



Learner Centric Advanced Manufacturing Platform



# **PNEUMATICS BASIC TRAINING**

## **(EXERCISES)**

WP6 COLLABORATIVE LEARNING FACTORY



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## Summary of the document

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<b>Document level</b>	Confidential until publication
<b>Document description</b>	This course seeks to acquire the physical fundamentals of pneumatics, an understanding of the operation of pneumatic components, design pneumatic control systems, operate pneumatic components, and maintain pneumatic systems.
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# EXECUTIVE SUMMARY

The main task of the pneumatics in modern technology is to convert the energy of compressed air into mechanical work, which enables fast, clean and cost-effective implementation of linear and rotational movements. In robotics and automation, it is indispensable especially in final execution elements, where it ensures the reliable operation of grippers, vacuum systems and fixation of workpieces. With the development of the electro-pneumatics, its functionality is upgraded with smart valves and sensors that enable connectivity to controllers and energy efficiency within the framework of Industry 4.0.



## Symbolism in control technology

### PNEUMATICS - Symbols of current valves in a pneumatics

ORIGIN AND PREPARATION	TRAVEL VALVE 2 / 2	TRAVEL VALVE 3 / 2- closed	TRAVEL VALVE 3 / 2- open	TRAVEL VALVE 4 / 2	TRAVEL VALVE 5 / 2

=

CHECK THROTTLE VALVE	HIGH-SPEED CH-WAVE VALVE	DC CYLINDER	BIDIRECTIONAL CYLINDER	EXCHANGE - OR VALVE	TWO-PRESSURE - AND VALVE

### COMPOUND VALVES - symbols of some elements

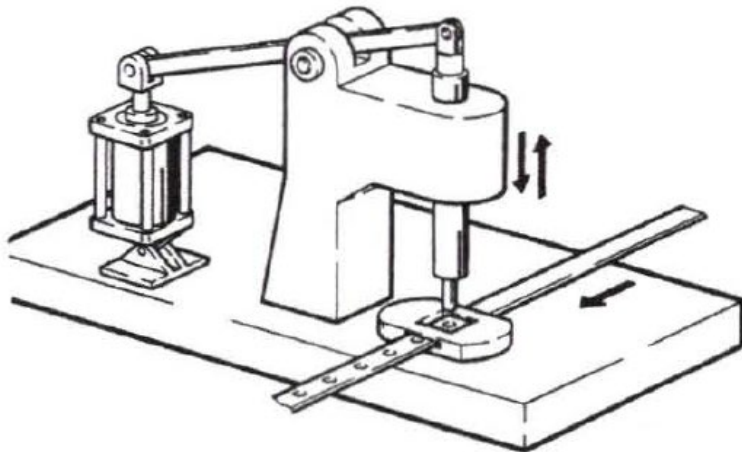
TIME VALVE OPEN	TIME VALVE CLOSED	VACUUM INJECTOR AND SUCTION CUP	PRESSURE SWITCH

The exercises that we will perform are supported by worksheets. These represent a certain situation of operation of a mechatronic device. When designing the control for this device, we will use a computer tool for design and simulation of the control. We will draw a control scheme, a function diagram and describe the operation of the control. This will be the basis for the manufacture of controls on the didactic board.

On the didactic board, we will realize and test the operation of the controls.



# EXERCISE 1 - PNEUMATIC PUNCH - POSITION CONTROL



Picture 1: Situational sketch of the device

Control requirements of the device's operation: A two-way pneumatic cylinder produces a force that is increased through a lever and transmitted to the tool of the stand.

After moving the tape, we activate the start key and a working movement is performed. When the bottom position of the tool is reached, this should return automatically. We will control the cylinder indirectly.

Create:

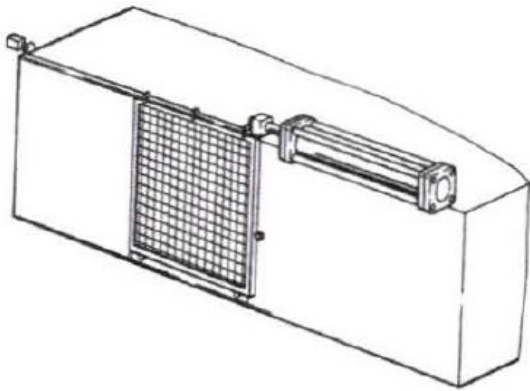
- Pneumatic control scheme
- Mark steering components
- Brief description of operation

Steering scheme:

Brief description of the operation of the steering:




# EXERCISE 2 - MOVING THE DOOR WITH SPEED CONTROL



Picture 2: Situational sketch of the device

Control requirements for the operation of the device:

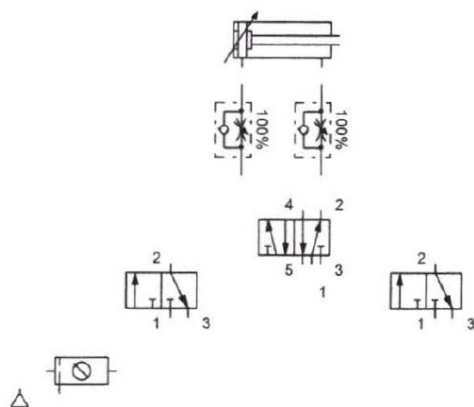
A two-way pneumatic cylinder with final damping moves the sliding door.

By activating one or the other hand button, the door closes or opens.

The cylinder will be controlled indirectly with the ability to adjust the speed of movement in both directions. Create:

- Pneumatic control scheme
- Mark steering components
- Path step diagram of actors with motion conditions
- Brief description of operation

Steering scheme:



Pot – korak diagram :

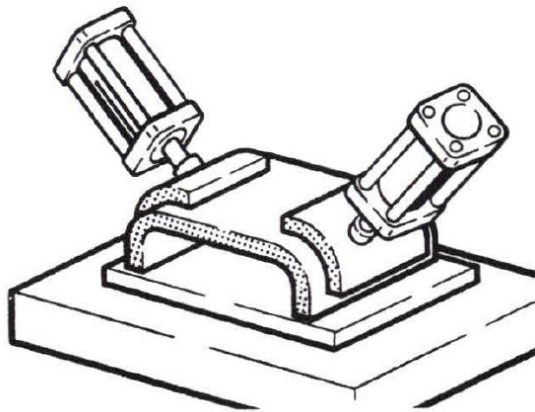
	0	1	2	3
Cil.				
1A1				



Brief description of the operation of the control:




# EXERCISE 3 - GLUING - TIME DEPENDENCE



Picture 3: Situational sketch of the device

Control requirements for the operation of the device:

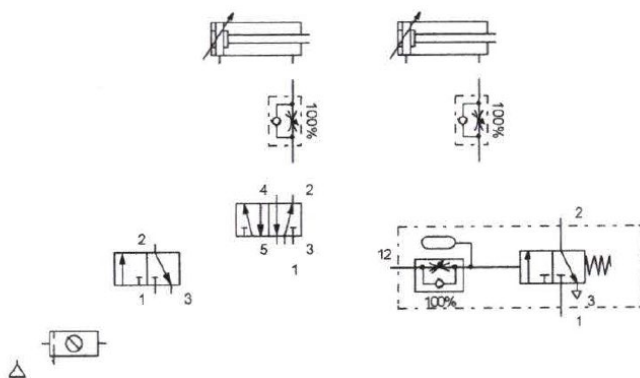
When the start control button is activated, the pneumatic cylinders press the liner against the adhesive. After the gluing time has elapsed, the cylinders automatically return.

The cylinder will be controlled indirectly with the ability to adjust the speed when moving forward.

Create:

- Pneumatic control scheme
- Path step diagram of actors with motion conditions
- Mark control components
- Brief description of operation

Control scheme:



Pot - korak diagram:

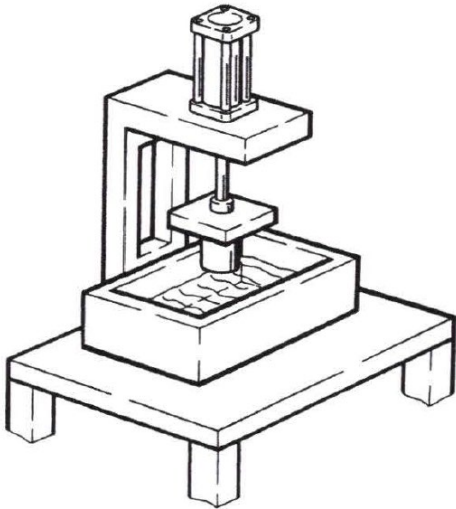
	0	1	2	3
Cil. 1A1				



Brief description of the operation of the control:




# EXERCISE 4 - DRY CLEANING - LEACHING OF WORKPIECES - POSITION AND TIME CONTROL



Picture 4: Situational sketch of the device

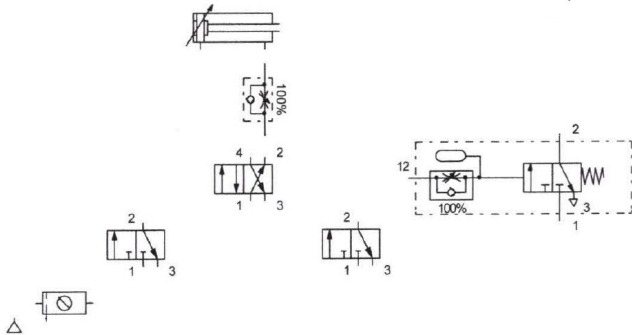
Control requirements for the operation of the device:

The bidirectional pneumatic cylinder should sink the magnetically attached workpiece to a certain position when the start control button is activated. When the cleaning time has elapsed, it should return to the starting position. The cylinder will be controlled indirectly with the ability to adjust the speed when moving forward and backward.

Create:

1. Pneumatic control scheme
2. Path step diagram of actors with motion conditions
3. Brief description of operation

Control scheme:



Pot - korak diagram:

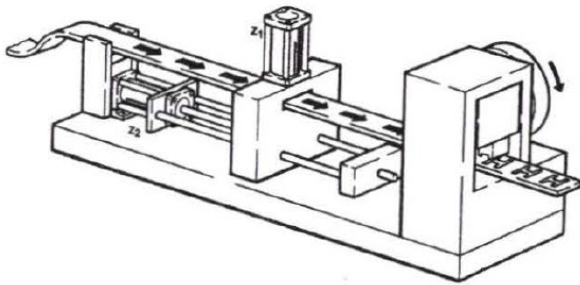
	0	1	2	3
Cil.				
1A1				



Brief description of the operation of the control:




# EXERCISE 5 - S - TAPE FEEDING - SEQUENCE OF CYLINDER OPERATION: 1A1+, 2A1+, 1A1-, 2A1-



Picture 5: Situational sketch of the device

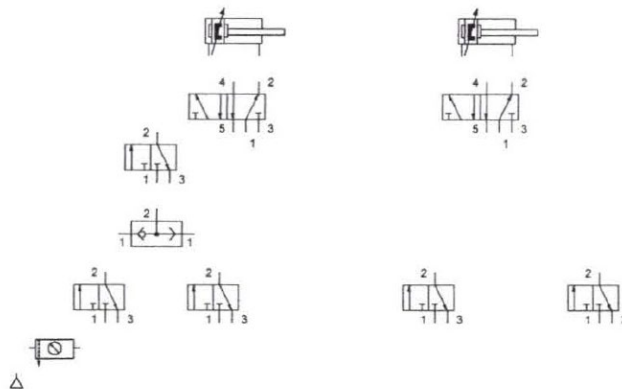
Control requirements for the operation of the device:

The feeder feeds the tape to the stand. Cylinder 1A1 clamps the tape when the ST is activated, then cylinder 2A1 performs the displacement. This is followed by stamping, after which cylinder 1A1 disengages the workpiece and cylinder 2A1 returns to its starting position. If the control valve is in the AUTO position, the cycle repeats automatically.

Create:

- Pneumatic control scheme
- Path step diagram of actors
- Brief description of operation

Control scheme:



Pot - korak diagram:

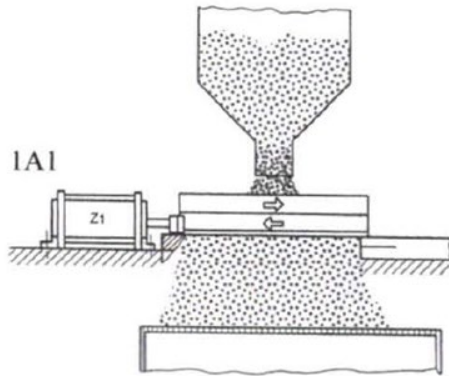
	0	1	2	3	4
Cil. 1A1					
Cil. 2A1					



Brief description of the operation of the control:




# NEED 6 - OSCILLATION - SEPARATION



Picture 6: Situational sketch of the device

Control requirements for the operation of the device:

The bidirectional pneumatic cylinder 1A1 should move forward when the start control button is activated and return automatically when it reaches the desired position. The mode of movement is repeated - it oscillates if the control valve is switched to the AUTO position. The cylinder will be controlled indirectly with the ability to adjust the speed in both movements.

Create:

- Pneumatic control scheme
- Path step diagram of actors with motion conditions
- Brief description of operation

Control scheme:

	0	1	2	3	4
Goal. 1A1					

Brief description of the operation of the control:




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