl. packaging	1

Selection of exercise books suitable for the learning topics:

Mat.-no.	Material short text	Description	Quantity
R901385282	EXERCISE BOOK TW-HY-LH-1/X 201EN	Exercises with solutions (trainer's manual) "On/off hydraulics – Manual operation (according to BIBB)" EN	1
R901385283	EXERCISE BOOK TW-HY-SH-1/X 201EN	Exercises (trainee's manual) "On/off hydraulics – Manual operation (according to BIBB)" EN	2
R901385284	EXERCISE BOOK TW-HY-LH-1/X 202EN	Exercises with solutions (trainer's manual) "On/off hydraulics – Electrical operation (according to BIBB)" EN	1
R901385285	EXERCISE BOOK TW-HY-SH-1/X 202EN	Exercises (trainee's manual) "On/off hydraulics – Electrical operation (according to BIBB)" EN	2
R961003805	EXERCISE BOOK TW-HY-AL-1/X 204EN	Exercises with solutions/exercises (trainer's/trainee's manual) "Fault detection in hydraulic systems" EN	3

In addition, you need the following accessories:

Mat.-no.	Material short text	Description	Quantity
R961009563	ANALYZER SET TS-HY BASIC	Basic measuring instrument set	2
R961002927	COUPLING BOX TS-HC-1-15-005-9-XX0&	Pressure release sleeve	2
R901448893	HOSE HOLDER TS-MC-9F	Hose holder for 16 hoses	1
R913046494	HYDRAULICS OIL AVIA FLUID RSL 22-20L	Hydraulic oil RSL22, packaging unit: 20 l	1
R961009591	FUNNEL 160 + SCHLAUCH	Filling funnel with hose	1
0538103012	TEST AND FILLING DEVICE FUER MEMBRANSPEICHER	Test and filling device for hydraulic accumulator	1
R961008677	CONNECTING KIT TS-MC-GN851-160-T2	Mounting kit for connecting the WS200 workstations	2

Suitable technical books, eLearnings, work equipment, posters, sectional models, multimedia and software are available in our media catalog:



www.boschrexroth.com/trainingmedia

With this equipment, you have completely covered the desired learning topics for 2 - 4 trainees and do not need any additional materials.

We are willingly prepared to prepare an offer for you for these order examples. If you have any additional questions or need information, do not hesitate to contact us.

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Continuous control valve technology

If you want to teach hydraulics from the basic knowledge to the on/off hydraulics (manual and electrical operation), troubleshooting, proportional hydraulics and closed-loop control hydraulics topics, we recommend the following equipment:

Selection of device sets suitable for the learning topics:

Mat.-no.	Material short text	Description	Quantity
R961009458	EQUIPMENT SET TS-HS 201-1X	Device set for workstation WS200/WS290 "On/off hydraulics – Manual operation (BIBB, A-H), complete"	2
R961009466	EQUIPMENT SET TS-HS 404-1X	Extension device set for workstation WS200/WS290 from "On/off hydraulics – Manual operation" to "On/off hydraulics – Electrical operation (BIBB, A-H)"	2
R901386159	EQUIPMENT SET TS-HS 503-1X	Device set Electrics for workstation WS290 "On/off hydraulics – Electrical operation (BIBB, A-H), without I/O module"	2
R961006620	EQUIPMENT SET TS-HS 204-1X	Device set for workstation WS200/WS290 "On/off hydraulics – Troubleshooting, electrical operation"	2
R961009468	EQUIPMENT SET TS-HS 406-1X	Extension device set for workstation WS290 from "On/off hydraulics – Electrical operation (BIBB, A-H)" to "Continuous control valve technology – Proportional hydraulics"	2
R901386161	EQUIPMENT SET TS-HS 505-1X	Extension device set Electrics for workstation WS290 from "On/off hydraulics – Electrical operation (BIBB, A-H)" to "Continuous control valve technology – Proportional hydraulics"	2
R961009474	EQUIPMENT SET TS-HS 411-1X	Extension device set for workstation WS290 from "On/off hydraulics – Electrical operation (BIBB, A-H)" + "Continuous control valve technology – Proportional hydraulics" to "Continuous control valve technology – Closed-loop control hydraulics"	2
R901386164	EQUIPMENT SET TS-HS 508-1X	Extension device set Electrics for workstation WS290 from "Continuous control valve technology – Proportional hydraulics" to "Continuous control valve technology – Closed-loop control hydraulics"	2

Workstations suitable for the learning topics:

Mat.-no.	Material short text	Description	Quantity
R961009457	WORKSTATION TS-WS290-1X/G2A1B2C1&	Workstation WS290, hydraulics, hydraulic power unit with double pump and flow controller, 230 VAC/50 Hz, double-sided for 2 - 6 trainees, with assembly carrier – assembled, incl. packaging	1
R961008856	WORKSTATION TS-WS200-1X/N0G6A0T0&	Workstation WS200, component carrier double-sided – assembled, incl. packaging	1

Selection of exercise books suitable for the learning topics:

Mat.-no.	Material short text	Description	Quantity
R901385282	EXERCISE BOOK TW-HY-LH-1/X 201EN	Exercises with solutions (trainer's manual) "On/off hydraulics – Manual operation (according to BIBB)" EN	1
R901385283	EXERCISE BOOK TW-HY-SH-1/X 201EN	Exercises (trainee's manual) "On/off hydraulics – Manual operation (according to BIBB)" EN	2
R901385284	EXERCISE BOOK TW-HY-LH-1/X 202EN	Exercises with solutions (trainer's manual) "On/off hydraulics – Electrical operation (according to BIBB)" EN	1
R901385285	EXERCISE BOOK TW-HY-SH-1/X 202EN	Exercises (trainee's manual) "On/off hydraulics – Electrical operation (according to BIBB)" EN	2
R961003805	EXERCISE BOOK TW-HY-AL-1/X 204EN	Exercises with solutions/exercises (trainer's/trainee's manual) "Fault detection in hydraulic systems" EN	3

Mat.-no.	Material short text	Description	Quantity
R961003873	EXERCISE BOOK TW-HY-LH-1/X 301EN	Exercises with solutions (trainer's manual) "Proportional valve technology" EN	1
R961003875	EXERCISE BOOK TW-HY-SH-1/X 301EN	Exercises (trainee's manual) "Proportional valve technology" EN	2
R961005091	EXERCISE BOOK TW-HY-LH-1/X 302EN	Exercises with solutions (trainer's manual) "Analog position control loop" EN	1
R961005092	EXERCISE BOOK TW-HY-SH-1/X 302EN	Exercises (trainee's manual) "Analog position control loop" EN	2

In addition, you need the following accessories:

Mat.-no.	Material short text	Description	Quantity
R961009563	ANALYZER SET TS-HY BASIC	Basic measuring instrument set	2
R961002927	COUPLING BOX TS-HC-1-15-005-9-XX0&	Pressure release sleeve	2
R913046494	HYDRAULICS OIL AVIA FLUID RSL 22-20L	Hydraulic oil RSL22, packaging unit: 20 l	2
R961009591	FUNNEL 160 + SCHLAUCH	Filling funnel with hose	1
0538103012	TEST AND FILLING DEVICE FUER MEMBRANSPEICHER	Test and filling device for hydraulic accumulator	1

In order to get continuous measuring results of the flow, we recommend the optional use of the following accessories:

Mat.-no.	Material short text	Description	Quantity
R913038909	ANALYZER SET 3020A-PP-10-10	Measuring instrument set 3020 The supplied suitcase contains cables, power supply unit and measuring connections. 2 pressures can be measured. Completely ready-to-use with 2 ISDS pressure transducers 200 bar and software full version.	2
R961002508	FLOWMETER TS-HC-GFM 3843-03-S-3	Gear wheel flow rate sensor	2
R900733207	CONNECTING CABLE TS-EC-ISDS-2500MM	Measuring cable for ISDS	2

Suitable technical books, eLearnings, work equipment, posters, sectional models, multimedia and software are available in our media catalog:



www.boschrexroth.com/trainingmedia

With this equipment, you have completely covered the desired learning topics for 2 - 4 trainees and do not need any additional materials.

We are willingly prepared to prepare an offer for you for these order examples. If you have any additional questions or need information, do not hesitate to contact us.

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Mobile hydraulics

If you want to teach hydraulics from the basic knowledge to the on/off hydraulics (manual and electrical operation), troubleshooting, mobile hydraulics (LUDV control) topics, we recommend the following equipment:

Selection of device sets suitable for the learning topics:

Mat.no.	Material short text	Description	Quantity
R961009458	EQUIPMENT SET TS-HS 201-1X	Device set for workstation WS200/WS290 "On/off hydraulics – Manual operation (BIBB, A-H), complete"	2
R961006619	EQUIPMENT SET TS-HS 203-1X	Device set for workstation WS200/WS290 "On/off hydraulics – Troubleshooting, manual operation"	2
R901465313	EQUIPMENT SET TS-HS 405-2X	Extension device set from "On/off hydraulics – Manual operation (BIBB, A-H)" to "Mobile hydraulics – Throttle control"	2
R961009471	EQUIPMENT SET TS-HS 409-1X	Extension device set for workstation WS290 from "Mobile hydraulics – Throttle control" to "Mobile hydraulics – Load-sensing control"	2
R961009472	EQUIPMENT SET TS-HS 410-1X	Extension device set for workstation WS290 from "Mobile hydraulics – Throttle control" to "Mobile hydraulics – LUDV control"	2

Workstations suitable for the learning topics:

Mat.no.	Material short text	Description	Quantity
R961009864	WORKSTATION TS-WS290-1X/G2A1B0C1&	Workstation WS290, hydraulics, hydraulic power unit with double pump and flow controller, 230 VAC/50 Hz, double-sided for 2 - 6 trainees, without assembly carrier – assembled, incl. packaging	1
R961008856	WORKSTATION TS-WS200-1X/N0G6A0T0&	Workstation WS200, component carrier double-sided – assembled, incl. packaging	1

Selection of exercise books suitable for the learning topics:

Mat.no.	Material short text	Description	Quantity
R901385282	EXERCISE BOOK TW-HY-LH-1/X 201EN	Exercises with solutions (trainer's manual) "On/off hydraulics – Manual operation (according to BIBB)" EN	1
R901385283	EXERCISE BOOK TW-HY-SH-1/X 201EN	Exercises (trainee's manual) "On/off hydraulics – Manual operation (according to BIBB)" EN	2
R961003805	EXERCISE BOOK TW-HY-AL-1/X 204EN	Exercises with solutions/exercises (trainer's/trainee's manual) "Fault detection in hydraulic systems" EN	3
R961005094	EXERCISE BOOK TW-HY-LH-1/X 303EN	Exercises with solutions (trainer's manual) "Mobile hydraulics – Throttle control 3SM-12" EN	1
R961005093	EXERCISE BOOK TW-HY-SH-1/X 303EN	Exercises (trainee's manual) "Mobile hydraulics – Throttle control 3SM-12" EN	2
R961005147	EXERCISE BOOK TW-HY-LH-1/X 304EN	Exercises with solutions (trainer's manual) "Mobile hydraulics – Load sensing control 2M4-12" EN	1
R961005146	EXERCISE BOOK TW-HY-SH-1/X 304EN	Exercises (trainee's manual) "Mobile hydraulics – Load sensing control 2M4-12" EN	2
R961005149	EXERCISE BOOK TW-HY-LH-1/X 305EN	Exercises with solutions (trainer's manual) "Mobile hydraulics – LUDV" EN	1
R961005148	EXERCISE BOOK TW-HY-SH-1/X 305EN	Exercises (trainee's manual) "Mobile hydraulics – LUDV" EN	2

In addition, you need the following accessories:

Mat.-no.	Material short text	Description	Quantity
R961009563	ANALYZER SET TS-HY BASIC	Basic measuring instrument set	2
R961002927	COUPLING BOX TS-HC-1-15-005-9-XX0&	Pressure release sleeve	2
R913046494	HYDRAULICS OIL AVIA FLUID RSL 22-20L	Hydraulic oil RSL22, packaging unit: 20 l	2
R961009591	FUNNEL 160 + SCHLAUCH	Filling funnel with hose	1
R913038909	ANALYZER SET 3020A-PP-10-10	Measuring instrument set 3020 The supplied suitcase contains cables, power supply unit and measuring connections. Completely ready-to-use with 2 ISDS pressure transducers 200 bar and software full version.	2
R961002508	FLOWMETER TS-HC-GFM 3843-03-S-3	Gear wheel flow rate sensor	2
R900733207	CONNECTING CABLE TS-EC-ISDS-2500MM	Measuring cable for ISDS	2
0538103012	TEST AND FILLING DEVICE FUER MEMBRANSPEICHER	Test and filling device for hydraulic accumulator	1

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If you want to teach hydraulics from the basic knowledge to the on/off hydraulics (manual operation), troubleshooting topics to mobile hydraulics with the topics throttle control, load-sensing control, LUDV control, hydrostatic steering systems and electro-hydraulic control of valves – Programmable remote control (joystick) with integrated power electronics, we recommend the following equipment:

Selection of device sets suitable for the learning topics:

Mat.-no.	Material short text	Description	Quantity
R961009458	EQUIPMENT SET TS-HS 201-1X	Device set for workstation WS200/WS290 "On/off hydraulics – Manual operation (BIBB, A-H), complete"	2
R961006619	EQUIPMENT SET TS-HS 203-1X	Device set for workstation WS200/WS290 "On/off hydraulics – Troubleshooting, manual operation"	2
R901465313	EQUIPMENT SET TS-HS 405-2X	Extension device set from "On/off hydraulics – Manual operation (BIBB, A-H)" to "Mobile hydraulics – Throttle control"	2
R961009471	EQUIPMENT SET TS-HS 409-1X	Extension device set for workstation WS290 from "Mobile hydraulics – Throttle control" to "Mobile hydraulics – Load-sensing control"	2
R961009472	EQUIPMENT SET TS-HS 410-1X	Extension device set for workstation WS290 from "Mobile hydraulics – Throttle control" to "Mobile hydraulics – LUDV control"	2
R901425727	EQUIPMENT SET TS-HS 415-1X	Extension device set for workstation WS290 from "On/off hydraulics – Manual operation (BIBB, A-H)" + "Mobile hydraulics – Throttle control" + "Mobile hydraulics – Load-sensing control" to "Mobile hydraulics – Steering systems, advanced"	2
R901408323	EQUIPMENT SET TS-HS 413-1X	Extension device set for workstation WS290 from "Mobile hydraulics – Load-sensing control" to "Mobile hydraulics – Programmable remote control (joystick)"	2

Workstations suitable for the learning topics:

Mat.-no.	Material short text	Description	Quantity
R961009864	WORKSTATION TS-WS290-1X/G2A1B0C1&	Workstation WS290, hydraulics, hydraulic power unit with double pump and flow controller, 230 VAC/50 Hz, double-sided for 2 - 6 trainees, without assembly carrier – assembled, incl. packaging	1
R961008856	WORKSTATION TS-WS200-1X/N0G6A0T0&	Workstation WS200, component carrier double-sided – assembled, incl. packaging	1

Selection of exercise books suitable for the learning topics:

Mat.-no.	Material short text	Description	Quantity
R901385282	EXERCISE BOOK TW-HY-LH-1/X 201EN	Exercises with solutions (trainer's manual) "On/off hydraulics – Manual operation (according to BIBB)" EN	1
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R961003805	EXERCISE BOOK TW-HY-AL-1/X 204EN	Exercises with solutions/exercises (trainer's/trainee's manual) "Fault detection in hydraulic systems" EN	3
R961005094	EXERCISE BOOK TW-HY-LH-1/X 303EN	Exercises with solutions (trainer's manual) "Mobile hydraulics – Throttle control 3SM-12" EN	1
R961005093	EXERCISE BOOK TW-HY-SH-1/X 303EN	Exercises (trainee's manual) "Mobile hydraulics – Throttle control 3SM-12" EN	2
R961005147	EXERCISE BOOK TW-HY-LH-1/X 304EN	Exercises with solutions (trainer's manual) "Mobile hydraulics – Load sensing control 2M4-12" EN	1
R961005146	EXERCISE BOOK TW-HY-SH-1/X 304EN	Exercises (trainee's manual) "Mobile hydraulics – Load sensing control 2M4-12" EN	2
R961005149	EXERCISE BOOK TW-HY-LH-1/X 305EN	Exercises with solutions (trainer's manual) "Mobile hydraulics – LUDV" EN	1

Mat.-no.	Material short text	Description	Quantity
R961005148	EXERCISE BOOK TW-HY-SH-1/X 305EN	Exercises (trainee's manual) "Mobile hydraulics – LUDV" EN	2
R961009561	EXERCISE BOOK TW-HY-LH-1/X 306EN	Exercises with solutions (trainer's manual) "Mobile hydraulics – Hydrostatic steering systems" EN	1
R961009562	UEBUNGSBUCH TW-HY-SH-1/X 306EN	Exercises (trainee's manual) "Mobile hydraulics – Hydrostatic steering systems" EN	2
R901407785	EXERCISE BOOK TW-HY-LH-1/X 413EN	Exercises with solutions (trainer's manual) "Mobile hydraulics – Electrohydraulic operation of valves – Programmable remote control (joystick) with integrated power electronics" EN	1
R901407788	EXERCISE BOOK TW-HY-SH-1/X 413EN	Exercises (trainee's manual) "Mobile hydraulics – Electrohydraulic operation of valves – Programmable remote control (joystick) with integrated power electronics" EN	2

In addition, you need the following accessories:

Mat.-no.	Material short text	Description	Quantity
R961009563	ANALYZER SET TS-HY BASIC	Basic measuring instrument set	2
R961002927	COUPLING BOX TS-HC-1-15-005-9-XX0&	Pressure release sleeve	2
R913046494	HYDRAULICS OIL AVIA FLUID RSL 22-20L	Hydraulic oil RSL22, packaging unit: 20 l	2
R961009591	FUNNEL 160 + SCHLAUCH	Filling funnel with hose	1
R913002273	ANALYZER SET TS-EC-3020P/P-10-10	"ANALYZER SET 3020P/P-10-10 The supplied suitcase contains cables, power supply unit and measuring connections. 2 pressures can be measured. Completely ready-to-use with 2 ISDS pressure transducers 200 bar and software full version."	2
R961002508	FLOWMETER TS-HC-GFM 3843-03-S-3	Gear wheel flow rate sensor	2
R900733207	CONNECTING CABLE TS-EC-ISDS-2500MM	Measuring cable for ISDS	2
R961008981	POWER STAGE TS-EC-230V/10A	Power supply unit 230V/10A	2

In order to get continuous measuring results of the flow, we recommend the optional use of the following accessories:

Mat.-no.	Material short text	Description	Quantity
0538103012	TEST AND FILLING DEVICE FUER MEMBRANSPEICHER	Test and filling device for hydraulic accumulator	1

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Components and spare parts



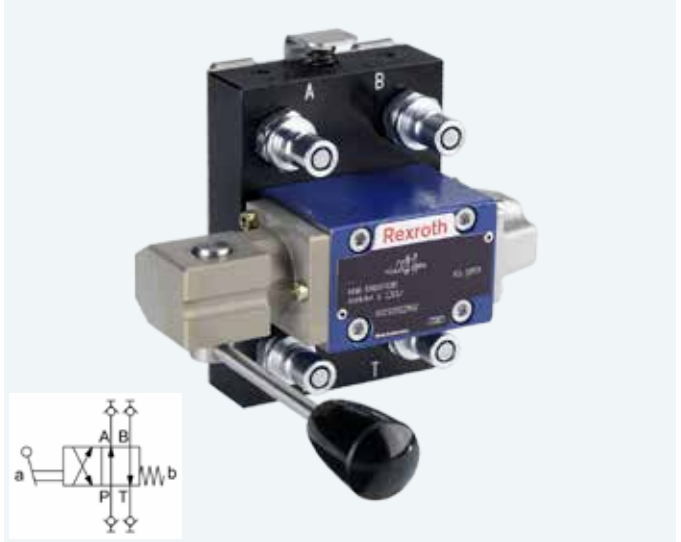
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Valves

Directional control valves – Manual operation

4/2 directional control valve 4WMM6C5X		
Material number	R961002552	
Material short text	DIR.-CONTROL VALVE TS-HC-4WMM 6 C5X/	
Directional control spool valve; 4 connections; 2 switching positions; manual operation by means of lever; spring return; control spool directly operated; control spool type "C"; in state of rest, P-A open, B-T open; mounted on component plate; Connections via self-sealing coupling plugs		
Dimensions	mm (L x W x H)	137 x 125 x 182
Weight	kg	2
Working pressure max.	bar	120
Industrial type	4WMM6C5X	



4/3 directional control valve 4WMM6G5X		
Material number	R961002550	
Material short text	DIR.-CONTROL VALVE TS-HC-4WMM 6 G5X/	
Directional control spool valve; 4 connections; 3 switching positions; manual operation by means of lever; spring centering; control spool directly operated; control spool type "G"; in state of rest, P-T open; A-B blocked; mounted on component plate; Connections via self-sealing coupling plugs		
Dimensions	mm (L x W x H)	137 x 125 x 182
Weight	kg	2
Working pressure max.	bar	120
Industrial type	4WMM6G5X	



4/3 directional control valve 4WMM6G5X manipulated		
Material number	R961006553	
Material short text	DIR.-CONTROL VALVE TS-HC-4WMM 6 G5X/-MA&	
Manipulated 4/3 directional control valve 4WMM6G5X/; the typical features of aging and wear have been simulated; Connections via self-sealing coupling plugs		

Directional control valves – Manual operation

4/3 directional control valve 4WMM6E5X/

Material number	R961002551
Material short text	DIR.-CONTROL VALVE TS-HC-4WMM 6 E5X/F

Directional control spool valve; 4 connections; 3 switching positions; manual operation by means of lever; with detent; control spool directly operated; control spool type "E"; in state of rest, P-T-A-B blocked; mounted on component plate; Connections via self-sealing coupling plugs

Dimensions	mm (L x W x H)	137 x 125 x 182
Weight	kg	2
Working pressure max.	bar	120
Industrial type	4WMM6E5X/F	



4/3 directional control valve 4WMM6J5X

Material number	R961002510
Material short text	DIR.-CONTROL VALVE TS-HC-4WMM 6 J5X/

Directional control spool valve; 4 connections; 3 switching positions; manual operation by means of lever; spring centering; control spool directly operated; control spool type "J"; in state of rest, P blocked; T-A-B open; mounted on component plate; Connections via self-sealing coupling plugs

Dimensions	mm (L x W x H)	137 x 125 x 182
Weight	kg	2
Working pressure	bar	120
Industrial type	4WMM6J5X/F	



Directional control valves – Manual operation

4/3 directional control valve 4WMM6H5X		
Material number	R961002511	
Material short text	DIR.-CONTROL VALVE TS-HC-4WMM 6 H5X/	
Directional control spool valve; 4 connections; 3 switching positions; manual operation by means of lever; spring centering; control spool directly operated; control spool type "H"; in state of rest, P-T-A-B open; mounted on component plate; Connections via self-sealing coupling plugs		
Dimensions	mm (L x W x H)	137 x 125 x 182
Weight	kg	2
Working pressure	bar	120
Industrial type	4WMM6H5X	



Directional control valve – Electrical operation
4/2 directional control valve 4WE6C6X/

Material number	R961002547
Material short text	DIR.-CONTROL VALVE TS-HC-4WE 6 C6X/EG24&

Directional control spool valve; 4 connections; 2 switching positions; electrical operation; spring return; concealed auxiliary control; control spool directly operated; control spool type "C"; state of rest, P-A open; B-T open; mounted on component plate; Connections via self-sealing coupling plugs

Dimensions	mm (L x W x H)	146 x 125 x 98
Weight	kg	2.35
Operating voltage	VDC	24
Working pressure max.	bar	120
Industrial type	4WE6C6X/EG24N9K4	

Accessories

Designation	Material number	Quantity
Solenoid cable with connector form A, black, with LED, with protective circuit	R901457044	1

4/3 directional control valve 4WE6G6X/

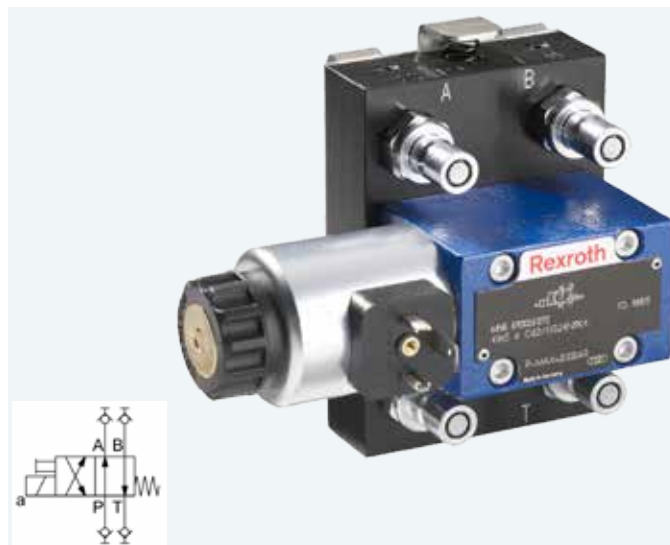
Material number	R961002548
Material short text	DIR.-CONTROL VALVE TS-HC-4WE 6 G6X/EG24&

Directional control spool valve; 4 connections; 3 switching positions; electrical operation; spring centering; concealed auxiliary control; control spool directly operated; control spool type "G"; state of rest, P-T open, A-B blocked; mounted on component plate; Connections via self-sealing coupling plugs

Dimensions	mm (L x W x H)	206 x 125 x 98
Weight	kg	2.9
Operating voltage	VDC	24
Working pressure max.	bar	120
Industrial type	4WE6G6X/EN24N9K4	
Plug-in connection	low leakage oil	Type W

Accessories

Designation	Material number	Quantity
Solenoid cable with connector form A, black, with LED, with protective circuit	R901457044	2



Directional control valve – Electrical operation

4/3 directional control valve 4WE6E6X/		
Material number	R961002549	
Material short text	DIR.-CONTROL VALVE TS-HC-4WE 6 E6X/EG24&	
Directional control spool valve; 4 connections; 3 switching positions; electrical operation; spring centering; concealed auxiliary control; control spool directly operated; control spool type "E"; state of rest, P, T, A, B blocked; mounted on component plate; Connections via self-sealing coupling plugs		
Dimensions	mm (L x W x H)	206 x 125 x 98
Weight	kg	2.9
Operating voltage	VDC	24
Working pressure max.	bar	120
Industrial type	4WE6E6X/EG24N9K4	
Accessories		
Designation	Material number	Quantity
Solenoid cable with connector form A, black, with LED, with protective circuit	R901457044	2



4/3 directional control valve 4WE6J6X/		
Material number	R961002554	
Material short text	DIR.-CONTROL VALVE TS-HC-4WE 6 J6X/EG24&	
Directional control spool valve; 4 connections; 3 switching positions; electrical operation; spring centering; concealed auxiliary control; control spool directly operated; control spool type "J"; state of rest, P blocked, T-A-B open; mounted on component plate; Connections via self-sealing coupling plugs		
Dimensions	mm (L x W x H)	206 x 125 x 98
Weight	kg	2.9
Operating voltage	VDC	24
Working pressure max.	bar	120
Industrial type	4WE6J6X/EG24N9K4	
Plug-in connection	low leakage oil	Type W
Accessories		
Designation	Material number	Quantity
Solenoid cable with connector form A, black, with LED, with protective circuit	R901457044	2



Directional control valves – Continuous control valves with feedback

4/3 proportional directional control valve 4WREE6E08-2X/ with int. elec. and load sim.

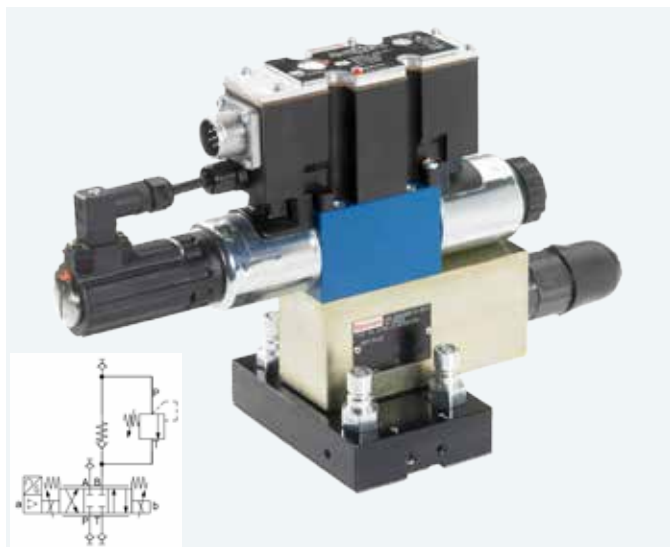
Material number	R961003533
Material short text	PROP DIRECT VALVE TS-HC-4WREE 6 E08-2X&

Direct-operated proportional directional control valve with electrical position feedback and on-board electronics (OBE); controls direction and amount of flow; operation by means of proportional solenoids with central thread and detachable coil; spring-centered control spool; control electronics with voltage input; load simulation via pressure relief valve in port B effective in the return flow; manually adjustable; non-return valve; free flow effective in the supply; mounted on component plate; Connections via self-sealing coupling plugs

Dimensions	mm (L x W x H)	350 x 125 x 210
Weight	kg	5.9
Supply voltage	VDC	24
Working pressure max.	bar	120
Industrial type	4WREE6E08-2X/G24K31/A1V + HSZ 06 A218	
Current consumption max.	A	2
Command value input	VDC	± 10 V

Accessories

Designation	Material number	Quantity
Cable 7-pole for integrated electronics	R961003550	1



Directional control valves –Continuous control valves with feedback

4/4 valve for closed-loop control 4WRPEH6 with integrated electronics		
Material number	R961002509	
Material short text	PROPORTIONAL DIRECTIONAL VALVE TS-HC-4WRPEH 6 C3 B04L-2X/G24K0/A1M	
<p>Direct-operated control directional control valve, with control spool and sleeve in servo quality; operated on one side with 4/4 fail-safe position in switched-off condition (P blocked, T-A-B open); electrical position feedback and on-board electronics (OBE); calibrated ex factory; signal input differential amplifier with voltage input; mounted on component plate; Connections via self-sealing coupling plugs</p>		
Dimensions	mm (L x W x H)	199 x 125 x 150
Weight	kg	4
Working pressure max.	bar	120
Supply voltage	VDC	24
Command value input	VDC	± 10
Industrial type	4WRPEH6C3B04L-2X/G24K0/A1M	
Power consumption max.	W	40
Connector plug 6P+P	according to E DIN 43563-AM6	
Accessories		
Designation	Material number	Quantity
Cable 7-pole for integrated electronics	R961003550	1



Pressure control valves – Manual operation

Pressure relief valve DBDH6G1X/

Material number	R961002520
Material short text	PRESS RELIEF VALVE TS-HC-DBDH 6 G1X/100&

The pressure relief valve is used to limit the system pressure. The continuous adjustment is effected by means of the rotary knob. Connections via self-sealing coupling plugs and coupling socket

Dimensions	mm (L x W x H)	233 x 126 x 52
Weight	kg	1.8
Working pressure max.	bar	120
Set pressure	bar	up to 100
Operation		manual
Industrial type		DBDH6G1X/100

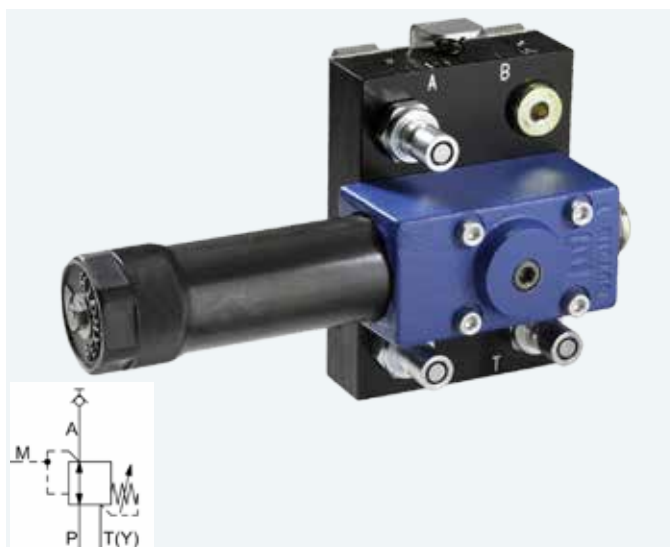


Pressure reducing valve, direct-operated, DR6DP1-5X/

Material number	R961002544
Material short text	PRESSURE RED.VALVE TS-HC-DR 6 DP1-5X/75&

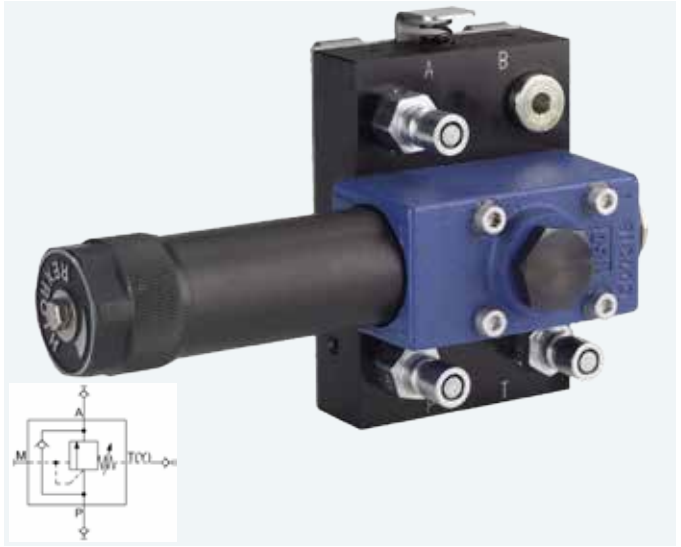
The direct-operated pressure reducing valve is used to reduce the system pressure, the setting is effected by means of a handwheel. Pilot oil supply internal, leakage oil drain external, without non-return valve, mounted on component plate. Connections via self-sealing coupling plugs

Dimensions	mm (L x W x H)	194 x 125 x 84
Weight	kg	2.45
Working pressure max.	bar	120
Outlet pressure max.	bar	75
Operation		manual
Industrial type		DR6DP1-5X/75YM

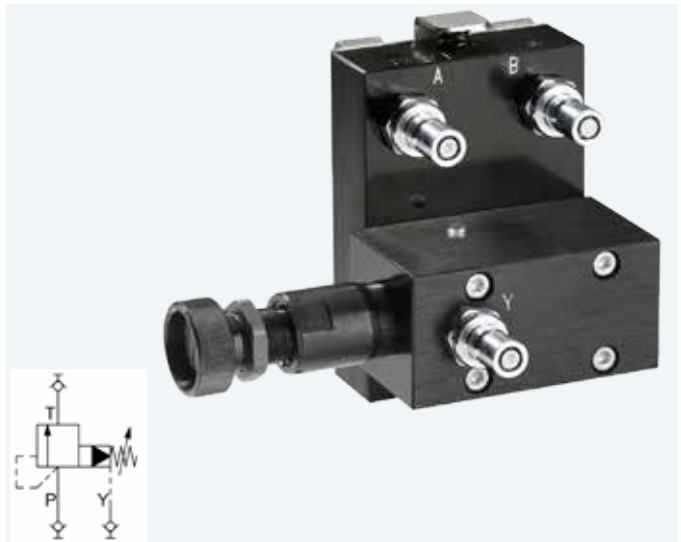


Pressure control valves – Manual operation

Pressure sequence valve, direct-operated, DZ6DP1-5X/		
Material number	R961002558	
Material short text	PRESSURE SEQUENCE TS-HC-DZ 6 DP1-5X/75Y	
The direct-operated pressure sequence valve is used for the pressure-dependent connection of a second system, the setting is effected by means of a handwheel. Pilot oil supply internal, leakage oil drain external, with non-return valve, mounted on component plate.		
Connections via self-sealing coupling plugs		
Dimensions	mm (L x W x H)	197 x 125 x 86
Weight	kg	2.47
Working pressure max.	bar	120
Sequencing pressure	bar	75
Operation	manual	
Industrial type	DZ6DP1-5X/75Y	

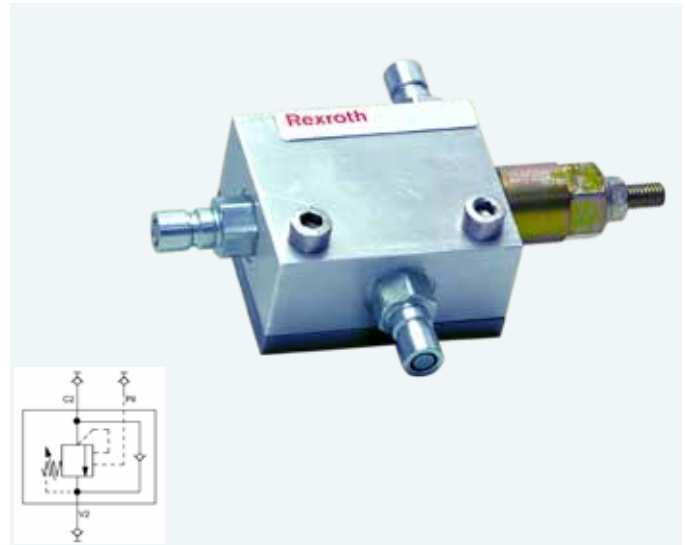


Pressure relief valve, pilot-operated, DB6K1-4X/		
Material number	R901460846	
Material short text	PRESS RELIEF VALVE TS-HC-DB 6 K1-4X/50YV	
The pilot-operated pressure relief valve is used to limit the system pressure, the setting is effected by means of a handwheel. Pilot oil supply internal, leakage oil drain external, mounted on component plate.		
Connections via self-sealing coupling plugs		
Dimensions	mm (L x W x H)	155 x 125 x 79
Weight	kg	1.5
Working pressure max.	bar	120
Set pressure	bar	50
Operation	manual	
Industrial type	DB6K1-4X/50YV	



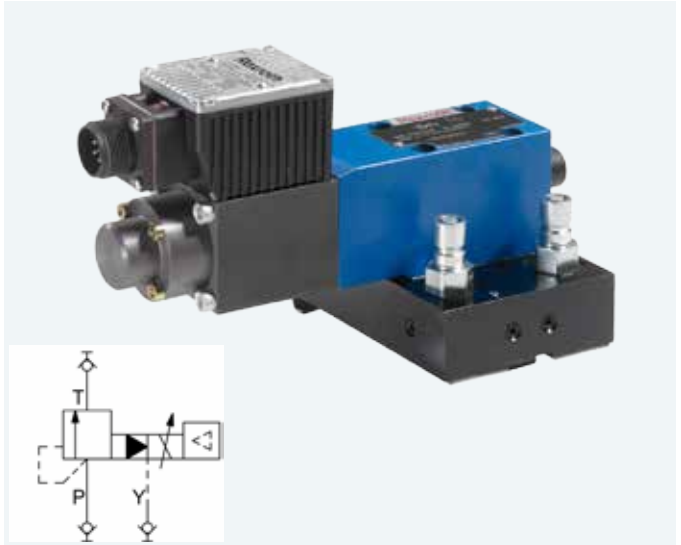
Pressure control valves – Counterbalance valve

Counterbalance valve A-VBSO-SE78-14-35	
Material number	R961002540
Material short text	COUNTERBAL. VALVE TS-HC-A-VBSO-SE-78-1&
The counterbalance valve controls the motion in case of leading loads. In the opposite direction, unhindered motion is possible.	
Dimensions	mm (L x W x H) 120 x 155 x 25
Weight	kg 1.23
Working pressure max.	bar 120
Industrial type	A-VBSO-SE-78

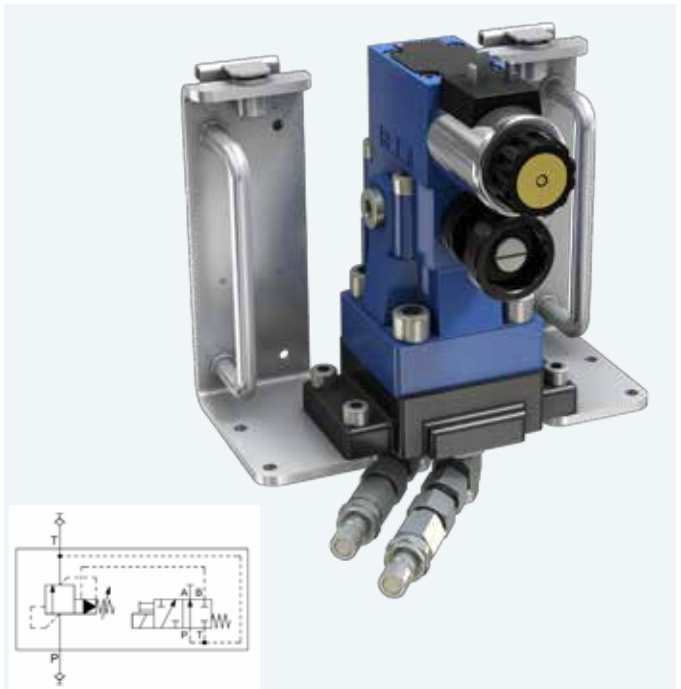


Pressure control valves – Electrical operation

Proportional pressure relief valve DBEE6-2X/50		
Material number	R961003924	
Material short text	PROPORTIONAL PR TS-HC-DBEE 6-2X/50YG&	
The proportional pressure relief valve with on-board electronics (OBE) is used to limit a system pressure. The system pressure to be limited can be continuously set depending on the electrical command value. Pilot oil supply internal, leakage oil drain external, mounted on component plate. Connections via self-sealing coupling plugs.		
Dimensions	mm (L x W x H)	213 x 125 x 123
Weight	kg	3.45
Adjustment range	bar	50
Working pressure max.	bar	120
Hysteresis	%	1.5
Industrial type	DBEE6-2X/50	
Electrical connection	K31	
Contact load max.	mA	1600
Accessories		
Designation	Material number	Quantity
Cable 7-pole for integrated electronics	R961003550	1



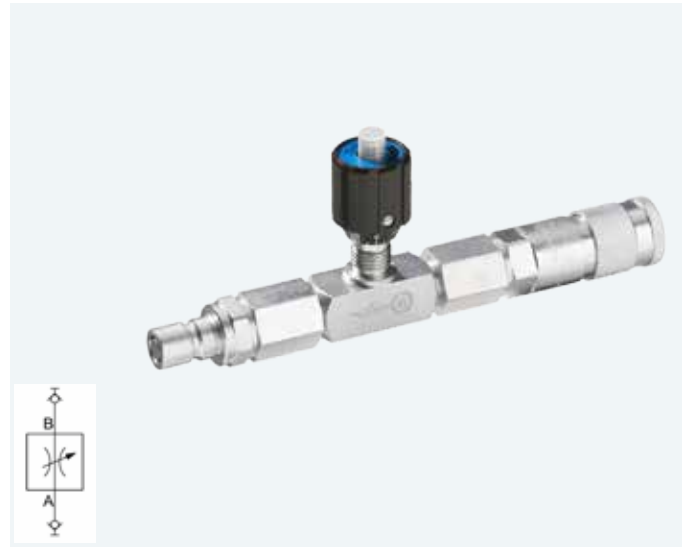
Pressure relief valve, pilot-operated, DBW10A1-5X/		
Material number	R961002553	
Material short text	PRESS RELIEF VALVE TS-HC-DBW 10 A1-5X/50	
The pilot-operated pressure relief valve provides the limitation and solenoid-operated unloading of the working pressure. For subplate mounting; with rotary knob; with directional control spool valve closed in deenergized condition; with concealed emergency operation; without mating connector Connections via self-sealing coupling plugs.		
Dimensions	mm (L x B x H)	182 x 190 x 230
Weight	kg	7.45
Operating voltage	VDC	24
Working pressure max.	bar	120
Set pressure	bar	50
Industrial type	DBW10A1-5X/50-6EG24N9K4	
Accessories		
Designation	Material number	Quantity
Solenoid cable with connector form A, black, with LED, with protective circuit	R901457044	1



Flow control valves – Manual operation

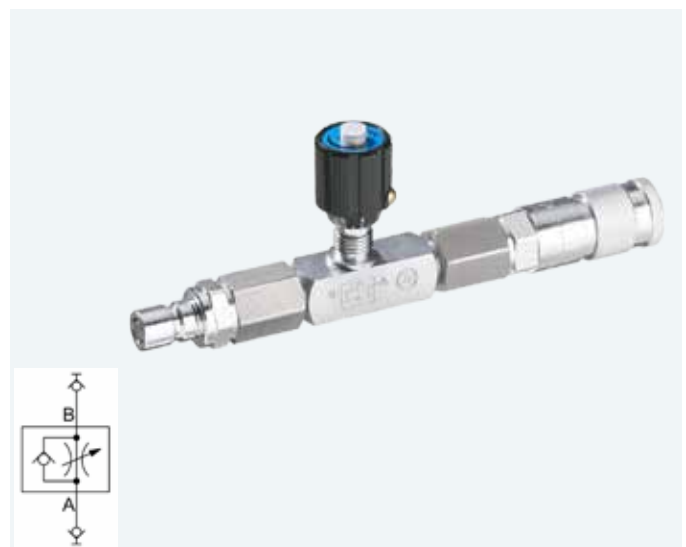
Throttle valve DV06-1-1X/V

Material number	R961002539	
Material short text	THROTTLE VALVE TS-HC-DV 06 -1-1X/V	
The throttle valve is used for the easy and exact setting and blocking of a flow in both directions. Connections via self-sealing coupling plug and coupling socket.		
Dimensions	mm (L x W x H)	174 x 65 x 24
Weight	kg	0.33
Working pressure	bar	120
Operation	manual	
Industrial type	DV06-1-1X/V	



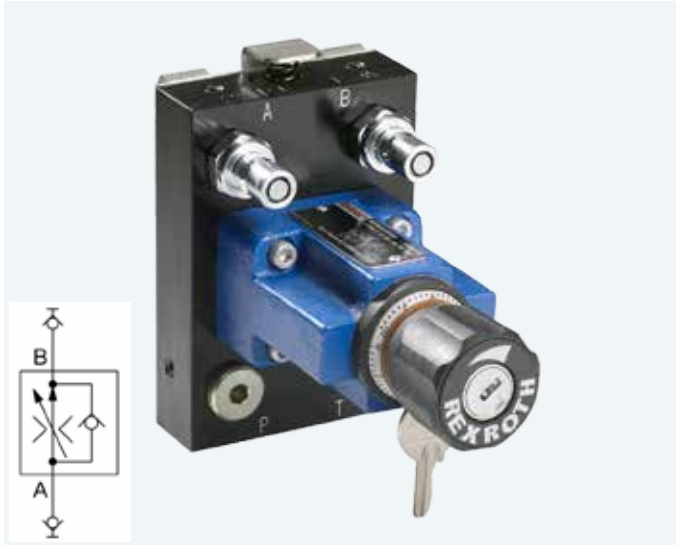
Throttle/non-return (check) valve DRV06-1-1X/V

Material number	R961002495	
Material short text	THROTTLE CHECK VLV TS-HC-DRV 06 -1-1X/V	
The throttle/non-return valve allows for throttling of the flow in only one direction (A to B). In the opposite direction, the throttle/non-return valve allows non-throttled flow. Connections via self-sealing coupling plug and coupling socket.		
Dimensions	mm (L x B x H)	180 x 65 x 24
Weight	kg	0.35
Working pressure	bar	120
Opening pressure	bar	0.5
Operation	manual	
Industrial type	DRV06-1-1X/V	



Flow control valves – Manual operation

2-way flow control valve 2FRM6B36-3X/		
Material number	R961002546	
Material short text	FLOW-CONTROL VALVE TS-HC-2FRM 6 B36-3X/&	
It is the task of the 2-way flow control valve to keep a flow constant, independent of pressure and temperature. Setting by means of lockable rotary knob with scale, without external closing of the pressure compensator, mounted on component plate. Connections via self-sealing coupling plugs.		
Dimensions	mm (L x B x H)	80 x 125 x 145
Weight	kg	1.86
Working pressure max.	bar	120
Non-return valve	bar	0.7
Operation	manual	
Industrial type	2FRM6B36-3X/10QRV	
Flow	max.	10 l/min



Flow divider		
Material number	R961002537	
Material short text	FLOW DIVIDER TS-HC-DRF-38-11-A	
The flow divider divides an inlet flow into 2 identical (50% - 50%) flows.		
Connections via self-sealing coupling plugs and coupling socket.		
Dimensions	mm (L x W x H)	143 x 40 x 225
Weight	kg	1.62
Working pressure	bar	120
Industrial type	DRF-38-11-A	
Division ratio	50 - 50	
Division error max.	3 %	
Industrial type	DRF	
Flow	l/min	6.5-11



Flow control valves – Electrical operation

Proportional flow control valve 2FRE6B-2X/

Material number	R961002557
Material short text	FLOW-CONTROL VALVE TS-HC-2FRE 6B-2X/10Q&

The proportional flow control valve has a 2-way function; it is able to control a flow specified by the electrical command value in a pressure- and temperature-compensated manner.

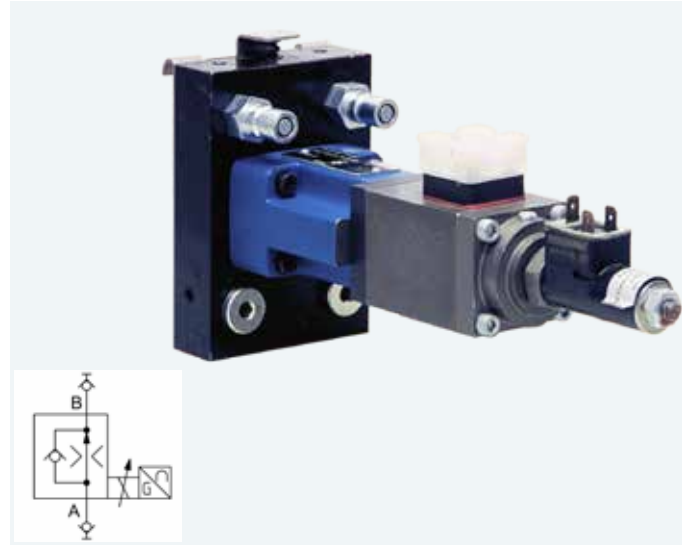
With inductive position transducer, pressure compensator without external locking, non-return valve and progressive flow characteristic; mounted on component plate.

Connections via self-sealing coupling plugs.

Dimensions	mm (L x W x H)	108 x 125 x 267
Weight	kg	3.91
Working pressure	bar	120
Control range	l/min	0.05 - 10
Industrial type		2FRE6B-2X/10Q K4 RV

Accessories

Designation	Material number	Quantity
Position transducer cable for proportional control valve	R900844180	1
Solenoid cable without LED form A black	R900846812	1
Control module VT-VRPA1 proportional amplifier, 4TE	R901057058	1



Isolation valves – Manual operation

Shut-off valve		
Material number	R961002491	
Material short text	BALL VALVE TS-HC-AB21-20/G 1/4-&	
Shut-off valves are used to shut off the flow of hydraulic fluid. Connections via self-sealing coupling plug and coupling socket.		
Dimensions	mm (L x W x H)	202 x 26 x 76
Weight	kg	0.53
Working pressure	bar	120



Isolation valves – Hydraulic operation

Non-return (check) valve S6A05-1X

Material number	R901462818
Material short text	NON-RETURN VALVE TS-HC-S 6 A05-1X/450J3

The non-return valve blocks the flow in one direction; in the opposite direction, the spring will open at 0.5 bar.

Connections via self-sealing coupling plug and coupling socket.

Dimensions	mm (L x D)	145 x 23
Weight	g	275
Working pressure	bar	120
Opening pressure	bar	0.5
Industrial type	S6A05-1X/450J3	



Non-return (check) valve S6A30-1X

Material number	R901462820
Material short text	NON-RETURN VALVE TS-HC-S 6 A30-1X/450J3

The non-return valve blocks the flow in one direction; in the opposite direction, the spring will open at 3 bar.

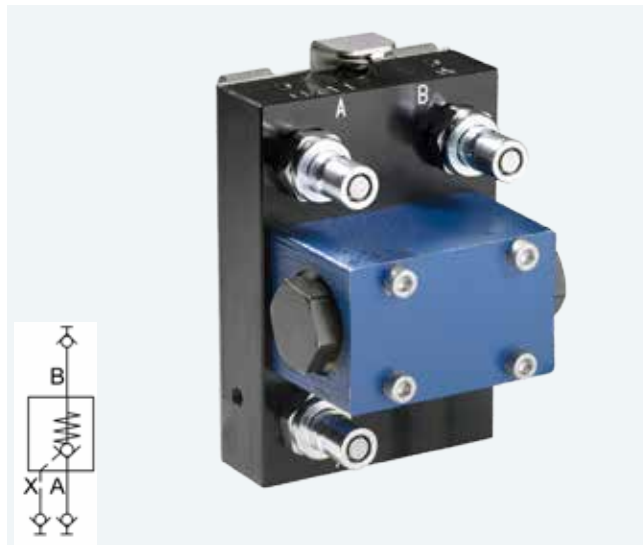
Connections via self-sealing coupling plug and coupling socket.

Dimensions	mm (L x D)	145 x 23
Weight	g	275
Working pressure	bar	120
Opening pressure	bar	3
Industrial type	S6A30-1X/450J3	



Isolation valves – Hydraulic operation

Non-return (check) valve, pilot-operated, SV 6 PB1-6X/		
Material number	R961002513	
Material short text	HY-CHECK VALVE TS-HC-SV 6 PB1-6X/	
The pilot-operated non-return valve blocks the flow in one direction (B to A). If sufficient pilot pressure is applied to port X, this flow path is opened. In the opposite direction (A to B), no pilot pressure is required and the spring will open at 1.5 bar. Connections via self-sealing coupling plugs.		
Dimensions	mm (L x W x H)	85 x 125 x 81
Weight	kg	1.73
Working pressure	bar	120
Opening pressure	bar	1.5
Operation	hydraulic	
Industrial type	SV6PB1-6X	

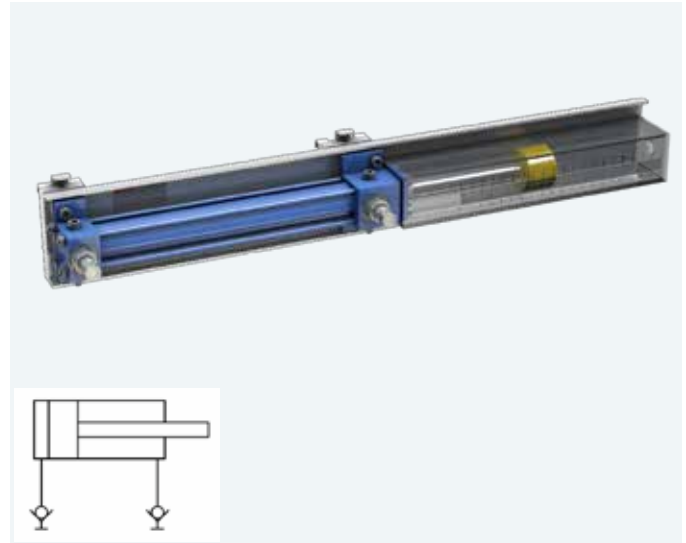


Cylinders, load units, motors

Cylinder

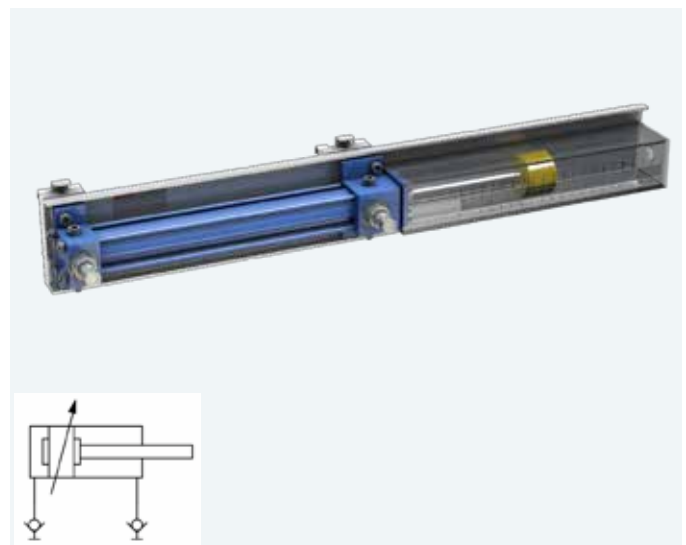
Differential cylinder CD70F25/16-200 with protective housing and connection possibility for load unit in workstation WS201

Material number	R961009526	
Material short text	CYLINDER TS-HC-CD 70F 25/ 16-&	
Hydraulic cylinder in tie rod design with mounting system for grid, mounted on base plate for holding sensors. Protective housing with measuring scale, piston rod with bolt for optional attachment to load unit.		
Connections via self-sealing coupling plugs.		
Dimensions	mm (L x W x H)	560 x 90 x 100
Weight	kg	3.9
Working pressure	bar	105
Industrial type	CD70F25/16-200Z11/01HCUM11T	
Stroke	mm	200
Piston diameter	mm	25
Piston rod diameter	mm	16
Piston ratio	1.6 : 1	



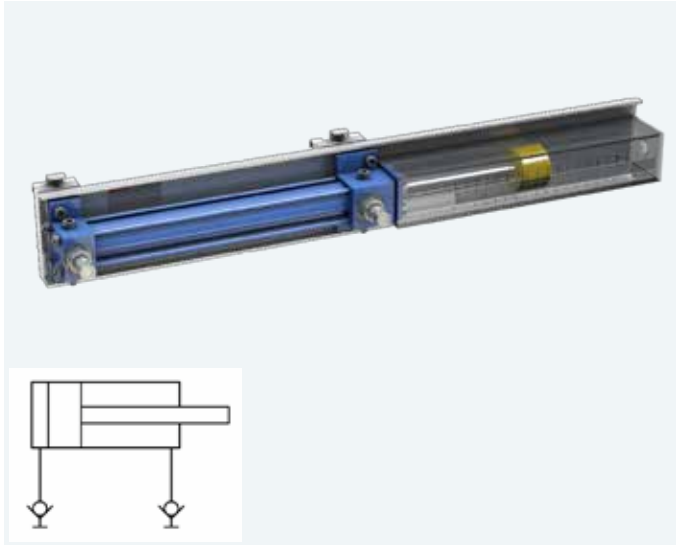
Differential cylinder CD70F25/16-200 with protective housing and end position damping

Material number	R961007508	
Material short text	CYLINDER TS-HC-CD 70F 25/ 16-&	
Hydraulic cylinder in tie rod design, with end position damping and mounting system for grid. Mounted on base plate for holding sensors. Protective housing with measuring scale, piston rod with bolt.		
Connections via self-sealing coupling plugs.		
Dimensions	mm (L x W x H)	560 x 90 x 100
Weight	kg	3.9
Working pressure	bar	105
Industrial type	CD70F25/16-200Z11/01HCUM11T	
Stroke	mm	200
Piston diameter	mm	25
Piston rod diameter	mm	16
Piston ratio	1.6 : 1	



Cylinder

Differential cylinder CD70F25/16-400 with protective housing		
Material number	R961003495	
Material short text	CYLINDER TS-HC-CD 70F 25/ 16-&	
Hydraulic cylinder in tie rod design with mounting system for grid, mounted on base plate for holding sensors. Protective housing with measuring scale.		
Connections via self-sealing coupling plugs.		
Dimensions	mm (L x W x H)	960 x 90 x 100
Weight	kg	5.55
Working pressure max.	bar	105
Industrial type	CD70F25/16-400Z11/01HCUM11T	
Stroke	mm	400
Piston diameter	mm	25
Piston rod diameter	mm	16
Piston ratio	1.6 : 1	



Load units

Load unit, controlled, for dynamic load simulation

Material number	R961004486
Material short text	LOAD UNIT TS-HC-2ZYL-25X14X200&

To impart the basic properties of controlled and regulated positioning systems. A position-controlled cylinder is moved against a load cylinder with damping buffer.

The load can be varied by means of a pressure reducing valve. The damper is used to prevent a metallic shock.

The position feedback is provided in a wire pull encoder. With mounting rail for proximity switches; with scalable ruler; POM plastic guides for absorbing radial forces.

Connections via self-sealing coupling plugs.

Dimensions	mm (L x W x H)	703 x 120 x 120
Weight	kg	6.3
Working pressure	bar	120
Industrial type	CYL1MF3/25/14/200 + CYL1MF3/25/14/50	
Controlled stroke	mm	200
Load stroke	mm	50
Position-controlled cylinder		25/14/200
Load cylinder		25/14/50
Measuring distance sensor, output	standardized	600 mm = 10 V
Load force at 50 bar, max.	kN	2.45 (hydraulically adjustable)



Motors

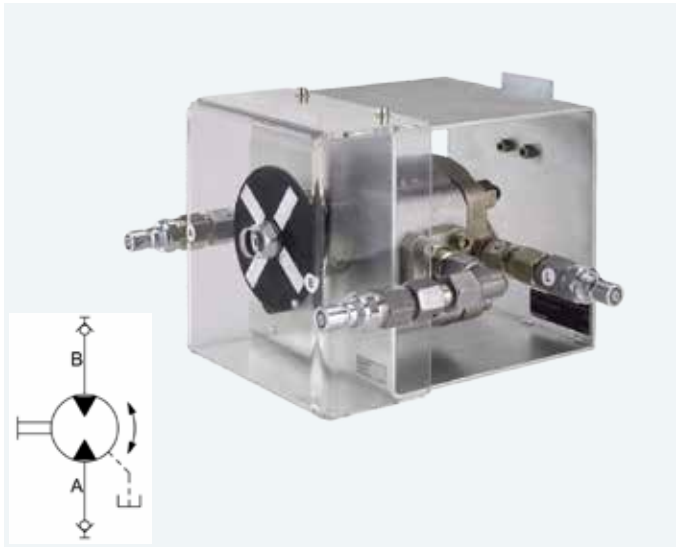
Gear motor	
Material number	R961004259
Material short text	PROTECTIVE COVER TS-MC-HYMOT-152X136X&

External gear motors are displacement machines in which the displacement chambers are made up of gears with external gearing. High and low-pressure range are separated by the contact of the meshing gears.

The motor shaft is fitted with a disc with reflective stripes and a protective housing made of Plexiglas which serves as contact protection and for holding optional speed sensor (material number R900892375, see page 195). The motor is suitable for both clockwise and anticlockwise rotation. Connections are via self-sealing coupling plugs.

Dimensions	mm (L x W x H)	250 x 220 x 160
Weight	kg	5.9
Working pressure	bar	120
Displacement	cm ³ /rev	8
Industrial type	AZMF-12-008	
Oil flow max.	l/min	8
Speed max.	RPM	1000

Accessories		
Designation	Material number	Quantity
Speed sensor	R900892375	1



Motors

Axial piston motor

Material number	R961002811
Material short text	AXIAL-PISTON MOTOR TS-HC-A2F5/60W-C3

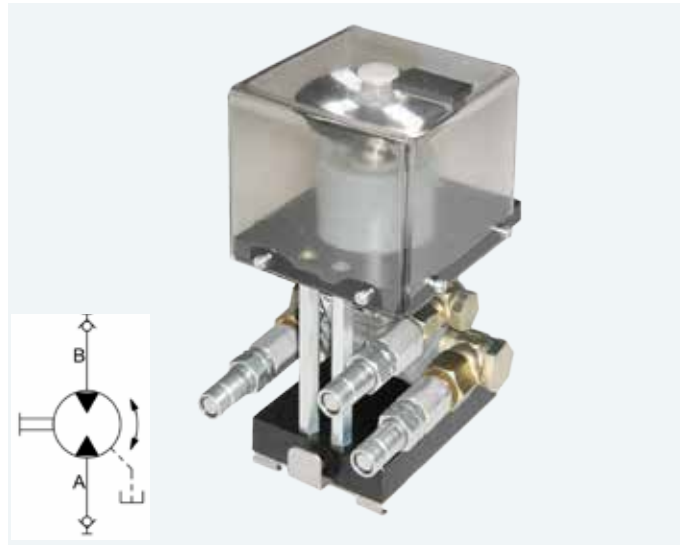
Axial piston motors in bent axis design are displacement machines with one cylinder drum pivot-mounted diagonally to the output axis. The pistons in the cylinder drum are positioned axially. The inflowing hydraulic fluid generates stroke motion of the pistons, resulting in rotation of the output shaft.

The motor shaft is fitted with a disc with reflective stripes and a protective housing made of Plexiglas which serves as contact protection and for holding optional speed sensor (material number R900892375, see page 195). The motor is suitable for both clockwise and anticlockwise rotation. Connections are via self-sealing coupling plugs.

Dimensions	mm (L x W x H)	130 x 230 x 205
Weight	kg	5.2
Working pressure max.	bar	120
Displacement	cm ³ /rev	4.93
Industrial type	A2F5/60W-C3	
Oil flow max.	l/min	49
Speed max.	RPM	10 000

Accessories

Designation	Material number	Quantity
Speed sensor	R900892375	1



Motors

Planetary motor

Material number	R961008748
Material short text	DRIVE MOTOR TS-HC-EPMM-S 8 C

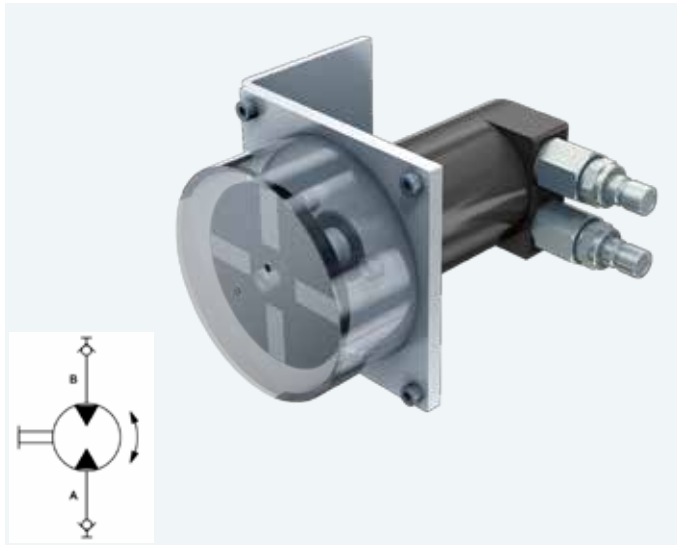
Planetary motors according to the gerotor principle are displacement machines with displacement chambers formed by the gear tooth system of pinion and internal gear, whereby the pinion has one tooth less than the internal gear. The pinion and the internal gear of these annular gear motors have a fixed rotational axis.

The motor shaft is fitted with a disc with reflective stripes and a protective housing made of Plexiglas which serves as contact protection and for holding optional speed sensor (material number R900892375, see page 195). The motor is suitable for both clockwise and anticlockwise rotation. Connections are via self-sealing coupling plugs.

Dimensions	mm (L x W x H)	156 x 115 x 155
Weight	kg	2.65
Working pressure max.	bar	120
Displacement	cm ³ /rev	8.2
Industrial type	EPMM-S8C	
Oil flow max.	l/min	16
Speed max.	RPM	1950

Accessories

Designation	Material number	Quantity
Speed sensor	R900892375	1



Mobile hydraulics

Hydraulic pilot control unit 2 levers 2-2TH6

Material number	R961005967
Material short text	JOYSTICK VALVE TS-HC-2-2 TH6 L70-10&

This hydraulic pilot control unit is e.g. used to operate directional valve spools. The pilot pressure at the output is controlled by deflecting the lever. The pilot control unit consists of 2 elements with 2 hydraulic pressure reducing valves each.
2 levers without detent;
Connections via self-sealing coupling plugs.

Dimensions	mm (L x W x H)	363 x 200 x 192
Weight	kg	4.5
Inlet pressure max.	bar	50
Pilot pressure max.	bar	35
Industrial type	2-2TH6L70-10/L70-M01	



Hydraulic pilot control unit joystick 4TH6

Material number	R961005968
Material short text	JOYSTICK VALVE TS-HC-4 TH6E 97-14/T&

This hydraulic pilot control unit is e.g. used to operate directional valve spools. The pilot pressure at the output is controlled according to a characteristic curve by deflecting the lever. A lever allows for the parallel control of two actuators.
The pilot control unit consists of one element with 4 hydraulic pressure reducing valves. 1 lever;
Connections via self-sealing coupling plugs.

Dimensions	mm (L x W x H)	405 x 213 x 184
Weight	kg	5
Inlet pressure max.	bar	50
Pilot pressure max.	bar	35
Industrial type	4TH6E 97-14/TT03M01	



Mobile hydraulics

Mobile control block Throttle control 3 SM12	
Material number	R961005970
Material short text	HY-MANIFOLD BLOCK TS-HC-SM12 3EL RR L&

The hydraulic control block with throttle control is used to control hydraulic actuators. The control block is controlled by manual lever motion or hydraulically. The actuator motion is effected depending on the load pressure and the pressure difference at the opening cross-section. The pressure difference is load pressure-dependent and not compensated.

The control block consists of an input and end element, 3 directional control valve elements with 2 hydr. controls and one manual operation. Input element with P connection; end element with T connection and P3 pressure forwarding; 2 secondary limitations.

Connections via self-sealing coupling plugs

Dimensions	mm (L x W x H)	366 x 275 x 344
Weight	kg	14
Working pressure max.	bar	120
Pilot pressure max.	bar	35
Industrial type	SM12 3EL BR LOHR	



Mobile control block LUDV 2SX-12	
Material number	R961005966
Material short text	HY-MANIFOLD BLOCK TS-HC-SX12 2EL RR L&

The hydraulic control block with LUDV control is used for the control of hydraulic actuators. The control block is controlled hydraulically. The actuator motion is effected depending on the pilot pressure and the pressure difference at the opening cross-section. The smallest pressure difference is controlled by the pump controller, the highest one by the downstream pressure compensators. The highest load pressure is fed in to the pump controller as LS signal. In case of undersupply (requested flow larger than the max. possible quantity supplied by the pump), the downstream pressure compensators are operated in closing direction. This ensures that in case of undersupply, no actuator will stop.

The control block consists of an input and end element and 2 directional control valve elements with hydraulic control.

In the input element, the LS pressure limitation and the unloading are realized. Every directional control valve is equipped with outlet pressure valves. The flow rate can be set by means of stroke limitations.

Connections via self-sealing coupling plugs

Dimensions	mm (L x W x H)	366 x 195 x 374
Weight	kg	17
Working pressure max.	bar	120
Pilot pressure max.	bar	35
Industrial type	SX12 2EL BR LOHR	



Mobile hydraulics

Mobile control block Load-sensing 2M4-12

Material number	R961005969
Material short text	HY-MANIFOLD BLOCK TS-HC-M4-7283-20/2M4&

The hydraulic control block with load-sensing control is used for the control of hydraulic actuators. The control is effected by manual lever motion or hydraulically. The actuator motion is effected depending on the pilot pressure and the pressure difference at the opening cross-section. Input element with pilot oil supply.

The pressure difference is controlled by the upstream pressure compensators. The highest load pressure is fed in to the pump controller as LS signal via a shuttle valve chain.

The control block consists of an input and end element and 2 directional control valve elements with hydraulic control and a manual operation. In the end element with LS unloading, 4 secondary limitations, 2 of them adjustable. One directional control valve element is equipped with LS pressure control valves. The flow rate can be set by means of stroke limitations.

Connections via self-sealing coupling plugs

Dimensions	mm (L x W x H)	366 x 280 x 391
Weight	kg	19
Working pressure max.	bar	120
Pilot pressure max.	bar	35
Industrial type	M4-7283-20/2M4-12JHLSYV01	



Mobile hydraulics

Electronic 2-axis joystick (with power outputs) with connection unit and programming interface

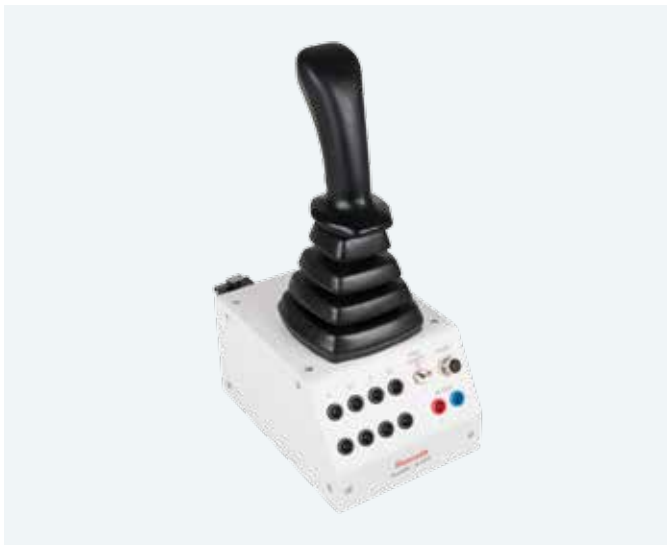
Material number	R901407766
Material short text	JOYSTICK VALVE TS-HC-4 THE5 E-20/TT&

The electronic remote control with integrated power electronics (joystick) is used to control electro-hydraulically operated mobile control blocks. By deflecting the operating lever, 2 of 4 cam followers can be operated at a time; one solenoid is attached to each cam follower. Everyone of the solenoids is led along a Hall sensor. Up to two sensors can be activated in parallel. The signals are recorded and analyzed by programmable electronics.

The joystick is fastened on a housing with connection unit and programming interface.

The joystick is used in connection with the remote control plate (R901408448).

Dimensions	mm (LxWxH)	152 x 228 x 352
Weight	kg	2.55
Industrial type	4THE5	
Operating voltage	VDC	24



Remote control plate with 4 proportional pressure reducing valves

Material number	R901408448
Material short text	CONTROL PLATE TS-HC-HICFP02-4A-AL-&

The remote control plate is equipped with 4 proportional pressure reducing valves. They regulate a hydraulic pressure proportionally to the command value and use this pressure for the pilot control of more hydraulic components.

The remote control plate is used in connection with the remote control (joystick - R901407766).

Connections via self-sealing coupling plugs.

Dimensions	mm (LxWxH)	233 x 127 x 138
Weight	kg	3.84
Working pressure max.	bar	120
Industrial type Plate	HICP	
Industrial type Valves	MHDRE	



Mobile hydraulics

Steering system with steering unit, steering assembly and steering wheel

Material number	R901403830
Material short text	STEERING UNIT TS-HC R913048340

The steering system consists of a steering unit, the steering assembly and the steering wheel.
The steering unit comprises the steering valve with rotary spool, the rotor kit, the pressure relief valve for system and/or LD pressure, two shock valves, one anti-cavitation valve and one non-return valve. The steering column serves as a connection element between steering wheel and steering unit. The rotary motion of the steering wheel is transmitted via the integrated steering shaft to the control spool of the steering valve and the rotor kit.
If the hydraulic pump fails, the steering unit works in emergency mode.

Connections via self-sealing coupling plugs.

Dimensions	mm (LxWxH)	250 x 350 x 250
Weight	kg	7.7
Working pressure max.	bar	120
Industrial type	LAGC50-15/ LD150-90M01	
Frame size	ccm/r	50
Setting of shock valves	bar	150
Setting of pressure relief valves	bar	90

Priority valve, 3-way flow control valve in Closed Center Load-sensing version

Material number	R901403832
Material short text	PRIORITY VALVE TS-HC R913048337

Priority valves provide for a division of the pump flow to the steering system and to the work hydraulics whereas supply of the steering takes priority.

The priority valve works independently of the steering pressure and of the load pressure of the work hydraulics.

Connections via self-sealing coupling plugs.

Dimensions	mm (LxWxH)	155 x 125 x 181
Weight	kg	1.85
Working pressure max.	bar	120
Industrial type	LPS40R11/LD7- 643/01	
Size (flow)	l/min	40



Mobile hydraulics

Ackermann steering functional module with one double-acting cylinder, 2 displays for steering angle (1 per wheel) and steering stroke, protective housing

Material number	R901419580
Material short text	STEERING TS-HC-AL

The Ackermann steering functional module simulates the function of the hydraulic Ackermann steering of mobile machines. The central component is a double-acting cylinder.

According to the real vehicle, the kinematics of the functional model are set-up so that when driving in circles, the steering angles for both wheels are different.

All moved parts are covered by contact protection made of Plexiglas to which the scales for piston stroke and wheel angle are attached.

Connections via self-sealing coupling plugs.

Dimensions	mm (LxWxH)	691 x 76 x 175
Weight	kg	4.2
Working pressure max.	bar	120
Setting of pressure relief valves	bar	90



Articulated steering functional module with 2 differential cylinders, display for kinking angle and steering stroke, protective housing

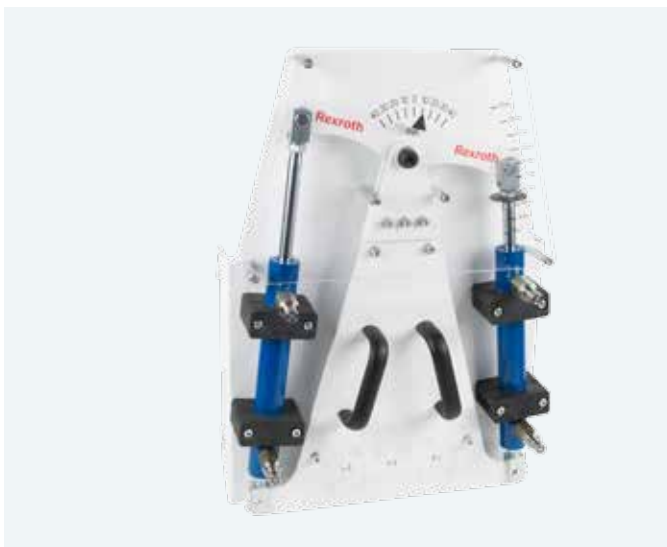
Material number	R901419587
Material short text	STEERING TS-HC-KL

The Articulated steering functional model simulates the function of the hydraulic articulated steering of mobile machines. The hydraulic control of both hydraulic cylinders causes a deflection of the connecting bar between the ends of the two piston rods.

All moved parts are covered by contact protection made of Plexiglas to which the scales for piston stroke and kinking angle are attached.

Connections via self-sealing coupling plugs.

Dimensions	mm (LxWxH)	365 x 162 x 510
Weight	kg	6.65
Working pressure max.	bar	120



Hydraulic accessories

Hydraulic accumulator, pressure filter, sight glass

Accumulator module	
Material number	R961002503
Material short text	DIAPHRAGM ACCUMUL TS-HC-HAD0,7-210-1X/&

The accumulator module takes up a certain volume of pressurized liquid and releases it again if required.

The accumulator shut-off block with pressure relief valve and manometer serves the manual limitation, blocking and unloading of the diaphragm-type accumulator.

Connections via self-sealing coupling plugs.

The accumulator module is delivered without filling.

Before operating it, fill it with nitrogen; for the corresponding instruction, please refer to the operating instructions.

Dimensions	mm (L x W x H)	225 x 165 x 350
Weight	kg	9.9
Nominal volume	l	0.75
Nominal pressure	bar	100
Pressure rating	bar	100
Industrial type	Accumulator: HAD 0,7-210-1X Accumulator shut-off block: ABZSS10M-2X/100B/S30V	

Accessories		
Designation	Material number	Quantity
Test and filling device for hydraulic accumulator	0538103012	1

Test and filling device for hydraulic accumulator	
Material number	0538103012
Material short text	TEST AND FILLING DEVICE FUER MEMBRANSPEICHER

By means of the test and filling device, the hydraulic accumulator can be filled with nitrogen and/or the available pre-filling pressure can be checked and changed.

Dimensions	mm (L x W x H)	450 x 350 x 100
Manometer display	bar	0-250



Hydraulic accumulator, pressure filter, sight glass

Line filter for hanging up		
Material number	R961004334	
Material short text	PRESS FILTER TS-HC-ABZFD-S0040-10&	
Line filter for installation into pressure lines, with bypass valve and visual clogging indicator.		
Connections via self-sealing coupling plugs.		
Dimensions	mm (L x W x H)	167 x 108 x 218
Weight	kg	2.1
Nominal pressure	bar	100
Industrial type	ABZFD-S0040-10N-100-1X/M-A	
Filter rating	μ	10



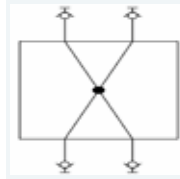
Sight glass		
Material number	R961006596	
Material short text	SIGHT GLASS TS-HC-120BAR-178X55	
The sight glass is used to visualize air locks in hydraulic fluids.		
Connections via self-sealing coupling plugs and coupling socket.		
Dimensions	mm (L x D)	178 x 55
max. admissible working pressure	bar	120
Material	Aluminum, transparent plastic	



Distributor

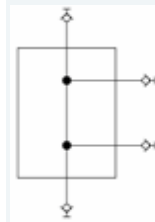
Hydraulic distributor 4 ports on component plate

Material number	R961002563
Material short text	DISTRIBUTOR TS-HC-4F-4M-P
Hydraulic distributor, 4 ports, on component plate; Connections via self-sealing coupling plugs	
Dimensions	mm (L x W x H) 80 x 125 x 64
Weight	kg 0.97
Working pressure max.	bar 120



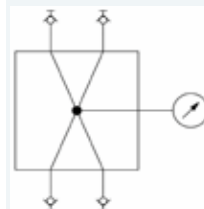
Hydraulic distributor 4 ports

Material number	R961002485
Material short text	DISTRIBUTOR TS-HC-4F-3M1W
Hydraulic distributor, 4 ports; Connections via self-sealing coupling plugs and coupling socket	
Dimensions	mm (L x W x H) 168 x 45 x 80
Weight	kg 0.63
Working pressure	bar 120



Manometer 0 to 100 bar with distributor, 4 ports, on component plate

Material number	R961002530
Material short text	PRESSURE GAUGE TS-HC-VERT-4F-M
Hydraulic distributor, 4 ports, on component plate with manometer; Connections via self-sealing coupling plugs	
Dimensions	mm (L x W x H) 80 x 125 x 91
Weight	kg 1.15
Working pressure	bar 120



Hose lines with locking couplings, nominal diameter DN5

Hose line 630 mm		
Material number	R961002474	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W00&	
Hose length	mm	630
Weight	kg	0.64
Working pressure	bar	120
Quick coupling	R96100481	Sleeve M16 x 1.5
Smallest bending radius	mm	85
Hose line 1000 mm		
Material number	R961002475	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W00&	
Hose length	mm	1000
Weight	kg	0.74
Working pressure	bar	120
Quick coupling	R96100481	Sleeve M16 x 1.5
Smallest bending radius	mm	85
Hose line 1500 mm		
Material number	R961002473	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W00&	
Hose length	mm	1500
Weight	kg	0.86
Working pressure	bar	120
Quick coupling	R96100481	Sleeve M16 x 1.5
Smallest bending radius	mm	85
Hose line 2000 mm		
Material number	R961002480	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W00&	
Hose length	mm	2000
Weight	kg	0.95
Working pressure	bar	120
Quick coupling	R96100481	Sleeve M16 x 1.5
Smallest bending radius	mm	85
Hose line 2500 mm		
Material number	R961002479	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W00&	
Hose length	mm	2500
Weight	kg	1.12
Working pressure	bar	120
Quick coupling	R96100481	Sleeve M16 x 1.5
Smallest bending radius	mm	85



Hose lines with locking couplings, nominal diameter DN5 and Minimes port

Hose line 630 mm with Minimes port		
Material number	R961002481	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W00&	
Hose length	mm	630
Weight	kg	0.83
Working pressure	bar	120
Quick coupling	R96100481	Sleeve M16 x 1.5
Smallest bending radius	mm	85
Minimes port	Threaded coupl.	AB20-11/K1G1/4

Hose line 1000 mm with Minimes port		
Material number	R961002476	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W00&	
Hose length	mm	1000
Weight	kg	0.93
Working pressure	bar	120
Quick coupling	R96100481	Sleeve M16 x 1.5
Smallest bending radius	mm	85
Minimes port	Threaded coupl.	AB20-11/K1G1/4

Hose line 1500 mm with Minimes port		
Material number	R961002482	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W00&	
Hose length	mm	1500
Weight	kg	1.05
Working pressure	bar	120
Quick coupling	R96100481	Sleeve M16 x 1.5
Smallest bending radius	mm	85
Minimes port	Threaded coupl.	AB20-11/K1G1/4

Hose line 2000 mm with Minimes port		
Material number	R961002478	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W00&	
Hose length	mm	2000
Weight	kg	1.18
Working pressure	bar	120
Quick coupling	R96100481	Sleeve M16 x 1.5
Smallest bending radius	mm	85
Minimes port	Threaded coupl.	AB20-11/K1G1/4



Hose lines with locking couplings, nominal diameter DN5 and 90° fitting

Hose line 700 mm with 90° fitting		
Material number	R961004332	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W90&	
Hose length	mm	700
Weight	kg	0.68
Working pressure max.	bar	120
Quick coupling	R961000481	Sleeve M16 x 1.5
Smallest bending radius	mm	85

Hose line 1000 mm with 90° fitting		
Material number	R961004331	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W90&	
Hose length	mm	1000
Weight	kg	0.85
Working pressure max.	bar	120
Quick coupling	R961000481	Sleeve M16 x 1.5
Smallest bending radius	mm	85

Hose line 2000 mm with 90° fitting		
Material number	R961002477	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W90&	
Hose length	mm	2000
Weight	kg	1.08
Working pressure	bar	120
Quick coupling	R96100481	Sleeve M16 x 1.5
Smallest bending radius	mm	85



Hose lines with locking couplings DN5, 90° fitting and Minimes port

Hose line 700 mm with 90° fitting and Minimes port

Material number	R961004329	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W90&	
Hose length	mm	700
Weight	kg	0.68
Working pressure max.	bar	120
Quick coupling	R961000481	Sleeve M16 x 1.5
Smallest bending radius	mm	85
Minimes port	Threaded coupl.	AB20-11K1 G1/4

Hose line 1000 mm with 90° fitting and Minimes port

Material number	R961004330	
Material short text	HOSE ASSEMBLY TS-HC-ZN10031-08-W90&	
Hose length	mm	1000
Weight	kg	0.75
Working pressure max.	bar	120
Quick coupling	R961000481	Sleeve M16 x 1.5
Smallest bending radius	mm	85
Minimes port	Threaded coupl.	AB20-11K1 G1/4

Pressure release sleeve

Material number	R961002927	
Material short text	COUPLING BOX TS-HC-1-15-005-9-XX0&	
For unloading clamped pressures. A spindle is used to open pressurized coupling nipples.		
Dimensions	mm (L x D)	79 x 50



Electrics

Distributor 19" variant - 10-fold		
Material number	R961009613	
Material short text	DISTRIBUTOR TS-EC-E-VER-NN-NN-B10	
Distributor, 10-fold, the red bushes for 24 V are electrically connected, the blue bushes for 0 V as well. Aluminum front plate with scratch-proof labeling, for fastening in assembly carrier in 19" technology, contact-protected 4 mm laboratory sockets.		
Height	HE*	3 U
Width	TE**	15
Depth	mm	36
Weight	g	136
Protection class	IP50	
Operating voltage	VDC	24
Current per bush max.	A	4



Circuit element 19" variant - 1 switch + 2 push buttons, 3 NO contacts, 3 NC contacts		
Material number	R961009617	
Material short text	CONTROL ELEMENT TS-EC-E-SST-S3-S3O3	
1 switch with detent, 1 NC contact and 1 NO contact, operation by rotating the switch knob; 2 push buttons with spring return, 1 NC contact and 1 NO contact each, operation by pushing the pushbutton. Aluminum front plate with scratch-proof labeling, for fastening in assembly carrier in 19" technology, contact-protected 4 mm laboratory sockets		
Height	HE*	3 U
Width	TE*	15
Depth	mm	36
Weight	g	136
Protection class	IP50	
Operating voltage	VDC	24
Current max.	A	4



*HE: Height unit

*TE: Horizontal pitch

Electrics

Display unit 19" variant - display 4x visual, 1x acoustic

Material number	R961009615	
Material short text	INDICATOR UNIT TS-EC-E-AZE-NN-04A1	
	Visual and acoustic signal display; display 4 x LED red, 1 x acoustic with buzzer, displays are active if 24 V are available at bush pair. Aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology, contact-protected 4 mm laboratory sockets	
Height	HE*	3 U
Width	TE*	15
Depth	mm	36
Weight	g	136
Protection class	IP50	
Operating voltage	VDC	24
Current consumption LED	mA	20
Current consumption buzzer	mA	10

Relay 19" variant - 4 changeover contacts

Material number	R961009538	
Material short text	RELAY TS-EC-E-REL-NN-W4-NN	
	1 relay with 4 changeover contacts; direct-switching; control light illuminated in switched condition; aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology, contact-protected 4 mm laboratory sockets	
Height	HE*	3 U
Width	TE*	15
Depth	mm	42
Weight	g	145
Protection class	IP50	
Operating voltage	VDC	24
Drop-out voltage	VDC	1.2
Response voltage	VDC	18
Current max.	A	4

*HE: Height unit

*TE: Horizontal pitch



Electrics

Relays 19" variant - with pick-up delay, 1 NO contact, 1 NC contact

Material number R961009600

Material short text RELAY TS-EC-E-RAN-NN-S1O1

Relay with 1 NO contact and 1 NC contact, switching with pick-up delay, delay time continuously adjustable up to 15 s, control light illuminated in switched condition; aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology, contact-protected 4 mm laboratory sockets

Height HE* 3 U

Width TE* 15

Depth mm 53

Weight g 136

Protection class IEC 60529 IP 50

Operating voltage VDC 24

Current consumption mA 80

Current max. A 4

Delay time s 0.5..15



Relays 19" variant - with drop-out delay, 1 NO contact, 1 NC contact

Material number R961009601

Material short text RELAY TS-EC-E-RAB-NN-S1O1

Relay with 1 NO contact and 1 NC contact, switching with drop-out delay, delay time continuously adjustable up to 15 s, control light illuminated in switched condition; aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology, contact-protected 4 mm laboratory sockets

Height HE* 3 U

Width TE* 15

Depth mm 53

Weight g 137

Protection class IEC 60529 IP 50

Operating voltage VDC 24

Current consumption mA 80

Current max. A 4

Delay time s 0.5..15



*HE: Height unit

*TE: Horizontal pitch

Electrics

Set-point adjuster 19" variant – +/- 10 V

Material number	R961009632
Material short text	SET-POINTGENERATOR TS-EC-E-SGM-NN-NN-NN

10-turn potentiometer; 1 rotary switch with 3 positions; visual display of the selected polarity; contact-protected 4 mm laboratory sockets for the voltage supply; 2 mm laboratory sockets for the command values; aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology, output voltage 0 - 10V

Height	HE*	3 U
Width	TE*	21
Depth	mm	55
Weight	g	221
Protection class		IP50
Operating voltage	VDC	24
Output voltage	V	± 10



Display unit 19" variant – 2 displays, max. display range 0-20 V

Material number	R961009623
Material short text	INDICATOR UNIT TS-EC-E-AZE-A2-A20V

2 digital voltmeters; display 3 ½ - figures; figure height 13 mm; aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology, contact-protected 4 mm laboratory sockets for the voltage supply; measured value connections with 2 mm and 4 mm laboratory sockets;

Height	HE*	3 U
Width	TE*	21
Depth	mm	82
Weight	g	325
Protection class	IEC 60529	IP50
Operating voltage	VDC	24
Measured voltage	VDC	± 20
Internal resistance	MΩ	1



*HE: Height unit
*TE: Horizontal pitch

Electrics

Set-point adjuster 19" variant – with ramp		
Material number	R961009631	
Material short text	SET-POINTGENERATOR TS-EC-E-SGG-NN-NN-NN	
Command value module for 4 selectable command values and 5 ramp times per command value; aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology, contact-protected 4 mm laboratory sockets; command value connections with 2 mm laboratory sockets		
Height	HE*	3 U
Width	TE*	21
Depth	mm	90
Weight	g	350
Protection class	IEC 60529	IP50
Operating voltage	VDC	24
Output voltage	VDC	± 10
Current consumption	mA	500



Adapter plate 19" variant – round connector laboratory socket		
Material number	R961009630	
Material short text	ADAPTER PLATE TS-EC-E-ADA-NN-NN-NN	
Adapter for connecting the 7-pole connector plug with laboratory sockets; aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology; 4 mm laboratory sockets for DC24V; contact-protected; 2 mm laboratory sockets for command and actual values; gold-plated contacts		
Height	HE*	3 U
Width	TE*	15
Depth	mm	53
Weight	g	130
Protection class	IEC 60529	IP50
Operating voltage	VDC	24



*HE: Height unit

*TE: Horizontal pitch

Electrics

Control module TS-BPS 30.0, analog controller module, 30TE

Material number	R961004782
Material short text	REGULATOR TS-EC-E-RPM-NN-NN-MA&

For setting up easy position controls with analog position measurement system. For controlling valves with installed electronics. The controller module is only equipped with the most essential features for setting up a control. The entire signal processing is effected analogously. Command and actual values are compared and the control signal resulting from the control parameters is forwarded to the output. Cable break detection for actual value cable; interfaces short-circuit-proof; test points on front plate; aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology; compensation step can be switched off; position: PT1 control; area adjustment cylinder

- ▶ Command value (2 x 2 mm bush, yellow)
- ▶ Output, control signal (2 x 2 mm bush, yellow)
- ▶ Actual value (5-pole bush M12)
- ▶ Enable signal (4 mm bush, black)
- ▶ Inposition signal (4 mm bush, black)
- ▶ Actual value adjustment "zero gain"
- ▶ Zero point valve "zero valve"

Height	HE*	3 U
Width	TE*	21
Depth	mm	82
Dimensions	mm (L x W x H)	153 x 82 x 129
Weight	g	492
Protection class	IEC 60529	IP50
Operating voltage	VDC	24
Current consumption	mA	500
Command value external	VDC	0-10
Ramp time	s	0.1-10
Control (proportional)	Kp	1-16
Time constant	KT1	1-16
I Control (integral)	KI	1-16
Area adjustment	Cylinder	1-16
Output signal Control voltage	V	± 10



*HE: Height unit

*TE: Horizontal pitch

Electrics

Control module BPS 2.1, adapter for analog control amplifier VT-VRPA1, 34TE

Material number R900711658

Material short text ADAPTER BEDIENPLATTE HPF-BPS&

Adapter for amplifier VT-VRPA1; converting the connections from connector strip to laboratory sockets; setting command value signals; connecting the position transducer at the valve and forwarding to the amplifier; aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology; voltage supply (red/black)

- ▶ 10-turn potentiometer for external command value presetting (3 x yellow)
- ▶ Control of the solenoids (2 x black)
- ▶ Connection for valve position transducer (3-pole plug-in connector)
- ▶ - 9 V supply for command value presetting (2 x blue)
- ▶ + 9 V supply for command value presetting (2 x red)
- ▶ Measurement of the set ramp (2 x white)
- ▶ Command value presetting (2 x yellow)
- ▶ external command value entry from PLC or CNC (2 x yellow)
- ▶ Switching input "Ramp off" (1 x green)

Height	HE*	3 U
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Width	TE*	34
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Depth	mm	180
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Weight	g	420
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Protection class		IP50
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Supply voltage	VDC	24
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*HE: Height unit

*TE: Horizontal pitch

Electrics

Control module VT-VRPA1 proportional amplifier, 4TE

Material number	R901057058
Material short text	AMPLIFIER VT-VRPA1-150-1X/V0/0

For controlling direct-operated proportional control valves, with one solenoid as actuator, with electric position feedback, suitable for directional, pressure and flow control valves; aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology;

- ▶ Command value signal inputs: 0 to + 6 V; 0 to + 9 V; 0 to + 10 V; 0 to 20 mA; 4 to 20 mA (jumpers)
- ▶ Potentiometer setting on the front plate for zero point and amplitude attenuator
- ▶ Measuring sockets for the ramp time
- ▶ Enable input and "Ramp off" input
- ▶ Jumpers for switching the maximum ramp time 0.02 to 5 s or 0.2 to 50 s
- ▶ Outputs for command value (0 to + 6 V) and actual value (0 to – 6 V)
- ▶ LED display "Ready for operation"
- ▶ Reverse polarity protection

Height	HE*	3 U
Width	TE*	4
Depth	mm	180
Supply voltage	VDC	24
Operating current	max. A	1.5
Industrial type	VT-VRPA1-150-1X/V0/0	



*HE: Height unit

*TE: Horizontal pitch

Electrics

Power supply unit 240V/50-60 Hz		
Material number	R901468181	
Material short text	POWER STAGE TS-EC-E-100-240V/50-&	
Power supply unit for direct voltage 24 VDC/6 A Contact-protected 4 mm safety sockets (red for 24 V, blue for 0 V), operating light, mains connection cable, aluminum front plate with scratch-proof labeling. For mounting in assembly carriers in 19" technology.		
Height	HE*	3 U
Width	TE*	42
Depth	mm	172
Weight	kg	2.5
Protection class	IEC 60529	IP20
Operating voltage	VAC	100-240
Mains frequency	Hz	50-60
Output voltage	VDC	24
Output current	A	6



Power supply unit 230V/10A		
Material number	R961008981	
Material short text	POWER STAGE TS-EC-230V/10A	
Power supply unit for direct voltage 24 VAC/10 A Contact-protected 4 mm safety sockets (red for 24 V, blue for 0 V), operating light, mains connection cable, plastic housing, aluminum front plate with scratch-proof labeling. Quick fastening system for grooved plate.		
Dimensions	mm (LxWxH)	280x150x140
Weight	kg	2.13
Protection class	IEC 60529	IP20
Operating voltage	VAC	110-230
Mains frequency	Hz	50
Output voltage	VDC	24
Output current	A	10



*HE: Height unit

*TE: Horizontal pitch

Electrics

Front plate 3HE/21TE		
Material number	1827008408	
Material short text	FRONT PANEL TS-MC-3HE/21TE 30838&	
Front plate for closing the unused installation areas at the 19" frame; aluminum; anodized, colorless; 2.5 mm thick; 4 captive screws		
Height	HE*	3 U
Width	TE*	21
Weight	kg	0.05



Front plate 3HE/8TE		
Material number	1827008409	
Material short text	FRONT PANEL TS-MC-3HE-8TE	
Front plate for closing the unused installation areas at the 19" frame; aluminum; anodized, colorless; 2.5 mm thick; 4 captive screws		
Height	HE*	3 U
Width	TE*	8
Weight	kg	0.038



Front plate 3HE/7TE		
Material number	1827008410	
Material short text	FRONT PANEL TS-MC-3HE-7TE	
Front plate for closing the unused installation areas at the 19" frame; aluminum; anodized, colorless; 2.5 mm thick; 2 captive screws		
Height	HE*	3 U
Width	TE*	7
Weight	kg	0.028



*HE: Height unit
*TE: Horizontal pitch

Electrics

Front plate 3HE/6TE		
Material number	R913004345	
Material short text	FRONT PANEL TS-MC-3HE/6TE	
Front plate for closing the unused installation areas at the 19" frame; aluminum; anodized, colorless; 2.5 mm thick; 2 captive screws		
Height	HE*	3 U
Width	TE*	6
Weight	kg	0.027

Front plate 3HE/4TE		
Material number	R961001336	
Material short text	FRONT PANEL TS-MC-3HE4TE	
Front plate for closing the unused installation areas at the 19" frame; aluminum; anodized, colorless; 2.5 mm thick; 2 captive screws		
Height	HE*	3 U
Width	TE*	4
Weight	kg	0.025



Control unit housing variant – BIBB module + I/O module		
Material number	R961009675	
Material short text	OPERATING UNIT TS-EC-G-CR-SVAI	
The control unit is used to establish electrical connections on the WS200 workstation. The number of the electrical components allows for the completion of all exercises according to BIBB A-Z. Via the I/O module, connection to a PC can be established. By means of corresponding software (e.g. Automation Studio), electr. valves and limit switches can be controlled.		
Control module 1 switch and 2 push buttons with 1 NC/NO contact each, 2 push buttons with NO contact, 6 relays, relay with pick-up delay, relay with drop-out delay, 12 x 24V distributor and 8 x 0V distributor, 8 sensor connections, 6 valve connections, 8 analog inputs 0 - 10 V, 4 analog inputs 4 - 20 mA, power supply unit 24V 10A, USB port, housing and mains cable, contact-protected 4 mm laboratory sockets, 25-pole Sub-D connector for connection at valve terminal, includes fastening system for fastening at the aluminum profile.		
Height	mm	296
Width	mm	455
Depth	mm	100
Weight	g	4930
Operating voltage	VDC	24
Supply voltage	VAC	110 - 230
Delay time	s	1 - 15



*HE: Height unit

*TE: Horizontal pitch

Electrics

Control unit housing variant – BIBB module

Material number	R961009678
Material short text	OPERATING UNIT TS-EC-G-CR

The control unit is used to provide electrical connections on the WS200 workstation. The number of the electrical components allows for the completion of all exercises according to BIBB A-Z. Control module 1 switch and 2 push buttons with 1 NC/NO contact each, 2 push buttons with NO contact, 6 relays, relay with pick-up delay, relay with drop-out delay, 8 x 24V distributor and 6 x 0V distributor, 2 LED displays, 1 acoustic display, power supply unit 24V 10A, housing and mains cable, contact-protected 4 mm laboratory sockets, incl. fastening system for fastening at the aluminum profile.

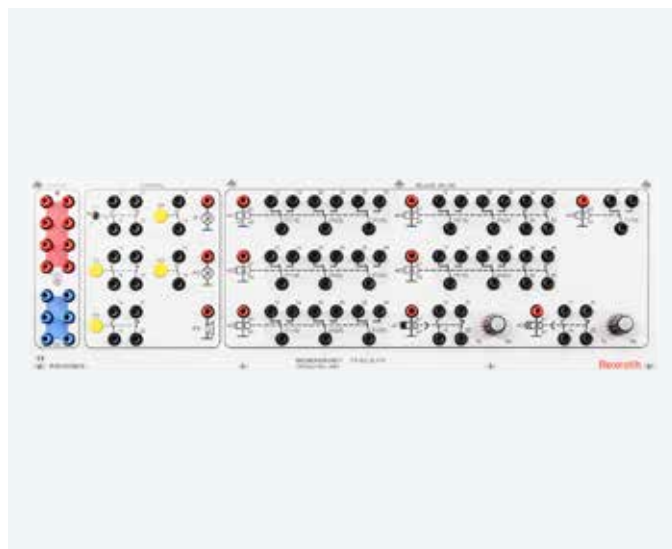
Height	mm	296
Width	mm	455
Depth	mm	100
Weight	g	4650
Operating voltage	VDC	24
Supply voltage	VAC	110 - 230
Delay time	s	1 - 15

Control unit 19" variant – BIBB module

Material number	R961009676
Material short text	OPERATING UNIT TS-EC-E-CR

This control unit corresponds to the previous control unit housing variant (R961009678). It is designed as 19" variant and can be mounted in the assembly carrier of the WS290 workstation.

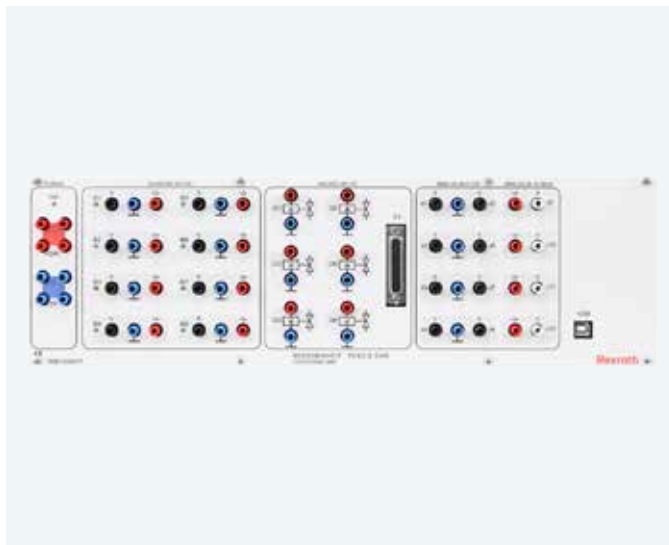
Height	HE*	3 U
Width	TE*	84
Depth	mm	85
Weight	g	1860
Operating voltage	VDC	24
Supply voltage	VAC	110 - 230
Delay time	s	1 - 15



*HE: Height unit
*TE: Horizontal pitch

Electrics

Control unit 19" variant – I/O module		
Material number	R961009677	
Material short text	OPERATING UNIT TS-EC-E-SVAI	
<p>The control unit is designed as 19" variant and can be mounted in the assembly carrier of the WS290 workstation. Via the I/O module, a connection to the PC can be established. By means of corresponding software (e.g. Automation Studio), electr. valves and limit value switches can be controlled.</p> <p>Control module 19" installation technology, 8 sensor connections with switching characteristics, 8 analog inputs 0 - 10 V, 4 analog inputs 4 - 20 mA, 6 valve connections, 25-pole Sub-D connector for connection at valve terminal, contact-protected 4 mm laboratory sockets, USB port</p>		
Height	HE*	3 U
Width	TE*	84
Depth	mm	128
Weight	g	970
Operating voltage	VDC	24
Delay time	s	1 - 15



Adapter plate 19" variant – 1 switch, cold-device socket, connecting cable 0.5m		
Material number	R901384795	
Material short text	ADAPTER PLATE TS-EC-E-ADA-S1-NN-NN	
<p>Adapter plate for the supply of the power supply unit in the control unit 19" variant - BIBB module, cold-device socket with 2-pole switch, illuminated, mains cable 0.5 m length. Aluminum front plate with scratch-proof labeling; for fastening in assembly carrier in 19" technology;</p>		
Height	HE*	3 U
Width	TE*	19
Depth	mm	40
Weight	g	160
Operating voltage	VAC	230



*HE: Height unit

*TE: Horizontal pitch

Electrics

Input/output unit for Automation Studio, complete with housing, Snap-In, USB connection cable and software

Material number	R961008946	
Material short text	OPERATING UNIT TS-AT-FT-DIV-15055 &	
The FAMIC I/O box enables the connection and control of real functional models by means of Automation Studio. The I/O box is controlled from Automation Studio. 8 digital inputs and 8 digital outputs (24 VDC) are available. The functional model is connected via 4 mm safety sockets. For fastening at a grooved plate. The connection to the PC is established by means of a USB cable.		
Dimensions	mm (L x W x H)	150 x 85 x 71
Supply voltage	VDC	24



Solenoid cable with connector form A, black, with LED, with protective circuit

Material number	R901457044	
Material short text	CONNECTING CABLE TS-EC-VEN-SW-MIT-LED&	
Cable for controlling directional control valves, with LED, with protective circuit, with connector form A DIN 43650, 2-wire		
Dimensions	mm (L)	3000
Weight	kg	0.3



Solenoid cable with connector form A, black, without LED

Material number	R900846812	
Material short text	CONNECTING CABLE TS-EC-VEN-SW	
Cable for controlling directional control valves, without LED, with connector form A DIN 43650, 2-wire		
Dimensions	mm (L)	3000
Weight	kg	0.3



*HE: Height unit
*TE: Horizontal pitch

Electrics

Pressure switch cable with connector form A, black		
Material number	R900846817	
Material short text	CONNECTING CABLE TS-EC-HED-4F	
Cable for controlling pressure switches, with connector form A DIN 43650, 4-wire		
Dimensions	mm (L)	3000
Weight	kg	0.3



Cable set, small, measuring line 4 mm		
Material number	R900029597	
Material short text	CABLE SET TS-EC-KLEIN-BIBB	
Cable set for establishing safe, electrical plug-in connections for exercise set-ups.		
Consisting of 39 contact-protected measuring lines, 4 mm:		
▶ 10 x 250 mm long, red		
▶ in each case 5 x 250 mm long, blue and green		
▶ in each case 3 x 500 mm long, blue and black		
▶ 2 x 500 mm long, green		
▶ 5 x 500 mm long, red		
▶ in each case 2 x 1000 mm long, red and black		
▶ in each case 1 x 2000 mm long, red and blue		
Weight	kg	1.1



Cable set, large, measuring line 4 mm		
Material number	R900021502	
Material short text	CABLE SET TS-EC-GROSS-BIBB	
Cable set for establishing safe, electrical plug-in connections for exercise set-ups.		
Consisting of 64 contact-protected measuring lines, 4 mm:		
▶ in each case 5 x 250 mm long, green and blue		
▶ in each case 10 x 250 mm long, red and black		
▶ in each case 5 x 500 mm long, red and black		
▶ 2 x 500 mm long, green		
▶ 3 x 500 mm long, blue		
▶ 2 x 1000 mm long, green		
▶ 3 x 1000 mm long, blue		
▶ in each case 6 x 1000 mm long, red and black		
▶ in each case 1 x 2000 mm long, red and blue		
Weight	kg	1.8



Electrics

Cable 7-pole for integrated electronics

Material number	R961003550
Material short text	CONNECTING CABLE TS-EC-7POL-VTL-OBE

Cable for controlling proportional control valves, 7-pole connecting cable (6 + PE) for on board electronics (OBE); for connection to connector K31 with mating connector according to DIN EN 175201-804 (OBE side); line connector CA 6LS (for adapter plate R961009630); cable: LiYC 7 x 0.75 mm²

Dimensions	mm (L)	1500
Weight	kg	0.45

Cable set for command value/actual value measurement, 2 mm/2 mm

Material number	R961009488
Material short text	CABLE SET TS-EC-ST/ST-2MM-RT/S&

Cable set for command value/actual value measurement
2 contact-protected measuring lines each, 2mm/2mm in red and black

Weight	kg	0.12
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Cable set for command value/actual value measurement, 2 mm/4 mm

Material number	R900826555
Material short text	CABLE SET TS-EC-2MM-4MM

Cable set for command value/actual value measurement
3 contact-protected measuring lines each, 2mm/4mm in red and black

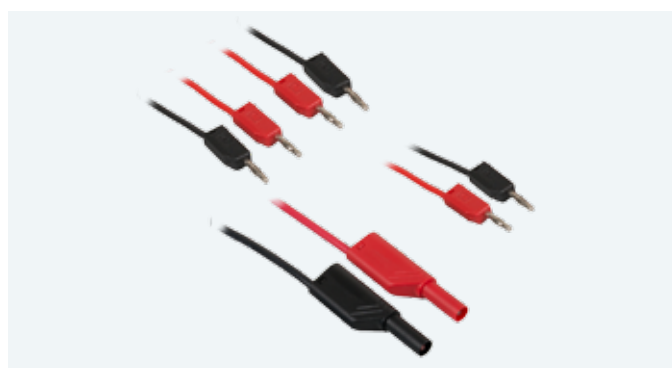
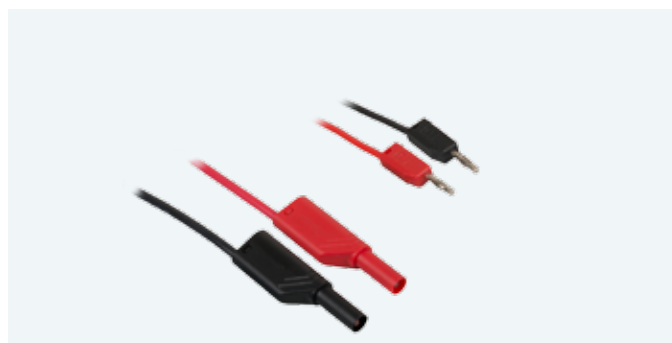
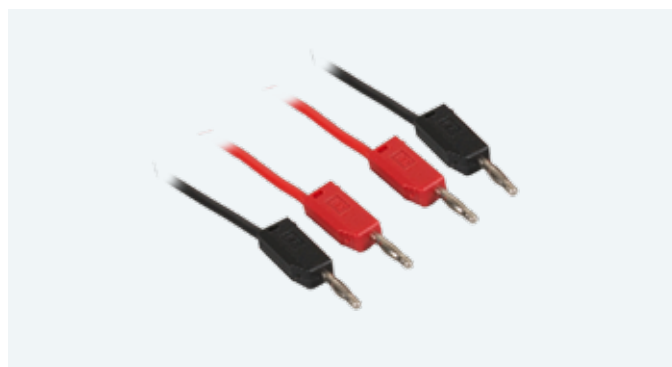
Weight	kg	0.1
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Cable set for command value/actual value measurement, 2 mm/2 mm and 2mm/4 mm

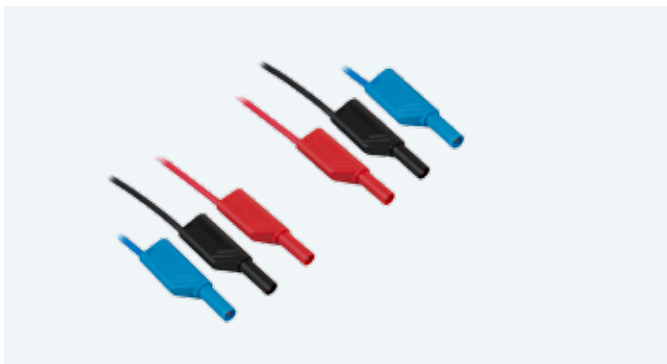
Material number	R901461031
Material short text	CABLE SET TS-EC-2/2MM-2/4MM-RT&

Cable set for command value/actual value measurement
2 contact-protected measuring lines each, 2mm/2mm in red and black
3 contact-protected measuring lines each, 2mm/4mm in red and black

Weight	kg	0.25
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Contact-protected measuring lines 4 mm	
Measuring lines for establishing safe, electrical plug-in connections for exercise set-ups. In each case 1x:	
Measuring line 250 mm, red	
Material number	1827003212
Material short text	MEASURING CABLE TS-EC-250MM-RD
Measuring line 250 mm, blue	
Material number	1827003213
Material short text	MEASURING CABLE TS-EC-250MM-BU
Measuring line 250 mm, black	
Material number	1827003214
Material short text	MEASURING CABLE TS-EC-250MM-BK
Measuring line 500 mm, red	
Material number	1827003215
Material short text	MEASURING CABLE TS-EC-500MM-RD
Measuring line 500 mm, blue	
Material number	1827003216
Material short text	MEASURING CABLE TS-EC-500MM-BU
Measuring line 500 mm, black	
Material number	1827003217
Material short text	MEASURING CABLE TS-EC-500MM-BK
Measuring line 1000 mm, red	
Material number	1827003218
Material short text	MEASURING CABLE TS-EC-1000MM-RD
Measuring line 1000 mm, blue	
Material number	1827003219
Material short text	MEASURING CABLE TS-EC-1000MM-BU
Measuring line 1000 mm, black	
Material number	1827003220
Material short text	MEASURING CABLE TS-EC-1000MM-BK
Measuring line 1500 mm, red	
Material number	1827003464
Material short text	MEASURING CABLE TS-EC-1500MM-RD
Measuring line 1500 mm, blue	
Material number	1827003465
Material short text	MEASURING CABLE TS-EC-1500MM-BU
Measuring line 1500 mm, black	
Material number	1827003466
Material short text	MEASURING CABLE TS-EC-1500MM-BK



Electrics

Position transducer cable for proportional flow control valve		
Material number	R900844180	
Material short text	SENSOR CABLE TS-EC-FUER-2FRE6B-2X	
Connecting cable for position transducer for proportional flow control valves with analog control; 3-pole and 3-wire		
Length	mm	3000
Weight	kg	0.23



Proximity switch, inductive		
Material number	R961003106	
Material short text	PROXIMITY SWITCH TS-EC-NBN8-18GM50-E2&	
Inductive proximity switch suitable for mounting with slotted housing and knurled screw. Activated by metallic object; switch indication by LED; contact-protected 4mm laboratory sockets; red 24V; blue 0V; black 24V signal		
Dimensions	mm (L)	3000
Weight	kg	0.2
Supply voltage	VDC	24
Detection range max.	mm	8
Reverse polarity protection		yes



Proximity switch, inductive, with NC and NO contact		
Material number	R961008585	
Material short text	PROXIMITY SWITCH TS-EC-NBB8-18GM60-A2	
Inductive proximity switch with NC and NO contacts. Suitable for mounting with slotted housing and knurled screw. Activated by metallic object; switch indication by LED; contact-protected 4mm laboratory sockets; red 24V; blue 0V; black signal NO contact, green signal NC contact		
Dimensions	mm (L)	3000
Weight	kg	0.2
Supply voltage	VDC	24
Detection range max.	mm	8
Reverse polarity protection		yes



Electrics

Pressure switch, electrical		
Material number	R961003488	
Material short text	PRESSURE SWITCH TS-HC-HED 8 OA-2X/10&	
The hydro-electric pressure switch will operate when the set pressure is reached. With mounting plate, including electrical cable and measuring hose.		
Dimensions	mm (L x W x H)	100 x 45 x 170
Working pressure max.	bar	120
Industrial type	HED8OA1X/100K14	
Switching accuracy	%	< ± 1 of setting
Contact load	VAC:250 V-2 A	50 V - 0.5A
Switching frequency max.	1/h	7200
Adjustment range	bar	10 - 100



Pressure switch, electronic, programmable		
Material number	R961003555	
Material short text	PRESSURE SWITCH TS-HC-HEDE10A1-2X/10&	
The pressure sensor records the system pressure in hydraulic systems, indicates it on a display and generates two output signals (switching outputs). With fastening, including cable, incl. measuring hose.		
Dimensions	mm (L x W x H)	72 x 44 x 157
Weight	kg	0.75
Working pressure max.	bar	120
Industrial type	HEDE10A1-2x/100/K41G24/2/V	
Switching accuracy	%	0.5
Contact load max.	mA	250
Electrical connection	K41 (M12)	
Switching frequency max.	Hz	170
Adjustment range	bar	0 - 100



Measurement technology

Multimeter VC175

Material number	R913038027
Material short text	MULTIMETER TS-EC-VC175

Digital multimeter VC175. Robust entry-level device with automatic measuring range selection incl. measuring lines

Equipment:

- ▶ Standard measuring ranges VDC, VAC, ADC, AAC
- ▶ Resistance
- ▶ Diode test
- ▶ Acoust. continuity tester
- ▶ Contactless AC voltage tester
- ▶ hFE transistor test (with optional adapter)
- ▶ Frequency measurement and duty cycle
- ▶ Hold function
- ▶ Low-batt display
- ▶ Robust housing with soft rubber protection

Dimensions	mm (L x W x H)	137 x 72 x 40
Weight	g	200
Current	A	10
Measuring category		CAT III 250 V
Display	Counts	4000



Measuring instrument set 3020

Material number	R913038909
Material short text	ANALYZER SET 3020A-PP-10-10

Two analog measuring inputs; 1 frequency input memory for 1 million analog measured values; LCD display

The measuring instrument set 3020 consists of:

- ▶ 1 measuring instrument Multi-Handy 3020
- ▶ 1 power supply unit 24 VDC with country adapter
- ▶ 1 USB data transfer cable
- ▶ 2 Minimes direct connections 1620
- ▶ 1 HYDROcomsys software
- ▶ 2 pressure sensors 250 bar
- ▶ 1 transport case
- ▶ 2 measuring cables



Measurement technology

Measuring instrument set 5060

Material number R913038907

Material short text ANALYZER SET 5060C-PP-10-10

With 24 channels; up to 1 GB data memory; color display; CAN bus technology

The measuring instrument set 5060 consists of:

- ▶ 1 measuring instrument Multi-Handy 5060
- ▶ 1 power supply unit 24 VDC with country adapter
- ▶ 1 USB data transfer cable
- ▶ 2 Minimes direct connections 1620
- ▶ 1 software CD
- ▶ 2 pressure sensors 250, bar
- ▶ 1 transport case
- ▶ 2 measuring cables



Basic measuring instrument set

Material number R961009563

Material short text ANALYZER SET TS-HY BASIC

The basic measuring instrument set comprises the following devices:

- ▶ 1 digital manometer with Minimes port (R961009534)
- ▶ 1 contactless tachometer with digital display (R961008893)
- ▶ 1 digital stop watch (R900061256)
- ▶ 1 transport case (not shown)



Stop watch, digital

Material number R900061256

Material short text DIAL INDICATOR TS-MC-DIG-ZEIT-STOPP

Digital stop watch in quartz design, 1/100 sec, time and date



Measurement technology

Tachometer, visual

Material number	R961008893	
Material short text	TACHOMETER TS-EC-CEM AT-6	
Contactless laser tachometer for recording the speed of the hydraulic motors. Display on 5-digit LC display in rpm or as even counting function;		
Dimensions	mm (L x W x H)	160 x 58 x 39
Weight	g	150
Operating voltage	9 V block	
Measuring distance	cm	5 - 50
Measurement range	rpm	2-99999



Speed sensor

Material number	R900892375	
Material short text	ROT. SPEED SENSOR TS-EC-OPTISCH DS 3	

The speed sensor is a sensor with reflection mark detection and intended for attachment to hydraulic motors. It works with pulsating red light (LED) which is reflected by a special mark at the rotating part.

Measuring cable, 25 reflection foils

Dimensions	mm (L)	3000
Weight	kg	0.43
Supply voltage	VDC	7.5 - 30
Switching current	mA	200
Response time	ms	1
Signal sequence frequency	Hz	5



Pressure transducer 0 - 250 bar with ISDS

Material number	R901465414	
Material short text	PRESSURE SENSOR TS-HC-3403-17-S-E5.37	
Dimensions	mm (L x D)	180 x 40
Weight	kg	0.17
Output current	mA	0 - 20
Measurement range	bar	0 - 250

Accessories

Designation	Material number	Quantity
Measuring cable	R900733207	1



Measurement technology

Temperature sensor with ISDS		
Material number	R900749653	
Material short text	TEMPERATURE SENSOR TS-EC-P/T1003973-04-&	
Temperature sensor can be used in combination with gear wheel flow rate sensor R961002508. Principle of measurement PT 100		
Dimensions	mm (L x D)	100 x 40
Weight	kg	0.46
Supply voltage	V (DC)	10 - 30
Measurement range	°C	-50 - 200
Measured signal output	mA	0 - 20

Accessories		
Designation	Material number	Quantity
Measuring cable for ISDS	R900733207	1

Measuring cable for ISDS		
Material number	R900733207	
Material short text	CONNECTING CABLE TS-EC-ISDS-2500MM	
Length	mm	2500



Gear wheel flow rate sensor		
Material number	R961002508	
Material short text	FLOWMETER TS-HC-GFM 3843-03-S-3	
Gear wheel flow rate sensor for the exact measurement of a flow. Mounted on component plate; Connections via self-sealing coupling plugs.		
Dimensions	mm (L x W x H)	230 x 180 x 115
Weight	kg	3.38
Measurement range	l/min	0.2 - 30
Pulses per liter		1640
Measured value non-linearity	%	± 0.5

Accessories		
Designation	Material number	Quantity
Measuring cable	R900733207	1



Measurement technology

Flow meter 1.0 to 7.5 l/min

Material number	R961002561
Material short text	FLOWMETER TS-HC-HP202S020 G1/4&

Flow rate sensor for measuring a flow
Connections via self-sealing coupling plugs.

Industrial type	FM-222-112	
Dimensions	mm (L x D)	160 x 60
Weight	kg	0.66
Working pressure max.	bar	100
Measurement range	l/min	1.0 - 7.5
Measuring accuracy of measurement range end value	%	± 2



Digital manometer 0 to 100 bar

Material number	R961009534
Material short text	PRESSURE GAUGE DIM 20 0/100 BAR KPL.

Compact, microprocessor-controlled pressure gage 0 - 100 bar. The pressure sensor signal is prepared by the microprocessor, converted into the desired unit and displayed.

Functions: Unit switchover, min./max. value memory, zero point and end point calibration, adjustable switch-off automatics, variable decimal point, battery condition display, with fastening, incl. measuring hose

Dimensions	mm (L x W x H)	133 x 75 x 43
Pressure range	bar	0 - 160



Measurement technology

Manometer 0 to 60 bar with measuring hose		
Material number	R961003403	
Material short text	PRESSURE GAUGE TS-HC-ABZMM 63-60BAR	
Manometer with glycerin filling, diameter 63 mm, scaling 5 bar, with fastening, incl. measuring hose		
Dimensions	mm (L x W x H)	63 x 56 x 147
Weight	kg	0.45
Pressure range	bar	0 - 60

Manometer 0-100 bar with measuring hose		
Material number	R961002715	
Material short text	PRESSURE GAUGE TS.HC-ABZMM 63-100BAR	
Manometer with glycerin filling, diameter 63 mm, scaling 5 bar, with fastening, incl. measuring hose		
Dimensions	mm (L x W x H)	63 x 56 x 147
Weight	kg	0.45
Pressure range	bar	0 - 100

Manometer 0 to 160 bar with measuring hose		
Material number	R961002720	
Material short text	PRESSURE GAUGE TS-HC-ABZMM 63-160BAR	
Manometer with glycerin filling, diameter 63 mm, scaling 5 bar, with fastening, incl. measuring hose		
Dimensions	mm (L x W x H)	63 x 56 x 147
Weight	kg	0.45
Pressure range	bar	0 - 160



Spare parts for workstations

Grooved plate for workstation WS200

Material number	R961008637
Material short text	GROOVED PLATE TS-MC-710X700X30 &

The grooved plate for the WS200 workstation is used to hold the components from the pneumatics and automatic control engineering device sets.

At the grooved plate, pneumatic and automatic control engineering components can be securely fastened by means of the Snap-In quick fastening system.

The grooved plate can be used on both sides. With fastening set.

Dimensions	mm (L x W x H)	710 x 700 x 30
Weight	kg	14
Groove distance	mm	25



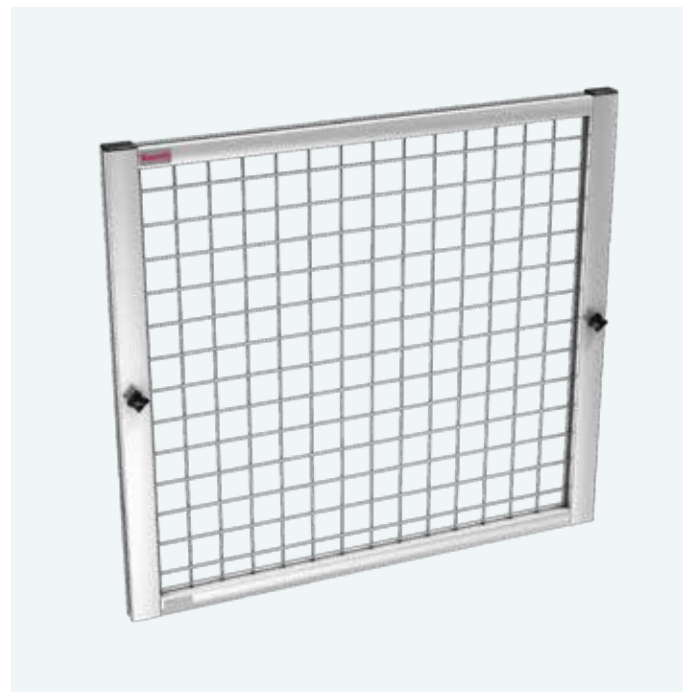
Grate for WS200 workstation

Material number	R961009533
Material short text	GRATING TS-MC-800X733X30

The grate for WS200 workstation is used for the safe holding of the components from the hydraulic device sets.

The grate can be installed and removed by hanging it into the base frame of the WS200 workstation. For the vertical securing, the grate holding set is attached. With fastening set.

Dimensions	mm (L x W x H)	800 x 733 x 48
Weight	kg	6.3
Raster	mm	50 x 50



Spare parts for workstations

Measuring glass for workstation WS201

Material number	R961009485
Material short text	GRADUATE TS-HC-WS200-1,5L

The measuring glass for the WS201 workstation is necessary for exercises on the On/off hydraulics according to BIBB learning topics.

The measuring glass with stable, transparent plastic housing and scale in the measurement range up to 1.6 liters can be used in connection with a stop watch to measure a flow.

The measuring glass is equipped with ball valve, overflow protection and air and air relief valve.

The calmed supply prevents an excessive amount of air bubbles in the hydraulic fluid during filling.

A discharge hose has already been mounted in the factory. It has a connection length of about 1 meter and is equipped with a fitting for safe connection to the tank of the hydraulic power unit of the WS200 workstation. With fastening set, connections via self-sealing coupling plugs.

Dimensions	mm (L x W x H)	142 x 242 x 590
Weight	kg	6
Measurement range	l	0 - 1.6



Load unit for workstation WS201

Material number	R961009507
Material short text	LOAD UNIT TS-HC-4/8/12/16KG

The load unit for the WS201 workstation is necessary for exercises on the On/off hydraulics according to BIBB learning topics.

The load unit is used to generate mechanically effective tensile and compressive forces on the piston rod of a hydraulic cylinder.

The differential cylinder contained in the device sets "On/off hydraulics – First steps" and "On/off hydraulics – Manual and electrical operation" (R961009526) is used in the load unit.

The load unit has 4 weights with 4 kg each; they can be installed in the lower part or the upper part of the load unit in order to simulate tensile or compressive forces there.

As protection against injuries, the load unit is accommodated in a housing; access is possible through two easy-to-open transparent plastic doors. With fastening set.

Dimensions	mm (L x W x H)	413 x 206 x 1338
Weight	kg	30



Spare parts for workstations

Drive unit 220 VAC/50 Hz 3X for extending the WS200 workstation to double-sided use, without cross bar

Material number	R961009539
Material short text	REFLECTOR AND DRIV TS-HC-WS200-220V/50H&

Drive unit 220V/50HZ 3X for extending the WS200 workstation to double-sided use

Scope of delivery	<ul style="list-style-type: none"> ▶ 1 hydraulic power unit, 230V/50Hz with pump, hose set, control box and P/T distributor ▶ 1 mounting set ▶ 1 damping set
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Dimensions	mm (L x W x H)	710 x 340 x 646
Supply voltage	VAC	230
Rated current	A	16
Mains frequency	Hz	50
Power	kW	0.37
Working pressure	bar	70
Maximum flow	l/min	3.2

Spare part for

Designation	Material number	Quantity
Workstation WS200 hydraulics, one-sided	R961008850	1
Workstation WS200 hydraulics, one-sided and pneumatics	R961009258	1



Spare parts for workstations

Drive unit 220 VAC/50 Hz 4X for extending the WS200 workstation to double-sided use, with cross bar		
Material number	R961009540	
Material short text	REFLECTOR AND DRIV TS-HC-WS200-220V/50H&	
Drive unit 220 V/50 Hz 4X for extending the WS200 workstation to double-sided use, with cross bar		
Scope of delivery	<ul style="list-style-type: none"> ▶ 1 hydraulic power unit, 230V/50Hz with pump, hose set, control box and P/T distributor ▶ 1 mounting bar ▶ 1 mounting set ▶ 1 damping set 	
Dimensions	mm (L x W x H)	710 x 340 x 646
Supply voltage	VAC	230
Rated current	A	16
Mains frequency	Hz	50
Power	kW	0.37
Working pressure	bar	70
Maximum flow	l/min	3.2
Spare part for		
Designation	Material number	Quantity
Workstation WS200 pneumatics, double-sided	R961008854	1



Spare parts for workstations

Drive unit 220 VAC/50 Hz 5X for extending the WS200 workstation to double-sided use, with cross bar

Material number	R961009541
Material short text	REFLECTOR AND DRIV TS-HC-WS200-220V/50H&

Drive unit 220 V/50 Hz 5X for extending the WS200 workstation to double-sided use, with cross bar

Scope of delivery	<ul style="list-style-type: none"> ▶ 2 hydraulic power units, in each case 230V/50Hz with pump, hose set, control box and P/T distributor ▶ 1 mounting bar ▶ 2 mounting sets ▶ 2 damping sets
-------------------	---

Dimensions	mm (L x W x H)	710 x 340 x 646
Supply voltage	VAC	230
Rated current	A	16
Mains frequency	Hz	50
Power	kW	0.37
Working pressure	bar	70
Maximum flow	l/min	3.2

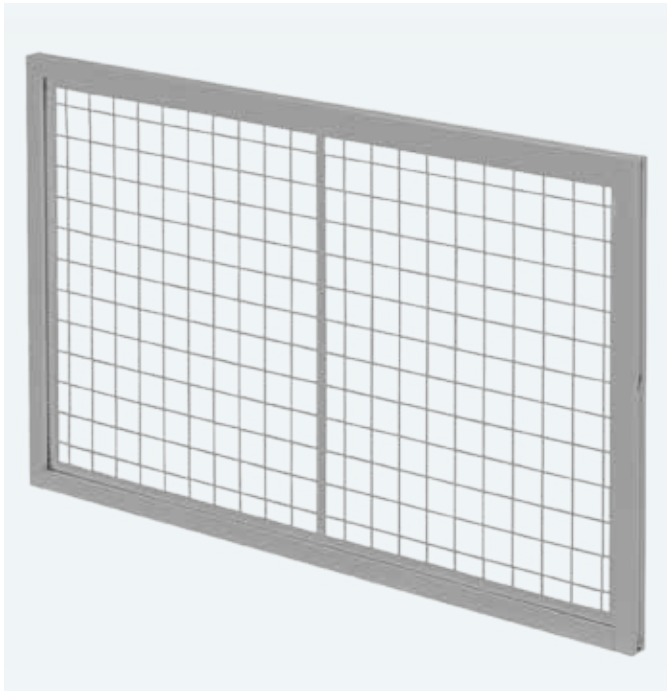
Spare part for

Designation	Material number	Quantity
Workstation WS200 pneumatics, double-sided	R961008854	1



Spare parts for workstations

Grate with reinforcement for hanging into workstation WS290		
Material number	R961000210	
Material short text	GRATING TS-MC-1130X700X30	
The grate for WS290 workstation is used for the safe holding of the components from the hydraulic device sets and can be quickly and easily hanged in and securely fastened on both sides of the WS290 workstation.		
Dimensions	mm (L x W x H)	1130 x 700 x 30
Weight	kg	11.75
Raster	mm	50 x 50



Assembly carrier for WS290 workstation, two-row		
Material number	R961000166	
Material short text	ASSEMBLY MOUNTING TS-MC-DS4-2R-1130X19&	
The two-row assembly carrier can be mounted at the upper part of the WS290 workstation. The component carrier is designed in 19" technology and holds both, the operating elements developed by Rexroth for didactic purposes and standard 19" components.		
Height	HE*	2 U x 3 U
Width	TE*	210
Depth	mm	185
Weight	kg	11.6



Spare parts for workstations

Measuring glass 2.5l for workstation WS290

Material number R961002564

Material short text GRADUATE TS-HC-2,5L

The measuring glass for the WS290 workstation is necessary for exercises on the On/off hydraulics according to BIBB learning topics.

The measuring glass with stable, transparent plastic housing and scale in the measurement range up to 2.5 liters can be used in connection with a stop watch to measure a flow. The calmed supply prevents an excessive amount of air bubbles in the hydraulic fluid during filling.

A discharge hose connects the measuring glass with the tank of the hydraulic power unit.

With fastening set, connections via self-sealing coupling plugs.

Dimensions mm (L x W x H) 160 x 200 x 700

Weight kg 6.5

Measurement range l 0-2.5



Hose deposit of the WS290 workstation for 50 hoses

Material number R961002634

Material short text HOSE HOLDER TS-MC-50F

The hose deposit can be attached laterally at the WS290 workstation. The hose holder is used to hold up to 50 hydraulic hose lines; the hose lines are hanged into the holder. The oil tank is used for the storage of small parts.

Dimensions mm (L x W x H) 708 x 320 x 191

Weight kg 11



Spare parts for workstations

Load unit for attachment at WS290 workstation, 15 kg, swivel-mounted		
Material number	R961000187	
Material short text	LOAD UNIT TS-HC-CD 70P 25/16-2&	
<p>The swivel-mounted load unit is necessary for exercises on the On/ off hydraulics according to BIBB learning topics. The load unit can be fastened at the basic frame of the WS290 workstation. By swiveling the load unit by 180°, mechanically effective tensile and compressive forces on the piston rod of a hydraulic cylinder can be generated. The load unit is secured by means of a safety mechanism preventing uncontrolled rotary motions. The mass of the weight is 15 kg. To prevent injuries, all moved parts are accommodated in housings. At the fastening sheet, proximity switches can be attached. Connections via self-sealing coupling plugs. Delivery incl. 2x2 m hose lines with 90° fitting.</p>		
Dimensions	mm (L x W x H)	1000 x 250 x 250
Weight	kg	31
Working pressure	bar	105
Industrial type	CD70P25/16-200Z11	
Piston diameter	mm	25
Piston rod diameter	mm	16
Load mass	kg	15
Stroke	mm	200



Writing pad for workstation WS290 and DS3		
Material number	1827003705	
Material short text	WRITING STAND TS-MC-DS3/DS4	
<p>Writing pad for insertion into the oil tank of the workstations WS290 and DS3</p>		
Dimensions	mm (L x W x H)	275 x 360 x 25
Weight	kg	0.53
Material	PMMA, white	
Delivery unit	Qty	2



Spare parts for hydraulic components

Minimesse hose coupling G1/4

Material number	R900009090	
Material short text	MEASURING COUPLING MCS20-SDS-E-G1/4-ST3&	
Dimensions	mm (L x D)	46 x 22
Weight	kg	0.1
Working pressure max.	bar	630
Connection thread	G1/4A	



Coupling plug G1/4

Material number	R961000482	
Material short text	CONNECTOR PLUG TS-HC-FF-005-2-XX014&	
Dimensions	mm (L x D)	68 x 22
Weight	kg	0.17
Working pressure	bar	120
Connection thread	G 1/4 A	
Sealing form	Profile seal	



Coupling socket G 1/4

Material number	R961000480	
Material short text	COUPLING BOX TS-HC-1-15-005-0-XX0&	
Dimensions	mm (L x D)	68 x 22
Weight	kg	0.17
Working pressure	bar	120
Connection thread	G 1/4 A	
Sealing form	Profile seal	



Spare parts for hydraulic components

Coupling socket M16 x 1.5		
Material number	R961000481	
Material short text	COUPLING BOX TS-HC-1-15-005-0-L10&	
Dimensions	mm (L x D)	68 x 22
Weight	kg	0.17
Working pressure	bar	120
Connection thread	M16 x 1.5	
Sealing form	24° internal cone according to DIN 2353	



Measuring hose with Minimes port and hexagon nut		
Material number	R900083425	
Material short text	MEASURING HOSE DN2-630/MCS20-MCS20/1000ST3Z00Z-P	
Hose length	mm	1000
Weight	kg	0.1
Working pressure	bar	630



Component plate for directional control valves, complete		
Material number	R961002568	
Material short text	CONNECTION PLATE TS-HC-LEER-MIT-BEF-4&	
Component plate with connection hole pattern according to ISO 4401-03-02-0-05, with clamping mechanism for grate and connections via self-sealing coupling plugs		
Dimensions	mm (L x W x H)	80 x 115 x 25



Spare parts for hydraulic components

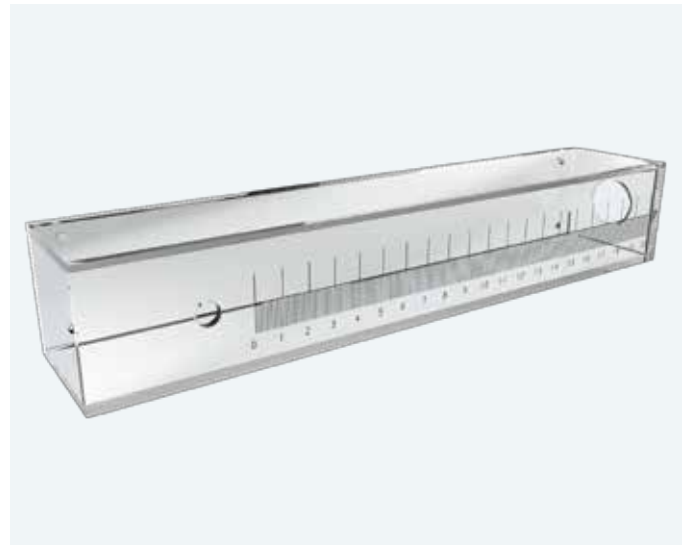
Empty component plate with holder for the grate

Material number	R900022483
Material short text	PLATE TS-HC-LEER-MIT-BEF
Empty component plate, with clamping mechanism for grates, for the individual fastening of components	
Dimensions	mm (L x W x H) 115 x 80 x 30



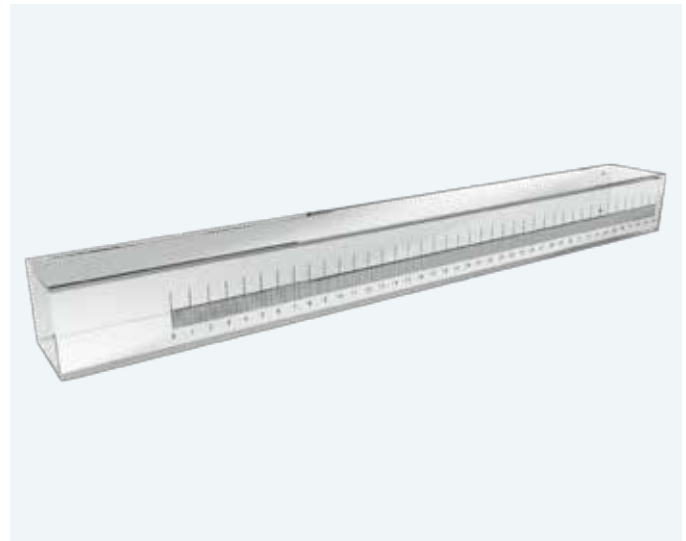
Protective housing for differential cylinder CD70F25/16-200 (R961009526)

Material number	R961009528
Material short text	PROTECTIVE COVER TS-MC-ZYL 46X52X263
Contact protection for differential cylinder 200 mm made of Plexiglas with ruler and through hole for tie rod	



Protective housing for differential cylinder CD70F25/16-400 (R961003495)

Material number	R961000369
Material short text	PROTECTIVE COVER TS-MC-ZYL 46X52X463
Contact protection for differential cylinder 400 mm made of Plexiglas with ruler	



Spare parts for hydraulic components

Protective housing for gear motor (R961004259)

Material number R961004248

Material short text PROTECTIVE COVER TS-MC-HYMOT-
152X136X&

Contact protection for gear motor made of Plexiglas



Protective housing for axial piston motor (R961002811)

Material number R900241023

Material short text PROTECTIVE COVER TS-MC-AXIAL-MOT

Contact protection for axial piston motor made of Plexiglas



Protective housing for planetary motor (R961008748)

Material number R961008749

Material short text PROTECTIVE COVER TS-MC-110X110X45
4XD&

Contact protection for planetary motor made of Plexiglas



Spare parts for hydraulic components

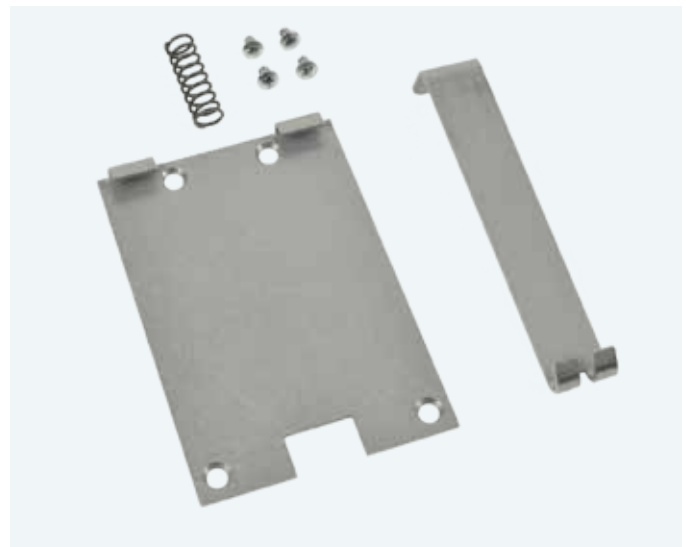
Clamp mounting for grate system

Material number	R961003498	
Material short text	SUPPORT TS-MC-GIT50-MANO	
Holder for mounting the manometer at the grate		
Dimensions	mm (L x W x H)	55 x 44 x 110
Weight	kg	0.130



Gripping technology

Material number	R901393362	
Material short text	FASTENING KIT TS-MC-GIT-GREIF	
Gripping technology for fastening component plates at the grate		



Grate holder

Material number	R901393364	
Material short text	FASTENING KIT TS-MC-GIT-MANO	
Holder for fastening component plates at the grate		



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Drive & Control Academy

Learning topics

Workstations

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