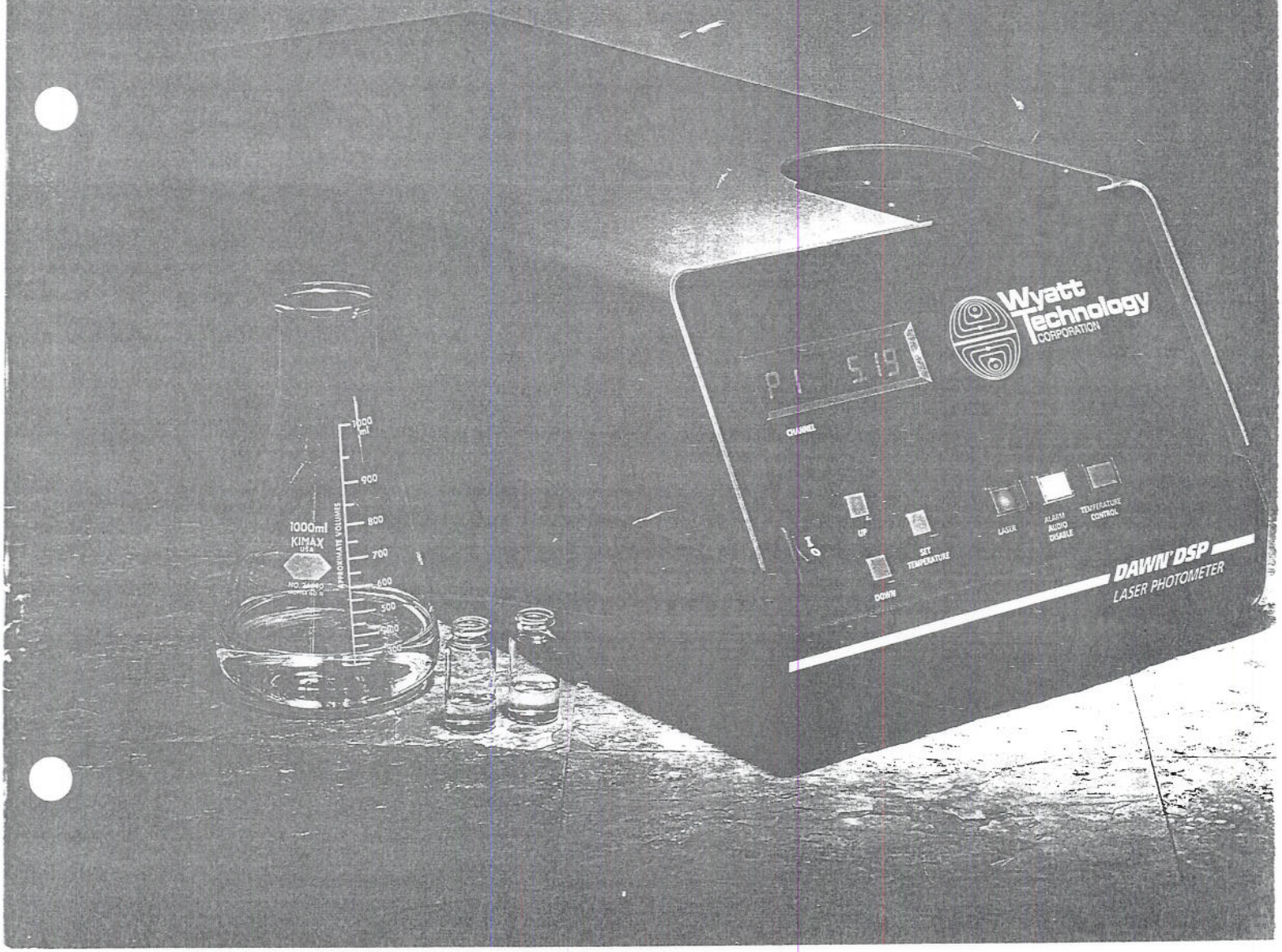
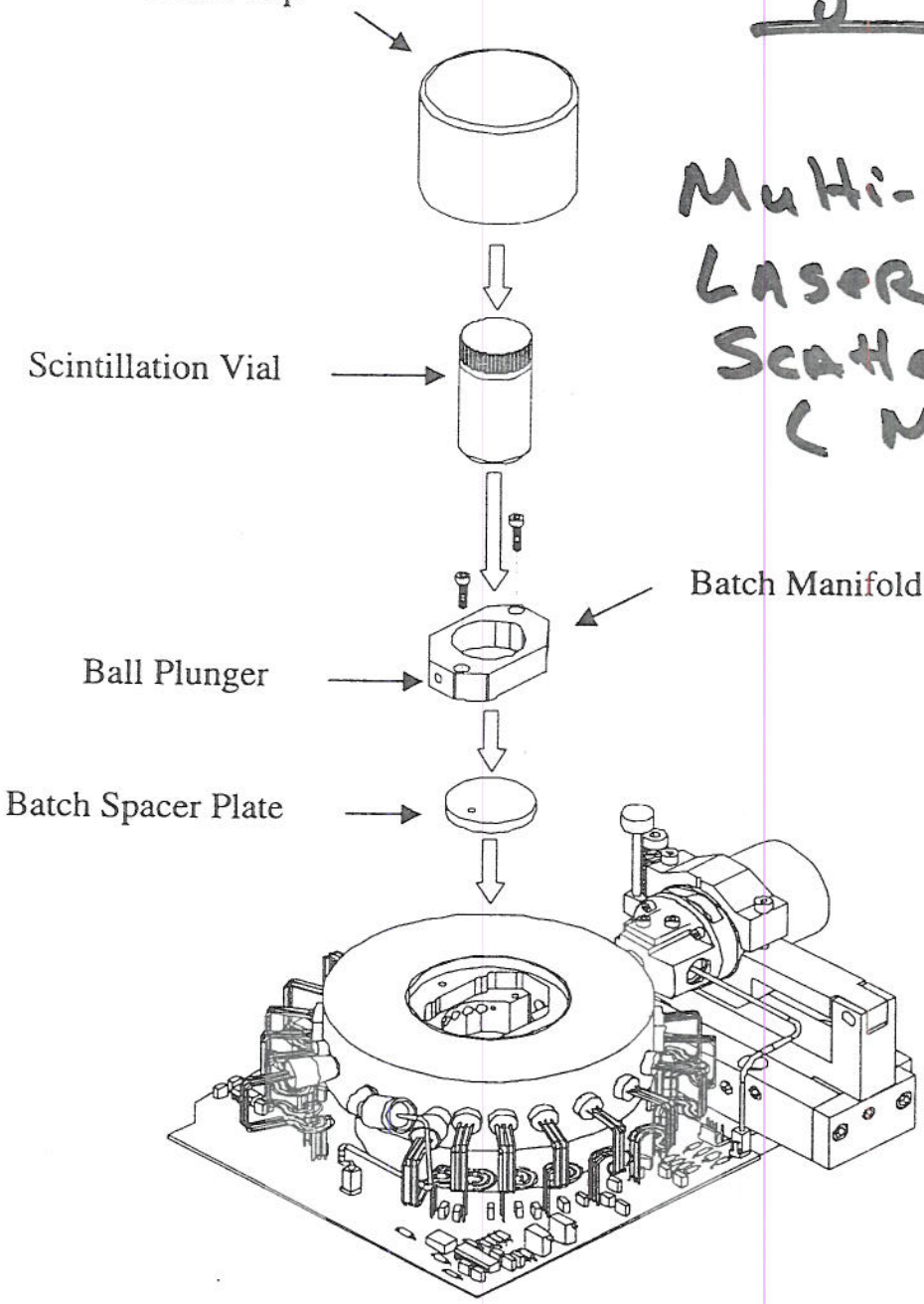
The world's finest and most versatile instrument for determining absolute molecular weights & sizes...





WyatH DAWN EOS

MuHi-Angle LaseR Light ScatteRing (MALLS)

Figure 0-2. Flow to Batch Conversion

Chromatography

Multi-platform GPC software runs on both IBM® and Macintosh® computers.

By coupling a DAWN DSP system to your existing Gel Permeation Chromatograph (GPC), or other separation technology, you have at your fingertips a truly unique instrument that may be used for routine on-line, near real-time determinations of absolute molecular weights, sizes and conformations.

ASTRA® is our intuitive, turn-key chromatography software for Windows® operating systems. (A version is also available for the Apple® Macintosh). Both software platforms enable simultaneous collection and processing of different data files, and permit multi-tasking with other applications. ASTRA will:

- Determine absolute number, weight and z-average molecular weights
- Determine the absolute rms (root mean square) radius, $<r_g^2>^{1/2}$
- Determine polydispersity values (M_w/M_n) and (M_z/M_n)
- Produce the molecular weight and rms radius for *each* elution slice
- Run with Waters' Millennium® GPC software
- Allow synchronization with auto-injectors for up to 99 unattended sample injections
- Calculate the *precision* of each result it reports.
- Run under Windows 95 and NT

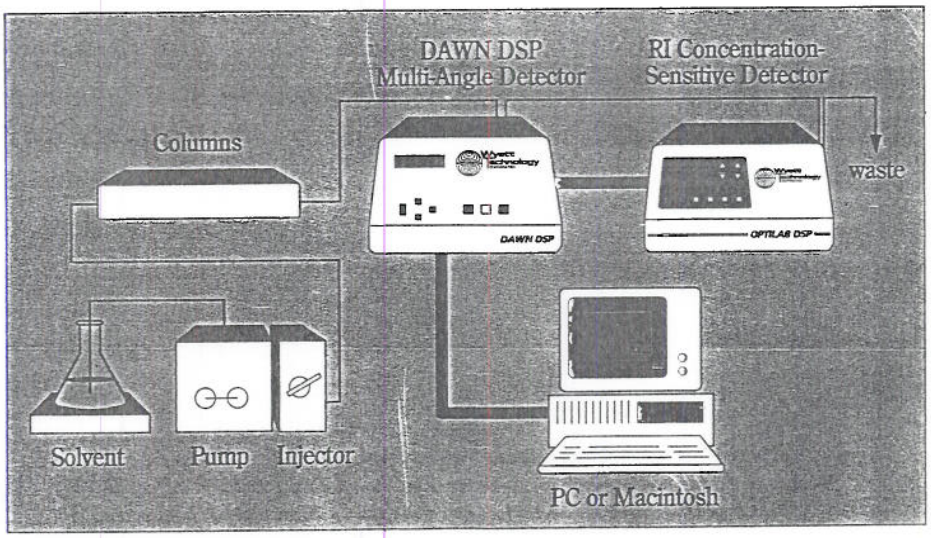
ASTRA reduces the data collected from the DAWN to produce results without reference to standards, quasi-empirical calibration techniques or assumptions about molecular structure/conformation. Every quantity required to make an unequivocal molecular weight determination has its own independent means of verification. ASTRA also provides an excellent means to monitor molecular aggregation and reactions over a range of time periods and experimental conditions.

With the DAWN and ASTRA, pump speed fluctuations no longer play a major role in determining molecular weights: whenever the sample elutes, ASTRA will calculate its absolute molecular weight at each elution volume. Change your columns, your plumbing, even your flow rate—it won't affect the DAWN's performance at all!

ASTRA also provides nine different families of graphical output. It permits simple data extrapolation (analytical continuation) and displays as many as 12 files on the same graph! ASTRA also calculates and displays branching ratios *directly*, rather than deriving them, to take full advantage of the multi-angle capabilities of the DAWN DSP. A variety of output plotting options are also provided. ASTRA's distinct display modes include:

- Molecular Weight and Molecular Size vs. Volume
- Differential Molecular Weight and Molecular Size Distributions
- Cumulative Molecular Weight and Molecular Size Distributions
- Branching ratio calculations and graphics
- Conformation plots of log M vs. log r_g
- Three dimensional plots of each light scattering detector as a function of elution volume

ASTRA's graphical output can be sent to virtually any printer or plotter supported by Windows, saved in ASCII or HPGL formats, or converted into Postscript® for presentation-quality typesetting.

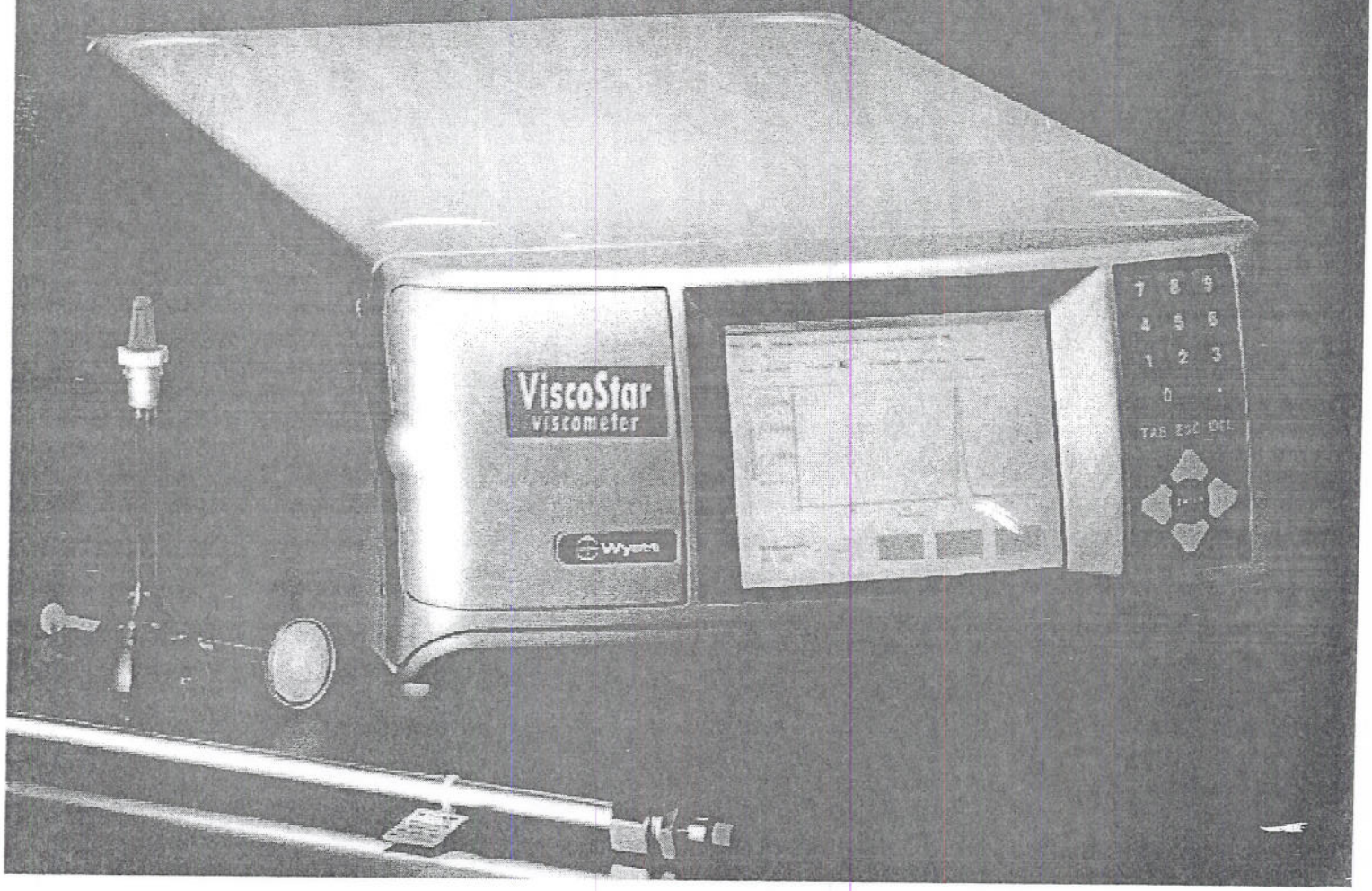


A Typical DAWN DSP chromatography layout. Just by adding a DAWN, you'll be determining absolute molecular weights and sizes without ever having to calibrate your GPC again.

WYATT TECHNOLOGY CORPORATION

ViscoStar™
Viscometer

A new generation of online differential viscometers



How it Works

The ViscoStar uses a traditional bridge design. The fluid stream splits at the top of the bridge, and half of the sample flows through each arm. Since the bridge is symmetric, the differential pressure transducer in the center of the bridge measures zero. When a sample is injected, it is also split evenly. In the left arm of the bridge is a delay volume. The sample enters the delay volume, but solvent exits causing a pressure imbalance in the bridge. This imbalance pressure, combined with the inlet pressure, gives the specific viscosity through the relation

$$\eta_{sp} = \eta/\eta_0 - 1 = 4\Delta p/(IP - 2\Delta p)$$

where η is the viscosity of the sample, and η_0 is the viscosity of the solvent, Δp is the imbalance pressure across the bridge, and IP is the pressure from top to bottom of the bridge. This is a direct measurement of the specific viscosity that depends only on calibrated transducers. At the end of the run, the delay volume is flushed with new solvent and a new measurement can be performed.

When combined with a concentration detector, such as the Optilab rEX, the ViscoStar can be used to compute the intrinsic viscosity, which is defined as

$$[\eta] = \lim_{c \to 0} \eta_{sp}/c \ .$$

The intrinsic viscosity measurements complement the molar mass measured by the MALS instruments. The data can be used to generate Mark-Houwink plots, which are plots of Log([η]) vs. Log(M). A fit of this data to the Mark-Houwink equation

$$[\eta] = K M^a$$

yields the coefficients K and a, which are measures of polymer conformation and its interaction with the solvent. The ViscoStar can also be used to define the hydrodynamic volume, which is the volume of a sphere that has the same intrinsic viscosity as the sample being measured, through the Einstein-Simha relation

$$V_h = M[\eta]/(2.5\ N_A)$$

where V_h is the hydrodynamic volume, M is the molar mass measured with a MALS detector, and N_A is Avogadro's number. From the hydrodynamic volume, one can derive the hydrodynamic radius as

$$r_h = (3V_h/4\pi)^{1/3}$$

which is the radius of a sphere with the same intrinsic viscosity as the sample.

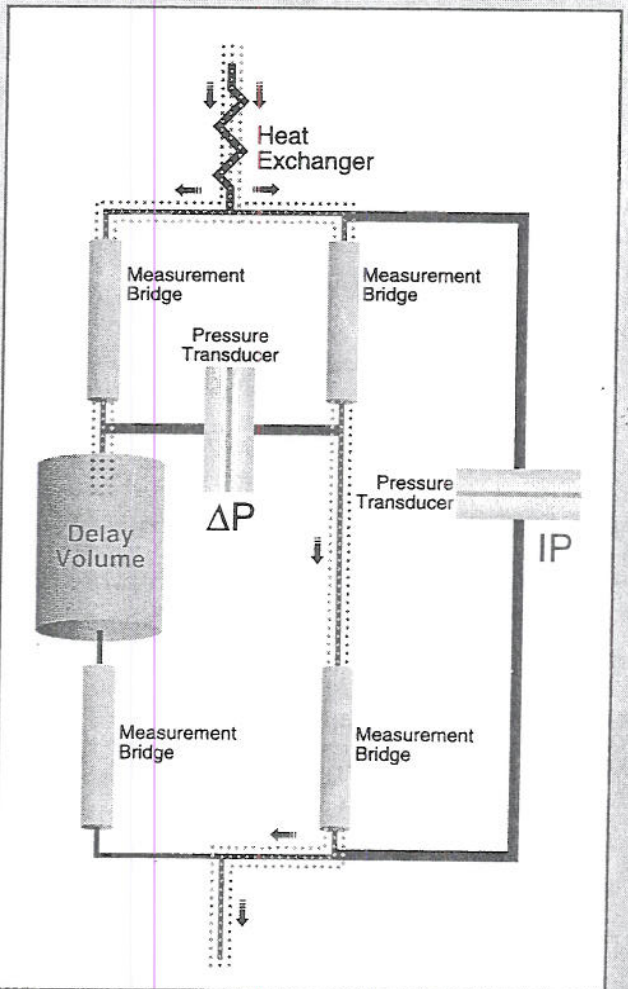


Fig. 1
Schematic of the ViscoStar design showing the measurement bridge, locations of the two pressure transducers, as well as the delay volume that holds the sample during the measurement run.