

High Pressure Switching Valves

High pressure manual switching valves simplify procedures and improve the speed, resolution, and sensitivity of HPLC analysis. The switching valves are available in 316 stainless steel and PEEK™, with a choice of 1.6 mm (1/16") or 3.2 mm (1/8") ports. See Table on page 132 for valve specifications.

Column Selection

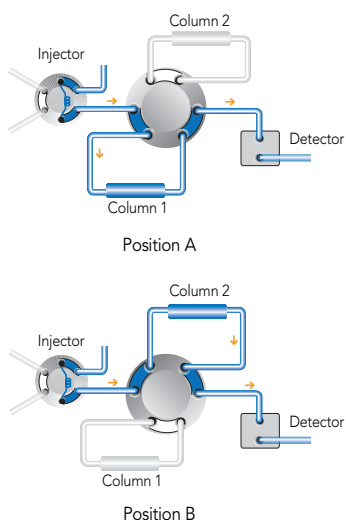
The six-position switching valves are used for column selection. These valves substitute one column for another without the need to manually disconnect the plumbing. This makes it easy to designate a separate column for each analysis, which helps eliminate equilibration delays, reduce interferences and prolong column life. Turning the valve handle selects the column desired for a particular analysis. Columns switched to off-line are automatically sealed at both ends.

Column Switching

The two-position switching valves can be used to reroute mobile phase during the chromatographic run without changing separation techniques. They can also be used to perform sequential separations with different columns and/or mobile phases.

Although the model 7000 is the most commonly used and versatile switching valve, other models have specific uses such as for three-way or four-way switching patterns.

Many models have flow passages available in both standard bore and large bore (designated with an "L" suffix). L models use 1/16" fittings and tubing but have larger flow passage diameters than non-L models. As such, L models can accommodate higher flow rates. Large bore tubing can be used when the pressure drop must be limited. Large bore valves have a lower pressure drop than standard bore valves when both valve sizes accommodate the same flow rate.



Column Selection Using a 2-Position, 6-Port Switching Valve

Effects of Valves and Tubing on Resolution

The effect of tubing on analytical and microscale analyses can be significant. Since dispersion caused by tubing is proportional to the fourth power of diameter, large bore tubing should be avoided when performing analytical scale or microscale analyses. Tubing ID size ≤ 0.25 mm (0.010") is recommended.

Consider a system with injector and column switching valves and analytical columns with small-bore connecting tubing. The chromatograms below, made using a typical analytical chromatograph, show these effects. Scheme A is the control (injector \rightarrow column \rightarrow detector) with no valve in the system. In Schemes B and C, two model 7060 Six-Position Switching Valves were placed side by side (injector \rightarrow valve #1 \rightarrow column \rightarrow valve #2 \rightarrow detector).

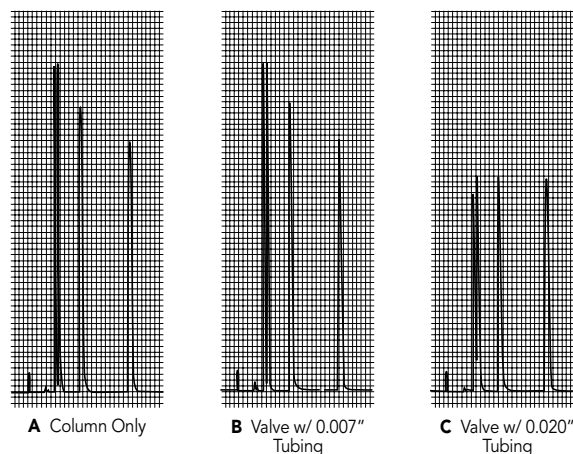
The injector and detector were connected to these valves by the same tubing used in the control. The extra tubing pieces required to connect the valves to the column were a 10 cm length for valve #1-to-column, and a 35 cm length for column-to-valve #2. The diameters of these tubes are indicated in the experimental details, below.

Comparison of Observed Column Plates of Rheodyne® Analytical and MicroScale Injectors

| | 7725 | 8125 | Δ |
|------------|------|------|----------|
| $k' = 0.6$ | 2930 | 5054 | 72% |
| $k' = 1.5$ | 4653 | 6904 | 48% |
| $k' = 7.9$ | 7875 | 8305 | 5.0% |

UV detector: 1 μ L volume, 4 mm path. Sample volume: 2 μ L, partial-filling method. Column: 2 mm ID x 100 mm long, 4 μ m C-18. True plates of column = 11,570.

Effects of Valves and Tubing on Resolution

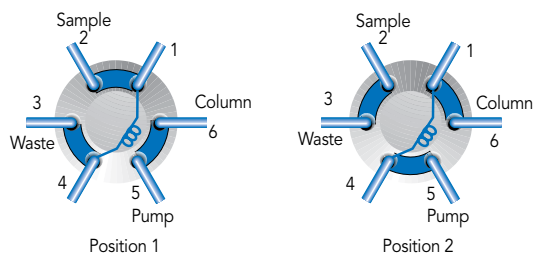


These chromatograms show the loss of resolution caused by the addition of two model 7060 column selection valves when using connection tubes of two different inside diameters. Conditions for all cases: 4.6 mm x 12.5 cm column, 5 μ m C-18 packing, 50% acetonitrile in water, 2.0 mL/min, 21 °C, 5.0 μ L sample partial filled into a model 7125 injector, 10 cm x 0.18 mm (0.007") bore injector outlet tube (to column or valve), 10 cm x 0.18 mm bore detector inlet tube (from column or valve), low dispersion 1.0 cm path UV detector cell, 0.2 sec detector time constant. See text above for details.

High Pressure Single Mode Injectors and Switching Valves

Models 7000(L), 7010, 3000-038, 3000 and 9010

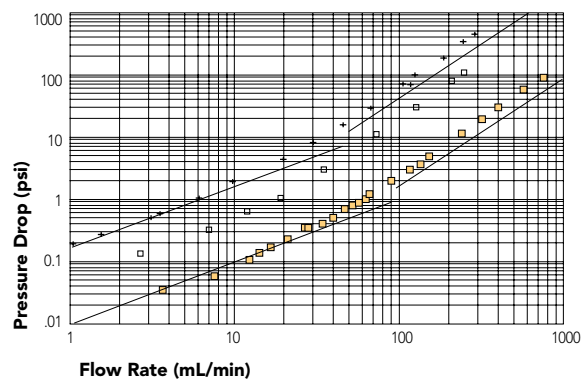
- ▶ Analytical and preparative scale available
- ▶ Stainless steel and PEEK™ materials
- ▶ Applicable for sample injection, column switching, and sample enrichment applications
- ▶ Field adjustable up to 7,000 psi (models 7000 and 9000 only)



Flow path of Two-Position, Six-Port Injection Valve



Pressure Drop vs. Flow Rate



Pressure drop vs. flow rate for model 7000 and model 7000L (large-bore) valves; water at 20 °C. Experimental measurements: The flow channel is one stator inlet port, one rotor seal groove, one stator outlet port and two connecting tubes. Solid squares = (1.0 mm 7000L valve) + (two 1.0 mm x 5.0 cm tubes). Open squares = (0.6 mm 7000 valve) + (two 1.0 mm x 5.0 cm tubes). Cross mark = (0.6 mm 7000 valve) + (two 0.5 mm x 5.0 cm tubes). Solid lines are theoretical values for 10 cm long tubes of 1.0 mm and 0.5 mm ID. Pressure drop is in units of psi.

Specifications

| Model | Stator Passage Diameter | Factory Set Pressure | Maximum Field Set Pressure | Maximum Temperature (°C) |
|-------------------|-------------------------|----------------------|----------------------------|--------------------------|
| 3000, 3030 (PEEK) | 1.0 mm (0.040") | 3,000 psi (207 bar) | 4,000 psi (276 bar) | 50° |
| 3000-038 | 1.0 mm (0.040") | 4,000 psi (276 bar) | 5,000 psi (340 bar) | 50° |
| 7000, 7010 | 0.6 mm (0.024") | 5,000 psi (340 bar) | 7,000 psi (483 bar) | 80° |
| 7000L | 1.0 mm (0.040") | 3,000 psi (207 bar) | 5,000 psi (340 bar) | 80° |
| 7060L | 1.0 mm (0.040") | 3,000 psi (207 bar) | 5,000 psi (340 bar) | 80° |

SST = Stainless Steel

| Part No. | Description | Tubing/Fitting Size | Wetted Material |
|---|--|---------------------------------|-----------------|
| HIGH PRESSURE SINGLE MODE INJECTORS AND SWITCHING VALVES | | | |
| 3000 | 2-position, 6-port Switching Valve, Preparative Scale | 5/16-24 Ports for 1/8" Tubing | PEEK |
| 3000-038 | 2-position, 6-port Switching Valve, Preparative Scale | 5/16-24 Ports for 1/8" Tubing | Stainless Steel |
| 7000 | 2-position, 6-port Switching Valve, Large Bore | 10-32 Ports for 1/16" OD Tubing | Stainless Steel |
| 7000L | 2-position, 6-port Switching Valve, Large Bore | 10-32 Ports for 1/16" OD Tubing | Stainless Steel |
| 7010 | 2-position, 6-port Single Mode Injector* | 10-32 Ports for 1/16" OD Tubing | Stainless Steel |
| 9010 | 2-position, 6-port Switching Valve Single Mode Injector* | 10-32 Ports for 1/16" OD Tubing | PEEK |

*Ships with a 20 µL sample loop attached to ports 1 and 4.