A FLEXIBLE MICROPROCESSOR-DIRECTED FERMENTATION SYSTEM FOR THE CONTROL OF HARDWARE AND MONITORED PARAMETERS.

Clarke, D.J. (1), White, N.J.M. (1), Burns, A. (2), Kell, D.B. (3) and Morris, J.G. (3).
(1) Datron Data Systems Ltd., Norwich Airport, Norwich, NR6 6HQ, (2) Postgraduate School of Studies in Computing, University of Bradford, Bradford, BD7 1DP and (3) Department of Botany and Microbiology, University College of Wales, Aberystwyth, SY23 3DA.

Although microcomputer control of fermentation hardware is not yet well established, it is derivative and clearly beneficial. Conventionally, a number of physical (e.g. temperature, pressure and agitation) and chemical (e.g. pH, redox and pO_2) parameters are continuously monitored. However, many more sensors of biological importance can be used and here have been developed to provide interpretable information for fermentation control and manipulation. In the interests of economy and quality of measurement, a single high quality, bus-compatible, multifunction digital voltmeter and serial drive scanner were used to monitor all parameters. These included NH_4^+, O_2, inorganic phosphate, K^+, Na^+, Mg^{2+}/Ca^{2+}, sugars, organic cations, biomass, solution conductivity. Novel software allowed near real-time conversion of all electrical signals into units used by the biologist and correction for interferences wrought by complex fermentation media. The system could be operated by non-graduate personnel and was essentially automatic. The course of any fermentation could be pre-defined in a flexible manner, stored and accessed during any repeatable run. This could be reaccessed and changed at any time.

Although the present system (20 to 30 channels of input and 40 to 50 of output) was interfaced to an existing conventional research scale fermenter, the flexible software configuration allowed the type, number and arrangement of fermenters to be easily changed. Similarly, the hardware conception allowed the system to be radically expanded at a relatively low cost per input/output channel to a system capable of running much larger fermenters.

We report on the applicability and capability of this fermentation system as a research tool and conclude that definition and optimisation of schedules of fermentation conditions is both greatly improved and speeded by the multiparameter monitoring approach.