THE MOFFETT PROCESS LIQUID CHROMATOGRAPH

by

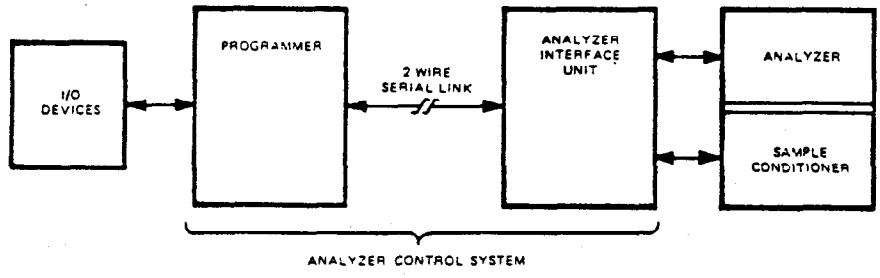
Jerry W. King

The development of automated analyzers for monitoring plant process streams has somewhat paralleled the increasing use of computer control in the chemical process industry. A host of analyzers, such as pH monitors, process refractometers, automated gas chromatographs, and on-line infrared spectrophotometers have been designed and integrated into the automated control sequence of many plants. Traditionally, the successful development of the "on-line" instrument has lagged five to ten years behind the introduction of its laboratory analogue. Hence, it was inevitable, that a process liquid chromatographic analyzer would debut in the wake of the sucessful application of high performance liquid chromatography (HPLC) for saccharide composition analysis in the corn wet milling industry.

The above pioneering effort has been initiated here at the Moffett Technical Center by a combined team of analytical chemists and R&D engineers in cooperation with the vendor, Applied Automation of Bartlesville, Oklahoma. Presently, the unit is located in the Northwest corner of the Moffett Pilot Plant where it has undergone testing for the past year. Operation of this "analytical robot" is initiated from the Pilot Plant second floor control room via a minicomputer called a microprocessor programmer. Activation of the analyzer unit by the programmer initiates a set of discrete steps which consecutively sample the process stream of interest, automatically injects and detects the saccharides in the process stream, and then transmits a digital signal to an output device, such as a recorder

or teletype.

The interrelationship between the various components of the analyzer can be seen in the block diagram below.



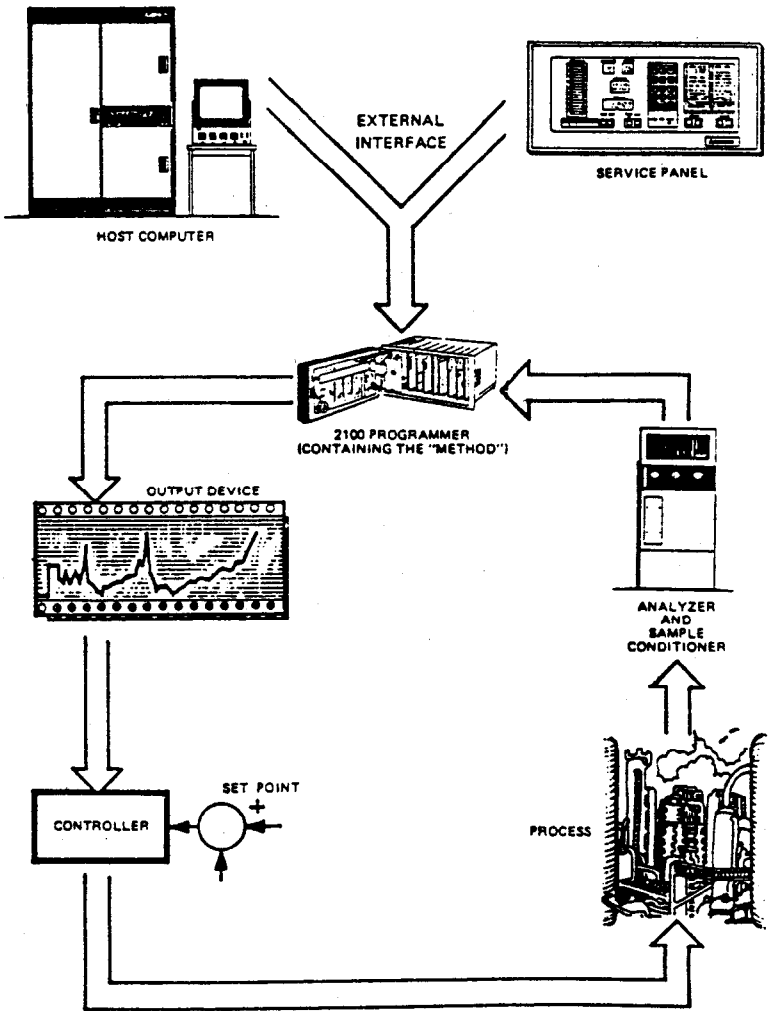
The programmer can initiate events at the analyzer and the sampling module through a signal cable and analyzer interface unit. The use of the signal cable permits geographical segregation of the programmer unit from the analyzer (for distances up to one mile). Solenoid valves on the sample conditioning board are activated by relays housed in an air-purged analyzer interface cabinet. Thus, upon command from the microprocessor, one of eight streams can be filtered automatically and diverted to the analyzer oven for chromatographic analysis.

Separation of the saccharide components in the sample is effected by utilizing an ion exchange chromatographic column (housed in the analyzer oven) which separates the individual sugars. The separated saccharides are then detected by a refractive index detector (RI) contained in the same oven as the column and the sampling valve. The signal from the RI detector is then transmitted through the interface unit and conveyed to the programmer module for analog or digital usage.

An assortment of CPC products have been analyzed continuously for periods from two to three weeks in duration. These have included the monitoring of active saccharification hydrolyzates brought over from

the Argo plant. In addition, ROYAL corn syrups have also been analyzed at low dry substance levels and 42% high fructose corn syrup has been analyzed in streams originating from the third floor saccharification tanks in the Pilot Plant. The above test materials have varied widely in terms of their solids content, viscosity, and clarity, yet all of the product streams have been handled successfully.

The process LC is but one component in the continuing quest to automate corn wet milling plants. As can be seen in the diagram below, information arriving at the programmer module can then be transmitted to an external host computer or used to control a set point that is critical to proper maintenance of process conditions. Hence, a control loop is established that can be monitored from a central



control facility.

Key personnel in the testing of the process LC have included besides the author, Tim Gruber of the Analytical R&D Department and Pat Mulvihill of Engineering R&D. Greg Terwee of the Moffett Instrument Shop also contributed significantly to the maintenance and installation of the analyzer. In addition, numerous individuals in the Pilot Plant, service departments, and management have made key contributions to the testing program. We all eagerly await the next stage of development; the implementation of the analyzer into a corn wet milling plant.
