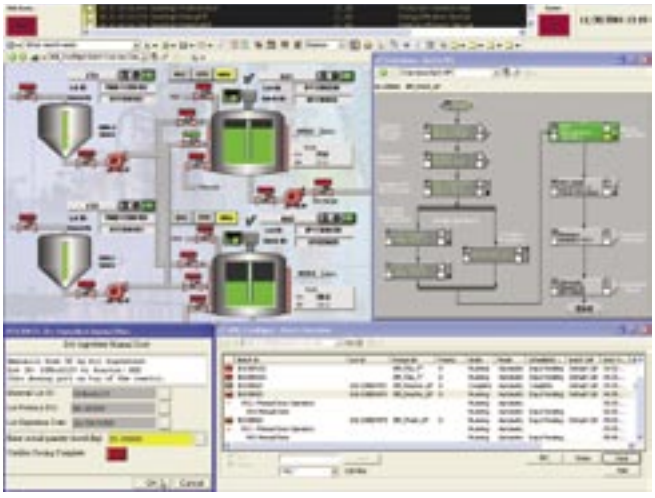
Industrial IT System 800xA
Production Management
Batch Management

Overview

Features and Benefits

- **Integration with 800xA Operations:** Seamless integration provides complete ease of navigation, system configuration, alarm/event management, and security enforcement.
- **Built-in Support for Optimization:** Optimize batch production yields with dynamic recipe parameter adjustments. Utilize Process Analytical Technology (PAT) models to improve quality and reduce cycle times.
- **Flexible Recipe Management:** Creates a library of re-usable recipe building blocks consistent with the ISA88 batch control standard. Online recipe editing during batch execution provides additional flexibility.
- **Customer Batch/Campaign Scheduling:** Easily schedules control recipes based on master recipes and batch-specific formulation data. Selects equipment at schedule time or dynamically at runtime. Supports multiple execution of batches within a campaign.
- **Informative Operator Displays:** Graphical display of control recipes provides current status information as well as ability to issue runtime commands without the need for additional graphic configuration effort.
- **Batch Production Data Management:** Coupled with 800xA Information Management, maintains complete electronic batch records for reporting and historical archiving.
- **Support for Regulatory Compliance:** System-wide technical features to ensure data integrity, control system access, create electronic records and manage electronic signatures.



Increasing competitive pressures have forced batch manufacturers to demand greater flexibility from production facilities. Production managers are being challenged to achieve seemingly incompatible objectives of increasing output and reducing the risk of regulatory noncompliance while implementing cost reduction initiatives. These pressures are driving the evolution of interoperability between distributed control systems and enterprise planning and information systems. Industrial IT System 800xA Production Management meets this challenge with the most advanced batch automation and manufacturing management system available in the marketplace. 800xA Manufacturing Management is an integrated software package for managing the essential elements of material inventory, equipment, quality and process instructions; and reducing the time and costs associated with ensuring and documenting compliance of manufacturing activities. 800xA Batch Management is a powerful application software package for configuring, scheduling, and managing batch operations.

800xA Batch Management is aligned with industry standards such as ISA88, ISA95, IEC 61512, and IEC 62264. It is further enhanced by ABB's extensive batch automation expertise. 800xA Batch Management delivers:

- Increased product consistency resulting in better quality
- Easy to use recipe management functions reducing time-to-market
- Integrated production management and control for maximum equipment utilization and minimized operating costs
- Regulatory compliance through the use of embedded system technical features

Industrial IT enabled

ABB

Functional Area Overview

Unmatched Flexibility

Any batch manager can sequence the process when steady-state conditions persist and everything goes according to plan. What happens, however, when unexpected events occur? 800xA Batch Management is the only batch control solution that is uniquely designed to help recover from the unexpected. The key to this is the flexibility that can be designed into batch control strategies with System 800xA.

800xA Batch Management supports the concept of dynamic recipe parameters. Master recipe procedures can be configured with one or more formulation parameters established as an expression, rather than a constant value. This enables the subsequently generated control recipe to evaluate one or more variable process conditions and dynamically update the formulation parameter at run-time. Improved product quality and reduced processing time are just two of the potential benefits when using a dynamic control recipe.

In many cases, operator or supervisor intervention in a batch process means aborting the batch recipe procedure and manually completing the batch. 800xA Batch Management provides the tools to allow user intervention to make the necessary adjustments and continue the processing of the batch through the control recipe procedure. An operator or supervisor can easily re-route the batch path to another allowable unit if the originally selected unit is not available or out-of-service. The most powerful feature, however, is the extensive runtime editing capability. Users with the correct permission level can perform a runtime edit on any currently executing recipe procedure. The runtime edit feature enables the modification of any subsequent operation or phase in the currently executing control recipe without stopping the recipe. Of course, all user-initiated changes are captured in System 800xA audit trail and batch production record.

All process automation systems support interlocking strategies at the control module level. Certainly, interlocks required for safety and preservation of process equipment should reside at the controller level. However, in a flexible batch production facility there could be one or more conditions that are dependent upon the type of material being processed in the unit. Only 800xA Batch Management provides exception procedures as an extension of the ISA88 procedural model to provide the ability to configure recipe-specific error handling logic. An exception procedure monitors for undesirable product related process conditions and contains handling instructions in case the condition occurs.

800xA Batch Management includes five primary functions:

- Product Definition Management
- Production Execution Management
- Production Resource Management
- Production Data Collection
- Production Dispatching

Product Definition Management

The batch master recipe procedure, and all subsequent procedure levels are configured graphically in 800xA Batch Management. The following information can be specified for each individual batch recipe:

- Procedure
- Formula
- Equipment requirements
- Header and other information

Procedure

Procedures are configured graphically using a specialized editor. The diagram is a Procedure Function Chart (PFC) based on ISA88 standards. Strict adherence to the procedure levels specified by ISA88 can be enforced, or, for additional flexibility, the procedure model can be expanded or collapsed. The procedure editor supports the configuration of conditional transitions, logical branching, parallel branching, looping structures and dynamic block labels for superior operational and control capabilities.

The procedure editor supports the creation and management of re-usable procedure building blocks. Unit procedures and operation procedures can be used in multiple higher level procedures. When a modification is made to one of these lower level procedure building blocks, all procedures using that block are updated.

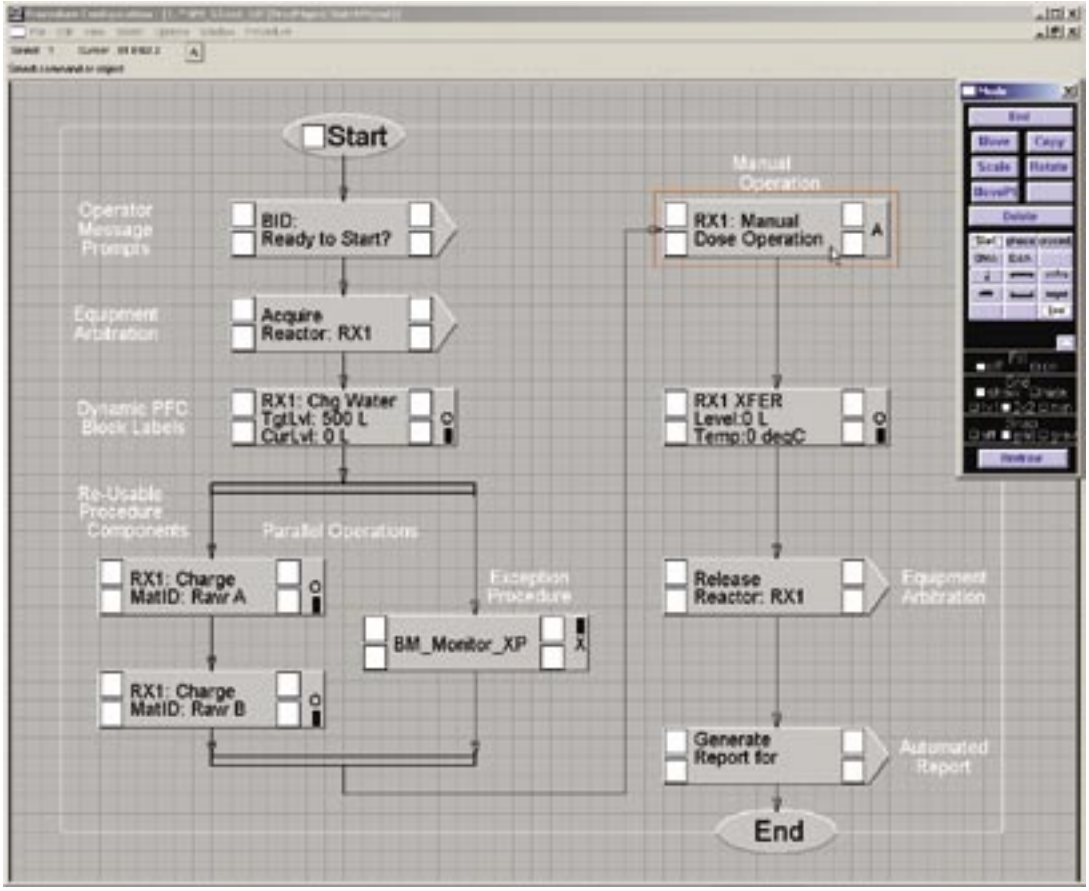


Figure 1. Procedure Configuration Window

Only System 800xA provides exception procedures that extend beyond the procedural model of ISA88. Exception procedures provide product recipe specific exception handling at the batch procedure level in addition to controller based exception and interlock logic.

All procedures are version controlled with revision history for each version. In addition to maintaining the approved version online, a user configurable number of previous versions of the procedure are stored and are available online. A procedure revision history includes the User ID, full user name, workstation node name, date/time stamp, comments about the changes made and electronic signatures. The user is prompted to increment the version number each time a development procedure is promoted to an approved procedure. An online comparison of two versions of a procedure is available via the difference report feature.

Formula

Formula information includes input parameters, process parameters, and output parameters. 800xA Batch Management supports the specification of formula information at any level of the procedure. Formula parameters may also be specified as an expression, rather than a predefined value. This facilitates the dynamic, real-time calculation of recipe parameters during the batch production execution.

Equipment Requirements

Equipment requirements are specified within the procedure using equipment allocation Batch Manager Action (BMA) procedure blocks. The batch recipe can be configured to reserve equipment for subsequent batch processing, acquire equipment for immediate batch processing, or dynamically select equipment from available equipment based upon pre-configured selection criteria and attributes.

Header and Other Information

The procedure header section provides administrative information about the individual procedure. A procedure description as well as free-form header text can be configured. The master recipe version, author, workstation name and creation date are also contained within the header. Standard operating procedures (SOP) can be defined and associated to the procedure. If configured, they can be invoked during the execution of the procedure and display the SOP applicable to the current step in the procedure.

Recipe Import/Export

Batch Management supports the import and export of master recipes via standard XML schemas defined in the WBF BatchML (World Batch Forum Batch Markup Language). The recipe model is supported including the top level elements of Batch Information, Master Recipe and Recipe Building Block.

Production Execution Management

800xA Batch Management supports the simultaneous execution of multiple control recipes in parallel. The configured and approved master recipe procedure becomes the control recipe procedure when the batch has been assigned a Batch ID and dispatched for production. Control recipe execution may proceed in one of three operating modes; automatic, semiautomatic or manual.

In automatic mode, procedural elements automatically execute sequentially through the procedure steps when the transition condition following the procedural element is satisfied. 800xA Batch Management communicates parameters, batch mode and state information to the equipment phases executing in the controller. 800xA Batch Management includes a standard phase interface to the AC800M controllers as well most of the controllers from the ABB heritage process control systems (e.g. Symphony Harmony, DCI System Six, Advant and Freelance).

800xA Batch Management provides the user with the ability to integrate equipment running on other controllers into the batch control recipe. Function Phase Driver is a user configurable application which maps batch states, commands and parameters between the batch server and user defined OPC points representing the interface to an equipment phase in a PLC or other process controller. This feature is quite useful in process applications that include one or more process equipment skids that are supplied and installed with equipment manufacturer supplied controllers.

Batch Execution Monitoring

The graphically based recipe procedure is available as a runtime display without any further configuration. During control recipe execution, its progress can be monitored on the PFC. The current status of each procedure step is represented by a unique combination of colors and symbols as the batch executes.

In addition to monitoring, the control recipe PFC display provides a number of navigation and interaction options, depending on the rights and permissions of the currently logged on user including:

- Navigating to a higher or lower level of procedure function chart
- Changing the operating mode (automatic, semiautomatic, or manual) at any level in the procedure
- Changing the state (running, aborted, stopping, etc.) of any active procedure block at any level in the procedure
- Responding to pending messages, or electronic authentication requests
- Viewing formula information
- Viewing header information
- Navigating to pre-configured active equipment phase aspects

System 800xA also provides simple to deploy graphic configuration objects that provide batch specific information on process graphic displays and enable easy navigation to PFC or batch status displays.

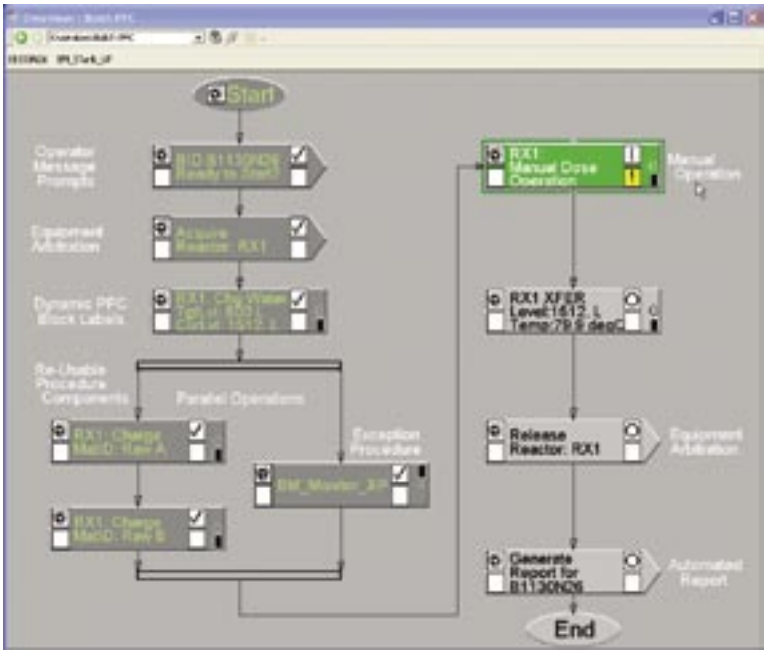


Figure 2. Procedure Function Chart

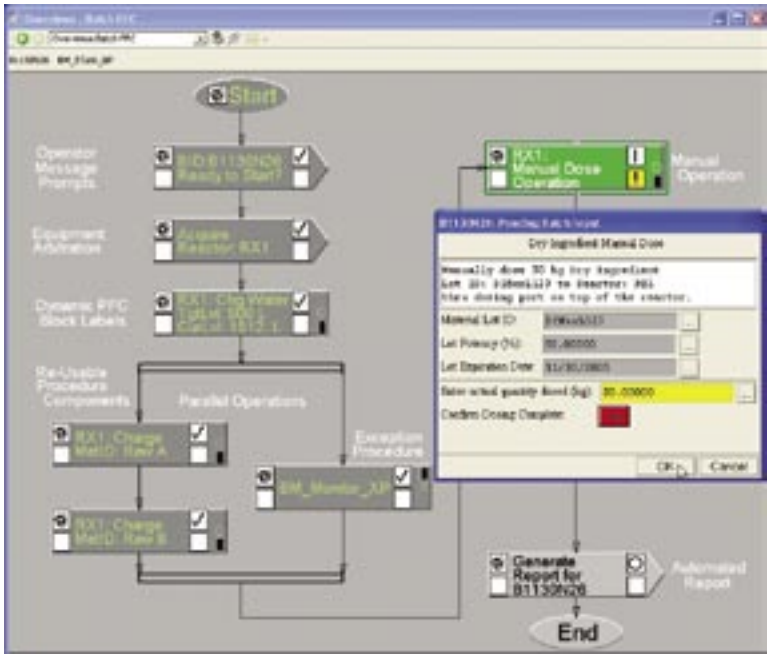


Figure 3. Procedure Function Chart with Operator Message Dialog

Online Recipe Editing

System 800xA provides unique online recipe editing flexibility during batch execution. Authorized users can modify procedure sequence and equipment assignments as well as recipe parameters without stopping any executing control recipe. All changes made to the control recipe are automatically saved in the batch production record.

Production Resource Management

800xA Batch Management supports network, multi-path and single path equipment configurations. This provides support of complex batch production facilities. The configuration of all units, shared-use equipment modules, and exclusive-use equipment modules is integrated with the common object model of the 800xA system. This makes adding or “cloning” a new process unit as simple as copy and paste. System 800xA is the only system that can use the new unit without having to modify existing master or control recipes. Pseudo-resources can be configured and used to identify resources, such as an operator, required at specified points in a procedure.

In addition to the equipment allocation BMA procedure blocks, all other resource management functions are accessible from the Equipment Overview display. The Equipment Overview presents the status of all batch equipment configured in the system as illustrated in Figure 4. The following information is presented in tabular format:

- Equipment name and status (available, busy, reserved, acquired)
- Batch, Lot and Campaign ID (when the equipment is allocated to a batch)
- Operating status (normal, disabled)

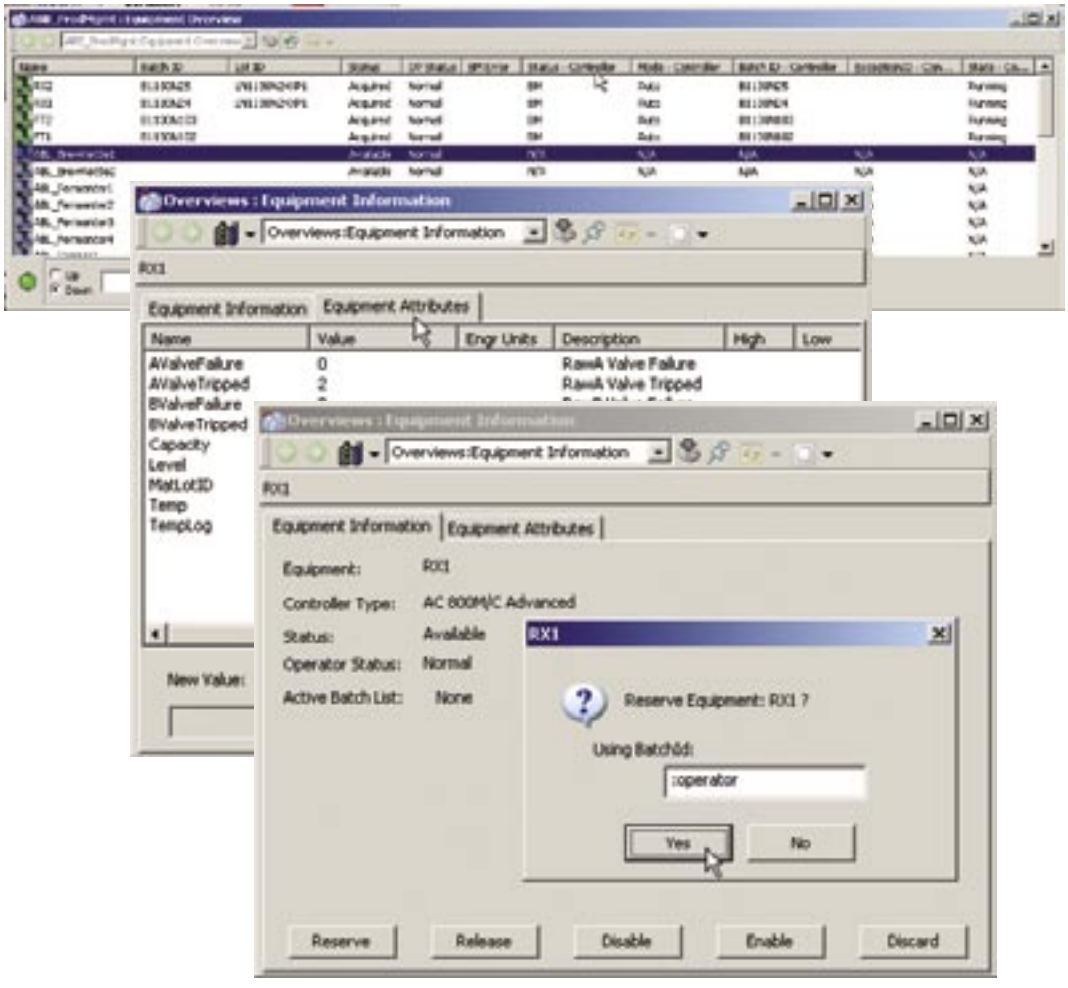


Figure 4. Equipment Overview Windows

The Equipment Information dialog is accessible from the Equipment Overview display. This dialog can be selected for any batch equipment unit appearing on the equipment overview. The equipment information dialog presents current status and provides the user with the ability to manually allocate the equipment, or remove it from service. The equipment specific attributes are also available for viewing from this dialog.

Production Data Collection and Tracking

Batch History Overview

The batch related alarms and events are routed to the 800xA System event system for collection and organization by Information Management. The Batch History Overview will display batch status and tag data for completed batches. Alarms and events generated by Batch Management are accessible from this view while still buffered in the base system history event storage. The completed Procedure Function Chart, displaying the final procedure path that was executed is also accessible from this screen.

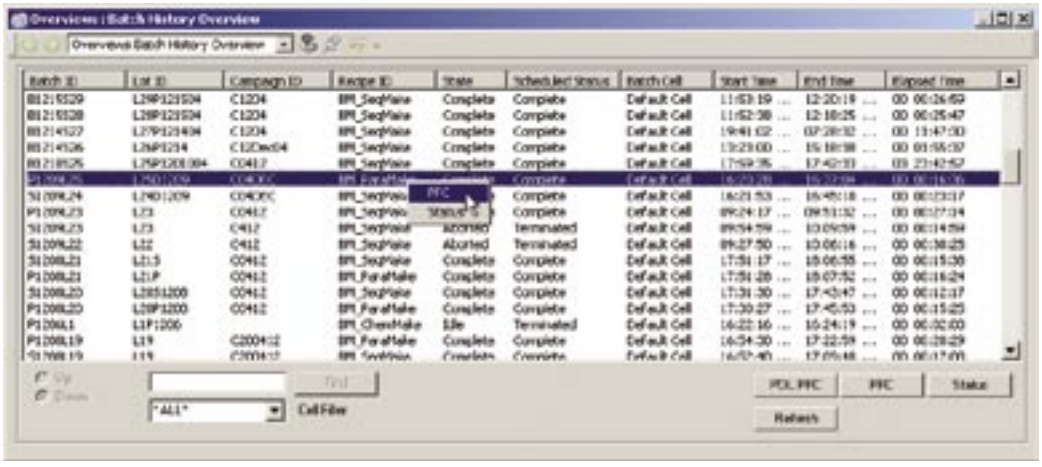


Figure 5. Batch History Overview Window

800xA Information Management

The Production Data Log (PDL) history function of 800xA Information Management provides hierarchal history logs of batch data and events. Often in batch process applications, information relationships cannot be pre-configured because they typically depend on the control recipe execution, rather than on some periodic time basis. The PDL of 800xA Information Management has built-in provisions for the organization, storage, archive and retrieval of this type of information.

The data records stored in Information Management are easily accessible to Microsoft Access, Microsoft Excel, and other popular reporting packages like Crystal Reports. Batch Management includes standard report templates that can serve as a basis for configuring detailed, application specific batch production reports.

With batch event data stored hierarchically in PDL, it is easy to perform batch-to-batch analysis of trend data using associations to batch data to select desired batches and trend variables for analysis.

Production Dispatching

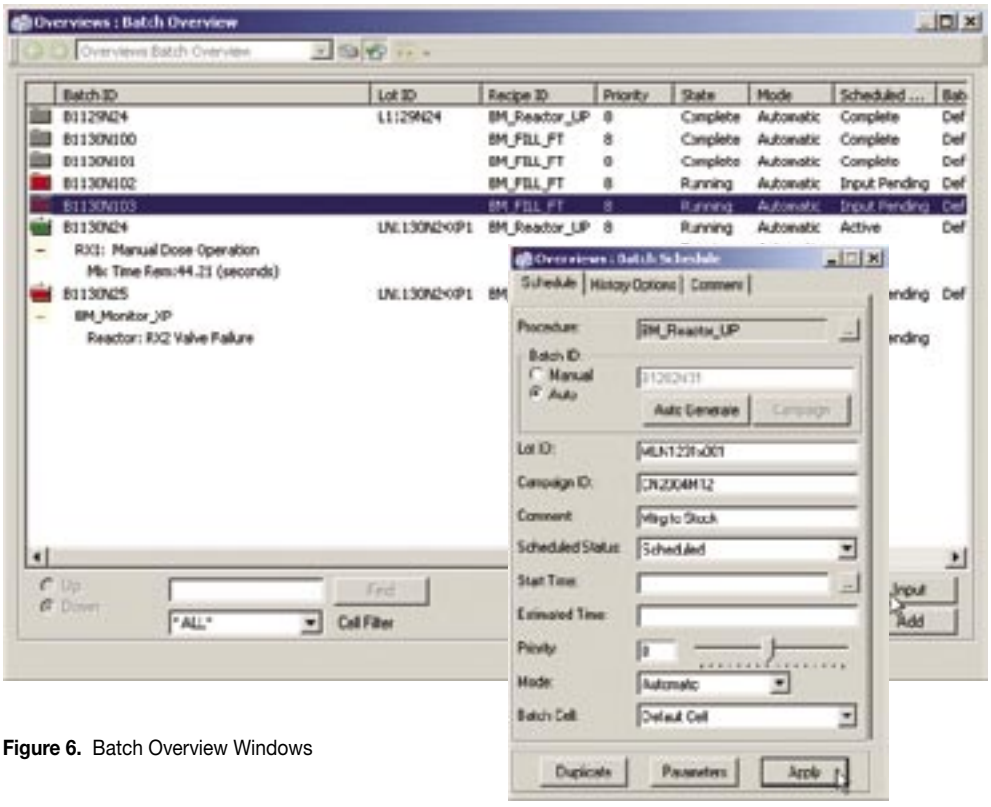


Figure 6. Batch Overview Windows

The production scheduling and dispatching functions of 800xA Batch Management are accessed from the Batch Overview display. This display provides a summary of all the batches in the current production queue.

The Batch Schedule dialog is used to add batches to the real-time production schedule or queue, in an efficient and user friendly manner. Functions available from the Batch Schedule dialog include:

- Select recipe procedure
- Schedule an individual batch or a campaign of multiple batches
- Duplicate a previously run batch
- Automatically generate a batch ID, or manual entry
- Optionally enter Lot & Campaign ID's
- Optionally enter scheduled start time
- Enter batch specific parameter values

For many facilities, the production dispatching functionality provided in 800xA Batch Management is used to schedule the batch manufacturing. However, it is recognized that some organizations have supply chain management solutions, enterprise resource planning systems or schedule optimization software packages in place for the determination of shop floor manufacturing requirements. 800xA Batch Management includes a schedule interface function to facilitate the bi-directional transfer of data between 800xA Batch Management and an external application.

The interface function is deployed as a web service. Web services are technologies that allow applications to communicate with each other in a platform and programming language independent manner. A web service is a software interface that

describes a collection of operations that can be accessed over the network through standardized XML messaging. It uses protocols based on the XML language to describe an operation to execute or data to exchange with another web service.

The interface provides pre-defined function calls to provide connectivity with 800xA Batch Management. Read function calls acquire real-time data from the batch system. Write function calls execute limited control over operations in the batch system.

Standard read function calls can be used to retrieve the following types of information:

- List of all active batches
- Details from any batch listed in the batch overview
- Details from any approved procedure
- Tag key (batch) data associated with the batch
- Details from any batch equipment

Standard write function calls can be used to perform the following operations:

- Schedule a batch, including values for some or all top-level recipe parameters
- Change a previously scheduled batch, including start time, priority, mode, and parameter values
- Change attribute values on batch equipment

In addition to the application programming environment provided in the batch schedule interface, System 800xA is available with an optional certified interface to the SAP PP-PI module. The 800xA Enterprise Connectivity Solutions Production Planning Connector facilitates the dispatch of Production Orders from SAP to 800xA Batch Management and monitors the process data to prepare a production response transaction back to SAP.

Evolution

ABB has been a pioneer and leader in the design and deployment of batch automation systems on a worldwide basis. ABB has a twenty-five year heritage in the design of batch automation system products and solutions for the fine chemicals, food, beverage and pharmaceutical markets.

800xA Batch Management, like all functional areas within System 800xA, has been designed to support the stepwise evolution of existing process control systems. As part of a facility's evolution strategy, one option is the introduction of System 800xA while retaining the existing controller and its existing control strategy.

800xA Batch Management can supervise controller phase logic in Harmony Bridge Controllers. The existing equipment phase logic configured using Batch90 and resident in PHASEX function codes can be reused without modification.

800xA Batch Management can supervise controller phase logic configured in TCL resident in either AC460 or SC controllers. The existing TCL equipment phase logic must be retrofitted into the S88PHASE TCL template for 800xA Batch Management.

800xA Batch Management can supervise controller phase logic in DCU Controllers. The existing equipment phase logic configured using CCL can be reused without modification.

Production Management without a Controller Connection

The benefits of 800xA Batch Management are available even without automated batch control. The master recipe procedure can be designed to provide sequencing of manual operations and manage the tracking of production data. 800xA Batch Management works in conjunction with 800xA Manufacturing Management to provide extended production manufacturing functionality including inventory, quality, and operation workflow management. The recipe procedure can specify the execution of one or more work instructions (called Intelligent Forms) for manufacturing operations outside of the batch automation strategy. In a similar manner, unit procedures and/or operations can be configured to report material consumption and/or creation to the Inventory module of 800xA Manufacturing Management.

Functionality to Meet Regulatory Requirements

For manufacturing processes subject to licensing and inspection by regulatory bodies such as FDA, MHRA, TGA, the Industrial IT Extended Automation System 800xA provides the tools needed to achieve compliance. Security, audit trail, change management, electronic signature, automated reporting, archival and retrieval are integral to all operations and system applications. 800xA Batch Management enforces the production sequences necessary to consistently produce on-spec product. In combination with 800xA Information Management and 800xA Manufacturing Management, complete electronic batch production records that fully document manufacturing compliance are generated.

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