Automation and Control Lab

Experiments 6: PLC for Pneumatic Cylinder

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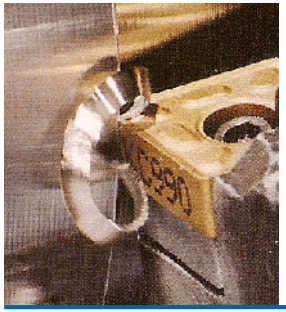
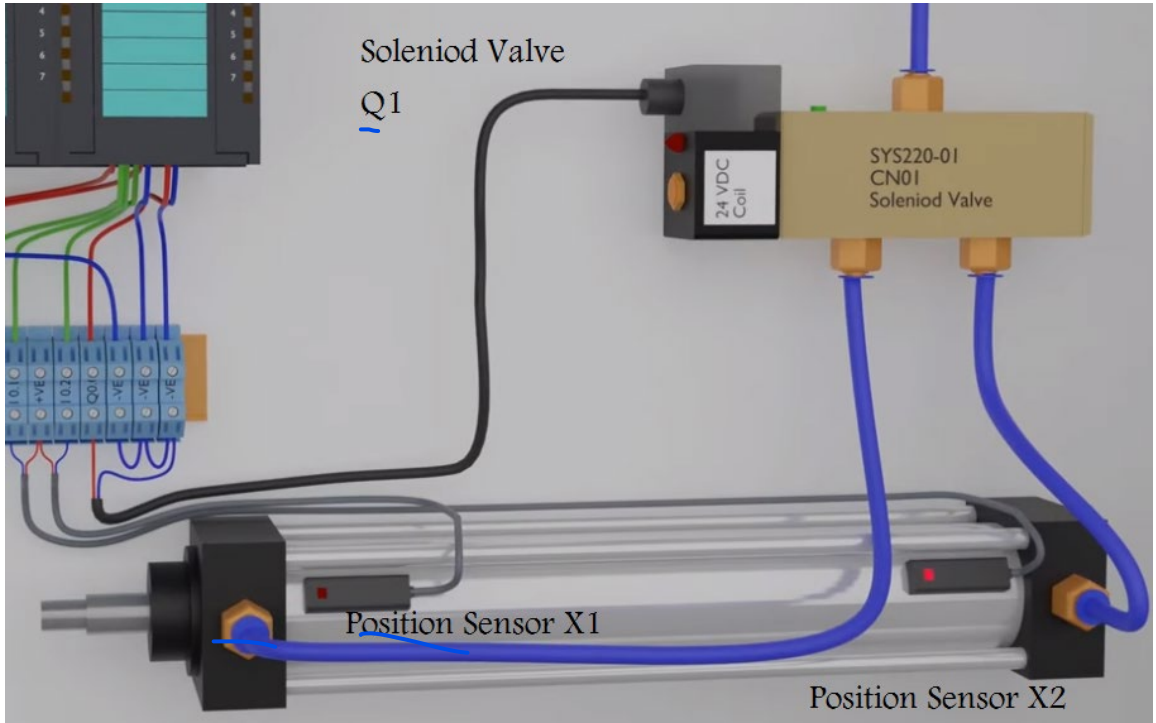
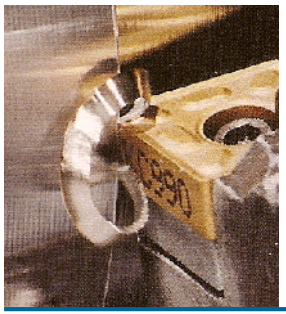


PLC for Pneumatic Cylinder

- Pneumatic cylinder is a binary actuator (ON/OFF)
- Any Pneumatic Cylinder can be controlled by The PLC by controlling the solenoid value that supplies cylinder with pressed air Q1.
- Two position sensors (X1 and X2) are needed to read the position of the cylinder rod if it is extended or retracted

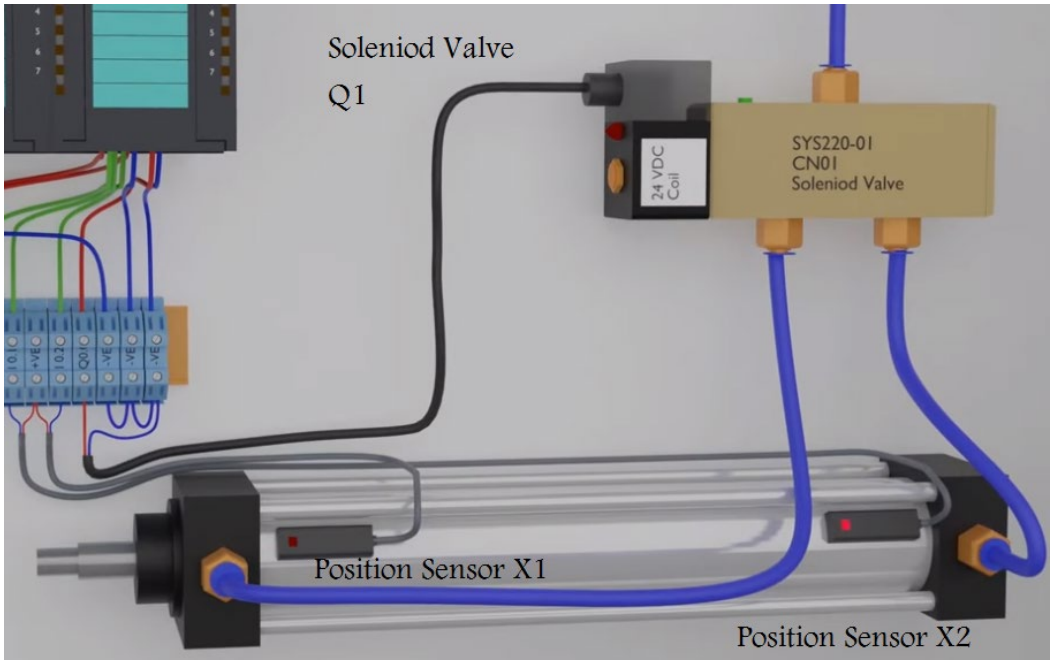




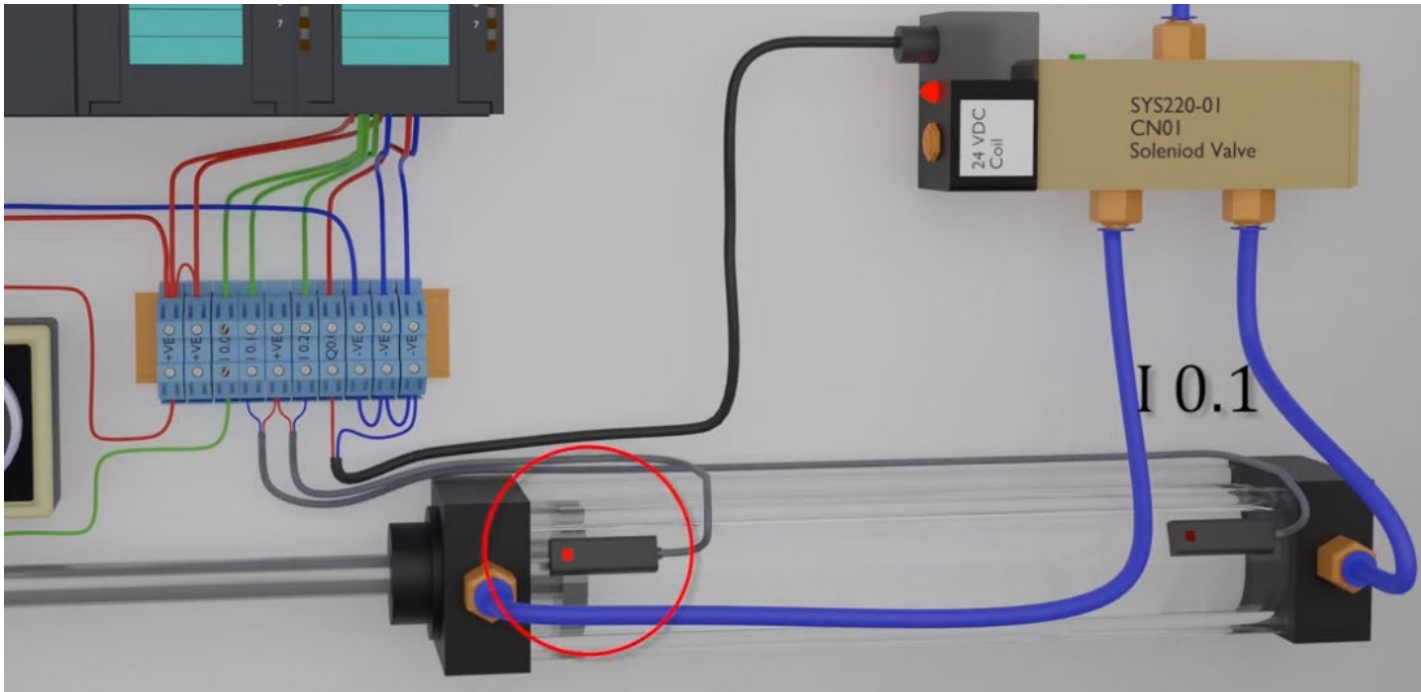
PLC for Pneumatic Cylinder

- Pneumatic cylinder is a binary actuator (ON/OFF), Any Pneumatic Cylinder can be controlled by The PLC by controlling the solenoid value that supplies cylinder with pressed air Q1.
- A general procedure for controlling a pneumatic cylinder by PLC is as follows:

1. An ON / OFF switch can start the process.
2. Two position sensors (X1 and X2) are needed to read the position of the cylinder rod if it is extended or retracted.
3. When X1 is high, an output signal activities Q to push the rod out of the cylinder.

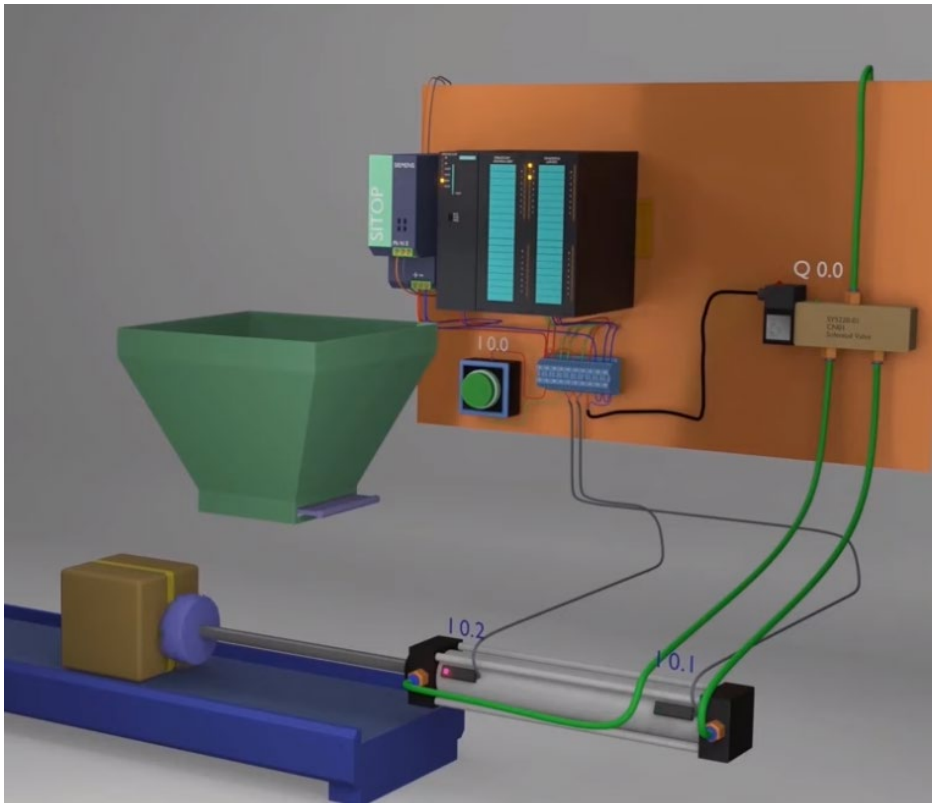


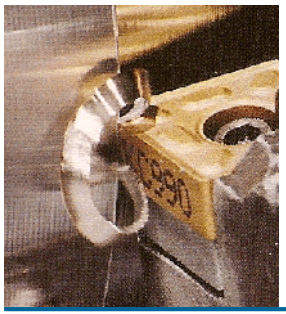
4. When the rod's piston reaches the forward position switch X, X1 will be high and Q1 (output of the solenoid will be off too), the rod will retracted inside the cylinder and X1 will be off again.
5. And when the rod piston reaches backward position switch X2, X2 will be high and Q1 will be high again. Pushing forward the rod again.
6. This cycle of movement will be repeated several times according to a counter reading (C1).
7. The counter will counts the number of times the cylinder's rod energised, and when the number reaches to C1 (for example 5 times) it will disable the over all process.



Question

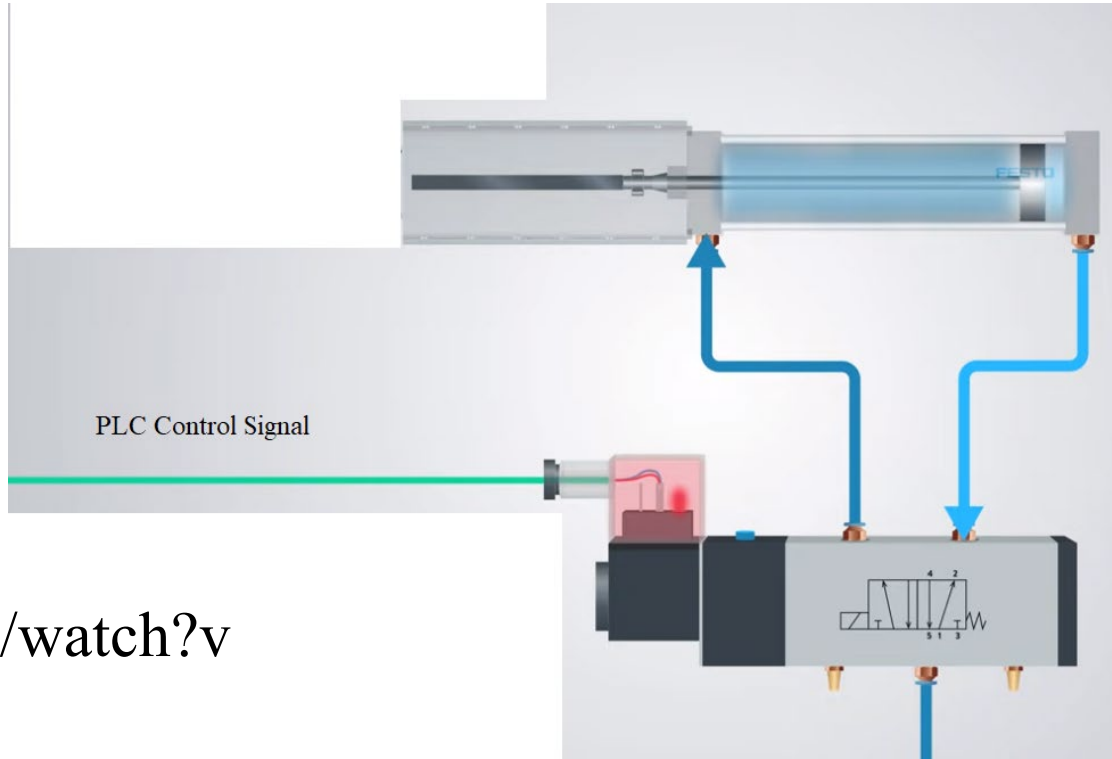
- Draw the ladder diagram to control the pneumatic cylinder shown in the Figure below. The system is composed of a double acting pneumatic cylinder that has to push a product immediately after fallen to the conveyer.
- The cylinder rod will be extracted forward and retracted backward again to the cylinder.
- This movement cycle has to be repeated for 5 times.



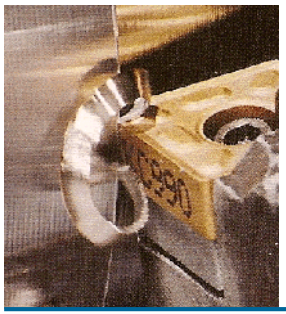


Solenoid Valve

- In order to solve the problem in the previous slides, the working mechanism of the soleniod valve, which control the supply of the pressure to the pneumatic double acting cylinder must be explained.

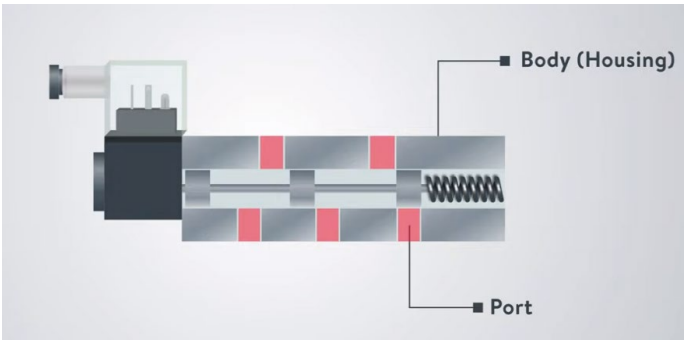


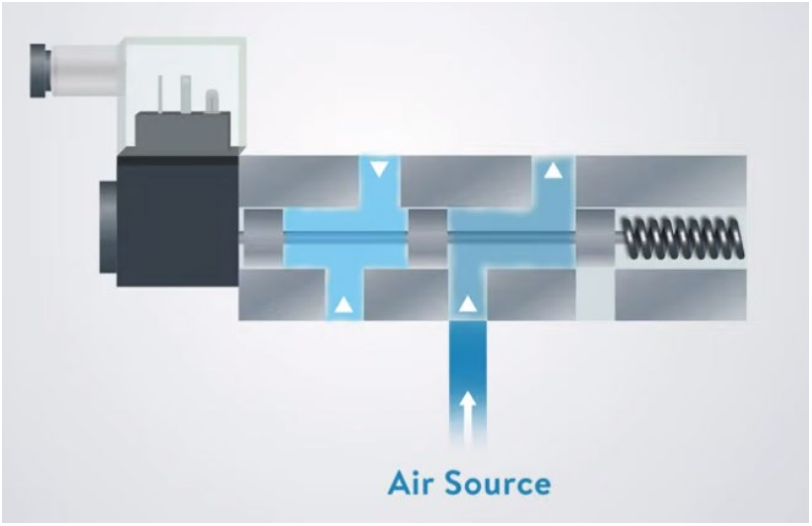
https://www.youtube.com/watch?v=bXXL-0sf8gs

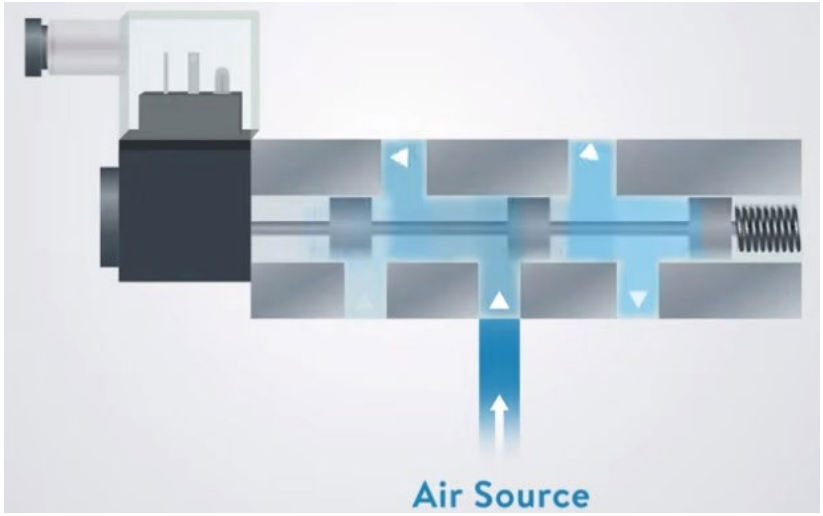


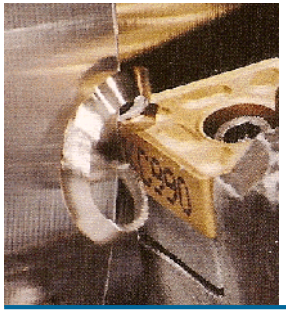
Solenoid Valve

- Soleniod valve is composed of ports that supply the air pressure in and out of the acting cylinder.



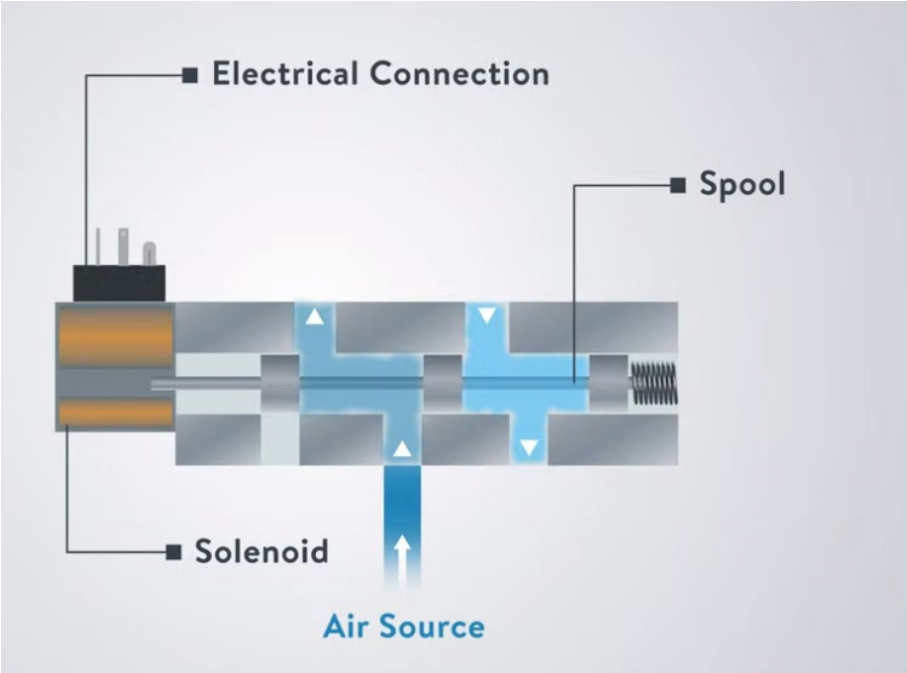


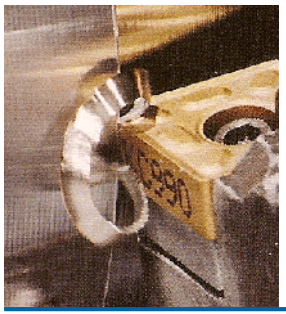




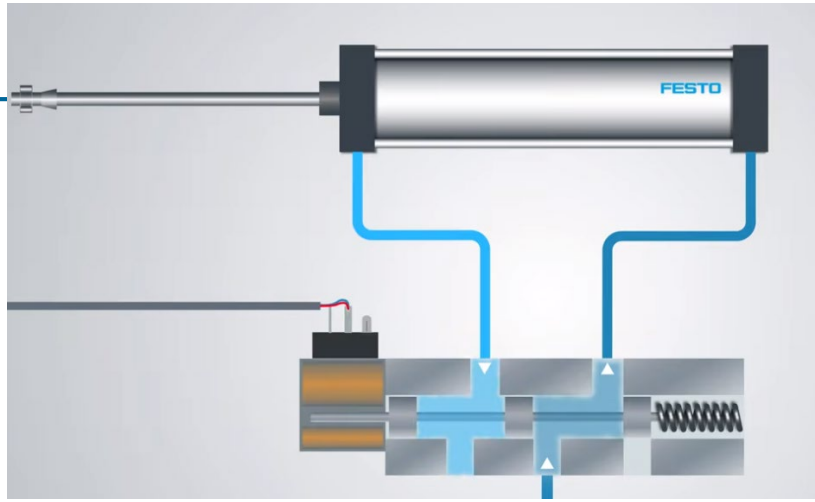
Solenoid Valve

- The moving part that open and close ports (and controlling the inlet and outlet of the air pressure) is performed by a moving part called spool.
- This moving part is controlled by an electric solenoid.
- The electric soliniod which is another ON / Off actuator will be controlled by an signal comming out from the PLC ports.

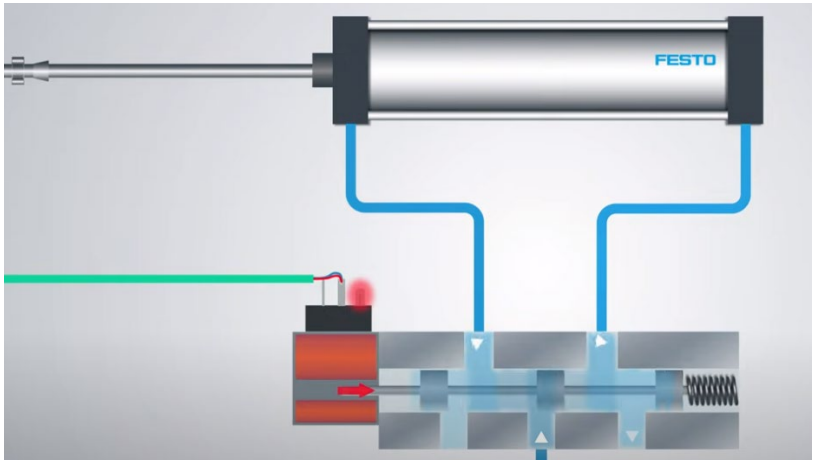




Solenoid Valve

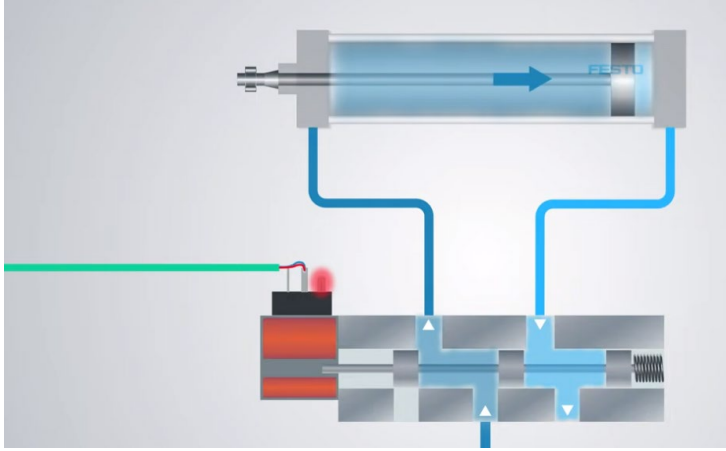


- The first Figure represent the rest position of the spool (the soliniod is not energized).

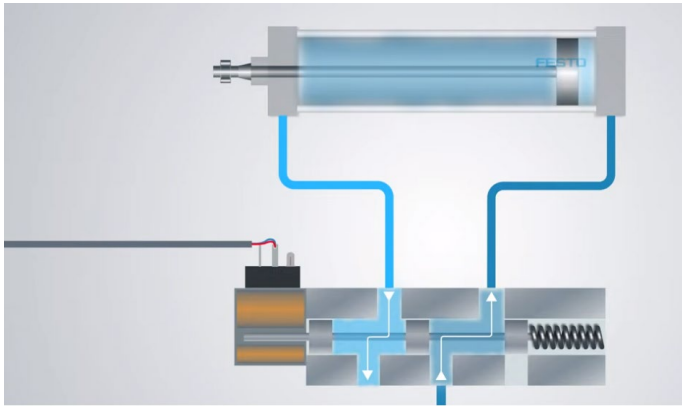


- When the signal comes from PLC and energized the soleniod, the soleniod will push spool and this it will squeez the spring to the other side.

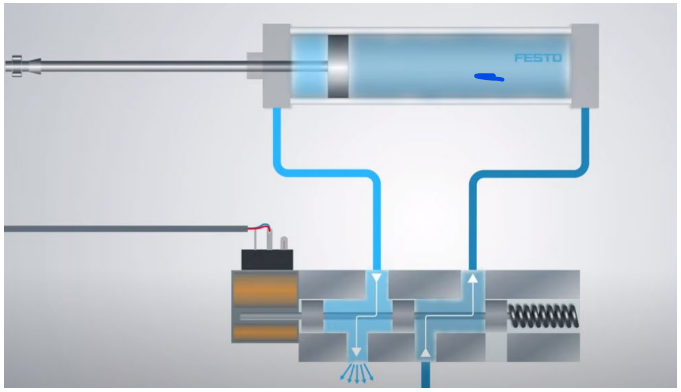
- As a result of moving the spool the the air path will be changed as illustrated in the Figure beside. This will cause the rode of the double acting cylinder to retrive inside the cylinder.

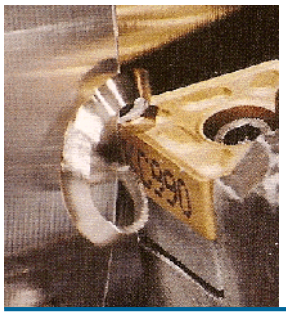


- As soon as the PLC removes the command the spring will retrun back to it's original position causing the direction of the air path to be reveresed.



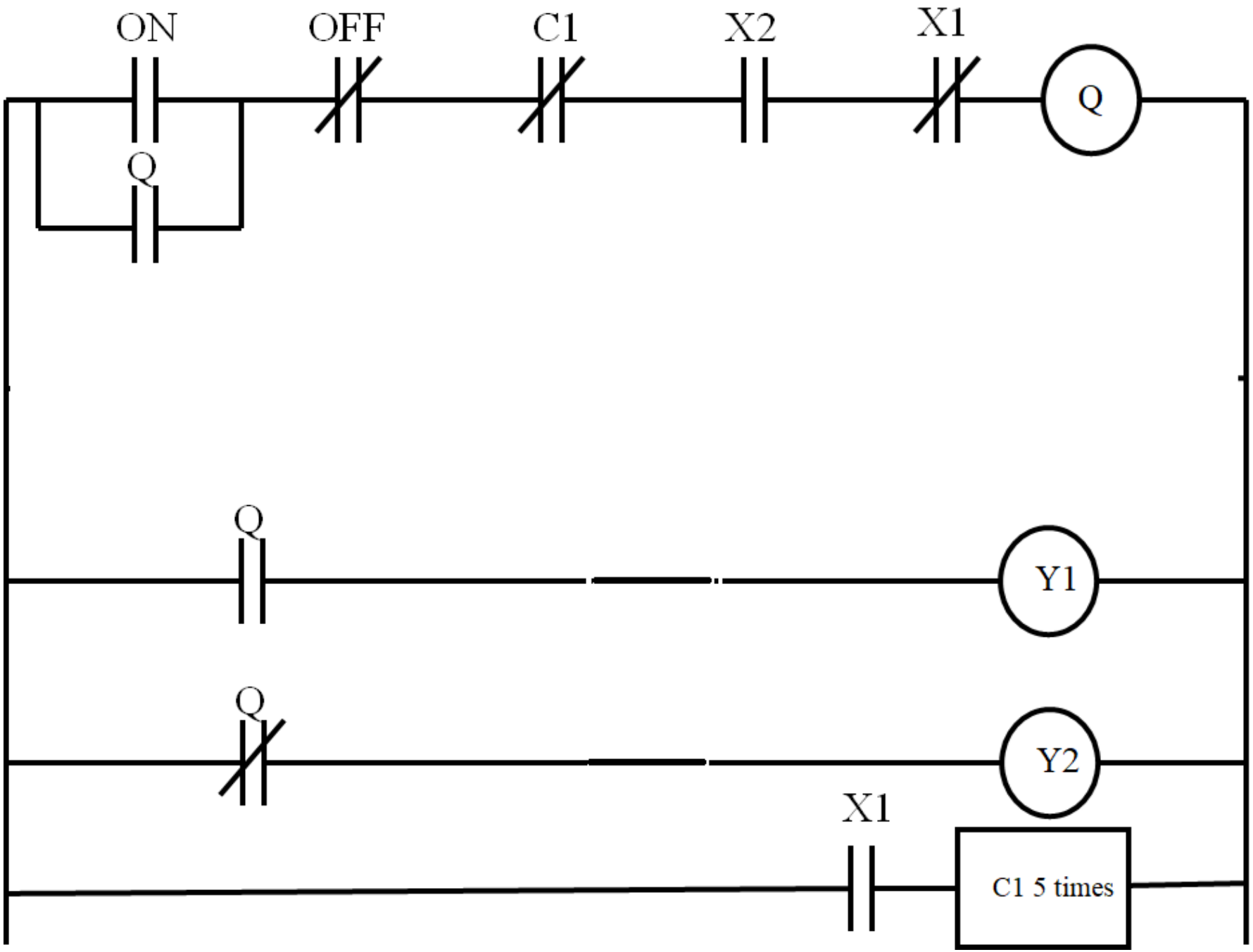
- As a result of that, the rod of the cylinder will extend again (the pressreized air will be behind the piston force the rode to exted as illustrated un the Figure beside.





Suggested Ladder Diagram

- Based on understanding the electric solinoid, a suggested ladder diagram is proposed next slide.
- Two complementry outputs are suggested : Y1 to keep the rode in the extraction position for 4 sec, and Y2 to retrive the rode inside the cylinder. Both Y1 and Y2 are controlled by the PLC activation signal Q.
- X1 (forward position sensor) will indicate the extraction of the rode, so it will inatiate both a timer T1 to keep extraction position for 4 sec, and accounter C1 to count the required repitation of the extraction process.
- When the counter counts up to 5, it will disapple the overall process.
- Any other suggestion to solve the problem ? Try to find another solution !.


ON
OFF
C1
X2
X1
Q
Q
Q
Y1
Q
Y2
X1
C1 5 times