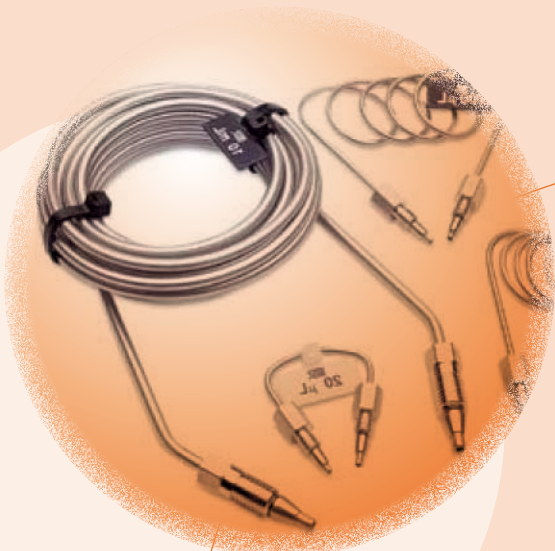
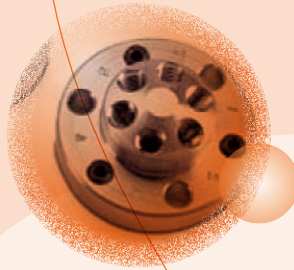


Upchurch® HIGH PRESSURE VALVES



HIGH PRESSURE VALVES

INTRODUCTION

Rheodyne® valves fit virtually any high-pressure flow control application. As you'll see from the table below and on the following pages, the line includes valves for preparative, analytical and microscale analysis in a variety of flow configurations. Pressure ratings of the valves in this chapter range from 4,000 psi (276 bar) to 7,000 psi (483 bar).

Rheodyne is committed to providing cutting-edge, user-friendly products. MX Modules are actuated electronically and can be easily adapted to existing instrumentation using contact closure or a TTL relay. Rheodyne's industry standard sample injectors and switching valves are designed to be manually actuated. Locate the valve module and flow configuration of choice using the table below.

High Pressure Valve Configurations:

Valve Module	Flow Configurations	Connecting Tubing Size	Page(s)
MX Modules: Nano-Scale	<ul style="list-style-type: none"> • 10nL Sample Injector • 2-position, 6-port Switching • 2-position, 10-port Switching 	1/32" OD	80-81
MX Modules: Analytical-Scale	<ul style="list-style-type: none"> • Semi-Automatic Sample Injector • 2-position, 6-port Switching • 2-position, 10-port Switching 	1/16" OD	80-82
Manual Sample Injectors	<ul style="list-style-type: none"> • Dual Mode Analytical, Micro and Preparative Scale Injector • Single Mode Analytical and Micro Scale Injectors 	.020", 1/16" or 1/8" OD	83-87
Manual Switching Valves	<ul style="list-style-type: none"> • 2-position, 6-port Switching • 2-position, 6-port 3-Way and 4-Way Switching • 6-position, 7-port Selection 	1/16" or 1/8" OD	84, 87-89

Genuine Rheodyne valve accessories are also featured in this chapter. Please see the pages indicated below for more information on these valve consumables:

- VespeI®, Tefzel® and PEEK™ Rotor Seals; Stainless Steel and PEEK Stators
- Rheodyne RheBuild® Kits
- Stainless Steel and PEEK Sample Loops
- Needle Port Accessories, Mounting Brackets, and the Rheodyne Wrench Upchurch Scientific® Micro Injection Port Adapters are also available.



MX SERIES AUTOMATION MODULES

A Complete Family of Productivity Enhancing Solutions for Laboratory Automation

- * Increase Laboratory Productivity
- * Expand Laboratory Capabilities
- * Increase Reproducibility
- * Improve Analytical Results
- * Increase Equipment Reliability
- * Save Time and Money
- * Make Life Easier

Today's HPLC fluid injection and switching applications require speed, precision and flexibility. Rheodyne's MX Series of productivity enhancing solutions for laboratory automation answer these needs. These completely self-contained, electrically actuated valves are available in a variety of flow paths for nano-, micro-, and analytical-scale applications.

"Manual" or Automatic Actuation

MX Modules can be operated by push button, allowing them to function as "manual" valves, or by contact closure for automated remote control. For multiple automated valve applications, a unique "Snap n' Stack" System allows units to be stacked vertically or connected horizontally to conserve bench space and reduce connection volumes.

These small, innovative packages and their simple installation make MX Modules the solutions of choice for all high-pressure fluid switching and sample injection applications. Many microscale applications may utilize the nanoscale modules.

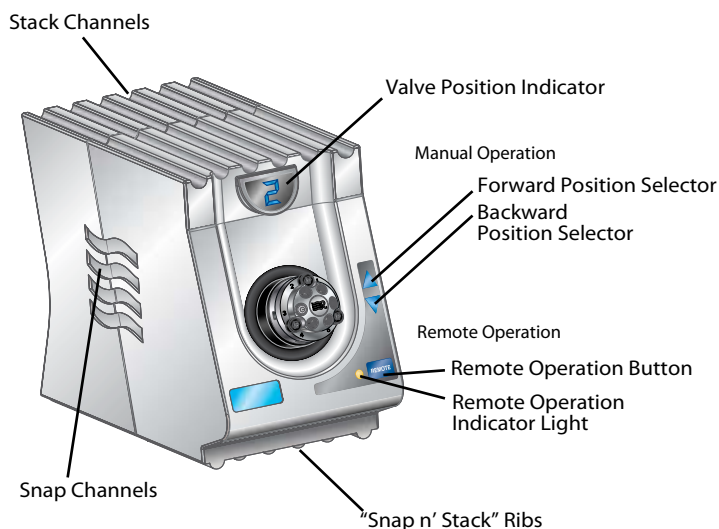
Nano-Scale Modules

With a mere 10nL internal sample chamber and, more importantly, outstanding dispersion characteristics, Rheodyne's MX Nano-Injector is the ultimate solution for nano- as well as microscale applications.

All three Nano-Scale MX Modules take advantage of Rheodyne's proprietary biocompatible DuraLife™ II technology for greatly extended duty cycles. MX nanodispersion Six- and Ten-Port Switching Modules are ideal for online sample preparation and LC/MS column switching with minimal band broadening.

Analytical-Scale Modules

The MX Semi-Automatic Injector combines the ease of use of Rheodyne's industry standard manual injectors with the precision actuation of an electrically actuated valve. With its specially designed needle port, sample is loaded directly into the valve. The push of a button injects your sample. By connecting the injector to a single contact closure, a sample can be loaded during system equilibration and injected automatically when the system is ready.



Outstanding Performance

MX Modules are also available in Analytical-Scale Six- and Ten-Port Switching Valves with low dispersion. All MX Modules incorporate Rheodyne's time tested miniature "Mighty Valve."

Versatile

MX Modules are designed to increase productivity, expand laboratory capabilities, save time, and make life easier.

Typical Solutions

- Sample Injection
- Two-Column Selection
- Alternating Column Regeneration
- High Speed Sample Enrichment
- High Speed Sample Clean Up
- Column Backflushing
- MS Solvent Diversion
- Multi-Dimensional Peptide Separation

These applications are discussed and illustrated in Rheodyne's MX Solutions Guide at http://www.rheodyne.com/pdfs/mx_solutions_guide.pdf Rheodyne's MX Operating Manual including installation instructions is available at http://www.rheodyne.com/pdfs/mx_operating_manual.pdf

MX Modules:

Module Scale	Available Flow Paths
Nano-Scale	10nL Sample Injector
	Two-Position, Six-Port Switching Valve
	Two-Position, Ten-Port Switching Valve
Analytical-Scale	Semi-Automatic Sample Injectors
	Two-Position, Six-Port Switching Valves
	Two-Position, Ten-Port Switching Valve

MX Module Specifications:

Maximum Pressure	5,000 psi (345 bar)
Flow Passages	Nano: 0.10mm (0.004") diameter Analytical: 0.25mm (0.010") diameter
Power Requirements	100-120 VAC, 50-60 Hz
Analytical-Scale	Semi-Automatic Sample Injector, 6-Port, 10-Port
Regulatory Compliance	CE Mark
Remote Control	One line contact closure (open = 1, closed = 2)
Operating Temperature	0° - 40° C, non-condensing
Storage Temperature	-40° - 75° C
Dimensions (H x W x D)	102mm x 76mm x 127mm (4.5" x 3.0" x 5.0")

NANO-SCALE SAMPLE INJECTOR

MX Nano Injector

Rheodyne® has created the world's smallest injection valve in a ready-to-use module. The MX Nano Injector has a 10nL internal sample chamber and outstanding low dispersion characteristics. The MX Nano Injector can also be used for microscale applications. Maximum pressure is 5,000 psi (345 bar).

Materials Technology

The MX Nano Injector takes advantage of Rheodyne's proprietary biocompatible DuraLife™ II technology for greatly extended duty cycles in a typical laboratory automation application.

Actuation

The MX Nano Injector can be used in "manual" or automatic mode. A front panel "REMOTE" button allows the injector to be actuated by contact closure from a controlling instrument. A bright LCD light indicates when the injector is in the automatic mode. Simply pressing the button switches the module to "manual" operation. Load your sample (Position 1) and press the module's forward position selector button and the module injects your sample (Position 2).



Position 1 (LOAD)



Position 2 (INJECT)

Flow path of MX Nano-Scale Sample Injector

NANO-SCALE TWO-POSITION, SIX-PORT SWITCHING MODULE

MX Nano Six-Port Switching Module

Rheodyne's MX Nano Six-Port Switching Module is designed to automate a variety of applications. Like the Nano Injector, this module can be operated by manual push button or, in remote mode, automatically by contact closure with a controlling instrument.

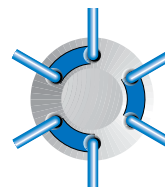
Passages and Pressure

Flow passages are 0.10mm (0.004") in diameter with a port-to-port volume of 25nL. This module is rated to 5,000 psi (345 bar).

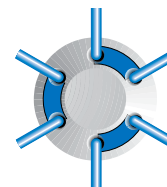
Extended Lifetime

Rheodyne's MX Nano Six-Port Switching Module contains DuraLife II wetted surfaces for high duty cycle lifetime. Following are typical applications:

- Two-Column Selection
- Column Backflushing
- High Speed Sample Clean Up and Enrichment
- MS Solvent Diversion



Position 1



Position 2

Flow path of MX Nano-Scale 6-Port Switching Valve

Please Note: the valves on this page ship with one set of RheFlex® M4 Fittings.

NANO-SCALE TWO-POSITION, TEN-PORT SWITCHING MODULE

The Rheodyne® MX Nano-Scale Ten-Port Switching Module provides a greater range of automated fluid switching solutions than the six-port module.

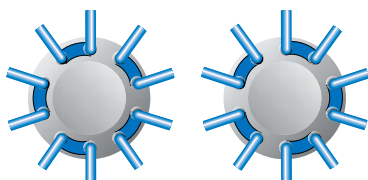
Passages and Pressure

This module contains the same 0.10mm (0.004") flow passages but with a port-to-port volume of 22nL. It is rated at 5,000 psi (345 bar) and is available with proprietary biocompatible DuraLife II™ wetted surfaces.

Applications

Typical applications are:

- Alternating Column Regeneration
- High Speed Sample Enrichment
- Multi-Dimensional Proteomic Peptide Separation



Position 1

Position 2

Flow path of MX Nano-Scale Ten-Port Switching Valve

ANALYTICAL-SCALE SYRINGE LOADING SAMPLE INJECTORS

"Semi-Automatic" Sample Injector

From the 7105 to the 7725i, Rheodyne has been the world's leader in HPLC sample injection for 25 years. The MX Semi-Automatic Injector is the next step in that legacy. By combining the ease of use of a manual injector with the precision actuation of a motorized valve, the MX Semi-Automatic Injector is the ideal solution for laboratory sample injection.

Passages and Pressure

Flow passages are 0.30 mm (0.010") in diameter with a port-to-port volume of 500nL. This module is rated to 5,000 psi (345 bar).

"Manual" or Automatic Injection

A specially designed needle port allows sample to be loaded directly into the valve. The push of a button begins sample injection in 120ms. The MX Semi-Automatic Injector is capable of complete automation.

For more information see MX Product Bulletin 231 at http://www.rheodyne.com/pdfs/product_bulletin_231.pdf

For additional illustrated solutions see Rheodyne's MX Solutions Guide at http://www.rheodyne.com/pdfs/mx_solutions_guide.pdf

For the MX Operating manual go to - http://www.rheodyne.com/pdfs/mx_operating_manual.pdf



Position 1

Position 2

Flow path of MX Analytical-Scale
Syringe Loading Sample Injectors

NANO-SCALE SAMPLE INJECTOR

MX7984-000 MX Nano Injector, 10nL Internal Loop
Biocompatible DuraLife II

ANALYTICAL-SCALE SYRINGE LOADING SAMPLE INJECTORS

MX7925-000 MX Analytical-Scale Syringe Loading Sample Injector
Stainless Steel

MX9925-000 MX Analytical-Scale Syringe Loading Sample Injector
Biocompatible

NANO-SCALE SIX-PORT SWITCHING VALVE

MX7980-000 MX Nano-Scale, Two-Position, Six-Port
Biocompatible DuraLife II

NANO-SCALE TEN-PORT SWITCHING VALVE

MX7986-000 MX Nano-Scale Two-Position, Ten-Port
Biocompatible DuraLife II

Please Note: the Nano-Scale Ten-Port Switching Valve ships with one set of RheFlex® M4 Fittings. The Analytical-Scale Syringe Loading Sample Injectors ship with one set of 10-32 RheFlex One-Piece Fingertight Fittings. Replacements and the alternative Two-Piece design are on pages 10 – 12. Sample loops are listed on pages 94 – 95.

ANALYTICAL-SCALE TWO-POSITION, SIX-PORT SWITCHING MODULES

MX Analytical Six-Port Switching Module

Rheodyne®'s MX Analytical Six-Port Switching Module is designed to automate a variety of applications. Like the Nano Injector, this module can be operated by manual push button or in remote mode, automatically via contact closure through a controlling instrument.

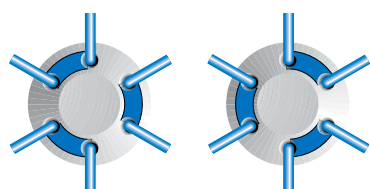
Passages and Pressure

Flow passages are 0.25mm (0.010") in diameter and the port-to-port volume is 0.36µL. This module is rated to 5,000 psi (345 bar).

Applications

Following are typical applications:

- Two-Column Selection
- High Speed Sample Clean Up and Enrichment
- Column Backflushing
- MS Solvent Diversion



Position 1

Position 2

Flow path of MX Analytical-Scale Six-Port Switching Valves

ANALYTICAL-SCALE TWO-POSITION, TEN-PORT SWITCHING MODULES

Rheodyne's MX Analytical Ten-Port Switching Module provides a greater range of automated fluid switching solutions than the six-port module.

Passages and Pressure

It features the same 0.25mm (0.010") flow passages and the port-to-port volume is 0.50µL. This module is rated at 5,000 psi (345 bar).

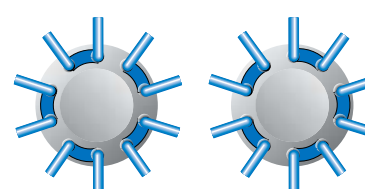
Applications

- Typical applications are:
- Alternating Column Regeneration
- High Speed Sample Enrichment
- Multi-Dimensional Proteomic Peptide Separation

For more information see MX Product Bulletin 231 at http://www.rheodyne.com/pdfs/product_bulletin_231.pdf

For additional illustrated solutions see Rheodyne's MX Solutions Guide at http://www.rheodyne.com/pdfs/mx_solutions_guide.pdf

For the MX Operating manual go to - http://www.rheodyne.com/pdfs/mx_operating_manual.pdf



Position 1

Position 2

Flow path of MX Analytical-Scale Ten-Port Switching Valves

Please Note: the valves on this page ship with one set of 10-32 RheFlex® One-Piece Fingertight Fittings. Replacements and the alternative Two-Piece design are available.

MX ANALYTICAL-SCALE SIX-PORT SWITCHING VALVES

MX7900-000 MX Two-Position, Six Port, Stainless Steel

MX9900-000 MX Two-Position, Six Port, Biocompatible

MX ANALYTICAL-SCALE TEN-PORT SWITCHING VALVE

MX7960-000 MX Two-Position, Ten Port, Stainless Steel

SAMPLE INJECTORS

How to Choose a Sample Injector

Table I below compares the characteristics of Rheodyne® manual sample injectors and will help you choose the most suitable model.

Types and Capabilities

Models ending in 25 (i.e. 7725) are dual mode injectors. Dual mode injectors can use both the partial-filling and the complete-filling method for loading the sample loop (See the “Sample Loop Loading” Application Note). They are variable volume injectors because they allow the loading of various sample volumes. These dual mode injectors, also called front-loading injectors, have a needle port for loading sample built into the handle. The unique Rheodyne injection port design allows the tip of the needle to connect directly to the sample loop for no sample loss during loading.

Models ending in -10 (i.e. 7010) are single mode injectors. Single mode injectors use only the complete-filling method to load the sample loop. They are called fixed loop injectors as the sample loop size determines the sample volume. These injectors require a Loop Filler Port accessory, as a needle port is not built into the valve handle. There is not a direct connection between the syringe and the sample loop. Therefore, an excess of sample must be used to overfill the Loop Filler Port and completely fill the sample loop.

Models with an “i” suffix (i.e. 7725i) are identical to the models with the same numbers but the “i” designates a built-in position sensing switch. The switch provides the chromatograph with a reproducible start signal to mark the injection time in the data system. The reproducibility of manual sample injectors depends on operator skill, syringe calibration, and the loading method. Partial-filling method is typically reproducible to 1.0% relative standard deviation (RSD). Complete-filling method is reproducible to 0.1% RSD for loops 5µL.

Scale, Sample Volume, and Loop Size

Analytical scale models are for conventional columns with samples from 1.0µL to 5.0mL. Microscale models are for 1.0mm and 2.0mm inner diameter columns. Model 8125 has a sample range of 0.1µL to 500µL, and can be used for both analytical and micro columns. Preparative scale models are for columns with diameters from 1 to 10cm, and operate at high flow rates with samples from 100µL to 20mL.

Liquid Contact Materials

All models have a polymeric rotor seal of Vespel® (pH 0 to 10 tolerance), Tefzel®, or PEEK™ (both pH 0 to 14). Stators are 316 stainless steel or PEEK. Most models have an inert ceramic stator face assembly.

Make-Before-Break (MBB®)

Models incorporating Rheodyne’s patented MBB architecture design provide uninterrupted flow when switching between LOAD and INJECT positions. MBB greatly reduces transient pressure shocks and is beneficial for flow-sensitive detectors, fragile columns, and pumps. Models 7725, 9725, 3725, and “i” versions contain the MBB design.

ChromTRAC™ Mapping

Selected Rheodyne manual valves contain the industry standard ChromTRAC Mapping to color-code your fluid connections. You can identify each port by its colored number, which designates the ChromTRAC color for each system component. Simply coordinate the ChromTRAC colored fittings with the port color.

All valves are ChromTRAC ready. The convenience of ChromTRAC color-coding knobs comes with the RheoFlex® Fittings you use for all your connections.

Table I. Characteristics of Rheodyne Manual Sample Injectors:

Type & Capabilities	Scale	Partial Filling Volumes (Range)	Sample Loop Sizes (Range)	Liquid-Contact Materials	Max. psi (bar) ¹	Max. T (°C)	MBB ²	Model ³
Dual Mode Can load the loop by two methods: 1) Partial filling – syringe determines volume without wasting sample 2) Complete filling – loop determines volume by over filling loop	Analytical	1µL - 2.5mL	2µL - 5.0mL	316 SST, Vespel	7,000 (483)	80°	Yes	7725, 7725i
		1µL - 5.0mL	2µL - 10mL	PEEK, Tefzel, ceramic	5,000 (340)	50°	Yes	9725, 9725i
	Micro	0.1µL - 500µL	5µL - 1.0mL	316 SST, Vespel, ceramic, PEEK	7,000 (483)	80°	No	8125
Single Mode Can load the loop by one method: Complete filling – loop determines volume by over filling loop	Analytical	Not Applicable	5µL - 5.0mL	316 SST, Vespel	7,000 (483)	150°	No	7000
			5µL - 10mL	PEEK, Tefzel, Ceramic	5,000 (340)	50°	No	9010
	Micro	Not Applicable	0.5µL - 5µL	316 SST, Vespel	7,000 (483)	150°	No	7410
			0.2µL - 1µL	316 SST, Vespel	7,000 (483)	80°	No	7520

SST = Stainless Steel

¹ This is the maximum pressure to which the valve can be adjusted. Some models are shipped from the factory set for lower pressures.

² MBB® (Make-Before-Break) is a patented Rheodyne design that provides uninterrupted flow when switching between LOAD and INJECT. MBB also greatly reduces transient pressure shocks.

³ Models with an “i” suffix have a built-in position sensing switch. Models 8125 and 9010 each have a built-in switch.

Table II. Specifications of Rheodyne Manual Switching Valves:

Model	Stator Passage Diameter	Factory Set Pressure	Maximum Field Set Pressure	Maximum Temperature (°C)
7000, 7030, 7040 (SST)	0.6mm (0.024")	5,000 psi (340 bar)	7,000 psi (483 bar)	150°
7060 (SST)	0.4mm (0.016")	5,000 psi (340 bar)	7,000 psi (483 bar)	80°
7000L, 7030L, 7040L, 7060L (SST)	1.0mm (0.040")	3,000 psi (207 bar)	5,000 psi (340 bar)	150° (7060L: 80°)
9010, 9030, 9060 (PEEK)	0.4mm (0.016")	5,000 psi (340 bar)	5,000 psi (340 bar)	50°
3000, 3030 (PEEK)	1.0mm (0.040")	3,000 psi (207 bar)	4,000 psi (276 bar)	50°
3000-038, 3030-038 (SST)	1.0mm (0.040")	4,000 psi (276 bar)	5,000 psi (340 bar)	50°

SST = Stainless Steel

HIGH PRESSURE SWITCHING VALVES

Rheodyne® offers high pressure manual switching valves to 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 1.6mm (1/16") or 3.2mm (1/8") ports.

Column Selection

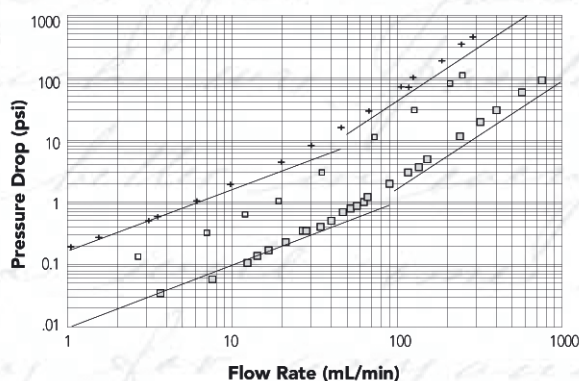
The six-position switching valves are used for column selection. These valves substitute one column for another without the need to manually disconnect the plumbing. This makes it easy to designate a separate column for each analysis. Designated columns eliminate equilibration delays, reduce interferences,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

Column Switching

The two-position switching valves are used to reroute mobile phase during the chromatographic run without changing separation techniques or 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. 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 (see graph below).

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 = (1.0mm 7000L valve) + (two 1.0mm x 5.0cm tubes). Open squares = (0.6mm 7000 valve) + (two 1.0mm x 5.0cm tubes). Cross mark = (0.6mm 7000 valve) + (two 0.5mm x 5.0cm tubes). Solid lines are theoretical values for 10cm long tubes of 1.0mm and 0.5mm ID. Pressure drop is in units of psi.

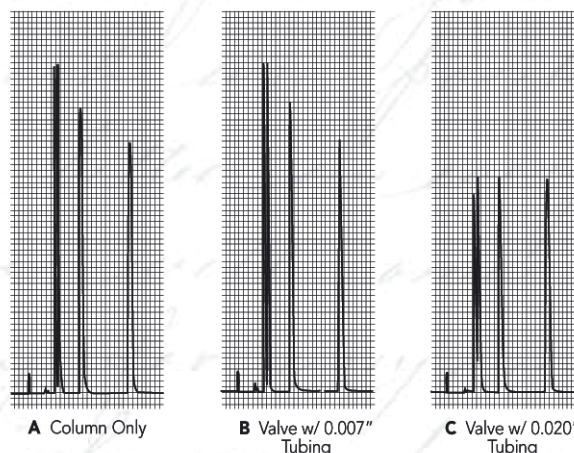
EFFECTS OF VALVES AND TUBING ON RESOLUTION

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 $\leq 0.25\text{mm}$ (0.010") is recommended.

Consider a system with a Rheodyne 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 10cm length for valve #1-to-column, and a 35cm length for column-to-valve #2. The diameters of these tubes are indicated in the experimental details, below.

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: 4.6mm x 12.5cm column, 5 μm C-18 packing, 50% acetonitrile in water, 2.0mL/min, 21°C, 5.0 μL sample partial filled into a Model 7125 injector, 10cm x 0.18mm (0.007") bore injector outlet tube (to column or valve), 10cm x 0.18mm bore detector inlet tube (from column or valve), low dispersion 1.0cm path UV detector cell, 0.2 sec detector time constant. See text above for details.

MICRO-SCALE INJECTOR

Model 8125

Model 8125 is Rheodyne®'s solution to your microscale analyses. Made of 316 stainless steel and designed for 1.0mm (0.04") and 2.0mm (0.08") microbore columns, the adaptable injector is also compatible with analytical columns (3.0-5.0mm, 0.12-0.20"). Model 8125's built-in position sensing switch provides the chromatograph with a reproducible start signal.

This versatile injector allows both partial-filling method (reproducibility of 1.0% RSD) and complete-filling method (reproducibility of 0.1% RSD). For more information, see the "Sample Loop Loading" and "Fluidic Movement in Tubes" and "Using Proper Syringe Needles" Application Notes on pages 96, 97 and 98, respectively. To save loading time into the 8125's small flow passages, the largest loop recommended for the complete-filling method is 200µL. This dual-mode capability allows varying sample volumes for your microscale analyses.

Micro-scale 8125 sample loops use 0.5mm (0.020") OD tubing instead of the conventional 1.6mm (1/16") OD tubing to provide low-dispersion performance. The versatile 8125 can also accommodate 1.6mm (1/16") OD tubing. The presence of a mixing cavity between the loop and injector port is less likely when using the smaller size tubing. Cavities may cause high dispersion and peak distortion. Valve flow passages are 0.3mm (0.013") in diameter.

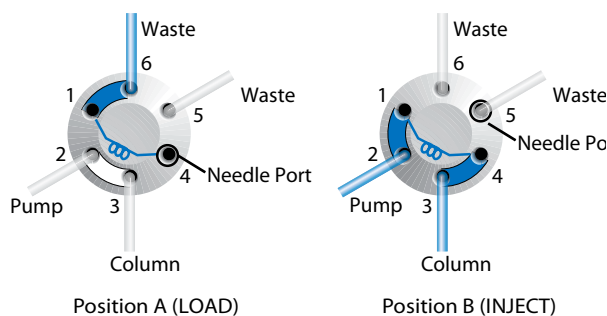
The table below compares the improved resolution using the 8125 to analytical scale injectors, such as the 7725. The improvement is greatest with relatively unretained (low *k'*) peaks.

Flow switching occurs at a flat interface between a polymeric rotor seal and a ceramic stator face assembly in both the stainless steel and PEEK™ models. You can have confidence in the long seal life of this genuine Rheodyne part combination.

A simple, three-step sample injecting operation involves inserting the syringe into the needle port while in the LOAD position and turning the handle to INJECT. The sample is on its way through your system and when the handle returns to LOAD, the injector is ready for the next injection. The flow path positions are illustrated to the right. In addition, see the "Using Proper Syringe Needles" Application Note.

See Table I in Introduction to Rheodyne Manual Valves for detailed specifications.

Please Note: the valve on this page ships with a 5µL stainless steel sample loop and one set of 10-32 RheFlex® Stainless Steel Fittings (3-long, 1-extra long). Replacements and alternatives are available on pages 94 – 95 and 15, respectively.



Flow paths of the LOAD and INJECT positions of Model 8125 sample injector for microscale analyses.

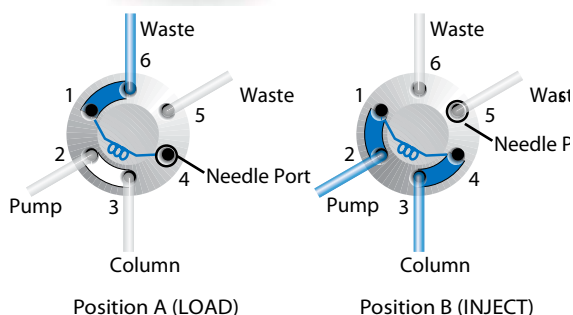
Comparison of Observed Column Plates of Rheodyne Analytical and MicroScale Injectors:

	7125	8125	Δ
k' = 0.6	2930	5054	72%
k' = 1.5	4653	6904	48%
k' = 7.9	7875	8305	5.0%

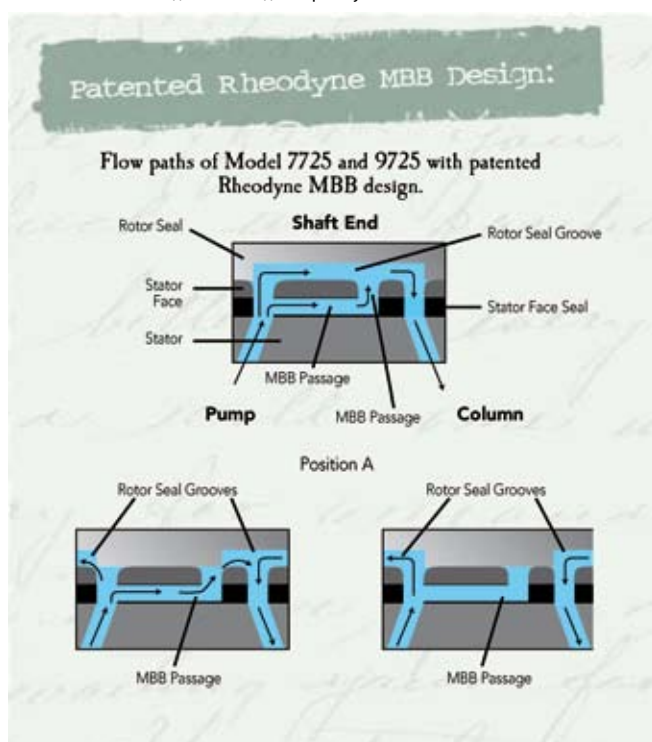
UV detector: 1µL volume, 4mm path. Sample volume: 2µL, partial-filling method. Column: 2mm ID x 100mm long, 4µm C-18. True plates of column = 11,570.

MICRO-SCALE SAMPLE INJECTOR

8125	Dual Mode, Micro-Scale Injector	Stator Material
		Stainless Steel



Flow paths of the LOAD and INJECT positions of models 7725(i) and 9725(i) sample injectors.



ANALYTICAL INJECTORS

Models 7725, 7725i, 9725 and 9725i

The 316 stainless steel models 7725 and 7725i, and PEEK™ models 9725 and 9725i are Rheodyne®'s most advanced manual sample injectors for analytical HPLC. Specialized features include:

- The Rheodyne patented Make-Before-Break (MBB®) architecture allows continuous flow between LOAD and INJECT positions which greatly reduces transient pressure shocks that disrupt your system.
- Wide, 30° port angles offer easier access to fittings using the Rheodyne Wrench (Part # 6810).
- Front-end pressure screw makes it easy to adjust and maintain pressure.
- Capability of a reproducible 2µL sample injection with a 2µL internal sample loop.
- A built-in position sensing switch ("i" versions) provides the chromatograph with a reproducible start signal.

The patented Rheodyne MBB valve design is illustrated below left. In the LOAD position, mobile phase flow from pump port to column port travels through both the rotor seal groove and the MBB passage (Position A). As the rotor seal grooves rotate to change from LOAD to INJECT, there is continuous mobile phase flow through both one rotor seal groove and the MBB passage (Position B) until the rotation stops and both rotor seal grooves are connected by the loop. Sample flow begins through the loop to the column just as all flow stops through the MBB passage (Position C). Sample flow never enters the MBB passage. Valve flow passages are 0.6mm (0.024") in diameter.

The injector contains a patented Rheodyne needle port design that connects the tip of the syringe needle directly to the sample loop ensuring zero sample loss, no cross-contamination, and syringe accuracy. These versatile frontloading injectors allow both partial-filling method (reproducibility of 1.0% RSD) and complete-filling method (reproducibility of 0.1% RSD). This dual mode capability allows varying sample volumes for your analytical analyses. For more information, see the "Sample Loop Loading," "Fluidic Movement in Tubes" and "Using Proper Syringe Needles" Application Notes, respectively.

Flow switching occurs at a flat interface between a polymeric rotor seal and a ceramic stator face assembly in both the stainless steel and PEEK models. You can have confidence in the long seal life of this genuine Rheodyne part combination.

A simple, three-step operation involves inserting the syringe into the needle port while in the LOAD position and turning the handle to INJECT. The sample is on its way through your system and when the handle returns to LOAD, the injector is ready for the next injection.

See Table I in Introduction to Rheodyne Manual Valves for detailed specifications.

Please Note: the valves on this page ship with a 20µL sample loop and one set of 10-32 RheFlex® Two-Piece Fittings (3-long, 1-extra long). The material of these accessories match that of the stator material (see below).

ANALYTICAL-SCALE SAMPLE INJECTORS

		Stator Material
7725	Dual Mode, Analytical Injector	Stainless Steel
7725i	Dual Mode, Analytical Injector with Switch	Stainless Steel
9725	Dual Mode, Analytical Injector	PEEK
9725i	Dual Mode, Analytical Injector with Switch	PEEK

PREPARATIVE-SCALE INJECTORS

Models 3725-038, 3725i-038, 3725 and 3725i

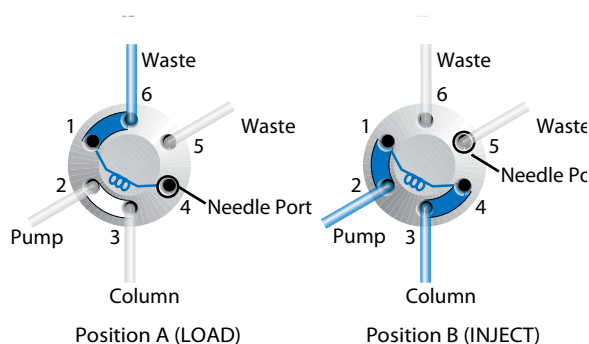
Models 3725-038 and 3725i-038 (316 stainless steel) and 3725 and 3725i (biocompatible PEEK™) are the most suitable manual valves to use with large sample volumes, high flow rates, and preparative columns sized 1.0-10cm (0.4-4.0") in diameter. The ports accommodate 3.2mm (1/8") OD tubing, and 1.6mm (1/16") OD tubing with the Adapter accessory (Part # 6000-076). The 1.0mm (0.040") diameter passages allow flow rates of 10 to 100mL/minute with virtually no pressure drop. These versatile injectors allow both partial-filling method (reproducibility of 1.0% RSD) and complete-filling method (reproducibility of 0.1% RSD). This dual-mode capability allows variable sample volumes for your preparative scale analyses. For more information, see the "Sample Loop Loading," "Fluidic Movement in Tubes" and "Using Proper Syringe Needles" Applications Notes on pages 96, 97 and 98, respectively. Please note: Rheodyne Preparative-Scale Injectors require a 16 gauge needle.

The "i" version injectors' built-in position sensing switch provides the chromatograph with a reproducible start signal.

These preparative scale injectors incorporate Rheodyne®'s patented Make-Before-Break (MBB®) architecture allowing continuous flow between LOAD and INJECT positions which greatly reduces disruptive transient pressure shocks to your system.

The information below illustrates the MBB valve design. In the LOAD position, mobile phase flow from the pump port to the column port, traveling through both the rotor seal groove and the MBB passage (Position A). As the rotor seal grooves rotate to change from LOAD to INJECT, there is continuous mobile phase flow through both one rotor seal groove and the MBB passage (Position B) until the rotation stops and both rotor seal grooves are connected by the loop. Sample flow begins through the loop to the column just as all flow through the MBB passage (Position C) stops. Sample flow never enters the MBB passage.

A simple, four-step operation involves inserting the syringe into the needle into the needle port while in the LOAD position and turning the handle to INJECT. The sample is on its way through your system. To prevent mobile phase from ejecting out of the needle port, remove the syringe and place the plug attached to the handle into the needle port while still in INJECT position. Turn the handle back to LOAD, and remove the plug for the next injection. The flow path positions are illustrated to the right.



Flow paths of the LOAD and INJECT positions of models 3725(i) and 3725(i)-038 sample injectors.

Flow switching occurs at a flat interface between a polymeric rotor seal and a PEEK stator face assembly in both the stainless steel and PEEK models. You can have confidence in the long seal life of this genuine Needle Port Rheodyne part combination.

See Table I in Introduction to Manual Valves for detailed specifications.

View the online product product bulletin - http://www.rheodyne.com/pdfs/product_bulletin_202.pdf

Please Note: the valves on this page ship with a 10mL sample loop and one set of 5/16-24 RheFlex® Fittings. The material of these accessories match that of the stator material (see below). Replacements and alternatives are available on pages 94 – 95, 12 and 15. Alternative 10-32 fittings for use with 1/16" OD tubing.

TWO-POSITION SWITCHING VALVES

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

The versatile two-position, six- and ten-port Rheodyne® valves are available in 1/16" and 1/8" port sizes, and 316 stainless steel and PEEK™ versions. These valves redirect flow among columns during the chromatographic run. They are also useful for selecting between two columns as shown in the Application Note below. Compare Model 7000 to the Three-Way Switching Valve (Model 7030) in which each end of the off-line column is independently sealed instead of connected together head-to-tail. Independent seals produce less shock to the column if the valve switches before all the pressure leaves the column. A ten-port valve can often accomplish the same operation that requires two six-port valves.

Model 9010 PEEK sample injector can convert to a six-port switching valve functionally identical to Model 7000 by removing the loop.

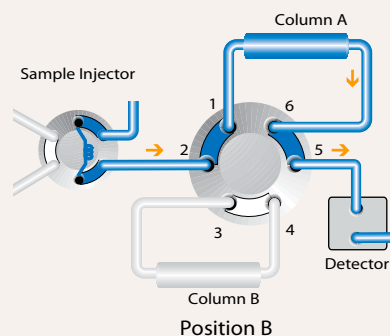
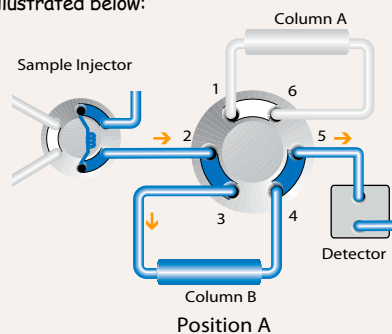
View the online product bulletin for the 7000(L) Valves - http://www.rheodyne.com/pdfs/product_bulletin_114.pdf.
View the online product bulletin for the 9010 Valve -

http://www.rheodyne.com/pdfs/product_bulletin_117.pdf
Please Note: the valves on this page ship with one set of 10-32 (1/16") or 5/16-24 (1/8") RheFlex® Two-Piece Fittings. The material of these accessories match that of the stator material (see below).



Application Note

A set-up for two column selection using Model 7000 is illustrated below:



PREPARATIVE-SCALE SAMPLE INJECTORS

		Stator Material
3725-038	Dual Mode, Preparative Injector	Stainless Steel
3725i-038	Dual Mode, Preparative Injector with Switch	Stainless Steel
3725	Dual Mode, Preparative Injector	PEEK
3725i	Dual Mode, Preparative Injector with Switch	PEEK

TWO-POSITION SWITCHING VALVES

		Stator Material
7000	Two-Position, 6-Port Switching Valve (1/16")	Stainless Steel
7000L	Two-Position, 6-Port Large Bore Switching Valve (1/16")	Stainless Steel
3000-038	Two-Position, 6-Port Switching Valve (1/8")	Stainless Steel
3000	Two-Position, 6-Port Switching Valve (1/8")	PEEK
9010	Single Mode, Analytical Injector	PEEK

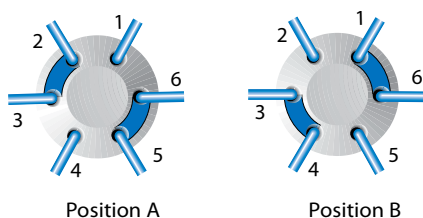
THREE-WAY SWITCHING VALVES

Models 7030(L), 9030, 3030-038 and 3030

Two-position, six-port valves with a double three-way switching pattern are available in 1/16" and 1/8" port sizes, and 316 stainless steel and PEEK™ versions. See Introduction to High Pressure Switching Valves for detailed specifications.

View the online product product bulletin for the 7030(L) Valves - http://www.rheodyne.com/pdfs/product_bulletin_114.pdf

View the online product bulletin for the 9030 Valve - http://www.rheodyne.com/pdfs/product_bulletin_117.pdf



Flow diagram of a Three-Way Switching Valve.

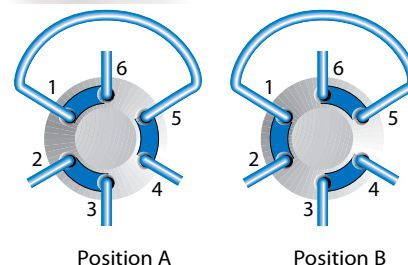
FOUR-WAY SWITCHING VALVES

Models 7040 and 7040L

The two-position, six-port 316 stainless steel valves contain an external loop that exchanges the flow pattern from ports (2 to 3 and 4 to 6) to (2 to 6 and 4 to 3). This flow pattern facilitates applications such as column backflushing.

Other Rheodyne® valves can convert to a four-way valve. Model 9010 PEEK sample injector becomes four-way by changing the loop to connect Ports 1 and 5. Model 3000 PEEK switching valve becomes fourway by adding an external loop connecting Ports 1 and 5.

View the online product product bulletin for 7040(L) Valves - http://www.rheodyne.com/pdfs/product_bulletin_114.pdf



Flow diagram of a Four-Way Switching Valve.

Please Note: the valves on this page ship with one set of 10-32 (1/16") or 5/16-24 (1/8") RheFlex® Two-Piece Fittings. The material of these accessories match that of the stator material (see to the left).

THREE- AND FOUR-WAY SWITCHING VALVES

Model	Valve Description	Stator Material
7030	Three-Way, Switching Valve (1/16")	Stainless Steel
7030L	Three-Way, Large Bore Switching Valve (1/16")	Stainless Steel
9030	Three-Way, Switching Valve (1/16")	PEEK
3030-038	Three-Way, Switching Valve (1/8")	Stainless Steel
3030	Three-Way, Switching Valve (1/8")	PEEK
7040	Four-Way, Switching Valve (1/16")	Stainless Steel
7040L	Four-Way, Large Bore, Switching Valve (1/16")	Stainless Steel

SIX-POSITION SWITCHING VALVES

Models 7060(L) and 9060

Rheodyne®'s Six-Position Switching Valves make HPLC analyses easier and better. Two manually operated six-position valves allow convenient selection among six columns for different analytical methods on the same chromatograph. The advantages of using these valves over manually changing columns are immediate selection, no wear on fittings from repeated tightening, and the valve seals both ends of the off-line columns, keeping them on stand-by for future use.

For manual column selection, the center port of one valve connects to an injector. Turning the valve handle directs flow into one of up to six columns connected to the valve's six peripheral ports. A second six-position valve connects to the column outlets to select the operating column effluent and to direct it to the detector.

The sixth port may be used for a bypass/flush-out tube. This connection permits rapid mobile phase changeover without exposing any column to a mobile phase other than the one with which it is routinely used. See the drawing to the right for a six column selection application set-up.

These six-position valves are available in different materials (such as 316 stainless steel and PEEK™) and in 1/16" port sizes. Models accepting 1.6mm (1/16") fittings have internal passages of 0.4mm (0.016") ID with a total internal volume of less than 2µL. Refer to the "Effect of Valves and Tubing on Resolution" section.

Large bore, "L" versions are used to avoid excessive pressure drops when using high flow rates. These models also can be used for mobile phase selection by connecting the center port to a pump inlet.

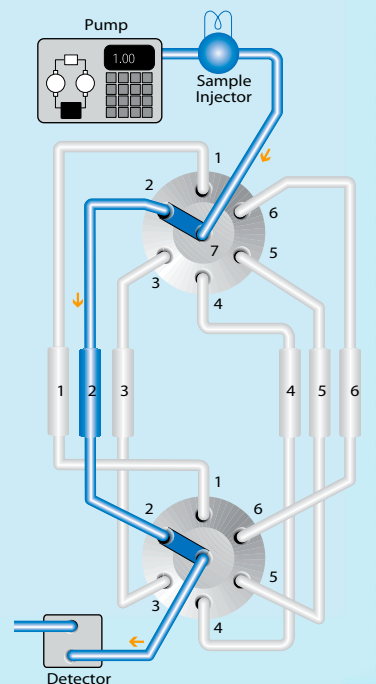
See Introduction to High Pressure Switching Valves.

View the online product bulletin for the 7060(L) Valves - http://www.rheodyne.com/pdfs/product_bulletin_114.pdf
View the online product bulletin for the 9060 Valve - http://www.rheodyne.com/pdfs/product_bulletin_117.pdf



Application Note

Six column selection using two Model 7060 switching valves.



Please Note: the valves on this page ship with one set of 10-32 (1/16") RheFlex® Two-Piece Fittings. The material of these accessories match that of the stator material (see below).

SIX-POSITION SWITCHING VALVES

		Stator Material
7060	Six-Position, Switching Valve (1/16")	Stainless Steel
7060L	Six-Position, Large Bore, Switching Valve (1/16")	Stainless Steel
9060	Six-Position, Switching Valve (1/16")	PEEK

RHEODYNE® ROTOR SEALS AND STATORS

The rotor seal is the polymeric disc that makes a high pressure seal against the stator. The seal wears with use and is one of the only parts that may need routine replacement.

Genuine Rheodyne rotor seals are unmatched in performance and product life. For a quarter of a century they have exceeded the needs and expectations of chromatographers. These rotor seals are products of rigid manufacturing and quality assurance procedures before they are incorporated into valves or shipped to customers. Only genuine Rheodyne parts ensure the continued precision performance of Rheodyne valves.

Rheodyne engineers develop exacting product specifications and designs including the factory-installed rotor seal ring which optimizes rotor seal efficiency. Rheodyne rotor seals must pass tougher-than-real-world standards of performance. Rheodyne rotor seals fully meet the demanding requirements of day-to-day manual instrument use as well as the operating conditions found in today's automated laboratories.

Rheodyne rotor seals are made from proprietary-blended polymers, formulated specifically for resistance to repetitive chemical and physical stresses of the entire 0 to 14 pH range. Vespel® blend rotor seals have an operating pH range from 0 to 10. Tefzel® blend and PEEK™ blend rotor seals have a pH range from 0 to 14. Strong oxidizing acids such as concentrated nitric and sulfuric are not compatible with PEEK.

Stators are available in 316 stainless steel and PEEK. Rheodyne construction materials have been researched and selected for their physical and mechanical strengths. Stators need replacement only if the ports or sealing surfaces become damaged. Avoid damage from use of improper injection needles by referring to the "Using Proper Syringe Needles" Application Note.

Please Note: rotor seals for MX Modules are available in RheoBuild® Kits. Stators for MX Modules are available on this page.



VESPEL BLEND ROTOR SEALS

7010-039	Vespel Rotor Seal for Models 7010, 7000, 7040
7030-003	Vespel Rotor Seal for Model 7030
7060-070	Vespel Rotor Seal for Models 7060, 7066
7125-047	Vespel Rotor Seal for Models 7125, 7725
7410-038	Vespel Rotor Seal for Model 7410
7413-013	Vespel Rotor Seal for Model 7413
8125-038	Vespel Rotor Seal for Model 8125

TEFZEL BLEND ROTOR SEALS

7010-071	Tefzel Rotor Seal for Models 7010, 7010-087, 7000, 7040
7030-015	Tefzel Rotor Seal for Model 7030
7060-074	Tefzel Rotor Seal for Models 7060, 7066, 9060
7125-079	Tefzel Rotor Seal for Models 7125, 7125-081, 7725
7410-075	Tefzel Rotor Seal for Model 7410
8125-097	Tefzel Rotor Seal for Model 8125
9010-051	Tefzel Rotor Seal for Model 9010
9125-082	Tefzel Rotor Seal for Models 9125, 9725

PEEK BLEND ROTOR SEALS

3030-005	PEEK Rotor Seal for Models 3030, 3030-038
3060-001	PEEK Rotor Seal for Models 3060, 3060-038
3710-008	PEEK Rotor Seal for Models 3000, 3000-038, 3710, 3710-038
3725-018	PEEK Rotor Seal for Models 3725, 3725-038
7610-011	PEEK Rotor Seal for Models 7610-400, 7610-600

STATORS FOR MX MODULES

Nano-Scale

7980-004	Stator for Model MX7980-000
7984-005	Stator for Model MX7984-000
7986-004	Stator for Model MX7986-000

Analytical-Scale

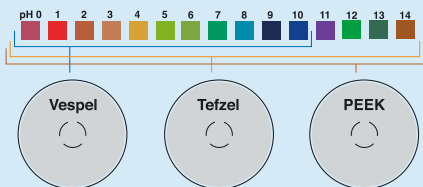
7900-107	Stator for Model MX7900-000
7900-146	Stator for Model MX9900-000
7925-002	Stator for Model MX7925-000
7960-002	Stator for Model MX7960-000
9925-002	Stator for Model MX9925-000

STATORS FOR OTHER RHEODYNE VALVES

3725-006	Stator for Models 3725, 3710-038, 3000-038 and 3030-038
3725-085	Stator for Models 3725-038, 3710-038, 3000-038 and 3030-038
7010-040	Stator for Models 7010, 7125, 7000, 7030 and 7040
7010-066	Stator for Models 7125-081 and 7010-087
7060-039	Stator for Models 7060 and 7066
7123-047	Stator for Model PR/EV500-100
7123-127	Stator for Model PR/EV750-107
7123-128	Stator for Model PR/EV700-107
7123-142	Stator for Model PR/EV500-104
7123-145	Stator for Model PR/EV550-104
7123-147	Stator for Model PR/EV550-100
7123-148	Stator for Model PR/EV500-101
7123-180	Stator for Model PR703-100
7123-221	Stator for Model PR753-100
7123-223	Stator for Model PR/EV700-112
7410-041	Stator for Models 7410 and 7413
7610-048	Stator for Model 7610-600
7650-002	Stator for Model PR/EV700-102
7725-010	Stator for Model 7725
7750-038	Stator for Model PR/EV700-100
8125-098	Stator for Model 8125
9060-016	Stator for Model 9060
9125-043	Stator for Models 9125, 9010, 9030 and 9725
9650-009	Stator for Model PR/EV750-102
9750-021	Stator for Model PR/EV750-100

Application Note

How to Select the Right Rotor Seal



The standard rotor seal in many Rheodyne manual valves is made from a Vespel® blend. This polyimide has low wear and high chemical resistance. Vespel tolerates a pH range of 0 to 10. Solutions more basic than pH 10 dissolve Vespel which damages the rotor seal. If you use any solutions above pH 10, Rheodyne recommends a PEEK™ blend rotor seal. PEEK offers a high chemical resistance and versatility, and will tolerate the entire pH range from 0 to 14. Tefzel® blend rotor seals may be appropriate for some applications.

RHEBUILD® KITS

RheBuild Kits with genuine Rheodyne® parts are available for all Rheodyne products. Included in each individualized RheBuild Kit are all parts, tools, and instructions to maintain precision performance of your particular Rheodyne product. RheBuild Kits eliminate individual part ordering.



Application Note

How to Avoid Pressure Transients

Air in the sample loop can cause instantaneous system pressure drop that eventually returns to a normal level. Air causes the pressure to drop when the injector moves from the LOAD to the INJECT position. When large sample loops ($\geq 100\mu\text{L}$) are partially loaded, air present in the needle port tube is pushed into the sample loop (see Figure 1). Air can also enter the sample loop from siphoning which occurs when the vent line is higher than the injection port. In either case, upon injection, the system pressure collapses the air bubble, causing pressure to drop momentarily.

A pressure drop in the system caused by air results in changes in retention time, artifact peaks, and affects column performance.

Avoid pressure drops by removing the air in the needle port tube. Do this by flushing about 1mL of mobile phase with a luer syringe with needle port cleaner. Keep the needle port tube filled with mobile phase by occasional flushing. Adjust the vent line(s) so the outlet is at the same horizontal level as the needle port (see Figure 2). For additional injection troubleshooting, refer to the Rheodyne Troubleshooting Guide for HPLC Injection Problems. You may download the Guide from the Rheodyne web site: www.rheodyne.com under Tech.

Support. You can also request a copy by using the reply card at the back of this publication.

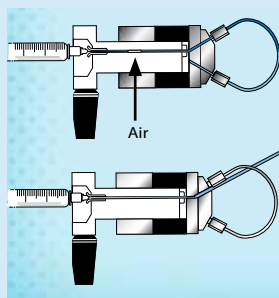


Figure 1 Air present in the needle port tube is pushed by the syringe during loading into the sample loop.

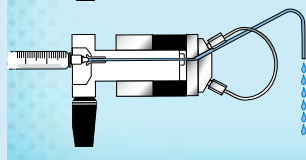


Figure 2 Pathway of the flushing mobile phase using the Needle Port Cleaner, Part # 7125-054 when the injector is in INJECT.

RHEBUILD KITS

3725-999	RheBuild Kit for Models 3725, 3725i, 3725-038, 3735i-038
7010-996	Conversion Kit including Stator Face Assembly for Model 7010
7010-997	RheBuild Kit including Stator for Model 7010
7010-999	RheBuild Kit for Model 7010 and 7010-type Valves
7125-999	RheBuild Kit for Models 7125 and 7126
7410-999	RheBuild Kit for Model 7410
7520-999	RheBuild Kit for Models 7520 and 7526
7725-999	RheBuild Kit for Models 7725 and 7725i
7900-999	RheBuild Kit for Models MX7925-000 and MX7900-000
7960-999	RheBuild Kit for Model MX7960-000
7980-999	RheBuild Kit for Model MX7980-000
7984-999	RheBuild Kit for Model MX7984-000
7986-999	RheBuild Kit for Model MX7986-000
8125-999	RheBuild Kit for Models 8125 and 8126

RHEBUILD FOR PEEK™ VALVES

7900-999	RheBuild Kit for Models MX9925-000 and MX9900-000
9010-999	RheBuild Kit for Model 9010
9125-999	RheBuild Kit for Models 9125 and 9126
9725-999	RheBuild Kit for Models 9725 and 9725i

RHEBUILD KITS FOR LABPRO® & EV AUTOMATED FLUIDIC INSTRUMENTS

1001-999	RheBuild Kit for Model PR100-101
1002-999	RheBuild Kit for Model PR100-102
1005-999	RheBuild Kit for Model PR/EV100-105
1006-999	RheBuild Kit for Model PR/EV100-106
5001-999	RheBuild Kit for Models PR/EV500-101 and PR/EV550-101
5100-999	RheBuild Kit for Models PR/EV500-100 and PR/EV550-100
5104-999	RheBuild Kit for Models PR/EV500-104 and PR/EV550-104
7004-999	RheBuild Kit for Models PR/EV700-104 and PR/EV750-104
7112-999	RheBuild Kit for Models PR/EV700-112 and PR/EV750-112
7501-999	RheBuild Kit for Models PR/EV700-100 and PR/EV750-100
7502-999	RheBuild Kit for Models PR/EV700-102 and PR/EV750-102
7507-999	RheBuild Kit for Models PR/EV700-107 and PR/EV750-107
7531-999	RheBuild Kit for Models PR703-100 and PR753-100

RHEBUILD KITS FOR OTHER VALVE MODELS

7125Ti-999	RheBuild Kit for Model 7125-081
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RHEODYNE® STAINLESS STEEL SAMPLE LOOPS

These high quality stainless steel sample loops have burr-free, square-cut ends to ensure a flush connection to valve ports. The size designations of loops are nominal. The actual volumes can differ from the theoretical designations because of the $\pm 0.025\text{mm}$ (0.001") tolerance of the metal tubing bore. Accuracy of large metal loops (1.0mm, 0.040" bore) is about $\pm 5\%$, intermediate loops (0.5mm, 0.020" bore) $\pm 10\%$, and small loops (0.2mm, 0.007" bore) $\pm 30\%$.

Since both standards and unknowns are usually analyzed using the same sample loop, knowledge of the actual, accurate volume is rarely needed. If the sample loop volume must be known, it is best to calibrate the loop in place on the valve so the flow passages in the valve are also taken into account. An alternative to calibration is to use a dual mode injector and partial-filling method of loading.

Model 7725 Injector loops are not interchangeable with loops for the Model 7125. The port angle for the 7725 is 30° whereas the port angle for the 7125 is 20° requiring the loops to have a different shape.

Model 8125 Micro-Scale Sample Injector requires special loops in the 5.0 μL to 50 μL range. The 8125 sample loops are made with 0.5mm (0.020") OD tubing.

Stainless steel sample loops are supplied with unswaged fittings. The two ends of the loop must be completely bottomed in the injector ports before the ferrule is swaged onto the loop. Swaging each end separately and then replacing the ends in their respective ports of the same valve ensures that the loop ends are bottomed into the ports. A fitting made up in one port may leave an undesirable cavity in another port. As all ports vary in all valves, careful attention to loop installation is important. Please see the "How to Properly Install Sample Loops".



1876
10 mL sample loop
for use with Rheodyne valves



RHEODYNE STAINLESS STEEL LOOPS FOR 7125, 7010 INJECTORS (DO NOT USE FOR 7725)

	Volume	Tubing
7020	5 μL Sample Loop	0.18 mm (0.007") ID x 1/16" OD
7021	10 μL Sample Loop	0.30 mm (0.012") ID x 1/16" OD
7022	20 μL Sample Loop	0.51 mm (0.020") ID x 1/16" OD
7023	50 μL Sample Loop	0.51 mm (0.020") ID x 1/16" OD
7024	100 μL Sample Loop	0.51 mm (0.020") ID x 1/16" OD
7025	200 μL Sample Loop	0.76 mm (0.030") ID x 1/16" OD
7026	500 μL Sample Loop	0.76 mm (0.030") ID x 1/16" OD
7027	1.0 mL Sample Loop	0.76 mm (0.030") ID x 1/16" OD
7028	2.0 mL Sample Loop	1.0 mm (0.040") ID x 1/16" OD
7029	5.0 mL Sample Loop	1.0 mm (0.040") ID x 1/16" OD
1876	10 mL Sample Loop	2.0 mm (0.080") ID x 1/8" OD
1877	20 mL Sample Loop	2.0 mm (0.080") ID x 1/8" OD

RHEODYNE STAINLESS STEEL LOOPS FOR 3725-038, 3725I-038 INJECTORS

	Volume	Tubing
3065-018	2.0 mL Sample Loop	2.0 mm (0.080") ID x 1/8" OD
3065-019	5.0 mL Sample Loop	2.0 mm (0.080") ID x 1/8" OD
3065-023	10 mL Sample Loop	2.0 mm (0.080") ID x 1/8" OD
3065-025	20 mL Sample Loop	2.0 mm (0.080") ID x 1/8" OD

RHEODYNE STAINLESS STEEL LOOPS FOR 7725, 7725i, PR/EV700-100, PR/EV703-100, MX MODULE INJECTORS (DO NOT USE FOR 7125)

	Volume	Tubing
7755-020	5 μL Sample Loop	0.18 mm (0.007") ID x 1/16" OD
7755-021	10 μL Sample Loop	0.30 mm (0.012") ID x 1/16" OD
7755-022	20 μL Sample Loop	0.30 mm (0.012") ID x 1/16" OD
7755-023	50 μL Sample Loop	0.51 mm (0.020") ID x 1/16" OD
7755-024	100 μL Sample Loop	0.51 mm (0.020") ID x 1/16" OD
7755-025	200 μL Sample Loop	0.76 mm (0.030") ID x 1/16" OD
7755-026	500 μL Sample Loop	0.76 mm (0.030") ID x 1/16" OD
7755-027	1.0 mL Sample Loop	0.76 mm (0.030") ID x 1/16" OD
7755-028	2.0 mL Sample Loop	1.0 mm (0.040") ID x 1/16" OD
7755-029	5.0 mL Sample Loop	1.0 mm (0.040") ID x 1/16" OD
1876	10 mL Sample Loop	2.0 mm (0.080") ID x 1/8" OD
1877	20 mL Sample Loop	2.0 mm (0.080") ID x 1/8" OD

RHEODYNE STAINLESS STEEL LOOPS FOR 8125 INJECTOR (USE 7755-024 TO 7755-029 FOR VOLUMES > 50 μL)

	Volume	Tubing
8020	5 μL Sample Loop	0.20 mm (0.008") ID x 1/16" OD
8021	10 μL Sample Loop	0.20 mm (0.008") ID x 1/16" OD
8022	20 μL Sample Loop	0.25 mm (0.010") ID x 0.020" OD
8023	50 μL Sample Loop	0.30 mm (0.012") ID x 1/16" OD

REPLACEMENT RHEOFLEX® AND SUPER FLANGELESS™ FITTINGS

		Qty.
6000-082	Nut/Ferrule Set, SST, 5/16-24, for 1/8" OD loops*	ea.
6000-083	Ferrules, SST, for 1/8" OD loops*	5-pk
6000-210	Ferrules, SST, for 1/16" OD loops	10-pk
6000-211	Nut/Ferrule Sets, SST, 10-32, for 1/16" OD loops	10-pk
P-331	Super Flangeless Nut, PEEK™, for 1876, 1877 loops	ea.
P-350x	Super Flangeless Ferrules, PEEK/SST, for 1/8" OD 1876, 1877 loops	10-pk
P-654	Adapter, PEEK, for 1/8" OD 1876 and 1877 loops	ea.

*Except 1/8" OD 1876 and 1877 loops.

RHEODYNE® PEEK™ SAMPLE LOOPS

Flexible PEEK sample loops are alternatives to stainless steel loops. PEEK loop ends are provided with clean, straight cuts for easy valve installation. PEEK polymer is inert to almost all organic solvents and is biocompatible, giving PEEK loops added versatility. Rheodyne uses natural PEEK for these sample loops. Like metal loops, the size designations of PEEK loops are nominal. The actual volumes can differ from the theoretical designations because of the $\pm 0.05\text{mm}$ (0.002") tolerance of the tubing bore. Accuracy of large PEEK loops (0.8mm, 0.030" bore) is about $\pm 14\%$, intermediate loops (0.5mm, 0.020") $\pm 21\%$, and small loops (0.2mm, 0.007") $\pm 65\%$.

PEEK loops are also supplied with unwaged RheFlex® fittings but do not require the same swaging precaution. The fittings can reposition along the loop tubing when the fitting reinserts in the ports for correct loop installation.

Please Note: several of our PEEK Sample Loops can also be used with Valco/VICI® sample injectors. Please refer to the product listing on this page to aid selection.

PEEK Physical Strength Characteristics

Although PEEK material is compatible with virtually all solvents, there are many factors that affect burst pressure of PEEK tubing. Factors such as increases in inner diameter, temperature, exposure time, and concentration of organic solvents affect the degradation of PEEK. Other solvents such as THF, methylene chloride, and DMSO cause PEEK tubing to swell while concentrated nitric acid and sulfuric acid weaken the tubing.

VALCO/VICI -COMPATIBLE STAINLESS STEEL SAMPLE LOOPS

Valco-Compatible Stainless Steel Loops are manufactured by Upchurch Scientific®. These loops are designed for use with Valco valve models CW6 and EC6W. Each loop has burr-free, polished ends and is passivated and flushed with reagent-grade methanol to ensure cleanliness.

Loops made with 1/16" OD tubing come complete with F-287 SealTight™ Fittings, which are pressure rated to 9,000 psi (620 bar)¹. The fittings and adapters that accompany the 1/8" OD sample loops are rated to 1,000 psi (69 bar)¹. Volumes are stated at $\pm 10\%$, with exact calibration services available. Each sample loop we calibrate is documented and supplied with a calibration certificate.

¹ These pressure ratings reflect the performance of the fittings, not the port or valve in which they are used.

Upchurch Scientific® manufactures many products designed as direct replacements for OEM components. Reference to these manufacturers does not imply their endorsement of our products.



PEEK LOOPS FOR 3725, 3725i INJECTORS

	Volume	Tubing
3055-018	2.0mL Sample Loop	1.6mm (0.062") ID x 1/8" OD
3055-019	5.0mL Sample Loop	1.6mm (0.062") ID x 1/8" OD
3055-023	10mL Sample Loop	2.0mm (0.080") ID x 1/8" OD
3055-025	20mL Sample Loop	2.0mm (0.080") ID x 1/8" OD

PEEK LOOPS FOR 9725, 9010, PR/EV750-100, PR/EV753-100 INJECTORS

	Volume	Bore/Tubing	Valco No.
7123-227	1µL Sample Loop (Model PR/EV750-100 only)	internal groove	NA
7755-015	2µL Sample Loop (9725 only)	internal groove	NA
9055-020	5.0µL Sample Loop	0.18mm (0.007") ID x 1/16" OD	SL5CWPK
9055-021	10µL Sample Loop	0.25mm (0.010") ID x 1/16" OD	SL10WPK
9055-022	20µL Sample Loop	0.25mm (0.010") ID x 1/16" OD	SL20WPK
9055-023	50µL Sample Loop	0.51mm (0.020") ID x 1/16" OD	SL50WPK
9055-024	100µL Sample Loop	0.51mm (0.020") ID x 1/16" OD	SL100WPK
9055-025	200µL Sample Loop	0.51mm (0.020") ID x 1/16" OD	NA
9055-026	500µL Sample Loop	0.76mm (0.030") ID x 1/16" OD	SL500WPK
9055-027	1.0mL Sample Loop	0.76mm (0.030") ID x 1/16" OD	SL1KCWPK
9055-028	2.0mL Sample Loop	0.76mm (0.030") ID x 1/16" OD	SL2KCWPK
9055-029	5.0mL Sample Loop	0.76mm (0.030") ID x 1/16" OD	NA
9055-033	10mL Sample Loop	0.76mm (0.030") ID x 1/16" OD	NA

PEEK LOOPS FOR 7725, 7725i, PR/EV700-100

	Volume	Bore
7123-227	1µL Sample Loop (Model PR/EV700-100 only)	internal groove
7755-015	2µL Sample Loop (Models 7725 and 7725i only)	internal groove

REPLACEMENT RHEFLEX® FITTINGS FOR PEEK LOOPS

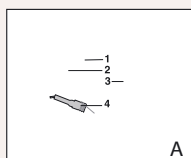
		Qty.
6000-251	Ferrules, Natural PEEK, for 1/16" OD loops	10-pk
6000-254	Nut/Ferrule Sets, Natural PEEK, 10-32, for 1/16" OD loops	10-pk
6000-078	Nut/Ferrule Set, Natural PEEK, 5/16-24, for 1/8" OD loops	ea.
6000-079	Ferrules, Natural PEEK, for 1/8" OD loops	5-pk

VALCO/VICI-COMPATIBLE STAINLESS STEEL LOOPS FOR C6W, EC6W INJECTORS

	Volume	Tubing	Valco No.
1750	5µL Sample Loop	0.18mm (0.007") ID x 1/16" OD	SL5CW
1751	10µL Sample Loop	0.25mm (0.010") ID x 1/16" OD	SL10CW
1752	15µL Sample Loop	0.25mm (0.010") ID x 1/16" OD	SL15CW
1755	20µL Sample Loop	0.51mm (0.010") ID x 1/16" OD	SL20CW
1758	25µL Sample Loop	0.51mm (0.010") ID x 1/16" OD	SL25CW
1759	50µL Sample Loop	0.51mm (0.020") ID x 1/16" OD	SL50CW
1762	100µL Sample Loop	0.51mm (0.020") ID x 1/16" OD	SL100CW
1778	200µL Sample Loop	0.76mm (0.030") ID x 1/16" OD	NA
1763	250µL Sample Loop	0.76mm (0.030") ID x 1/16" OD	SL250CW
1764	500µL Sample Loop	0.76mm (0.030") ID x 1/16" OD	SL500CW
1770	1mL Sample Loop	0.76mm (0.030") ID x 1/16" OD	SL1KCW
1772	2mL Sample Loop	1.02mm (0.040") ID x 1/16" OD	SL2KCW
1775	5mL Sample Loop	2.03mm (0.080") ID x 1/8" OD	SL5KCW
1776	10mL Sample Loop	2.03mm (0.080") ID x 1/8" OD	SL10KCW

Application Note

How to Properly install sample loops **STAINLESS STEEL**
 Stainless steel sample loops are supplied with fittings that are not swaged onto the tube. It is important that the loop be completely bottomed in the injector port before the ferrule is swaged onto the tube. The depth of the tubing holes may vary slightly from port to port and from valve to valve. A fitting made up in one port may leave a small cavity in another port. The cavity causes high dispersion and peak distortion such as fronting, tailing, or broadening. It is good practice to label loop ends so they will be replaced in the same, respective ports that were used in swaging the ferrules. Hint: swaging ferrules separately on each side, into each respective valve port makes loop installation easier. To install the sample loop:



a) Take one end of the loop and place the nut (1) and ferrule (2) onto the tubing (3) with the threaded portion of the nut and tapered portion of the ferrule toward the end. See Figure A.

b) Insert the tubing into port (4). Confirm that the tubing is bottomed in the valve port as shown in Figure A.



c) While firmly pressing down on the tubing, hand-tighten the nut as tight as possible.

d) With the Rheodyne Wrench, designed especially for fittings, tighten one 90° turn past finger tight. Remove the loop to confirm the ferrule is swaged onto the tube.



e) Repeat steps a-d with the other end of the loop while the swaged end remains outside the valve port. See Figure B.

f) Reinstall each end of the loop to their respective ports. See Figure C.

Figure 1 Cut-away view of stainless steel sample loop installation.

RHEFLEX® PEEK™ FITTINGS AND PEEK Tubing
 PEEK loop installation requires steps a-c in the stainless steel section above. Finger tightening of PEEK fittings is adequate to make a leak-free connection. The slotted backside of the ferrule (1) is squeezed down onto the tube (2) by the mating conical surface in the nut (3). See Figure 2. The nut and ferrule can both be reused many times. Unlike ordinary fittings, the unique RheFlex PEEK design, specifically the angles and surface contacts between the ferrule and nut, prevents the nut from gripping the ferrule and twisting both the ferrule and the tube during tightening. Otherwise, such twisting stresses the PEEK tubing and lowers the pressure rating of the tubing. The ferrule can slide and reposition itself along the tube when the fitting is reinserted into a port. It is important that the PEEK tubing is completely bottomed in the injector port before the fittings are tightened to avoid leaving an undesired cavity. Both stainless steel and PEEK.

Figure 2 Cut-away view of PEEK sample loop installation.



Application Note

sample loop loading: Partial-filling vs. Complete-filling

PARTIAL-FILLING use the partial-filling method if you need to conserve sample, or if you want to vary sample volume frequently. In partial-filling, the syringe sets the volume injected onto the column. There is no sample waste, and the volume injected onto the column is equal to that dispensed from the syringe. Reproducibility is 1.0% relative standard deviation (RSD). The volume of the sample loaded is limited to half the sample loop volume. For example, the most you can load into a 200µL sample loop is 100µL. See Figure 1. This limitation is because fluidic movement in tubes affects reproducibility. See the "Fluidic Movement in Tubes" Application Note.

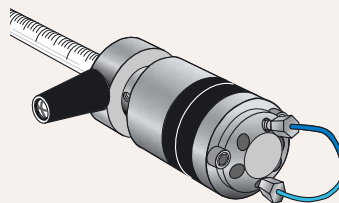


Figure 1 The sample loop can fill up to half the loaded volume in partial-filling method.

COMPLETE-FILLING

use the complete-filling method if you have plenty of sample, if you do not vary sample volume, or if you need high reproducibility. In complete-filling, the loop sets the volume loaded onto the column. Use excess sample (two to five loop volumes) to replace all the mobile phase in the loop. See Figure 2. Change the loop to vary the sample volume. Reproducibility is typically 0.1% RSD for loop sizes ≥ 5µL. Accuracy is limited as loop volumes are nominal. Q: "Which method should use and which Rheodyne sample injectors use this method?"

a: There are two types of injectors available: dual mode and single mode. Dual mode injectors allow both partial- and complete-filling whereas single mode injectors allow only complete-filling. If you are collecting experimental data, sample is scarce, and/or you want to use different sample volumes, a dual mode injector with a large volume sample loop is appropriate. Only dual mode injectors allow the partial-filling method for easily varying your volumes (up to half your sample loop volume) by setting the syringe volume. Once you begin routine analysis, and/or you have an abundance of sample, either a dual mode or single mode injector is appropriate. Both types of injectors allow the complete-filling method in which you overflow the sample loop. Complete-filling maximizes the reproducibility of your results.

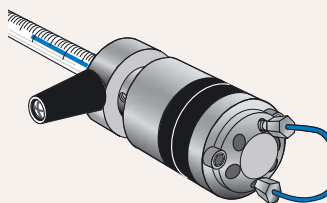


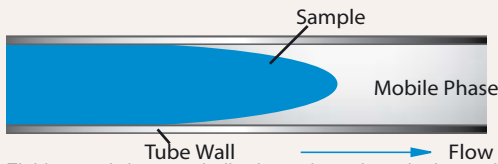
Figure 2 The sample loop is filled in excess in complete-filling method.

Application Note

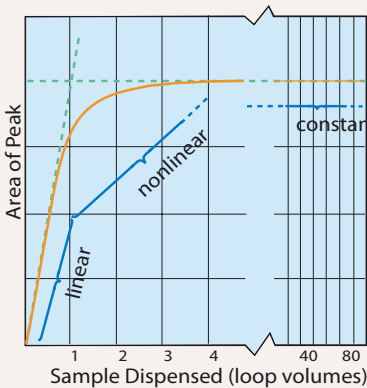
Fluidic Movement In Tubes

Q: "Why can I load only up to half of the volume of the loop in partial-filling method?"

A: Sample occupies 2 μ L of loop for every 1 μ L loaded from the syringe. For example, 10 μ L of sample spreads out over the entire length of a 20 μ L loop. Any additional sample loaded will overflow the end of the loop and exit out to waste. Reproducibility is poor because the volume of sample in the loop is different from the known volume originally loaded by your syringe.



Fluid spreads in a parabolic shape through a tube instead of moving in one plug because the velocity is different at the center of the tube than at the walls. The velocity at the center of the tube is twice the average velocity, and near the wall the velocity is almost zero, creating a parabolic shape.



This fluidic movement is called laminar flow. See Figure 1. In dual mode injectors the sample from the syringe needle loads directly into the sample loop. The sample volume is known since there is no sample waste. The laminar flow

phenomenon accounts for the shape of the plot as shown in Figure 2. Note that the plot has three regions:

a) Partial-Filling Region. When the volume dispensed is less than half the loop volume, the curve is linear. Sample has not reached the end of the loop. Within this region, performance depends on the syringe and operator.

b) Nonlinear Region. When the volume dispensed is between half the loop volume and about two loop volumes, the curve is nonlinear. Sample is lost from the loop, so reproducibility is poor. If you dispense a volume equal to the loop size, you are in this region of poor performance.

c) Complete-Filling Region. When the volume of sample dispensed is several loop volumes, the loop contains only pure sample, undiluted by residual mobile phase. Within this region, reproducibility is highest.

In the single mode injectors the sample must pass through a connecting passage before it reaches the sample loop. Since some of the sample dispensed from the syringe remains in the connecting passageway, an unknown amount enters the sample loop. Therefore, single mode injectors achieve high reproducibility only by using the complete-filling method.

Application Note

How to find and fix Common sample injector leaks Leaks cause valuable sample loss. Nobody wants that. The key to the valve holding pressure is the integrity of the sealing surfaces. If there is a scratch on the sealing surface, or the needle seal in the rotor seal is damaged, a leak may appear. It is also important to realize what appears to be a leak can instead be a result of siphoning. The following are the three most common situations in which fluid leaks occur.

1. If fluid leaks out of the needle port only while loading the loop (i.e., while pushing down on the plunger of the syringe), the problem is most likely that the needle seal or the needle port fitting in the loop filler port is not gripping the syringe needle tightly enough. Tighten the needle seal grip by pushing down on the needle port (See Figure 1). The tightening reduces the hole diameter of the needle seal and port fitting.

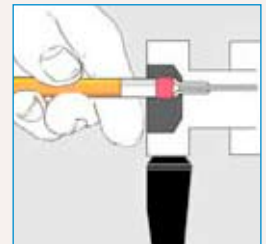


Figure 1 To reform the needle seal, push the eraser end of a pencil against the needle port.

2. If fluid leaks continuously from the needle port or vent lines and/or from the stator-to-stator ring interface, replace the rotor seal and/or stator face assembly. Scratches on the rotor seal or cracks in the stator face assembly allow mobile phase to escape and cause cross port leakage. Genuine Rheodyne replacement rotor seals are listed.

3. If fluid leaks from the needle port and/or vent lines but eventually stops, the cause is most likely siphoning and not a leak. Siphoning occurs if the vent lines are lower or higher than the needle port. Adjust the vent line(s) so that the outlet is at the same horizontal level as the needle port to prevent siphoning. (See Figure 2).

For other leakage or injection troubleshooting, refer to the Rheodyne Troubleshooting Guide for HPLC Injection Problems. You may download the Guide from the Rheodyne web site: www.rheodyne.com under Tech. Support. You can also request a copy by using the reply card at the back of this publication.

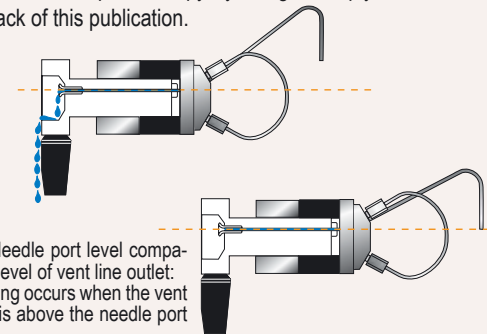


Figure 2 Needle port level compared to the level of vent line outlet: (A) siphoning occurs when the vent line outlet is above the needle port level; (B) siphoning does not occur if the vent line outlet is the same horizontal level as the needle port.

Application Note

Using Proper Syringe Needles

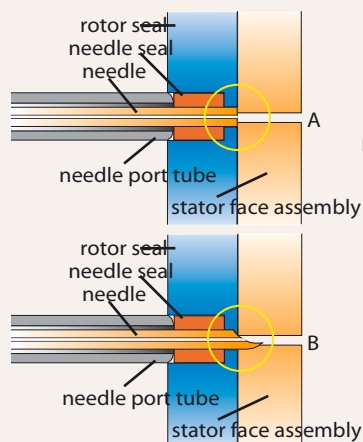


Figure 1
A square cut needle (A) stops against the stator face assembly. The tip of a pointed needle (B) slips into the stator face and the tip breaks off as the valve rotates.

With front-loading injectors it is important to use the correct needle when loading the sample loop. An incorrect needle will damage the valve and can cause poor reproducibility. When the needle is too short the tip will not reach the needle seal. When the needle is too small in diameter the seal will not grip tightly enough. Needles with a beveled tip can damage the rotor seal and stator face assembly (see Figure 1). The needle should be #22 gauge, and 90° point style (square cut end). Model 3725 requires a #16 gauge needle. never use a beveled, pointed, or tapered needle. Needle specifications are not critical when using a Loop Filler Port to load the sample loop. However, it is important to tighten the needle port fitting around the needle if using a syringe needle with a slightly smaller diameter than 0.7mm (0.028”).

If the loading method used is complete-filling, a syringe without a needle can be used. A syringe fitted with a Needle Port Cleaner can be used with a front-loading valve (Figure 2A) or with a Loop Filler Port (Figure 2B). Needle port accessories are listed on this page.

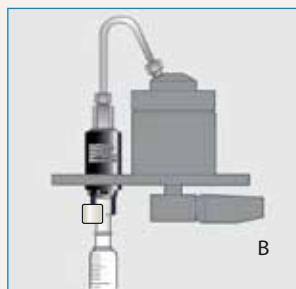
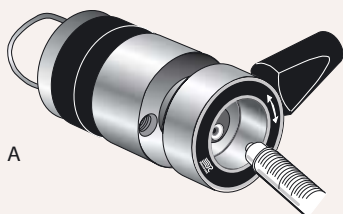


Figure 2 (A) Syringe fitted with Needle Port Cleaner (Part # 7125-054) loading a front-loading valve (Model 7725); (B) loading a Loop Filler Port (Part # 7012).

RHEODYNE WRENCH

The smartly designed Rheodyne Wrench is a double-ended slotted socket wrench that fits over 1/16” and 1/8” OD tubing. It easily loosens and tightens 1/4” and 5/16” stainless steel or PEEK™ fittings. The “Z” shape of the Rheodyne Wrench provides ideal leverage for changing sample loops and fittings, and keeps one end from restricting the use of the other.



NEEDLE PORT ACCESSORIES

Rheodyne’s adaptable Loop Filler Ports (Part #7012 and 9012) are used to load sample from syringe needles or luer tips. The Needle Port (Part #9013) conserves sample by minimizing the volume between the needle and the valve.



RHEODYNE WRENCH

6810 Rheodyne Wrench

NEEDLE PORT ACCESSORIES

7012 Stainless Steel Loop Filler Port

9012 PEEK™ Loop Filler Port

9013 PEEK Needle Port

7125-054 Needle Port Cleaner

9125-076 Suction Needle Adapter (for Model 9725)

MOUNTING BRACKETS

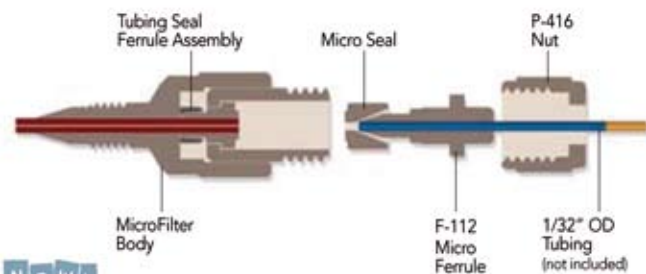
Rheodyne® mounting brackets and panels of different shapes and sizes organize and provide a sturdy support for Rheodyne valves. The Ring Stand Mounting Bracket now allows the valves to mount onto common laboratory equipment.



VALVE ADAPTER FOR 10-32 PORTS

For 1/32" OD Stainless Steel Tubing
Low Swept Volume
Extends the Life of the Rotor

As a result of customer requests, Upchurch Scientific® has created a Valve Adapter for 10-32 ports designed specifically for use with 1/32" OD stainless steel tubing. This product extends the life of and prevents damage to the rotor, guarding against such potential hazards as tubing that may pass through the stator and scratch the rotor. The Valve Adapter protects the rotor without adding significant volume. In fact, this adapter has a very low swept volume, at 300nL. Additionally, the all-PEEK™ fluid pathway ensures biocompatibility.



M-400
Valve Adapter
(Includes indicated products)

MICRO INJECTION PORT

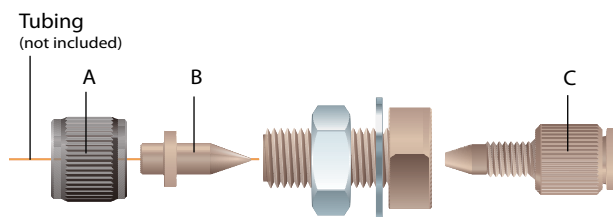
ADAPTERS

- * For 1/32" or 360µm OD Tubing
- * Mount on Actuator, Bracket or Bulkhead

To introduce sample, connect 1/32" or 360µm OD capillary tubing to an Upchurch Scientific® Injection Port Adapter Assembly. These adapters accept standard 22 gauge Hamilton-style injection syringe needles. No additional swept volume is added to the fluid pathway by these adapters, as the needle butts directly against the connecting tubing during injections. The adapters can be bulkhead mounted or mounted with the V-433 or V-447 Kits. Refer to the chart below to select the appropriate adapter assembly.



To introduce a sample directly into a 10-32 port, purchase a M-432-03 separately.



M-432
Micro Injection Port Adapter Assembly

Micro Injection Port Adapters:

	Replacement Parts*		
	A	B	C
For 1/32" OD Tubing			
M-433 and V-433	P-416	F-112	M-432-03
For 360µm OD Tubing			
M-432 and V-447	P-416 BLK	F-152	M-432-03

*See diagram above.

MOUNTING BRACKET ACCESSORIES

7160	Mounting Panel
7160-010	Valve Angle Bracket
7160-029	Ring Stand Mounting Bracket
5060-007	MX Module Ring Stand Mounting Bracket

MICRO INJECTION PORT ADAPTER FOR 1/32" OD TUBING

F-112	Replacement MicroFerrule for M-433, Natural PEEK™
M-433	Micro Injection Port Adapter Assembly for 1/32" OD tubing
M-432-03	Replacement Tubing/Fitting Assembly for M-432 & M-433
M-400	Valve Adapter for 10-32 Ports
P-416	Replacement Female Nut for M-433, Natural PEEK
V-433	Micro Injection Port Adapter Assembly Actuator Mounting Kit Includes (1) M-433 with mini-actuator bracket and (2) mounting screws

MICRO INJECTION PORT ADAPTER FOR 360µm OD TUBING

F-152	Replacement Mini MicroFerrule for M-432, Natural PEEK
M-432	Micro Injection Port Adapter Assembly
M-432-03	Replacement Tubing/Fitting Assembly for M-432 & M-433
P-416BLK	Replacement Female Nut for M-432, Black PEEK
V-447	Micro Injection Port Adapter Assembly Actuator Mounting Kit Includes (1) M-432 with mini-actuator bracket and (2) mounting screws