

programmers defining the methods used to cause the monitor to perform the desired functions.

Applications

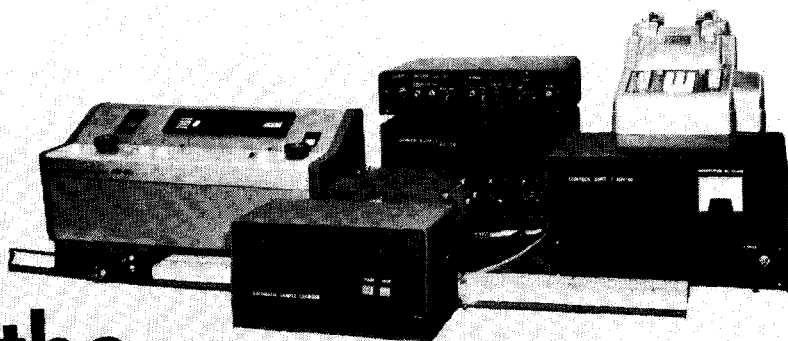
The application of digital control computers to laboratory automation is proceeding along many paths. This can best be illustrated by describing some of the recent commercial and noncommercial applications. Those described below are not intended to represent a comprehensive list. Rather, they illustrate several different approaches and are systems that are most familiar to the author.

Varian Associates has under development several automation systems. One system pursues the concept of one small computer per instrument. Figure 1 is a block diagram of the engineering prototype system as interfaced to an NMR spectrometer and shown in March 1968 at the Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy.

The central processor used for this system is the 620/i computer. It is a 16-bit machine having a memory reference cycle time of 1.8 microseconds and 4K words of core memory. Although many options (such as hardware multiply-divide, magnetic disk, priority interrupts, etc.) are available, none are required for control and data acquisition of the NMR spectrometer. For ease of operation and conservation of core memory, there has been considerable trade-off between hardware and software. Figure 2 is a photo of this system consisting of an A-60 NMR spectrometer, teletype, and the 620/i computer plus the control console.

The control console allows the scientist to select one at a time, many different *operations* and enter the desired *parameters*. As a simple example, he may want signal-to-noise enhancement by means of multiple scans. He first selects the operation "multi-scan average." Next for "parameter" he may want to enter 15 for the "number of scans," etc. The many operations and corresponding parameters necessary for NMR analysis are selected and defined via this control

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