

Equipment set TP 511

Basic closed-loop hydraulics training



Closed-loop hydraulics, Basic Level

Hydraulic closed-loop control circuits are normally operated with continuous valves. A control valve with integrated electronics, linear characteristic curve (volumetric flow to control piston position), and zero overlap makes commissioning easy and provides good results in the closed-loop control circuit.

Training content

Position control circuits:

- Characteristic curve of a displacement sensor
- Flow rate characteristics of a continuous directional control valve
- Linear unit as a controlled system for position control
- Designing and commissioning a position control circuit
- Lag errors in the position control circuit
- Position control with a changed controlled system
- Commissioning a position control circuit with disturbances
- Characteristics and transition functions of a status controller
- Parameterizing a status controller

Pressure control circuits:

- Characteristic curve of a pressure sensor
- Controlled system for pressure control
- Characteristics of a PID controller board

- Transition function of a P controller
- Control performance of a pressure control circuit with P controller
- Transition functions of I and PI controllers
- Transition functions of D, PD and PID controllers
- Empirical parameterization of a PID controller
- Parameterizing using the Ziegler-Nichols method
- Changed controlled system with disturbances

Controllers in hydraulics:

- Controlled systems with and without compensation
- Low-delay hydraulic controlled systems
- First, second, and third order hydraulic controlled systems
- Classifying controlled systems according to their step response
- Operating point and controller amplification
- Discontinuous controllers
- Block diagrams for discontinuous and continuous controllers
- P, I, D, PI, PD and PID controllers

- Status controllers
- Selecting the controller structure
- Disturbance reaction and control factor
- Designing control circuits
- Hydraulic, mechanical and electrical controllers
- Analog and digital controllers
- Selection criteria for controllers

Valves and measuring systems:

- Designation, circuit symbols and function of continuous directional control valves
- Stationary characteristics and dynamic behavior of continuous directional control valves
- Function, design, and mode of operation of a pressure regulating valve
- Pressure control with a directional control valve
- Mode of operation and interface of a measuring system

Complete equipment set TP 511 in equipment tray 8028723

The most important components at a glance:

1	1x PID controller	162254
2	1x Status controller	162253
3	2x Pressure sensor	525964
4	1x Pressure gauge	152841
5	1x Hydraulic motor	152858
6	1x Flow sensor	567191
7	1x Pressure filter	548609
8	1x Flow control valve	152842
9	1x Shut-off valve	152844
10	2x 4-way distributor with pressure gauge	159395
11	2x T-distributor	152847
12	1x 4/3-way regulating valve	567269
13	1x Linear drive	8028726
14	2x Weight, 5 kg, for linear drive	34065

Necessary accessories, also order:

4x	Hose line with quick release couplings, 600 mm	152960
3x	Hose line with quick release couplings, 1000 mm	152970
2x	Hose line with quick release couplings, 1500 mm	159386
2x	Hose line with quick release couplings, 3000 mm	158352
1x	Pressure relief unit	152971
1x	Function generator	152918
3x	Cable BNC – 4 mm	152919
1x	Cable BNC – BNC	158357
1x	T-connector BNC	159298
	4 mm Safety laboratory cables → Page 155	
	Digital multimeter	8040005
	Aluminum profile plate → Page 39	
	Digital storage oscilloscope → Page 154	
	Hydraulic power pack $q > 3.5$ l/min → Pages 148 – 149	
	Power supply unit for mounting frame → Page 155	

Also order:

Workbook



The 20 exercises in this book are used to introduce the fundamentals of analog closed-loop hydraulics: pressure and position control with PID controllers, and position control with status controllers. For extra task number 21, which deals with position control with disturbance variables and an active load, the cush-

ioning cylinders for linear drives (order no. 152295), three additional tubing lines with quick connection coupling and a shut-off valve (order no. 152844) are required. These are not included in the scope of delivery.

The workbook contains:
 – Sample solutions, training notes
 – Worksheets for students

Campus license (→ Page 19):

de	94460
en	94469
es	94368
fr	94348

Supplementary media

- FluidSIM®
- FluidLab®
- WBT Hydraulics
- WBT Electrohydraulics
- WBT Open- and closed-loop control
- Textbook: Proportional hydraulics, Basic level
- Hydraulics poster set

