Control software comes to personal computers

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The growing involvement of engineers with personal computers promises to accelerate the application of all kinds of microcomputers in industrial control. The reason underlying this promise is the very personal involvement with software learning experiences that personal computers encourage, especially in the relative privacy of the engineer's own workspace. Personal competence grows with practice, and a feeling of confidence emerges that engenders a boldness to attack those real control problems with real computers. Packaged software, for control engineers to run on personal computers, opens the door to wide use for control system design and testing. This article looks at the design objectives and capabilities of a control software package expressly written for use on personal computers which is available on five minifloppy discs for the IBM PC and other computers.

A typical manufacturing processing plant functions to transform materials and/or energy to products of the desired specification while meeting physical, safety, economic and environmental constraints.

Information concerning inventories, sales, targets, controls, and plant performance is constantly circulated and used to set and hold targets, regulate the plant, manage, maintain, and improve the operation. All of these activities take place in the 400-case-per-week brewery or the 100 000-barrel-a-day refinery with or without the use of computers.

Many of these activities can and are being implemented by plant automation systems designed by control engineers to assist plant management operations and staff.

Automation systems must satisfy many interests: accounting, process engineers, operations, instrument engineers, maintenance, management, lab, environmental engineers, and the owner. Research by Dr Marvin Manheim at MIT and large control project experience both show that implementing systems that can serve many interests results in complex projects that are expensive and difficult to manage. In fact, the odds against successful implementation, even with a technically sound design, run five to one.

In many cases, large amounts of money have been spent on digital instrumentation to regulate plant activity, and no plant automation system is achieved, even though a cost/benefit analysis shows the greatest return from a plant automation implementation. These lost opportunities, for more productive plants, usually result from: the large amount of money traditionally required for the plant automation system; the difficulty of obtaining agreement among the various organisational interests; and the cost of engineering, particularly for software.

New control software package expressly written for personal computers may well give the control engineer the freedom to develop designs with greater flexibility and a lower cost than ever before.

Modular approach

Through the use of control software written expressly for personal computers, large unwieldy projects can be broken down into modular tasks that allow individual control problems to be mastered by those people directly responsible for them. Each task can thus be modelled, simulated, and specified for optimum function and competitiveness.

The control software package is a set of five 5,25" floppy discs formatted for several popular personal computers. Onspec control software is written in Pascal, and includes the following supervisory control functions:

Display—dynamically refreshed colour process graphic displays custom designed using ISA process control graphics characters or tabular displays (ISA graphic symbols reside in a supplied EPROM);

Trend—trends of process variables that can be combined with graphic or tabular displays;

Alarm—prioritised alarm scheme with messages, a history file, display attributes, and user-defined alarm logic;

Historian—a compressed and time-stamped data log with status arranged by time series for analog and digital values;

Log row and column reporter—a spread-sheet program for acquired and manually entered data;

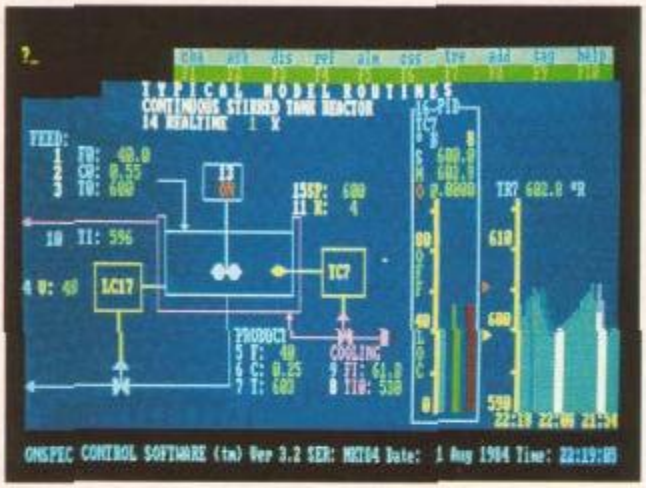
Writer—an editor for shift logs, reports, and programs;

Pascal compiler and linker—machine code compiler, with interrupt and overlay implementation; and

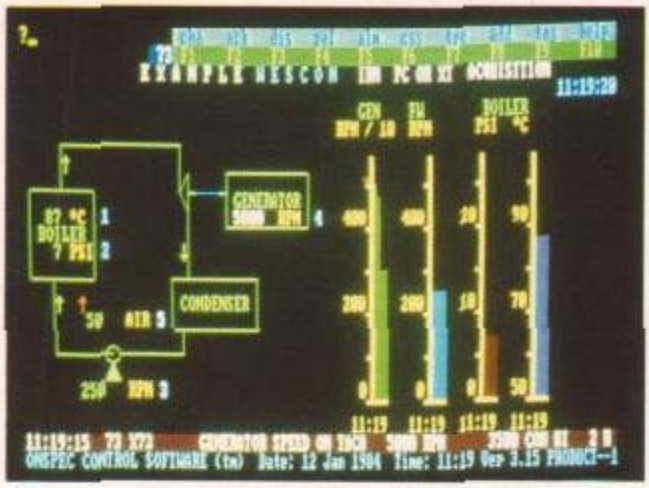
Multitasking operating system—concurrent CP/M supports four virtual consoles running four tasks in four 'windows' on CRT, accesses up to 254 independent tasks.

Additional Onspec control software products include: a process modelling kit; PID control blocks; an instrument listing and data base manager; a high-resolution trending package; and a process I/O subsystem.

The engineering expense, whether purchased from system engineers or performed by staff, must be added to the

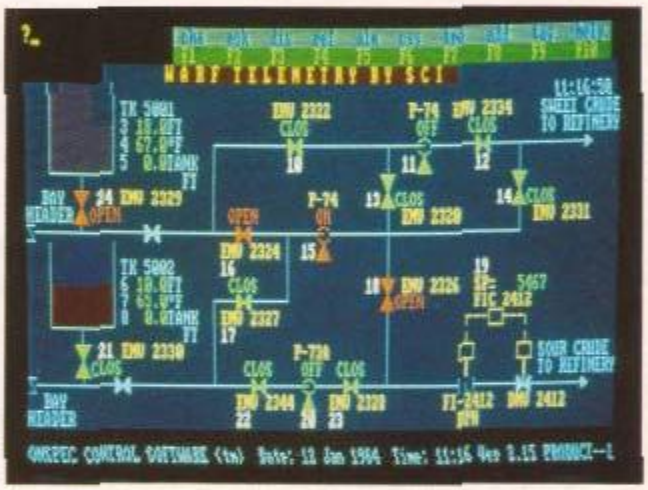


A system diagram can be built on the CRT, with each loop process described by the word processing software and the system modelled by programming process simulations.



A typical display capability — a steam engine monitoring system.

A typical 'help' menu showing the displays/formats configured in the system.



A warf telemetry system display demonstrates another typical application.

personal computer and I/O hardware and software costs. Experience shows that in most cases this engineering expense is far lower than the annual operating expense associated with the previous necessary manual tasks and a tiny fraction of the benefit to be obtained from the automation.

Although the modular approach made possible by these new personal computer tools serving individual interests may not fit an explicit 'master plan,' the approach will work because the plant will get designed, built, retrofitted, and running more efficiently.

Tools for control system designers

Software tools can assist the control engineer with design studies for, and implementation of, plant automation systems. The primary areas of interest are, for design: preparation of diagrams, lists, specifications, and reports; for analysis: modelling and simulation; for process control: displays, alarms, trends, historical reporting, process I/O, procedural language, and multitasking operating system.

Other available software tools can be brought to bear using the personal computer, including linear programming, Kalman filtering, voice recognition, design calculations, communications, self-tuning algorithms, linear analysis, nonlinear regression, elementary population statistics, learning pattern recognition, training, project planning, batch languages, decision tables, logic and ladder diagrams, instrumentation documentation, and configuration programs.

The use of such tools in the development and implementation of plant automation systems is the personal creation and expression of the system designer. With 'Onspec' one could engineer as follows:

☐ build a control system diagram on the CRT and, in response to prompts, define instrument tags and their display presentations;

☐ use the writer (word processor) to describe the purpose of each loop and document the design basis;

☐ model the proposed control system through a set of block diagram displays, with the aid of process and control loop simulations;

☐ interface digital instrumentation, programmable controllers, analog and digital I/O, or other computers;

☐ define operating summary displays, process status displays, trend displays, process analysis reports, and off target summaries; and

☐ install, commission, and operate the plant automation system, using the same software tools.

The primary objective of 'Onspec' control software is to allow the control engineer to design and implement a host computer supervisory control system. The software tools suggested, when combined with IBM or other personal computers and digital process I/O and appropriate applications engineering, make this possible. ☐

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