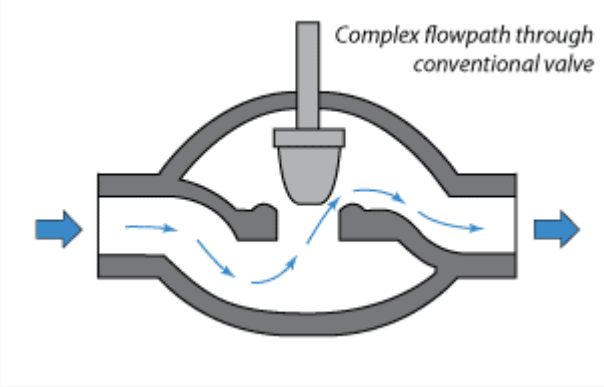
Methods in Common Fluidic Design

The real value to our customers of Bio-Chem's collective experience in fluidic system design is the knowledge we are able to pass on to help them solve common issues. Why not share some of those secrets with you here?

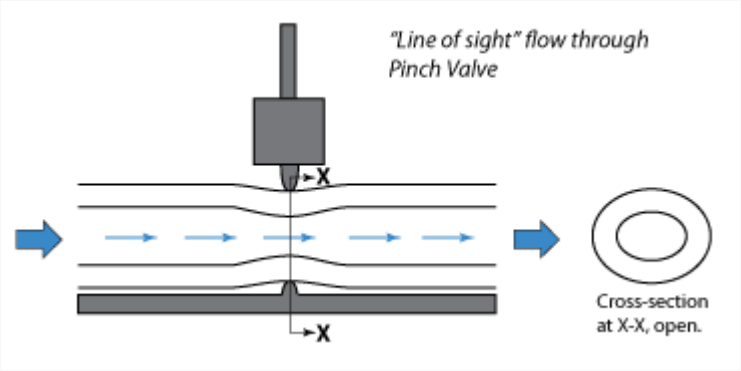
Two Common Pinch Valve Applications

Prevention of shear in sensitive materials

Pinch Valves are typically used in "on-off" applications; applications that don't require flow control or modulation – you just want to start and stop the flow.



Conventional on-off valves often require the fluid to be regulated to move through a convoluted / complex flow path, even when fully open. This can be an issue for biological materials (proteins, DNA, etc.) which can be easily "sheared" when forced through complicated paths.



Pinch Valves offer "line-of-sight" flow paths where the open tube, even if slightly pinched does not significantly block the flow

path. Because of the slight Venturi effect produced by the pinch, flow through the tubing can actually be enhanced rather than restricted.

Handling of non-liquid effluents

Pinch Valves are often used on the waste side of instrumentation, “dumping” solutions to a collection device or simply out of the instrument. The waste stream can have many components; liquid, particulates, precipitates and coagulations inadvertently formed from mixtures of chemicals. These accumulated non-liquids can lead to coating on the inner surface of a conventional valve. The coating process is uneven and can eventually lead to the valve becoming clogged.

Pinch Valves offer a three-fold solution to this problem:

1. The tubing can be pre-treated to prevent the build-up of films. Bio-Chem Valve™ silicone tubing (link opens pdf data sheet) is Platinum cured which significantly reduces the possibility of film build-up.

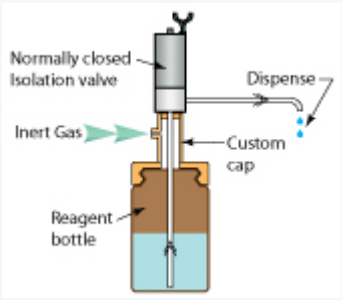
2. The tubing is subjected to a very hard squeeze when the valve is closed. This squeeze is particularly effective in removing any film build-up

3. If the tubing does become blocked – it can quickly and easily be replaced without having to remove the valve from service.

Read more about Bio-Chem Fluidics Pinch Valves here.

Isolation Valve Applications

Precise, repeatable dispensing of reagents



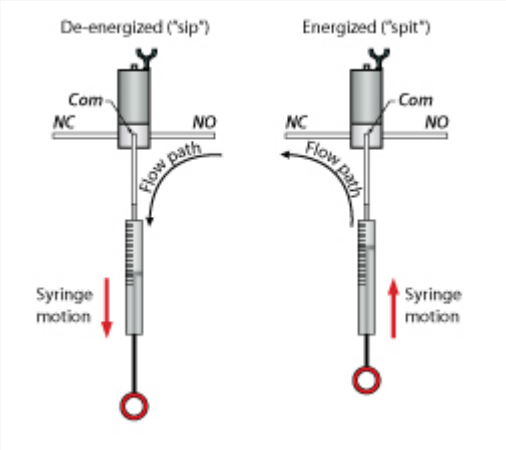
Maintaining a repeatable dispense of aggressive (and often very expensive) reagents into an analytical instrument can be problematic with conventional pumping equipment.

Some forward thinking instrument designers have abandoned the concept of using a pump and have instead turned to using a Bio-Chem Fluidics Isolation Valve.

In such applications, a standard 2-way normally closed isolation valve is connected to a dip tube, which is inserted into the bottom of a reagent bottle. Low pressure nitrogen (or other appropriate inert gas) is introduced seperately to blanket the volume above the liquid in the reagent bottle. The pressure inside the bottle (maintained precisely at a calibrated low value) is sufficient to force the reagent liquid up the dip tube.

When the valve is energized the diaphragm opens and flow through the valve is established. The isolation valve now becomes a very repeatable fluid dispenser – the amount of liquid dispensed is dependent only on the time the valve is open.

Aspirate and Dispense (“sip and spit”)



Sometimes the volume of liquid to be dispensed needs to be either very small, extremely precise or both. In these situations, it is very common to use a precision machined syringe to control the dispense volume.

Bio-Chem Fluidics 3-way Isolation Valves are commonly used as the link between the liquid reservoir, the syringe and the instrument. A 3-way valve has three ports; normally open (NO in illustration), normally closed (NC) and common (Com). The common port is connected to

the syringe. When the plunger is withdrawn, the valve is not energized and the flow is between the reservoir and the syringe via the NO port (aspiration or “sip”).

When the syringe is pushed in, the valve is simultaneously energized. The flow path switches to the to the NC port, which is connected to the instrument (dispense or “spit”). Download the Isolation Valve brochure to read more.

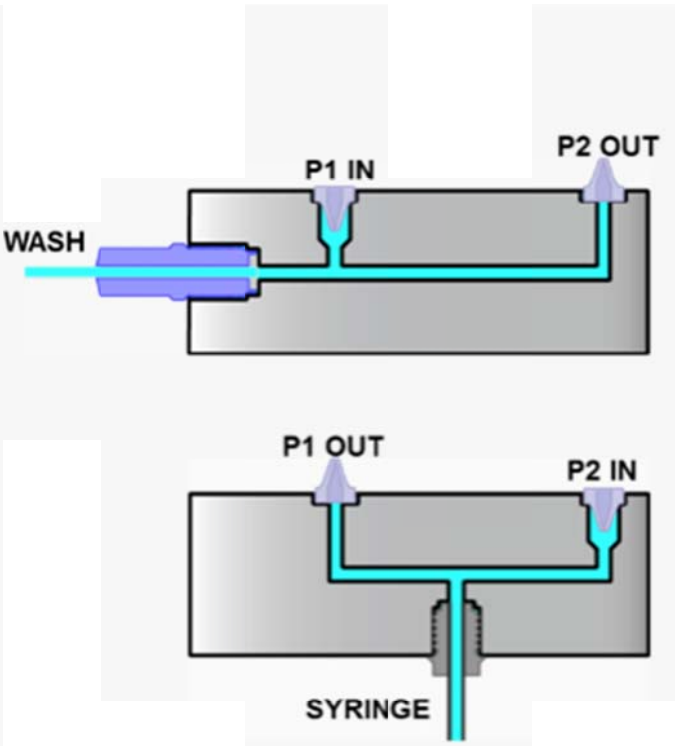
Although standard threaded port valves are common in this application, Bio-Chem Fluidics can, as an option, supply valves with luer fittings to allow direct coupling to the syringe (contact BCF here for more details).

Micro-Pump Applications

Pumping for lower cost

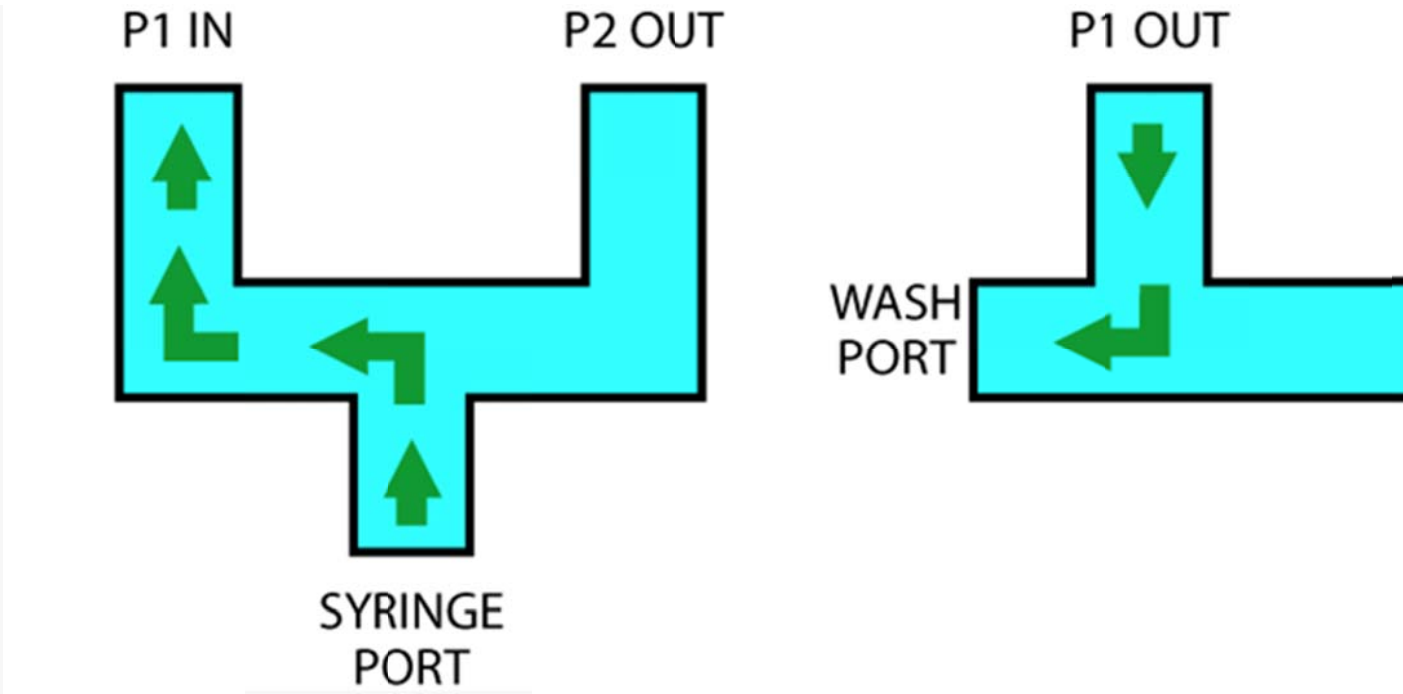
Many applications employ syringe pumps when the accuracy, and thus cost, is not truly necessary. The following images show a way to combine a couple of solenoid pumps to recreate the aspirate and dispense functions of a syringe pump, but at a much lower cost.

The rendering is two self-priming pumps on a manifold. The manifold block has one wash port with a blue fitting in it and one dip tube shown here as a needle. Simply explained, the inlet of one pump is connected to the outlet of the other and vice versa. That allows them to pump in a loop. Open up that loop by tapping the wash port into one of the channels and the dip tube into the other. With those connections in place, actuate/de-actuate the solenoids in a certain pattern to create an aspirate and dispense function, just like a syringe pump. The wash port allows our solution to directly clean out all the flow paths in the system.



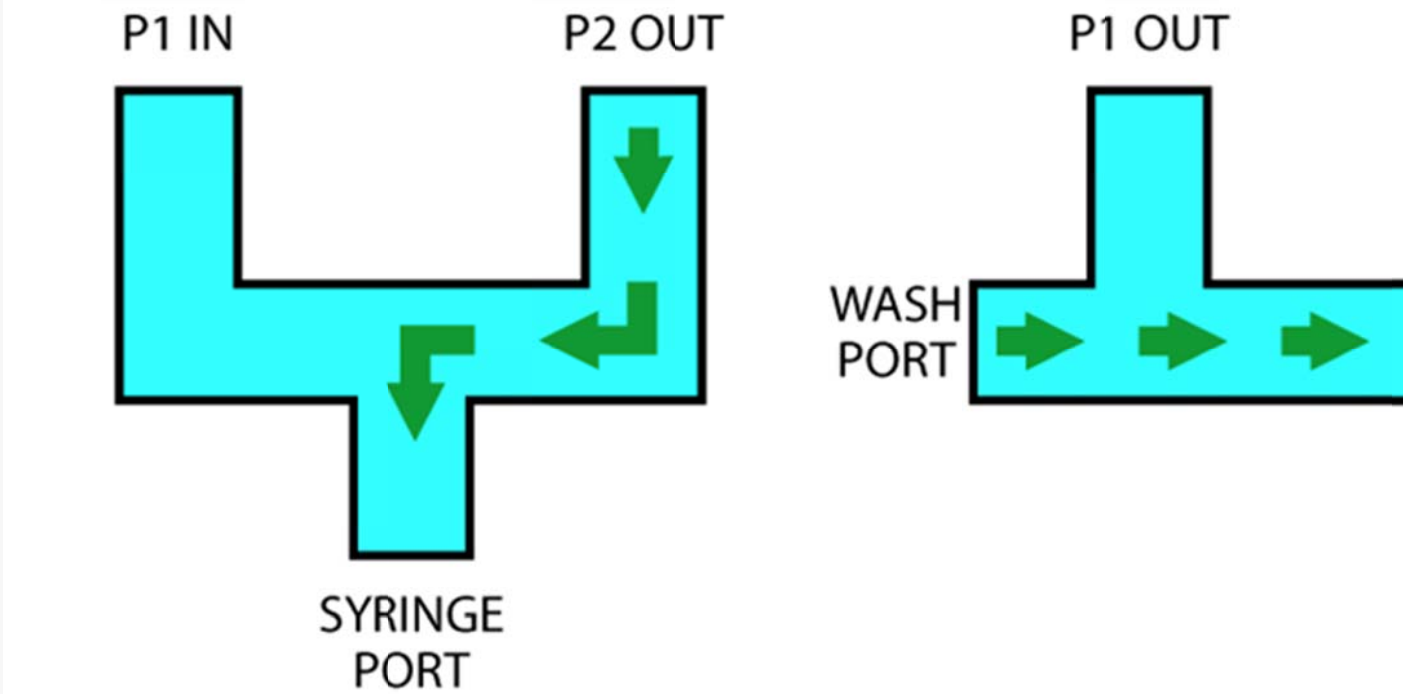
Aspirate

Cycle pump 1 with pump 2 off. This sucks the sample in through the syringe port and pushes the wash fluid out through the wash port. The connection lengths need to be chosen so that the sample does not rise up into the loop, but stays in the needle.



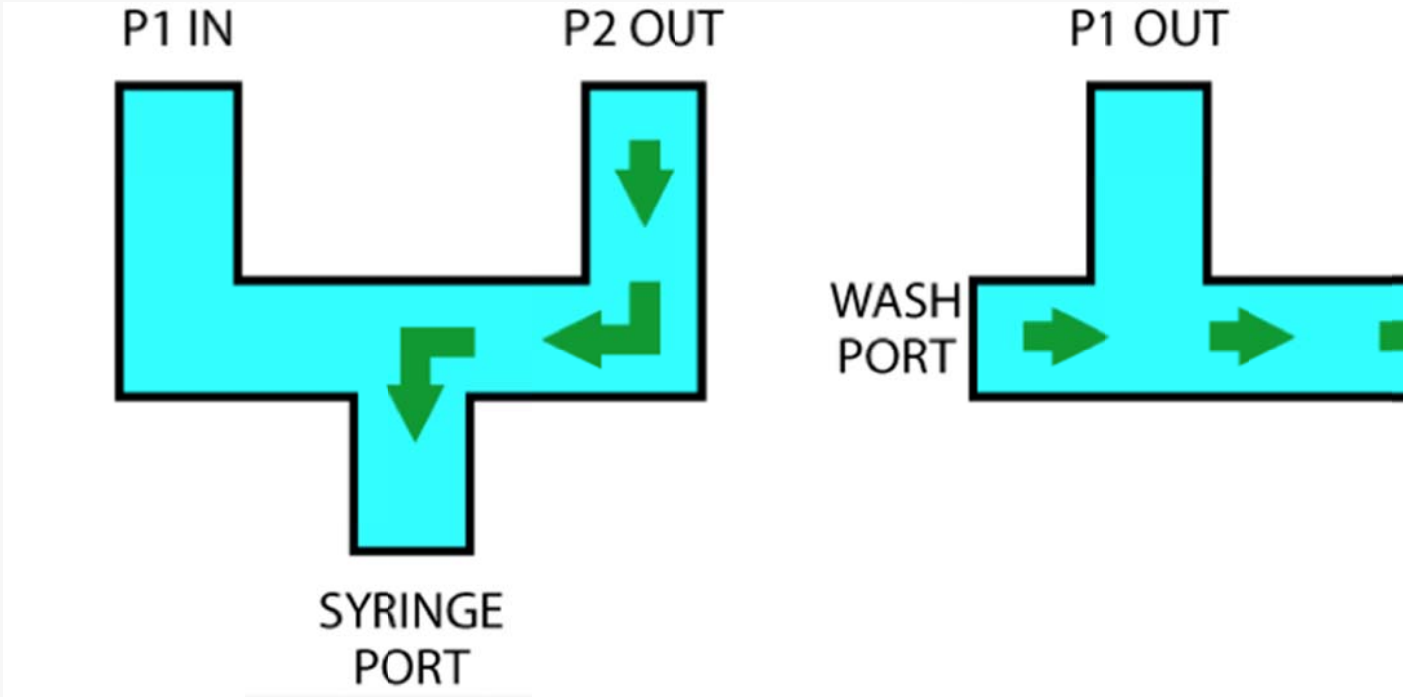
Dispense

Cycle pump 2 with pump 1 off. This sucks the wash fluid in through the wash port and pushes the sample out through the syringe port.



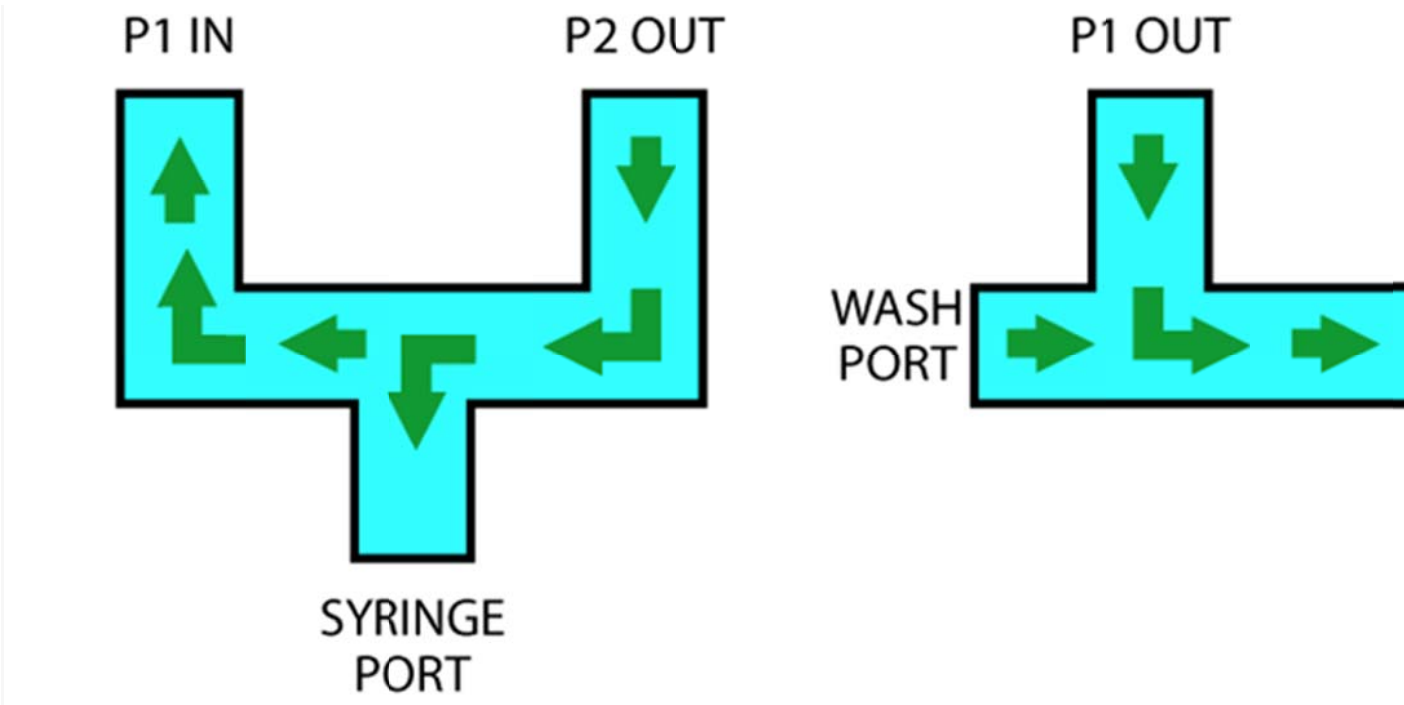
Clean Tip

Cycle pump 1 repeatedly with pump 2 off. This pushes the wash fluid out through the syringe port, thereby washing out the needle tip. The wash fluid is plumbed straight into the manifold, so the needle can be put right on a waste collection are instead of having to move to a separate wash fluid station.



Pump Wash

Cycle pump 1 and pump 2 repeatedly at the same time. This pushes the wash fluid throughout the entire manifold to avoid any biological build-up.


P1 IN
P2 OUT
SYRINGE
PORT
P1 OUT
WASH
PORT