

Sample Dilution

Metered Dispensing of Dilution Solvents for Sample Preparation

It is often necessary to dilute sample material prior to analysis (“dilute and shoot”). For single samples this is done easily using a pipette. Pipettes are available for the simultaneous dilution of multiple samples. These are typically limited to five samples at one time and requires handling of the solvent and sample vessels, often resulting in spills, air pockets and inaccurate measurements.

An alternative automated approach to sample dilution prior to introduction into a GC, HPLC, MS or other analytical instrument, is through the use of a pump for dispensing accurate volumes of solvent into the sample vials. This can be done directly into an autosampler or manually without the use of pipettes. Configurations can be designed to dispense solvent sequentially or simultaneously. An example of sequential dilution is illustrated in the figure below.

In the automated sequential mode, the sample vials are placed on a carousel or moving platform; e.g.: fraction collector. A Micropump reciprocating piston pump or micro annular gear pump will deliver finite volumes of solvent to each vial base on timed movement of the vials. Typically the volume of solvent would be determined by the desired concentration for analysis. The flow rate of the pump times the vial fill time equals the volume in each vial. With piston pumps exactly the same amount of solvent is delivered per piston stroke, so the delivered volume is independent of viscosity or back pressure. Using a programmable fraction collector, each vial may be timed for different volumes of solvent fill. Micropump annular gear pumps may be programmed to deliver discrete amounts of solvent per dilution.



Advantages of a Micropump Positive Displacement Pump

- Accurate and precise flow performance
- Pumps dispense volumes as low as .25 µl and deliver flow rates starting at 150 µl/min
- Chemical resistance to a wide array of solvents
- Analog and RS 232 interface with instrument controllers
- Pumps are small and compact
- Micropump pumps can be modified to meet specific requirements

Common Pumping Requirements

Flow rates

Variable depending on % concentration desired, raw sample wt and/or volume, detector sensitivity and sample homogeneity

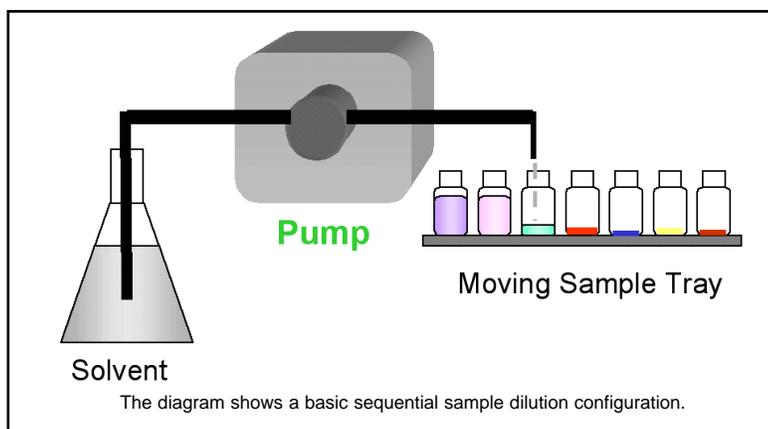
Accuracy

better than ±0.5%

Precision

CV of 2% or better

- Chemical compatibility of wetted materials
- Similar arrangements can be set-up for preparative HPLC and flash purification scale samples. Sample volumes tend to be higher for these applications so higher dilution flow rates might be considered.



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System Configuration Variations

- Sequential dilution
- Simultaneous dilution

Simultaneous Dilution Configuration

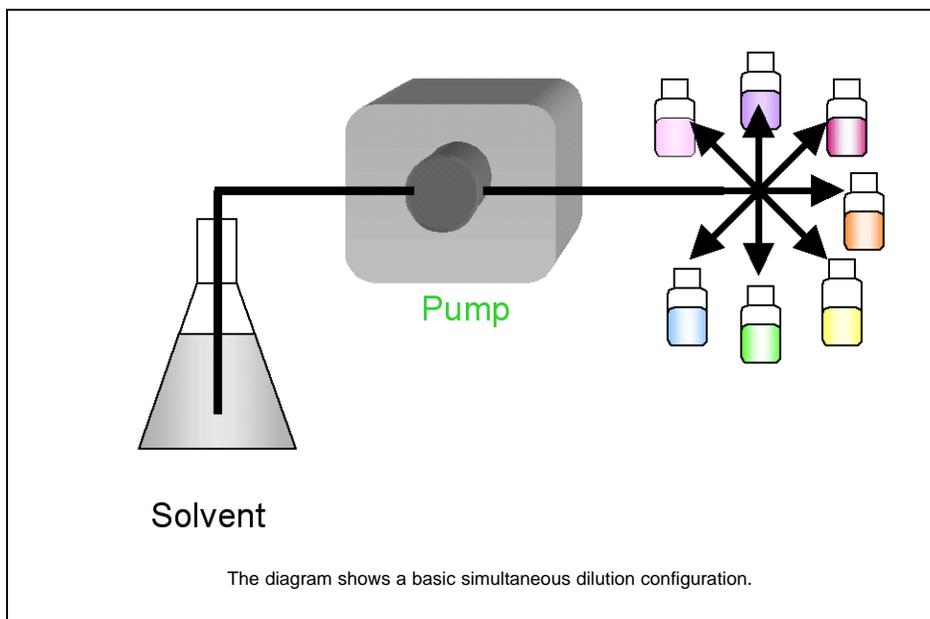
For fast simultaneous dilution, the configuration requires a manifold for solvent distribution as shown below.

The simultaneous dilution configuration permits all sample vials to be filled to exactly the same volume. The total volume of delivered solvent is calculated by multiplying the number of vials times the flow rate times the delivery time.

Pumping Technology

Manufacturers of dilution instruments will find an array of pump choices from Micropump.

- Micropump piston or micro annular gear pumps are options for for a dilution pump application
- Micro annular gear pump model dependent on exact pumping requirements
- REGLO-CPF RHOO or RHO
- Series Delta



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