BASIC PNEUMATIC CIRCUITS

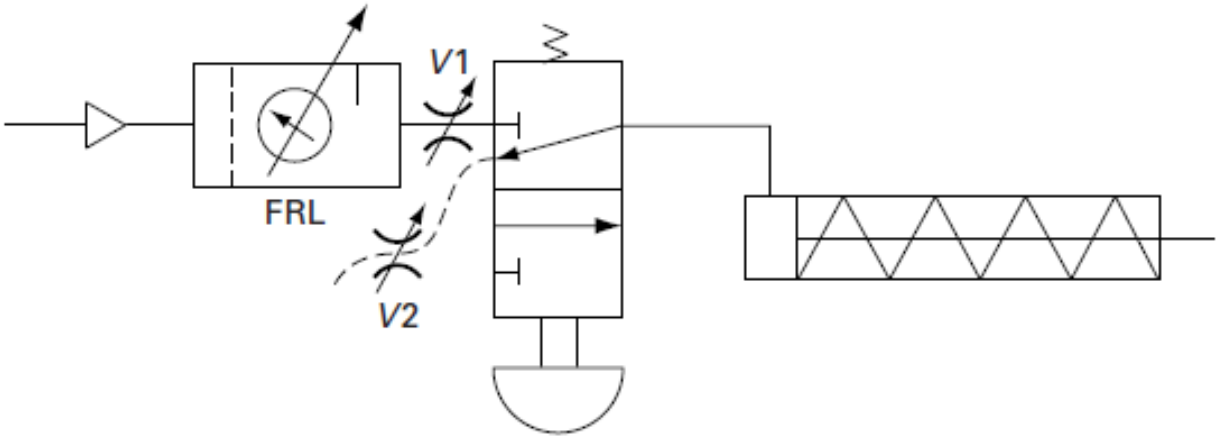
Introduction

In this section we present a number of basic pneumatic circuits using pneumatic components that have been previously discussed. Pneumatic circuits are similar to their hydraulic counterparts. One difference is that no return lines are used in pneumatic circuits because the exhausted air is released directly into the atmosphere.

This is depicted by a short dashed line leading from the exhaust port of each valve. Also, no input device (such as a pump in a hydraulic circuit) is shown, because most pneumatic circuits use a centralized compressor as their source of energy. The input to the circuit is located at some conveniently located manifold, which leads directly into the filter-regulator-lubricator (FRL) unit.

Operation of Single-Acting Cylinder

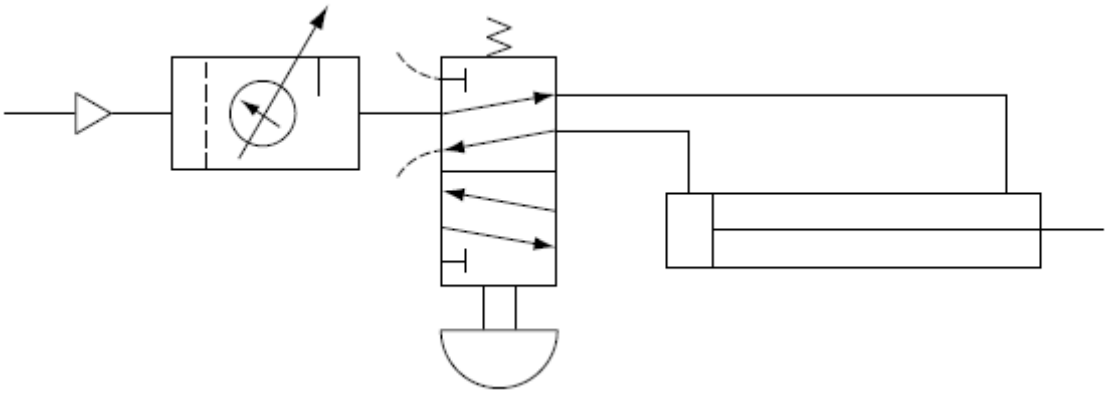
Figure shows a simple pneumatic circuit, which consists of a three-way valve controlling a single-acting cylinder. The return stroke is accomplished by a compression spring located at the rod end of the cylinder. When the push-button valve is actuated, the cylinder extends. It retracts when the valve is deactivated. Needle valves *V*1 and *V*2 permit speed control of the cylinder extension and retraction strokes, respectively.



Operation of Double-Acting Cylinder

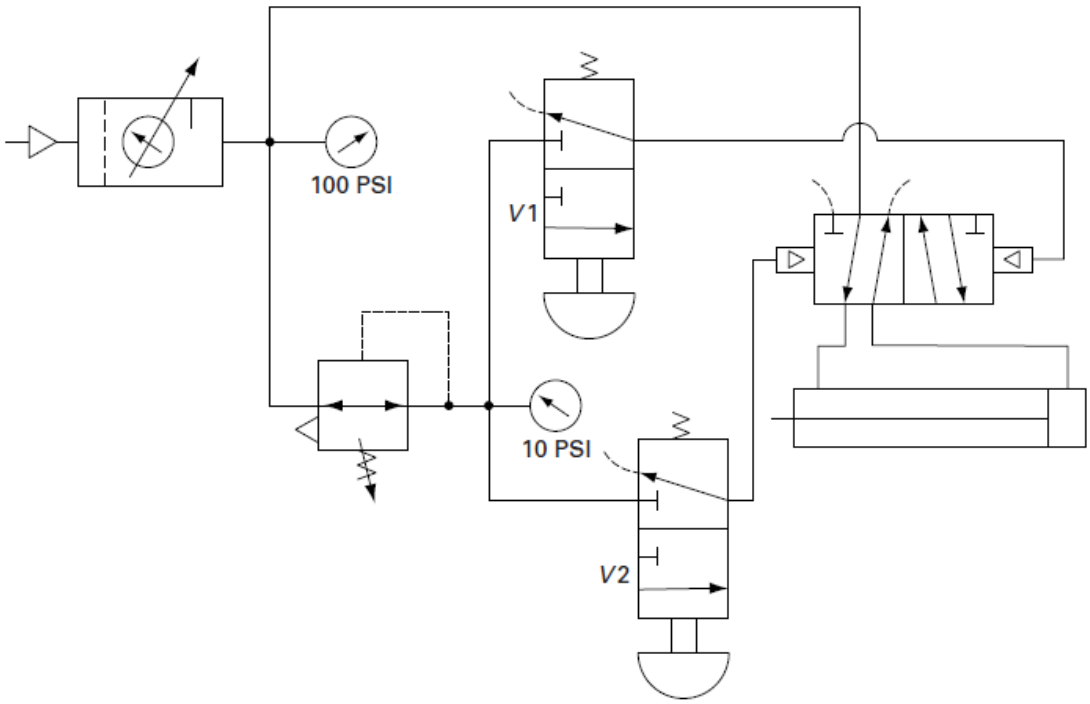
Figure shows the directional control of a double-acting cylinder using a four-way valve. Control of a double-acting cylinder requires a DCV with four different functioning ports (each of the two exhaust ports perform the same function). Thus, a four-way valve has four different functioning ports. In contrast, the control of a single-acting, spring-return cylinder requires a DCV with only three ports. Hence a three-way valve has only three ports, as shown in the previous Figure. Actuation of the push-button

valve extends the cylinder. The spring-offset mode causes the cylinder to retract under air power.



Air Pilot Control of Double-Acting Cylinder

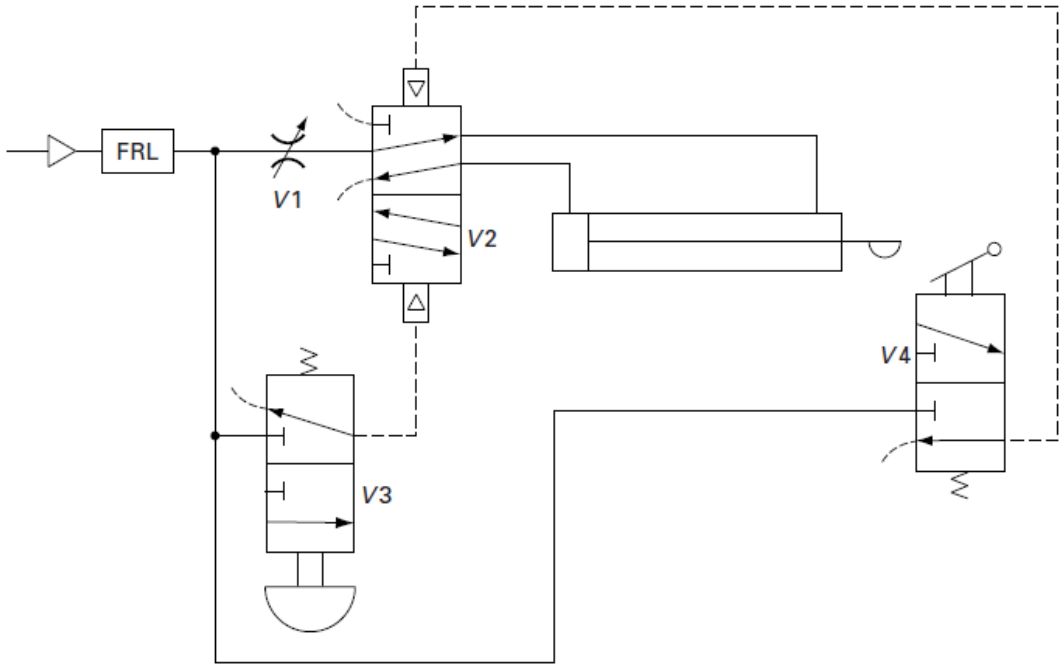
Figure shows a circuit in which a double-acting cylinder can be remotely operated through the use of an air-pilot-actuated DCV. Push-button valves *V*1 and *V*2 are used to direct airflow (at low pressure such as 10 psi) to actuate the air piloted DCV, which directs air at high pressure such as 100 psi to the cylinder. Thus, operating personnel can use low-pressure push-button valves to remotely control the operation of a cylinder that requires high-pressure air for performing its intended function. When *V*1 is actuated and *V*2 is in its spring-offset mode, the cylinder extends. Deactivating *V*1 and then actuating *V*2 retracts the cylinder.



Cylinder Cycle Timing System

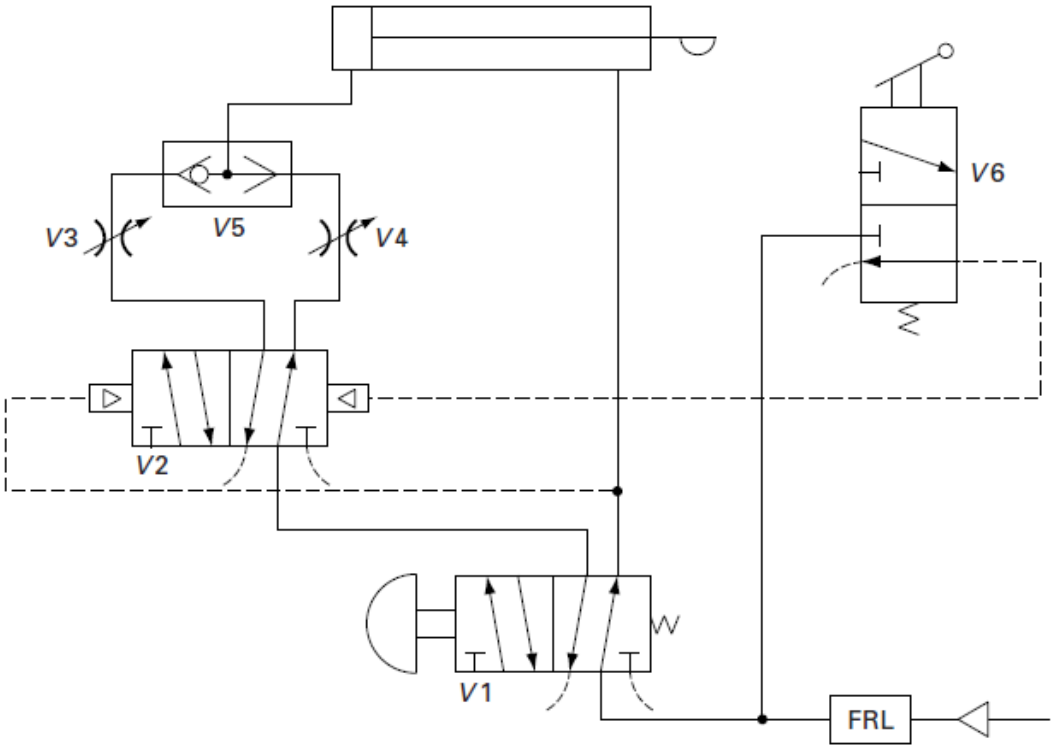
Figure shows a circuit that employs a limit valve to provide a timed cylinder extending and retracting cycle. When push-button valve *V*3 is momentarily actuated, valve *V*2 shifts to extend the cylinder. When the

piston rod cam actuates limit valve *V*4, it shifts *V*2 into its opposite mode to retract the cylinder. Flow control valve *V*1 controls the flow rate and thus the cylinder speed.



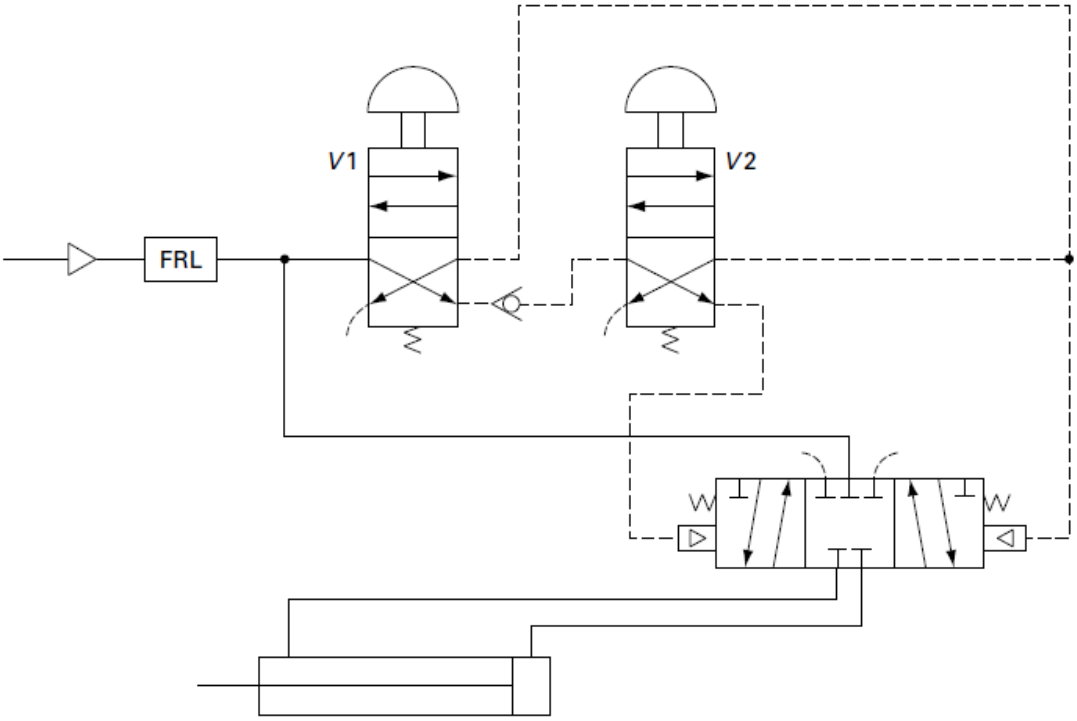
Two-Step Speed Control System

A two-step speed control system is shown in Figure. The operation is as follows, assuming that flow control valve *V*3 is adjusted to allow a greater flow rate than valve *V*4. Initially, the cylinder is fully retracted. When push-button valve *V*1 is actuated, airflow goes through valves *V*2, *V*3, and the shuttle valve *V*5 to extend the cylinder at high speed. When the piston rod cam actuates valve *V*6, valve *V*2 shifts. The flow is therefore diverted to valve *V*4 and through the shuttle valve. However, due to the low flow setting of valve *V*4, the extension speed of the cylinder is reduced. After the cylinder has fully extended, valve *V*1 is released by the operator to cause retraction of the cylinder.



Two-Handed Safety Control System

Figure shows a two-handed safety control circuit. Both palm-button valves (*V*1 and *V*2) must be actuated to cause the cylinder to extend. Retraction of the cylinder will not occur unless both palm buttons are released. If both palm-button valves are not operated together, the pilot air to the three-position valve is vented. Hence, this three-way valve goes into its spring-centered mode, and the cylinder is locked.



Control of Air Motor

Figure shows a circuit used to control an air motor. The operation is as follows. When the START push-button valve is actuated momentarily, the air pilot valve shifts to supply air to the motor. When the STOP push-button valve is actuated momentarily, the air pilot valve shifts into its opposite mode to shut off the supply of air to the motor. The flow control valve is used to adjust the speed of the motor.