

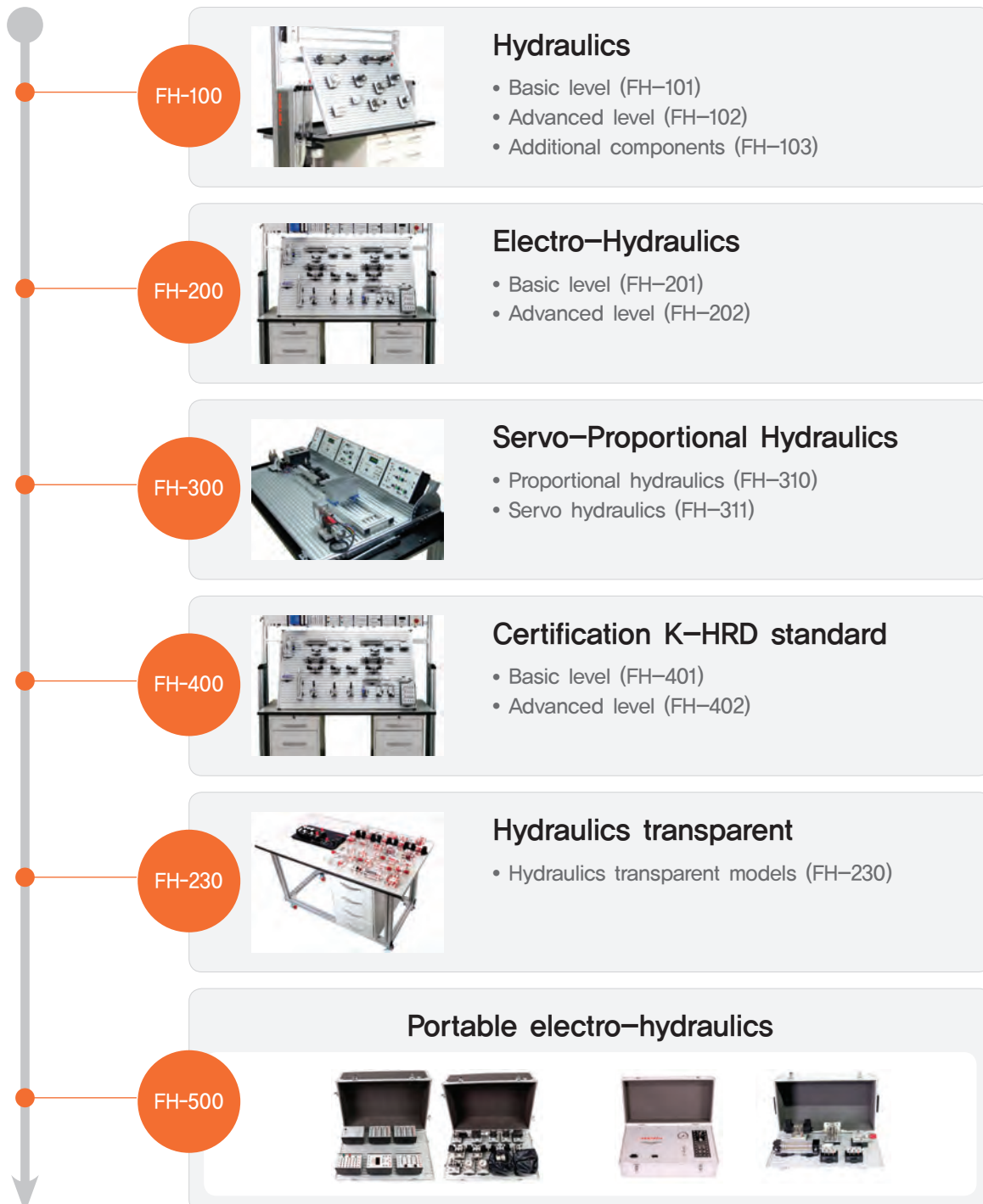
CHAPTER

02-1

HYDRAULICS TRAINING SET

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HYDRAULICS TRAINING SET



Introduction

Hydraulics are often used in the machine tools of heavy industry for the high power generated and the ability to realize high precision position control with non-compressed fluid.

The FESTECH hydraulics training set is composed of industrial parts which are used in real applications. They are specially developed to prevent leakage of oil with Non-Leakage Quick Coupling connector and can be used in both basic and advanced hydraulics training courses.

Proportional hydraulic control and servo hydraulic control are also supported.



Hydraulics training set, basic level (FH-101)



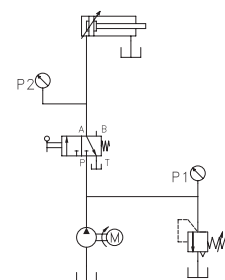
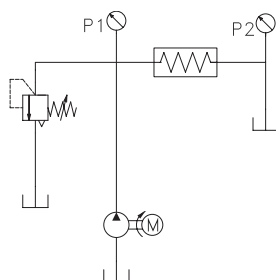
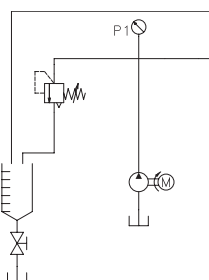
Training content

- Application of hydraulics
- Physical principles of hydraulics
- Hydraulic symbols and standards
- Types and properties of hydraulics fluids
- Measurement and calculation the characteristic curve of a hydraulic pump
- Measurement of the characteristic curve of a pressure relief valve
- Characteristic curve of a flow control valve
- Flow control valves, directional control valves, non-return valve
- Measurement of times and pressures during advancing and retracting of a cylinder
- Calculations of force and speed
- Basic circuits with single and double acting cylinders
- Difference between pressure relief valves and pressure regulators
- Using 4/3-way valves with different mid-positions
- Using the flow control valve in adjusting the speed
- Design and operation of a differential circuit
- Usage of pilot operated non-return valves
- Commissioning and maintenance of hydraulic system

Recommended items

Component	Order number
Hydraulic basic working table (single side)	14006
H-Lab simulation software	40006
Hydraulics text book	42053

Component	Order number
Hydraulics work book, basic level	42047
Magnetic symbol (pneumatics and hydraulics)	13501



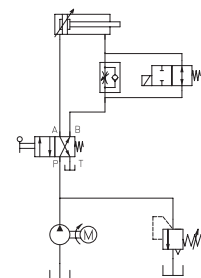
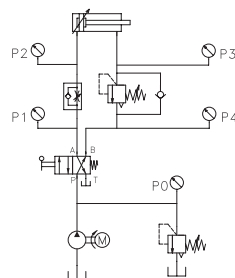
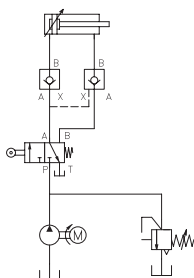
Hydraulics training set, basic level (FH-101)

Component

No.	Component	Order number	Qty
1	Oil tray	14011	1
2	Power unit 1 Pump	15010	1
3	Power unit overload protector	15019	1
4	Flow measuring unit	15020	1
5	Weight	15022	1
6	Double-acting cylinder	15031	1
7	Hydraulic motor	15035	1
8	Transparent double-acting cylinder	15039	1
9	4/2-way hand lever valve	15040	1
10	4/3-way hand lever valve (ABT connecte)	15042	1
11	4/3-way hand lever valve (PT connected)	15043	1
12	Pressure relief valve (directly actuated)	15050	2
13	Pressure relief valve (pilot actuated)	15051	1
14	Counter balancing valve	15056	1
15	3-way pressure reducing valve	15052	1

No.	Component	Order number	Qty
16	Shut-off valve	15063	1
17	Flow control valve	15060	1
18	One-way flow control valve	15061	1
19	Flow control valve (pressure compensative)	15053	1
20	Check valve (1bar)	15064	3
21	Pilot actuated check valve	15062	1
22	Pressure gauge	15070	3
23	Pressure gauge with distributor	15071	2
24	T connector	15066	2
25	Accumulator	15080	1
26	Hose 1500mm	15090	2
27	Hose 1000mm	15091	6
28	Hose 600mm	15092	10
29	Hydraulic hose hanger	15093	1
30	Pressure remover	15099	1

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Hydraulics training set, advanced level (FH-102)

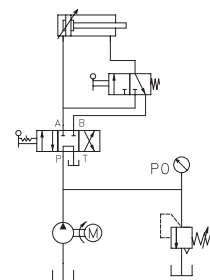
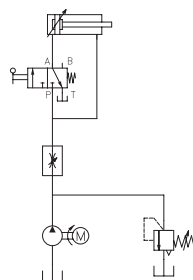
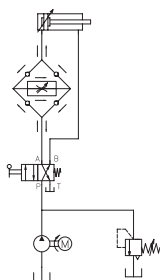


Training contents

- Application of hydraulics
- Physical principles of hydraulics
- Hydraulic symbols and standards
- Types and properties of hydraulics fluids
- Measurement and calculation of the characteristic curve of a hydraulic pump
- Measurement of the characteristic curve of a pressure relief valve
- Characteristic curve of a flow control valve
- Flow control valves, directional control valves, non-return valve
- Measurement of times and pressures during advancing and retracting of a cylinder
- Calculations for force and speed
- Basic circuits with single and double acting cylinders
- Difference between pressure relief valves and pressure regulators
- Using 4/3-way valves with different mid-positions
- Using the flow control valve in adjusting the speed
- Design and operation of a differential circuit
- Usage of pilot operated non-return valves
- Commissioning and maintenance of hydraulic system
- Pressure sequence control
- Counter balance circuit for tractive loads
- Usage of hydraulic motors
- Rapid feed with various directional valves, flow control valves
- Synchronous control of forward and return strokes
- Bypass flow control
- Function and usage of a flow dividing valve
- Synchronous control of two cylinders with flow dividing valve
- Design and use the rectifier circuit
- Configuration and description of a sequence control with two cylinders
- Circuits with hydraulic accumulator

Recommended items

Component	Order number
Hydraulic basic working table (single side)	14006
H-Lab simulation software	40006
Hydraulics text book	42053
Hydraulics work book, basic level	42047
Hydraulics work book, advanced level	42048
Magnetic symbol (pneumatics and hydraulics)	13501

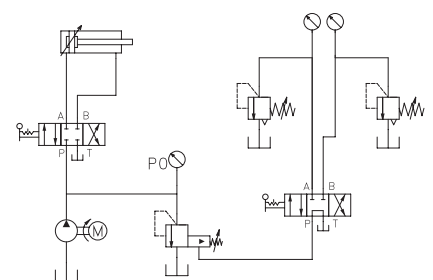
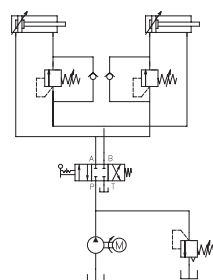
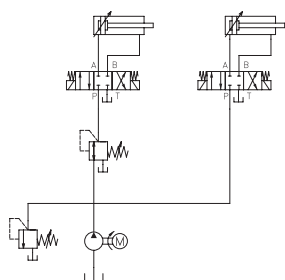


Hydraulics training set, advanced level (FH-102)

Component

No.	Component	Order number	Qty
1	Oil tray	14011	1
2	POWER UNIT 1 PUMP	15010	1
3	POWER UNIT overload protector	15019	1
4	Flow measuring unit	15020	1
5	Transparent double-acting cylinder	15039	1
6	Double-acting cylinder	15031	1
7	Weight	15022	1
8	Hydraulic motor	15035	1
9	Flow meter	18021	1
10	Measuring display unit	18018	1
11	3/2-way hand lever valve	15037	1
12	4/2-way hand lever valve	15040	1
13	4/3-way hand lever valve (PABT blocked)	15041	1
14	4/3-way hand lever valve (ABT connected)	15042	1
15	4/3-way hand lever valve (PT connected)	15043	1
16	2/2-way limit valve	15049	1
17	Cylinder guide	15024	1
18	Pressure relief valve (directly actuated)	15050	2
19	Pressure relief valve (pilot actuated)	15051	1
20	3-way pressure reducing valve	15052	1

No.	Component	Order number	Qty
21	Counter balancing valve	15056	1
22	Shut-off valve	15063	1
23	Flow control valve	15060	1
24	One-way flow control valve	15061	2
25	Flow control valve (pressure compensative)	15053	1
26	Flow dividing valve	15054	1
27	Check valve (1bar)	15064	3
28	Check valve (5bar)	15065	1
29	Pilot actuated check valve	15062	1
30	Pressure gauge	15070	3
31	Pressure gauge with distributor	15071	3
32	T connector	15066	4
33	Accumulator	15080	1
34	Hose 1500mm	15090	2
35	Hose 1000mm	15091	6
36	Hose 600mm	15092	12
37	Hydraulic hose hanger	15093	1
38	Pressure remover	15099	1
39	Pressure sequence valve	15101	1



Additional hydraulics control module (FH-103)

			
Double-acting cylinder with brake 15032	Double-acting cylinder(16-10-200) 15033	Double-acting cylinder(16-10-300) 15034	Cylinder cover 15100
			
2/2-way hand lever valve 15036	3/2-way hand lever valve 15037	Pressure relief valve (externally actuated) 15055	Pressure sequence valve 15101
			
Inline flow meter 15072	Pipe resistor 1 15201	Pipe resistor 2 15202	Pipe resistor 3 15203
			
2-way pressure reducing valve 15102	Flow control valve (cam operated) 16021	Cross axial transparent block 15081	Orifice transparent block 15082
			
Transparent pump (manually operated) 15083	Measurement display unit 18018	Flow meter 18021	

Additional hydraulics control module (FH-103)

Component

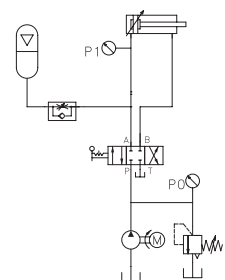
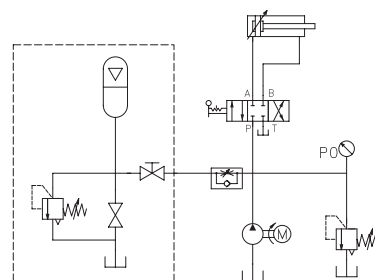
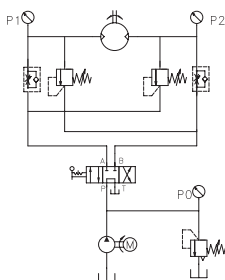
No.	Component	Order number	Qty
1	Double-acting cylinder with brake	15032	1
2	Double-acting cylinder	15033	1
3	Double-acting cylinder	15034	1
4	Cylinder cover	15100	1
5	2/2way valve	15036	1
6	3/2way valve	15037	1
7	Pressure relief valve (externally actuated)	15055	1
8	Pressure sequence valve	15101	1
9	Inline flow meter	15072	1
10	Pipe resister 1	15201	1

No.	Component	Order number	Qty
11	Pipe resister 2	15202	1
12	Pipe resister 3	15203	1
13	2-way pressure reducing valve	15102	1
14	Cam operating pressure reducing valve	16021	1
15	Cross axial transparent block	15081	1
16	Orifice transparent block	15082	1
17	Transparent pump (manually operated)	15083	1
18	Measuring display unit	18018	1
19	Flow meter	18021	1

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Recommended items

Component	Order number
H-Lab simulation software	40006
Hydraulics text book	42053
Hydraulics work book, basic level	42047
Hydraulics work book, advanced level	42048



Electro-hydraulics training set, basic level (FH-201)



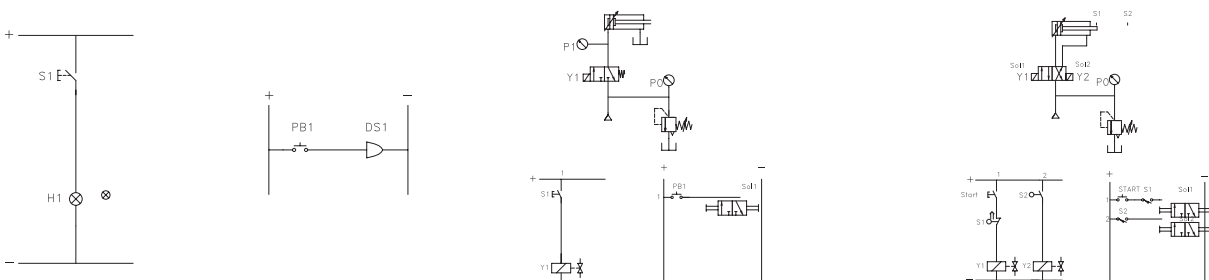
Training contents

- Function of electrical push-button switches and limit switches
- Function and use of hydraulic solenoid valves
- Design and mode of operation of a relay
- Recognizing and reading of electrical and hydraulic diagrams
- Design, construction and operation of basic circuits
- Selecting solenoid valves according to the technical control requirements
- Using and designing of basic logic functions
- Direct and indirect control of actuators
- Explaining and designing an electric latching circuit
- Electrically a locking of signals in a relay control system
- Manual and automatic operation
- Interlocking circuits
- Rapid traverse circuits
- Use a pressure switch
- Fault finding in electro-hydraulic control system

Recommended items

Component	Order number
Hydraulic basic working table (single side)	14007
H-Lab simulation software	40006
Electro-hydraulics text book	42054
Electro-hydraulics work book, basic level	42049

Component	Order number
Magnetic symbol (pneumatics and hydraulics)	13501
Magnetic symbol (electrics)	13502
Cable hanger	13091



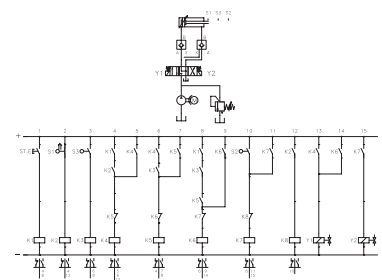
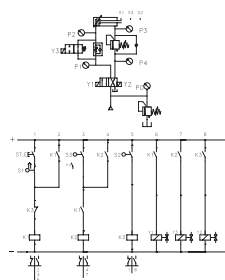
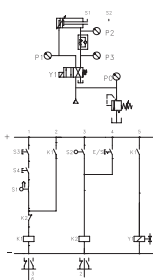
Electro-hydraulics training set, basic level (FH-201)

Component

No.	Component	Order number	Qty
1	Oil tray	14011	1
2	POWER UNIT 1 PUMP	15010	1
3	POWER UNIT overload protector	15019	1
4	Flow measuring unit	15020	1
5	Transparent double-acting cylinder	15039	1
6	Double-acting cylinder	15031	1
7	Weight	15022	1
8	Hydraulic motor	15035	1
9	Pressure relief valve (directly actuated)	15050	2
10	One-way flow control valve	15061	2
11	Flow control valve (pressure compensative)	15053	1
12	Check valve (1bar)	15064	1
13	Pilot actuated check valve	15062	1
14	Pressure gauge	15070	3
15	Pressure gauge with distributor	15071	2
16	T connector	15066	2
17	Hose 1500mm	15090	2
18	Hose 1000mm	15091	4
19	Hose 600mm	15092	8

No.	Component	Order number	Qty
20	Hydraulic hose hanger	15093	1
21	Pressure remover	15099	1
22	3/2-way solenoid valve	16011	1
23	4/2-way solenoid valve	16012	1
24	4/2-way double solenoid valve	16013	1
25	4/3-way double solenoid valve (PABT blocked)	16014	1
26	4/3-way double solenoid valve (PT connected)	16016	1
27	Power supply	13090	1
28	Pressure switch	16020	1
29	Push-button switch set (3-fold)	13033	1
30	Pilot lamp & buzzer unit	13034	1
31	Relay unit (3-fold)	13030	2
32	Digital time relay	13031	1
33	Electric limit switch (left)	13051	2
34	Electric limit switch (right)	13052	2
35	Inductive sensor	13040	1
36	Capacitive sensor	13041	1
37	Optical sensor	13042	1
38	Cable set	13080	1

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Electro-hydraulics training set, advanced level (FH-202)

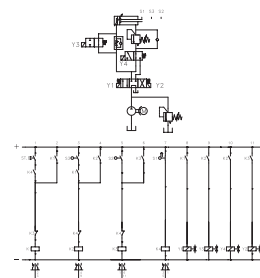
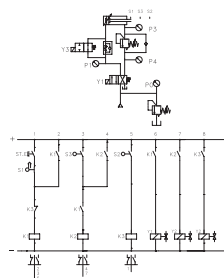
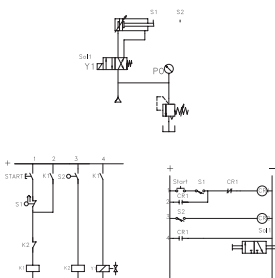


Training contents

- Function of electrical pushbuttons switches and limit switches
- Function and use of hydraulic solenoid valves
- Design and mode of operation of a relay
- Recognizing and reading of electrical and hydraulic diagrams
- Design, construction and operation of basic circuits
- Selecting solenoid valves according to the technical control requirements
- Using and designing of basic logic functions
- Direct and indirect control of actuators
- Explaining and designing of an electric latching circuit
- Electrically a locking of signals in a relay control system
- Manual and automatic operation
- Interlocking circuits
- Rapid traverse circuits
- Using of a pressure switch
- Fault finding in electro-hydraulic control system
- Function and use of electric sensors
- Comprehensive sequence controls
- Combined position and pressure-dependent controls
- Electrical controls with several actuators
- Sequence controls with peripheral conditions
- Controls with on-delay and off-delay time relays
- Creating sequence control as a displacement-step diagram
- Single cycle and continuous cycle
- Counter control with preset counter
- Manual/automatic, Emergency Stop
- Using of different proximity sensors
- Identifying signal overlaps in a sequence control and taking the appropriate action

Recommended items

Component	Order number
Hydraulic basic working table (single side)	14007
H-Lab simulation software	40006
Electro-hydraulics text book	42054
Electro-hydraulics work book, basic level	42049
Electro-hydraulics work book, advanced level	42050
Magnetic symbol (pneumatics and hydraulics)	13501
Magnetic symbol (electrics)	13502
Cable hanger	13091

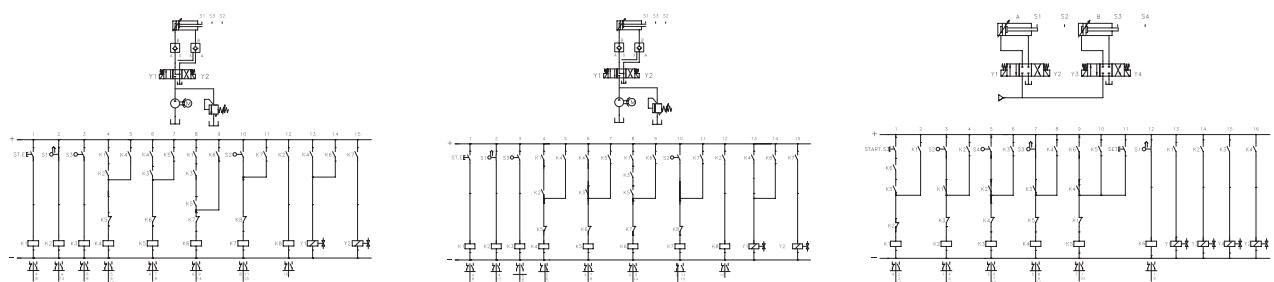


Electro-hydraulics training set, advanced level (FH-202)

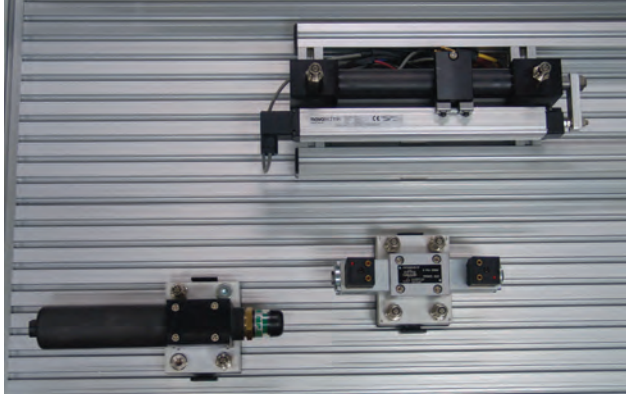
Component

No.	Component	Order number	Qty	No.	Component	Order number	Qty
1	Oil tray	14011	1	26	Hose 600mm	15092	10
2	POWER UNIT 1 PUMP	15010	1	27	Hydraulic hose hanger	15093	1
3	POWER UNIT overload protector	15019	1	28	Pressure remover	15099	1
4	Flow measuring unit	15020	1	29	2/2-way solenoid valve (Normally closed)	16010	1
5	Transparent double-acting cylinder	15039	1	30	3/2-way solenoid valve	16011	1
6	Double-acting cylinder	15031	2	31	4/2-way solenoid valve	16012	2
7	Weight	15022	1	32	4/2-way double solenoid valve	16013	1
8	Hydraulic motor	15035	1	33	4/3-way double solenoid valve (PABT blocked)	16014	1
9	Pressure relief valve (directly actuated)	15050	2	34	4/3-way double solenoid valve (ABT connected)	16015	1
10	Pressure relief valve (pilot actuated)	15051	1	35	4/3-way double solenoid valve (PT bypassed)	16016	1
11	3-way pressure reducing valve	15052	1	36	Power supply	13090	1
12	Counter balancing valve	15056	1	37	Pressure switch	16020	1
13	Flow control valve	15060	1	38	Push-button switch set (3-fold)	13033	1
14	One-way flow control valve	15061	2	39	Pilot lamp & buzzer unit	13034	1
15	Flow control valve (pressure compensative)	15053	1	40	Relay unit (3-fold)	13030	3
16	Flow dividing valve	15054	1	41	Digital time relay	13031	1
17	Check valve (1bar)	15064	1	42	Digital counter	13032	1
18	Check valve (5bar)	15065	1	43	Emergency switch	13035	1
19	Pilot actuated check valve	15062	2	44	Electric limit switch (left)	13051	2
20	Pressure gauge	15070	3	45	Electric limit switch (right)	13052	2
21	Pressure gauge with distributor	15071	3	46	Inductive sensor	13040	1
22	T connector	15066	4	47	Capacitive sensor	13041	1
23	Accumulator	15080	1	48	Optical sensor	13042	1
24	Hose 1500mm	15090	2	49	Cable set	13080	1
25	Hose 1000mm	15091	8				

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Proportional hydraulics training set (FH-310)



Recommended items

Component	Order number
Hydraulic basic working table (single side)	14007
Cable hanger	13091
H-Lab simulation software	40006

Component

No.	Component	Order number	Qty
1	Oil tray	14011	1
2	POWER UNIT 1 PUMP	15010	1
3	POWER UNIT overload protector	15019	1
4	Flow measuring unit	15020	1
5	Hydraulic distributor	15023	1
6	Double-acting cylinder	15031	1
7	Hydraulic motor	15035	1
8	Pressure relief valve (directly actuated)	15050	1
9	Flow control valve	15060	1
10	One-way flow control valve	15061	1
11	T connector	15066	2
12	Pressure gauge	15070	2
13	Pressure gauge with distributor	15071	2
14	Hose 1500mm	15090	2
15	Hose 1000mm	15091	4
16	Hose 600mm	15092	10
17	Hydraulic hose hanger	15093	1
18	Pressure remover	15099	1
19	4/2-way solenoid valve	16012	1
20	Relay unit (3-fold)	13030	1
21	Digital time relay	13031	1
22	Push-button switch set (3-fold)	13033	1
23	Pilot lamp & buzzer unit	13034	1

Training contents

- Function and characteristics of proportional solenoid,
- Characteristics of the proportional pressure relief valve
- Characteristics of the 4/3-way proportional valve
- Characteristics and function of the proportional amplifier
- Basic circuits with proportional directional control and pressure valves
- Setting the basic current, step current and maximum current
- Setting ramp times
- Measurements and calculations:
 - Measuring of pressure, volumetric flow and time
 - Designing and commissioning control systems
 - Controlling pressure and speed
 - Getting to know the various pressure control system
 - Calculating the flow for proportional directional control valves
 - Load-independent feed speed
 - Fault finding of the proportional hydraulic control system
- If you already have electro-hydraulics training set, we recommend you to purchase only the component No. 32~46 from the list below,

No.	Component	Order number	Qty
24	Inductive sensor	13040	1
25	Capacitive sensor	13041	1
26	Optical sensor	13042	1
27	Electric limit switch (left)	13051	1
28	Electric limit switch (right)	13052	1
29	Cable set	13080	1
30	Power supply	13090	1
31	Double-acting cylinder	15033	1
32	Set point control module	18001	1
33	Proportional amplifier	18002	1
34	Comparator module	18003	1
35	Linear potentiometer	18004	1
36	Linear potentiometer guide	18005	1
37	Proportional pressure relief valve	18006	1
38	4/3-way proportional control valve	18007	1
39	Pressure filter	18008	1
40	Pressure compensation valve	18009	1
41	PID module	18010	1
42	Measurement display unit	18018	1
43	Pressure sensor	18019	1
44	Temperature sensor	18020	1
45	Flow meter	18021	1
46	Digital multimeter	21012	1

Servo-hydraulics training set (FH-311)



Recommended items

Component	Order number
Hydraulic basic working table (single side)	14007
Cable hanger	13091

Component

No.	Component	Order number	Qty
1	Oil tray	14011	1
2	POWER UNIT 1 PUMP	15010	1
3	POWER UNIT overload protector	15019	1
4	Flow measuring unit	15020	1
5	Hydraulic distributor	15023	1
6	Double-acting cylinder	15031	1
7	Hydraulic motor	15035	1
8	Pressure relief valve (directly actuated)	15050	1
9	Shut-off valve	15063	1
10	T connector	15066	2
11	Pressure gauge	15070	2
12	Pressure gauge with distributor	15071	2
13	Hose 1500mm	15090	2
14	Hose 1000mm	15091	4
15	Hose 600mm	15092	10
16	Hydraulic hose hanger	15093	1
17	Pressure remover	15099	1
18	Push-button switch set (3-fold)	13033	1

Training contents

- Determining the necessary signal transmitters
- Designing the electric signal control system
- Structuring and commissioning the proportional hydraulic control system
- Construction and function of hydraulic components for load compensation
- Function of electronic modules for the adaption of sensor signals
- Time-dependent control system with hydraulic motor
- Speed control of cylinders without limit switch
- Determining characteristics curves and characteristics of different sensors
- Creating characteristic curves for displacement, pressure and temperature sensors
- Measuring displacement, time, pressure and temperature
- Further signal processing of analogue signals
- Controlling pressure, speed, acceleration, delay and position
- Designing and commissioning proportional hydraulic control systems
- Implementing oscillating movements for a cylinder
- If you already have electro-hydraulics training set, we recommend you to purchase only the component No. 22~36 from the list below.

No.	Component	Order number	Qty
19	Cable set	13080	1
20	Power supply	13090	1
21	Double-acting cylinder	15033	1
22	Set point control module	18001	1
23	Linear potentiometer	18004	1
24	Linear potentiometer guide	18005	1
25	Pressure filter	18008	1
26	PID module	18010	1
27	Status controller	18011	1
28	4/3-way servo valve	18012	1
29	Weight test unit	18015	1
30	Weight, 5Kg (A)	18016	1
31	Weight, 5Kg (B)	18017	1
32	Measurement display unit	18018	1
33	Pressure sensor	18019	1
34	Temperature sensor	18020	1
35	Flow meter	18021	1
36	Digital multimeter	21012	1

Hydraulic K–HRD set, basic level (FH–401)

Component

No.	Component	Order number	Qty
1	Oil tray	14011	1
2	POWER UNIT 1 PUMP	15010	1
3	POWER UNIT overload protector	15019	1
4	Flow measuring unit	15020	1
5	Transparent double-acting cylinder	15039	1
6	Double-acting cylinder	15031	1
7	Weight	15022	1
8	Hydraulic motor	15035	1
9	Flow meter	18021	1
10	Measurement display unit	18018	1
11	4/2-way hand lever valve	15040	1
12	4/3-way hand lever valve (PABT blocked)	15041	1
13	4/3-way hand lever valve (ABT connected)	15042	1
14	4/3-way hand lever valve (PT connected)	15043	1
15	2/2-way limit valve	15049	1
16	Cylinder guide	15024	1
17	Pressure relief valve (directly actuated)	15050	2
18	Pressure relief valve (directly actuated)	15051	1
19	Pressure relief valve (pilot actuated)	15052	1
20	Counter balancing valve	15056	1
21	Shut-off valve	15063	1
22	Flow control valve	15060	1
23	One-way flow control valve	15061	2
24	Flow control valve (pressure compensative)	15053	1
25	Flow dividing valve	15054	1
26	Check valve (1bar)	15064	3
27	Check valve (5bar)	15065	1
28	Pilot actuated check valve	15062	1
29	Pressure gauge	15070	3

No.	Component	Order number	Qty
30	Pressure gauge with distributor	15071	3
31	T connector	15066	4
32	Accumulator	15080	1
33	Hose 1500mm	15090	2
34	Hose 1000mm	15091	6
35	Hose 600mm	15092	12
36	Hydraulic hose hanger	15093	1
37	Pressure remover	15099	1
38	3/2-way solenoid valve	16011	1
39	4/2-way solenoid valve	16012	1
40	4/2-way double solenoid valve	16013	1
41	4/3-way double solenoid valve (PABT blocked)	16014	1
42	4/3-way double solenoid valve (ABT connected)	16015	1
43	4/3-way double solenoid valve (PT bypassed)	16016	1
44	Power supply	13090	1
45	Push-button switch set (3-fold)	13033	1
46	Pilot lamp & buzzer unit	13034	1
47	Relay unit (3-fold)	13030	3
48	Digital time relay	13031	1
49	Digital counter	13032	1
50	Emergency switch	13035	1
51	Electric limit switch (left)	13051	2
52	Electric limit switch (right)	13052	2
53	Pressure switch	16020	1
54	Inductive sensor	13040	1
55	Capacitive sensor	13041	1
56	Optical sensor	13042	1
57	Cable set	13080	1

Recommended items

Component	Order number
Hydraulic basic working table (single side)	14007
H–Lab simulation software	40006
Hydraulics text book	42053
Hydraulics work book, basic level	42047
Electro–hydraulics text book	42054

Component	Order number
Electro–hydraulics work book, basic level	42049
Magnetic symbol (pneumatics and hydraulics)	13501
Magnetic symbol (electrics)	13502
Cable hanger	13091

Hydraulic K–HRD set, advanced level (FH–402)

Component

No.	Component	Order number	Qty
1	Oil tray	14011	1
2	POWER UNIT 1 PUMP	15010	1
3	POWER UNIT overload protector	15019	1
4	Flow measuring unit	15020	1
5	Hydraulic distributor	15023	1
6	Single-acting cylinder	15030	1
7	Transparent double-acting cylinder	15039	1
8	Double-acting cylinder	15031	2
9	Cylinder cover	15100	1
10	Weight	15022	1
11	Hydraulic motor	15035	1
12	Flow meter	18021	1
13	Measuring display unit	18018	1
14	3/2- way hand lever valve	15037	1
15	4/2-way hand lever valve	15040	1
16	4/3-way hand lever valve (PABT blocked)	15041	1
17	4/3-way valve (ABT connected)	15042	1
18	4/3-way valve (PT bypassed)	15043	1
19	2/2-way limit valve	15049	1
20	Cylinder guide	15024	1
21	Pressure relief valve (directly actuated)	15050	2
22	Pressure relief valve (pilot actuated)	15051	1
23	3-way pressure reducing valve	15052	1
24	Counter balancing valve	15056	1
25	Pressure sequence valve	15101	1
26	Pressure relief valve (externally actuated)	15055	1
27	Shut-off valve	15063	1
28	Flow control valve	15060	1
29	One-way flow control valve	15061	2
30	Flow control valve (pressure compensative)	15053	1
31	Flow dividing valve	15054	1
32	Check valve (1bar)	15064	3

No.	Component	Order number	Qty
33	Check valve (5bar)	15065	1
34	Pilot actuated check valve	15062	1
35	Pressure gauge	15070	3
36	Pressure gauge with distributor	15071	3
37	T connector	15066	4
38	Accumulator	15080	1
39	Hose 1500mm	15090	2
40	Hose 1000mm	15091	8
41	Hose 600mm	15092	12
42	Hydraulic hose hanger	15093	1
43	Pressure remover	15099	1
44	2/2-way solenoid valve (Normally closed)	16010	1
45	3/2-way solenoid valve	16011	1
46	4/2-way solenoid valve	16012	2
47	4/2-way double solenoid valve	16013	1
48	4/3-way double solenoid valve (PABT blocked)	16014	1
49	4/3-way double solenoid valve (ABT connected)	16015	1
50	4/3-way double solenoid valve (PT bypassed)	16016	1
51	Power supply	13090	1
52	Push-button switch set (3-fold)	13033	1
53	Pilot lamp & buzzer unit	13034	1
54	Relay unit (3-fold)	13030	4
55	Digital time relay	13031	1
56	Digital counter	13032	1
57	Emergency switch	13035	1
58	Electric limit switch (left)	13051	2
59	Electric limit switch (right)	13052	2
60	Pressure switch	16020	1
61	Inductive sensor	13040	1
62	Capacitive sensor	13041	1
63	Optical sensor	13042	1
64	Cable set	13080	1

Recommended items

Component	Order number
Hydraulic basic working table (single side)	14007
H-Lab simulation software	40006
Hydraulics text book	42053
Hydraulics work book, basic level	42047
Hydraulics work book, advanced level	42048
Electro-hydraulics text book	42054

Component	Order number
Electro-hydraulics work book	42049
Electro-hydraulics work book, advanced level	42050
Magnetic symbol (pneumatics and hydraulics)	13501
Magnetic symbol (electrics)	13502
Cable hanger	13091

Portable electro-hydraulics trainer (FH-500)



Order number : 16024



Order number : 16025

Feature of the equipment

- Each case contains pump, electric modules, and hydraulics components so that user can carry and store them easily.
- All components can be attached in aluminum profile panel in case.

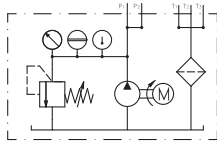
Component

No.	Component	Qty
1	POWER UNIT 1 PUMP (Portable)	1
2	Aluminum case	2
3	Double-acting cylinder	1
4	Hydraulic motor	1
5	Pressure relief valve (pilot actuated)	1
6	Pressure relief valve (directly actuated)	1
7	One-way flow control valve	4
8	Flow control valve (pressure compensative)	1
9	Pilot actuated check valve	2
10	3-way pressure reducing valve	1
11	4/2-way solenoid valve	1
12	4/2-way double solenoid valve	1

No.	Component	Qty
13	4/3-way double solenoid valve	1
14	Pressure gauge with distributor	4
15	Hose 600mm	6
16	Hose 1000mm	4
17	Push-button switch set	1
18	Relay unit (3-fold)	2
19	Digital time relay	1
20	Digital counter	1
21	Electric limit switch (left)	1
22	Electric limit switch (right)	1
23	Cable set	1
24	Power supply	1

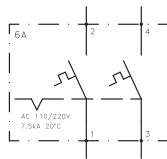
Components

POWER UNIT 1 PUMP **Order number : 15010**



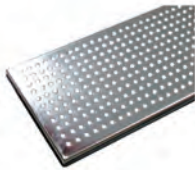
- Motor : AC 220, 1,5 KW, 12,3 A,
- Gear pump type
- Flow rate : 4 LPM
- Operating pressure : 5 ~ 60 bar
- Tank capacity : 30 ℓ
- Pressure gauge included
- Filter, level, temperature meter included

POWER UNIT overload protector **Order number : 15019**



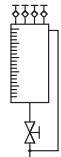
- POWER LED display
- One-touch clamp included
- Max. allowed current : 15A

Oil tray **Order number : 14011**



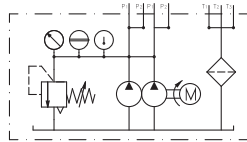
- Hydraulic table
- Material : Stainless Steel
- Press punching
- Size : 1500(L)x200(W)x20(H) mm

Flow measuring unit **Order number : 15020**



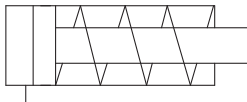
- Capacity : 2ℓ
- Hydraulics couplings : 4ea
- Inner pressure protector silencer : 1ea
- Flow limit sensor
- Hand lever valve attached

POWER UNIT 2 PUMP **Order number : 15011**



- Motor : 230V/50Hz 1,1kw, 7,2A
- Gear pump type : 2ea
- Operating pressure : 5 ~ 250 bar
- Tank capacity : 40 ℓ
- Pressure gauge : 2 ea
- Pressure relief valve : 2ea

Single-acting cylinder **Order number : 15030**

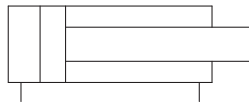


- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Piston diameter : 25mm
- Piston rod diameter : 18mm
- Cylinder stroke : 200 mm

Components

Double-acting cylinder(25-18-200)

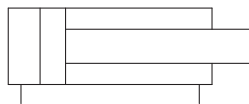
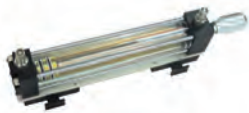
Order number : 15031



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Piston diameter : 25mm
- Piston rod diameter : 18mm
- Cylinder Stroke : 200 mm
- Differential cylinder
- Surface area ratio = 2,08 : 1

Transparent double-acting cylinder

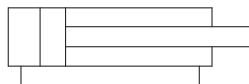
Order number : 15039



- Pressure range : 0 ~ 120 bar
- Operating pressure : 40 bar
- Piston diameter : 20mm
- Piston rod diameter : 12mm
- Cylinder Stroke : 200 mm
- Surface area ratio = 1,56 : 1

Double-acting cylinder(16-10-200)

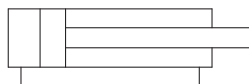
Order number : 15033



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Piston diameter : 16mm
- Piston rod diameter : 10mm
- Cylinder Stroke : 200 mm
- Surface area ratio = 1,64 : 1

Double-acting cylinder(16-10-300)

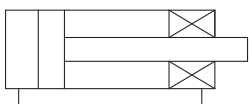
Order number : 15034



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Piston diameter : 16mm
- Piston rod diameter : 10mm
- Cylinder Stroke : 300 mm
- Surface area ratio = 1,64 : 1

Double-acting cylinder with brake

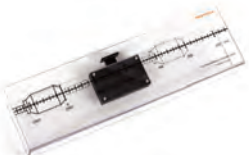
Order number : 15032



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Piston diameter : 25mm
- Piston rod diameter : 18mm
- Cylinder Stroke : 200 mm
- Hand brake attached

Cylinder cover

Order number : 15100

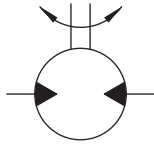


- Measuring scale : -300~250mm
- Material : transparent polycarbonate

Components

Hydraulic motor

Order number : 15035



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Operation : CW / CCW rotary
- Motor type : planetary gears(internal)
- Geometric displacement : 8,2 cc/rev
- Max. speed : 1950rpm

Weight

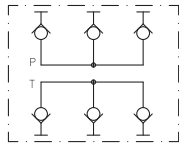
Order number : 15022



- Weight : 9 Kg
- diameter : 120mm
- Length : 120mm

Hydraulic distributor

Order number : 15023

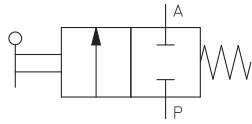


- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- 6 couplings for distribution

Components

2/2-way hand lever valve

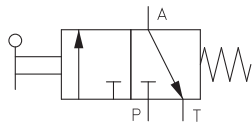
Order number : 15036



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override

3/2-way hand lever valve

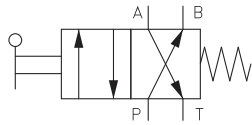
Order number : 15037



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override

4/2-way hand lever valve

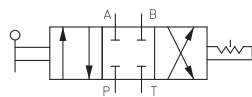
Order number : 15040



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override

4/3-way hand lever valve (PABT blocked)

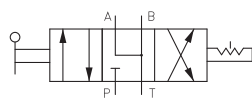
Order number : 15041



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override
- PABT blocked type

4/3-way hand lever valve (ABT connected)

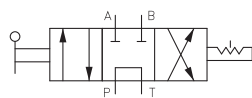
Order number : 15042



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override
- ABT connected type

4/3-way hand lever valve (PT connected)

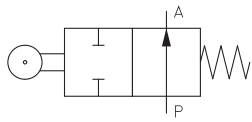
Order number : 15043



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override
- PT bypassed type

Components

2/2-way valve Order number : 15049



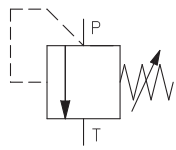
- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Stem operated valve
- Normally open valve
- Use with cylinder guide (ON, 15024)

Cylinder guide Order number : 15024



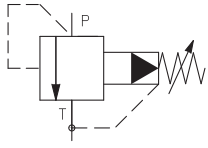
- Attached on hydraulic cylinder
- Use with 2/2-way limit valve (ON,15049)

Pressure relief valve (directly actuated) Order number : 15050



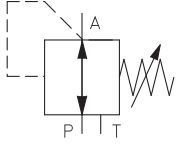
- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override

Pressure relief valve (pilot actuated) Order number : 15051



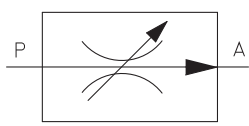
- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override

3-way pressure reducing valve Order number : 15052



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override

Flow control valve (pressure compensative) Order number : 15053

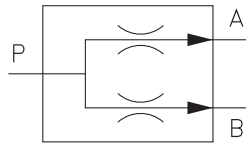


- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override
- 2-way flow control valve
- Pressure balance function

Components

Flow dividing valve

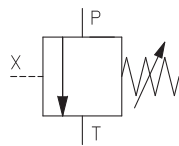
Order number : 15054



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Pressure balance function
- Dividing rate A : B = 50 : 50

Pressure relief valve (externally actuated)

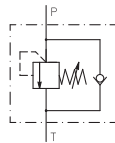
Order number : 15055



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override
- External pilot actuated

Counter balancing valve

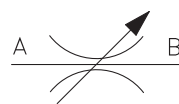
Order number : 15056



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override
- External pilot connection
- External drain

Flow control valve

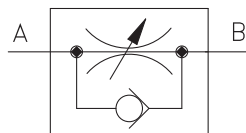
Order number : 15060



- Pressure range : 0 ~ 120 bar
- Flow rate : 10 LPM
- Operating pressure : 60 bar
- Manual override

One-way flow control valve

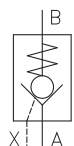
Order number : 15061



- Pressure range : 0 ~ 120 bar
- Flow rate : 10 LPM
- Check valve pressure : 1 bar
- Operating pressure : 60 bar
- Manual override

Pilot actuated check valve

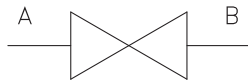
Order number : 15062



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Pilot operation

Components

Shut-off valve Order number : 15063



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override

Check valve (1 Bar) Order number : 15064



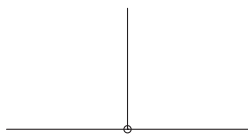
- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Check pressure : 1 bar

Check valve (5 Bar) Order number : 15065



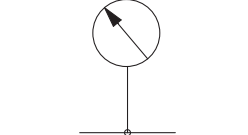
- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Check pressure : 5 bar

T connector Order number : 15066



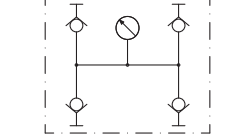
- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar

Pressure gauge Order number : 15070



- Pressure range : 0 ~ 100 bar
- Precision : 1,6%
- Glycerin filling
- Operating fluid : hydraulic oil
- Gauge diameter : 60 mm

Pressure gauge with distributor Order number : 15071

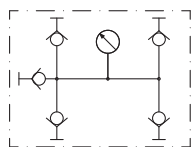


- Pressure range : 0 ~ 100 bar
- Precision : 1,6%
- Glycerin filling
- Operating fluid : hydraulic oil
- Gauge diameter : 60 mm
- Distribution connector : 4ea

Components

Pressure gauge with distributor (5Port)

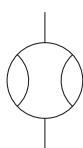
Order number : 15073



- Pressure range : 0 ~ 100 bar
- Precision : 1,6%
- Glycerin filling
- Operating fluid : hydraulic oil
- Gauge diameter : 60 mm
- Distribution connector : 5ea

Inline flow meter

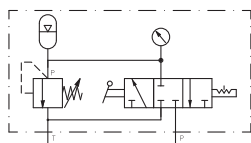
Order number : 15072



- Operating pressure : Max, 240 bar
- Flow range : 1 ~ 8 LPM
- Measuring accuracy : 25% over
- mid-scale : 4% FSD
- Repeatability : ±1% of full scale
- Input connector : Female
- Output connector : Male

Accumulator

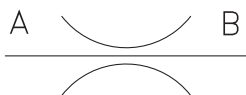
Order number : 15080



- Filling gas : nitrogen
- Gas filling pressure : 10 bar
- Volume : 0,5ℓ
- Manual override
- Max, pressure : 120 bar

Choke axial transparent block

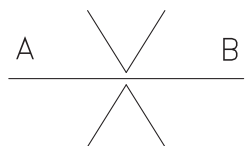
Order number : 15081



- Pressure range : 0 ~ 70 bar
- Operating pressure : 60 bar
- Diameter : 1mm
- Length : 15mm
- Transparent block

Orifice transparent block

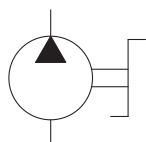
Order number : 15082



- Pressure range : 0 ~ 70 bar
- Operating pressure : 60 bar
- Diameter : 1mm
- Length : 2mm
- Transparent block

Transparent pump (manually operated)

Order number : 15083



- Gear pump
- Manual override pumping type
- Transparent block

Components

Hose 1500 mm	Order number : 15090
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- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Temperature : -40°C ~ 125°C
- Min. flexibility : 80mm

Hose 1000 mm	Order number : 15091
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- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Temperature : -40°C ~ 125°C
- Min. flexibility : 80mm

Hose 600 mm	Order number : 15092
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- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Temperature : -40°C ~ 125°C
- Min. flexibility : 80mm

Hydraulic hose hanger	Order number : 15093
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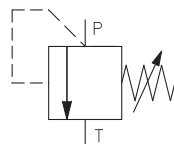
- Capacity : 30 hoses
- Material : Steel

Pressure remover	Order number : 15099
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- Remove the remaining pressure
- Manual override

Pressure sequence valve	Order number : 15101
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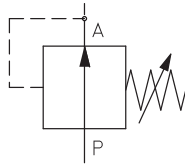


- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override

Components

2-way pressure reducing valve

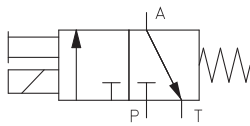
Order number : 15102



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override

Shuttle valve

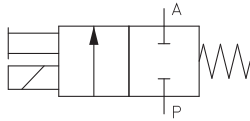
Order number : 15103



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- OR function

Pressure compensative flow control valve (3-way)

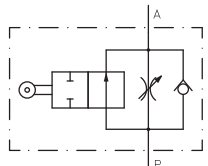
Order number : 15104



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Manual override
- 3-way flow control valve
- Pressure balance function

Flow control valve (cam operated)

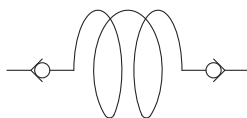
Order number : 16021



- Operating input range : 0~120bar
- Operating pressure : 60bar
- Cam operating

Pipe resister 1

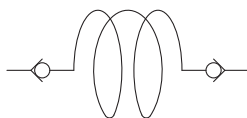
Order number : 15201



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- ϕ 1,6-1700mm
- Material : steel pipe

Pipe resister 2

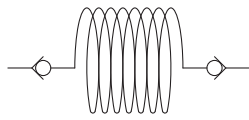
Order number : 15202



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- ϕ 3,2-1700mm
- Material : steel pipe

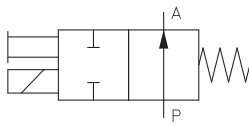
Components

Pipe resister 3 Order number : 15203



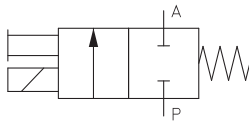
- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- \varnothing 1,6–3400mm
- Material : steel pipe

2/2–way solenoid valve (Normally open) Order number : 16009



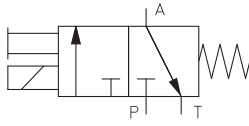
- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Power consumption : 27W
- Power : DC 24V
- LED and protection circuit included

2/2–way solenoid valve (Normally close) Order number : 16010



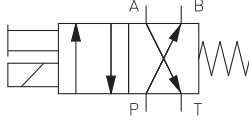
- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Power consumption : 27W
- Power : DC 24V
- LED and protection circuit included

3/2–way solenoid valve Order number : 16011



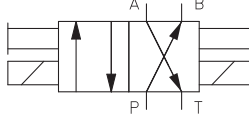
- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Power consumption : 27W
- Power : DC 24V
- LED and protection circuit included

4/2–way solenoid valve Order number : 16012



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Power consumption : 27W
- Power : DC 24V
- LED and protection circuit included

4/2–way double solenoid valve Order number : 16013

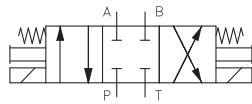


- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Power consumption : 27W
- Power : DC 24V
- LED and protection circuit included

Components

4/3-way double solenoid valve (PABT blocked)

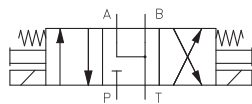
Order number : 16014



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Power consumption : 27W
- PABT blocked (All blocked)
- Power : DC 24V
- LED and protection circuit included

4/3-way double solenoid valve (ABT connected)

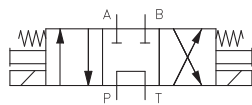
Order number : 16015



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Power consumption : 27W
- ABT connected
- Power : DC 24V
- LED and protection circuit included

4/3-way double solenoid valve (PT bypassed)

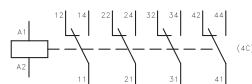
Order number : 16016



- Pressure range : 0 ~ 120 bar
- Operating pressure : 60 bar
- Power consumption : 27W
- PT bypassed type
- Power : DC 24V
- LED and protection circuit included

Relay unit (3-fold)

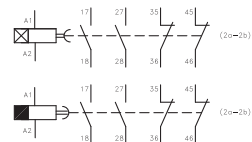
Order number : 13030



- Power : DC 24V
- Contact : 4 C – contact
- Contact load : Max, 5A
- Allowable : Max, 120W
- Operating time : < 20 ms
- Block time : < 20 ms

Digital time relay

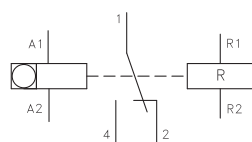
Order number : 13031



- Power : DC 24V
- Contact : 2a-2b
- Contact load : Max, 5A
- Allowable : Max, 100W
- Delay time : 1~99 sec
- On-delay / Off-delay


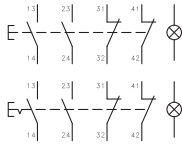

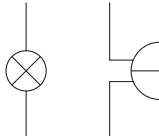

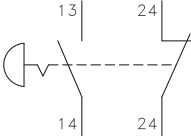

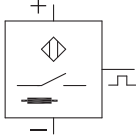

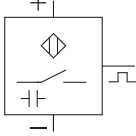

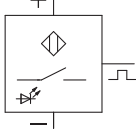
Digital counter

Order number : 13032



- Power : DC 24V
- Contact : 1 C – contact
- Contact load : Max, 5A
- Power consumption : 2.4W
- Counter pulse : 20 ms
- Display : 4 digit

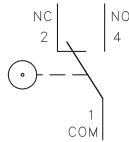
Components

<p>Push-button switch set</p>	<p>Order number : 13033</p>
	 <ul style="list-style-type: none"> ● Power : DC 24V ● Consist of : 2 push-buttons, 1 locking push-button ● Contact : 2 a-contact, 2 b-contact ● Contact allowable : Max, 1A ● Power consumption : 0,48W
<p>Pilot lamp & buzzer unit</p>	<p>Order number : 13034</p>
	 <ul style="list-style-type: none"> ● Power : DC 24V ● Lamp power consumption : 1,2W ● Buzzer power consumption : 0,04W ● Buzzer frequency : 420W
<p>Emergency switch</p>	<p>Order number : 13035</p>
	 <ul style="list-style-type: none"> ● Power : DC 24V ● Type : mushroom locking button ● Contact : 1a, 1b ● Contact load : Max, 8A
<p>Inductive sensor</p>	<p>Order number : 13040</p>
	 <ul style="list-style-type: none"> ● Switching power : DC10~30V ● Switching distance : 5mm ● Switching frequency : Max, 500Hz ● Output contact : Normally open contact, PNP ● Output current : Max, 200mA ● Protection circuit included
<p>Capacitive sensor</p>	<p>Order number : 13041</p>
	 <ul style="list-style-type: none"> ● Switching power : DC10~30V ● Switching distance : 8mm ● Switching frequency : Max, 50Hz ● Output contact : Normally open contact, PNP ● Output current : Max, 200mA ● Switching capacity : 4.8W ● Protection circuit included
<p>Optical sensor</p>	<p>Order number : 13042</p>
	 <ul style="list-style-type: none"> ● Switching power : DC10~30V ● Switching distance : 100mm ● Response time : 1ms ● Output contact : Normally open contact, PNP ● Output current : Max, 200mA ● Protection circuit included

Components

Electric limit switch (left)

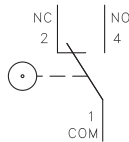
Order number : 13051



- Contact : DC 24V, 5A
- Contact : 1C
- Switching frequency : Max. 200Hz
- Roller lever electric switch

Electric limit switch (right)

Order number : 13052



- Contact : DC 24V, 5A
- Contact : 1C
- Switching frequency : Max. 200Hz
- Roller lever electric switch

Cable set

Order number : 13080



- Color : red, blue, black
- Length : 1500mm, 1000mm, 500mm, 300mm, 100mm
- High elasticity and special coating

Cable set (safety socket)

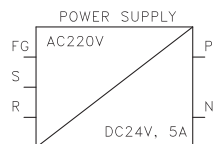
Order number : 113080



- Color : red, blue, black
- Length : 1500mm, 1000mm, 500mm, 300mm, 100mm
- High elasticity and special coating
- Safety socket type

Power supply

Order number : 13090



- Power : AC 220 V, 50/60Hz
- Output power : DC 24V
- Output current : 5A

Cable hanger

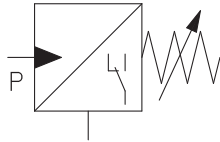
Order number : 13091



- Round plate diameter : 400mm
- Height : 1100 ~ 1800mm adjustable type
- Castor : 5 ea
- Cable hanger : 16 holes

Components

Pressure switch Order number : 16020



- Diaphragm switch
- Operating pressure : 10 ~ 70 bar
- hysteresis : 15%
- contact capacity : 5A
- Manual override

Current measurement unit Order number : 16022



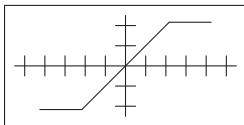
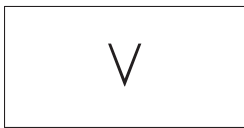
- Current measuring unit
- Power : DC24V

Voltage measurement unit Order number : 16023



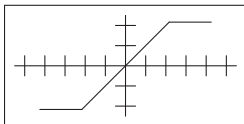
- Voltage measuring unit
- Power : DC24V

Signal controller Order number : 26013



- Input range : 0~20mA, -10 ~ 10V
- Signal measuring function
 - Voltage : -10 ~ 10V
 - Current : 0~20mA
- Voltage control function
 - Selectable voltage controller
 - Voltage control (I) : 0 ~ DC10V
 - Voltage control (II) : -10 ~ DC10V
- Output signal : 0 ~ 10V, -10 ~ 10V
- Input, output select : toggle switch
- 4mm cable socket and terminal type
- Power : DC24V
- One-touch clamp
- Aluminum case

Set point control module Order number : 18001

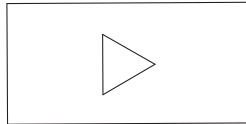


- Set point input : 3 (8 combination)
- Output : -10 V ~ +10 V
- Ramp time : 4 (0~10,0s/1V)
- Input operating voltage : Min. 15V
- Output frequency : 1 kHz

Components

Proportional amplifier

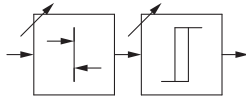
Order number : 18002



- Set point range : ± 10 V DC
- Switching signal range : 15~30V DC
- Output capacity : 0~1000mA
- Basic Current setting : 0~250mA
- Jump current setting : 0~250mA
- Max. current setting : 100~1000mA
- Dither frequency setting : 100~250Hz

Comparator module

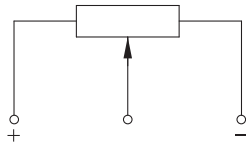
Order number : 18003



- 2 independent comparator
- Voltage range : $-10V \sim +10V$
- Hysteresis range : $0V \sim +5V$
- Input range : $-10V \sim +10V$
- Input impedance range : >10 k Ohm
- Display precision : $\pm 30mV$
- Contact load : 24V DC/2A

Linear potentiometer

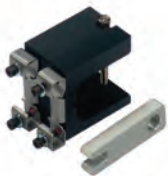
Order number : 18004



- Power : 13 ~ 30 V DC
- Output voltage : 0 ~ 10 V DC
- Range : 200mm
- Register : 10K Ω $\pm 20\%$

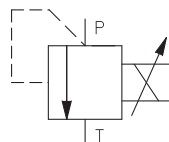
Linear potentiometer guide

Order number : 18005



Proportional pressure relief valve

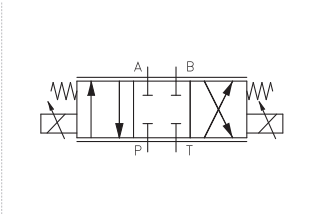
Order number : 18006



- Valve type : proportional pressure relief valve (directly operated)
- Operating type : proportional solenoid
- Pressure range : 100bar
- Min. flow rate : 0,1 LPM
- Max. flow rate : 20 LPM
- Resolution : 1mA
- Repeat precision : $\leq 1\%$
- Hysteresis : $\leq 2\%$

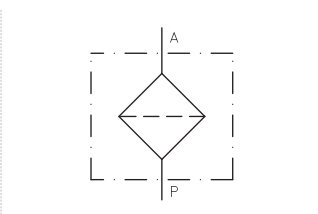
Components

4/3-way proportional control valve Order number : 18007



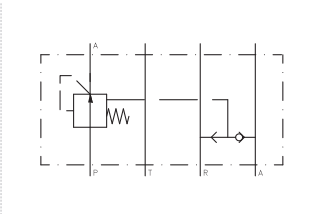
- Valve type : spool valve (directly actuated)
- Max. pressure : 250 bar
- Flow rate : 5 LPM
- Min. flow rate : 0,02 LPM
- Resolution : 1 mA
- Repeat precision : ≤ 1%
- Hysteresis : ≤ 2%

Pressure filter Order number : 18008



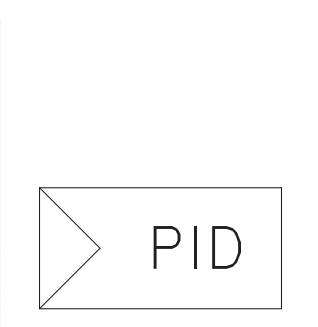
- Filter level : 5 μm
- Pressure range : 0 ~ 120 bar
- Filter contamination indicator
- Cartridge pressure filter

Pressure compensation valve Order number : 18009






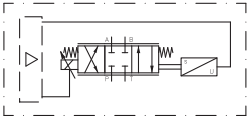

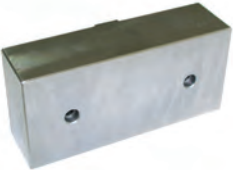

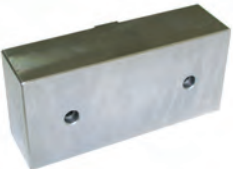

- Valve type : cartridge
- Flow rate : 8 LPM
- Pressure drop : 10bar
- Function : pressure balance (flow control)

PID module Order number : 18010



- Indicating range : -10 V ~+10 V
- Input range voltage : -13V ~ +13V
- Proportionality factor KP : 0~1000
- Integrating factor KI : 0~1000 s-1
- Integrating factor KD : 0~1000ms
- Output voltage : 0~+10V, -10~+10V
- Offset range : 5V ±3,5V(0~10V)
0 V ±7V(-10~+10V)
- Component : power supply, differential input part, comparator, proportion controller, integration controller, differential controller, offset part, summer, limiter, output part

Components

<p>Status controller</p>	<p>Order number : 18011</p>
	 <ul style="list-style-type: none"> ● Indicating range : $-10\text{ V} \sim +10\text{ V}$ ● Position factor K_x : $0 \sim 10$ ● Speed factor K_x : $0 \sim 100\text{ms}$ ● Accelerometer coefficient K_x : $0 \sim 10\text{ s}^2$ ● Gain range : $0 \sim 1000$ ● Output voltage : $0 \sim +10\text{V}$, $-10 \sim +10\text{V}$ ● Offset range : $5\text{V} \pm 3.5\text{V}(0 \sim 10\text{V})$ $0\text{ V} \pm 7\text{V}(-10 \sim +10\text{V})$ ● Component : power supply, differential input comparator, position controller, speed controller, accelerometer controller, gain setting part, offset part, summer, limiter, output part
<p>4/3-way servo control valve</p>	<p>Order number : 18012</p>
	 <ul style="list-style-type: none"> ● Valve type : single sleeve spool valve ● Operating type : directly, magnetic linear motor ● Flow rate : $5\text{ LPM}(\Delta P_n=35\text{bar}, \pm 10\%)$ ● $2\text{LPM}(\Delta P_n=5\text{bar}, \pm 10\%)$ ● Max. pressure : P,A,B port-120bar ● T port -50bar ● Power/ Max. current : $\text{DC}24\text{V}/1.2\text{A}$ ● Input/ operating voltage range : $\pm 10\text{V}$ ● Response time : $\leq 12\text{ms}$
<p>Weight test unit</p>	<p>Order number : 18015</p>
	<ul style="list-style-type: none"> ● Size : $800 \times 180\text{ mm}$ ● component : hydraulic double-acting cylinder 1ea, cylinder guide (AL Profile), flexible joint weight slide
<p>Weight, 5 kg (A type)</p>	<p>Order number : 18016</p>
	 <ul style="list-style-type: none"> ● Weight : 5 kg ● Size : $170 \times 80 \times 45\text{mm}$ ● Function : additional weight
<p>Weight, 5 kg (B type)</p>	<p>Order number : 18017</p>
	 <ul style="list-style-type: none"> ● Weight : 5 kg ● Size : $170 \times 80 \times 45\text{mm}$ ● Function : additional weight

Components

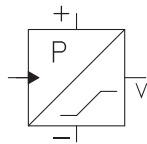
Measurement display unit **Order number : 18018**



Temperature	°C
Pressure	bar
Flowrate	l/min

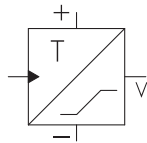
- Display : Voltage, current, flow rate
- Type : 7-segment digital display
- Temperature : input – current
- Pressure : input – voltage
- Flow rate : input – pulse
- Output : 0 ~ 10V DC

Pressure sensor **Order number : 18019**



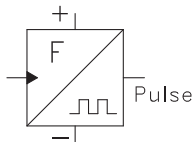
- Power : 24V DC
- Output voltage : 0 ~ 10 V DC
- Measuring range : 0 ~ 100bar
- Load Impedance : $R_x(\min) \geq 2 \text{ k}\Omega$

Temperature sensor **Order number : 18020**



- Power : 12 ~ 24V DC
- Output Current : 4 ~ 20 mA
- Measuring range : 0 ~ 100 °C
- Load Impedance : $R_L \leq 0,65 \text{ k}\Omega$

Flow meter **Order number : 18021**



- Use with hydraulic motor (ON.15035)
- Rotary encoder pulse output
- Display : 0 ~99 LPM

Digital multimeter **Order number : 21012**



- DC/AC voltage, current, register
- AC/DC current : 0,01 mA ~ 10 A
- AC/DC voltage : 0,1 mV ~ 1000 V
- Temperature : -40°C ~ +400°C (-40°F ~ +75°F)
- Diode test
- Frequency : 2 Hz ~ 100 kHz

Function generator **Order number : 18013**



- Signal type : sine wave, square wave, triangular wave, TTL
- Frequency range : 0,1 Hz~500 kHz
- Output voltage : DC
- Off set : -15...+15 V
- Output voltage range : 0...30 V

Components

Oscilloscope

Order number : 18014



- Trigger system 2 CH memory
- Width of band : 20 MHz
- Time setting range : 0,2 μ s...5 s
- Voltage setting range : 5 mV...5 V

Hydraulic oil

Order number : 15105



- ISO VG32
- 20l

Magnetic symbol set (pneumatics and hydraulics)

Order number : 13501



Pneumatic
&
Hydraulics
SYMBOLS

- Pneumatics and hydraulics symbols based on ISO
- Cylinders, valves and other symbols
- Magnetic included

Magnetic symbol set (electrics)

Order number : 13502



Electric
SYMBOLS

- Electric symbols based on ISO
- Switches, sensors, and relay contacts
- Magnetic included

Hydraulics Textbook

Order number : 42053



- Hydraulics textbook





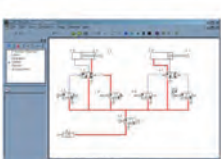
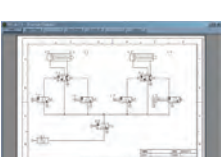
Electro-hydraulics textbook

Order number : 42054



- Electro-hydraulics textbook

Components

<p>Hydraulics workbook (Basic level)</p>	<p>Order number : 42047</p>
	<ul style="list-style-type: none"> ● Hydraulics workbook (Basic level)
<p>Hydraulics workbook (Advanced level)</p>	<p>Order number : 42048</p>
	<ul style="list-style-type: none"> ● Hydraulics workbook (Advanced level)
<p>Electro-hydraulics workbook (Basic level)</p>	<p>Order number : 42049</p>
	<ul style="list-style-type: none"> ● Electro-hydraulics workbook (Basic level)
<p>Electro-hydraulics workbook (Advanced level)</p>	<p>Order number : 42050</p>
	<ul style="list-style-type: none"> ● Electro-hydraulics workbook (Advanced level)
<p>PH-Lab simulation software</p>	<p>Order number : 40003</p>
	<ul style="list-style-type: none"> ● Pneumatics and Hydraulics software
<p>H-Lab simulation software</p>	<p>Order number : 40006</p>
	<ul style="list-style-type: none"> ● Hydraulics software

Components

Easy Servo Interface

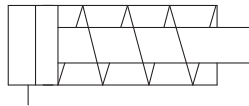
Order number : 40004



- Real time actuator control using servo control unit
- Digital signal processing
- Display : digital & analog
- Proportional control (open loop control)
- Servo control (Closed loop control)

Single acting cylinder

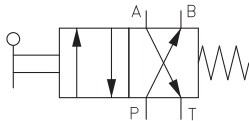
Order number : 17072



- Pressure range : 50bar
- Piston diameter : 20mm
- Piston rod diameter : 12mm
- Stroke : 100 mm
- Plate aluminum material : 6mm
- Weight tester included

4/2-way valve

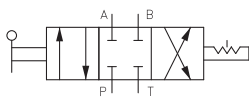
Order number : 17075



- Hand lever operated
- Spring return type
- Pressure range : 50bar

4/3-way valve (PABT blocked)

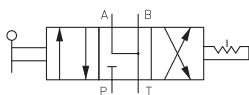
Order number : 17077



- Hand lever operated
- Spring return type
- Pressure range : 50bar

4/3-way valve (ABT connected)

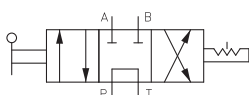
Order number : 17102



- Hand lever operated
- Spring return type
- Pressure range : 50bar

4/3-way valve (PT bypassed)

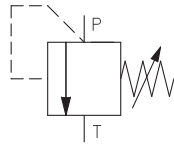
Order number : 17076



- Hand lever operated
- Spring return type
- Pressure range : 50bar

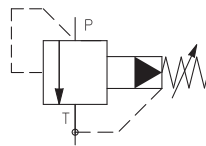
Components

Pressure relief valve (directly controlled) Order number : 17078

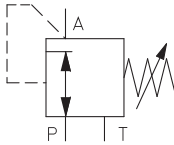


- Function : pressure relief valve, pressure sequence valve
- Pressure range : 50bar

Pressure relief valve (pilot controlled) Order number : 17079

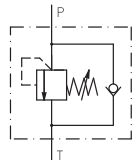


3-way pressure reducing valve Order number : 17087



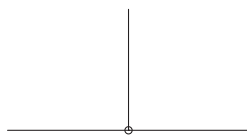
- 3 Port
- Spring adjusted
- Lever operated
- Flow control
- Flow rate : 9LPM
- Pressure range : 50bar
- Pressure control valve included

Counter balancing valve Order number : 17089



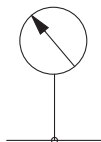
- Operating pressure range : 0~60bar
- Pressure range : 50bar
- Manual control
- External pilot connected
- External drain

T connector Order number : 17092



- Hose connector and flow control
- Check valve coupling socket / 2ea nipple

Pressure gauge Order number : 17088

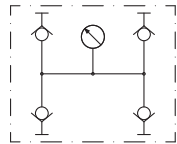


- Indicator : 0~50bar
- Gauge diameter : 60 ∅
- Precision : 1,6%
- Check valve coupling socket / nipple
- Pressure range : 50bar

Components

Pressure gauge with distributor

Order number : 17129



- Indicator : 0~50bar
- Gauge diameter : 63φ
- Distribution connector : 4ea
- Pressure range : 50bar

Transparent model hose

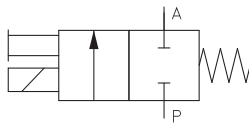
Order number : 17123, 17125



- Length : 600, 1200mm
- Hose diameter : 4mm
- Pressure range : 30bar

2/2-way solenoid valve

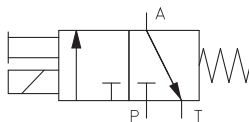
Order number : 17111



- Spring return type
- LED included
- Current consumption : 12W
- +, - integrated socket, 4mm cable socket 2ea included
- Pressure range : 50bar

3/2-way solenoid valve

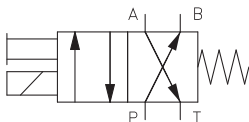
Order number : 17112



- Spring return type
- LED included
- Current consumption : 12W
- +, - integrated socket, 4mm cable socket 2ea included
- Pressure range : 50bar

4/2-way solenoid valve

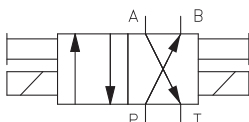
Order number : 17113



- Spring return type
- LED included
- Current consumption : 12W
- +, - integrated socket, 4mm cable socket 2ea included
- Pressure range : 50bar

4/2-way double solenoid valve

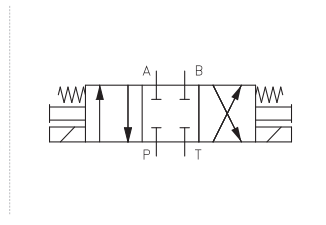
Order number : 17117



- Double solenoid operated
- LED included
- Current consumption : 12W
- +, - integrated socket, 4mm cable socket 2ea included
- Pressure range : 50bar

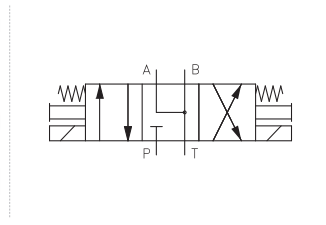
Components

4/3-way double solenoid valve (PABT blocked) Order number : 17115



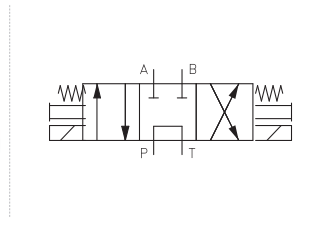
- P,A,B,T blocked
- LED included
- Current consumption : 12W
- +, - integrated socket, 4mm cable socket 2ea included
- Pressure range : 50bar

4/3-way double solenoid valve (ABT connected) Order number : 17119



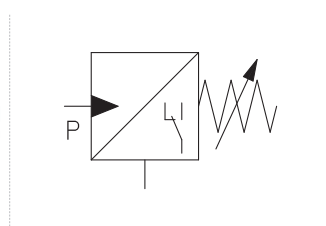
- A,B,T connected
- LED included
- Current consumption : 12W
- +, - integrated socket, 4mm cable socket 2ea included
- Pressure range : 50bar

4/3-way double solenoid valve (PT bypassed) Order number : 17120



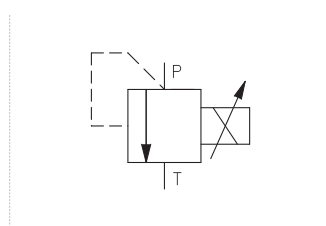
- P,T bypassed
- LED included
- Current consumption : 12W
- +, - integrated socket, 4mm cable socket 2ea included
- Pressure range : 50bar

Pressure switch Order number : 17116



- Hysteresis : ~15%
- Load capacity : 2A
- Operating type : hydraulic oil
- 1ea C contact
- Type : diaphragm switch
- Pressure range : 50bar

Proportional pressure relief valve Order number : 17130

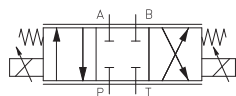


- Pressure range : 50bar
- Min. Flow rate : 0,1 LPM
- Max. Flow rate : 20 LPM
- Resolution : 1mA
- Hysteresis : 2%
- Precision : 1%
- Flow rate : 5 LPM

Components

4/3-way proportional control valve

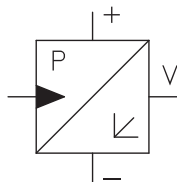
Order number : 17131



- Valve type : spool valve
- Filter level : 10 μ m
- Pressure range : 50bar
- Flow rate : 1,5 LPM
- Power : 24V DC
- Current : 680mA
- Setting Time : < 60ms
- Repetition accuracy : < 1%

Pressure sensor

Order number : 17132



- Power : 24V DC
- Output voltage : 0~10V DC
- Measurement range : 0~100bar
- Load Impedance : $R_x(\min) \geq 2 \text{ k}\Omega$

Modular valve unit—Flow control circuit

Order number : 17133



- Throttle & Check Modular Valve
 - * Pressure range : 50bar
- Pressure Reducing Modular Valve
 - * Pressure range : 50bar
- 4/3-way Double Solenoid Valve(All blocked)
 - * Pressure range : 50bar

Modular valve unit—Break circuit

Order number : 17134



- Brake Modular Valve
 - * Pressure range : 50bar
- Pilot Check Modular Valve
 - * Pressure range : 50bar
- 4/3-way Double Solenoid Valve(ABT connected)
 - * Pressure range : 50bar

Modular valve unit—Counter balance circuit

Order number : 17135



- Counter Balance Modular Valve
 - * Pressure range : 50bar
- Pressure Relief Modular Valve
 - * Pressure range : 50bar
- 4/3-way Double Solenoid Valve(PT connected)
 - * Pressure range : 50bar

Components

Modular valve unit–Sequence circuit

Order number : 17136



- Sequence Modular Valve
 - * Pressure range : 50bar
- Pressure Reducing Modular Valve
 - * Pressure range : 50bar
- 4/2–way Double Solenoid Valve
 - * Pressure range : 50bar

Transparent logic valve

Order number : 17137



- ① Transparent logic valve unit valve unit
 - * Block size : 245x245x100
 - * Pressure range (max) : 50bar
 - * Max. flow : 5 LPM
- ② Logic Pressure Relief Valve
 - * Pressure range (max) : 50bar
 - * Max. flow : 5 LPM
- ③ Logic One Way Flow Control Valve
 - * Pressure range (max) : 50bar
 - * Max. flow : 5 LPM
- ④ Forward Logic Pilot Check valve(Power)
 - * Pressure range (max) : 50bar
 - * Max. flow : 5 LPM
- ⑤ Forward Logic Pilot Check valve(Drain)
 - * Pressure range (max) : 50bar
 - * Max. flow : 5 LPM
- ⑥ 4/3–way Double Solenoid valve(PAB)
 - * Pressure range (max) : 50bar
 - * Max. flow : 5 LPM
- ⑦ Reverse Logic Pilot Check valve(power)
 - * Pressure range (max) : 50bar
 - * Max. flow : 5 LPM
- ⑧ Reverse Logic Pilot Check Valve(drain)
 - * Pressure range (max) : 50bar
 - * Max. flow : 5 LPM