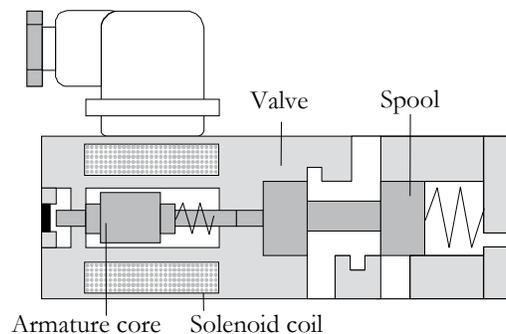


[You may download this article at: <https://fluidsys.org/downloads/>]

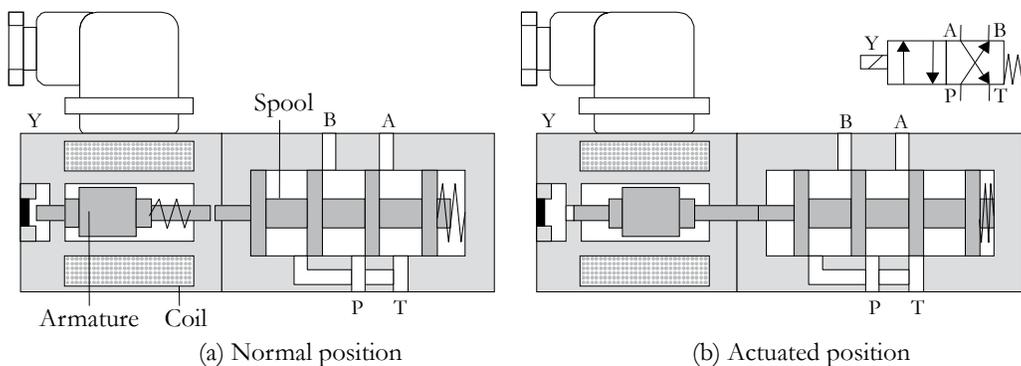
Relay-based Electro-hydraulic Systems

In the electrical actuation of a hydraulic valve, the necessary actuating force is obtained electrically with the help of a solenoid. The off-centre core of the solenoid coil is pulled towards the centre of the coil when the electric current is passed through it. This discrete movement of the core is used to actuate the solenoid valve. The solenoid valve in an electro-hydraulic system acts as an interface between the hydraulic part and the electrical part of the system.



4/2-way Single-solenoid Valve, Spring Return

In the normal position of the solenoid valve, the pressure port P is connected to the working port B, and the working port A is connected to the tank port T. The valve is actuated when the rated voltage is applied to the coil Y. In the actuated position of the valve, the port P is connected to the port A, and the port B is connected to the port T. When supply to the coil is cut off, the valve returns to its normal position. This valve can be used as the final control element for controlling a double-acting cylinder.

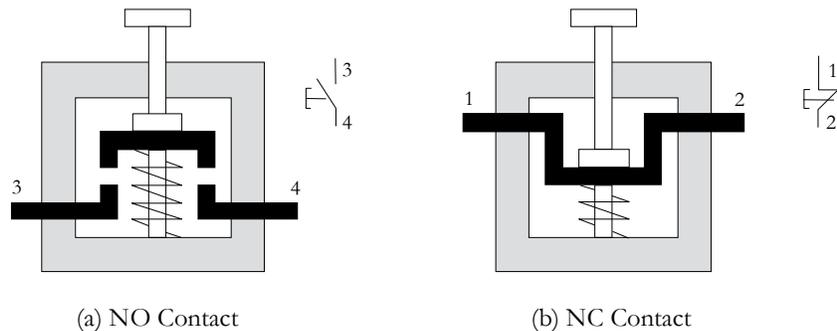


4/2-way double-solenoid Valve

A 4/2-way double-solenoid electro-hydraulic valve consists of two solenoid coils on either side of the valve controlling its hydraulic part. The valve remains in a particular position due to the application of a pulse or continuous signal to the coil at one end as long as no opposing signal is presented to the coil at the other end. Hence, this valve shows the memory characteristics.

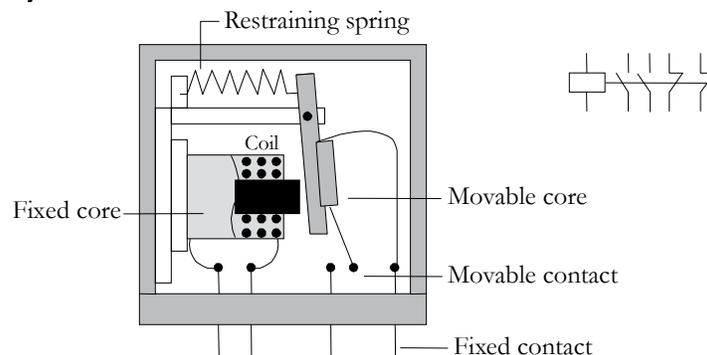
Push-button Switch

A push-button switch is a device used to close or open an electric circuit. This control device consists of a push-button actuating head, a set of fixed and movable contacts, and a restraining spring. Pressing the push-button against the restraining spring operates its contacts.



The types of contacts distinguished according to their functions are (1) Normally open (NO) type, (2) Normally closed (NC) type, and (3) Change-over (CO) type. In the NO pushbutton, the contacts are open in the normal position, inhibiting the energy flow through the pushbutton. In the actuated position of the NO pushbutton, its contacts are closed, permitting the energy flow through the pushbutton. In an NC pushbutton, the contacts are closed in the normal position, permitting the energy flow through the pushbutton. In the actuated position of the NC pushbutton, its contacts are open, inhibiting the energy flow through the pushbutton. The change-over type contact is a combination of NO and NC contacts.

Electromagnetic Relay

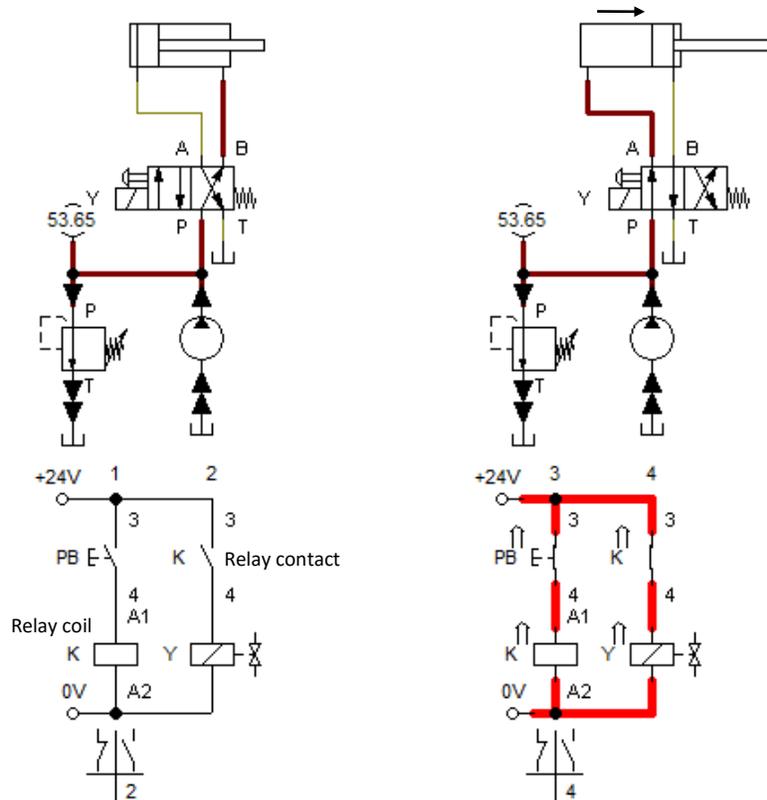


The relay mainly consists of a coil and a number of independent contact sets. Each contact set consists of a stationary contact and a movable contact. It also includes a stationary core and a movable core to confine the magnetic field. The movable contacts are coupled to the movable

core. Therefore, when the coil is energized with the help of an additional electrical circuit, the movable core is pulled towards the stationary core, thus operating all its coupled contacts simultaneously. This movement either makes or breaks the connection of the movable contact with its respective fixed contact in each contact set.

Indirect control of a double-acting hydraulic cylinder using a relay

Two positions of a self-explanatory electro-hydraulic circuit for the indirect control of a double-acting hydraulic cylinder are given below.



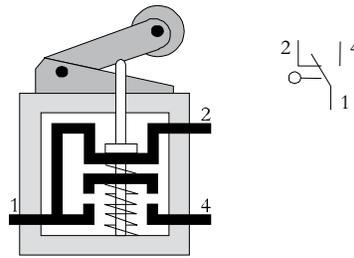
Sensors

Sensors can detect the presence of objects. A sensor can work either by the actual physical contact with an object or by the movement of an object in its proximity. Accordingly, the sensors are classified as contact-type sensors (e.g. limit switch) and contactless-type sensors (e.g. proximity sensors). A contact-less type sensor uses some physical medium to achieve the sensing function. Any disturbance of the medium produces a signal at the output of the sensor.

Limit Switch

A limit switch is a contact-type sensor comprising a set of switching contacts (NO/NC/CO type), a roller-operated plunger and return springs. The roller lever is mechanically linked to the contacts. It is usually actuated mechanically by a moving element, such as a cylinder piston, in the associated machine to indicate a particular position of the moving element. The electrical contact is established or interrupted by means of the actuating force acting on the roller lever. The limit

switch produces an electrical signal upon detecting the position of the mechanical member to be detected.



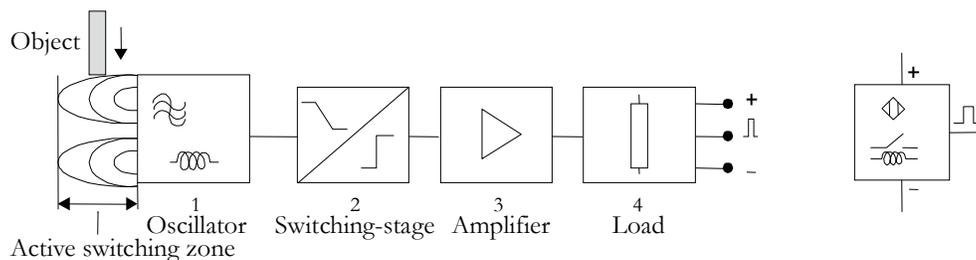
Proximity Sensors

A proximity sensor is a contactless-type sensor that detects the presence of an object using a detection system and converts this information into a corresponding electrical signal. One type of detection system uses the eddy currents that are generated in a metallic sensing object by the interaction of the detection system and the object. Another type detects the changes in the electrical capacity of the capacitor in the detection system when an object approaches the sensor. Yet another type detects objects through a variety of optical properties. Accordingly, there are three basic types of proximity sensors. They are (1) Inductive-type sensors, (2) Capacitive-type sensors, and (3) Optical-type sensors.

Inductive Proximity Sensor

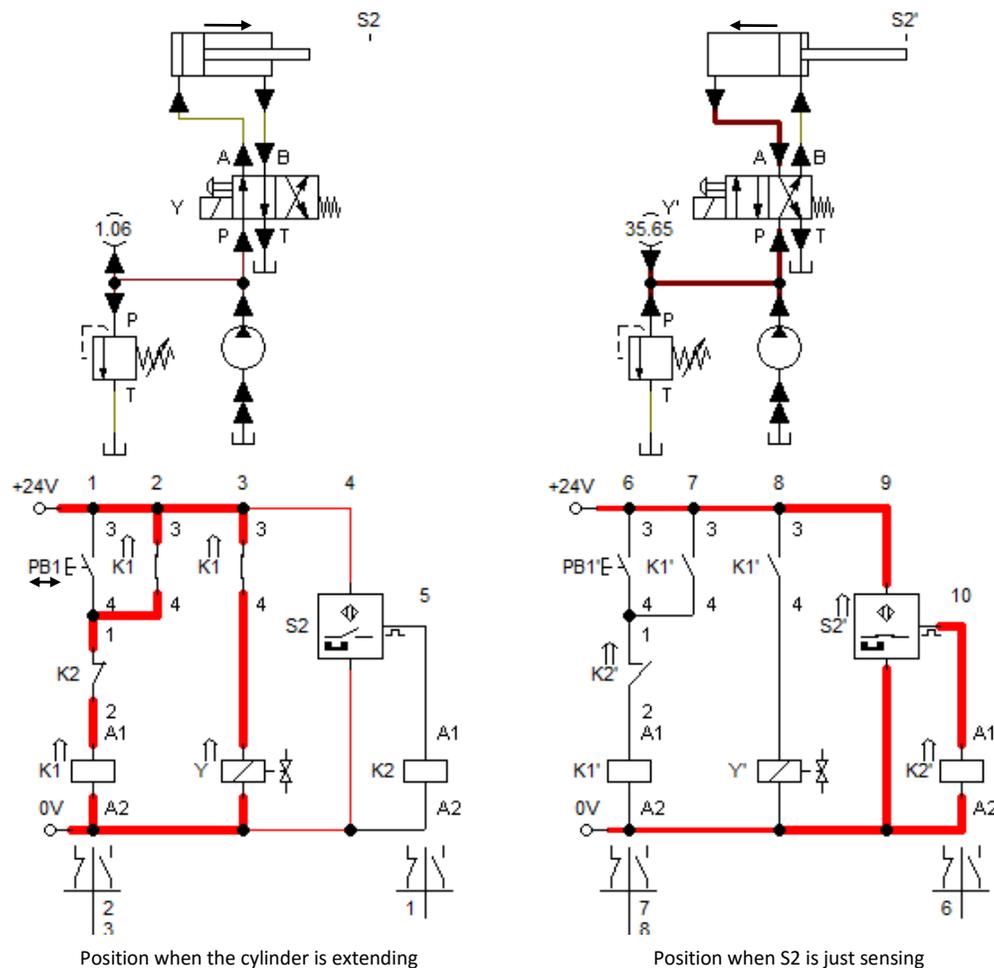
Inductive proximity sensors are widely used in modern high-speed industrial and process control systems for the detection of metallic objects. An inductive proximity sensor consists of the following blocks (1) an oscillator circuit, (2) a switching circuit, (3) an amplifier, and (4) an output stage, all housed in a resin-encapsulated body.

A part of the oscillator circuit is a coil capable of producing high-frequency magnetic oscillations in the active switching area when the rated voltage is applied to the sensor. If any metallic object is brought near to the active switching area of the sensor, eddy currents are generated in the object. The eddy currents are converted into heat. In fact, this loss draws energy from the oscillator. As a result, the oscillations are weakened. The switching circuit converts this state of the oscillator into a clear signal through the switching stage. Finally, the output signal is amplified and delivered to the load circuit. The sensing range of inductive proximity sensors is usually small, typically up to 12 mm.



Semi-automatic operation of a double-acting hydraulic cylinder using a sensor

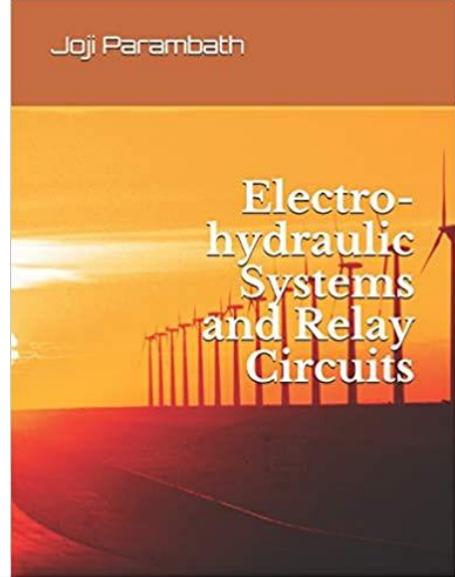
The hydraulic part and the electrical part of the circuit for the semi-automatic operation of a double-acting hydraulic cylinder using a proximity sensor (S2) are given below. The circuit is also presented in two critical positions for easy understanding. Figure on the left-hand side gives the position of the electrical part of the circuit when the pushbutton PB1 is pressed and then released. The cylinder extends to its forward position and influences the proximity sensor ('S2'). The relay coil ('K2') connected to the proximity sensor converts the voltage output of the proximity sensor to the corresponding contact operations. A normally-closed (NC) contact of the relay K2 is used in the latching circuit for the automatic interruption of the electrical circuit whenever the proximity sensor senses the presence of the cylinder piston. The second part of the figure shows this position of the electrical circuit. The cylinder, then, retracts to its home position automatically.

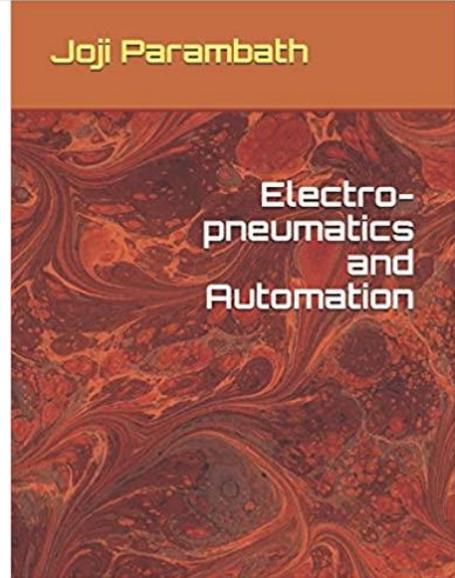


Fluid Power Educational Series Books

1. Pneumatic Systems and Circuits -Basic Level (In the SI Units)
2. Industrial Pneumatics -Basic Level (In the English Units)
3. Pneumatic Systems and Circuits -Advanced Level
4. Electro-Pneumatics and Automation
5. Design of Pneumatic Systems (In the SI Units)
6. Design Concepts in Pneumatic Systems (In the English Units)
7. Maintenance, Troubleshooting, and Safety in Pneumatic Systems
8. Industrial Hydraulic Systems and Circuits -Basic Level (In the SI Units)
9. Industrial Hydraulics -Basic Level (In the English Units)
10. Hydraulic Fluids
11. Hydraulic Filters: Construction, Installation Locations, and Specifications
12. Hydraulic Power Packs (In the SI Units)
13. Power Packs in Hydraulic Systems (In the English Units)
14. Hydraulic Cylinders (In the SI Units)
15. Hydraulic Linear Actuators (In the English Units)
16. Hydraulic Motors (In the SI Units)
17. Hydraulic Rotary Actuators (In the English Units)
18. Hydraulic Accumulators and Circuits (In the SI Units)
19. Accumulators in Hydraulic Systems (In the English Units)
20. Hydraulic Pipes, Tubes, and Hoses (In the SI Units)
21. Pipes, Tubes, and Hoses in Hydraulic Systems (In the English Units)
22. Design of Industrial Hydraulic Systems (In the SI Units)
23. Design Concepts in Industrial Hydraulic Systems (In the English Units)
24. Maintenance, Troubleshooting, and Safety in Hydraulic Systems
25. Hydrostatic Transmissions (HSTs) (In the SI Units)
26. Concepts of Hydrostatic Transmissions (In the English Units)
27. Load Sensing Hydraulic Systems (In the SI Units)
28. Concepts of Load Sensing Hydraulic Systems (In the English Units)
29. Electro-hydraulic Proportional Valves
30. Electro-hydraulic Servo Valves
31. Cartridge Valves
32. Electro-hydraulic Systems and Relay Circuits

For more details, please visit: <https://jojibooks.com>

 <p>Joji Parambath</p> <p>Electro-hydraulic Systems and Relay Circuits</p>	<p>Electro-hydraulic Systems and Relay Circuits</p> <p>Joji Parambath</p> <p>This book explains the functioning of primary solenoid valves and various electrical control components. Many typical single-actuator electro-hydraulic circuits are developed to illustrate various applications of electro-hydraulics.</p> <p>Books available at Amazon</p>
--	--

 <p>Joji Parambath</p> <p>Electro-pneumatics and Automation</p>	<p>Electro-pneumatics and Automation</p> <p>Joji Parambath</p> <p>This book explains the functioning of primary solenoid valves and various electrical control components. Many typical single-actuator and multiple-actuator electro-pneumatic circuits are also developed to illustrate various applications of electro-pneumatics.</p> <p>Books available at Amazon</p>
--	--