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ENGINEERING DATA TRANSMITTAL

Page 1 of 1

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This document provides evaluation information to justify a Windows based Human Machine Interface (HMI) replacement to the existing DOS based Iconics HMI currently used in the Data Acquisition and Control System (DACS) used to mitigate flammable gas at 241-SY-101.

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10. System/Bldg./Facility: 241-SY-101

11. Receiver Remarks: 11A. Design Baseline Document? [ ] Yes [X] No
The report concludes with the recommendation of Intellution's FIX software to be used at DACS trailer (MO-461) to provide a Windows based HMI to replace the existing DOS based Iconics HMI.

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1	HNF-1539		0	HUMAN-MACHINE INTERFACE (HMI) REPORT FOR 241-SY-101 DATA ACQUISITION SYSTEM (DACS) UPGRADE STUDY	N/A	3	4	~~6~~ N/A 10-24-97 6

16. KEY

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6	4	Cog.Eng. G.J. Gauck	G.J. Gauck	10-9-97	T4-09						
3	4	Cog. Mgr. R.P. Tucker	R.P. Tucker	10/20/97							
3	4	QA R. True	R. True	10-9-97	T4-08						
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A.M. Erwi Signed per telecon with A.M. Erwi 10-20-97 ~~Design Agent~~ G.J. Gauck 10-9-97 Signature of EDT Originator Date	R.P. Tucker 10/20/97 Authorized Representative for Receiving Organization Date	W.G. Brown 10/9/97 Design Authority/ Cognizant Manager Date	[ ] Approved [ ] Approved w/comments [ ] Disapproved w/comments

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HUMAN-MACHINE INTERFACE (HMI) REPORT FOR 241-SY-101 DATA ACQUISITION SYSTEM (DACS) UPGRADE STUDY

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PLC's Plus, Richland, WA 99352 SESC
U.S. Department of Energy Contract DE-AC06-96RL13200

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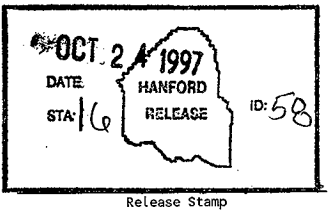
Key Words: HMI, System Architecture, Operating System, Networking, Configuration, Development, Database, Hardware, Software, Scripting

Abstract: This report provides an independent evaluation of information for a Windows based Human Machine Interface (HMI) to replace the existing DOS based Iconics HMI currently used in the Data Acquisition and Control System (DACS) used at 241-SY-101

Per General Counsel documents that list products for Conceptual Design or Procurement have been given a waiver for trademark call out.



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HUMAN-MACHINE INTERFACE (HMI) REPORT FOR 241-SY-101 DATA ACQUISITION SYSTEM (DACS) UPGRADE STUDY

Prepared by:

PLCs Plus
Richland, WA

August 1997

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1.0 INTRODUCTION

PLCs Plus was tasked with the responsibility of producing a Human Machine Interface (HMI) report. The purpose of the report is to provide evaluation information for a Windows based HMI to replace the existing DOS based Iconics HMI currently used in the Data Acquisition And Control System (DACS) used at 241-SY-101.

A fundamental reason for this evaluation is because of the difficulty of maintaining the system with obsolete, unsupported software. The DACS uses a software operator interface (Genesis for DOS HMI) that is no longer supported by its manufacturer, Iconics. In addition to its obsolescence, it is complex and difficult to train additional personnel on. The FY 1997 budget allocated $40K for phase 1 of a software/hardware upgrade that would have allowed the old DOS based system to be replaced by a current Windows based system. Unfortunately, budget constraints during FY 1997 has prompted deferral of the upgrade.

The upgrade needs to be performed at the earliest possible time, before other failures render the system useless. Once completed, the upgrade could alleviate other concerns: spare pump software may be able to be incorporated into the same software as the existing pump, thereby eliminating the parallel path dilemma; and the newer, less complex software should expedite training of future personnel, and in the process, require that less technical time be required to maintain the system.

2.0 DISCUSSION

Information presented in this HMI report has been compiled from several sources. Each of the HMI suppliers' internet web sites and sales literature were used in gathering pertinent data regarding these suppliers and the systems they offer.

PLCs Plus does not assume any responsibility for the validity of the information provided by suppliers, as only the suppliers can verify the accuracy of their statements. Verification would best be accomplished by witnessing demonstrations of those systems that seem applicable to the needs of the 241-SY-101 project.

Other sources of information for data used in this report are: Managing Automation (June 1997), Control Engineering (February 1997), Manufacturing Systems (July 1996), and the engineering staff of PLCs Plus.

The following topics were selected because of the estimated impact with regard to a decision for selection of an HMI to be used as a possible upgrade for the current system used at DACS, controlling the Hydrogen Mitigation mixer pump in tank 241-SY-101: Product Descriptions, Features - System Architecture, Operating System(s), Open/Scalable/Flexibility/Compatibility, Networking, Configuration/Development/ Database, Hardware/Software - System Specifications, Support, and Scripting.

Items not covered in this report, since several of the products capabilities were judged to be relatively equal, were: Graphics, Drivers, Trends/Reports/History, Alarms, Security, Wizards/Dynamos, Optimization/Polling.

Four suppliers were selected for consideration: Iconics-Genesis For Windows, Wonderware-InTouch, Intellution-FIX, and Ci Technologies-Citect. The suppliers chosen for review in this report were based on the experience of PLCs Plus, availability of the products for evaluation, and various demonstrations presented by the suppliers. The order of presentation of the products was selected randomly as follows: Iconics, Wonderware, Intellution, and Citect. Product discussions throughout this report were kept in this order to help simplify reading the report.

Also, included in this report are four surveys, three from industry publications and one that was conducted as an internal survey by the staff of PLCs Plus. Brief results are as follows:

> The Control Engineering survey is an alphabetical listing of approximately 50 companies' Supervisory Control And Data Acquisition (SCADA) software. There are two significant categories: Operating System and Features. The survey shows only Iconics having exceptions compared to the other three. It is indicated that Iconics is still reliant upon a DOS based Real-Time Server and is not capable of Multi-Channel Signal Conditioning. All of the other suppliers provide Multi-Channel Signal Conditioning. (Appendix A provides complete results of the survey.)
>
> Managing Automation's, "Hot 100 Manufacturing Software Companies" listing is based on a composite of size, market dominance, and technology. This is an alphabetical listing, rather than a ranked list of their "choice of significant software vendors." There are four items listed for each of the companies covered in this report: Location, Product, Application, and Outlook. (Appendix B provides complete results of the survey.)

From Manufacturing Systems "Top 50" survey, the rankings are based solely on revenue derived from manufacturing software in calendar year 1995. Some key comments taken from the listing are:

Iconics - did not make the Top 50 listing.

Wonderware - "appeared to hit rough waters" and was forced to "grow-up" after experiencing entrepreneurial growth. It was stated, "not so much a company in dire straits, but one working to establish a new identity."

Intellution - "continues to churn out leading-edge process-automation and control software, and manufacturing companies around the world keep gobbling it up." Current successes are attributed to "the market's rapid adoption of 32-bit computing environments. Thirty-two bit computing is a synonym for Windows NT and Windows 95. Intellution began building its products for those environments in 1993, and it appears customer demand for those systems finally has materialized." Intellution received Microsoft's Leonardo Medal for Technical Innovations in Manufacturing. It was stated, this "solidifies our leadership role in the industrial automation software market." (Appendix C contains the complete results of the survey.)

An evaluation copy of Citect was not available at the time of the PLCs Plus internal survey, so only Iconics, Wonderware, and Intellution software were considered. Thirteen categories were defined with a weighted ranking assigned to each, 5=BEST to 1=WORST. (Appendix D lists the complete results of the survey.)

Table A lists the strengths and weaknesses of each product, according to the PLCs Plus staff:

Table A

PRODUCT	STRENGTHS	WEAKNESSES
Iconics	Tools, Scripting (VBA)	Operating System, Difficult to Learn, Reliability
Wonderware	Technical Support	Operating System, Drivers, Networking
Intellution	Operating System, Drivers, Networking, Reliability	None Identified

Microsoft Windows is the dominant operating system for PC-based systems. On the plant floor, Windows NT 4.0 will solidify that position as more manufacturing companies adopt it as their operating system platform. Vendors with Windows 3.X or DOS applications will be forced into 32-bit development leaving 16-bit development all but "dead." The scaleability, flexibility, and power of NT will continue to attract users and vendors providing low-cost and high-performance engineering solutions.

With development of an OLE-based data exchange standard as their focus, five companies -- Fisher-Rosemount Systems, Intellution, Intuitive Technology, Opto-22, and Rockwell Software -- along with OLE consultants from Microsoft, formed the OLE for Process Control (OPC) Task Force. This standard will be instrumental in overcoming challenges of sharing information among intelligent devices on the plant floor.

3.0 SYSTEM PERFORMANCE

Performance is an often ignored element in the evaluation of HMI systems. However, our recommendation would be to limit the choices to one or two products then perform tests, including the following items:

- Data acquisition speed.
- Data processing speeds (alarms, calculations, etc.).
- Data presentation speeds (graphics).
- Data storage speeds (historical archiving).
- System responsiveness to user requests.

Since data acquisition is the data source for most other HMI tasks, it is often acknowledged as one of the key system performance features and because of this the performance of device drivers is very important. Since device drivers are the interface gateways to the rest of the system, these drivers limit the overall performance of HMI software and control the updating capabilities of the other HMI tasks.

Repeatable testing with a number of programmable controllers and with a number of HMI systems has been performed. Consistently, DLL drivers outperform DDE drivers by a factor of 10 and the end-user is dependant on the device-driver performance. The update efficiency of graphics, trends, and other functions depends on the device driver, and directly controls the presentation of timely information used to make critical, informed decisions.

4.0 CONCLUSION

The evidence as indicated from the various reference sources used in this report leads to the recommendation of Intellution's FIX software to be used at DACS. The data in Control Engineering's survey reveals there are serious drawbacks of a DOS based system, such as Iconics Genesis. (Some of the problems include limited vendor support, 16-bit portability, training difficulties, and more.) Manufacturing System's "Top 50" rankings lists favorably the 32-bit Windows NT based "leading edge" software from Intellution. Also, the DACS computers are "highly" networked, with networking being another strong point of Intellution.

Intellution has become more prevelant on the Hanford Site. There are several projects currently using Intellution software: PUREX - SAMCONS, W211, W259 T-Plant, and Spent Nuclear Fuel - Canister Storage Building and Cold Vacuum Drying Facility.

This report is intended to give an overview of these products for possible use at DACS. Hopefully, this information will prove useful as a tool in making an informed decision related to these product technologies and associated vendors.

Note: The information presented in the following pages is vendor supplied.

5.0 PRODUCT DESCRIPTIONS

Iconics

The complete Automation Tool Suite for MMI, SCADA and Control! See for yourself how the Project Manager coordinates the operation of GFW's modular components and how GEN-NET is used to connect GENESIS for Windows and GENESIS Control Series (DOS) workstations. Other features include Dynamic Data Exchange (DDE), and VBA Compatible Scripting. For additional information see Specifications and Accessories.

Introducing GENESIS for Windows the first complete software Automation Tool Suite for PC-based Operator Interface (MMI) and Supervisory Control (SCADA). GENESIS for Windows (GFW) features a suite of independent 'Best-In-Class' applications for graphics, trending and data logging, alarm management, I/O scanning, control logic, and more. These are just a few of the features that make GENESIS for Windows the best choice for any application.

GENESIS for Windows is a total software solution for factory automation and process management. GFW is a modular system, made up of fully independent client and server applications. Assemble your own custom MMI/SCADA system by combining the GENESIS for Windows modular components with any other Windows software.

Wonderware InTouch

Wonderware pioneered the use of Microsoft® Windows on the factory floor in 1989, with the introduction of our revolutionary InTouch™ man-machine interface (MMI) software. Since then, Wonderware has rapidly become the world leader in industrial automation solutions, offering the Wonderware Factory Suite™ of products that span the enterprise, from the factory floor to the executive offices -- from supervisory control and data acquisition (SCADA) applications to production management and resource tracking, flexible batch management, expert machine diagnostics, and connectivity products to link them to control devices and computing networks.

Wonderware InTouch is an object-oriented, graphical man-machine interface (MMI) application generator for industrial automation, process control and supervisory monitoring applications. A core module of Factory Suite, InTouch allows engineers to readily create, on a computer display screen, graphical representations of the physical devices (gauges, meters, knobs, switches, etc.) used to control equipment in a factory or process control system - and to animate them with a wide range of properties to replicate the real process. Version 6.0 for Windows NT 4.0 includes several new distributed alarm handling, distributed historical data, dynamic resolution conversion and remote application development and maintenance for use in large PC-based networks. Enhancement modules include Recipe Manager, Statistical Process Control (SPC) and SQL Access. Included with InTouch is FactoryFocus™, a view-only node that gives managers and office workers a low-cost and convenient way to monitor plant floor operations from their desktop anywhere within a company. InTouch 6.0 also contains the Wonderware Productivity Pack, a handy software tool that helps users to develop custom wizards. For Windows NT users, the Productivity Pack has more than 2,000 wizards that make application development easier than ever before.

Intellution

For more than 15 years, Intellution has been setting the industry standard for easy, powerful, and reliable automation solutions for manufacturers across the globe.
The #1 Automation Software for Windows 95 and Windows NT. A True 32-bit design - Intellution's proven 32-bit FIX™ automation software is the only automation solution that takes full advantage of all the powerful capabilities of Windows 95 and Windows NT. With more 32-bit installations than all other automation software vendors combined, only Intellution has the experience and technology to solve your most difficult manufacturing challenges, now and in the future. Unlock the power, performance and security of Windows 95 and Windows NT with the proven 32-bit performance of Intellution's 32-bit FIX automation software. 32-bit processing is the future of industrial automation, and it's here today with Intellution's 32-bit FIX software for Windows 95 and Windows NT.

Intellution's FIX family of products for MMI and SCADA applications is consistently rated number one by industry analysts, integrators and end-users alike. The FIX is industry's top choice because it enables users to quickly and easily build a powerful window into their manufacturing operation.

Citect

Welcome to Citect for Windows!

You can configure a Citect monitoring and control system to suit any industrial application. And because Citect has been designed with flexibility in mind, you can design a system to suit your exact requirements.

Citect suits both small and large applications. Because it is flexible, Citect will keep pace with your plant and information requirements as they change and expand.

I/O Optimization

•Operates on a demand basis •Supersedes the conventional predefined scan method •Automatic optimization of block data requests to PLCs and DCs •Automatic rationalization of network wide user data requests •Maximization of control vendors highway bandwidth

Applications Language (Cicode)

•Fully pre-emptive multi-threaded language •Client Server, Remote Procedure Calls (RPC) •User Written Functions •Indirect Read and Write of tags •Functions are re-usable, modular and transportable throughout the system •Full mathematical and Boolean functions •Full string manipulation •If-then-else, For-Do, While-Do, Conditional Executors •Over 500 standard Cicode functions provided •Designed especially for plant monitoring and control applications

Citect is easy to learn and use. Features such as templates, genies, and wizards reduce the time and effort required to configure your Citect system, as well as maximize its performance.

6.0 FEATURES

6.1 System Architecture

Iconics

Information not available.

Wonderware

Information not available.

Intellution

FIX Automation Software Features:

- Distributed, Client/Server Architecture
- Intuitive Man-Machine Interface
- 100% Data Integrity
- Real-Time Process Monitoring
- Supervisory Control and Data Acquisition

- SQL/ODBC Relational Database Connectivity
- Alarming and Alarm Management
- Comprehensive, Accurate Reporting
- Real-Time and Historical Trending
- Statistical Process Control
- MMI and SCADA Solutions for All Size Applications

Citect

Systems Architecture

- Client Server Distributed Processing
- Open architecture design
- Imbedded real-time multi-tasking kernel
- Centralized alarm, trend and report processing
- Automatic update of configuration across a network
- Concurrent support of multiple display nodes
- Access any tag and or any data from any node
- Scalable architecture allows expansion without configuration changes
- Single Database configuration source for Large Networked Systems

Fault Tolerance

- Automatic change over and recovery
- Full hot standby supported
- Supports primary and secondary equipment configurations
- Intelligent redundancy allows secondary equipment to contribute to processing load
- Dual Networks for full LAN Redundancy
- No configuration required may be enable via single check box
- Redundant writes to PLCs with no programming
- Redundant File Server Support

6.2 Operating System(s)

Iconics

DOS/Windows 3.X/95/NT

Wonderware

Windows 3.X/95/NT

Wonderware continues to lead the industry in implementation of automation solutions based on Microsoft Windows 95™ and Windows NT™ operating systems as well as on the Microsoft BackOffice suite of server solutions. The Wonderware InTrack™ production management system, in fact, is the first -- and still the only -- industrial automation software system certified for use on Microsoft BackOffice.

Intellution

Windows 3.X/95/NT

FIX for Windows 95 and Windows NT is a true 32-bit software application written to Microsoft's Win-32 specification. This means that, unlike 16-bit software systems, FIX takes full advantage of all the powerful capabilities of Microsoft's Windows 95 and Window NT operating systems, including pre-emptive multitasking, multithreading, plug and play hardware compatibility, symmetric multiprocessing and much more.

The first automation software vendor to introduce a 32-bit application for the Windows NT platform. Intellution today has more 32-bit installations than all other automation software vendors combined.

Citect

Windows 3.X/95/NT

6.3 Open/Scalable/Flexibility/Compatibility

Iconics

Recognized Standards

With today's fast changing technology, GENESIS for Windows is designed to stay current by adopting widely recognized standards. Exchange data with other Windows applications using Windows DDE and OLE. Enjoy direct database connectivity using ODBC and SQL. Distribute real-time data around the plant, or around the world, using TCP/IP networking. Customize the system with easy to learn Visual Basic scripting commands. Standards save engineering time and protect your valuable software investment.

•Over 250 interfaces to PLCs, Loop Controllers, and I/O Systems for maximum industrial connectivity •Distributed client/server architecture for expandable plant wide networking •Powerful DDE, OLE, and direct DLL communication capacity that offers full connectivity to other applications

GEN-RTU is the Remote Terminal Unit option used for executing periodic communications with up to 120 remote I/O devices via telephone modems. This provides a highly flexible, low cost solution for PC-based distributed data acquisition systems. Types of polling include sequential, periodic, and on-demand. Up to 300 telephone numbers can be configured and can be changed on the fly. Use this option whenever it is impractical to maintain continuous modem communications with remote I/O.

GEN-TEXT is an ASCII text messaging driver that provides a general purpose interface for sending predefined ASCII messages to a serial port based on logic within the RTS. Up to 1024 different messages can be defined. Use this option whenever custom ASCII text messages need to be sent to printers, telephone pagers, modems, or any other device that can be connected to COM 1-4. This option counts as one of the six RTS device drivers.

ODBC Configuration Tools

An I/O Server consists of two parts-Configuration and Runtime. The configuration utility uses an ODBC compliant database to define the I/O "points." This might include the tag name, point type (e.g., analog or digital), the memory location of the desired data, scaling parameters, alarm information, and so on. Separate screens configure the communication ports and addressing information of networked devices. The use of Microsoft standard ODBC technology means that the configuration information can be accessed, imported, or exported to a variety of database and spreadsheet programs. This makes it possible to transfer information from PLC programming software directly into the I/O Server configuration.

Fast Runtime Engine

The I/O Server Runtime engine performs the actual communication functions to the field devices. It is optimized to maintain a real-time database of only the I/O data and alarm information. Calculations and logic must be provided by other applications. This design helps the I/O Server runtime use the minimum system resources for best performance. Multiple I/O Servers can be running simultaneously.

Large I/O Capacity

Each I/O point, or tag, can be configured for continuous update or scan-on-demand. Continuous updates are used for points which are always required, or which must be scanned for alarm conditions. With scan-on-demand, only those points being requested by the client applications are automatically updated. This method allows the I/O Server to simultaneously manage thousands of data points. Most applications use a combination of the two methods.

Development Tool Kit

A tool kit is available for users who want to create their own custom I/O Servers. The I/O Server developer needs only to define the configuration GUI and the Runtime communication protocol section. The I/O Server Tool Kit will do the rest.

Wonderware

NetDDE
Using Wonderware's NetDDE, included with InTouch, users benefit from DDE connectivity between applications on different nodes over the network. Connectivity support is provided between Windows, VMS, and UNIX operating environments over a range of network protocols such as NetBIOS, TCP/IP, and DecNET, plus serial port communication. NetDDE enables the workstation to be a virtual gateway between network protocols.

Dynamic Tag Referencing

InTouch has many NEW distributed features. Dynamic Referencing lets users change database references to input/output tags at runtime. This means that users can change data references on the fly for PLC addresses, Excel spreadsheet cells, Dynamic Data Exchange (DDE) references, and the like. Using this exciting new capability, operators can use a single tag to 'view' any cell in a spreadsheet, for example. Coupled with Wonderware's existing ability to dynamically switch between I/O servers or other DDE-aware applications, Dynamic Referencing provides tremendous application flexibility. Distributed Alarming supports multiple alarm servers or 'providers' simultaneously, which gives operators the ability to view alarm information from multiple remote locations at the same time. The new distributed alarm functions let users implement 'point-and-click' alarm acknowledgement, alarm scroll bars and many other new features for networked use. The new Distributed Historical Trending system allows users to dynamically specify different historical file data sources for each of the pens on a trend chart. Since InTouch permits the use of up to eight pens per trend chart, users can have an unprecedented amount of historical data available for viewing at any given time. Remote Development features have been added to accommodate large multi-node installations. These include application updating of all nodes on a network, either automatically in a time-based fashion or in response to operator triggers or application events.

DDE I/O Servers

DDE I/O Servers are input/output drivers that use Microsoft's Dynamic Data Exchange (DDE) protocol to provide seamless data sharing between Wonderware InTouch and programmable logic controllers (PLCs) or other control devices. The servers' use of DDE also allows the exchange of data with any DDE-aware Windows programs. Wonderware offers hundreds of DDE Servers, as well as a DDE Server Toolkit that lets users develop their own servers.

Professional Developers Kit (PDK)

The Wonderware InTouch PDK, available on CD-ROM, is a comprehensive product bundle consisting of Wonderware InTouch Standard for Windows, Windows 95 and a full 32-bit version for Windows NT. It includes all of Wonderware's powerful options: SPC, SQL Access, Recipe, NetDDE, all the I/O Servers, and documentation for all bundled software. The PDK is targeted at System Integrators and other power users.

SQL Access

Wonderware's SQL Access option provides InTouch users with access to virtually all of the large database programs, including Microsoft SQL Server, ORACLE, SyBase, dBase, and others that support the Open Data Base Connectivity (ODBC) standard.

Extensibility Toolkit

This software package allows users to customize and extend the capabilities of InTouch according to their specific needs. The Toolkit includes the Wizard Development Kit, the Script Enhancement Kit and the IDEA Toolkit. Users with "C" programming competence can create their own Wizards and unique script functions and include them as part of their development system. They can also tap into the power of Visual Basic, FORTRAN, Pascal, etc., for additional development of visual elements, forms, database access and manipulation.

DDE I/O Servers

A wide range of I/O servers are available from Wonderware as well as third-party developers for hundreds of the most popular control devices, including Allen-Bradley, Siemens, Modicon, Opto 22, Square D and more. All Wonderware servers provide standard DDE communication to any Windows/DDE application as well as "fastDDE" for communication with Wonderware products. Wonderware also offers a DDE Server Toolkit that lets users develop new or proprietary DDE servers.

Intellution

•Open, Scalable and Compatible -- Expanding your FIX MMI system into a multi-node networked SCADA application is as easy as plugging a PC into your network. •Distributed, Client/Server Architecture -- All FIX products are designed for both stand-alone and networked applications. With our distributed client/server architecture, you can instantly share data across the enterprise, for faster, better-informed business decisions. •The Strategic Choice for Windows Platforms -- Because of Intellution's partnership with Microsoft and our commitment to developing high-performance solutions for Microsoft operating systems, your purchase of Intellution software is as safe and smart investment, for today and the future.

Citect

Citect systems network in the true spirit of Scalable Control Systems. Processing tasks can be distributed, multiple LANS added and redundancy built in - without replacing any hardware or software. File Server functions can be split into multiple nodes for brilliant performance in even the largest systems.

Access to Data

•Direct, real-time access to data by any network user •Third-party access to real-time data ie Access and excel •Network DDE including: Read, Write and Execute.

Database

•ODBC driver support •Direct SQL commands •Built-in dBase file access

Protocol Compatibility

•DDE servers supported •Drivers included for PLCs, DCS, RTUs, Loop Controllers, Bar Code Readers and other serial equipment •Driver or Toolkit available

6.4 Networking

Iconics

GEN-NET is an advanced networking protocol designed for the needs of real-time process control systems. It is used to connect GENESIS for Windows and GENESIS Control Series (DOS) workstations. The GEN-NET protocol provides real-time simultaneous network access to process data, alarms, file transfer, and time synchronization.

Reliable Client/Server Design

GEN-NET uses a distributed client/server architecture that can be easily expanded. This design ensures that the failure of any single node does not affect the operation of others. All data within a GFW node, whether from the RTS, scripting, I/O Server, or DDE, may be accessed by any other node. Graphic displays, reports, data loggers, and trend windows act as clients that automatically locate the data they need from the network.

Simultaneous File Transfer

In addition to real-time data, GEN-NET supports simultaneous file transfer capability. Files can be exchanged between GENESIS nodes while they are running without interfering with the important task of executing other runtime functions. Use this to copy history data to a file server, or import new graphic displays into a system without shutting down.

ICONICS offers a choice of industry standard networks which can be used to implement GEN-NET. Choose ARCNET, NetBIOS or TCP/IP implementations. The NetBIOS version supports all commonly used networks including Ethernet, Novell, Token Ring, DEC-NET, and more. All GEN-NET functions are available with all network types.

Wonderware

Wonderware Scout is a client/server Internet tool designed for visualizing industrial automation applications over the Internet and corporate Intranet implementations. Scout extends the highly graphical viewing capabilities found in InTouch and its FactoryFocus enhancement by allowing industrial users to view factory operations at remote sites simply by dialing into the Internet's World Wide Web.

Networking:
Supports any standard NetBIOS network: Ethernet, Novell, Token Ring, Arcnet, etc. DECnet, Serial and TCP/IP connectivity supported.

NetDDE

Using Wonderware's NetDDE, included with InTouch, users benefit from DDE connectivity between applications on different nodes over the network. Connectivity support is provided between Windows, VMS, and UNIX operating environments over a range of network protocols such as NetBIOS, TCP/IP, and DecNET, plus serial port communication. NetDDE enables the workstation to be a virtual gateway between network protocols.

Intellution

Distributed, Client/Server Architecture -- All FIX products are designed for both stand-alone and networked applications. With our distributed client/server architecture, you can instantly share data across the enterprise, for faster, better-informed business decisions.

View Client

View Clients are ideal for additional operator stations and engineering or configuration workstations. A View Client is networked to one or more SCADA Servers. It has complete read/write access to all data in these SCADA Servers, yet does not maintain a copy of the FIX database.

Citect

- Supports all NetBIOS compatible networks such as Netware LAN Manager, Windows for Workgroups, Windows NT
- Built-in dual network cable support provides full LAN Redundancy
- Network configuration via simple menu check box
- LAN licensing is based on the number of concurrent users logged into Citect not the number of nodes on the network
- Multi-user system with full communication between operators
- PSTN dial up RAS and WAN fully supported

6.5 Configuration/Development/Database

Iconics

Control and data acquisition functions in GENESIS for Windows are provided by the high performance Real-Time Server (RTS). The RTS scans the I/O, executes the database and control algorithms, checks for alarms, and services all data requests from the GFW applications. Its prioritized, multi-tasking kernel ensures that the most critical functions, such as I/O updates, are given the highest priority.

Configuration of the RTS is done using the Strategy Builder. It is an object oriented, icon-driven tool that graphically defines the database functions. The RTS uses advanced function block programming techniques to define all of the I/O scanning, calculation, data logging, and control tasks. These function blocks (called algorithms) are placed on the screen and edited with pop-up dialog boxes. Each algorithm has input and output signals that can be used by other blocks in the Strategy simply by drawing connections with the mouse.

Graphical configuration is the fastest way to build sophisticated control and monitoring logic, especially for non-programmers. It's also much easier to maintain and update. If you know how to draw to a flow diagram of your process, you can program it.

The Strategy Builder includes a complete library of over 60 algorithms that provide all of the functionality you need to graphically configure anything from simple MMI systems to sophisticated batch and continuous process applications. The algorithm library is what makes GENESIS for Windows so powerful. Graphical programming is what makes it so easy to use.

All functions, including math, logic, control, and alarming, are graphically programmed using these algorithms. Algorithms are selected from the menu and placed on the screen in the desired size and location.

The GENESIS for Windows Real Time Server (RTS) utilizes a prioritized, preemptive, multi-tasking kernel that insures the integrity of data coming from the plant floor. The RTS always executes its highest priority tasks first, making it so dependable and responsive that you can actually use it to control your manufacturing process from a PC! With more than 250 off-the-shelf interfaces to PLCs, Loop Controllers, and I/O Systems, GENESIS for Windows communicates with more types of plant equipment than any other MMI or SCADA package. The RTS features object oriented, graphical programming that is easy to learn and produces fast results. Configuring a GFW database is as simple as drawing a flow diagram of your process.

The Strategy Builder also features advanced error checking that detects illegal block connections and incomplete databases. Editing tools include grid, gravity, pan, zoom, copy, paste, move, and the ability to convert the Strategy into an AutoCAD DXF file. The copy and paste feature allows portions of existing strategies to be reused. A Strategy can be exported in a dBase format file for editing in other programs such as spreadsheets or databases. The modified dBase file can then be imported back into the GENESIS for Windows system.

At any time during the configuration process, hard copy printouts can be obtained with the click of a mouse. All algorithm definitions and their connections are documented in printed or ASCII file format. Nothing could be easier or faster than graphically programming and documenting your SCADA application with the GENESIS for Windows Strategy Builder!

Wonderware

Real-time Database tags can be configured as discrete, real and integer values, and strings. There is no limit to the number of each type. Utilities are included for database exporting/importing to/from spreadsheets, other databases, or editors.

Intellution

•FIX Draw Workspace -- Build your application quickly and easily from within our single, integrated Workspace environment. In FIX Draw, you can add, modify, delete, and view I/O information. Plus, you can access other system development applications like Historical Assign, Display and Recipe. •Graphic Dynamo™ Wizards -- Create dazzling displays using our library of pre-built Dynamos including pumps, valves face plates, meters, pipes, buttons and check boxes. To use a Dynamo, you simply drag it from the library and drop it into your display. Configuration is simple because Dynamos prompt you for all necessary information. •QuickDraw and QuickView -- Enjoy unprecedented speed in your screen development by instantly verifying that your screens work the way you want. •On-line Configuration --Build and enhance your application on-line without rebooting or losing any of your valuable data. •Configurable Toolbox -- Customize your toolbox so that the development tools you use most, such as snap-to-grid, align and group, are just a mouse click away. •Templates --Create sizzling screen displays is a snap when you start with our pre-built screen templates. •Command Language -- Create simple or sophisticated sequences of commands using FIX's powerful scripting capabilities.

Citect

•Extensive Online Multi-media help and Design guide •"Fill in the forms" configuration •Included Libraries of graphics symbols and templates all user expandable •Express Wizards for communications set-up •Genies for configuration of complex animation objects •Super Genies for configuration and display of repetitive plant processes, that allow common displays to be reused by different sets of variables.

6.6 Hardware/Software - System Specifications

Iconics

Information not available.

Wonderware

Hardware Specifications:
PC as required by operating system with a minimum of 8 MB of RAM

Software Specifications:
Windows for Workgroups 3.11 or Windows 95.

Intellution

●Hardware Specifications:

●Computer:
486 or Pentium-based personal computers supported by the manufacturer for Window 95 and Window NT ●Memory: 16 megabytes ●Disk Space: 200 megabytes ●Graphic Support:
VGA, SVGA, or XGA ●Mouse:
IBM or Microsoft mouse required for configuration ●Networking:
Supports the NETBIOS interface in Windows For Workgroups, Novell and IBM LAN using Ethernet or Token Ring TCP/IP and Serial

●Software Specifications:

●Operating Systems:

Windows 95 and Windows NT v3.51 and greater ●Standard Features:
Dynamos,Sample System, Distributed Networking, Object-Oriented Graphics, Historical Trending and Displays, DDE Client and Server,Batch Blocks, and Excel Macros ●Options:
Standard Process Control (SPC), Continuous Control,I/O Driver, Recipe Builder, Real-Time SQL/ODBC Interface, Software and I/O Driver Development Toolkits, and More

Citect

Information not available.

6.7 Support

Iconics

Information not available.

Wonderware

InSupport provides computer-based assistance for the troubleshooting and repair of complex processes and equipment used in manufacturing. InSupport aids in the diagnosis of equipment and process failures and then presents technical support information to factory technicians on-line, on standard personal computers instead of manuals, books and notebooks. The same multimedia information can be used for interactive training and documentation.

Wonderware's award-winning technical support staff has been rated the best in the industry. Continuing our commitment to customer support, Wonderware offers the Comprehensive Support CD-ROM (CSCD), which expands the concept of support and elevates it to new levels. The CSCD support package includes quarterly software updates, additions to the Wizards library, complete product documentation, sample applications, embedded "how-to" videos and multimedia presentations, news releases, application stories, technical support papers, solutions, and access numbers to Wonderware's Bulletin Board System (BBS).

Intellution

•QuickStart Tutorial -- With our animated, on-line tutorial, you'll quickly master all the basics of system development as you learn to create customized display screens. •On-line Help -- With a simple click of the mouse, you'll find comprehensive answers to all your automation software questions. •Treasure Chest -- Uncover our treasure chest of hot development tips that make building and optimizing your application fast and easy. •Remote Control Software Support.

Citect

On-Line Support
•Technical Assistance Centre •Training packages •Knowledge Base •Dial-in modem access •Internet Access •Ongoing software maintenance program •Application support •Engineering support

6.8 Scripting

Iconics

All modules feature full Visual Basic for Applications compatible scripting. Or let the Script Wizard write your scripts for you! Based on the world's most popular macro language, Microsoft Visual Basic for Applications, the GENESIS for Windows script language is both powerful and easy to learn. Over 600 commands are available to perform almost any function you can imagine. Use scripts to perform calculations, read and write files, SQL database interface, and much more.

For non-programmers, the ICONICS Script Wizard makes it easy. Hundreds of pre-configured actions are available for selection. Simply fill in the blanks and the Wizard will write the necessary script for you!

GENESIS for Windows features a powerful scripting language for performing calculations, key macros, or other intelligent functions. Scripting commands let you completely customize how the system responds to process changes and operator actions. The GFW scripting language and commands are based on the world's most popular macro language, Microsoft's Visual Basic for Applications. If you know Visual Basic or VBA, you already know how to write GFW scripts!

Scripts can change screens, generate reports, read and write process data, modify trends, acknowledge alarms, and even play multimedia clips. In addition to over 400 standard VBA compatible commands, there are more than 150 language extensions that support functions specific to the GFW applications. Each script may be defined to execute on a periodic basis, on operator action, time of day, or on an event.

Whether you are an experienced programmer, or just learning, the ICONICS' Script Wizard can help you create useful scripts in minutes. The Script Wizard automatically generates custom scripts based on your menu selections and fill-in-the-blank dialog boxes. With the Script Wizard, you can add powerful custom functions to your SCADA system without any programming knowledge.

The GFW Scripting language supports the concept of global variables. Data in global variables is available to all scripts. This provides a mechanism for passing data between scripts or for synchronization of scripts. Global variable data can also be incorporated into graphic displays and trends. For example, a graphic display object can be made to rotate based on the value of a global script variable. Or a trend may show the result of a script calculation.

Built-in Editor/Debugger The scripting system includes a full editing environment. The editor enables you to develop and debug your own scripts. Standard windows functions such as cut and paste allow you to take code from one script and move it to another. You can even cut and paste code from Visual BASIC applications.

The Script Editor also includes a dialog box editor and macro recorder. You can easily create custom dialog boxes that prompt the user through a series of steps or selections. Or use the macro recorder to save key strokes and mouse movement for replay.

Scripts can be run and fully tested from within the editor saving considerable debugging time. Debug tools include single step and procedure step. This allows you to execute the script one line at a time. The watch point window displays the value of selected script variables. Break points can be inserted at any point in the code. You have all of the tools you need to follow the actions of a simple script, or a complex one.

A syntax checker points you directly to any problems found in a script before you run it. Syntax is also checked when scripts are saved. All scripts are saved in separate files making it easy to use them in multiple places, or to move them from project to project.

GEN-USER is the C user task option. GEN-USER provides comprehensive C and assembly language tools that let you implement your own custom programs for execution in the Real-Time Server. Use this option whenever you need to create special functions and programs to complement the real-time control functionality of the RTS. The package includes a variety of functions and libraries supporting access to the real-time database, serial and parallel ports, and file data. A typical user task may include: optimization routines; file format conversion; read\write functions with serial and parallel ports; or batch sequences. Use of this option requires a Microsoft C compiler.

GEN-R&R is the option for handling custom Reports and Recipe storage within the RTS. This option is supported by the RTS only for compatibility with GENESIS for DOS V3.x strategies. For new systems, it is recommended that GEN-R&R functions be accomplished using the GENESIS for Windows scripting language.

Wonderware

Script Editor InTouch provides extensive scripting capability for rapid prototyping, background calculations, and simulation. Condition Scripts include On True, On False, While True, and While False. Button Scripts include On Button Down, While Button Down, and On Button Up. Window Scripts can be invoked when Opened, Closed or While Open. Data Change Scripts activate when data changes value, upon operator actions such as selecting objects, or as the result of events such as alarm conditions.

Scripting is easy. All functions are simply buttons that are adjacent to the script window. All script functions and data variables are chosen by point and click. The script editor itself has Find/Replace and Convert, and it offers up to 256 character expressions for Condition Scripts.

Script functions support logical and mathematical expressions. Users can display single precision floating point numbers, while internal calculations use double precision floating point numbers. New functions have been added such as string manipulation, math functions, file I/O, system resources, hexadecimal and scientific numerical representations. Users can also write their own script functions and add them to their script menu through the use of the Extensibility Toolkit.

The Recipe option allows users to easily create, modify and download recipes or machine set-up parameters. Process variables such as setpoints, ingredients, process limits, timing, and temperatures, are stored in a .CSV formatted worksheet and can be downloaded to the PLC based upon an event or action.

Intellution

Version 6.0 of this batch operating supervisor system offers enhanced recipe management including full version control and tracing and secured development. The planning and scheduling function has been upgraded to provide product plan tracking, created control recipes, and determine batch schedules. Report generation now automatically validated data integrity, security, and online documentation, and batch management offers real-time batch view capabilities, automatic selection of procedures, and pre-start verification.

Citect

Cicode unleashes the power of Citect. Cicode is a structured language similar to other languages such as Pascal or "C", yet you do not have to be an experienced programmer to use Cicode.

Cicode uses "basic" - like syntax and standard mathematical terminology. This means that Cicode is easy to use. A complete set of mathematical, relational and logical operators are included in the Cicode instruction set.

Welcome to Citect for Windows!

You can configure a Citect monitoring and control system to suit any industrial application. And because Citect has been designed with flexibility in mind, you can design a system to suit your exact requirements.

Citect suits both small and large applications. Because it is flexible, Citect will keep pace with your plant and information requirements as they change and expand.

I/O Optimization

•Operates on a demand basis •Supersedes the conventional predefined scan method •Automatic optimization of block data requests to PLCs and DCs •Automatic rationalization of network wide user data requests •Maximization of control vendors highway bandwidth

Applications Language (Cicode)

•Fully pre-emptive multi-threaded language •Client Server, Remote Procedure Calls (RPC) •User Written Functions •Indirect Read and Write of tags •Functions are re-usable, modular and transportable throughout the system •Full mathematical and Boolean functions •Full string manipulation •If-then-else, For-Do, While-Do, Conditional Executors •Over 500 standard Cicode functions provided •Designed especially for plant monitoring and control applications

7.0 APPENDICES

Appendix A:	Reprint from Control Engineering, February 1997
Appendix B:	Reprint from Managing Automation, June 1997
Appendix C:	Reprint from Manufacturing Systems, July 1996
Appendix D:	PLCs PLUS Internal Survey
Appendix E:	Competitive Review - Paragon TNT
Appendix F:	Reprint from InTech, May 1996
Appendix G:	Reprint from Design Engineering, June 1996
Appendix H:	Reprint from Measurements and Control, April 1996
Appendix I:	Reprint from Computerworld, May 1996
Appendix J:	Reprint from Maintenance Technology, May 1996

Process Management Software

Company	Product	Type: Advisory Control Package	Type: Alarm Management	Type: Data Acquisition/Collection	Type: MES	Type: Monitoring	Type: PID Loop Tuning/Control	Type: SCADA	Type: SPC/SQC	Operating System: DOS	Operating System: Windows 3.x	Operating System: Windows 95	Operating System: Windows NT	Operating System: Unix	Operating System: OS/2	Features: Alarming	Features: Built-in Diagnostics	Features: I/O Monitoring	Features: Multichannel Signal Conditioning	Features: On-Line Changes	Features: Scheduling	Features: Support Multiple Diagnostics	Features: Support Multiple Users	Features: Trending	Reader Service Number
BV Technologies, Inc. *(Brook Pk., O.)*	BVC ToolSet for Rapid Application Development		X	X	X	X		X	X		X	X	X			X	X	X	X	X	X		X	X	427
Canary Labs, Inc. *(Martinsburg, Pa.)*	Trend Link					X					X	X	X											X	428
Ci Technologies, Inc. *(Freeport, N.Y.)*	Citect		X	X		X		X	X		X	X	X			X	X	X		X		X	X	X	429
Control Systems International, Inc. *(Fairway, Kan.)*	UCOS Distributed Control System		X	X		X	X	X					X			X	X	X	X	X		X	X	X	430
ControlSoft, Inc. *(Cleveland, O.)*	INTUNE Mantra QuickTune						X X X	X			X		X			X		X		X		X		X	431
Cycle Software, Inc. *(Quincy, Mass.)*	LiveData Intranet		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	432
DataMyte/Rockwell Automation *(Minnetonka, Minn.)*	Quantum SPC Software								X		X	X	X			X							X	X	433
duTec *(Jackson, Mich.)*	Local Control Function Blocks			X		X	X	X			X	X	X			X		X	X						434
ExperTune Inc. *(Hubertus, Wis.)*	Multi-Channel Loop Analysis and PID Tuning PID Loop Analyzer and Tuner						X X				X X	X X	X X				X X	X X	X X	X X		X X	X X	X X	435
Facility Management Technology, Inc. *(Plymouth, Minn.)*	Report/View-Win (Historical Data Management & Reporting)	X	X	X		X			X		X	X	X					X					X	X	436
FASTech Integration, Inc. *(Lincoln, Mass.)*	SPCworks			X					X				X	X		X			X		X			X	437
Fisher Rosemount Systems, Inc. *(Austin, Tex.)*	Provox Process Automation System Delta V (Scaleable Process Automation System) RS3 Process Automation System	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	X X X	438
Foxboro Co., The *(Foxboro, Mass.)*	Data for Windows FoxAlert FoxAnalyst FoxDMM (Dynamic Maintenance Management) FoxDPM.com (Dynamic Performance Monitor) FoxEDM FoxHistory FoxSPC.com (Statistical Process Control) I/A Series Integrated Control Software	X		X X X X	X X X	X X X		X X	X		X X X X X	X X X X X	X X X X X			X X X X	X X	X	X X	X X	X X	X X	X X	X X	439
GE Fanuc Automation *(Charlottesville, Va.)*	CIMPLICITY HMI	X	X	X	X	X		X	X		X	X	X			X	X	X		X		X	X	X	440
Gensym Corp. *(Cambridge, Mass.)*	GDA (G2 Diagnostic Assistant)	X	X		X	X		X	X		X	X	X	X		X		X		X	X	X	X	441

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Process Management Software

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Hathaway Industrial Automation *(Owings Mills, Md.)*	Info/Mation Systems	X	X	X	X	X	X	X					X	X		X	X	X	X	X	X	X	X	X	442
Hilco Technologies, Inc. *(Earth City, Mo.)*	Monitrol	X	X	X	X	X	X	X	X				X	X		X	X	X	X	X	X	X	X	X	443
Honeywell IAC *(Phoenix, Ariz.)*	Scan 3000		X	X				X	X		X	X	X	X		X	X	X	X	X	X	X	X	X	444
Iconics, Inc. *(Foxborough, Mass.)*	GENESIS for Windows	X	X	X		X	X	X		X	X	X	X			X	X	X		X		X	X	X	445
Industrial Automation Technology *(Phoenix, Ariz.)*	LogMate for Honeywell TDC3000 QuickTune for Honeywell TDC3000		X					X		X	X	X				X				X X			X		446
Intec Controls Corp. *(Walpole, Mass.)*	Paragon-INT	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	447
Intellution *(Norwood, Mass.)*	FIX	X	X	X		X		X	X		X	X	X			X	X	X	X	X		X	X	X	448
IQS, Inc. *(Cleveland, O.)*	IQS Collect IQS Process	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	449
Kistler-Morse Corp. *(Bothell, Wash.)*	ROPE Inventory Software System	X	X	X		X				X						X	X	X		X			X	X	450
LSP Deeco Systems *(Hayward, Calif.)*	Power Assist	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	451
Major Micro Systems, Inc. *(Southfield, Mich.)*	AutoTrans SPC Express SPC Express for Windows							X X X	X X			X	X									X X X	X X X		452
Max Control Systems *(Lansdale, Pa.)*	MAX1000 Workstation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	453
MGE UPS Systems *(Costa Mesa, Calif.)*	Solution Pac UPS Monitoring Software	X	X									X	X	X	X	X	X					X			454
Micro Specialty Systems (Bethlehem, Pa.)	RTM3500/DSM	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	455
Minitab Inc. (State College, Pa.)	Minitab Release 11 for Windows			X					X		X	X	X												456
Modcomp (Ft. Lauderdale, Fla.)	Access Point	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	457
National Instruments (Austin, Tex.)	BridgeVIEW Lookout	X X	X X	X X	X X	X X	X X	X X	X X		X	X X	X X			X X	X X	X	X	X X	X X	X X	X X	X X	458
NetMotion, Inc. (Fremont, Calif.)	Distributed Programmable Controllers & Software	X	X	X	X	X	X	X		X	X	X	X			X	X	X		X	X	X	X	X	459

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CONTROL ENGINEERING

Process Management Software

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TA Engineering Co., Inc. *(Moraga, Calif.)*	AIMAX-Win		X	X				X	X	X	X	X	X			X		X		X			X	X	477
Taylor Industrial Software *(Edmonton, Alberta, Canada)*	Process Window TE55		X	X		X		X	X	X	X	X	X			X		X		X			X	X	478
USDATA *(Richardson, Tex.)*	FactoryLink ECS	X	X	X	X	X		X	X	X	X	X	X	X	X	X		X			X		X	X	479
User Solutions, Inc. *(South Lyon, Mich.)*	Resource Manager for Excel				X						X	X	X							X	X			X	480
VME Microsystems International Corp. *(Huntsville, Ala.)*	IOWorks Soft Logic Control Software Package	X	X	X		X	X						X			X	X	X		X	X	X			481
WE Instrumentation Ltd. *(Sutton, England)*	Westronics SmartView Paperless Chart Recorder		X	X		X					X	X	X			X	X	X							482
Wonderware Corp. *(Irvine, Calif.)*	InTouch	X	X	X	X	X	X	X	X		X	X	X			X	X	X	X	X		X	X	X	483
Zontec Inc. *(Cincinnati, O.)*	Synergy Statistical Process Control Software			X		X																			484
	Timesaver Statistical Process Control Software			X		X																			

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range of factory-floor products designed to link manufacturing operations to business management. Process Window is a graphical MMI system while TESS is a constraint-based, finite scheduling tool operating on real-time updates from the shop floor. ...RC# 194

TETRA INTERNATIONAL

Location: Houston, TX. **Product:** Chameleon 2000, CS/3. **Applications:** ERP. **Outlook:** Tetra has an opportunity to capitalize on the growth in mid-range, client/server ERP systems. It has focused on electronics and CPG companies with large numbers of international sites. Like some others, it is hoping these companies will want to standardize on a single package that can quickly be deployed in distributed sites. .....RC# 195

TSW INTERNATIONAL

Location: Atlanta, GA. **Product:** Enterprise MPAC. **Applications:** CMMS. **Outlook:** Enterprise MPAC defines a new approach to asset care with a robust client/server system designed to link users across the enterprise with financial, personnel, asset, and inventory data. Open architecture links EMPAC with third-party applications from Oracle, SAP, and PeopleSoft. TSW's Web strategy, TSWNet, adds Java applets for RFQs, supply chain management, and electronic document retrieval. .....RC# 196

USDATA

Location: Richardson, TX. **Product:** FactoryLink ECS. **Applications:** MMI, SCADA, MES. **Outlook:** USDATA has developed an open, scalable, and modular software system for building real-time industrial applications in Microsoft Windows NT. FactoryLink ECS can be used to create easy-to-use, high-speed, graphical applications from a single process to an enterprise-wide, multinational operation. Major features of the system include graphical monitoring and control; enterprise database connectivity, and a real-time engine for core functionality such as timing and counting. .....RC# 197

VISIBILITY INC.

Location: Wilmington, MA. **Product:** Visibility. **Applications:** ERP. **Outlook:** Visibility offers a powerful, graphically rich ERP program directed specifically at make-to-order and engineer-to-order environments. The Visibility software package forms a completely integrated suite which includes financial, material management, project management, cost estimating, and field service applications for customer-driven manufacturers. .....RC# 198

WONDERWARE CORP.

Location: Irvine, CA. **Product:** InTouch, InTrack. **Applications:** MES, MMI, SCADA. **Outlook:** Wonderware offers a complete suite of software products for industrial and process automation under Microsoft Windows NT. InTouch is a true 32-bit, object-oriented graphical interface. InTrack is a full-featured production management system for tracking work in process. These and other Wonderware products can be integrated into a single, tightly bundled applications suite with FactorySuite development tools .....RC# 199

CHESAPEAKE DECISION SCIENCES INC.

Location: New Providence, NJ. Product: MIMI. Applications: Finite capacity scheduling. Outlook: Chesapeake has probably done more than any single software supplier in the process industries to analyze the dynamics of the supply chain and its effects on manufacturing and distribution of chemicals, oil and gas, and formulated products. Chesapeake has a highly experienced implementation team and strong partnerships. .....RC# 111

CI TECHNOLOGIES

Location: Fairport, NY. Product: CITECT. Applications: MES, finite capacity scheduling. Outlook: CITECT is a Windows-based MMI for discrete and repetitive manufacturing. Version 4.0 makes it possible to build a high-speed automation network using PCs running any flavor of Windows, and can accommodate up to 40,000-point SCADA systems. .....RC# 112

CIMVISION

Location: Torrance, CA. Product: CIM+. Applications: MES, SPC, warehouse management. Outlook: CIMvision offers a unique combination of integrated plant-floor and warehouse solutions that collect, monitor, and control data flow. CIM+ supports a distributed client/server architecture developed with an "open" toolset supporting multiple databases and platforms.....RC# 113

CINCOM SYSTEMS INC.

Location: Cincinnati, OH. Product: Control, Control:Acquire. Applications: ERP. Outlook: After nearly 30 years as a software supplier, Cincom has staked out the highly engineered product market. Control:Acquire is designed to manage the entire sales cycle, including prospecting, product configuration, cost estimating, and quoting, and integrate it within the enterprise. .....RC# 114

CMI-COMPETITIVE SOLUTIONS

Location: Grand Rapids, MI. Product: TRANS4M. Applications: ERP. Outlook: Few ERP software vendors concentrate as completely on one manufacturing environment as CMI does on repetitive manufacturing. TRANS4M is a thoroughly integrated system for the needs of manufacturers in such industries as plastic injection molding, rubber and plastic extrusion, sand and die casting, metal stamping, and assembly. .....RC# 115

COMPUTER TECHNOLOGY CORP.

Location: Milford, OH. Product: Interact. Application: MMI, SCADA. Outlook: CTC offers one of the easiest-to-use MMI systems available, on both PCs and its own touch-screen workstations. Interact software modules are open and flexible enough to run in any combination on CTC's PowerStations. .....RC# 116

DATASTREAM SYSTEMS INC.

Location: Greenville, SC. Product: MP2 Enterprise. Applications: CMMS. Outlook: Datastream takes CMMS to enterprise level with a 32-bit, Windows NT-based, client/server asset management system which scales up easily and runs across intranets. Version 5.0 supports global inventory management, allowing control and access to multiple inventory locations and individualized reordering of equipment, parts, and supplies. .....RC# 117

DATAWORKS CORP.

Location: San Diego, CA. Products: ManFact II, DataFlo, Vantage, Vista, Enterprise Server. Applications: ERP, MRP II. Outlook: DataWorks has an unusual breadth of ERP products, from Vista, an easy-to-use Windows-based system, to Enterprise Server, a sophisticated solution offering distributed client/server computing based on object technology. Vantage is for the order-intensive mid-range manufacturer with a mix of custom and standard part orders and multilevel assemblies. ManFact II is designed for larger job shops and make-to-order organizations. DataFlo contains 32 sophisticated modules for deep ERP solution in high-volume, repetitive, and discrete manufacturing. ....RC# 118

DEMAND MANAGEMENT INC.

Location: St. Louis, MO. Product: Demand Solutions. Applications: Demand forecasting and planning. Outlook: Operating primarily in the make-to-stock as well as assemble-to-order and manufacturing distribution environments, Demand Management offers a highly functional product based on Windows NT and 95. It is capable of multisite management and consolidation, and offers workflow-enabled routing of documentation. .....RC# 119

DP SOLUTIONS INC.

Location: Greensboro, NC. Product: PMC for Windows. Applications: CMMS. Outlook: DPSI has one of the most complete CMMS solutions, using client/server technology and written in Microsoft Access. Through the Frank J. Meitz Maintenance Management Institute, DPSI does exceptional training and evangelism work for advanced CMMS, emphasizing the importance of maintenance management in the enterprise.....RC# 120

EFFECTIVE MANAGEMENT SYSTEMS

Location: Milwaukee, WI. Product: Time-Critical Manufacturing. Applications: ERP, MRP II, MES. Outlook: EMS combines enterprise planning and shop- floor control in one "preintegrated" product suite with machine tool interfaces, SPC, and engineering interfaces. EMS believes this unique strategy saves significant time in achieving returns and benefits from the software by eliminating expensive enterprise-wide system integration.....RC# 121

ENTERPRISE PLANNING SYSTEMS INC.

Location: Kanata, Ontario, Canada. Product: webPLAN. Applications: Advanced planning and scheduling. Outlook: No other company is trying to establish a manufacturing software product in the market by giving it away over the Internet. The basic webPLAN product is free, and a number of modules are available for materials planning, consolidating procurement across multiple sites, etc. EPS is firmly entrenched in real-time planning over the Web.....RC# 122

EXPANDABLE SOFTWARE

Location: Santa Clara, CA. Product: Expandable Software. Applications: ERP. Outlook: Expandable Software is extremely strong in global, repetitive manufacturing and offers one of the

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INFINIUM SOFTWARE

Location: Hyannis, MA. **Product:** Process Enterprise Resource/Planning (PERP). **Applications:** ERP. **Outlook:** Formerly Software 2000, Infinium is capitalizing on the growth in ERP for process manufacturing. Infinium offers a full range of client/server financial, HR/payroll, materials management, and process manufacturing applications. As a result, the company enjoys a 90%-plus customer retention rate.....RC# 135

INTELLUTION INC.

Location: Norwood, MA. **Product:** FIX BOS. **Applications:** MES, MMI, SCADA. **Outlook:** Intellution's FIX family of products for MMI and SCADA applications is considered one of the best engineered on the market. Intellution was one of the first out of the gate with a 32-bit Windows NT product and claims to have more 32-bit installations than all other automation software vendors combined. FIX BOS is the first PC-based automation solution to seamlessly integrate a batch manufacturer's SCADA operations with higher-level MES functions. .....RC# 136

INTENTIA NORTH AMERICA

Location: Rosemont, IL. **Product:** Movex. **Applications:** ERP. **Outlook:** Intentia offers a fully integrated business application system covering logistics, manufacturing, finance, product development, marketing, and human resources. Movex operates in make-to-stock, assemble-to-order, configure-to-order, engineer-to-order, repetitive, make-to-demand, batch process, continuous process, and manufacturing distribution. The company is devoted exclusively to the AS/400 platform. .....RC# 137

INTERACTIVE GROUP

Location: Burlington, MA. **Product:** JIT Enterprise, InfoFlo. **Applications:** ERP. **Outlook:** Concentrating on to-order manufacturing, Interactive offers two complementary products. InfoFlo incorporates a rules-based product configurator for estimating, quoting, engineering, and order processing of highly engineered products, with integrated financials in a client/server environment. JIT Enterprise System is a native Oracle-based solution for discrete manufacturers with special features for contract manufacturing such as aerospace and defense.....RC# 138

INTUITIVE MANUFACTURING

Location: Kirkland, WA. **Product:** MRP9000. **Applications:** ERP, MRP II, shop floor execution. **Outlook:** A spin-off from PRO:MAN, one of the earliest providers of UNIX-based MRP II software, Intuitive offers a completely integrated ERP/MRP solution especially suitable for small and medium-sized manufacturers. Totally Windows- and Windows NT-based, it combines MRP II functionalities with a strong emphasis on ISO 9000 quality-assurance features.....RC# 139

JBA INTERNATIONAL

Location: Rolling Meadows, IL. **Product:** System 21 Manufacturing. **Applications:** ERP. **Outlook:** JBA has founded its fully integrated ERP suite on JIT, TQM, and continuous-improvement techniques. It is completely scalable and adaptable with open, client/server, and object-oriented technologies, enhanced further by the recently released Constructor. Agile planning is also possible with a feature allowing concurrent co-product planning, which calculates the optimum production of co-products from a single manufacturing process.....RC# 140

JCIT

Location: Englewood, CO. **Product:** Demand Flow. **Applications:** MRP, MRP II. **Outlook:** The John Costanza Institute of Technology is devoted solely to the implementation and advancement of non-scheduling-based manufacturing. Its flow manufacturing techniques are used around the world to speed product manufacturing and delivery. Emphasizing kanbans, group technology, customer responsiveness, and total employee involvement, the system comes with hardware, software, and training included. .....RC# 141

J.D. EDWARDS CO.

Location: Denver, CO. **Product:** OneWorld, ERPx. **Applications:** ERP. **Outlook:** One of the fastest-growing companies in ERP, J.D. Edwards has made extensive forays into process manufacturing industries. It is leading in adoption of client/server with a migration path for users called Configurable Network Computing, an architectural foundation designed to insulate users from the technical details of client/server. OneWorld also has strong mixed-mode manufacturing capabilities. .....RC# 142

JNL INDUSTRIES

Location: Robesonia, PA. **Product:** Front Office. **Applications:** ERP. **Outlook:** JNL has one of the most complete manufacturing management systems available, with a unique, Windows-based product packaging information for the shop floor and communicating it to the proper people on the plant floor. Front Office has workflow, demand replenishment, pricing and promotion, and multicurrency capabilities. .....RC# 143

JOBBOSS SOFTWARE

Location: Minneapolis, MN. **Product:** JobBOSS for Windows. **Applications:** MES. **Outlook:** JobBOSS offers a very comprehensive business management and shop-floor control system for make-to-order and contract manufacturers. The Windows-based software handles all aspects of a job-shop environment, with both 16- and 32-bit processing. Offers full Internet support. ....RC# 144

KRONOS INC.

Location: Waltham, MA. **Product:** ShopTrac, Timekeeper/AS. **Applications:** MES, shop-floor control. **Outlook:** Kronos offered the first computerized timekeeping and attendance system in the 1980s, with ShopTrac, now a Windows product. The Timekeeper/AS Labor Data Collection module is developed exclusively for the IBM AS/400 to measure labor content of every job in-house, track work in process, allocate labor, and maintain quality control through feedback on scrap and rework.....RC# 145

LANNER GROUP

Location: Cleveland, OH. **Product:** Provisa. **Applications:** MES, finite-capacity scheduling, simulation. **Outlook:** Formerly AT&T Istel, Lanner's finite capacity software has the advantage of

The 1996 Manufacturing Systems Software TOP 50

Communicating computers, intra-office and worldwide

Kevin Parker
Editor

LOOKING AT THE *TOP 50* LISTING FOR 1996, one is struck by the realization that the true business of the top software system vendors is communications. What started out as an inventory-tracking tool has become *enterprise* resources planning (ERP). Maintenance management systems are *fully integrated* with financial and production management systems. Supervisory control is *distributed* process management. Document management systems are a *communications substrate*. Supply-chain software *shares information* that used to be hoarded. And so it goes.

That manufacturing is such a social and spiritual endeavor is what makes it so fascinating. Yes, things get made through the execution of various physical processes. But none of that could take place if it weren't for the accumulation and communication of information, all different kinds of information.

Looking at the numbers

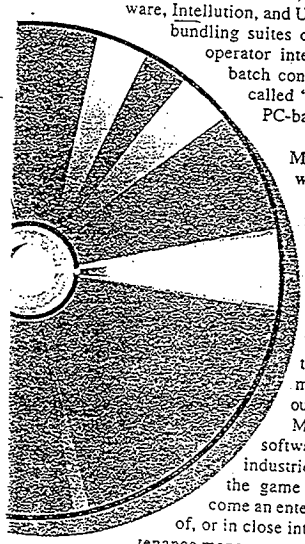
The major markets for manufacturing software systems, once CAD has been eliminated from consideration, are ERP, supervisory control, maintenance management, warehouse management, and supply-chain software. Like any list that starts with a company that has manufacturing software-related revenues of $1.3 billion and ends with a company taking in a respectable $19 million, it covers considerable ground.

The *Top 50* in 1994 included companies with software-related revenues of nearly $3 billion. In 1995, the listed revenues increased to $5.4 billion. This year, the number

is $5.6 billion. A remarkable increase, bearing in mind that the very large CAD vendors have been removed from the list.

Besides the *Top 50*, the magazine in this issue profiles 10 additional software suppliers. Of the total 60 companies, 36 are ERP vendors. The market for ERP systems is huge, and expanding. It's been said that there are as many as 250 ERP/MRP II software vendors worldwide. Market analysts speculate as to when an eventual consolidation will occur, but as new software is developed the suppliers continue to successfully differentiate themselves from one another. Eventually, this ability to specialize will result in a market that consists of many vendors that provide a specific functionality, say, order entry for consumer packaged goods, and a smaller group of "framework" providers that put together solutions consisting of basic functionality and the appropriate applets.

If you include "intelligent real-time systems" provider, Gensym, five companies profiled in the *Top 50* are primarily in the business of supervisory control. Having begun as PC-based operator interfaces, supervisory-control systems have grown to take on a range of process-management, and even production-management, capabilities. The largest vendors, Wonderware, Rockwell Software, Intellution, and USDATA have lately taken to bundling suites of products that include the operator interface, supervisory control, batch control, and what's now being called "Soft PLC," in other words, PC-based control.



Maintenance and warehousing, etc.

In years past, both maintenance management and warehousing management were marked by a plethora of small competitors. Clearly, a limited number of suppliers in each area have now been able to extend their systems' functionality, and their means of distribution, to get out ahead of the rest of the pack.

Maintenance-management software, used largely in process industries or wherever the name of the game is capital assets, has become an enterprise system used in place of, or in close integration with, ERP. Maintenance management vendors profiled in the *Top 50* include PSDI, TSW International, Datastream Systems, and Revere.

Warehouse-management systems also have become more sophisticated, able to handle push, pull, or hybrid environments, and with specific functionality appropriate to a wide range of industries and operational modes. Warehouse management companies profiled include HK Systems, McHugh Freeman, Catalyst International, and Optum Software (formerly American Turnkey). It should be noted that several ERP and supply-chain vendors are also known for their warehousing systems, including Computer Associates, Marcam, JBA, J.D. Edwards, SAP, IMI, and Manugistics.

The other supply-chain companies are a bit of a mixed bag, although one of the most interesting mixed bags you could ever hope to find. The supply-chain section includes Manugistics, IMI North America, Numetrix, and i2 Technologies. IMI's product, System ESS, is a customer-oriented transactional system, while Manugistics and Numetrix have primarily decision-support applications that use memory-based processing to do forecasting, demand planning, distribution management, plant production scheduling and planning, transportation management, and supply-chain optimization. i2 Technologies is a planning and scheduling vendor that has introduced a system for optimizing supply chains, and even multiple supply chains.

Last, but not least, three companies, SAS Institute, FileNet, and Cimlinc, are primarily concerned with document management, though their approaches vary widely.

What follows

As noted, there are actually 60 profiles included in the *Top 50* profile section. A list of the additional companies appears in a supplemental listing on page 131. In addition to that, a software directory of many other of the top software suppliers surveyed for the *Top 50* appears on page 133.

Ranking of the *Top 50* is based on revenue derived from manufacturing software in the calendar year 1995. This includes revenues associated with training, services, and support, earned anywhere in the world. Companies wishing to compete in the *Top 50* completed questionnaires that asked for 1995 total revenues, as well as revenues related to manufacturing software applications only. Some vendors could not complete the form, either because their companies are privately held or for other reasons, and have been left off the list.

The survey was conducted by Plant-Wide Research Corp., North Billerica, Mass. The task was a formidable one, calling for both organizational skills and knowledge of the manufacturing software markets.

It has proven both interesting and enlightening to watch the changes in manufacturing software companies over the last several years. The *Top 50* serves as an indication of where this very important industry is today, and where it will be going tomorrow. More importantly, the listing can serve as a tool to help managers make informed decisions involving product technologies and vendors. The company profiles are snapshots of societal efforts—at the same time both cooperative and competitive—to achieve a revolution in information technology.

Web browers, or through company Intranets. With WebMiner, users can pull data from virtually any source on the World Wide Web and have WebMiner use its intelligence to make suggestions about how that data would be useful to the operation of the business.

While most of its software is designed to improve production processes, Gensym recently released a product with a slightly different goal: the modeling and optimization of business processes. Moore says this product, called ReThink, "takes the ability to do object modeling and extends it to the entire supply chain."

He says Rethink users can put business processes into an object-based model—just as G2 users do with production processes—and let the system work out the best method of arranging those processes to improve a company's efficiency.

"Our process-level models estimate states that can be measured, such as quality or emissions levels," Moore explains. "We have taken that technology up to the enterprise level. There, we can treat supply chains like processes by estimating how various behaviors within an organization affect productivity," Moore says.

ReThink is a perfect tool for companies considering business process reengineering. Xerox Corp. used ReThink to help streamline its purchasing process, and Moore says IBM and EDS have expressed interest in having their consulting groups use it to aid their clients' reengineering efforts.

The system lets groups of managers collaborate—even from different locations—to build graphical models of a business process, then run simulations to see how the process performs under real-world conditions. "They can test different scenarios until they find the one works," Moore says. "Then they can use it as an ongoing model to monitor the process, and to diagnose problems when necessary." ■

Manufacturing Systems Software TOP 30

Ranking 1996	Company	Revenue from Manufacturing Software (in millions of dollars)	Percent Revenue from Manufacturing Software	Total Revenue (in millions of dollars)	Percent Revenue from International Sales	Ranking 1995
1	**SAP America** *Wayne, Pa./610-725-4500*	1,320	70%	1,867	70%	1
2	**Computer Associates International** *Islandia, N.Y./800-225-5224*	735	23%	3,200	50%	2
3	**Oracle Corp.** *Redwood Shores, Calif./415-506-7000*	506	14%	3,500	68%	4
4	**System Software Associates (SSA)** *Chicago/312-641-3737*	394	100%	394	66%	3
5	**J.D. Edwards & Co.** *Denver/303-488-4000*	245	72%	341	32%	11
6	**BAAN Company** *Menlo Park, Calif./415-462-8581*	216	100%	216	70%	12
7	**Marcam Corp.** *Newton, Mass./800-9MARCAM*	203	99%	204	40%	9
8	**SAS Institute** *Cary, N.C./919-677-8000*	140.6	25%	562	52%	14
9	**Intentia** *Rosemont, Ill./847-768-1300*	134	100%	134	95%	#
10	**Filenet Corp.** *Costa Mesa, Calif./714-966-3400*	130	60%	215.5	34%	#
11	**JBA International** *Mt. Laurel, N.J./800-JBA-INTL*	124	63%	197	58%	16
12	**MDIS** *Los Angeles/310-305-4000*	76	32%	240	48%	21
13	**QAD Inc.** *Carpinteria, Calif./805-684-6614*	76	67%	114	58%	19
14	**American Software** *Atlanta/800-SCM-2WIN*	62	75%	83	13%	18
15	**Cincom Systems** *Cincinnati/800-543-3010*	58	37%	157	55%	26
16	**Micro-MRP/Kewill Systems** *Foster City, Calif./800-338-6921*	57	88%	65	70%	25
17	**Wonderware Corp.** *Irvine, Calif./714-727-3200*	55	100%	55	43%	34
18	**PSDI** *Cambridge, Mass./617-661-1444*	54	96%	56	38%	32
19	**Manugistics** *Rockville, Md./301-984-5000*	53	90%	58.6	25%	41
20	**TSW International** *Atlanta/770-952-8444*	50.3	100%	50.3	28%	44
21	**Datalogix International** *Valhalla, N.Y./914-773-8000*	50.1	100%	50.1	10%	35
22	**Rockwell Software** *West Allis, Wis./414-321-8000*	48	100%	48	15%	23
23	**HK Systems** *Milwaukee/800-HK-SYSTEMS*	46	30%	155	10%	22
24	**Tetra International** *Houston/713-782-4000*	45	60%	75	90%	#
25	**IMI North America** *Tarrytown, N.Y./914-631-2700*	42	100%	42	65%	30

SOFTWARE CATEGORIES

EDI Electronic Data Interchange
ERP Enterprise Resources Planning
MES Manufacturing Execution System
MM Maintenance Management
MRP II Manufacturing Resources Planning
DM Document Management
PM Project Management
QM Quality Management
SC Supervisory Control
SCM Supply-Chain Management
WM Warehouse Management

Not ranked in 1995

For additional information, circle the appropriate number on the reader service card.

Software Categories	Major Products/Brand Names	Server platforms	Reader Information Number
ERP/MRP II	R/2, R/3	AS/400, Unix, Windows NT	1
ERP/MRP II, WM	CA-MANMAN/X, CA-PRMS, CA-KBM, CA-CAS, CA-Warehouse Boss	Mainframe, Unix, Windows NT, AS/400	2
ERP/MRP II	Oracle Applications	Unix	3
ERP/MRP II	BPCS	AS/400, Unix, Windows NT	4
ERP/MRP II, WM	OneWorld, WorldSoftware, WorldVision, Genesis	AS/400, Unix, Windows NT	5
ERP/MRP II	BAAN	Unix, Digital Alpha	6
ERP/MRP II, WM	PRISM, Proteam, Mapics XA, Maintenance Management	AS/400, Unix, Digital Alpha	7
SQC	The SAS System, JMP Software	Multiple	8
ERP/MRP II	MOVEX	AS/400	9
DM	WorkFlo	Unix, Windows NT	10
ERP/MRP II, WM	System21	AS/400, Unix, Windows NT	11
ERP/MRP II	CHESS	Unix, Digital Alpha	12
ERP/MRP II	MFG/PRO, MFG/NT	Digital VAX, Unix, Windows NT	13
ERP/MRP II, SCM, WM	Supply Chain Management, Supply Chain Planning	AS/400, Unix, IBM mainframe	14
ERP/MRP II	CONTROL	Midrange, Unix, Windows NT	15
ERP/MRP II	MAX	Wiedows NT, Windows 95, 3.X DOS	16
MES, SC	InTouch, InTrack, InBatch, InSupport	Intel 486/Pentium, Digital Alpha, Unix	17
MM	MAXIMO Enterprise, MAXIMO Advantage	Unix, PCs	18
SCM	Supply-chain planning and scheduling products	Unix, Windows NT	19
MM, DM	Enterprise MPAC, Curator	Unix, Windows NT	20
ERP, MRP II	GEMMS, CIMPRO	Unix	21
SC	Control View, WINtelligent series	Intel PCs	22
MES, WMS	PLANTMASTER SOLUTIONS, STOCKMASTER, Integrated System Software, ECS, System II	Unix, Intel PCs	23
ERP/MRP II	Tetra CS/3	Unix, Windows NT	24
SCM, WM	System ESS	Unix	25

SERVER PLATFORMS

Different versions of Unix run on various hardware platforms; server platforms are indicated except for PC-based systems.

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Software TOP 50

Ranking 1996	Company	Revenue from Manufacturing Software (in millions of dollars)	Percent Revenue from Manufacturing Software	Total Revenue (in millions of dollars)	Percent Revenue from International Sales	Ranking 1995
26	**Symix** *Columbus, Ohio/614-523-7000*	41.7	97%	43	11%	31
27	**McHugh Freeman** *Waukesha, Wis./414-798-8600*	40	100%	40	20%	#
28	**BBN Domain** *Cambridge, Mass./617-873-5000*	39	18%	215	35%	33
29	**Intellution** *Norwood, Mass./617-769-8878*	38	95%	40	55%	40
30	**Kronos Corp.** *Waltham, Mass./800-225-1561*	37.5	30%	125.6	6%	36
31	**Fourth Shift Corp.** *Minneapolis/510-866-0111*	37.2	100%	37.2	28%	27
32	**Ross Systems** *Atlanta/404-851-1872*	36	55%	65.6	45%	28
33	**Consilium** *Mountain View, Calif./415-691-6100*	34.6	100%	34.6	35	39
34	**Datasul** *Atlanta/404-237-2229*	34	100%	34	95%	#
35	**Interactive Group** *San Diego/619-560-8525*	33	100%	33	38%	38
36	**DataWorks Corp.** *San Diego/800-413-2797*	31.5	100%	31.5	3%	42
37	**Numetrix** *Toronto/416-979-7709*	31	100%	31	30%	#
38	**Pivotpoint (formerly Spectrum Assoc.)** *Woburn, Mass./617-932-0932*	30	88%	34	15%	37
39	**Effective Management Systems (EMS)** *Milwaukee/414-359-9800*	29	100%	29	3%	47
40	**USDATA** *Richardson, Texas/214-680-9700*	28.4	64%	44.4	40%	43
41	**Gensym Corp.** *Cambridge, Mass./617-547-2500*	28	100%	28	44%	51
42	**Premenos Corp.** *Concord, Calif./510-602-2000*	25.5	100%	25.5	10%	53
43	**Friedman Corp.** *Deerfield, Ill./847-948-7180*	24	100%	24	12%	52
44	**Visibility** *Wilmington, Mass./508-694-8000*	23	100%	23	20%	54
45	**Cimlinc** *Itasca, Ill./708-250-0090*	22	100%	22	10%	49
46	**Lawson Software** *Minneapolis/800-477-1357*	21.7	26%	84.6	15%	#
47	**Catalyst International** *Milwaukee/414-352-5800*	21	100%	21	30%	#
48	**Syspro Group** *Santa Ana, Calif./714-437-1000*	20.4	80%	25.4	64%	55
49	**Datastream Systems** *Greenville, S.C./864-422-5001*	20	100%	20	11%	#
50	**i2 Technologies** *Irving, Texas/214-860-8000*	19	73%	26	8%	#

Not ranked in 1995

SOFTWARE CATEGORIES

EDI Electronic Data Interchange
ERP Enterprise Resources Planning
MES Manufacturing Execution System
MM Maintenance Management
MRP II Manufacturing Resources Planning
DM Document Management
PM Project Management
QM Quality Management
SC Supervisory Control
SCM Supply-Chain Management
WM Warehouse Management

For additional information, circle the appropriate number on the reader service card.

Software Categories	Major Products/Brand Names	Server platforms	Reader Information Number
ERP/MRP II	Symix	Unix, PC-MS/DOS	26
WM	DM Plus	Unix	27
DM	RS/series, Cornerstone, Starfire, Prove, Patterns	Unix, Windows 3.1, Windows NT, Windows 95	28
SC, MES	FIX MMI, FIX, FIX BOSS, PLANT TV	Windows, 3.X, Windows NT, Windows 95	29
MES	Shoptrac, Timekeeper, Datakeeper	Unix, Open VMS, AS/400, PCs	30
ERP/MRP II	Manufacturing Software System	Intel-based platforms	31
ERP/MRP II	Renaissance CS Manufacturing	Digital VAX, Unix	32
MES	WorkStream DFS, Flowstream	Unix, Digital UMS	33
ERP/MRP II	Datasul EMS	Unix	34
ERP/MRP II	InfoFLO, JIT Enterprise System	Unix, Windows NT	35
ERP/MRP II	DataFLO, MAN-FACT-II	Unix	36
SCM	Supply-chain planning and scheduling products	Multiple	37
ERP/MRP II	Point Man, Minxware, GrowthPower	Unix, Windows NT	38
ERP/MRP II, MES	TCM-EMS, TCM-MES, TCM-SFIS	Unix, Windows NT	39
SC, MES	FactoryLink Enterprise Control Systems, VisualLink	Unix, Windows NT, Windows 95, OS/2 Warp	40
SC, MES	G2	Unix, Windows NT	41
EDI	Templar, EDI/400, EDIfe	Unix, AS/400	42
ERP/MRP II	HFA To-Order Manufacturing System	AS/400, Windows	43
ERP/MRP II	Visibility	Digital OpenVMS, Unix	44
DM, MES	CimLinc Business Process Execution Solutions	Unix, Windows NT	45
ERP	Open Enterprise, Financials, HR, Distribution, Materials Mgmt.	AS/400, Unix	46
WM	Catalyst WMS	Unix	47
ERP/MRP II	Impact Award, Impact Encore	Unix, Windows NT, Novell Windows for Workgroups	48
MM	MP2, MaintainIt	Unix, PCs	49
SCM	Rhythm	Unix, Windows NT	50

SERVER PLATFORMS

Different versions of Unix run on various hardware platforms; server platforms are indicated except for PC-based systems.

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A far-reaching impact

Microsoft Windows NT gains favor with supervisory-control vendors, users

Jim Fulcher, Senior Editor

Over the past several years, Microsoft Windows NT has figured prominently in the product development plans of process-automation and control vendors. Of those vendors profiled in this section, one recently received a technical innovation award from Microsoft, while another has gone so far as to declare Windows 95 and NT to be *the* environment of the future.

Driven by an awareness of the increasing functionality of Microsoft's products, not to mention customer demand for Microsoft-compatible applications, supervisory-control vendors have been on the Microsoft bandwagon for quite some time. It's been big business, and there are no indications it will slow down anytime soon.

Supervisory-control systems—originally conceived of as PC-based operator interfaces for processes controlled by programmable logic controllers (PLCs)—have evolved far beyond process monitoring and data acquisition. Today, applications include managing production and manufacturing execution.

As has been seen in numerous other technology market segments, as microprocessor power becomes more readily available, the cost of the systems decreases. By combining reduced prices with richer functionality, new supervisory-control applications continue to arise.

In industrial-control applications, PCs typically have been used for operator interfaces, controller configuration, and data acquisition. Citing a lack of robustness, reliability, and security, manufacturers historically have been hesitant to use PC platforms for mission-critical applications.

That's where Microsoft entered the picture. Once some initial bugs were ironed out, Windows NT has caused many manufacturers to reevaluate their concerns about PCs and the shop floor. NT's multitasking, high levels of security, and memory and crash protection have done much to soothe those worries. And with Windows, Windows 95, and other Microsoft products continuing to set the standard for office applications, using Windows NT for the shop floor makes sense because it naturally integrates with those other applications.

The first four companies profiled—Wonderware, Rockwell, Intellution, and USDATA—are the most successful companies in a very successful market.

The fifth company profiled, Gensym, is one of the successful vendors of what has been called "artificial intelligence" in production environments. When used in manufacturing, Gensym's "intelligent real-time" system's software is most often used to monitor and manage production processes.

17 Wonderware Corp.

Some growing pains

After sailing along smoothly since launching its InTouch supervisory-control package in 1987, Wonderware Corp. appeared to hit rough waters last year. Despite a 54-percent increase in revenue, the company closed its books on 1995 with a net loss of $14.3 million. Its stock price fluctuated wildly as well, rising as high as $42 and falling below $13 over the course of the year.

Despite these outward appearances, a close look inside Wonderware's Irvine, Calif., headquarters reveals not so much a company in dire straits, but one working to establish a new identity. "What we've experienced this past year is typical of what happens when an entrepreneurial company reaches critical mass and is forced to grow up," says Don Allen, Wonderware's director of public relations. "This is our adolescence."

In other words, recent management changes at Wonderware are not much different than what happens at any fast-rising

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startup that becomes a mature corporation. Last November, Wonderware's principal founder, Dennis Morin, retired as chairman and CEO. Both titles, as well as the mantle of president, are now held by Morin's hand-picked successor, Roy Slavin, former CEO of Siemens Industrial Automation.

In true adolescent fashion, Wonderware no longer wants to be seen as a company dependent on a single product. Instead, it wishes to be known as a first-rate provider of an integrated suite of factory automation tools. To that end, the company has unveiled The Wonderware Factory Suite, a group of five products designed to control and execute manufacturing processes, in addition to aiding in the maintenance and repair of manufacturing equipment.

Allen says Wonderware's original management team had long dreamed of taking the company in this direction, "but they also knew they didn't have the big company experience to pull it off." Thus, the selection of Slavin to head a new management team. Allen says Morin felt the combination of Slavin's experience at running a large industrial automation company and the skills he exhibited during several years he spent acquiring and turning around troubled companies would prove handy in leading Wonderware into a new era.

The original management team actually started Wonderware on its present course in 1994, when it purchased Rubicon Technology of Mountain View, Calif., and its product for automatic troubleshooting and repair of manufacturing equipment. That was followed by the June 1995 acquisition of EnaTec Software Systems, of Cupertino, Calif., developer of a manufacturing execution system (MES). Two months later, Wonderware bought York, Pa.-based Soft Systems Engineering (SSE) and its product for controlling batch-production processes.

These were all logical moves for a company seeking products to complement its highly successful InTouch package, but Allen says Wonderware's goal was to make these products fit a common architecture. Once that was done, he says, it was time to announce the Factory Suite. The suite consists of the following products: InTouch, Wonderware's original supervisory-control package; InTrack, an MES component based on the product purchased from EnaTec; InSupport, an automatic equipment troubleshooting and repair package derived from the Rubicon Technology system; InBatch, a system for modeling and controlling batch-oriented production processes modeled on the system acquired from SSE; and DDE Servers, input/output devices that facilitate data sharing between InTouch and factory-floor control devices. Allen says Wonderware now is working to make all of the products compatible with a plant-floor database product called Prealism that was purchased last December from Professional Technology Management Ltd. of South Africa.

Despite all the changes, there is one part of its original heritage that Wonderware wants to keep: its identification as a Windows-based solution provider. Much of InTouch's original success has been attributed to its status as the first industrial application to run on Windows. The Factory Suite is designed to run on Microsoft's BackOffice family of server products. And Allen says Wonderware hopes to take the Microsoft tradition a step further. "Eventually, we want to offer the entire Factory Suite on a single CD, and sell it the same way Microsoft sells BackOffice," Allen says.

If that strategy works, Wonderware's earnings and stock price, both of which already have begun to rebound, should continue rising for some time to come.

22 Rockwell Software

On a virtual roll

Although it happened less than two years ago, the creation of Rockwell Software from the merger of the Allen-Bradley Co.'s software business with ICOM Inc. seems almost like ancient history. That's mainly because the melding of the two companies' management structures and product lines was a fairly smooth process.

The company now is neatly organized into four strategic business units. The Programming unit is responsible for products used to program PLCs and related equipment; the MMI group handles supervisory-control and data-acquisition products; the Communications group develops software to facilitate data sharing between shop-floor control and higher level systems; and the Components group creates specialized packages that manufacturers can use to develop their own custom applications.

With this structure in place, Rockwell Software is concentrating on maintaining its leadership position in the process-automation marketplace. That has generated tremendous activity on the "virtual campus" created through electronic links between the company's dual headquarters in West Allis, Wis. and Highland Heights, Ohio.

Each Rockwell Software business unit has released at least one series of new products within the past year, all of them designed to run in the Windows environment. "We believe Windows NT and Windows 95 is the environment of the future," says Mark Moriarty, Rockwell Software's commercial marketing manager, in explaining the new product blitz. "That's where we have to be if we want to stay leading-edge and give customers better tools to do their jobs."

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Moriarty says Rockwell Software is particularly proud of the new products from the Components and MMI groups. The MMI products are led by a package called RSView, a supervisory-control system designed for the Windows NT and Windows 95 platforms. The features in RSView include an alarming function that allows the user to monitor process incidents, trending capabilities for real-time plotting of process-information trends, and an event detector that triggers system commands based on the occurrence of certain events, which can be defined by the user. RSView is complemented by another new MMI group product, RSTrend. This package displays real-time and historical data simultaneously, expanding the capabilities for process monitoring, data analysis, diagnostic troubleshooting, data reporting, and even regulatory compliance.

The Components group released a family of products under the name RSTools. These products, built in compliance with Microsoft's ActiveX component architecture, are specially designed software packages that allow users to create custom applications using Microsoft development tools like Visual Basic and Access. RSTools include programs for creating everything from custom gauge controls to special data comparison applications. Because they are based on the ActiveX technology, Moriarty says, programs created with RSTools can be made to freely interact with applications not created by Rockwell Software.

The Rockwell Software Communications group has a new family of products, called RSLinx, that facilitates data sharing between all Rockwell Software applications as well as third-party applications that use Microsoft's DDE utility. The latest releases from the Components group are Windows-based programs for programming Allen-Bradley SLC 500 and MicroLogix processors.

Moriarty says the underlying structure of all these products allows manufacturers to, in effect, construct their own process-automation networks. He says it also proves that Rockwell Software is "not focused on just providing products, or groups of products. We are looking to provide solutions."

29 Intellution

Just rolling along

Though it has been part of Emerson Electronic for more than a year, not much has changed at Intellution. The Norwood, Mass., company continues to churn out leading-edge process-automation and control software, and manufacturing companies around the world keep gobbling it up.

Intellution sells a complete suite of factory automation and control software. The suite starts with the FIX package, a client/server system that provides everything from data collection to monitoring and control of production processes. The system provides graphical displays for things like historical trending, and has various options for setting alarms to alert production managers of situations that warrant their attention. Other products in the suite are FIX MMI, a man-machine interface product for viewing production operations and conditions; FIX BOS, a recently released product for monitoring and controlling batch-oriented production in the process industries; and PLANTTV, a graphics-based system that lets plant managers check the status of any operation within an organization, even at remote sites, at any given time.

Intellution posted record revenues in the second quarter of this year, a 44 percent increase over the same period last year. Those revenue numbers were fueled by a 50 percent increase in product shipments over the second quarter of 1995, with the latest release of FIX leading the way. The market also has responded well to the December 1995 release of FIX BOS.

Intellution® Intelligent Solutions

James Blaschke, Intellution's vice president of sales and marketing, attributes Intellution's current success to "the market's rapid adoption of 32-bit computing environments." Thirty-two bit computing is a synonym for Windows NT and Windows 95. Intellution began building its products for those environments in 1993, and it appears customer demand for those systems finally has materialized. Blaschke says Intellution's latest releases "have not only exceeded our revenue and profit goals, but they have brought on accolades from our peers and the press."

The accolades include Intellution's recent selection as winner of Microsoft Corp.'s Leonardo Medal for Technical Innovations in Manufacturing. The award was based on implementation of a process-monitoring and control system at a Chevron plant that combined Intellution applications with Microsoft products, including Microsoft's BackOffice server suite.

Intellution president and CEO Stephen Rubin says the award "solidifies our leadership role in the industrial automation software market, and we intend to extend that leadership by continuing to convert technology into world-class manufacturing solutions to enhance our customers' competitiveness."

40 USDATA Corp.

Growing in all directions

Any way you look at it, this has been a year of growth for Richardson, Texas-based USDATA Corp.

The pattern started last August, when its ownership base was increased through an initial public offering. The money raised by selling those first shares of stock was then used to augment nearly every phase of the company's operations.

The product development budget grew by 40 percent, with much of those funds used to complete a major expansion of FactoryLink, USDATA's flagship factory-automation toolset. Forty new people were hired to provide additional technical support for the expanded product line and to staff two new worldwide support centers—one at the Richardson headquarters and another in Europe. USDATA also heightened its public profile through greater use of advertising and more aggressive marketing strategies, including formal marketing alliances with companies like Microsoft, Sun Microsystems, and Siemens Industrial Automation. Finally, the company increased its sales staff and started placing more emphasis on international sales.

While all these moves are critical to the future of USDATA, the one that probably is most important to its customers and potential customers is transformation of its FactoryLink product. In keeping with its new high-profile marketing style, USDATA unveiled this product at a joint press conference with Microsoft at the National Manufacturing Week trade show in Chicago this past March. Called FactoryLink ECS, it figures to broaden USDATA's market.

USDATA®

Up to now, FactoryLink has been used by companies seeking to build supervisory-control and data-acquisition systems. But with the enhancements included in FactoryLink ECS, the product can be used to build and control manufacturing execution systems as well.

John Keenan, USDATA's vice president of worldwide marketing, says FactoryLink ECS is a reflection of manufacturers' desire to "move away from automating single functions, and look more toward corporatewide, or enterprisewide, control architectures." Keenan says USDATA focused on four key areas in making sure that FactoryLink ECS would, indeed, allow users to build systems that could be deployed across an enterprise. These areas are: system power, ease-of-use, compatibility with multiple operating platforms, and a strong USDATA support organization.

The most exciting upgrade from a technical standpoint relates to ease-of-use. USDATA addressed that issue by creating a set of tools it calls Power DragOns.

These essentially are application objects that users can pull from a USDATA object library, or create for themselves using the FactoryLink software. They then have the ability to reuse the objects—by dragging and dropping them—to expand an existing application or begin creating a new one. Keenan says early studies have shown that use of Power DragOns cuts typical application-development time in half.

While it expects big things from FactoryLink ECS, Keenan says this product is just one part of USDATA's strategy for offering enterprisewide automation systems. USDATA also offers a warehouse-management system called TrakLink and a warehouse application-development tool called VisualLink, in addition to selling automatic data collection hardware.

Keenan says the company plans to combine FactoryLink ECS with its other products "to offer an integrated suite of software tools, applications, hardware, and services for companies looking to build complete manufacturing and distribution systems."

41 Gensym Corp.

Enterprise control

Sometimes its difficult to tell whether Gensym Corp. is a commercial software developer or a private research laboratory. That's because the Cambridge, Mass., company consistently finds practical uses for a class of technology that shows up more often in science fiction movies than it does in the business world. Gensym's entire product line is built on the use of expert systems, or as Gensym's president, Dr. Richard Moore, prefers to call them, "intelligent systems."

Gensym's systems start with its flagship G2 package, which really is more an environment in which users employ intelligent software to build their own systems for automating and controlling production processes. Most G2 users build interfaces for controlling shop-floor systems or production processes, but it also has been used to create manufacturing execution systems. G2 is supported by a variety of products that not only allow users to execute and control production processes, but optimize them as well.

The supporting products include G2 Standard Interface, a communications program that facilitates smooth passing of data between various applications and databases; Telewindows, an interactive interface program that lets multiple users view and work with G2 applications simultaneously; G2 Diagnostic Assistant, a system that allows production workers to build applications to improve their work processes; and Dynamic Scheduling Package, a program for creating and adjusting schedules of complex operations. A new product from Gensym, NeurOnline, offers an environment for building automated production processes with neural-network technology.

Gensym
Intelligent Real-Time Systems

Gensym also is taking its technology to the Internet with two new products called G2 WebLink and G2 WebMiner. WebLink provides a means for users to access and use the tools available in the G2 environment through World Wide

Attachment 4: PLCs Plus Internal Survey

The following data resulted from a survey conducted internally at the offices of PLCs Plus, polling several of the systems integrators on staff:

ATTRIBUTE	WW	GFW	FIX	DACS GFW	DACS FIX
System Requirements	3	3	3	3	3
Operating System	3★	2†	5	5✱	2
Ease of Learning	4	2	3	3	2
Help/Tech Support	5	4/3	4	4	4
Graphic Development	4	3	4	4	3
Tools/Scripting	3	4	3/4	N/A	N/A
Trending	3	4	4	4	3
Drivers	2 (DDE)	3	4/5	N/A	N/A
Data Sharing	3	3	4	N/A	N/A
Flexibility (Expansion)	*	Keys/Driver Seperate	(*)	N/A	N/A
Networking	2	3	5	4/5✿	4
Alarming	4	3	4	N/A	N/A
Reliability	4	2	5	3	5

Notes:

Scale: 5 = Best, 1 = Worst

★ - No O.S. portability
✱ - If keep strategy
† - No NT / RTS-DOS
* - I/O pts internal, Drivers separate, internal blocks count
(*) - I/O pts, drivers separate } scalable
✿ - If ACRNET

While "surfing" the web for "Hits" related to the four software packages, the following was obtained:

Wonderware - 7,300 Intellution - 3,950 Iconics - 258 CiTect - 256

Competitive Review - Paragon TNT
July 15, 1996

Overview

Paragon TNT is from Intec Controls - Walpole, MA. Paragon was first introduced as Paragon Control in 1986 as a DOS based package. The name was later changed to Paragon 500/550 around 1990. Control and 500/550 were DOS based only and there are approximately 8,000 DOS packages installed worldwide.

Paragon TNT came out in 1993 as OS/2 only. In late 1995 it was released on Windows NT and just recently it was released on Windows 95. There have been approximately 3,000 Paragon TNT packages sold with about 75% of them being OS/2. Paragon was never released for Windows 3.1 or Windows for Workgroups.

Paragon TNT Architecture

The Architecture is broken down into 3 major server subsystems and a Client subsystem: Process I/O (PIO), Continuous Strategy (CS), Data Manager (DM) and the Operator Interface (OI) client. The 3 servers and the OI client communicate to each other via the Common Resource Access. This CRA is the proprietary backbone that allows the communication between the servers and client. The CRA can be distributed over a network. This architecture is what Intec calls Functional Software Architecture (FSA). FSA is not an industry standard, the name was made up by Intec.

The 3 servers can be on one node or distributed over a TCP/IP or NetBios . In both the standalone application and networked application each server has its own configuration and database files. You cannot add blocks to the database files and have those changes start scanning. The server must be brought down and restarted before any changes start scanning. In order to pass data from the PIO server to the CS server you must import (duplicate) the PIO database into the CS database.

Process I/O Server Subsystem

The PIO server allows the communication to PLC's and control devices. The server uses TNT Engines (Drivers) for the control. Intec writes the major portion of their drivers and they do not promote third party drivers. The driver list is limited to the common PLC's and control devices: Allen Bradley, Modicon, Opto, etc.

The PIO provides:

- Signal Conditioning
- Alarming with 4 different alarm levels (LoLo,Lo,Hi,HiHi).
- Block read/writes
- Diagnostics

There is a driver development kit, however, there is no training offered for this toolkit.

Continuous Strategy Server Subsystem

The CS server executes the continuous control of the process. The library includes math, Boolean, discrete & supervisory control, and ASCII string functions.

This server is the heart of Paragon. It has a graphical interface for connecting blocks. The database has a layering concept. Function blocks are grouped together inside process blocks. There is a limit to how much each process block can hold that is based on the type of function blocks.

Function blocks are linked together with a connecting line and process blocks are linked together with a conduit. Each interprocess connection inside a conduit must be configured. Interprocess connections must also have terminators. Here is an example: Make one connection from an Analog Input Block in Process A to a Math Block in Process B and run it. First configure the analog input block and a terminator block, then draw a line from the analog input block to the terminator block. Now inside the other process block, configure the math block and another terminator and draw a line from the math block to the terminator block. Now draw a conduit from process A to process B and configure the conduit to connect the two terminators. In order for the two new blocks to start scanning you need to first save and compile the database, and then restart the server. For large databases this compile can take up to 15 minutes.

The majority of the CS function blocks are continuously scanned at a scan time. Also there is no timer block in the CS. To measure time you need to build a chain of 3 blocks.

When TNT was first released and until the NT version, the CS was still a DOS application.

Data Manager Server Subsystem

The Data Manager server stores historical and real-time data from the CS and PIO servers. The DM is also a place holder for all alarms and system, and operator events.

Each storage area (block) must be configured using the Data Manager Builder, and like the CS you cannot add block on scan without restarting the server.

The Relational Database Interface is also a function of the DM. There is a SQL/ODBC interface, however the building of the SQL commands is very difficult and there are no short cuts for entering the commands. Intec provides ODBC drivers for their OS/2 version. The list includes Dbase, DB2/2/, Oracle, SQL Server and Text. For the NT and 95 versions you must provide the driver. On NT and 95 Intec does not publish any testing with any Database or driver. There have been some problems with even the Microsoft 32 bit ODBC drivers.

Operator Interface Client Subsystem

The Operator Interface Client is for creating and running the displays. With the OI you can provide Data Display & Entry Boxes, Real Time and Historical Trends, Alarm and Event Journals, Bitmaps and Presentation Manager GUI Objects such as List Boxes, Radio & Push Buttons, and Sliders. Animation of objects is also supported by the OI.

The bitmaps do not become a part of the display and are very slow in opening a display. The alarm summary journal has no color or blink configuration for the Text messages. The Library of common valves and pumps is very limited.

String Handling

ASCII string data collection is done directly into the CS and can bypass the PIO. While Intec promotes being able to collect ASCII data without an I/O driver as a feature, if the string messages are short and do not require any acknowledgment, this is a nice interface. If the string messages are complex you need to develop a driver to handle the I/O.

All string blocks are event based.

Microsoft 32 bit compliant

TNT has only been on a Microsoft Windows platform since late 1995 and only under NT and 95.

Intec came out with the NT release first and shortly after that they released the 95 release. The first 95 release was actually separate code. There is no documentation stating that Paragon runs as a service under NT.

Miscellaneous Information

The DDE link is a client link and there are no macros that come with the package. There is also no recipe builder or SPC. Redundancy configuration under TNT is also a problem. There is no published write up detailing any redundancy for Paragon TNT. Lastly, the DOS release 500/550 cannot interface to TNT. Paragon TNT uses a Rainbow protection key for copy protection.

Pricing

Paragon TNT is broken down into builder and enablers for runtime functionality. To develop a 256 point networked node with DDE, Alarm, Trending, one Driver and all Subsystem Builders the price is $9,500 list. The same configuration as a Stand Alone node would be around $6,900 list. This configuration as unlimited I/O points would be an additional $1,800. (Contact your Inside Sales Engineer for a Price List).

Summary

Paragon TNT for Windows NT and 95 is just about a year old and the driver list is very limited as well as the functionality compared to FIX.

Intellution's Inside Sales Department has a complete literature package with pricing for Paragon TNT, along with a full and limited demo package with documentation.

- Intellution Inside Sales.

Paragon TNT Price List

U.S. Pricing – Effective with V3.2 Release

How to Specify Your Order

For each computer (stand-alone or network node) which will run Paragon TNT, you must specify one of the following combinations of TNT products:

- Some number of Enablers and one or more Builders (a Full System)
- Some number of Enablers only (a Runtime System)
- One or more Builders only (a Builder System)

Keep in mind that you can run only one TNT product at a time on a single computer.

Enablers:

Enablers determine the number of Runtime TNT Clients, Servers, and related Options you can run concurrently on a single computer. Each TNT Client, Server, and Option requires a specific number of enablers. You must purchase at least the total number of enablers required to activate all of the Runtime Clients, Servers, and Options your application requires. Note that whatever the number of enablers you purchase, you will still receive *all* of the available TNT Clients, Servers, and Options. The enabler system allows you to change the configuration of your TNT package before system start-up by exchanging one Client, Server, or Option with another of equal or lesser "enabler value". For example, you could enable a Process I/O Driver (3 enablers) for a particular application, and then later disable the driver and enable the DDE Client Link (2 enablers) for a different application. Enablers are sold in bundles called "EPAKs", specifying the number of enablers required, e.g., EPAK*32* (see next page).

Builders:

Builders are the tools required to build specific applications for each of the TNT Clients and Servers. You must specify in your order which Builders will be required for each computer. Builders are not governed by enablers, i.e., you cannot "disable" a builder and enable something else. Each Builder is available in two different versions: Builders for stand-alone applications, and Builders for networked applications. An application built with a networked Builder will run in stand-alone mode, but applications built with a stand-alone Builder will not run in a networked environment.

Pricing Examples

The following pricing examples describe the amount of enablers and types of Builders required for a stand-alone application and a networked application. Please see the next page for a listing of all Clients, Servers, and Options, their enablers, and prices.

Example #1

The application requires a stand-alone graphical operator interface which acquires and displays data from 60 I/O points originating from a single brand of PLC. Trending and data logging is also required.

Required Subsystems/Options		# of Enablers
OI	Operator Interface Client	4 enablers
PIO-64	Process I/O Client - 64 points	0 enablers
PIO-D	One PIO driver	3 enablers
DM	Data Manager Server	0 enablers
DM-HST	History Option	4 enablers
	Total Required:	11 enablers

For a Runtime-only System, order: EPAK11[1] = $2200

Builders Required for Development		Price
OIB-S	Operator Interface Builder - Stand-alone	$ 700
PIOB-S	Process I/O Builder - Stand-alone	$ 350
DMB-S	Data Manager Builder - Stand-alone	$ 350
		$1400

Full System Order: EPAK11[1] @ $2200 + Builders @ $1400 = $3600

[1]While this EPAK would be sufficient to run the application, we strongly advise that "extra" enablers be purchased to allow for unforeseen application requirements.

Example #2

The application requires a fully networked TNT node with full operator graphics, access to several hundred I/O points from a PLC network, trending and data logging, math computations on acquired data, and the ability to transfer data to third-party applications via DDE.

Additional Subsystems/Options		# of Enablers
OI	Operator Interface Client	4 enablers
PIO-512	Process I/O Subsystem - 512 points	6 enablers
PIO-D	One PIO driver	3 enablers
DM	Data Manager Server	0 enablers
DM-HST	History Option	4 enablers
CS	Continuous Strategy Server	2 enablers
DDE-L	DDE Client Link	2 enablers
NAO-N	Network Access Option	6 enablers
	Total Required:	27 enablers

For a Runtime-only System, order: EPAK27[1] = $5400

Builders Required for Development		Price
OIB-N	Operator Interface Builder - Network Apps	$1050
PIOB-N	Process I/O Builder - Network Apps	$ 700
DMB-N	Data Manager Builder - Network Apps	$ 700
CSB-N	Continuous Strategy Builder - Network Apps	$1050
		$3500

Full System Order: EPAK27[1] @ $5400 + Builders @ $3500 = $8900

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Paragon TNT Runtime Clients, Servers, and Options

Operator Interface Client

Process graphic display and operator interaction.

Product	Description	Enablers Required
OI	Operator Interface Client	4

Process I/O Comms Server

Interface to I/O hardware, basic signal conditioning and alarming. Select one server option and one or more driver options.

PIO-64	Process I/O Server — 64 Points	0
PIO-256	Process I/O Server — 256 Points	3
PIO-512	Process I/O Server — 512 Points	6
PIO-2048	Process I/O Server — 2048 Points	9
PIO-UL	Process I/O Server — Unlimited Points	12
PIO-D	Process I/O Driver (each PIO type - Intec or user developed)[2]	3

[2]Requires PIO-64, PIO-256, PIO-512, PIO-2048, or PIO-UL. 3rd-party license fee required for TCS LIN ($1000) and Allen-Bradley Ethernet ($500-OS/2 only); 3rd-party software required for Siemens H1, Siemens L2, Siemens Teleperm M, Allen-Bradley Ethernet (NT/95 only), and Modbus Plus (NT/95 only) (contact Intec).

Continuous Strategy Server

Functions for computation, supervisory and direct control, and string handling.

CS-1500	Continuous Strategy Server—1500 (maximum of 1500 function blocks). Includes Computation Blocks.	2
CS-UL	Continuous Strategy Server—Unlimited (unlimited number of function blocks). Includes Computation Blocks.	5
CS-SUP	Supervisory Block Option[3]	2
CS-STR	String Block Option[3]	5
CS-UB	User Block Runtime Link[3]	2

[3]Requires CS-1500 or CS-UL. Refer to the back page for the function blocks contained in each option.

Data Manager Server

Data collection and reduction, alarm and event management, relational database/SQL support, and historical and real-time trends.

DM-500	Data Manager Server—500 (maximum of 500 functions, from options below). Includes default alarm/event functions.	0
DM-UL	Data Manager Server—Unlimited (unlimited number of functions). Includes default alarm/event functions.	3
DM-TND	Trending Option. Real-time trending with compression.[4]	1
DM-HST	History Option. Historical data collection and trending with compression.[4]	4
DM-AE	Advanced Alarm/Event Management Option. Permits configuration of unique alarm/event functions.[4]	3
DM-RDB	Relational Database Interface Option. Export/import data to/from ODBC-compliant RDB systems.[4]	5
DM-ADV	Advanced Linkable Functions Option. Set of linkable data manager functions.[4]	3

[4]Requires DM-500 or DM-UL. Refer to the back page for the functions contained in each option.

Recipes Client

Recipe download/upload functions.

RECP	Recipes Client	3

Engineer Interface Client

Application test interface.

EI	Engineer Interface Client	0

DDE Client Runtime Link

Third-party application software link via DDE.

DDE-L	DDE Client Runtime Link	2

Client Object Interface (COI) Runtime Link

Links user-developed or Intec-written COI clients to TNT.

COI-L	User Client Runtime Link (for clients developed using COI or CDK tools)	3

Network Access Option

Full networking capabilities for a single TNT node.

NAO-N	Netbios Network Access Option	6
NAO-T	TCP/IP Network Access Option	6

ENABLER PRICING

Enablers are sold for $200 each in Enabler Pak's (EPAK's). For example, if you require 10 enablers, you would purchase an EPAK10 at a price of $2000 (10 x $200); if you require 27 enablers, you would purchase an EPAK27 at a price of $5400 (27 x $200), etc. For a Builder-only system, specify EPAK0. Be sure to include product code, e.g., EPAK10:*TNTOS2* (see below). Complete documentation is shipped with each TNT system that includes builders. For EPAK only orders, only the User's Guide is included.

PRODUCT CODES

Please include the appropriate Product Code with each Product Number, e.g., EPAK32:*TNTOS2* or UP1:*550/TNTNT*.

CNTRL	- Paragon Control	550	- Paragon 550	TNTNT	- Paragon TNT for Windows NT
500	- Paragon 500	TNTOS2	- Paragon TNT for	TNTW95	- Paragon TNT for Windows 95

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Builders

When selecting Builders, select either all-Stand-alone Builders or all Networking Builders. Networking Builders are required for LAN networking. *Different Builder types cannot be mixed on a single computer.* For "Builder-only" systems, specify EPAK0 on order.

Product	Description	Price
	For Developing Networked Applications	
OIB-N	Operator Interface Builder	$1050
PIOB-N	Process I/O Comms Builder	$ 700
CSB-N	Continuous Strategy Builder	$1050
DMB-N	Data Manager Builder	$ 700
	For Developing Stand-alone Applications	
OIB-S	Operator Interface Builder	$ 700
PIOB-S	Process I/O Comms Builder	$ 350
CSB-S	Continuous Strategy Builder	$ 700
DMB-S	Data Manager Builder	$ 350
	For Development & Test Environment	
DEV-N	Integrated development and test environment (for networked applications)[5]	$5000
DEV-S	Integrated development and test environment (for stand-alone applications)[5]	$3600
	For Entry-level Development Environment	
BNDL-S	Bundle of all stand-alone builders for small systems[6]	$1000

Please include product code on order, e.g., PIOB-N:*TNTOS2*. See bottom of facing page.
[5]Includes all builders and EPAK 96. Runtime is limited to 5 hours (intended for development and testing, not actual production runs).
[6]Available only when purchased in conjunction with EPAK7 through EPAK25.

Developer Kits

TNT Developer Kits include all of the software tools necessary to develop and integrate custom functions for Paragon TNT.

Product	Description	Price
PDK	Process I/O Driver Development Kit[7] (for user-developed I/O comms drivers)	$ 500
COI	Client Object Interface tool set[8] (for user-developed TNT clients)	$1000
BDK	User Block Development Kit[7] (for user-developed continuous strategy blocks)	$ 500

Please include product code on order, e.g., PDK:*TNTOS2*. See bottom of facing page.
[7]For OS/2, VisualAge C++ V3.0 compiler required; for NT/95, Visual C++ compiler required. Extra Development Kit manuals $35 each.
[8]For OS/2, 32-bit compiler, CA Realizer, or IBM SmallTalk required; for NT/95, 16- or 32-bit compiler or Visual Basic required.

COI-based Client Applications[9]

Product	Description	Price
QRPT	Quick Reports (Process report generator. Includes modifiable source code and executables.)	$ 400
VEP	Visual Expert Professional (NT version only. Real-time expert system tool from SoftSell Inc.)	$ 495[10]

[9]COI-L Client Object Interface Runtime Link must be enabled to operate.
[10]Available from and supported by third-party vendor.

Support Programs

The *Customer Support Program (CSP)* includes telephone support, no-cost version updates, and other priority services for a period of one year. The CSP contract should be purchased within the 90 day warranty period to avoid a surcharge. (Note that software version updates are only available to customers with CSP.) An *Upgrade* is the exchange of one Paragon product for a different Paragon product. Note that adding additional enablers or builders to an existing TNT product is accomplished through an Upgrade (*UP1*). *Corporate Training* is held at a facility selected by the customer; *Regional Training* is held periodically in Intec-selected cities throughout North America.

Product	Description	Price
CSP:*[prod. code]*	Customer Support Program for 1 year (per product)	12% of List$[11]
UP1:*[existing prod. code/new prod. code]*	Upgrade existing TNT product within same operating system	$ 450 + delta list$[12]
UP2:*[existing prod. code/new prod. code]*	Upgrade existing TNT product to a different operating system	$ 450 + delta list$[12]
UP3:*[existing prod. code/new prod. code]*	Upgrade Paragon CNTRL/500/550 to TNT	$3000 + delta list$[12,13]
TR-INTEC:*[prod. code]*	4 Day Training (Part I) at Intec (1 computer per person)	$1495/person
TR-INTEC-ADV:*[prod. code]*	4 Day Training (Part II) at Intec (1 computer per person)	$1495/person
TR-CORP:*[prod. code]*	4 Day Corporate Training at customer facility (max. of 6 people)	$10,000 + expenses[14]
TR-REG:*[prod. code]*	4 Day Regional Training (1 computer per person, min. of 8 people)	$1895/person
DOC:*[prod. code]*	Specify Ref: Manual, User's Guide, PIO Engines, and/or Tutorial	$ 65 per manual
SDX	Same Day Express Shipment (order placed before 3 PM EST)	$ 200 + freight
OSS	On-site Support (per day)	Contact Intec
AC	Application Consulting, per hour (telephone) or per day (on-site)	Contact Intec

[11]Site discounts available.
[12]Delta List cannot be less than zero. UP3 requires exchange of protection key. Please specify package serial number and configuration of existing product.
[13]If upgrading a 500/550 OP Station, a $500 credit will be given and the $3000 upgrade fee will be waived (training will not be included).
[14]Additional attendees at $250 each.

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Continuous Strategy Server Function Block Options

Continuous Strategy Server (Computational)

- Add
- Alarm
- Analog Input
- Analog Keyboard
- Analog Output
- And
- Average
- Average over Time
- Characterizer
- Conditioner
- Counter
- Digital Input
- Digital Keyboard
- Digital Output
- Digital Rotation
- Divide
- Exclusive Or
- Execute Program
- Expression
- Filter
- Flip-flop
- Internal Counter
- Invert
- Multiply
- Or
- Process
- Pulse
- Switch
- Totalizer

Supervisory Block Option

- Auto/Manual Bias
- Dead Time
- Delay
- High Select
- Integral
- Lead-Lag
- Low Select
- Middle Select
- PD
- PID
- Schedule
- Sequence
- Sequence Extender
- Simulation
- Time Control
- Time-proportional Output
- Truth Table
- Truth Table Extender

String Block Option

- Analog-to-string Convert
- Digital-to-string Convert
- Message Input
- Message Output
- String Build
- String Compare
- String Input
- String Keyboard
- String Output
- String Parse by Format
- String Parse by Position
- String Switch
- String Table
- String Table Change
- String Table Index
- String-to-analog Convert
- String-to-digital Convert
- String Time Difference

User Block Runtime Link

Allows user-developed Function Blocks (developed using the Block Development Kit) to be connected into the strategy.

Data Manager Server Function Options

Data Manager Server

- CSV export/import
- Default Alarm function[15]
- Default Event function[15]

Advanced Alarm/Event Management Option

- Alarm function[16]
- Event function[16]

Relational Database Interface Option[17]

Interfaces to any ODBC-compliant RDB including:

- dBase III/IV
- Oracle
- Sybase
- Ingres
- DB2/2

Trending Option

- Trend function
- TransTrend function
- DbandTrend function

History Option

- History function
- TransHistory function
- DbandHistory function
- MsgOut function

Advanced Functions Option

- Accumulator function
- DeadbandFilt function
- DiskStream function
- LinearFilter function
- Mean function
- Sampler function
- Stream function
- SyncMean function
- TransFilter function

[15]Non-configurable.
[16]Permits configuration of any number of unique functions; built-in printer support.
[17]Supports ODBC-compliant RDB's. Contact database vendor for information on ODBC driver availability.

Recommended Minimum Computer Configurations

TNT/OS2 or TNT/W95 Platform:

- 486DX-33Mhz system (internal math co-processor)
- OS/2 V 2.1 or higher (TNT/OS2) / Windows 95 (TNT/W95)
- 16MB RAM memory
- VGA graphics adaptor and monitor, or higher[18]
- 100MB of free hard disk space before TNT installation
- Parallel port
- Serial port
- Mouse (or trackball)

TNT/NT Platform:

- 486DX-66Mhz system (internal math co-processor or Pentium)
- Windows NT 3.51 or higher
- 24MB RAM memory
- Local bus VGA graphics adaptor and monitor or higher
- 120MB of free hard disk space before TNT installation
- Parallel port
- Serial port
- Mouse (or trackball)

[18]If SVGA support is required, refer to OS/2 compatibility list for video boards; available from Intec upon request.

Recommended Network Configurations

Network Software	Hardware	Protocol
IBM TCP/IP Version 2 for OS/2	SMC/Western Digital Ethercard Elite 16C Ultra Combo	TCP/IP Ethernet
Novell Advanced Netware 3.12	NE2000 Ethernet Adapters	NetBios Ethernet
Novell Advanced Netware 3.12	IBM 16/4 8-Bit Token Ring Cards	NetBios Token RIng
Microsoft Windows NT	NE2000 Ethernet Adapters	TCP/IP (Winsock) Ethernet
Microsoft Windows NT/95	NE2000 Ethernet Adapters	NetBios Ethernet

Shipping Information

All products will be shipped by Federal Express Second Day Air to any point in the United States, FOB Walpole, MA. Shipping charges will be prepaid and added to the invoice. A $50 handling charge will be added for international shipments requesting alternatives to FedEx. Normal delivery will be made within 14 days of receipt of your hardcopy order with purchase order number (verbal PO's not accepted). Same day shipment is available at a cost of $200 plus shipping charges (specify SDX).

Prices and specifications subject to change without notice.

Intec Controls Corporation/55 West Street/Walpole, MA 02081/Tel: 508-660-1221/Fax: 508-660-2374

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The World's First Functional Software Architecture

Paragon TNT

A White Paper Prepared By:

Intec Controls Corp.
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Walpole, MA 02081
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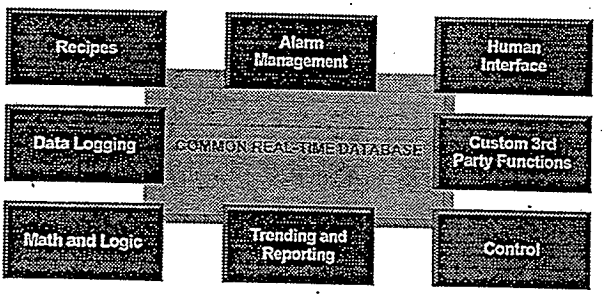
August 10, 1994

The World's First Functional Software Architecture

Paragon TNT

Traditional Package Approach to Software Design

Software design philosophy over the past decade has primarily focused on an approach that treats the entire application set as a single software package with a single common database. Automation software packages developed using this design were intended to operate as stand alone entities in a single hardware platform, very often a PC, with a monolithic real-time database. All required automation functions typically accessed this "tightly coupled" local database.



Traditional, Monolithic Design

In recent years customers have required larger, more distributed solutions. The response to this requirement by the software package vendors has been simply to network a number of computers together, each with its own package and a copy of the database.

The simplicity of design of the packaged approach has been appealing; but as requirements have grown more demanding the inherent constraints of packaged approaches have surfaced. Automation system capability has been constrained by the limitations of the hardware platform the packages operate on. Most packaged software is designed on a "one size fits all" basis, therefore expanding packaged systems typically requires purchase of an additional complete package even if only limited incremental functionality is needed. Scalability and effective expandability of traditional packaged automation systems has been quite limited. Reliability has also been a significant issue with automation software packages. The monolithic design of these systems limits reliability, with a single fault often causing the entire system to fail and/or cause the database to be corrupted. Finally, automation software packages have typically been designed around single operating systems. When the operating system encounters the end of its life cycle, the automation software package follows suit.

What Are the User Requirements?

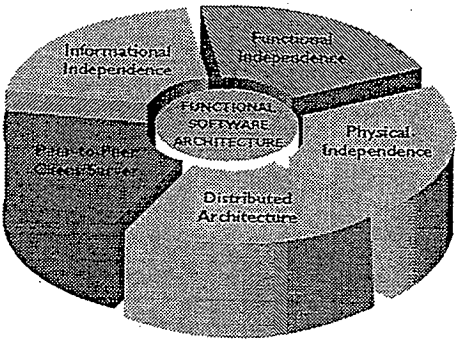
Over the past few years, users of software automation packages began to encounter the constraints imposed as a result of this packaged approach. Vendors were driven to investigate new design approaches to overcome these constraints. Users demands include meeting a number of new software requirements:

- o A functionally modular design which gives them the freedom necessary to match their application requirements with the automation solution.
- o Hardware independent software to run on a variety of hardware platforms and in a variety of software environments.
- o Long system life cycles to protect their investment.
- o A totally systematic design so that all modules within the software had the same basic "look and feel", making it easier for users to learn and apply the software to their application needs.
- o An architectural design to their automation software, to provide greater flexibility in matching operation requirements across a wide range of applications.

In summary, users require solutions which are modular and functionally independent, yet offer a unifying architecture to retain the simplicity of operation offered by the monolithic packages.

Functional Software Architectures

A totally new software design is emerging for automation systems based on overcoming the constraints of the "packaged" approach, and meeting the requirements of automation users. The *new class of software* resulting from this design approach is referred to as *Functional Software Architectures*. In this design approach, the architecture itself is the product. Paragon TNT from Intec Controls is the first member of this new class of software.



In order to overcome the constraints of traditional software packages, Functional Software Architectures must exhibit several key characteristics. The first major characteristic of Functional Software Architectures is that they are designed around a peer-to-peer client/server computing model. This means that each major automation function is designed to be either a server, a software module that generates, stores and provides information, or a client, a software module that uses and presents information. Each client and/or server has the capability to effectively interact with every other client and/or server in a user-oriented manner. The peer-to-peer aspect of this model means that communications between clients and servers is direct, not via a central server or other type of indirect agent. In many packages that have been said to be based on the client/server model, clients have assumed the active role in the system with servers only taking on a passive data storage role. In Functional Software Architectures, both clients and servers can be active and proactively perform automation and information management functions. For example, the Control Strategy server can monitor alarms and trigger shutdown sequences independently of any client. This provides a much higher level of flexibility and a more natural environment to automation software users.

Another key characteristic of Functional Software Architectures is that the software is designed around a truly distributed approach. Each of the clients and/or servers required for the application can reside either within the same hardware platform or in totally separate hardware platforms networked together either in a local area network, a wide area network, or a combination. The interaction between the clients and servers is the same, regardless of whether they are in the same hardware platform or distributed across a network. The combination of peer-to-peer client/server design and a distributed architecture leads to both effective functional distribution and geographic distribution, so the automation system architecture can be designed around exact automation requirements without sacrificing the ease of use automation users have come to expect.

Functional independence is another key characteristic of Functional Software Architectures. Functional independence means that each software module in the architecture contains all of the necessary functionality to effectively perform its task, either independently or as an integral part of a total automation architecture. Because each module is designed for a *specific* task, there are no design compromises. The distributed nature of Functional Software Architectures applies to identical functional modules as well as different functional modules. For example, if a user needs control in two different locations in the operation, a control server can be put in each location, along with other clients and servers as required. The resulting architecture operates as a single system. This characteristic allows users to add clients and servers as required without impacting the operating system and provides a high level of location independence across the system. With this characteristic, many of the constraints of the traditional package approach become non-issues.

Physical independence throughout the system is another key characteristic of Functional Software Architectures. Physical independence decomposes into four key subcharacteristics: processor independent design, I/O independent design, operating system independent design and communications independent design. Processor independent design means that the *software modules are not tied to a single processor or processor family*, but can run on a wide range of processors, eliminating some traditional processor constraints from the software design. I/O independent design means that the software architecture can effectively interact with process equipment through a wide range of I/O, and is not limited to a single vendor or small number of vendors' I/O. Operating system independent design means that the software architecture does not rely

on the services of a particular operating system, and therefore has the ability to operate on a variety of operating systems. Communication independent design means that the software architecture is independent of communication protocols and can, therefore, use or interact with a variety of communication systems, both standard and non-standard. This combination of characteristics that comprise physical independence provides automation users with great choice and flexibility while overcoming many of the limitations of traditional packaged systems.

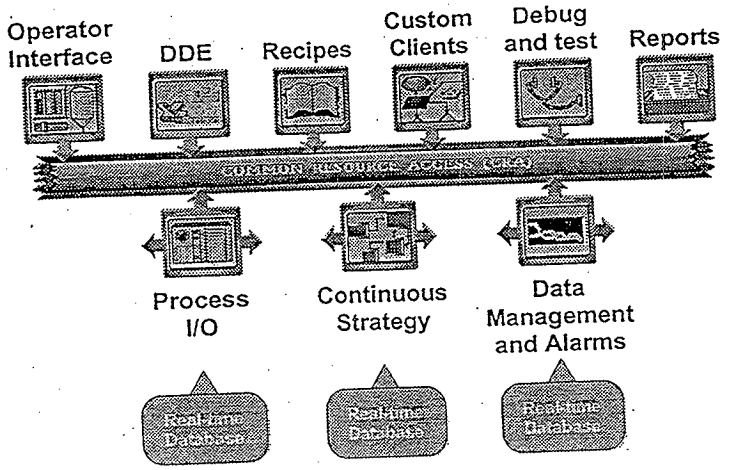
The final characteristic of Functional Software Architectures is information independence. This characteristic provides user-oriented access to all critical information throughout the architecture, independent of access point or information location. The basis for information independence is global object access across the entire architecture. This provides global data point access anywhere in the architecture merely by specifying the name of the data point without requiring network node names or hardware addresses. No knowledge of the network topology is required to effectively operate the system. If you cannot recall a name, the software architecture provides a name browsing facility to help out. Because of this global object access, no duplication of data is required throughout the architecture. Data is always stored at its point of origin, and is globally accessible from that point. Information independence also implies that the software architecture operates on uniform data types. For example, real-time and historical data are stored using identical storage methods, allowing for common data usage in trending and reporting functions. Information independence also applies to file-based data by the incorporation of standard database access techniques such as SQL. This characteristic also supports flexible information constructs such as CSV, DDE, Networked DDE and even National Language Support.

These five characteristics of Functional Software Architectures combine to provide a new paradigm for automation software that overcomes the limitations of traditional software packages and pave the way for the automation approaches of the next century.

Paragon TNT -- The World's First Functional Software Architecture

Paragon TNT was designed as the world's first Functional Software Architecture for automation systems. Paragon TNT incorporates all five Functional Software Architecture characteristics into its design, and is clearly modularized into a distributed, functional client/server approach. Currently, Paragon TNT offers three functionally-based server modules: the Process I/O (PIO) server, Control Strategy (CS) server and Data Manager (DM) server. Paragon TNT also offers a number of client modules: the Operating Interface (OI) client, Dynamic Data Exchange (DDE) client, Recipe Management client, Engineering Interface (EI) client and Report client. In addition, the Client Development Kit (CDK) allows users to develop their own clients. The Functional Software Architecture called Paragon TNT is poised to revolutionize the design of automation systems.

Some industry consultants have agreed that this architecture will be the basis of future automation systems, but predicited that these systems will not become available until 1997. Paragon TNT is available now and has been operating in user sites for since mid 1993. You do not have to wait. You can realize the benefits a Functional Software Architecture *today*.



Paragon TNT's Functional Software Architecture

The Benefits of Functional Software Architectures

Merely by describing the chief characteristics of Functional Software Architectures, many benefits of such an automation system design are readily apparent. The primary benefits offered by a Functional Software Architecture can be catagorized into five areas, each of which is very important to users as they move forward with their automation strategies.

The first key benefit is the *scalability* of the software offering. Because of the Functional Software Architecture design, users are able to scale the software to exactly meet the requirements of their application, no matter how simple or complex the application may be.. No longer must users "force-fit" an ill-suited software *package* on top of their application. With a Functional Software Architecture, the solution always matches the requirement on a function-by-function basis.

The second general benefit of Functional Software Architectures is expandability. *Expandability* is the capability to incrementally add functional components (clients or servers) as your automation requirements dictate and your financial requirements allow. A user can start very small and incrementally grow to an integrated plant-wide automation architecture. Automation components already installed are not impacted on the addition of a function or set of functions.

A very high level of system *reliability* is the third of the five key benefit areas incurred by using a Functional Software Architecture. Distribution and independence of function leads to high levels of reliability. Any single fault involves, at most, the

function in which the fault originates, even when multiple functions are running in the same machine. Also, the modular approach to system implementation, design and test leads to a higher reliability and faster implementation of automation applications.

The fourth key benefit area of Functional Software Architectures is improved system and operational *performance*. No longer will the limitations of a single hardware platform limit your automation capability. With a Functional Software Architecture, such as Paragon TNT, if you run into a hardware limit, you can either change platforms or add hardware platforms to the architecture without impacting the running modules. Because each functional module contains all resources required to execute its task, valuable CPU resources are optimized since the traditional resource allocation load is reduced. Also, the capability inherent in a Functional Software Architecture typically calls for higher performance software approaches, such as using native 32-bit operating systems as is the case with Paragon TNT, which serves to increase overall system performance. If the system is performing optimally, it will clearly contribute to the performance of your entire operation. This is the bottom line for any automation system.

The final key benefit area of Functional Software Architectures is, with a minimal investment, an automation user can *maximize the financial return*. Users need only purchase the components of the architecture required to meet current needs, and can thereby limit the investment with a "pay-as-you-go" approach that allows users to avoid large up front payments. The Functional Software Architecture provides an easy to use, high performance and functionally focused approach to automation that will minimize demand on critical plant resources, while optimizing the automation through an exact fit of customer automation needs and advance automation techniques. The investment will be small compared to the pay back realized through the use of a Functional Software Architecture to meet your automation needs.

The Challenge

The next time you are in the position of deciding on the appropriate automation approach for your facility, consider a Functional Software Architecture. If you believe you could reap the benefits of such an architecture, call Intec Controls and ask about Paragon TNT -- the world's first and only Functional Software Architecture for automation.

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elopment, adds open systems products to its area of responsibility.

Major automation software upgrades bow

Arch-rivals Wonderware, Intellution, and USData, plus statistical process control (SPC) software supplier Gensym, all unveiled significant new offerings at the recent National Manufacturing Week show in Chicago. The Wonderware Factory Suite for continuous, discrete and batch applications is designed to run on Microsoft's BackOffice family of server products, including the SQL Server, which now can be incorporated into InTrack; Windows NT Server; and Microsoft Systems Management Server, as well as the Windows NT Workstation and Windows 95 operating system. Meanwhile, Intellution introduced version 6.0 of its FIX BOS (batch operating supervisor) system for Windows NT. FIX BOS 6.0 is an open development, process control, and batch management system based on the ISA SP88 batch standard philosophy. The product also provides manufacturing execution system (MES) functions. USData, as expected (see March *InTech*, p. 9), released its FactoryLink Enterprise Control System, which focuses on ease-of-use. Gensym Corp. introduced GSPC, an add-on module to Gensym's G2 Diagnostic Assistant, to speed configuring online statistical process control applications.

Design Engineering
June, 1996

CONTROL ENGINEERING

MMI software offers insight into control

No control system is foolproof. However, the power of sophisticated, graphics-based control software can help keep your staff aware of emerging problems—and even suggest solutions

By Tom Kelly

Animated computer graphics are at the heart of the most significant development yet to occur in man-machine interfaces (MMIs).

Over the past few years, a number of companies have developed software which applies animated graphic displays to industrial control. A significant trend has been set in motion. Managers, supervisors and operators are gaining an unprecedented clarity of insight into the internal operations of their plants, machinery and processes.

Minimize error

This technology offers a number of benefits:

- It can rule out any possibility of plant personnel misinterpreting annunciators.
- It helps operators recognize when a fault in one part of a plant is triggering an unanticipated reaction in another—as happened in the Three Mile Island incident.
- It can eliminate wastage of spoiled product, by continuously analyzing operating conditions and giving early warnings when a production line or a process is drifting out of specification.
- And, since most of these software systems are based on Microsoft Windows, they can communicate with other computers, to download process recipes or control sequences from databases, or to feed production data to corporate management.

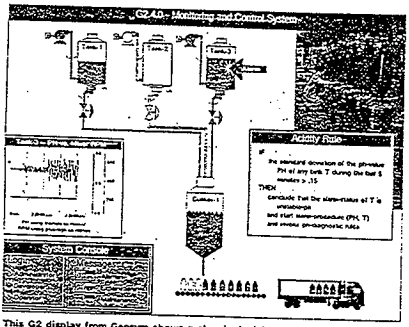
These developments are truly changing the nature of supervision and control in the manufacturing and process industries.

Wonderware Corp. of Irvine, Calif. was the first company to develop Windows-based MMI and SCADA (supervisory control and data acquisition) software. Roy H. Sarin, president of the firm, was not exaggerating when he said at a recent product introduction: "Software is replacing hardware as the key component of automating industrial processes."

Upgrade existing controls

A number of developers are at work on MMI and SCADA software, in addition to Wonderware, firms like Intellution, of Norwood, Mass., Taylor Industrial Software, Edmonton, Genesym Corp., which has a subsidiary in Mississauga, Ont., and National Instruments, with offices in Cambridge, Ont. and Pointe-Clair, Que., have developed products.

Such packages are compatible with a broad range of industrial computers and programmable controllers, and can upgrade existing control and monitoring systems. The software does not necessarily replace basic process meters, digital displays, control knobs, switches and other conventional operator interface devices. It can complement them, so that the conventional devices can be located as normal in a plant, connected to Windows-based computers in a central control room.



This G2 display from Gensym shows a chemical-mixing process. A panel on the left shows a graph of pH, on the right is an 'Acidity Rule' telling the operator what to do under prolonged deviation of the pH value. Top right is a video from a TV camera on the plant floor.

In many applications, however, Windows-based computers are located throughout a plant to give shop-floor personnel as well as supervisory managers more detailed information than is possible through conventional means. To limit the amount of remaining needed for operators, the traditional push-buttons, *sliders* and other manual controls can be replaced by icons on a Windows screen, selected and operated with a mouse.

Dynamic displays

The displays can depict process vessels, valves, conveyors, machines, trucks being loaded from a chute—any piece of machinery, in fact, that is used in a plant, along with all the piping, electrical wiring, mechanical linkages and other equipment interconnecting them. As the system accepts inputs from sensors and controllers on the plant or machinery under control, the animated graphics shows the movements taking place, such as levels in vessels, parts on a conveyor, or material being loaded into a truck.

The displays can include depictions of meters, digital readouts and other indicators showing the values of the variables associated with the equipment being monitored and controlled. They can also present plain-language messages describing the operating conditions or processes or machinery and giving warnings of alarms.

Gensym has developed an expert system which enhances this capability by displaying instructions and advice to operators, which is especially beneficial when rare alarm conditions occur.

Many different displays can be programmed into a system. An operator can switch from an overview of a plant to views of individual sections or machines. In other cases, the system will automatically switch to a display of a section of plant where a fault has occurred or special attention is needed.

All this may sound complex—and indeed, the technology behind these software packages is. But the developers have made use of standard Windows dialog boxes and tools to assist a designer in building displays and entering data and messages. The designer selects icons and symbols from preprogrammed libraries, or uses standard Windows software to create unique symbols, and drags and drops each one to move them into position.

"You don't need to be a programmer to read, understand or modify an application," says Gensym of its expert system.

Design principles

According to Intellution, buyers should make sure that the Windows-based SCADA and MMI they select are based on two design principles.

The first is that the software they select be truly compatible with other types of Windows-based software, to make sure it can be upgraded to new versions and can exchange data with databases and spreadsheets for analysis.

The second principle is that data acquisition and alarm monitoring should not be interrupted while you are performing routine Windows tasks, such as opening files or printing graphics. Intellution uses Microsoft's multimedia extensions to Windows to ensure that displays of data are always current and trend information is always up-to-date and correct.

Statistical software

Early this year, Intellution combined its FIX SCADA/MMI software with a statistical process control (SPC) package developed by Applied Statistics Inc. to produce FIX Stats, which it says is especially suitable for packaging and discrete manufacturing industries.

When an operator presses a single button, FIX Stats processes real-time data from the SPC and historical data from FIX to produce charts, data tables and histograms allowing up to 225 variables, such as process measurements or the static and relative dimensions of components, to be evaluated against desired specifications.

More recently, Intellution upgraded software designed to manage batch processes throughout an enterprise. FIX BOS 6.0 (Batch Operating Supervisor) can be used to create batch recipes, generate batch schedules, monitor and control batch production, provide real-time displays, track production and generate full batch records. Modules are available for material control, work-in-progress inventory, quality tracking and barcoding.

The software runs under Windows NT as either a client or a server in client/server configurations, and can store recipes, schedules, operating data and other information in commonly-used relational databases: Microsoft SQL Server, Oracle and Sybase.

One window of an Intellution screen can display live video from television cameras installed around a plant. *Reader Service Number 313*

Management software

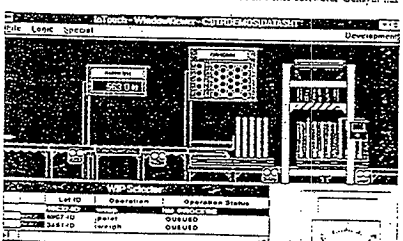
During the National Manufacturing Week trade show held in Chicago in May, Wonderware unveiled a product which bundles together its InTrack manufacturing execution system (MES) with Microsoft's SQL server.

InTrack tracks work-in-progress and inventory, prioritizes work for scheduling and dispatch, displays work instructions at each manufacturing step, monitors operations, and manages quality through SPC and analysis of collected data.

It is the first of a series of products in Wonderware's Factory Suite, developed to run on Microsoft's BackOffice servers to interface machine, manufacturing and process control to corporate-level systems—such as manufacturing resource planning and financial management. *Reader Service Number 312*

Expert systems

By incorporating expert-system software, known as G2, into Wonderware's InTouch MMI software, Genesym has



Wonderware claims to be the first company to integrate Microsoft SQL Server within a suite of easy-to-use application tools targeted at the production operations of a variety of industries.

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CONTROL ENGINEERING

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expanded the information that can be displayed to a plant operator. G2 allows a designer to program a control or supervisory computer to follow the same rules and procedures that an expert operator would in running a process or manufacturing operation. These rules can be written in simple, English-like phrases.

"Instead of simply showing an alarm, G2 can warn operators early that a process is drifting towards an out-of-spec condition and provide intelligent advice on how to take corrective action," says Kathy Kessel, Gensym's vice president of marketing.

As well as monitoring and diagnosis, the software can assist in real-time quality management, dynamic scheduling, process design and simulation of processes allowing designers to test the effects of proposed changes in production. *Reader Service Number 311*

Production scheduling

Production schedules can be generated by a PC from up-to-the-minute data and information from a shop floor, order desk and management systems by Taylor Industrial Software's TESS scheduling package.

TESS monitors production and highlights problems such as machine downtime or lack of resources. It provides information enabling staff to report actual production status to customers. It can exchange data with other manufacturing systems, such as MRP II, shop-floor data collection systems and databases.

Designers familiar with relay-ladder logic programming of PLCs will find themselves at home with Taylor's Walter software, which uses RLL as its primary programming language. This reduces the "learning curve and retraining costs to near zero," according to Taylor's strategic business unit manager, Jay Einerson.

The software also integrates with Windows applications and allows programs to be written in C/C++, Visual Basic and other languages. Sessions can run concurrently, so that ladder logic can be combined with drag-and-drop symbols. RLL programs can be displayed at the same time as animated graphics on a single screen. The software can drive mixed installations of Allen-Bradley, Modicon, GE Series and Cutler Hammer PLCs, and drivers for others are being developed. *Reader Service Number 310*

Easy programming

National Instruments, which has been marketing PC-based data acquisition and test instrumentation for some years, has recently expanded into MMI/SCADA through its acquisition of Georgetown Systems, developer of a system called Lookout.

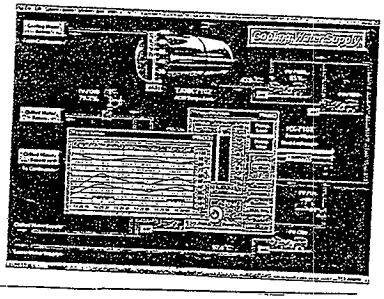
National has upgraded it to a 32-bit system for Windows NT and Windows 95, doubling the data acquisition speed. A particular advantage of Lookout is that it allows a designer to improve or upgrade a system while the process or manufacturing line under control is running. PLC and field I/O connections, graphics and control logic can be added, deleted and modified without the need to shut down a process.

Data can be logged at regular intervals, on demand, when an event occurs, or any combination of these. Historical and real-time data are presented in a seamless trend graph which the operator can scroll through or jump to any point using a mouse. Data logged into a database can be fed into other applications—such as spreadsheets—for analysis. *Reader Service Number 309*

Trend to openness

These most recent developments exemplify a trend set for the future in MMI and industrial control—an increasing openness and compatibility with other types of computers. This extends MMI beyond the shop floor and process supervision level to integrate it into corporate information systems. Shop floor and process managers can now have a finger on every pulse in a plant, no matter how complex. And senior management can be given the ability to make the swift changes to production necessary to be able to respond to today's rapid market changes.

Tom Kelly is Technical Field Editor, Electronics.



Lookout, from National Instruments, is a fully configurable, object oriented, event-driven MMI and SCADA package for Windows 95 and NT.

Measurements & Control
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OPINION

Have Reports of the Death of the Greatly Exaggerated?

Desktop and industrial PCs are permeating the factory floor in increasing numbers. The operator-interface (O/I) task, once the domain of the industrial workstation, is being performed with graphical brilliance by the PC. When examining the market and technical forces at work in the operator-interface market, one concludes that reports of the death of the industrial workstation have been greatly exaggerated.

Let's first examine the forces and trends that brought the PC to the factory floor.

1. PCs are cheap with respect to their considerable computing power. They excel at displaying and storing data and connecting to other computers.

2. Enabling the use of PCs in industrial environments has been the explosion of Windows-based O/I software applications (i.e., Wonderware, Intellution and USdata). These packages give the user easy means to create rich graphical, animated operator-interface screens.

3. Windows-based O/I software brought unprecedented connectivity to all brands of PLCs and remote I/O networks, and to plant computing networks like Ethernet and TCP/IP. It also brought *software* connectivity that allowed several programs to run simultaneously and share data.

Now let's examine the forces that limit the PC as an operator interface in industrial applications.

1. The desktop PC is packaged for the desktop. A large percentage of control-systems designers opt for industrially packaging PCs. Prices for industrial PCs start at more than twice that of desktop PCs.

2. The Windows-based O/I software applications are expensive. Unlimited "tag" development systems list for $5000, individual runtime licenses go for $1500, and PLC connection drivers command $250 to $500.

3. Windows-based run-time systems are resource hogs. If you are running Windows you need at least a 486 at 66MHz with 8MB of memory and a big hard disk. Unfortunately, memory prices have been stubbornly fixed due to shortages.

The PC as an operator interface has extensive capabilities, and these capabilities carry a price. This price is in many instances at odds with another market trend — the growth of mini and micro PLCs. These are extremely capable, range in price from $500 to $2500, and are the fastest growing segment of the PLC market.

How can the industrial workstation compete with the venerable PC? The general and open architecture of the PC and its software let it be all things to all users. The new industrial workstation will find new life by being all things to *some* users. But how can it compete with bit-mapped graphics and animation, industry-standard expansion, and connectivity to major PLCs?

THE NEW HARDWARE

The new workstation will effectively be a PC — not a full-blown PC, but a mini-PC or mutant-PC or an embedded PC, one stripped of its excess baggage and optimized for workstation functionality. This PC will use an Intel code compatible processor such as the 25 MHz 80386EX processor. This highly integrated processor and chipset family brings the benefits of the PC to the workstation, such as local bus graphical horsepower for detailed graphics and object animation. This approach also gives the workstation the same industry-standard expansion and connectivity options as the PC via an ISA bus, serial ports, parallel port and PC-card expansion.

For economy and ruggedness, the PC's hard drive is discarded in favor of flash memory. Expensive DRAM memory will be minimized by shunning the Windows environment. High-resolution color flat-panel displays will facilitate compact, rugged packaging and effective display of graphical objects.

Industrial Workstation Been

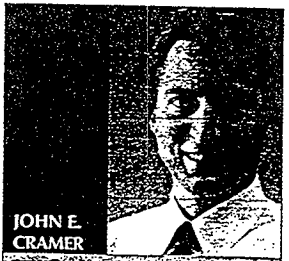
THE NEW SOFTWARE

The new workstation user demands dragging and dropping of graphical objects like pushbuttons, pilot lights, gauges and bar graphs. For ease of screen development, nothing beats a Windows-based development system. What about the run-time system? Windows? No, because it's a resource hog. How about a small real-time executive that provides real-time response, great graphics, and requires 1/16 the memory and no hard disk? This is the new workstation paradigm: develop on your desktop Windows system and download to the flash memory of a robust, real-time, PC-compatible engine. As far as pricing goes, workstation development systems have traditionally cost $500 to $1500, and run-time licenses are usually free.

Where will this new workstation find a home amidst the PC explosion? The answer is O/I applications of low- to mid-range complexity. As a general rule, if a workstation meets your needs, it will be a lower-cost solution than any PC solution. Using the following guidelines, you should be able to determine whether you are a good candidate for a PC or a workstation.

1. If your O/I task will require a display of larger than 14", buy a PC. Displays are expensive, and workstations with larger displays cost as much as PCs. If your O/I screens are so detailed that they need large, high-resolution displays, the application probably needs a PC to run.
2. Analyze your O/I task. If you will primarily be displaying screens consisting of pushbuttons, indicator lights, gauges and alphanumeric text, a workstation should be fine. Even if you venture to object animation, alarming, reports and recipes, you should be OK with a workstation. But if you need to display more than a few bit-mapped images, along with more than 50 or 100 screens, you'll tax the limited memory of a workstation. Logging, trending, scripting and simultaneously running other programs (i.e., MS-Excel or SPC package) are also beyond the capabilities of the workstation.
3. Workstations are designed to connect to popular PLCs. This connection is typically an RS-232/422/485 variant and is built into the workstation. If you need to connect to a PC or other computer(s) via an Ethernet, fiber-optic or other high-speed link, you are in the domain of the PC.

Workstation and PC technologies, both hardware and software, have merged to create a new breed of workstation that boasts improved expansion, graphics, processing performance, and ease of use. The merging of technologies will be of great value to control-system designers faced with low- to mid-range O/I applications. □



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Will NT 4.0 elbow out Win 95 on desktop?

By Laura DiDio

Nine months after one of the most hyped product introductions ever, Windows 95 may be getting some stiff competition from Windows NT Workstation. The most recent reports from analysts and users indicate that after it ships in September, NT 4.0 may leapfrog older sibling Windows 95 onto user desktops.

Dataquest statistics show that Microsoft Corp. sold 18 million copies of Windows 95 last year, but so far, most of the 200 million Windows 3.x users have stayed with the older operating system, warily eying upgrade options. Windows NT 4.0 is expected to change all that.

Momentum has been building for NT Server, but it now looks as if NT Workstation will grab significant market share as well. Dataquest, a market research firm in San Jose, Calif., estimated that unit shipments for Windows NT Workstation will reach $25 million next year.

In some cases, NT Workstation is piggybacking on the burgeoning popularity of its server sibling. That is one of several reasons Scott Rackliffe, vice president of information systems at Farm Credit Financial Partners, Inc. in Agawam, Mass., chose it over Windows 95.

Windows migration costs

Upgrading from	To	Price	Incentives
Windows 3.x or Windows for Workgroups	Windows 95	$50 per desktop (average)	Hardware and operating systems
Windows 3.x	Windows NT Workstation	$1,000 to $2,000 per desktop	Memory upgrade, operating system and possible replacement of the PC to accommodate video and specific hardware drivers

Source: Giga Information Group, Inc., Santa Clara, Calif.

"We're already using our fourth release of NT Server. NT Workstation is just a smaller version of the server software, so there's no real learning curve," Rackliffe said. "The Windows 95 GUI is pretty, but we need the industrial strength of NT Workstation."

The big lure of Windows NT Workstation 4.0 is its powerful 32-bit operating system, which includes multitasking, multiprocessing and fault-tolerant capabilities that make it ideal for supporting mission-critical applications, users and analysts said.

For example, Rob Enderle, an analyst at Giga Information Group in Santa Clara, Calif., said when problems occur in applications running on Windows 95, they can crash the entire operating system. But "the built-in fault tolerance in NT Workstation provides users with a safety net, ensuring that their systems don't go down."

NT Workstation's fault tolerance can literally save lives, claimed Corey Eaves, manufacturing systems product manager at Intellution, a division of Emerson Electric Corp. in Norwood, Mass. "If a Windows 95 system crashed while communicating with a chemical reactor for instance ... you could have a potentially deadly situation on your hands. For us, NT Workstation wasn't an option: it was the only choice," he said.

Dan Ramos, chief architect at Visteon Corp. in Maitland, Fla., which develops customized applications for health care organizations, scoffed at reports of problems running 16-bit legacy applications on NT Workstation and said they are largely unfounded. "I've found very few applications that won't run on NT workstations," he said.

Other corporate users are moving to NT Workstation for more pragmatic reasons, not the least of which is Microsoft's stance that Windows 95 is an interim solution, whereas NT Workstation is its strategic operating system.

But moving to NT will be no cakewalk. Analysts such as Enderle and First Albany Corp.'s Laura Hanny advise caution. The following top the list of NT Workstation drawbacks:

- A lack of backward compatibility with some 16-bit applications, mainly fax gateways.
- The more expensive cost to upgrade memory or replace PCs.
- A short battery lifespan for NT 4.0-based Pentium notebooks.

That's why some users, such as Bruce Smith, systems administrator at Logicon Communication Technology, Inc., a Department of Defense subcontractor in Arlington, Va., said they will confine their NT Workstation 4.0 upgrades to power users for now and migrate the majority of their Windows for Workgroup users to Windows 95.