Analytical
SALES & SERVICES, Inc.

Advantage™
Flow Splitters

Operation & Maintenance Instructions

Maintenance and Troubleshooting Guide

GENERAL CONSIDERATIONS

Cleaning:

All wetted surfaces in the fixed series of flow splitters are either PEEK™ or stainless steel. Both materials can be sonicated in a variety of solvents and back flushed without problem. Only the low flow resistor cartridge in the adjustable series of flow splitters can be sonicated and flushed.

Routine Maintenance:

Replace the inlet filter every six months or if the pressure drops across the splitter increases to more than 200psi. Never store the splitter with pure water as biological growth may cause clogging. Please refer to the product brochure for ordering information.

FIXED AND MULTIPORT FLOW SPLITTERS:

Leaks:

Make sure all threaded connections are secure and tight. Inlet filter must be seated properly in the inlet nut to ensure leak free operation. If leak persists, contact technical support.

High Pressure or Blockage:

Isolate the blockage to the low or high flow resistor cartridge by plugging one of the resistor ports while checking the flow at the other port. If both high and low flow channels appear plugged, check the splitter body by removing both resistors and inlet filter, then sonicate and flush. If the blockage can be localized to a specific resistor cartridge, sonicate the cartridge and reverse the flow to dislodge any contaminants. If the restrictor cartridge function cannot be restored, you will need to purchase a new resistor(s).

ADJUSTABLE FLOW SPLITTERS

High Pressure or Blockage:

Isolate the blockage to the low flow (fixed resistor cartridge) or high flow (adjustable resistor) by plugging one of the resistor ports while checking the flow at the other port. If the blockage is isolated to the low flow resistor cartridge follow the recommendations above for Fixed Splitters. If the blockage is localized to the adjustable portion of the splitter, remove the low flow resistor housing and cartridge and flush the splitter with water (1mL/min) while adjusting the valve from the highest split ration (max clockwise) to the lowest split (max counter clockwise) a couple of times. If this procedure does not solve the problem, contact technical support for factory repair.

Leaks:

Make sure all the threaded connections are secure and tight. Inlet filter must be seated properly in the inlet nut to ensure leak free operation. If the leak appears to be coming from the main body of the splitter contact technical support.

CONNECTIONS:

All inlet and outlet ports on Advantage™ Flow Splitters are female 10/32 thread type. Connect all ports with Parker Hannifin or equivalent bushings and ferrules for 1/16” OD tubing. Connecting the splitter valves with tubing smaller than 1/16”OD may require special fittings.

INLET PORT / INLET FRIT:

The inlet port is machined into the inlet nut for all splitter valves. The inlet nut houses a replaceable inlet frit. The frit volume varies with the type of splitter valve. Standard frit dimensions are provided in the product bulletin shipped with each valve. The inlet frit can be accessed and changed by removing the inlet nut.

HIGH FLOW PORT:

The tubing connected to this port should be 0.01” ID or larger. Smaller ID tubing can be used, however, may result in sufficient back pressure to affect the split ratio. If this flow is routed to a chromatography detector or fraction collector, choice of tubing ID may affect peak dispersion.

LOW FLOW PORT:

The tubing ID connected to this port should be small enough to minimize peak dispersion and short enough to minimize additional back pressure at the splitter. Please refer to Table 1 as a guide to estimate pressure drop across various connecting tubing.

MULTIPORT SPLITTERS

Multiport splitters are generally configured for custom applications and may contain both high and low flow rate ports. The principals outlined above also apply to port connections.

FLUID RESISTOR CARTRIDGE REPLACEMENT

A resistor cartridge is located in the low flow outlet housing on the Adjustable Flow Splitters and in both the low and high flow outlet housings on the Model 63, and all outlet housing the Model 53. Unscrew the housing to replace the resistor cartridges. The cartridge flow is bi-directional.

TABLE 1

Pressure Drop	Tubing ID	Tubing ID	Tubing ID
Flow Rate	0.0025	0.005	0.010
0.1mL/min	15.4 PSI	1.0 PSI	0.06 PSI
1.0mL/min	154 PSI	9.6 PSI	0.6 PSI
10.0mL/min	1540 PSI	96 PSI	6.0 PSI

IMPORTANT EQUATIONS

$R = Q1/Q2$

$R = (Q-Q2)/Q2$

R = Split Ratio
Q1 = High Flow Rate
Q2 = Low Flow Rate
Q = Input Flow

Model 62 - Adjustable Flow Splitters / Model 53 & 63 - Fixed Flow Splitters

Setting the Split Ratio on the Adjustable Flow Splitter
Use Metering Rod Scale to Determine Split Ratio

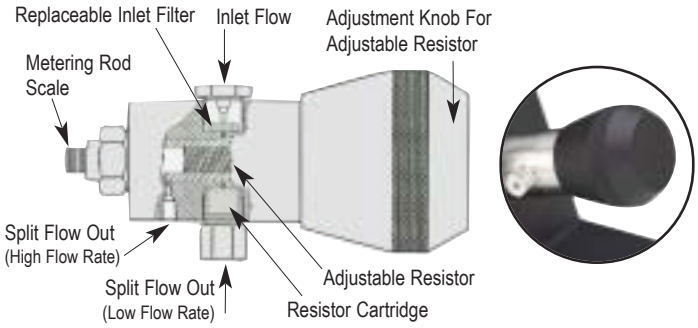
The Adjustable Flow Splitter is shipped with a chart of split ratios as a function of metering rod setting. These split ratios can be used to calculate the flow rate at the low flow channel.

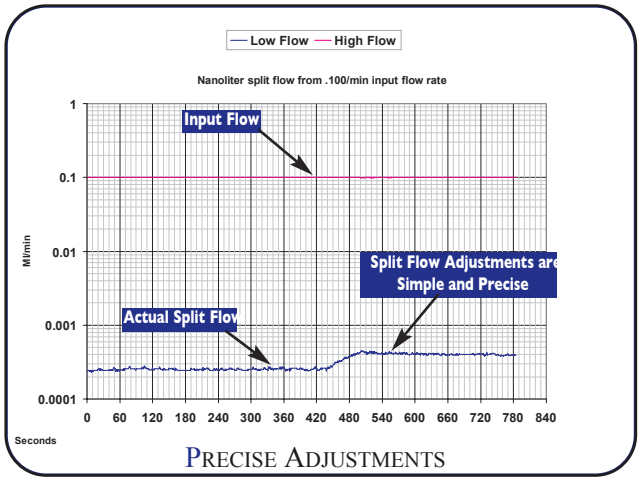
	Q2 : Low Flow Channel
Q2=Qi x R	**Qi : Inlet Flow**
	R : Split Ratio (provided)

Adjust Back Pressure

Use pressure drop across the flow splitter and Ohm's Law

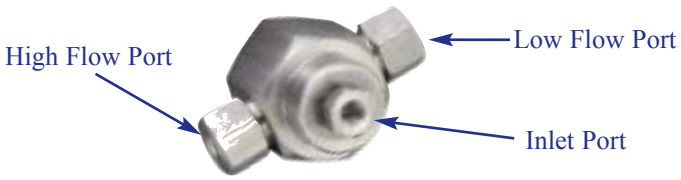
	Q2 : Low Flow Channel
P=L x Q2 x V	**P : Pressure drop across splitter, PSI**
	L : Fluid resistor value PSI/mL/min
	V : Viscosity in centipoise



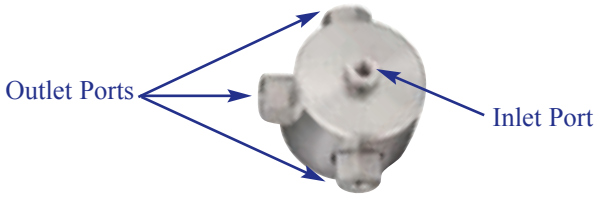


PRECISE ADJUSTMENTS

Model 63 Binary Fixed Splitter with its interchangeable fluid resistors, eliminates the need to cut capillary tubing to change the split ratio. Split ratios can be changed by replacing the resistor set.

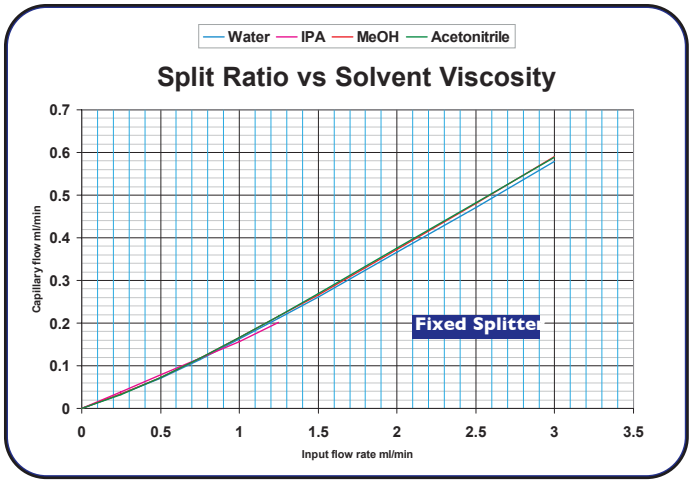


Model 53 Multiport Fixed Splitter is ideal for applications that use multiple detectors and/or a fraction collector.



The Advantage **Fixed Flow Splitters** are shipped with resistors installed that deliver the nominal stated split ratio. The split ratios have a tolerance range of ±10%. The exact split ratio is measured and is stated on the certificate shipped with the splitter. The input flow rate can be adjusted to compensate for the tolerance in split ratios. For instance, a 10% increase in input flow rate will result in a 10% increase in flow at both the capillary and waste stream channels. Flow rate and viscosity changes will change the back pressure generated by the splitter, but will not affect the actual split ratio.

These Fixed Flow Splitters can be used for LC/MS, Flow Fractionation, Pre or Post Column Flow Splitting and Capillary Chromatography.



Characteristics of Fixed & Adjustable Flow Splitters

COMMON CHARACTERISTICS OF BOTH FIXED AND ADJUSTABLE FLOW SPLITTERS

Fluid Resistor:

- Machined Capillary: Creates Pressure Drop
- Low dead volume: Nanoliters
- Calibrated at 1.0mL/min with H^2O
  Resistance value (K) rated in psi/mL/min
- Resistance is indirectly proportional to flow:
  High resistance / Low Flow

Parallel Flow Path:

- Fixed Flow Splitters contain two fixed fluid resistors in parallel
- Adjustable Flow Splitter has one fixed resistor and one adjustable resistor (metering valve)

Inlet Filter:

- Both splitters contain a replaceable 2µm inlet filter
- The filter size can be changed to accommodate various applications and inlet flow rates

Prep Splitters:

- Prep and analytical splitters differs in manifold porting, dead volume and inlet frit size

Post Column:

- Split ratios will not be affected by changes in solvent viscosity or gradients.

PreColumn:

- Column pressure will change the split ratio and must be compensated for (column R value)
- Nanocolumn (75µm ID) applications at 200nL/min flow require an additional piece for FS capillary tubing (10µm) to connect the splitter to injector and insulate the splitter from split ratio changes. Fluid resistor R values are not high enough.

FIXED FLOW SPLITTER

- Easy to Use "Plug and Play" Device - Predefined split ratioeliminates tedious adjustments to capillary tubing. Split ratio changes are accomplished by changing the resistor set.
- Multiport Flow Splitters for applications which require 3 to 8 channels.
- Split ratio is determined by the ratio of fluid resistors installed in manifold. The pressure drop across the splitter is determined by the relative values of the resistors.
  EXAMPLE: 10:1 split can use 0.2K & 2.0K or 2.0K & 20K.The only difference is the pressure drop across the splitter. Pressure drop spec is 300-500psi at 1.0mL/min H2O for post column applications.

OHM'S LAW & THE ADJUSTABLE FLOW SPLITTER

Adjustable Flow Splitter:

Enables the user to adjust splitter to the desired outlet low (split ratio)

Q=P/R V	Q	: Low Flow Channel
	P	: Pressure drop across splitter, PSI
	R	: Fluid resistor value PSI/mL/min
	V	: Viscosity in centipoise

Example:

Split 30:1, Low flow 50µL, Solvent 50/50 ACN H2O,
R = 10,000 psi/mL/min (10K) Postcolumn Split

.050 = P/10K 0.70 P = 350 psi

Adjust valve to 350psi, measure flow. Adjust if necessary.
Note: For precolumn applications you must know the R value (psi/mL/min) for the column and add this to your calculated P.

ADJUSTABLE FLOW SPLITTER

- Adjustable Flow Splitter enables direct real time control over split ratio optimization.
- Split ratio range can be changed by replacing the resistor cartridge.

- **Three Ways to Set the Split Ratio on the Adjustable Flow Splitter**

1. Adjust back pressure

Use pressure drop across the flow splitter and Ohm's Law
P = R x Q x V
The metering valve acts like a back pressure restrictor with the resistor port plugged. The specific range is 0-5000psi with H2O at 0.5mL/min. At 200µL/min ACN, the range will be 0-760psi.

2. Use the metering rod scale to determine split ratio.

The adjustable flow splitter will ship with a chart of split ratio as a function of metering rod setting. These split ratios can be used to calculate the flow rate at the low flow channel.

Q = Qi x SR	Q	: Low Flow Channel
	Qi	: Inlet Flow
	SR	: Split Ratio

3. Measure the Capillary Output

Use a 0.50 or .100mL syringe barrel attached to the splitter low flow channel and make a direct measurement of flow. For precolumn work, measure the flow out of the column.

Once Set, the split ratio will remain constant regardless of changes to input flow rate or solvent viscosity.

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