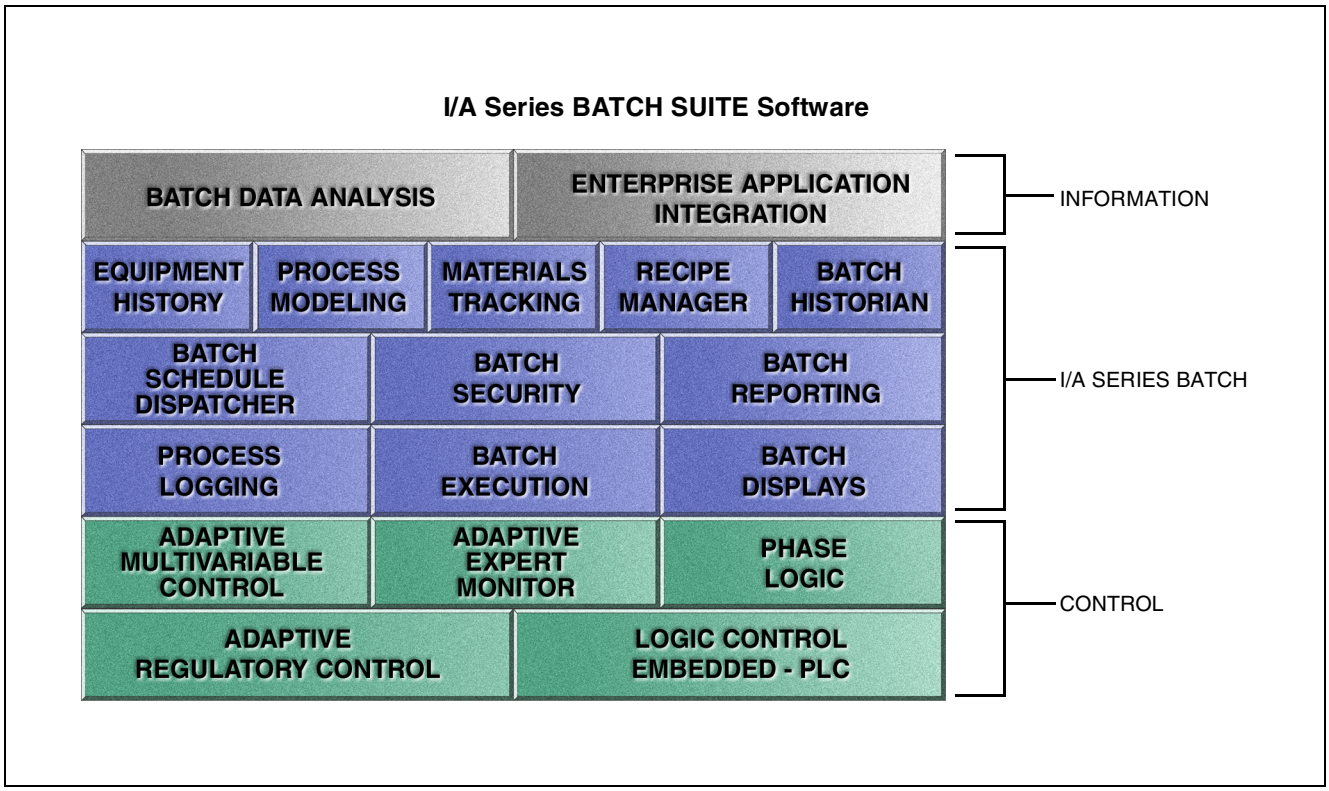
FOXBORO®

PSS 21S-4V3 B3

I/A Series® Software
I/A Series Batch™ Software



I/A Series Batch software provides comprehensive batch control solutions to process industries, such as food, beverage, pharmaceuticals, and fine chemicals.

I/A Series Batch software is a flexible batch management system that automates batch processes and provides a complete production history. Consistent with the Instrumentation, Systems, and Automation Society of America ANSI/ISA 88.01 - 1995 standard, Batch software allows you to quickly and easily create recipes and simulate their execution against a model of the process - all before writing one line of control code. Batch software also provides a complete materials genealogy.

I/A Series Batch software features include:

- Batch engine field proven at over 200 sites
- Redundant Batch Server option
- Materials genealogy
- Integrated Batch human interface (Batch View)
- Integration with I/A Series FoxView™, FoxAlert™, Sequential Function Chart and Structured Text (SFC/ST) Display Manager, and AIM*AT™ software
- Portal to Batch History data
- Web-based reporting using Active Server pages
- Compatibility with Microsoft™ Windows NT™ and UNIX™ operating systems
- FoxBatch™ Application Migration
- Integration with ProcessConnect for Enterprise Application Integration (EAI).
- Aid to customer compliance with FDA 21 CFR Part 11 on Electronic Records and Electronic Signatures.

I/A Series Batch software offers these significant benefits:

- Reduces the life-cycle engineering effort and facilitates recipe development and updating
- Reduces dependence on system experts (Recipe configuration can be done by process engineers or chemists.)
- Speeds batch processing for greater production capability
- Produces more consistent batches that meet tighter tolerances
- Provides flexibility for manufacturing different products, grades of products, and quick switchover between products
- Offers extensive data collection and batch production reports that help in production tuning and in meeting FDA requirements
- Provides expandability from entry level system to large installations while maintaining full functionality.

OVERVIEW

I/A Series Batch software is an easy-to-use graphical control package that requires no programming. A model of the process is created interactively on workstation display screens with icons and selections from pull-down menus. Recipes are configured by specifying unit and phase data interactively. The recipes are represented graphically in IEC 61131-3 based sequential function charts.

Batch software provides recipe management, production information management functions, and an appropriate environment for hierarchical structuring of batch process control.

Batch software has a hierarchical management and control structure that allows plant engineers to maintain the system easily. By splitting the logic into real-time process control (the phases running in sequence blocks) and supervisory (Batch) control, a top-down/bottom-up approach allows a structured and efficient implementation of batch projects. All configuration data, recipes, and batch records are kept in relational databases.

Integration of the Batch system with I/A Series ProcessConnect allows batch production management and scheduling using enterprise resource planning (ERP) methods.

PROCESS MODELING

A batch processing plant is made up of units, process classes, connections, transfer classes, process phases, and transfer phases.

- A unit is a group of equipment that processes materials such as reactors, mixers, blenders, trains and retorts. A unit can also simply hold materials. Examples of units are reactors, holding tanks, bulk storage vessels, filling stations, and manual addition stations.
- Process classes are groups of units. Each unit in the class has the same processing capabilities and/or performs the same function.
- Connections define a group of equipment that transfers material from a source unit to a destination unit.
- Transfer classes define a group of connections where all source units are in the same process class and all destination units are in the same process class.
- Process phases with their parameters define the capability of process classes.
- Transfer phases with their parameters define the capabilities of transfer classes.

I/A Series Batch software supports three approaches to structuring the batch process plant into the process model:

- Comprehensive model
- Connectionless model
- Hybrid model.

The comprehensive model uses all the available configuration tools of the Batch software including process classes as well as transfer classes, while the connectionless model deals only with the definition of process classes. In this case, the movement of material between units is accomplished using complementary transfer phases that are assigned to a process class rather than to a transfer class. The hybrid model uses a combination of the comprehensive and connectionless models, maximizing the benefits of both approaches. To decide which approach is optimal for your specific application, analyze the batch philosophy of your company, the process being modeled, the flexibility requirements, the user interface requirements, and the historical batch recording requirements.

An integral part of process modeling involves defining specific data points, called tags, for units, processes, connections, and transfers. Tags allow the mapping of data between the Batch software and the controllers.

The process model also specifies the relationship between the tags used in workstations and controllers. Initially, the Batch software generates default relationships which can be modified during the modeling process.

The process model allows each process variable to have a unit of measure assignment. This unit of measure attribute is assigned to the formula parameter, such as Degrees Fahrenheit for the formula parameter named Temperature. The Process Model Editor also provides an enumeration data class option. This option allows the assignment of a Set Name to a list of integer values, each one having a corresponding alphanumeric string value. An example might be Automatic -2, Semi-Auto -1, and Manual -0.

Run-Time Model Edits

The physical model of the plant can be edited while the system is running. Edits are actually made to a different database than that used by the run-time system. To effect the model changes, the Batch run-time applications must be stopped, an “update run-time” action must be taken, and then the Batch run-time applications can be started. These actions are performed from the Environment display.

Automatic Tag Creation

The capability to automatically add, change, delete and assign all phase parameter, control and status tags is provided, significantly reducing the time it takes to build a physical model of a plant.

MATERIALS TRACKING

Materials tracking defines materials as ingredients, intermediates, finished goods, by-products and others, and includes the characteristics of each material. The batch materials database is used to automatically track the location of materials stored in different units.

The batch management function uses the ingredients’ location data to get ingredients during the manufacture of a batch. This capability allows ingredient locations to be independent of recipes and control programs and permits ingredients to change location with no effect on recipe execution provided that a comprehensive process model is used.

The unit location can be entered in the materials database by plant personnel, when new ingredients are received. A lot identification can also be assigned to a material, and multiple lots of the same ingredient can be stored in the same vessel.

The batch management system updates the database when ingredients are used and when intermediates and finished goods are produced. The materials database provides easy access to work-in-process (WIP) information and can be used to update higher level management and Material Resource Planning (MRP) systems with ingredient usage, work-in-process, and finished goods production information. Materials tracking can be used to complement an existing inventory system.

PROCESS MANAGEMENT

Batch Scheduling

A batch is scheduled by entering the campaign, lot, batch, and recipe name. The train also needs to be selected with the batch size and the mode. The mode can be automatic, semi-automatic, or manual.

AUTO: In automatic mode, the default mode, the unit operations and phases are activated automatically as specified in the recipe. If the option is enabled, the operator can abort any phase and the batch auto-switches to the semi-automatic mode.

SEMI-AUTO: In semi-automatic mode, the operator must start each phase manually. The order of phases is specified in the recipe.

MANUAL: In manual mode, the operator can select any available phase in the recipe to be performed next. For example, manual mode allows an operator to retry a failed phase or to choose DISCHARGE and dump a batch immediately.

The batch scheduling function maintains a list of batches to be produced and allows priority based execution of batches, where the priorities can be manually specified or modified.

Batch Validation

A batch must be validated before it can execute. Validation of a batch consists of:

- Verification of recipe existence in the database
- Verification of process model references made from the recipe
- Verification of materials database references made from the recipe
- Verification of train existence
- Verification of the batch size against the allowed boundaries.

Batch Management

The Batch Manager directs and supervises the execution of the batches. Based on the recipe procedure, phases are executed in sequential and parallel fashions after checking that the appropriate transition conditions are satisfied.

The Batch Manager also interfaces with batch display modules and provides operators with information on the batches running in the system. The Batch Manager coordinates the usage of process units for each batch and allocates units as they are available, within the specified train. Unit selection can also be done manually. The Batch Manager captures all batch execution events and operator activities during the execution of a batch and sends this information to the Batch History database.

Restart Capability

Batch Manager has the capability to recover from abnormal events such as system shutdowns due to hardware failures and other unanticipated failures. This functionality is known as Warm Restart. As the batch management system executes batches, all back execution and equipment allocation information is written to multiple data files. If a system failure occurs, these files are read by the batch management system when restarted. The data in these files allows the batch management system to resume batch operation.

To maintain the exact state of the batch in these data files when power fails, an uninterruptable power supply (UPS) is required on the Batch server. The UPS allows for an orderly shutdown of the Batch server to preserve batch state data.

Simulating Batches

I/A Series Batch software allows batches to be run in a simulation mode, where batches are created and run without actually starting the phases in a control processor. You specify a global phase duration time to permit operator interaction during the simulated execution.

Recipe Procedure Jumps

The Batch View allows you, as the operator, to jump forward or backward in the recipe procedure and edit phase parameters (formula). To enter the jump mode, the batch must be in the Held state.

After exiting the jump mode, you can restart the batch at the selected procedure. All events are logged by the Batch Historian.

Save Control Recipe as Master Recipe

At batch completion, as an operator, you may save 1) all phase parameter edits, and/or 2) the equipment used (creating an equipment-dependent recipe), as a master recipe. You have the option to overwrite the existing master recipe increasing the version level, or to save it as a new master recipe. You are required to enter a user name and, if desired, may enter a comment. You must have an appropriate security level for a save to occur.

Viewing Transition Logic Status

Transition logic expressions, their description and status can be viewed at run time. Additionally, the ability to force a transition to a true state is provided.

View and Edit Phase Parameter Values

Phase configuration and phase parameters can be edited for any batch that has a Ready, Run, Done, Held or Aborted status. All edits are saved to history. This includes changed formula parameters, phase instructions and enabling or disabling comment required or operator acknowledgment (Ack on Entry or Exit).

Operator Entered Comments

A comment may be entered and saved to history for any batch that has a Ready, Run, Done, Held or Aborted status.

Display Equipment Name on Procedural Element

The actual unit or connection name that is allocated is displayed on the unit operation procedural element.

Print Schedule

Use this feature to print the list of scheduled batches.

View Schedule

In order to manage large numbers of scheduled batches, you may specify view and filter criteria by which the Batch Scheduler application alters the list of scheduled batches.

The function supports user selection of trains, recipes, recipe types, recipe states, or specific campaign, lot, and/or batch information (refer to Figure 1). The scheduler then presents a list of batches that match the criteria.

View and Edit Equipment Allocation Queue

From the Batch Scheduler and Batch Display, you can review equipment allocation, deallocate equipment, and switch allocation to a different piece of equipment.

If you need to ensure that the equipment will be ready before batch processing begins, you can manually allocate equipment for a batch.

Automatic Creation of Batch ID using User Prefix

The capability to append a numerical character to a user-defined Batch ID prefix has been provided.

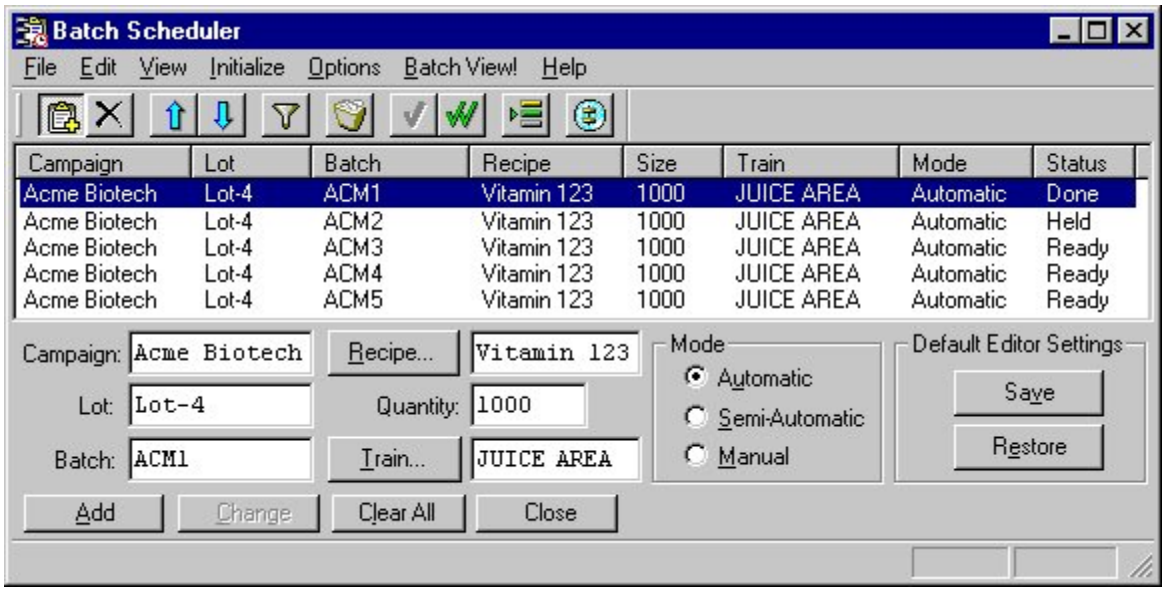


Figure 1. Batch Schedule Display (Windows NT Version)

RECIPE MANAGEMENT

The recipe management function provides the environment to configure, copy, and modify master recipes in an IEC 61131-3 graphical environment. The recipe structures follow the ANSI/ISA 88.01 - 1995 standard and support all three levels of the standard: unit procedure, unit operation, and phase. Refer to Figure 2.

An option allows the recipe to collapse to two levels: unit procedure and phases. To migrate three-level recipes to two levels, unit operations become unit procedures.

Batch Suite software provides the environment for maintaining version history of a master recipe with date and time stamp, author name, and optional comments. Up to five levels of recipe approvals can be implemented.

A master recipe is scalable to the batch size specified manually or by production schedule. All formula quantities for ingredients, intermediates, by-products, and finished goods are scalable and can be entered either as actual quantities or as a percent of the total batch size.

Recipe Database Import and Export

The Recipe Editor features an import and export capability that allows you to move recipes from one recipe database to another. The export function creates a binary file of one or more selected recipes to the local hard drive.

Approved for Test

A recipe can be “Approved for Test”. Any recipe that is “Approved for Test” may be scheduled.

Formula Association to Procedure

The ability to associate formula input, output, and process variable values to phases and to easily edit them from the formula display is provided.

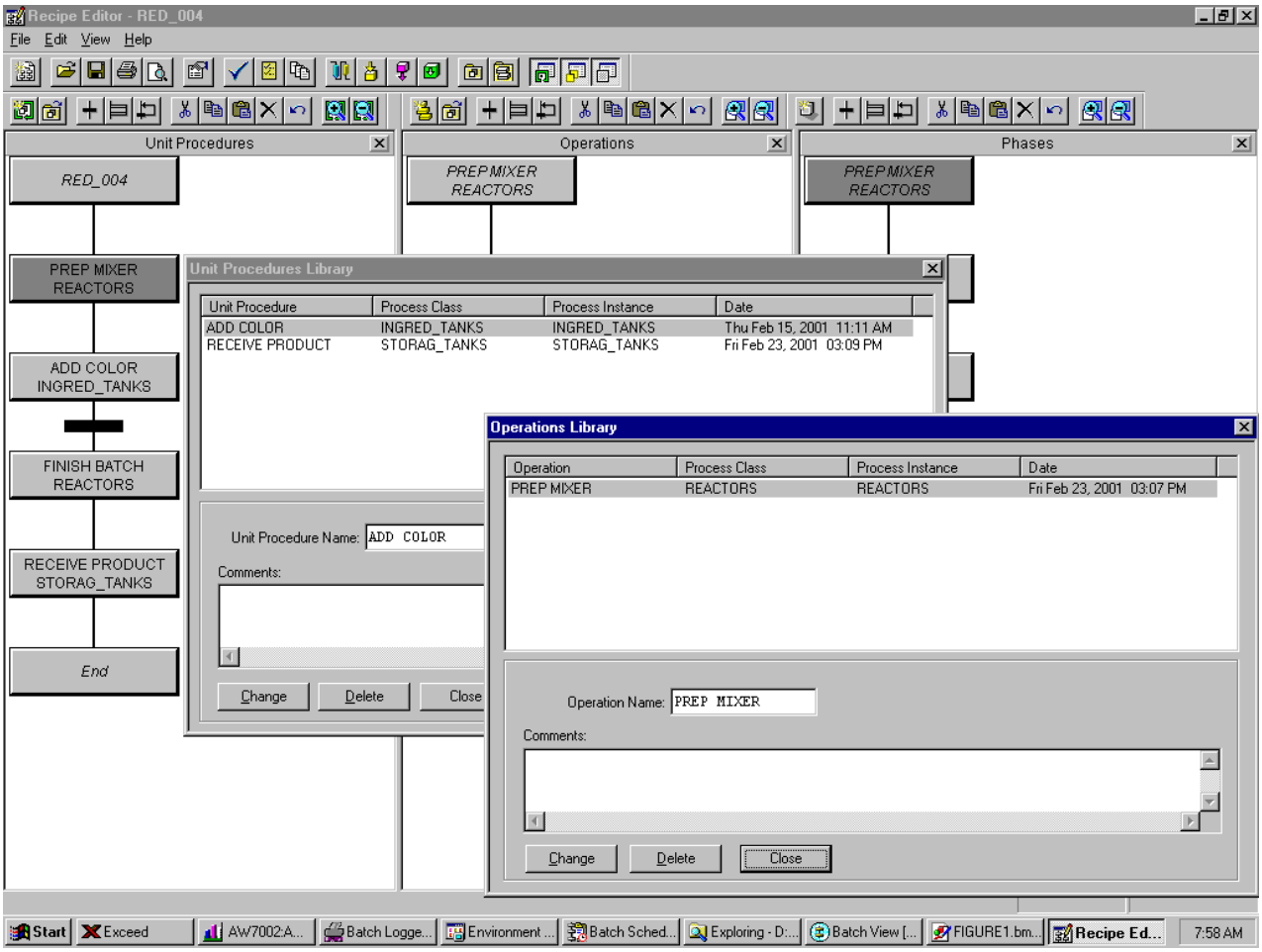


Figure 2. Batch Recipe Structure

Recipe Unit Procedure and Operation Libraries

You can save unit procedures to a procedures library and unit operations to an operations library. To accomplish this, you drag and drop the procedure or operation object on the appropriate library display. You can also retrieve and insert a procedure or operation from the appropriate library into a recipe procedure or operation in the same manner.

Recipe Types

You have the ability to define recipe types. This allows you to group recipes for easy retrieval and scheduling. Examples of recipe types include clean-in-process, barbecue sauce, salad dressing.

Recipe States

You have the ability to define recipe states. Examples of these states include Development, Production, Test, Review, Archive, and so forth. This allows you to group recipes for easy retrieval for editing.

Recipe Selection, Filtering, and Sorting

In order to manage large numbers of recipes, you can set the filter by state or type and can sort the list of recipes by Recipe ID, Recipe Name, State or Type.

Propagation of Process Model Changes

The Recipe Editor provides a function to automatically propagate phase changes in the process model to all the affected recipes.

Recipe Editing Tools

Cut, copy, and paste menu commands and tools provide flexibility when editing elements in the recipe procedure.

Recipe Validation

The validation function allows you to validate one or all recipes to verify that:

- The process model database information used in the recipe exists
- The material database information used in the recipe exists
- The minimum, maximum, and default batch sizes defined in the recipe header are appropriate
- All the formula parameters defined in the recipe procedure are linked to the appropriate information
- All reports triggered by phases exist in the reporting database
- All transition logic, including loop logic, is valid.

Recipe Configuration Reports

You can print recipe configuration reports using the available report templates. The print preview option allows you to view the report before sending it to the printer, which can be a non-PostScript™ printer (refer to Figure 3).

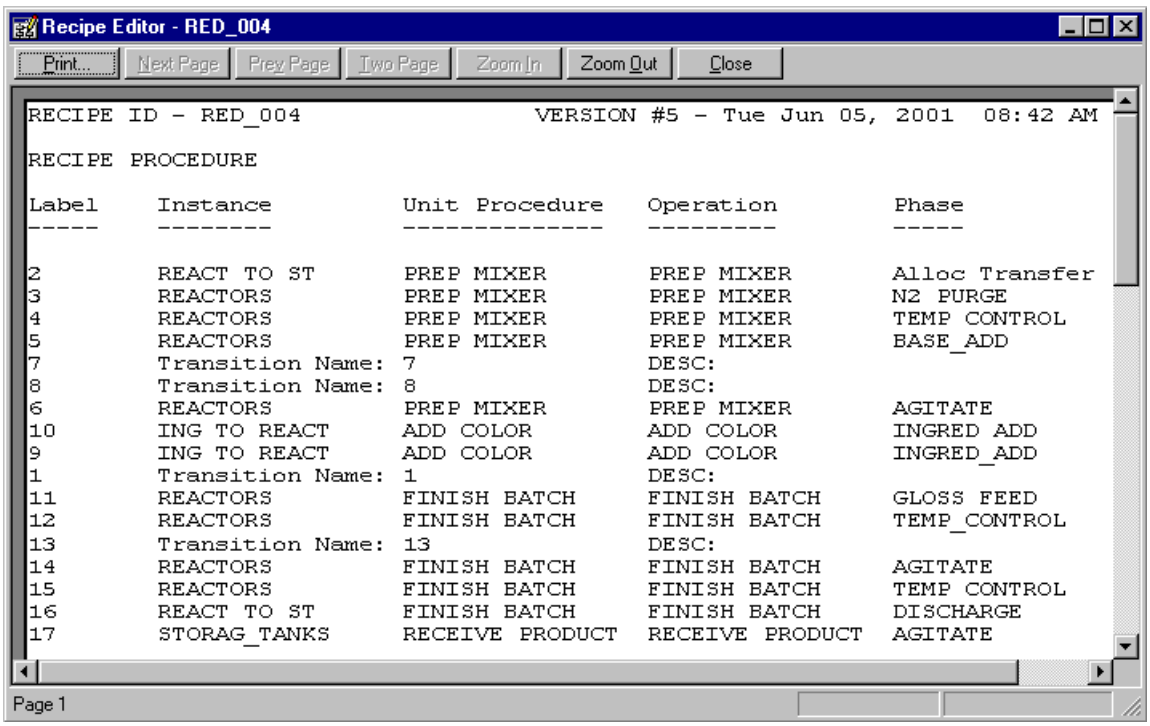


Figure 3. Print Preview of Simplified Procedure Report for Non-PostScript Printer

PRODUCTION INFORMATION MANAGEMENT

Production information management comprises:

- Batch Information Server
- Historian
- Batch, Equipment, and Security History
- Historian Archive Function
- Process Logger
- Reporting System.

Batch Information Server

Both UNIX and Windows NT batch control systems use a separate Batch Information Server for Batch History and Reporting functions (refer to Figure 4).

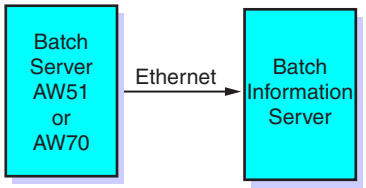


Figure 4. Batch System Architecture

The Batch Server maintains a history cache to ensure no loss of historical data in the event of a temporary communications failure.

Historian

Comprehensive batch, equipment, and security history and flexible real-time reporting are hallmarks of I/A Series Batch software. The Batch Historian uses Microsoft SQL Server Version 7 to store batch history information.

Batch, Equipment, and Security History

I/A Series Batch software provides the most comprehensive batch historian available, capturing all Electronic Batch Record (EBR), equipment, and security events.

- EBR events are the event data the Batch Manager captures and logs to the Batch Historian when batches are executing (refer to Figure 5). All these events are stored with time, date, and batch ID for easy retrieval.

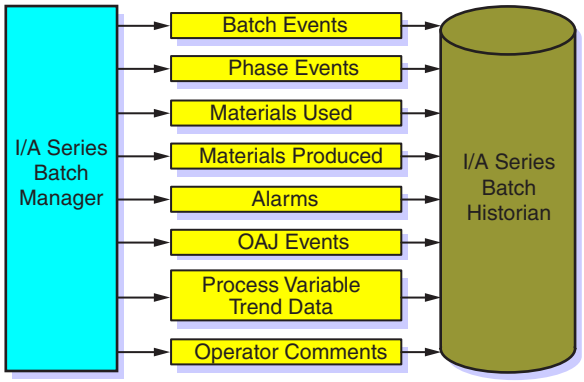


Figure 5. Batch History (EBR)

- Equipment events occur each time the status of a piece of equipment changes, and the Batch Manager captures and logs the change to the Batch Historian (refer to Figure 6). All these events are stored with the old status, new status, current recipe ID, and last recipe ID.

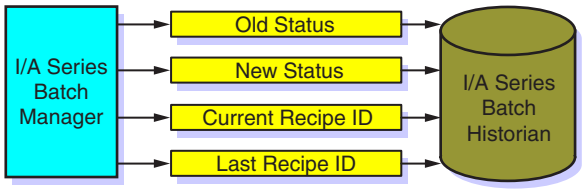


Figure 6. Equipment History

- Security events occur whenever the Batch Manager captures and logs security events to the Batch Historian (refer to Figure 7). Configuration edits include security database changes such as deleting a user and changing a user's password.

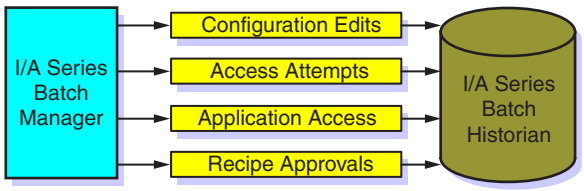


Figure 7. Batch Security History

History Archive Function

The History Archive function allows you to create, edit, and execute archiving tasks that are registered by SQL Server. You identify the starting point and the ending point for archiving history data. The dates are inclusive, i.e., all batches completed on or after the starting date and all batches completed on or before the ending date are archived. A batch is considered completed when it has obtained a status of Done or Aborted, and is closed (removed from the batch schedule). After an archive has been created, it can be deleted, restored or purged.

Process Logger

The Process Logger retrieves data and passes it to the printer or to the Batch Suite Historian for storage. The Process Logger Editor window creates data collection configurations, which consist of one or more groups of tags with each group having its own data collection configuration. The run-time Process Logger uses the logging configuration to determine how each group of tags and its respective values should be collected and logged. Data collection may be periodically scheduled or event driven.

Reporting System

With I/A Series Batch software, real-time reporting capabilities are available whether you use the UNIX or the Windows NT solution. On either platform, reports are easy to configure and generate using Crystal Reports on the Batch Information Server.

Reports are available to any I/A Series workstation equipped with network connections (a second Ethernet connection is required) and an Internet browser. For 50 Series workstations, NetScape™ Navigator is used; for 70 Series workstations, Internet Explorer is used. The reporting system offers end-of-batch reports and time triggers, such as time of day. Both batch and continuous data can be combined in one report.

The Batch software provides more than 20 report templates as examples for your use. You can run and view reports using the browsers.

Reports can retrieve any piece of information stored in the Batch Historian and can be used in a real-time or off-line mode. Refer to Figure 8 and Figure 9.

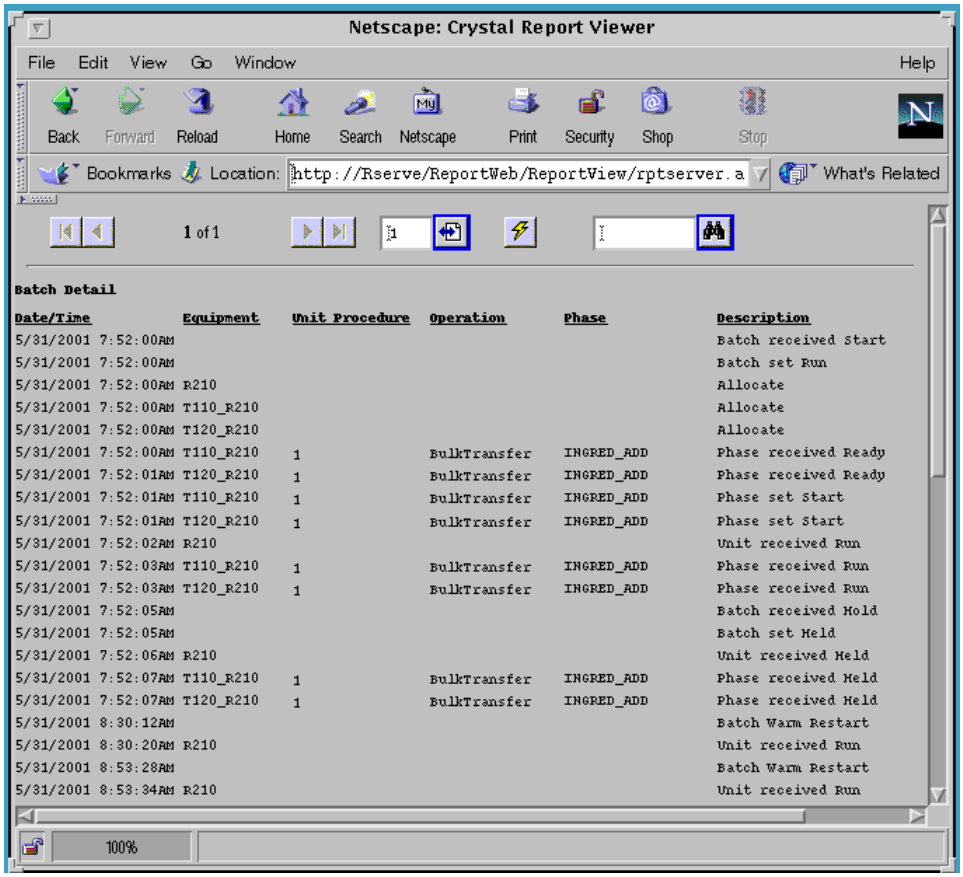


Figure 8. Sample Batch Report Display (Solaris™ Version)

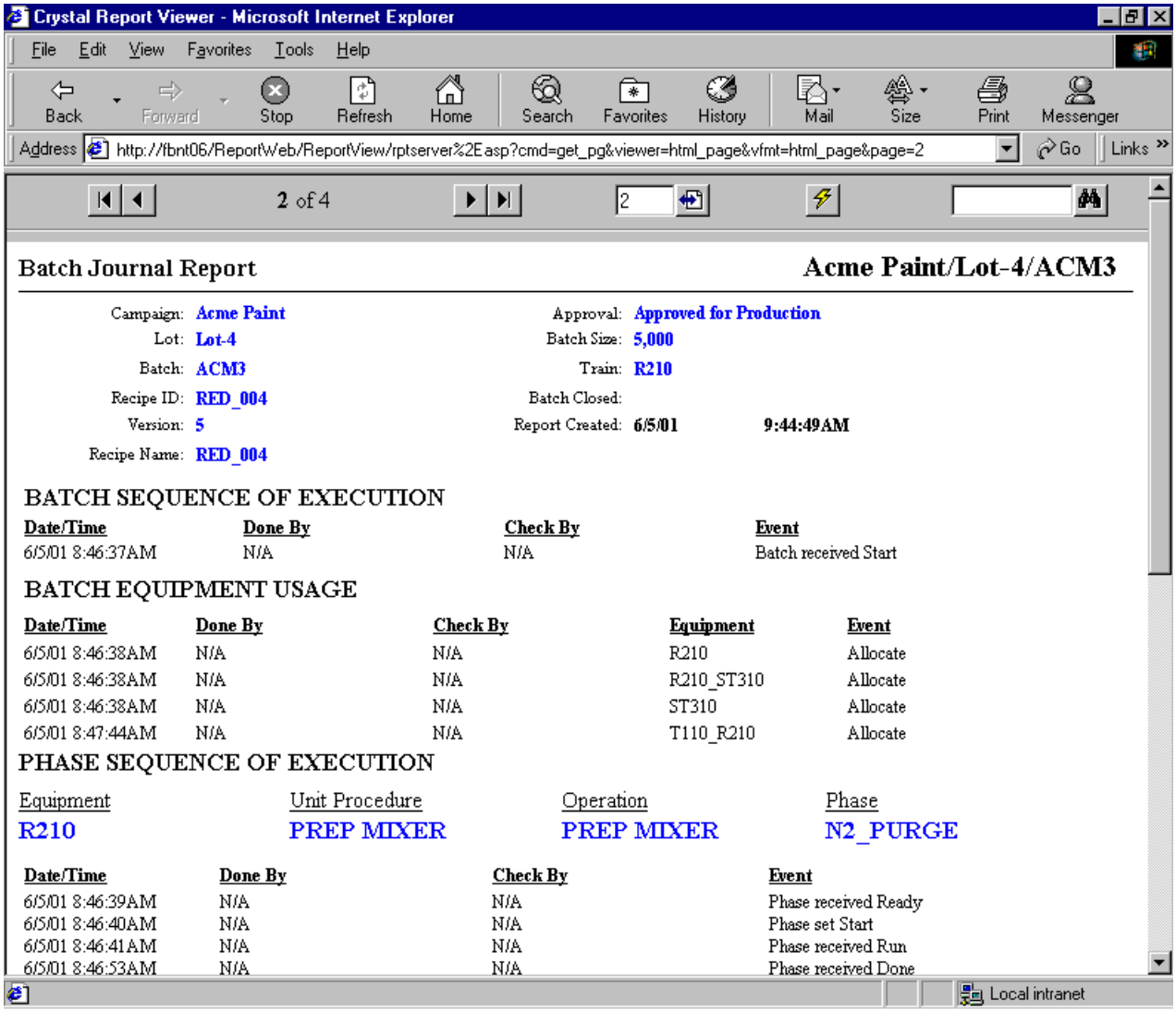


Figure 9. Sample Batch Journal Report (Windows NT Version)

Examples of Batch report templates are:

- A listing of I/A Series analog alarms issued for a batch
- A summary of all batch execution activity for a batch
- A summary of all questions for a batch
- A listing of I/A Series Boolean alarms issued for a batch
- A summary of all material characteristics for a campaign, lot and batch
- A summary of the changes made by operators to the original formula input quantities for a batch
- A summary of all materials consumed in a batch
- A summary of all materials produced by a batch
- Totals of all materials produced for a batch
- A summary of all operator comments for a batch
- A summary of all recipe phase instructions for a batch
- A summary of all process log values for a batch
- Statistical information of all process log values recorded for a specific tag
- A summary of all process variable target and actual values for a batch
- A summary of changes made by operators to the original formula process variables for a batch
- A listing of I/A Series sequence block messages issued for a batch

- A list of batches that used a specific material or material from a specific vendor
- A summary report of all batches produced
- A summary report of all equipment status changes
- A summary of all finished products produced
- A summary report that includes the number of finished products produced, number of lots, number of batches and total quantity produced.

The Historical Reporting System is an on-line data retrieval and report generation utility. Using standard SQL (Structured Query Language) queries, data is retrieved from the Historian and either displayed or sent to a printer.

Batch Reporting Tools include:

- Report triggers - Triggers allow the operator to request reports on demand, automatically and at specific intervals.
- Destinations and Formats - Destination criteria directs reports to a printer and/or a file. Report formats determine the structure of reports generated using the reporting system.

Pre-defined reports in Batch software provide summaries of all batch execution activities, including journal reports, material characteristics, operator comments, recipe phase instructions, process log values, equipment status, finished products, and so forth.

ENHANCED SECURITY OPTION

I/A Series Batch software provides a security system which may be used to control the access and manipulation capability of users. A security level is assigned to users based on their job functions such as operators, supervisors, engineers, and so forth. Only one security level can be assigned to a given user. New security levels can be added to the security system at any time, and there is no limit to the number of levels that can be defined.

I/A Series Batch applications and their associated functions can be assigned security levels defining which groups of users can access an application and which groups can execute and verify the various functions available within that application. The Batch applications include Archive Manager, Batch Display, Batch Scheduler, Recipe Editor, and so forth. Each application can be assigned one or more security access levels permitting groups of users to access the application. Applications can be added to the security system at any time.

The Batch software supports security for execution and verification of the functions available within an application. As an example, the Batch Display application includes functions such as Abort Batch, Allocate Equipment, Start Batch, Unit Hold, and so forth. Each function can be assigned one or more Done By and Check By security levels. More than one level of user can be permitted to perform or verify a function, for example, both operators and supervisors could be permitted to perform a function, but only supervisors could verify the function. Functions can be added to the security system at any time.

Recipe and operator station security assignments are made on a per user basis.

Recipe assignments protect against operators working on products for which they have not been trained. None, one, many, or all recipes can be assigned to a user. Security for the recipe delete function prevents an unauthorized user from deleting a master recipe.

Operator station assignments protect against operators working at operator stations to which they should not have access. None, one, many, or all operator stations can be assigned to a user.

Each user has an account consisting of a user name containing a maximum of 30 characters and a user identification containing a maximum of 12 characters. When a security clearance is required, the security system prompts the user for an ID and password. The permitted number of requests for security clearance can be limited and access denied if the number of retries is exceeded by a user.

The system supports password time-out (the number of days a password is valid) and password reuse (the number of day which must pass before a password can be re-used). All passwords in the security system are stored and transmitted in an encrypted format.

User Access Activity Report

A report query template is provided to retrieve security administration and user access activity from history for display or printout.

FDA 21 CFR Part 11 on Electronic Records and Electronic Signatures Regulation

I/A Series Batch software has been designed for use in validated processes that must comply with the FDA 21 CFR Part 11 on Electronic Records and Electronic Signatures. A white paper describing the regulation and how the Batch software helps users comply with the regulation is available.

ENVIRONMENT MANAGEMENT SYSTEM

The Environment Management capability provides a controlled interface so you can monitor and manipulate the Batch Server applications and configurations in both the configuration and run-time environments. The Environment Management capability is configurable using the Environment Editor. The editor is used to define the applications that can run in the configuration or run-time environments and to set option switches for executables. The Environment display shows editor icons and run-time GUI-based applications that you can select and run. Additionally, you can start and stop background applications, monitor their status and start and stop individual editor and display applications.

Listed below are the significant functions of the Environment Management capability:

- Copy Edit_Model to Run_Model
- Copy Run_Model to Edit_Model
- Start All Applications
- Stop All Applications
- Start Application
- Stop Application
- Edit Environment and Configure Applications Switches
- Update Environment
- Exit and Shutdown
- Exit.

PROGRAMMATIC INTERFACES TO I/A SERIES BATCH (WINDOWS NT VERSION)

These functions are included with the Batch Server license at no additional charge.

COM Automation Servers

I/A Series Batch software (Windows NT version) includes two Automation Servers that provide access to the material and the recipe databases. Each server is comprised of a set of object classes that contain a variety of methods and properties. You can use these to develop custom applications within COM-based environments such as Visual Basic™ and Visual C++™.

Materials Database Automation Server

The Materials Database Automation Server (*MaterialSrv.exe)* provides read and write access to the materials database. You use the server to develop custom applications that provide the following functionality:

- Add, change, and delete materials (ingredients, intermediates, etc.)
- Define default characteristics for a material
- Query and assign available units to a material
- Add and remove lot tracking information for a material assigned to a unit
- Query material lot tracking information
- Define actual characteristic values for a specific lot of material
- Find the location of a material
- Query the contents of a unit
- Query the total quantity of a material.

Recipe Database Automation Server

The Recipe Database Automation Server (*RecipeEdit.exe*) provides read and write access to the recipe database. You use the server to develop custom applications that provide the following functionality:

- Add, change, and delete recipes
- Query and change recipe header information
- Query and change recipe equipment requirements
- Query formula inputs defined for a recipe
- Query formula outputs defined for a recipe
- Define and modify the formula for a recipe
- Define a recipe procedure.

Batch Function Interface Libraries

I/A Series Batch (Windows NT version) includes two types of libraries that define an interface from which you can create an in-process server (.dll) to interact with the batch function interface. Each type of library is comprised of a set of object classes that contain a variety of methods and properties. You can use these to develop custom servers with COM-based environments such as Visual Basic and Visual C++.

The Batch Hooks Type Library (*batchvbserver.dll*) includes functions and subroutines that can be used to access the batch function interface. The batch function interface consists of several hooks into the execution of Batch Manager. Adding logic to these hooks allows you to extend the capabilities of Batch Manager.

The Batch Object Type Library (*batchobjsrv.dll)* provides objects that contain the appropriate batch, phase, parameter, and equipment data available and modifiable within the hooks.

PROGRAMMATIC INTERFACES TO I/A SERIES BATCH (UNIX VERSION)

The Developer's Toolkit has been created to allow you to quickly and easily write custom applications that would interface with the batch software. The toolkit is a separately priced and part numbered item.

Batch Talk Library

Functions are provided to allow you to write custom applications to interface with the Batch database. Also, the library allows you to create custom operator interfaces that have all or a portion of the functionality contained in the Batch Display module.

Batch Database Library

Functions are provided to allow you to write custom applications to interface with the Materials database.

Tag Talk Library

Functions are provided to allow you to write custom applications to interface with any of the tags defined within the batch system. The functions supported with this library include:

- Create application specific tags that can be used in other custom applications.
- Read and write values for any tag defined in the system.

Function Library

Functions are provided to allow you to write custom applications that will be called by other modules in the batch system.

Security Library

The Security library provides an interface for restricting access to applications and their functions. It also provides the capability to modify user passwords. Applications using the Security library are clients of the Security Manager who decides whether a potential user has the required security clearance. The Security library provides an application with two types of functions for security execution. One set uses X-Window system GUIs to interface with the Security Manager while the other provides straight function calls.

Message Library

The Message library provides an interface for reading and writing notification messages between the Batch system and an external application. Applications using the Message library are clients of the Message Manager. All messages generated by the Batch Messaging system can be read with this library. This library can also be used to broadcast messages to existing Message display applications and can be stored in the Message database.

FOXBATCH MIGRATION UTILITIES

I/A Series Batch software includes a set of utilities that enable migration of FoxBatch Model, Recipe, Material, Link, Logger, and Security databases to I/A Series Batch databases for the UNIX or Windows NT operating system.

I/A SERIES INTEGRATION

I/A Series Batch software is well integrated with the rest of the I/A Series platform. Associations between equipment and a batch are dynamically made in the control package so that any batch related alarm messages contain the Batch ID. This ensures data integrity when queries are made later on the Batch Historian and obviates the need to infer associations between equipment and a batch based on time.

Using the Batch display for a given batch, you can launch FoxAlert software with match filtering automatically set to the Batch ID of that batch. This ensures that only those alarms that pertain to that batch are displayed in this view (refer to Figure 10).

Phase and formula parameter descriptions are available from the Batch display.

Phase logic is implemented using I/A Series sequence blocks. The use of the companion product, I/A Series SFC software, allows these sequence blocks to be configured and displayed in a graphical format that follows the IEC 61131-3 standard. When viewing a phase from the Batch display, you can launch the SFC/ST display for that phase (if it was configured using the SFC/ST Configurator) to quickly and easily determine, via highlighting, where you are in that phase and to view the live, updating evaluation of any active transitions (refer to Figure 10). This greatly reduces the time to debug and commission phase logic as well as provides a handy tool to operations people for ongoing support.

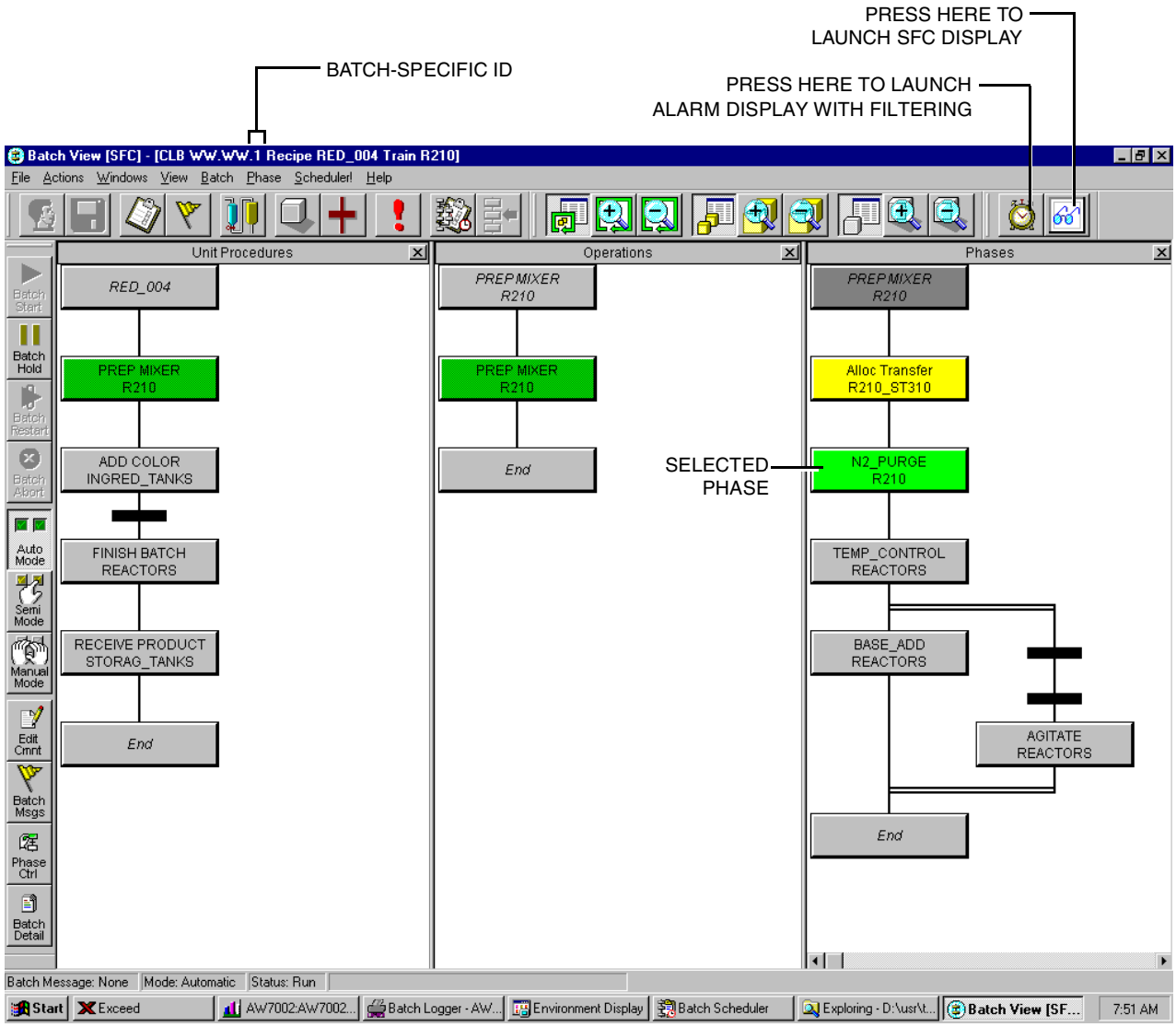


Figure 10. Integration with Alarm Alert and SFC/ST Display Manager

BATCH SYSTEM CONFIGURATION

The I/A Series Batch server is scalable and available in three sizes: large, medium, and small. The number of operator and configuration stations is selectable.

The Batch Server license includes one Operator Client license and one Configurator Client license giving complete functionality from the Batch Server application workstation (AW). Additional Operator and Configuration clients may be installed on other application workstations and workstation processors as required.

Redundant Batch Server Option

Server redundancy capabilities allow the server to automatically switch batch control to a backup server in the event of a primary server shutdown due to a hardware failure or power loss. Two identical servers are required to configure a redundant system (refer to Figure 11 and Figure 12).

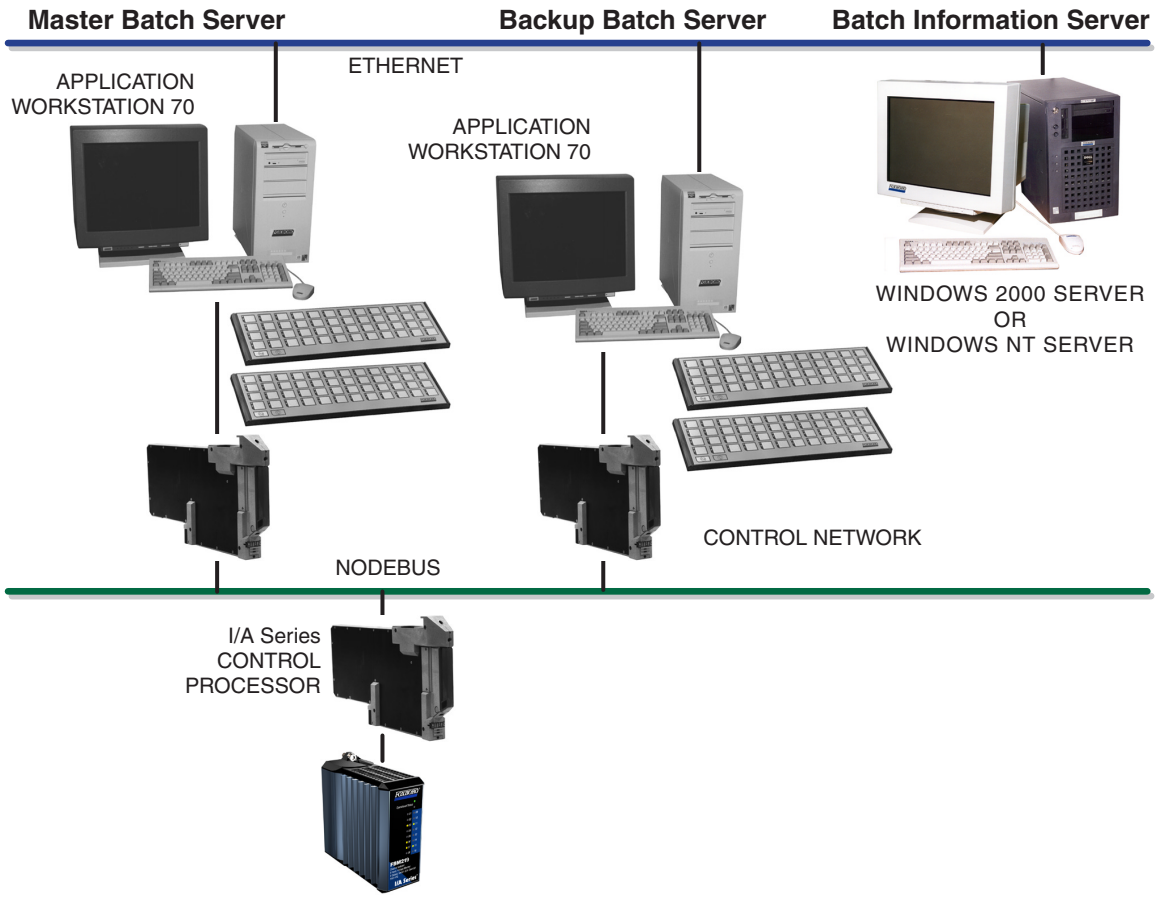


Figure 11. Batch Server Redundancy for Windows NT Operating System

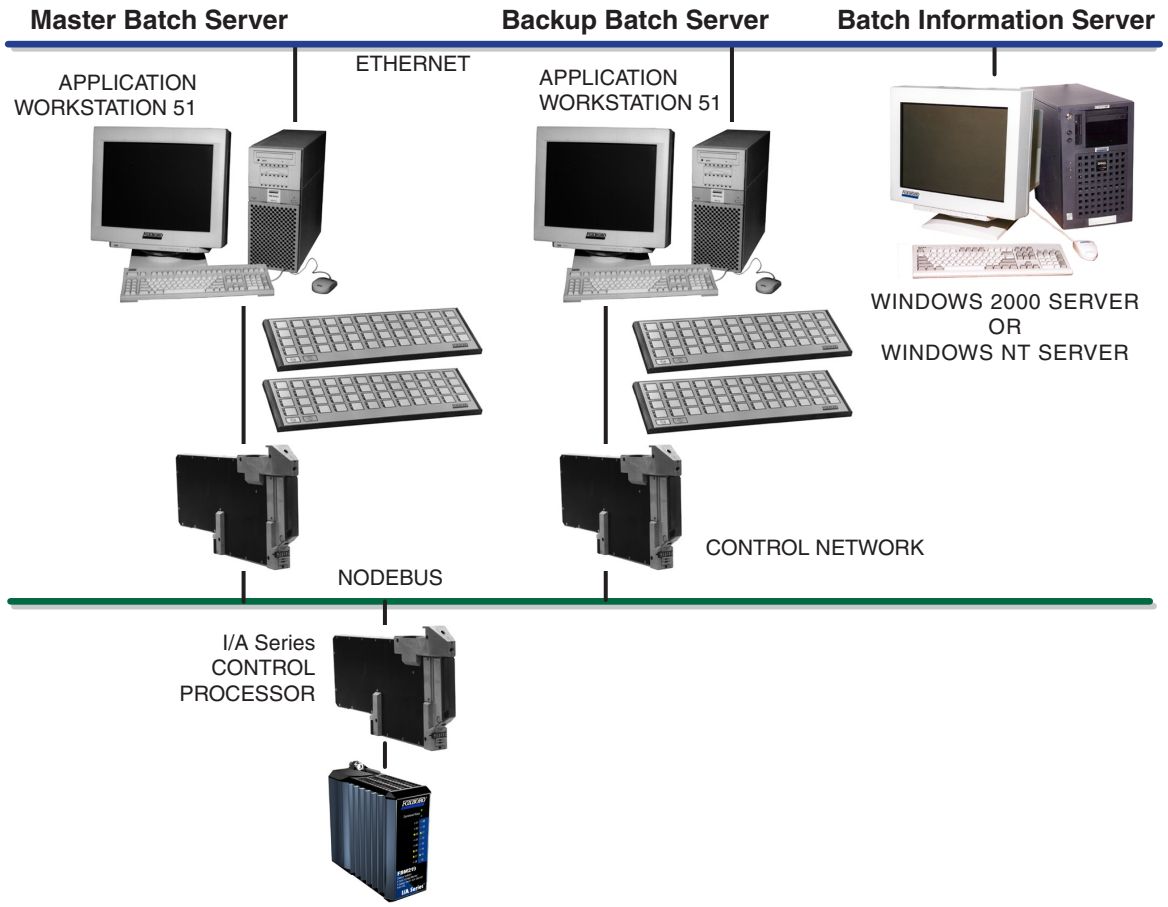


Figure 12. Batch Server Redundancy for UNIX Operating System

ETHERNET NETWORKS

Ethernet networks (in addition to the Control Network, Nodebus or Ethernet) are recommended for best performance between the Batch Server and Batch Clients. Refer to Figure 13 and Figure 14. Ethernet networks are required for applications where:

- Reports are to be viewed from operator workstations
- Operators enter alarm comments from operator workstations
- Batch Client workstations are connected via Carrierband LAN to their Batch Server application workstations (AWs).

Batch Information Server

The Batch Information Server functions rely heavily on resource intensive SQL Server, Internet Information Server, and Crystal Report Server. This requires a powerful computer.

Operating System Considerations

The Batch Information Server can be deployed on a Windows NT 4.0 or Windows 2000 platform. Memory, disk space, and minimum processor requirements for Windows NT and Windows 2000 servers differ.

The Windows 2000 platform has considerable operational and functional advantages over the Windows NT 4.0 system. Additional memory is generally needed when using Windows 2000, with a production system recommendation of at least 256 MB.

Hardware Considerations

Information server configuration should consider failure of the disk drive, network interface card, and power supply.

Disk subsystems (controllers/disk) should be SCSI and ideally be a hardware RAID. When a RAID configuration is not used, SCSI provides a level of fault tolerance, since Windows NT operating system dynamically relocates detected disk errors to good sectors (IDE simply fails).

SQL Server, a significant disk resource consumer, also has specific system requirements that necessitate separate hard drives for the database and database log for recovery purposes.

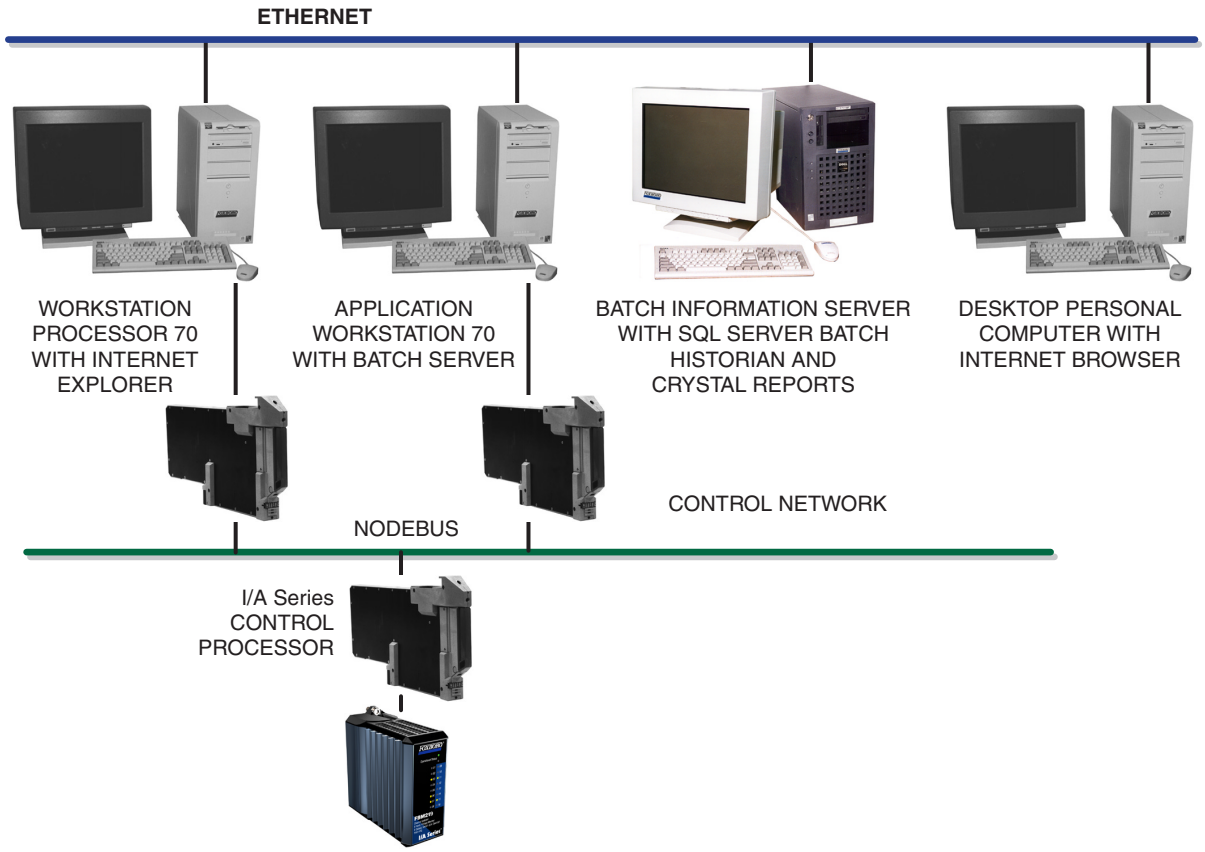


Figure 13. Windows NT Batch Reporting System Configuration

Basic Production System

For a minimum configuration, disregarding fault resilience and performance concerns, the following platform is sufficient: a current Intel™ compatible processor, 128 MB memory, three IDE disk drives (OS, database, and database logs), and a modest 8 mm tape drive.

Power Production System

Multiple processors help to ensure processor availability during extreme non-OLTP processing. Reporting demands can change the processor requirements dramatically.

A RAID configuration utilizing two disk drives at RAID1 and four drives at RAID5 is ideal. The operating system, application software, and database logs are on mirrored drives (RAID1).

The database is on three drives at RAID5 with data parity striped across all drives. For additional performance, RAID10 can be used. A hot spare drive (RAID5) is included to rapidly recover from reduced performance and to increase availability.

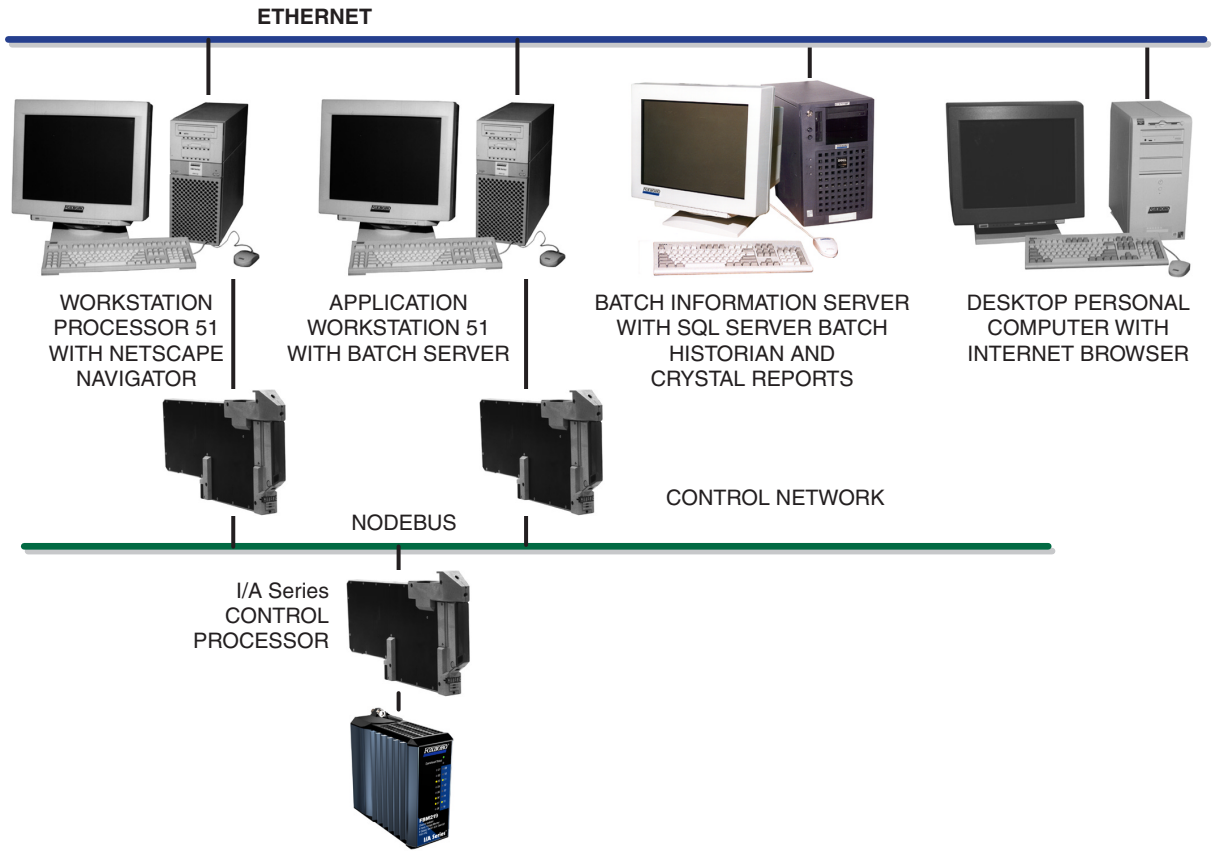


Figure 14. UNIX Batch Reporting System Configuration

BATCH INFORMATION SERVER HARDWARE FUNCTIONAL SPECIFICATIONS

Basic Production Server Minimum Hardware Requirements

PROCESSOR TYPE
Pentium™ III class, 733 MHz or better
MEMORY
128 MB ECC RAM (Windows NT)
256 MB ECC RAM (Windows 2000)
INTERNAL DIAGNOSTICS
Self-checking performed at power-up. Run-time checks can be performed during operation.
VIDEO PERFORMANCE
- 75 Hz refresh rate
- 256 colors
- 1024 x 768 resolution (pixels)

VIDEO OUTPUT TYPE
Analog RGB with horizontal and vertical sync
DEVICES SERVED
IDE Peripherals
– Three internal system disk drives (OS, database, and database logs), each a minimum of 2 GBs
– One CD-ROM drive
– One internal 10 GB tape drive (DLT)

Controller Peripherals
One internal 1.44 MB, 3.5-inch disk drive
Interfaces to External Devices
– Mouse or optional trackball (PS/2 bus)
– Alphanumeric keyboard (PS/2 or USB)
– Printer (parallel or USB)

ETHERNET INTERFACE COMMUNICATIONS
Redundant (bonded) PCI Ethernet cards providing connection to Ethernet data bus (AUI, 10Base2/5, 10BaseT)
POWER SUPPLIES
Two redundant hot-swap 330 W universal input power supplies with separate power cords
POWER REQUIREMENTS
Mini Tower Input Power
115 to 230 V ac nominal, 50 to 60 Hz, auto select
Mini Tower Power Consumption
330 W maximum

Power Production Server Minimum Hardware Requirements

PROCESSOR TYPE
Multi-processor (2 to 4), Pentium III class, 733 MHz or better
MEMORY
1 GB ECC RAM
INTERNAL DIAGNOSTICS
Self-checking performed at power-up. Run-time checks can be performed during operation.
VIDEO PERFORMANCE
- 75 Hz refresh rate
- 256 colors
- 1024 x 768 resolution (pixels)

VIDEO OUTPUT TYPE
Analog RGB with horizontal and vertical sync
DEVICES SERVED
SCSI Peripherals
– Two internal drives at RAID1 (OS, software, and database logs)
– Three internal drives at RAID5 (database)
– One internal drive (hot spare) at RAID Level 5
– One CD-ROM drive
– One internal 20 GB tape drive (DLT)

Controller Peripherals
One internal 1.44 MB, 3.5-inch disk drive
Interfaces to External Devices
– Mouse or optional trackball (PS/2 bus)
– Alphanumeric keyboard (PS/2 or USB)
– Printer (parallel or USB)

ETHERNET INTERFACE COMMUNICATIONS
Redundant (bonded) PCI Ethernet cards providing connection to Ethernet data bus (AUI, 10Base2/5, 10BaseT)
POWER SUPPLIES
Two redundant hot-swap 330 W universal input power supplies with separate power cords
POWER REQUIREMENTS
Mini Tower Input Power
115 to 230 V ac nominal, 50 to 60 Hz, auto select
Mini Tower Power Consumption
330 W maximum

BATCH INFORMATION SERVER SOFTWARE FUNCTIONAL SPECIFICATIONS

Windows NT 4.0 Server

- Server software:
  - Windows NT Server
  - Windows NT Enterprise Server
- Windows NT 4.0 Service Pack 5
- Internet Information Server, 5.0
- SQL Server software(a):
  - SQL Server, Version 7
  - SQL Server Enterprise, Version 7
- SQL Server Service Pack 2(a)
- Windows NT Option Pack, initial version (includes Internet Information Server 4.0, a requirement for the platform)
- Crystal Reports, Version 8(a)
- Microsoft Data Access Components (MDAC)(a) Version 2.1 Service Pack 2 or greater (MDAC 2.5 consistent with Windows 2000)
- Internet Explorer, Version 5.01(a)

(a) Included on the I/A Series Batch software distribution CD-ROMs.

Windows 2000 Server

- Server software:
  - Windows 2000 Server, initial version (128 bit cipher)
  - Windows 2000 Advanced Server, initial version
  - Windows 2000 Data Center, initial version (MDAC 2.5 integrated in operating system)
- Windows 2000 Service Pack 1
- Internet Information Server, 5.0 (included in operating system distribution)
- SQL Server, Version 7(a)
- SQL Server Service Pack 2 or greater [SQL Server, Version 7(a), SP2]
- Crystal Reports, Version 8(a)
- Internet Explorer, Version 5.01(a) (Version 5.5 generally available)

BATCH SERVER HARDWARE FUNCTION SPECIFICATIONS

Application Workstation

AW MEMORY
128 MB ECC RAM minimum (Windows NT)
256 MB ECC RAM minimum (Solaris)
AW COMMUNICATIONS
Requires second Ethernet port

Workstation Processor

WP COMMUNICATIONS
Requires second Ethernet port in order to view reports

Printer

PostScript printer required for printing graphical recipes

BATCH SOFTWARE FUNCTIONAL SPECIFICATIONS

Process Model

There are no absolute limits on the number of process units or connections. The only limitation is hard disk space in the host processor.

Maximum Number of Formula Variables per Phase when Downloading to a Sequence Block

24 booleans, 8 integers, 15 reals and 10 strings
{Note: These limitations do not apply when downloading to multiple blocks.}

Maximum Number of Recipes

Unlimited. The only limitation is hard disk space in the host processor.

Maximum Number of Serial Steps (Operations) in a Recipe

510

Maximum Number of Serial Steps (Phases) in an Operation

510

Maximum Number of Phases for Operator Selection of Parallel Execution

20

I/A SERIES BATCH PART NUMBERS

The following tables list the Windows NT software license part numbers, UNIX software license part numbers, Batch Backup Server part numbers, and related product part numbers.

Table 1. I/A Series Batch Software for Windows NT Software License Part Numbers

Part Number	Title	Description
J0200TC	I/A Series Batch Operator Client License V8.0 (70 Series)	The Operator Client package provides Batch Scheduler and Batch detail displays for operators. The Operator Client runs on Workstation Processor 70/Application Workstation 70 (WP70/AW70) platforms at Version 6.2 and higher. One Operator Client license is required for each AW or WP where operator Batch displays can be viewed. Each Batch Server license includes one Operator Client.
J0200TD	I/A Series Batch Server Large License V8.0 (70 Series)	A comprehensive Batch control package that provides process modeling, recipe management, unit supervision, production information management, and material tracking functions. The server runs on AW70 platforms at Version 6.2 and higher. The performance of the large server is limited to system resources. This includes one Operator/Run-Time Client and one Configuration/Development Client. Also includes reporting development software consisting of Crystal Reports (CR) 8.0 Professional, (5) Crystal Report 8.0 Web Clients, and (5) MS-SQL Server Client Access Licenses (CAL). Additional reporting clients available as part number J0200TQ.
J0200TE	I/A Series Batch Server Medium License V8.0 (70 Series)	A comprehensive Batch control package that provides process modeling, recipe management, unit supervision, production information management, and material tracking functions. The Batch server runs on AW70 platforms at Version 6.2 and higher. The medium server accommodates up to 40 S88 units. This includes one Operator/Run-Time Client and one Configuration/Development Client. Also includes reporting development software consisting of Crystal Reports (CR) 8.0 Professional, (5) Crystal Report 8.0 Web Clients, and (5) MS-SQL Server Client Access Licenses (CAL). Additional reporting clients available as part number J0200TQ.
J0200TF	I/A Series Batch Server Small License V8.0 (70 Series)	A comprehensive Batch control package that provides process modeling, recipe management, unit supervision, production information management, and material tracking functions. The server runs on AW70 platforms at Version 6.2 and higher. The small server accommodates up to 15 S88 units. This includes one Operator/Run-Time Client and one Configuration/Development Client. Also includes reporting development software consisting of Crystal Reports (CR) 8.0 Professional, (5) Crystal Report 8.0 Web Clients, and (5) MS-SQL Server Client Access Licenses (CAL). Additional reporting clients available as part number J0200TQ.
J0200TG	I/A Series Batch Configuration Client License V8.0 (70 Series)	The Configuration Client package provides configuration capability for the I/A Series Batch package. The Configuration Client runs on WP70/AW70 platforms at Version 6.2 and higher. One Configuration Client license is required for each AW or WP where configuration can be performed. Each system must have at least one Configuration Client. Each Batch Server license includes one Configuration Client.
J0200TQ	I/A Series Batch Reporting License V8.0 (50 Series and 70 Series)	Includes (1) Crystal Report 8.0 Web Client and (1) MS-SQL Server Client Access License (CAL).

Table 2. I/A Series Batch Software for UNIX (50 Series) Software License Part Numbers

Part Number	Title	Description
J0200SW	I/A Series Batch Operator Client License V8.0 (50 Series)	The Operator Client package provides Batch Scheduler and Batch detail displays for operators. The Operator Client runs on Workstation Processor 51/Application Processor 51 (WP51/AW51) platforms at Version 6.2 and higher. One Operator Client license is required for each AW or WP where operator Batch displays can be viewed. Each Batch Server license includes one Operator Client.
J0200SX	I/A Series Batch Server Large License V8.0 (50 Series)	A comprehensive Batch control package that provides process modeling, recipe management, unit supervision, production information management, and material tracking functions. The server runs on AW51 platforms at Version 6.2 and higher. The performance of the large server is limited to system resources. This includes one Operator/Run-Time Client and one Configuration/Development Client. Also includes reporting development software consisting of Crystal Reports (CR) 8.0 Professional, (5) Crystal Report 8.0 Web Clients, and (5) MS-SQL Server Client Access Licenses (CAL). Additional reporting clients available as part number J0200TQ.
J0200TA	I/A Series Batch Configuration Client License V8.0 (50 Series)	The Configuration Client package provides configuration capability for the I/A Series Batch package. The Configuration Client runs on WP51/AW51 platforms at Version 6.2 and higher. One Configuration Client license is required for each AW or WP where configuration can be performed. Each system must have at least one Configuration Client. Each Batch Server license includes one Configuration Client.
J0200TB	I/A Series Batch Developer's Toolkit License V8.0 (50 Series)	The Developer's Toolkit is an optional package intended for those users who write C or C++ programs to access the I/A Series Batch databases (recipe, materials, and so forth.) and/or the Application Programming Interface (API). It runs on an AW51 at Version 6.2 or higher.
J0200TQ	I/A Series Batch Reporting License V8.0 (50 and 70 Series)	Includes (1) Crystal Report 8.0 Web Client and (1) MS-SQL Server Client Access License (CAL).

NOTE

Small and Medium Server Licenses are not offered on the UNIX Platform.

Table 3. Batch Backup Server Part Numbers

Part Number	Title	Description
J0200TH	I/A Series Batch Backup Server Large License V8.0 (50 Series)	In redundant server configurations, this provides backup for I/A Series Batch Server Large License (50 Series) Part Number J0200SX.
J0200TL	I/A Series Batch Backup Server Large License V8.0 70 Series)	In redundant server configurations, this provides backup for I/A Series Batch Server Large License (70 Series) Part Number J0200TD.
J0200TM	I/A Series Batch Backup Server Medium License V8.0 (70 Series)	In redundant server configurations, this provides backup for I/A Series Batch Server Medium License (70 Series) Part Number J0200TE.
J0200TN	I/A Series Batch Backup Server Medium License V8.0 (70 Series)	In redundant server configurations, this provides backup for I/A Series Batch Server Small License (70 Series) Part Number J0200TF.

Table 4. Advantage Upgrade Part Numbers

Part Number	Title
Special Advantage pricing may be used for migrations from all previous Foxboro Batch products, including FOX 1/A™ Batch, EasyBatch™, Batch Plant Management, RBATCH™, RBATCH II™, and FoxBatch. Advantage pricing on I/A Series Batch software licences is also extended to competitive migration projects.	
P0997EM	I/A Series Batch Operator Client ADVANTAGE License V8.0 (50 Series)
P0997EN	I/A Series Batch Server Large ADVANTAGE License V8.0 (50 Series)
P0997ER	I/A Series Batch Configuration Client ADVANTAGE License V8.0 (50 Series)
P0997ES	I/A Series Batch Developer's Toolkit ADVANTAGE License V8.0 (50 Series)
P0997ET	I/A Series Batch Operator Client ADVANTAGE License V8.0 (70 Series)
P0997EU	I/A Series Batch Server Large ADVANTAGE License V8.0 (70 Series)
P0997EV	I/A Series Batch Server Medium ADVANTAGE License V8.0 (70 Series)
P0997EW	I/A Series Batch Server Small ADVANTAGE License V8.0 (70 Series)
P0997EX	I/A Series Batch Configuration Client ADVANTAGE License V8.0 (70 Series)
P0997EY	I/A Series Batch Backup Server Large ADVANTAGE License V8.0 (50 Series)
P0997FB	I/A Series Batch Backup Server Large ADVANTAGE License V8.0 (70 Series)
P0997FC	I/A Series Batch Backup Server Medium ADVANTAGE License V8.0 (70 Series)
P0997FD	I/A Series Batch Backup Server Small ADVANTAGE License V8.0 (70 Series)
P0997FF	I/A Series Batch Reporting Client ADVANTAGE License V8.0 (50 and 70 Series)

Table 5. Server Size Upgrade Part Numbers

Part Number	Title	Description
J0200TV	I/A Series Batch Server Upgrade Small to Medium (70 Series)	For customers who presently have a Small Server License and wish to expand their applications from 15 or fewer units to 40 or fewer units.
J0200TW	I/A Series Batch Server Upgrade Medium to Large (70 Series)	For customers who presently have a Medium Server License and wish to expand their applications from 40 or fewer units to greater than 40 units.
J0200TX	I/A Series Batch Backup Server Upgrade Small to Medium (70 Series)	For customers who presently have a Small Backup Server License and wish to expand their applications from 15 or fewer units to 40 or fewer units. J0200TV is also required.
J0200TY	I/A Series Batch Backup Server Upgrade Medium to Large (70 Series)	For customers who presently have a Medium Backup Server License and wish to expand their applications from 40 or fewer units to greater than 40 units. J0200TW is also required.

Table 6. Related Product Part Numbers

Part Number	Title	Description
J0200LA	I/A Series SFC Software License (70 Series)	The SFC software comprises the Sequential Function Chart and Structured Text (SFC/ST) Configurator and Display Manager for I/A Series sequence blocks. This includes SFC/ST sequence block displays which may be viewed from any WP hosted by the AW where I/A Series SFC resides. SFC runs on AW70 platforms at Version 6.2 and higher. One SFC license is required for each instance of the I/A Series Integrated Control Configurator (ICC).
J0200LB	I/A Series SFC Software License (50 Series)	The SFC software comprises the Sequential Function Chart and Structured Text (SFC/ST) Configurator and Display Manager for I/A Series sequence blocks. This includes SFC/ST sequence block displays which may be viewed from any WP hosted by the AW where I/A Series SFC resides. SFC runs on AW51 platforms at Version 4.3 and at Version 6.2 and higher. One SFC license is required for each instance of the Integrated Control Configurator (ICC).

RELATED PRODUCT INFORMATION

The following table lists references to other products that are commonly used with I/A Series Batch software.

Table 7. Related Product Specification Sheets

Batch Data Analysis		
PSS 21S-7A5 B3	I/A Series AIM*Explorer™	AIM*Explorer software tool is for visualizing and exploring real-time and historical process data served from I/A Series systems and other data servers.
PSS 21S-6C3 B3	I/A Series AIM*SPC™ Statistical Process Control	AIM*SPC software provides on-line displays of charts and other Statistical Process Control (SPC) tools for process variables.
Enterprise Application Integration		
PSS 21S-4V8 B3	I/A Series ProcessConnect	As part of the I/A Series Information Suite, ProcessConnect uses state-of-the-art messaging, middleware, and services to install and configure your solution, and train your personnel to maintain the solution as your business changes.

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