SymBatch NT is a powerful application software package for configuring, scheduling, and managing flexible batch operations. SymBatch NT is the batch management add-on for Maestro NT.

Maestro NT is a true native Windows NT® based product. It is designed around the following standard technologies:

- Windows NT.
- Web browser technology.
- ActiveX® controls.
- SQL based historian.
- COM/DCOM interfaces.
- OLE DB interfaces.

By taking full advantage of these standard technologies, Maestro NT and SymBatch NT provide the latest in human system interface capabilities. They promote easy communication and window navigation with all other Windows NT compatible software. The implementation of these technologies opens the Symphony system to the rest of the enterprise management information world.
System Overview

Increasing competitive pressures have forced batch manufacturers to demand greater flexibility from their production facilities. These pressures are driving the evolution of interoperability between distributed control systems and enterprise planning and information systems. At corporate sites around the world, business managers, production managers and engineers are dependent upon the seamless exchange of electronic information. This tight integration is critical to the implementation of strategic manufacturing execution systems. SymBatch NT meets this challenge with the most advanced batch automation system available.

Combining industry standards such as NAMUR NE 33 or ISA S88.01 along with ABB batch automation expertise, SymBatch NT delivers an automation solution that provides the following benefits:

- Increased product consistency resulting in better quality.
- Easily created recipes resulting in faster time-to-market and shorter delivery lead times.
- Integrated production management and control resulting in maximized equipment uptime and minimized operating cost.
- Reduced manual documentation resulting in comprehensive audit trails required for regulatory compliance.

SymBatch NT is comprised of five primary functions:

- Batch overview.
- Unit overview.
- Batch historian overview.
- Equipment configuration.
- Recipe configuration.

Batch Overview

The batch overview provides a summary of all the batches in the production queue. This window offers the flexibility to manipulate the batches in the production schedule. Figure 1 illustrates a batch overview window. The batch overview window lists detailed information for each batch including:

- Batch, lot and campaign ID.
- Recipe ID.
- Batch priority.
- Batch area.
- Mode of operation (automatic, manual or semi-automatic).
- State (running, aborted, stopping, etc.).
- Scheduled status (not scheduled, scheduled, active, messages pending, etc.).
- Comments.
- Start and end times.
The batch overview options include:

- Scheduling a new batch.
- Invoking the status display for a batch.
- Displaying the recipe procedure diagram for a batch.
- Responding to pending messages for a batch.

The batch scheduler and batch information status display are accessible from the batch overview window. The scheduler offers self explanatory options making the addition of batches efficient and user friendly. The batch scheduler options include:

- Scheduling a new batch.
- Scheduling a campaign of batches.
- Duplicating an existing batch.

The batch information status display provides batch status information and the ability to issue batch commands.

Recipe Procedure Diagram

The recipe procedure diagram is also accessible from the batch overview window. The diagram is a graphical representation of the control recipe. Figure 2 illustrates a typical recipe procedure diagram. The current status of each step is displayed to the operator by a unique combination of colors and symbols.
The recipe procedure display options include:

- Navigating to a higher or lower level of the recipe procedure diagram.
- Changing the operating mode (automatic, manual or semi-automatic) at any level in the recipe procedure.
- Changing the state (running, aborted, stopping, etc.) of an active step at any level in the recipe procedure.
- Responding to pending messages.
- Invoking the online recipe editor to make changes to the active recipe.
- Selecting a recipe restart point.
- Changing the breakpoint or skip status of any step in the recipe procedure.
- Viewing recipe header information.
- Viewing formula information.
- Viewing the standard operating procedure.
- Invoking the active equipment phase faceplate to perform manual control of that phase.
- Invoking the equipment phase debugger from the equipment phase faceplate.

Figure 3 illustrates the Batch 90™ dynamic debugger which is accessible from the (Harmony) PHASEX faceplate on the Maestro NT console.
Unit Overview

The unit overview window displays the status of all batch equipment configured in the system as illustrated in Figure 4. At the overview level the following information is provided:

- Equipment name and status (available, busy, reserved, etc.).
- Batch, lot and campaign ID (if the equipment is in use).
- Operator status (normal, disabled, etc.).

The unit information display is accessible from the unit overview window. The unit information display can be invoked for any equipment on the unit overview. From this display the following additional details are presented:

- Type of equipment (unit, shared equipment module, etc.).
- Attributes of the equipment including name, value, engineering units and description.
- Pending batch list, if applicable, that contains batch ID, priority and reservation time.

Batch Historian Overview

The batch historian overview window provides access to batch historical information for all completed and terminated batches. Batch events, tag data and periodic data can be viewed as shown in Figure 5. Batch reports can also be generated using Excel spreadsheets. Similar information for active batches can be accessed from the batch information status display.
SymBatch NT supports network, multipath and single path equipment configurations. This allows for greater support of complex batch production facilities. Units, shared-use equipment modules and exclusive-use equipment modules are all configured using this tool. Pseudo resources can also be configured. They can be used to identify resources, such as an operator, required at specified points in a recipe.

Equipment configurations contain equipment and other resources that are used during the execution of a batch. The following information can be defined for equipment:

- **Description** – Describes the equipment.
- **Attributes** – Defines specific characteristics of the equipment (operating temperatures, construction materials, etc.). Attributes include name, value, engineering units and a description.
- **Capabilities** – Specifies which phases can be processed by the equipment (heat, react, mix, etc.) and the parameters for those phases.
- **Type** – Identifies equipment as units, exclusive-use equipment modules or shared-use equipment modules, including the maximum number of allowed users.
- **Pseudo** – Identifies whether equipment is an actual equipment entity or some other resource.
Recipe Configuration

The SymBatch NT recipe configuration tool provides the ability to configure the following information for each recipe:

- Recipe procedure.
- Formula.
- Equipment requirements.
- Header and other information.

Recipe Procedure

The recipe procedure is configured graphically through a specialized editor. The recipe procedure diagram is a sequential function chart based on the general concepts of IEC 61131-3. The user has the option of having the strict ISA S88.01 procedure levels enforced, or the user may make use of full collapsibility and expandability to provide additional flexibility. The recipe configuration tool supports conditional transitions, logical branching, parallel branching and looping structures.

The recipe configuration tool supports the creation and modification of recipe procedural building blocks. These building blocks can be used in multiple recipe procedures. When a modification is made to a building block, all the recipes utilizing that modified element are updated. The recipe configuration tool also supports the creation of exception recipes for enhanced exception handling at the product level.
Formula

Formula information includes input parameters, process parameters and output parameters. SymBatch NT allows formula information to be assigned at any level of the recipe procedure. Formula information includes the following data:

- Parameter names.
- Parameter descriptions.
- Actual and default values.
- Allowable ranges.
- Engineering units.

Equipment Requirements

Equipment requirements are specified in the recipe through the equipment allocation batch manager actions:

- Reserve unit – Reserve one or more units for use within a batch.
- Unreserve unit – Release a unit that was previously reserved.
- Acquire unit – Acquire one or more units for a specific purpose during batch execution.
- Release unit – Release a unit that was previously acquired.
- Select unit – Select a unit from available units based upon selection criteria and attributes.
- Deselect unit – Release a unit that was previously selected.

Header and Other Information

Header and other information can be configured for a batch. The options include:

- Master recipe and version.
- Author and creation date.
- Description and header text.
- Equipment database version.
- Standard operating procedures (SOP).

Standard operating procedures can be defined for the operator. They can be invoked during the execution of the recipe to display the SOP applicable to the current step in the recipe.