FactoryTalk Batch Material Manager Getting Results Guide

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Rockwell Automation

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

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IMPORTANT Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

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Summary of changes in FactoryTalk Batch Material Manager Getting Results Guide

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

Topic	Reason for change
Using manual phase control on page 71	Functional change
Material Phase Binding on page 72	Functional change

About this manual

This manual introduces the basics of FactoryTalk Batch Material Manager. It is one of a set of related manuals that describe installing, programming, and operating the FactoryTalk Batch system.

To review FactoryTalk Batch release notes and latest information regarding product compatibility refer to the Product Compatibility and Download Center (PCDC).

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  Includes the name of the open-source component, its version number, and the type of license.
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Additional resources

Following is a comprehensive list of documentation for the FactoryTalk® Batch products from Rockwell Automation.

Installation, Quick Start, and Getting Results Guides

Resource	Description
FactoryTalk Batch Components Installation and Upgrade Guide (BATCH-IN002)	Provides information and procedures for FactoryTalk Batch system installation. Includes information for FactoryTalk Batch Material Manager, FactoryTalk Event Archiver, and associated FactoryTalk Batch Client and Server components.
FactoryTalk Batch View Quick Start Guide (FTBVS-QS001)	Provides information about using FactoryTalk Batch View to create, view, and command control recipes, acknowledge prompts and signatures, view equipment phases and diagnostic information, and view profile information.
FactoryTalk Batch View HMI Controls Quick Start Guide (BATCH-QS001D)	Provides a general overview of FactoryTalk Batch View HMI Controls.
FactoryTalk Batch eProcedure® Getting Results Guide (BWEPRO-GR011)	Explains the basics of FactoryTalk Batch eProcedure.
FactoryTalk Batch Getting Results Guide (BATCH-GR011)	Introduces the basics of automated batch manufacturing and the FactoryTalk Batch product components.
FactoryTalk Batch Material Manager Getting Results Guide (BWMTR-GR011)	Introduces the basics of FactoryTalk Batch Material Manager.

User Guides

Resource	Description
FactoryTalk Batch Material Editor User Guide (BWMTR-UM001)	Provides access to information and procedural instructions required to configure materials and the containers to hold them. The material data is stored in the material database, which is used to create material-based recipes. This information is intended as a reference for formulators.
FactoryTalk Batch Equipment Editor User Guide (BATCH-UM004)	Provides information on creating and maintaining an equipment database (area model). The area model is available to all other FactoryTalk Batch programs, including the Recipe Editor, Batch View, and Phase Simulator.

Resource	Description
FactoryTalk Batch PhaseManager™ User Guide (BATCHX-UM011)	Describes the integration of the FactoryTalk Batch software with the Studio 5000 Logix Designer® application and the Logix 5000™ family of controllers. The integration simplifies the configuration and maintenance of the FactoryTalk Batch automation system, provides better communication between the FactoryTalk Batch Server and the Logix 5000 controller, and significantly reduces the programming effort required to develop the phase logic code that resides in your Logix 5000 controller.
FactoryTalk Batch Recipe Editor User Guide (BATCH-UM006)	Provides instructions on using FactoryTalk Batch Recipe Editor to create and configure master recipes for use in batch automation. The interface is based on IEC 61131-3 sequential function charts to organize recipes graphically into procedures, unit procedures, operations, and phases. Build recipes using either the SFC format or a table-based format.
FactoryTalk Batch View HMI Controls User Manual (FTBVS-UM003)	Provides details about using FactoryTalk Batch View HMI Controls to monitor and interact with the production process within a FactoryTalk View SE Display Client.
FactoryTalk Batch View User Manual (FTBVS-UM002)	Provides information and procedural instructions for using FactoryTalk Batch View in a modern and intuitive portal into a comprehensive batching solution for effective operations, leveraging its own web server using HTML5 technology to provide connectivity into a FactoryTalk Batch Server.
FactoryTalk Event Archiver User Guide (BATCH-UM012)	Provides information and instructions specific to the FactoryTalk Event Archiver. Intended for use by system administrators and production supervisors.

Administrator Guides

Resource	Description
FactoryTalk Batch Administrator Guide (BATCH-UM003)	Provides instructions for configuring security and services, and implementation and use of components not typically accessed or used by batch operators, such as the FactoryTalk Batch Server.
FactoryTalk Batch eProcedure Administrator Guide (BWEPRO-UM011)	Provides procedures specific to FactoryTalk Batch eProcedure, such as implementing security and configuring the user-defined area Active Server Page. Included are instructions for tasks specific to FactoryTalk Batch, such as configuring security and services to support FactoryTalk Batch eProcedure. Provides instructions on the implementation and use of components not typically accessed or used by batch operators, such as the FactoryTalk Batch Server.
FactoryTalk Batch Material Manager Administrator Guide (BWEPRO-UM011)	Provides information and instructions specific to FactoryTalk Batch Material Manager. Intended for use by system administrators and database administrators.

Reference Guides

Resource	Description
FactoryTalk Batch Material Server API Technical Reference (BWMTR-RM001)	Provides access to information regarding the interface between the FactoryTalk Batch Material Server and the FactoryTalk Batch Material Editor and FactoryTalk Batch. It is intended to be used as a reference information by custom interface developers.
FactoryTalk Batch PCD Programming Reference Manual (BATCH-RM004)	Provides information and instructions about the FactoryTalk Batch PCD interface design. It is intended to be used as a reference guide for PCD programmers.

Resource	Description
FactoryTalk Batch Server API Reference Manual (BATCH-RM003)	Provides information regarding the interface between the FactoryTalk Batch Server and FactoryTalk Batch View — the Server Application Programming Interface (API). It is intended to be used as a reference guide by custom interface developers.
FactoryTalk Batch System Files Reference Manual (BATCH-RM005)	Provides the technical information for configuration and maintenance of a FactoryTalk Batch system. It can be used as a reference information for implementation engineers and system administrators.
FactoryTalk Batch eProcedure Instruction File Design Reference Manual (BWEPRO-RM001)	Includes information about the building of instruction files for use in equipment database creation and recipe development. This information is intended to be used as a reference by instruction file authors.

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Introducing Material Manager

FactoryTalk® Batch Material Manager is an integral part of the FactoryTalk Batch suite of software components. As part of the FactoryTalk family, the FactoryTalk Batch components increase overall plant efficiency by delivering the visibility, control, and reporting you need to optimize manufacturing. With coordinated execution, you can reduce scrap and rework and improve product quality and consistency. Through real-time management of equipment utilization, you can maximize your return on assets. By implementing optimized recipes and procedures, you can increase your plant capacity. By using electronic, paperless operations, you can improve your productivity. You also reduce compliance costs by using electronic batch record implementation, paperless manufacturing, and quality sign-offs. By lifting the compliance burden from manufacturing, you reduce inventory levels and cycle times, which greatly improves customer service.

The FactoryTalk Batch components ensure that plant floor operations are optimized, giving you quick return on your net assets. New product definitions are deployed quickly into manufacturing. Production order information is accurate. Business and plant-level control systems are tightly coordinated and multiple sites operate as a team. Our completely open, configurable set of products helps you define, manage, monitor, and control manufacturing at local, remote, or contractor plants. Best of all, you can deploy any of the FactoryTalk Batch components wherever you need them — one at a time or all at once — to improve productivity and plant control. The FactoryTalk Batch components include:

- FactoryTalk Batch
- FactoryTalk eProcedure®
- FactoryTalk Batch Material Manager

What is Material Manager?

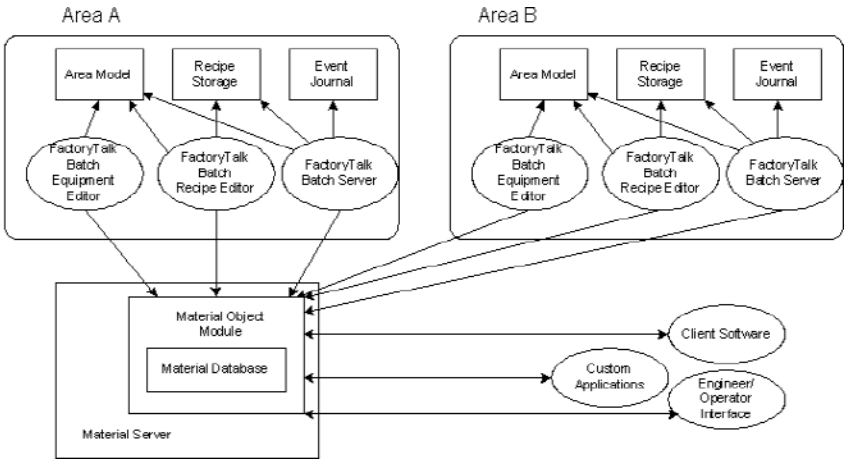
As one of the FactoryTalk Batch components, Material Manager provides plant-level material management and tracking that is tied to corporate material management systems. Material Manager manages and tracks the use of materials by material type, lot, and sublot. It manages and tracks vessels, containers and pallets, as well as permanent and transient storage. It also provides automatic support for bulk containers with multiple lots either as composites or plug flow separated.

Material Manager adds material definitions to the recipes, significantly reducing the number of recipes needed for flexible storage facilities. Material consumption, production, and association of materials to containers and

vessels are automatically logged, providing complete information for forward and backward material tracking within and across process cells.

The material recipes, called material-based recipes, allow you to define recipes in terms of materials used, not just by plant equipment. A material-based recipe uses material-enabled phases, which are configured in the Equipment Editor and stored in the area model. Material-enabled phases support the specification of a material as a means to find appropriate equipment and bind to that equipment in a control recipe.

The following figure is a conceptual diagram of the elements of the material-based recipe function and illustrates the relationships among the functional components.



FactoryTalk Batch Components

FactoryTalk Batch comes with several components that interact with each other to design, create, configure and run batch recipes.

FactoryTalk Batch Server

The FactoryTalk Batch Server is the engine that runs FactoryTalk Batch. It is the component that controls system information, phases and recipes. The server allows integration with process-connected devices (PCDs) and third-party software packages. Prior to opening FactoryTalk Batch View, the FactoryTalk Batch Server must be running and remain active during all batch functions.

The FactoryTalk Batch Server operates as a Windows service, which means that the FactoryTalk Batch Server can be configured to start automatically and that control of the FactoryTalk Batch Server can be given to the Windows Service Manager. Because the FactoryTalk Batch Server runs as a service, it does not require an operator to log on to run. Therefore, logging on or off Windows during operation does not disrupt the performance of the FactoryTalk Batch Server.

FactoryTalk Batch Recipe Editor

The FactoryTalk Batch Recipe Editor is used to graphically create and configure recipes.

- The interface is based on IEC 61131-3 sequential function charts (SFC) that graphically organizes recipes into procedures, unit procedures, operations and phases along with any applicable comments.
- In addition to the SFC view, the FactoryTalk Batch Recipe Editor offers a table view. Table-based recipes provide a mechanism for creating simple recipes that do not require a complex recipe structure or elaborate transition expressions. Additionally, you can view table-based recipes and edit all recipe parameters without having to navigate between steps.
- The FactoryTalk Batch Recipe Editor allows you to specify sequences of phases. The actual phase logic must be configured in the process-connected device (PCD) while the interface to the PCD must be configured in the FactoryTalk Batch Equipment Editor.
- Recipe reports can be generated in SFC and/or descriptive format.
- If Recipe Approvals are enabled in the underlying area model, approval signoffs are executed in the FactoryTalk Batch Recipe Editor.
- When Recipe Version Control is enabled, a version of a recipe (a read-only, numbered snapshot of a recipe) can be saved and protected from further editing. New work-in-progress (WIP) copies of a version allow the recipe author to continue to make changes and updates to a recipe. When a versioned recipe no longer matches the underlying area model, or references a deleted or non-existent sub-recipe, it is marked as obsolete.

FactoryTalk Batch Equipment Editor

The FactoryTalk Batch Equipment Editor is a graphical interface through which a database of process equipment is defined and maintained (an area model).

- Components defined in the FactoryTalk Batch Equipment Editor are used to interface with process-connected devices (PCDs) in the facility. During recipe configuration, the area model provides a list of available units and phase classes.
- Configure phases and commands to trigger an electronic signature request when a report or recipe parameter is out of range (parameter deviation), or when specific commands are executed on a batch (such as Abort Batch or Active Step Change).
- During recipe verification, the area model confirms that the designated equipment is capable of executing the procedures.
- During recipe execution, resource arbitration functions use the area model to allocate equipment based on recipe and operator requests.
- The area model is available to all other FactoryTalk Batch applications.

In addition to the area model, the FactoryTalk Batch Equipment Editor allows configuration of the following:

- Communication functions
- Electronic signatures
- Enumeration sets
- Data servers
- Recipe approvals
- Recipe version control
- FactoryTalk Event Archiver functions

FactoryTalk Event Archiver

The FactoryTalk Event Archiver's purpose is to translate the FactoryTalk Batch tab-delimited ASCII electronic batch record files to a user-specified file type. These electronic batch record files are maintained separately for each batch created and viewed with a word processor or spreadsheet. Many plants have standardized on one of the many commercially available Relational Database Management System (RDBMS) software packages. We recommend using a high-performance database, such as SQL Server, due to their better robustness and performance. The Archiver collects data from each electronic batch record file and stores it in the specified RDBMS database format.

FactoryTalk Batch Network Editor

The FactoryTalk Batch Network Editor is a utility that indicates where other FactoryTalk Batch and FactoryTalk Batch Material servers are located on the network. This network configuration allows for ease of integration with other FactoryTalk Batch components and simplifies the process of reconfiguring a multi-computer system. If FactoryTalk Batch Material Manager is also installed the FactoryTalk Batch Network Editor is also used to indicate the location of the material database.

FactoryTalk eProcedure Server

The FactoryTalk eProcedure Server provides the services to the FactoryTalk Batch Server to enable the use of HTML instruction files. Prior to connecting a client to FactoryTalk eProcedure, FactoryTalk eProcedure Server must be running and remain active during all batch functions.

FactoryTalk Batch Material Manager

FactoryTalk Batch Material Manager is used to track material consumption in batch recipes. It consists of two components: Material Server and Material Editor.

The Material Editor provides an interface to help you create the material database, which consists of material, lot, sublot, container, and storage location data. The Material Server provides the communication between the material database and the FactoryTalk Batch Server. During a batch run, information about available containers is presented to the operator for binding decisions. Binding is the process of mapping steps within a control

recipe to actual equipment in a plant. After a batch is run, quantities consumed or distributed are updated in the material database for use in inventory tracking.

The Material Server consists of a group of components that work together to service various applications. The primary applications that the Material Server services are the Material Editor, FactoryTalk Batch Server, FactoryTalk Batch Recipe Editor, and FactoryTalk Batch Equipment Editor. Any third-party application can also use custom solutions based on the exposed Material Object Model (MOM).

FactoryTalk Batch View

Use FactoryTalk® Batch View to initiate and control the batch process. A batch is a running control recipe. The material produced by a single execution of a recipe is also considered a batch.

- Use **Batches** to create, view, and command a control recipe, observe the execution of a single recipe, and bind units for class-based recipes. Once a control recipe is created, it remains in the **Batches** list until it is removed or until the FactoryTalk Batch Server is restarted with a cold boot. A graphical representation of a running batch and its associated data is displayed.
- Use **Prompts** to alert operators to value requests for parameters, unit binding, material binding, and signatures or manual instructions. A control recipe cannot complete execution until the operator provides the requested information. In most cases, pending requests for information (value prompts, signatures, or manual instructions) are not acknowledged until a user either provides the information or stops or aborts the control recipe.
  - Value prompts alert operators to requests for parameter values, unit binding, and material phase/container binding.
  - Signatures are requests for signoffs that require user permissions and optional comments. When a signature is generated against a control recipe, acknowledge the signature by completing the associated signoffs. The requested user information in a signature is determined by the signature template defined in the area model.
  - Instructions are individual steps of a manually executed phase. As a batch executes, the instruction for each active step appears. Instructions execute in the order specified within the master recipe.
- Use **Equipment** for an equipment-centric view of the defined area model. There are three levels of equipment: process cell, unit, and phase.
- Use **Diagnostics** to view server and service status, server performance, server statistics, arbitration, and journals.
- Use **Profile** to change the default language, view assigned groups, enable or disable the minimal view, and view authorization settings

For more information on using these features, see FactoryTalk Batch View Help.

Material data

To implement material-based recipes, you must configure three types of data:

- **Material Data**
  Use the Material Editor to add the materials, lots, sublots, and the containers that hold them. This data is stored in the material database.
- **Equipment Data**
  Use the FactoryTalk Batch Equipment Editor to create material-enabled phases and then associate the resultant equipment module with a container.
- **Recipe Data**
  Use the FactoryTalk Batch Recipe Editor to define the materials and amounts to use in a recipe.

There are two stages to configuring material data. First is the initial system configuration which is the process of adding elements, such as material types, materials, material storage containers, and storage locations that are unique to the given installation. Once these initial elements are defined, configured, and tested, the process of initial system configuration is considered complete. The second stage is the on-going system upkeep, which is the process of day-to-day activities that keep the material-based recipe system current and operational. An example of the upkeep process is the addition or distribution of a new lot of a given material to the database.

Introduction to the Material Server

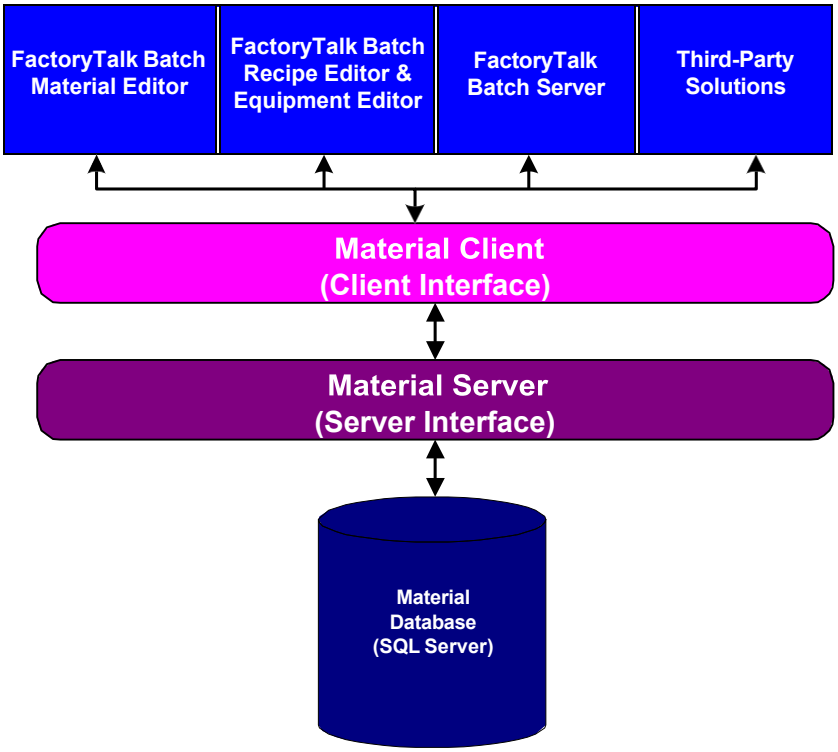
For ease of understanding, and for tutorial purposes, this guide refers to configuring and using the sample files that are installed with FactoryTalk® Batch. The SampleDemo folders contain complete area models and recipes for a simulated plant. Before running the demonstrations:

- Configure the Network Editor to recognize the material database
- Add a FactoryTalk Security user
- Configure the FactoryTalk Batch Server to recognize the required project directories
- Select the initialization path and file name
- Start the FactoryTalk Batch Server and the FactoryTalk Batch Phase Simulator

Tip: This guide outlines the configuration and use of the SampleDemo2 demonstration files. Because these files are used as an example throughout the guide, it is recommended that you follow the directions for using this demonstration step by step.

Looking at the Material Server

The FactoryTalk Batch Material Server is a group of components that work together to service various client applications. The primary clients that the Material Server services are the Material Editor, FactoryTalk Batch Server, FactoryTalk Batch Recipe Editor, and FactoryTalk Batch Equipment Editor. Also, any third-party application can use custom solutions based on the exposed Material Object Model (MOM). The Material Server also interacts with SQL Server to read to and write from the material database.



Material Server Communications

The Material Server runs with the context of a COM+ component, which is an extension to the Component Object Model (COM). This component resides on the client workstations and provides a rich programming model. See the *FactoryTalk Batch Material Server API Technical Reference* for more information about the material object model.

The Material Server coordinates the following functions:

- Records actions to the material database that occur during configuration and run-time in the Activity Journal.
- Loads the material and container lists from the material database to the Batch Server at startup for population of the area model material and container enumeration sets.
- Loads the equipment module/container associations from the area model into the material database.
- Communicates with the FactoryTalk Batch Server during binding.

- During Unit Binding, the FactoryTalk Batch Server communicates with the Material Server to determine if the required materials can be satisfied by the containers within a unit.
- During Phase Binding, the FactoryTalk Batch Server communicates with the Material Server to get a list of containers and equipment modules based on the material to add or distribute in the step. In Prompted Phase Binding, the Operator selects the binding solution from a list of container-equipment pairs. In Automatic Phase Binding, phases are selected based on current container priority.
- In Manual Phase Binding, the FactoryTalk Batch Server communicates with the Material Server to obtain a list of containers, lots and equipment modules that support the required material. The list is presented to the operator for selection of the equipment module to bind to the material step.
- Updates the material database with actual amounts consumed or distributed during a batch run. During an addition or distribution, when the Feed Complete is true, the FactoryTalk Batch Server communicates the actual amount to the Material Server. When the Feed Complete is not true, the FactoryTalk Batch Server communicates the actual amount to the Material Server, which in turn calculates the difference between the promise amount and the actual amount and sends this back to the FactoryTalk Batch Server. The FactoryTalk Batch Server uses this difference to update the setpoint for the split feed.

This guide also describes the different binding methods and how to handle split feeds.

Set up the sample demonstrations

The installation process placed the *SampleDemo1* and *SampleDemo2* folders in the **BATCHCTL** share on your hard drive. Within each of these *SampleDemo* folders are four subfolders that contain the files for the area model. To run the sample demonstrations, configure the Network Editor to locate the material database, add a FactoryTalk Security user, configure the FactoryTalk Batch Server to locate the area model, and then verify the recipes in the area model.

IMPORTANT The default databases MaterialBasedRecipe and SAMPLE2_Materials cannot be removed from SQL Server. You are free to add another database and use it for production or test, but you must keep the originally installed databases intact even though they are not being used.

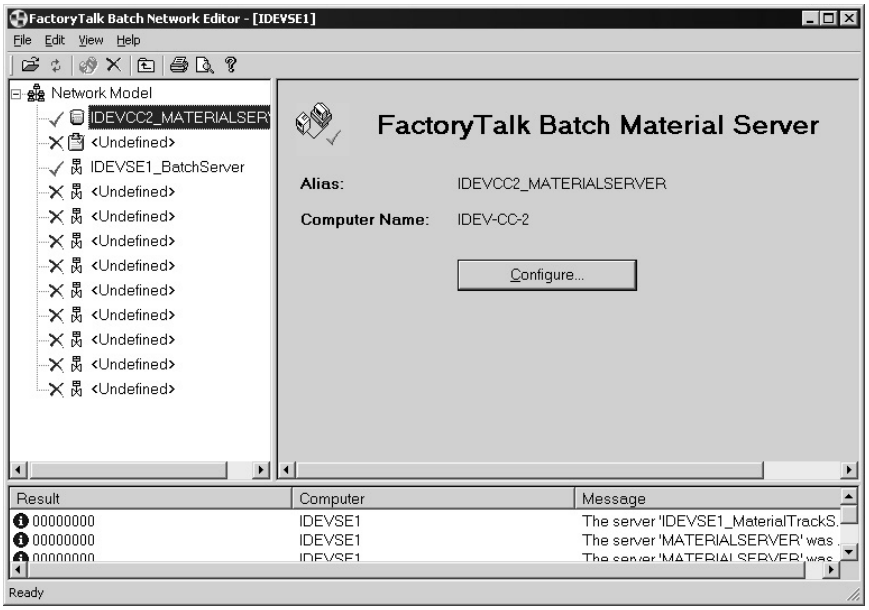
Configure the Network Editor

Configure the Material Server with the location of the SQL database that contains the materials for the SampleDemo2 recipes.

1. Select **Start > Rockwell Software > Material Manager**, and then select **Network Editor**. The Network Editor window opens.

   IMPORTANT Administrator privileges are required to perform this procedure.

2. Select the Material Server.



3. Select **Configure**. The **Configure MaterialTrack** dialog box opens.
4. In the **MaterialTrack Database** box, type **SAMPLE2_MATERIALS**, and then select **OK**.
5. Select **Synchronize**.
6. Select **File > Exit**, and then click **Yes** to exit the Network Editor.

Add sample FactoryTalk Security users

For the sample demonstrations file, create FactoryTalk user accounts for an operator and an engineer. Create these user accounts in the FactoryTalk Directory.

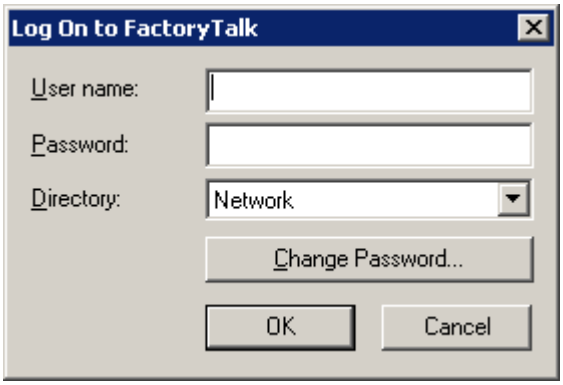
To add sample FactoryTalk Security users:

1. Select **Start > Rockwell Software > FactoryTalk Administration Console**. The **Select FactoryTalk Directory** dialog box opens.

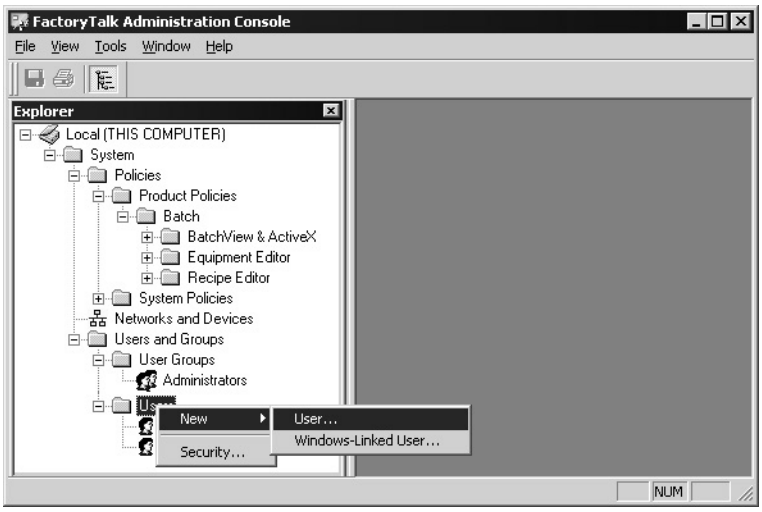
IMPORTANT Administrator privileges are required to perform this procedure.

2. Select **Network** to add this user account to the FactoryTalk Network Directory, and select **OK**.
3. If not already logged on to the FactoryTalk Network Directory, the **Log On to FactoryTalk** dialog box opens. In **User name**, type the user name

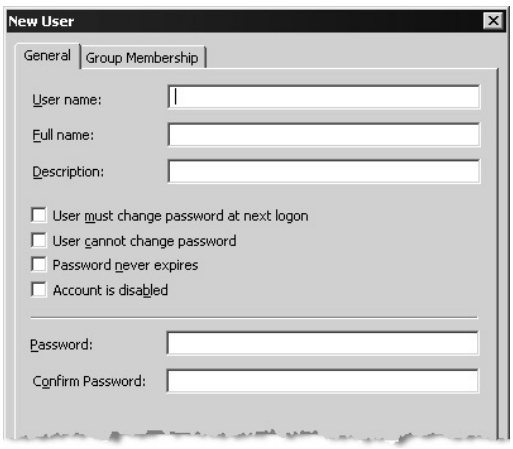
for the Administrator that was configured when the FactoryTalk Services Platform was installed.



4. In **Password**, type the password for the Administrator.
5. Verify the **Directory** and select **OK**. The **FactoryTalk Administration Console** window opens and displays the specified FactoryTalk Directory.
6. Expand **Users and Groups**.
7. Right-click the **Users** folder, and select **New > User** to create a new FactoryTalk Security user account in FactoryTalk Directory.



8. The **New User** dialog box opens and displays the **General** tab. In the **User name** box, type **OPER**.



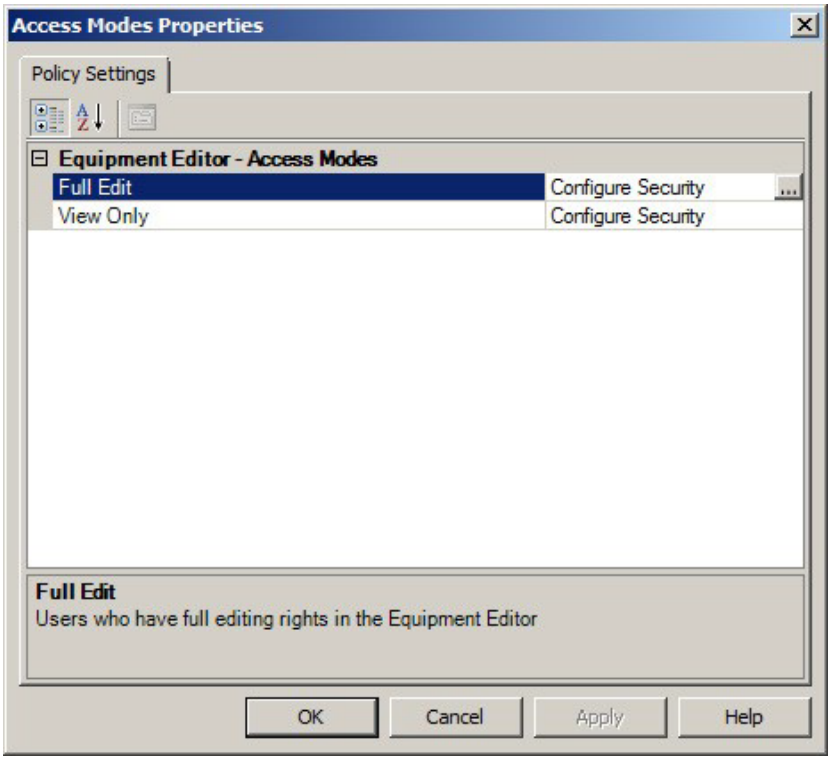
9. In **Full name**, type **Operator**.
10. In **Password**, type **password**, and confirm it by re-entering **password** in the **Confirm Password** box.
11. Select **Create**.
12. Repeat steps 7-11, but this time in the **User Name** field, enter **ENG** and in the **Full Name** field, enter **Engineer**.
13. Keep the FactoryTalk Administration Console open to configure permissions for these FactoryTalk Security users in the next exercise.

Configure sample permissions for FactoryTalk Security users

After creating the FactoryTalk security users, set up access modes for each FactoryTalk Batch component to specify which users are permitted to view or perform actions. Configure security settings in the FactoryTalk Administration Console. To tighten security in the client, remove the **All Users** group from the **Full Edit** policy setting.

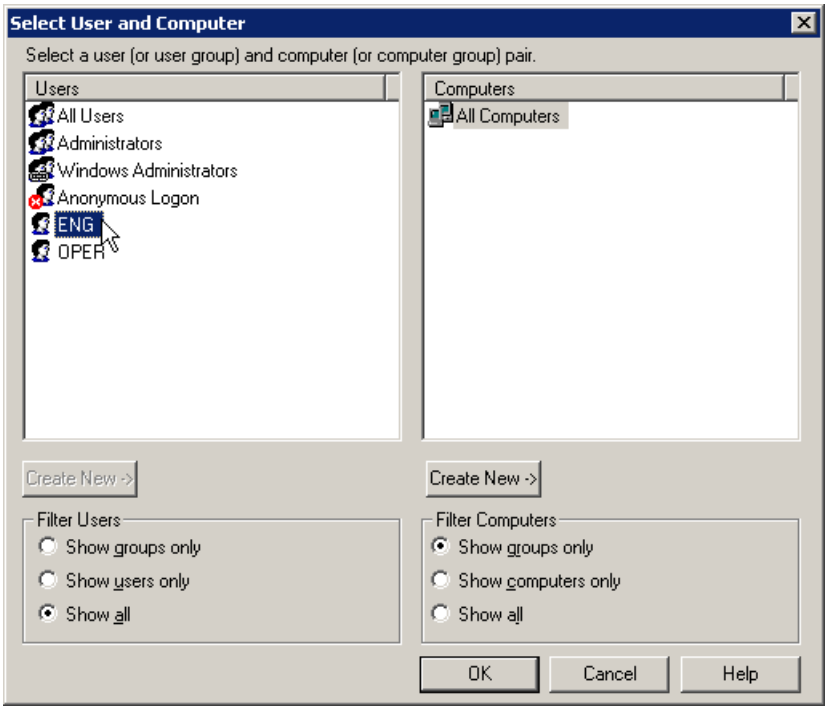
To configure sample permissions for FactoryTalk Security users:

1. In the FactoryTalk Administration Console Explorer pane, navigate to **System > Policies > Product Policies > Batch > Equipment Editor > Access Modes.**
2. Right-click **Access Modes**, and then select **Properties**. The **Access Modes Properties** dialog box opens.

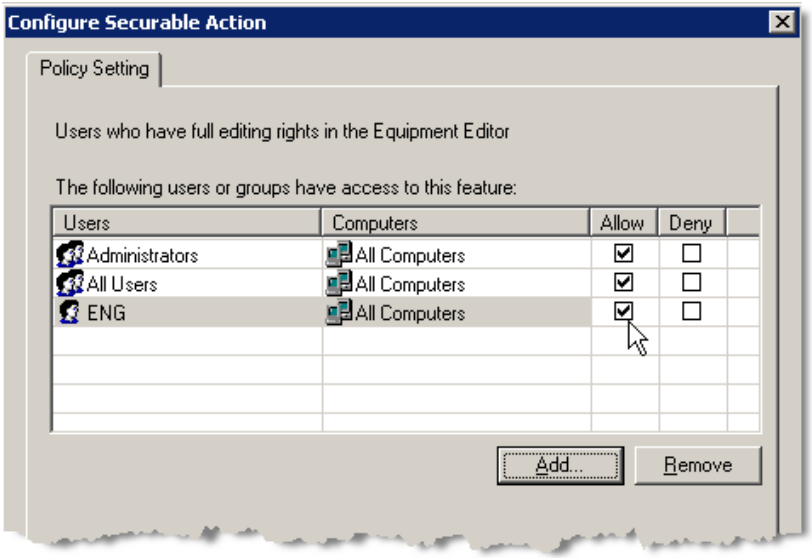


3. In the **Full Edit** row, select the **Configure Security** browse button. The **Configure Securable Action** dialog box opens.
4. Select **Add**. The **Select User and Computer** dialog box opens.
5. In the **Filter Users** box, select **Show All**.

6. In **Users**, select **ENG**.



7. Select **OK**. The **Configure Securable Action** dialog box is updated, showing ENG in the list of **Users** with the **Allow** checkbox selected.



8. Select **OK** to close the **Configure Securable Action** dialog box.
9. In the **Access Modes Properties** dialog box, select **View Only**.
10. In the **View Only** row, select the **Configure Security** browse button. The **Configure Securable Action** dialog box opens.
11. Select **Add**. The **Select User and Computer** dialog box opens.
12. In the **Filter Users** box, select **Show All**.
13. In **Users**, select **OPER**.
14. Select **OK**. The **Configure Securable Action** dialog box is updated, showing OPER in the list of **Users** with the **Allow** checkbox selected.
15. Select **OK** to close the **Configure Securable Action** dialog box.
16. Select **OK** to close the **Access Modes Properties** dialog box.

See the *FactoryTalk Batch Administrator Guide* for more information on security.

Configure the sample FactoryTalk Batch Server

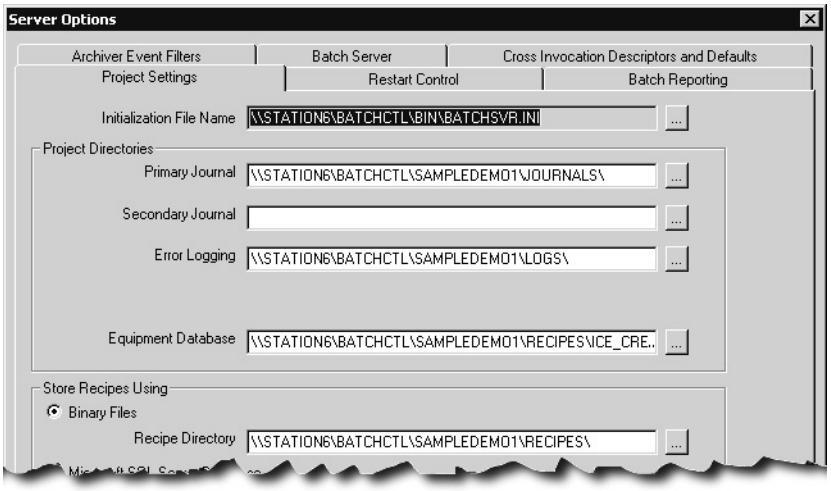
To set up the sample demonstrations, configure the FactoryTalk Batch Server to locate the folders that contain the demonstration files and to the **\Restart** and **bin** folders where the FactoryTalk Batch Server writes data upon system failure. Configure the FactoryTalk Batch Server in the FactoryTalk Batch Equipment Editor.

To configure the sample FactoryTalk Batch Server:

1. Select **Start > Rockwell Software > Equipment Editor**. The FactoryTalk Batch Equipment Editor opens (log on to FactoryTalk if prompted).

   IMPORTANT Administrator privileges are required to perform this procedure.

2. Select **Options > Server Options**. The **Server Options** dialog box opens to the **Project Settings** tab.

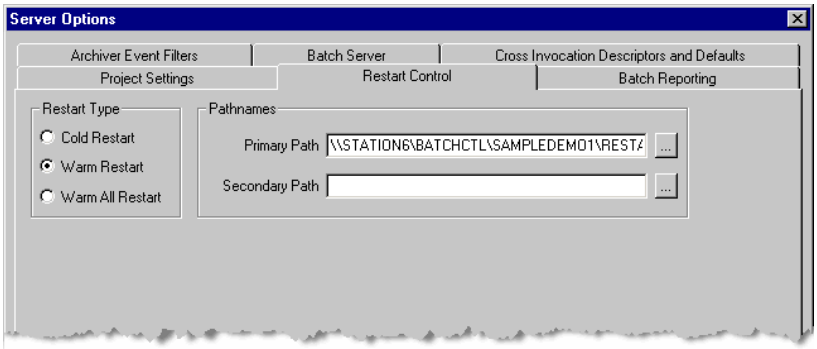


3. In the **Project Directories** area, select the **Primary Journal** browse button. The **Select Directory** dialog box opens.
4. From the **Look in** list, select the **SampleDemo1\Journals** folder, and then select **Open**.
5. Select the **Error Logging** browse button. The **Select Directory** dialog box opens.
6. From the **Look in** list, select the **SampleDemo1\Logs** folder, and then select **Open**.
7. Click the **Instructions** browse button. The **Select Directory** dialog box opens.

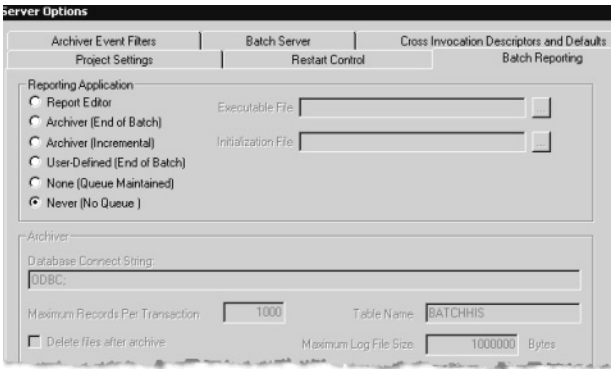
   IMPORTANT In order for the *e*Procedure Server to start, you must define the instruction path and an instruction file for each instruction-based phase in the area model. (See the *FactoryTalk Batch Equipment Editor User Guide* for instructions on defining instruction-based phases.)

8. Select the **Equipment Database** browse button. The **Select Equipment Database** dialog box opens.

9. From the **Look in** list, open the **SampleDemo1\ Recipes** folder, select the **ice_cream1.cfg** file, and then select **Open**.
10. In the **Store Recipes Using** area, select **Binary Files**, and then select the **Recipe Directory** browse button. The **Select Directory** dialog box opens.
11. From the **Look in** list, select the **SampleDemo1\Recipes** folder, and then select **Open**.
12. Select the **Restart Control** tab.



13. Select the **Primary Path** browse button. The **Select Directory** dialog box opens.
14. From the **Look in** list, select the **SampleDemo1\Restart** folder, and then select **Open**.
15. Select the **Secondary Path** browse button. The **Select Directory** dialog box opens.
16. From the **Look in** list, select the **Bin** folder.
17. Select the **Batch Reporting** tab. Leave **Never (No Queue)** as the default reporting application.



18. Select **OK** to close the **Server Options** dialog box.
19. Select **File >Exit** to exit the FactoryTalk Batch Equipment Editor.

Tip: These steps set up the FactoryTalk Batch Server to run the tutorial steps in this manual. There are many other settings to consider when setting up the FactoryTalk Batch system. (See the *FactoryTalk Batch Administrator Guide* for more information on the **Server Options** dialog box.)

Rebuild the recipe directory

To run the demonstration recipes, you must rebuild the recipe directory and verify the recipes in the area model using the FactoryTalk Batch Recipe Editor.

IMPORTANT Administrator privileges are required to perform this procedure.

To rebuild the recipe directory:

1. Select **Start > Rockwell Software > Recipe Editor**. The FactoryTalk Batch Recipe Editor reads the area model.

   Tip: If you are logged in with an account that does not have administrator privileges, right-click **Recipe Editor** and select **More > Run as administrator** to run under elevated privileges.

2. If prompted, log on to FactoryTalk. If a message displays asking you to verify the recipes, select **Cancel**.
3. Select **File > Rebuild Recipe Directory**. When the rebuild is complete, select **OK**, and then select **Yes** to verify the recipes.
4. When the recipe verification is complete, select **Accept** to save the recipes, and then select **Close**.
5. Select **File > Exit** to exit the FactoryTalk Batch Recipe Editor.

Start the FactoryTalk Batch and Material Manager Servers

The FactoryTalk Batch and Material Manager Servers may start automatically when the computer starts. By default, the FactoryTalk Batch Server starts in production mode. If FactoryTalk Batch has not been activated, the tutorial can run in demo mode. While in demo mode, the FactoryTalk Batch Server runs for a two-hour period and then stops.

Tip: The FactoryTalk Batch Server does not start in production mode without activation. The Material Manager Server starts automatically when the FactoryTalk Batch Server starts. See *Activating Material Manager* for more information.

To start or restart the FactoryTalk Batch Server:

1. Select **Start > Rockwell Software > Batch Service Manager**.

   IMPORTANT If you are logged in with an account that does not have administrator privileges, right-click **Batch Service Manager** and select **More > Run as administrator** to run under elevated privileges.

2. In the **FactoryTalk Batch Service Manager**, select the FactoryTalk Batch Server if it is not listed in the **Service** box.

3. If the FactoryTalk Batch Server is running, select **Stop**.

4. If the name of the computer where the FactoryTalk Batch Server is installed does not display in the **Computer** box, select the **Select Computer** button.
5. In the **Select Computer** dialog box under **Enter the object name to select**, type the name of the computer where the Batch Server is installed (or select **Advanced** to search for a computer). Select **OK**.

   Tip: The FactoryTalk Batch Service Manager must communicate with the Windows Service Manager of the selected computer to determine what services are available. There may be a noticeable delay when establishing communications. If the Service Manager cannot communicate with the Windows Service Manager of the selected computer, a message displays.

6. From the **Service** list, select **FactoryTalk Batch Server**.

   Tip: If **No Batch Services** displays in the list, the FactoryTalk Batch Server is not installed on the selected computer. See the *FactoryTalk Batch Components Installation and Upgrade Guide* for installation instructions.

7. To start the FactoryTalk Batch Server in Demo mode, select **Allow Demo Mode**.
8. Select the method to use for booting the server.

Cold Boot	Restarts the FactoryTalk Batch Server in a cold state. All journal data or recipe content is erased upon startup.
Warm Boot	Restarts the FactoryTalk Batch Server, restoring the set of batches that were on the batch list when the server previously terminated.
Warm All Boot	Restarts the FactoryTalk Batch Server only if it is able to restore all of the batches to the batch list.

9. Select the **Start/Continue** button. The Service State area changes from STOPPED to START PENDING. After a few moments, RUNNING displays and the light changes to green. The Material Server starts automatically with the FactoryTalk Batch Server.

   The FactoryTalk Batch Phase Simulator starts automatically. Minimize the window.

10. Select **Close** to close the FactoryTalk Batch Service Manager.

Tip: If conversation becomes LOST while running in Demo mode, make sure that the Simulator is running and try starting the server(s) again. See *Starting the FactoryTalk Batch Phase Simulator* for more information.

Start the sample FactoryTalk Batch Phase Simulator

FactoryTalk Batch comes with a phase logic simulation program, referred to as the FactoryTalk Batch Phase Simulator used to simulate the batch process without connecting to a PCD. The Phase Simulator imitates the functionality of a data server and can communicate with the FactoryTalk Batch Server using OPC communication protocol. The Phase Simulator is a powerful tool for testing, experimentation and demonstration purposes. In this guide, run the sample demonstration using the Phase Simulator.

Tip: If the Phase Simulator is required and OPC protocol is used for communications, the FactoryTalk Batch Server automatically starts the Phase Simulator. Check the Windows taskbar to see if the Phase Simulator is started.

To run the sample demonstration correctly, open the **ice_cream1.sim** file in the Phase Simulator.

To start the sample FactoryTalk Batch Phase Simulator:

1. If the Phase Simulator is already running, maximize it from the Windows taskbar. If the Phase Simulator is not running, select **Start > Rockwell Software > Simulator**. The FactoryTalk Batch Phase Simulator opens.

   IMPORTANT Administrator privileges are required to perform this procedure.

2. Select **File > Open**. The **Open Simulator Configuration File** dialog box opens.
3. From the **Look in** list, open the **Program Files > Rockwell Software > Batch > SampleDemo1 > Recipes** folder. Select the **ice_cream1.sim** file, and then select **Open**.
4. Minimize the **FactoryTalk Batch Phase Simulator** window.

Verify PCD communications

Use the following instructions to verify PCD communications.

IMPORTANT Administrator privileges are required to perform this procedure.

To verify PCD communications:

1. Select **Start > Rockwell Software > Batch Service Manager**. The **FactoryTalk Batch Service Manager** opens.
2. Make sure **FactoryTalk Batch Server** is selected in the **Service** box.
3. Select **Server Details**. The **FactoryTalk Batch Server Details** dialog box opens.

4. Select the **PCD Communications** tab. The Data Server Status area displays the status of the conversation with the OPC_SIM data server (Phase Simulator), which should be PHASES GOOD.
5. In the **Tag Verify** area, select **Start** to begin the verify process. The tag verification process takes several minutes.
6. When the **Status** box shows COMPLETED, select **OK** to close the **FactoryTalk Batch Server Details** dialog box.

Summary

In this chapter, you:

- Set up the Network Editor and the FactoryTalk Batch Server to run the sample demonstration
- Started the FactoryTalk Batch Server in demo mode
- Opened the *.sim* file in the FactoryTalk Batch Simulator to run the sample demonstration

This chapter provided a brief overview of the capabilities of the Material Server. (See the *FactoryTalk Batch Administrator Guide* for more information about the FactoryTalk Batch Server. See the *FactoryTalk Batch Material Manager Administrator Guide* for more information about the Material Server.)

The rest of this document is designed to give you a tour through Material Manager using the sample demonstration. Follow the step-by-step instructions to learn how to define and run material-based recipes using Material Manager and FactoryTalk Batch software.

Introducing the Material Editor

The FactoryTalk® Batch Material Editor provides an interface to help you create the material database, which consists of several tables of data that are stored in your Microsoft SQL Server database. The Material Editor presents the material database as two types of data:

- **Material configuration data**, which defines the materials, consists of items such as the material name, description, properties, minimum and maximum quantity, and the default quantity.
- **Material storage configuration data**, which defines the containers that hold the materials, consists of items such as the container name, description, type, properties, and capacity.

You also use the Material Editor to create relationships between the material and container data by assigning materials to containers and distributing lots to the containers.

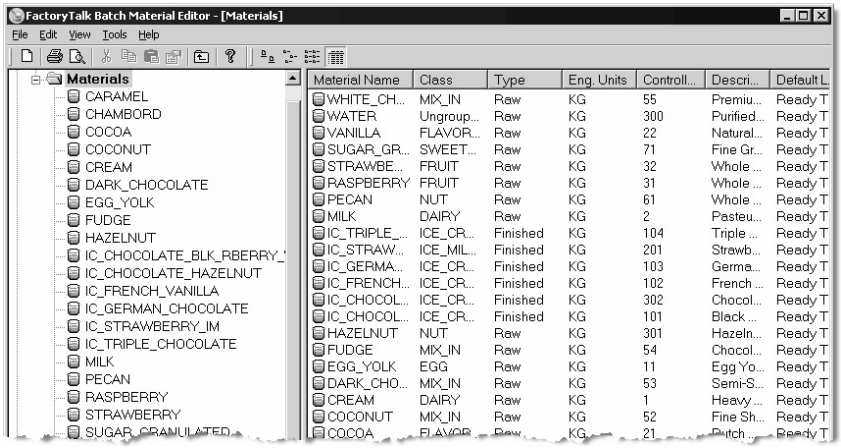
In this chapter you add new data to the *SAMPLE2_MATERIALS.mdf* database that was created automatically when you installed Material Manager.

Start the Material Editor

Click the **Start > Rockwell Software > Material Manager > Material Editor**.

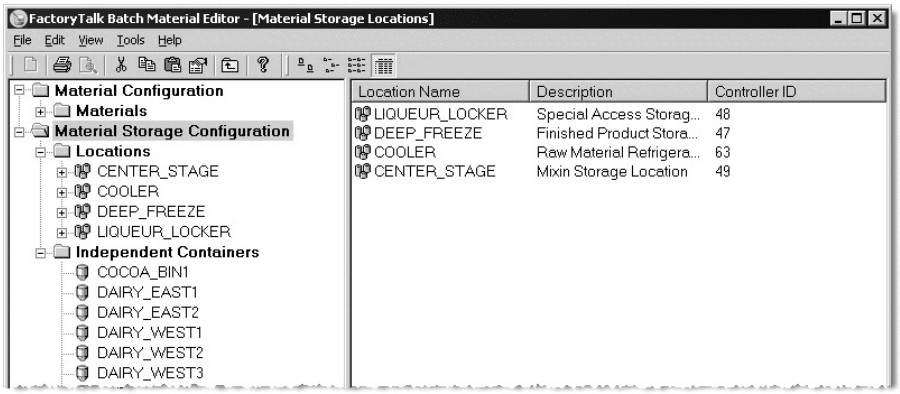
IMPORTANT Administrator privileges are required to perform this procedure.

1. Expand the **Materials** folder. The list of materials in the SAMPLE2_MATERIALS material database displays in the left pane.
2. Click the **Materials** folder. The detailed list of materials displays in the right pane.



A material is the logical representation of a recipe ingredient, such as cream or sugar. For each material, you create lots, which are physical instances of a material. For example, when a new shipment of cream arrives at the factory you add a new lot to uniquely identify that shipment of cream. When you distribute a lot to containers, the distributed portions become sublots, which are the physical inventory that is stored in a container. For example, your lot of cream may be divided into two sublots that are stored in two separate containers.

3. Collapse the **Materials** folder, expand the **Locations** folder, and then expand the **Independent Containers** folder. The lists of storage locations in the SAMPLE2_MATERIALS material database display. The detailed list of materials remains in the right pane until you click another folder.



The **Independent Containers** folder displays a list of containers, which are repositories for inventory. In Material Manager you define associations between materials and containers. In the area model, you define associations between containers and equipment modules. The FactoryTalk Batch Server uses these associations at runtime to find the container holding the appropriate material and its associated equipment module to bind to a material-enabled phase step.
The **Locations** folder contains storage locations, which are a grouping of containers. Normally, containers assigned to a storage location have a short life span; they might be created by one recipe and deleted by the next. This is a common activity for a pre-weigh recipe that distributes measured amounts of material onto pallets and then a mixing recipe that uses the pallets as its source of material.

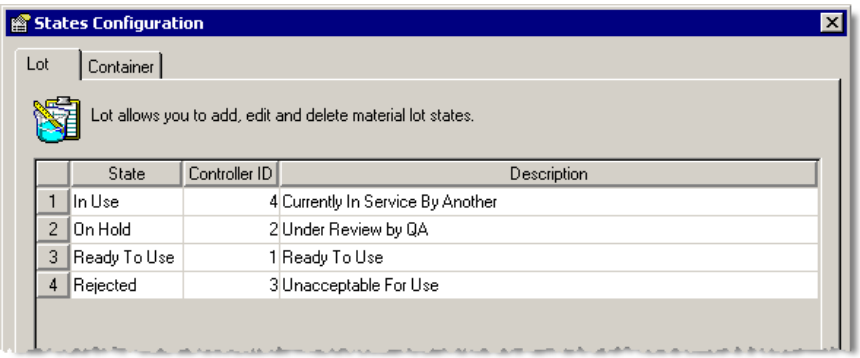
4. Collapse the **Locations** and **Independent Containers** folders.

Adding material states

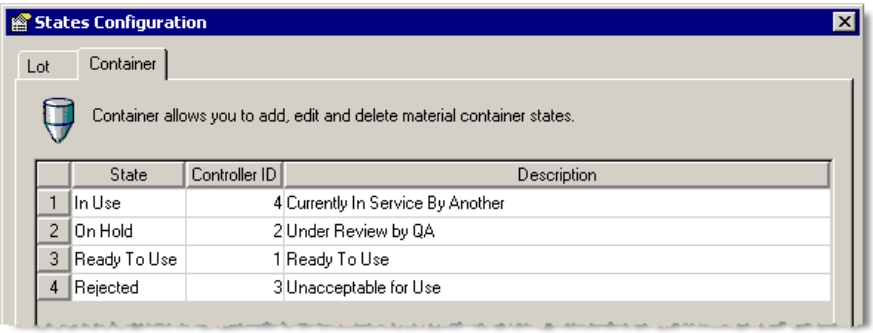
To be used in a batch, both the container and the materials within the container must be in a Ready to Use state. Any other state prevents the material and container from being used and provides you a means to identify offline equipment and materials. For example, you could create a lot state called QATest and assign it to a material lot to keep it from being used while it is being tested. To put the lot and container into use again, you would change the state to Ready to Use.

In this exercise, you create a container state called Maintenance so you can keep a container from being used while it's being repaired.

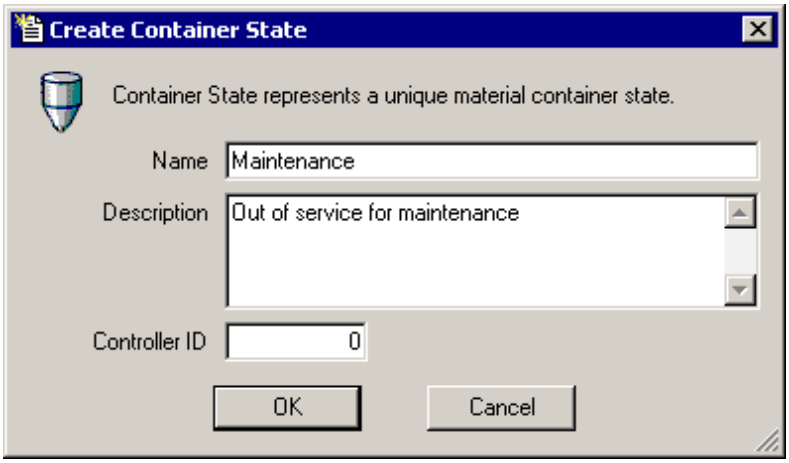
1. From the **Edit** menu, select **States**. The **States Configuration** dialog box opens to the **Lot** tab, which shows the lot states defined in the *SAMPLE2_MATERIALS.mdf* material database.



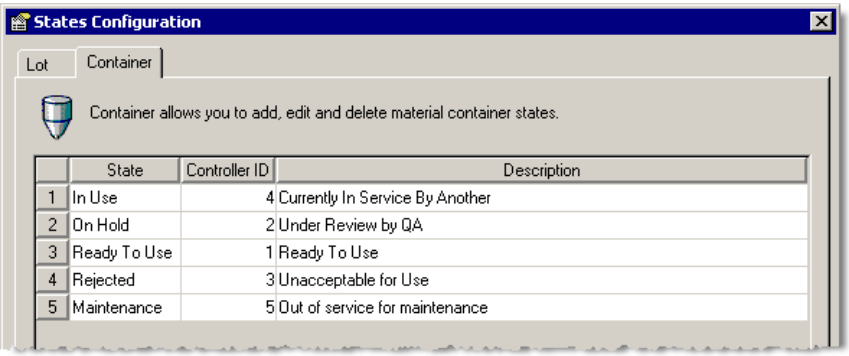
2. Select the **Container** tab. The container states defined in the *SAMPLE2_MATERIALS.mdf* material database display.



3. Click the **New State** button. The **Create Container State** dialog box opens.
4. In the **Name** box, type **Maintenance**.
5. In the **Description** box, type **Out of service for maintenance**.



6. Click **OK.** The new state is added to the list. Because you didn't assign a controller ID, the Material Editor automatically assigned the next available number.



Controller IDs are used throughout the Material Editor to uniquely identify items in the material database. A PCD programmer can use these controller IDs to access pieces of data in the material database.

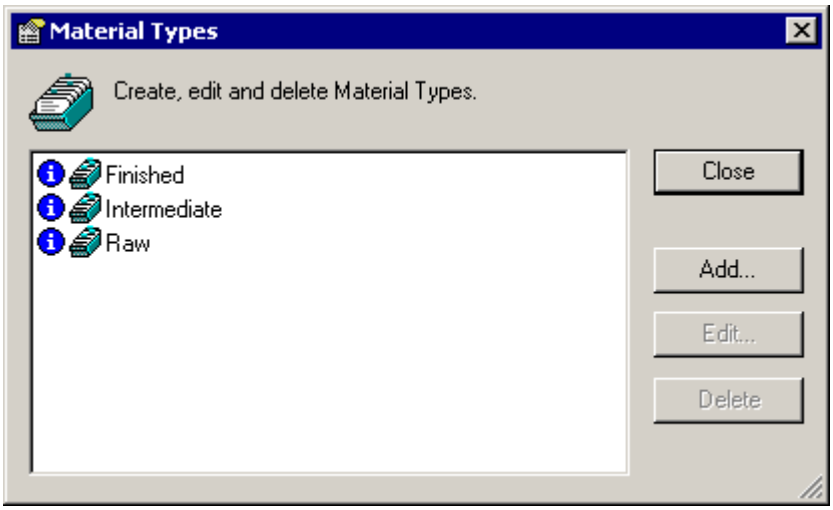
7. Click **Close**.

Adding material types

Material types are used for informational and organization purposes and do not affect the building or execution of material-based recipes. The material types appear in a selection list when you define a material.

In this exercise, you create two new material types: Dry and Liquid.

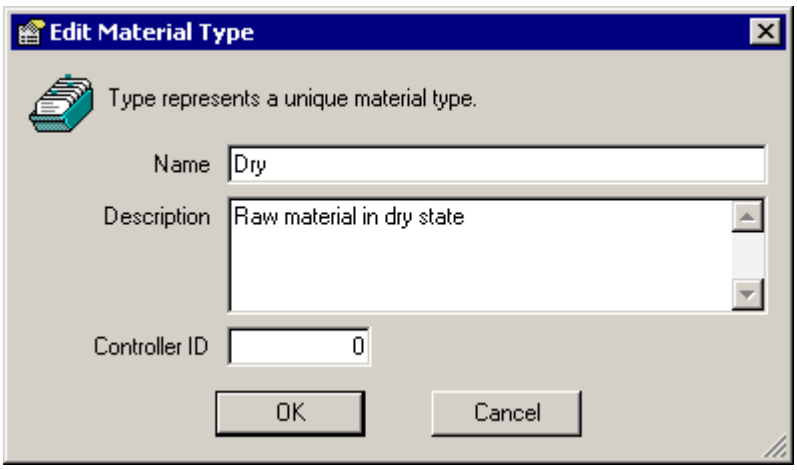
1. From the **Edit** menu, select **Material Types**. The **Material Types** dialog box opens.



The types defined in the *SAMPLE2_MATERIALS.mdf* material database are finished, intermediate, and raw, which are the defaults (indicated by the blue information icon) and not editable. You can add more material types, which are editable.

2. Click the **Add** button. The **Edit Material Type** dialog box opens.
3. In the **Name** field, type **Dry**.

4. In the **Description** field, type **Raw material in dry state**.



Leaving **Controller ID** at zero forces the Material Editor to assign the next available number.

5. Click **OK**. The Dry material type displays in the list.
6. Click the **Add** button. Add another type, **Liquid**, with the description **Raw material in liquid state**.
7. Click **OK**, and then click **Close**.

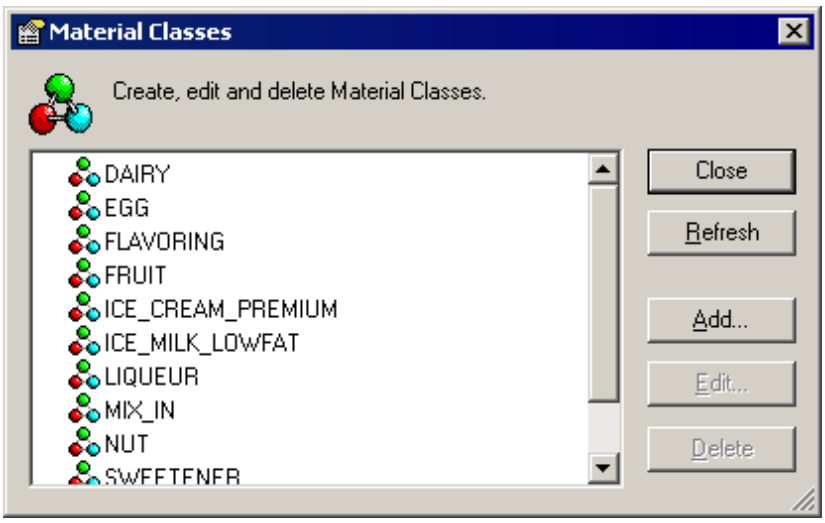
Adding a material class

A material class defines a group of materials that are similar. For example, a material class called Sweetener could contain materials such as Granulated Sugar and Corn Syrup. Material classes are used for organizational purposes and do not affect the execution of material-based recipes.

You can use material classes to simplify the assignment of materials to storage containers. When you define a storage location, you must indicate the material(s) that can be stored in the container. Using material classes, you can assign all of the members of a class of materials to a container, instead of assigning the materials individually.

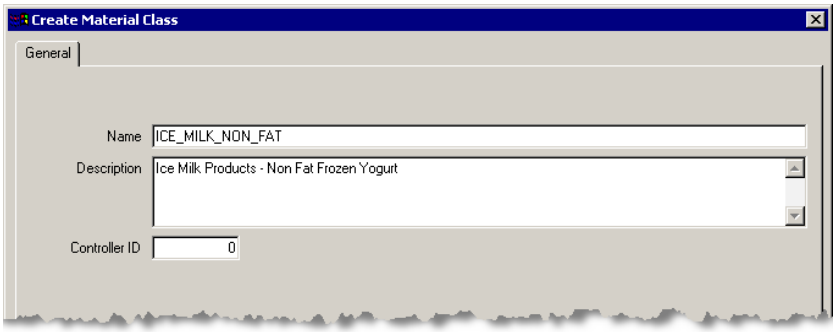
In this exercise you create a new material class for nonfat frozen yogurt products and define properties to define the class of materials.

1. From the **Edit** menu, select **Material Classes**. The **Material Classes** dialog box opens displaying the material classes defined in the *SAMPLE2_MATERIALS.mdf* material database.



The material classes display in alphabetical order. Ungrouped is the system default, indicated by the blue information icon, and therefore not editable.

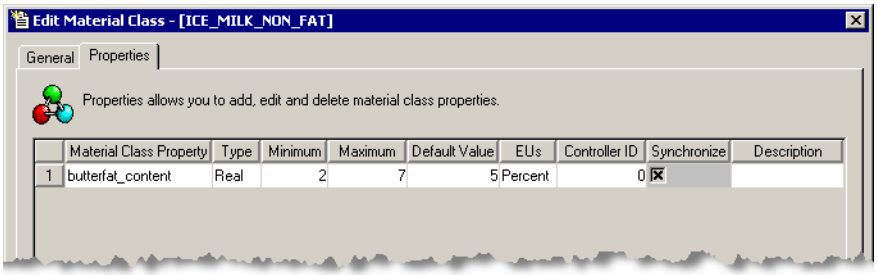
2. Click **Add**. The **Create Material Class** dialog box opens to the **General** tab.
3. In the **Name** box, type **ICE_MILK_NON_FAT**.
4. In the **Description** box, type **Ice Milk Products - Non Fat Frozen Yogurt**.



Leaving **Controller ID** at zero forces the Material Editor to assign the next available number.

5. Click **Apply**. The **Edit Material Class** dialog box opens to the **General** tab.
6. Select the **Properties** tab, and then click the **New Property** button.
7. In the **Material Class Property** box, type **butterfat_content**.
8. In the **Minimum** box, type **2**.
9. In the **Maximum** box, type **7**.
10. In the **Default Value** box, type **5**.

11. In the **EUs** box, type **Percent**.



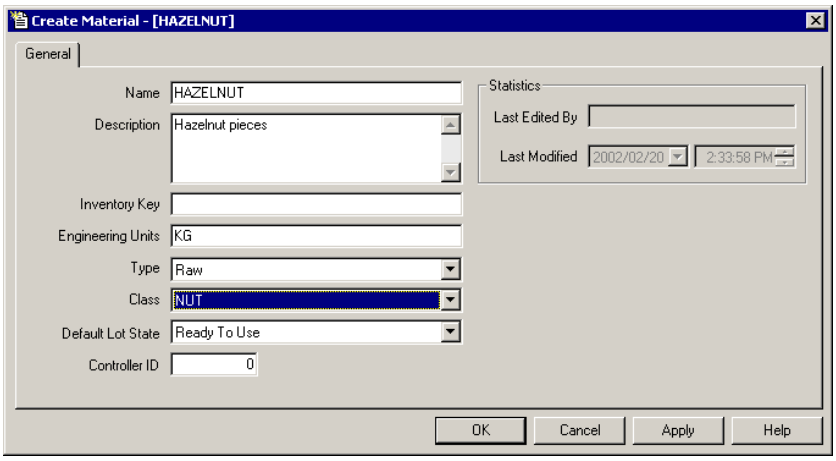
12. Click **Apply**, then select the **Synchronize** checkbox.
13. Click **OK**, click **Yes** to propagate the change, and then click **Close**.

Adding a material

A material is an ingredient in a recipe. For each material, you specify lots, which are instances of a material. When you distribute a lot to containers, the distributed portions of the lot become sublots. A sublot is physical inventory that is stored in a container.

You are going to add a new product to your line — Chocolate Hazelnut Ice Cream. There is already a recipe for Triple Chocolate Ice Cream that uses the same materials you need so you only have to add Hazelnuts (raw) and Chocolate Hazelnut Ice Cream (finished) as materials.

1. Right-click the **Materials** folder, and then select **New Material**. The **Create Material** dialog box opens to the **General** tab.
2. In the **Name** box, type **HAZELNUT**.
3. In the **Description** box, type **Hazelnut pieces**.
4. In the **Engineering Units** box, type **KG**.
5. From the **Type** list, select **Raw**, if necessary.
6. From the **Class** list, select **NUT**.
7. From the **Default Lot State** list, select **Ready to Use**, if necessary.



You can use **Inventory Key** to interface the material inventory with your plant production processes. Leave **Inventory Key** blank for this exercise. Leaving **Controller ID** at zero forces the Material Editor to assign the next available number.

8. Click **OK**.
9. In the same manner, add:

- Name = **IC_CHOCOLATE_HAZELNUT**
- Description = **Chocolate Hazelnut Premium Ice Cream**
- Engineering Units = **KG**
- Type = **Finished**
- Class = **ICE_CREAM_PREMIUM**
- Default Lot State = **Ready To Use**

Adding containers

Containers are repositories for inventory. In the Material Editor, you create containers and then distribute lots of materials to them. When you run a batch, the FactoryTalk Batch Server asks the Material Server to look for containers that meet the material requirements of the step. That container is then selected for binding to the batch if the total inventory of the container is greater than the defined heel property. The type of container you associate with a material also affects the binding process, which you will read more about in a later chapter.

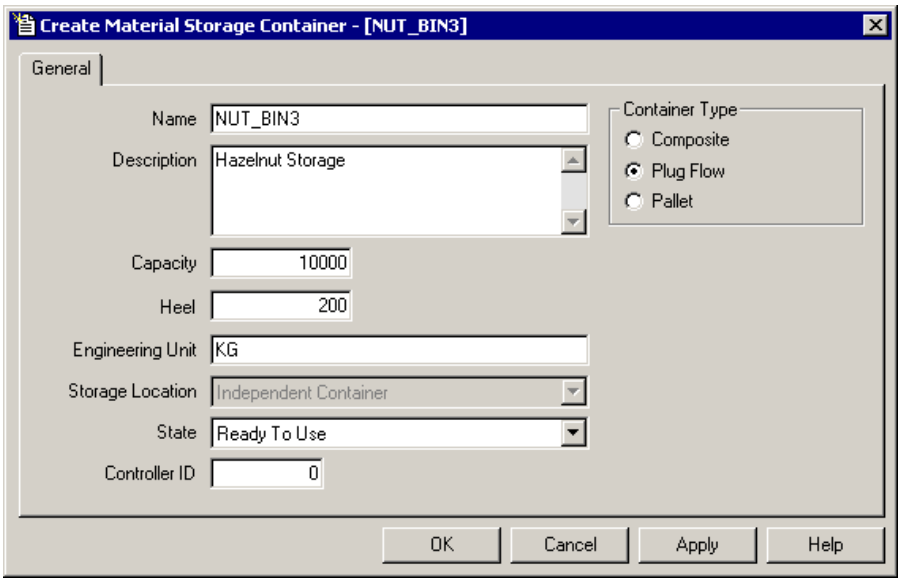
Material Manager supports three different types of containers:

- **Composite Containers** hold only one material and lot at a time. As new sublots are created and linked to a composite container, the sublots are combined within the container. An example of a composite container is a tank that holds multiple sublots of milk. As each sublot is added to the container they blend together making it impossible to distinguish between the sublots. During binding the entire content of the container is considered.
- **Plug-Flow Containers** hold only one material, but can hold multiple sublots. Each sublot remains distinct when added to the plug-flow container. Sublots that are added to a plug-flow container are available for use in a first-in/first-out fashion. The first sublot placed in the container is the first sublot used, then the second sublot is used, and so on. Material Manager tracks the usage of each sublot, and recognizes when each lot is exhausted. During binding only the first-out sublot is considered.
- **Pallet Containers** hold many different materials and many sublots of each material. Each sublot can have a label, which is the only property unique to a sublot. All other sublot properties are inherited from the lot properties. You can use labels to distinguish between sublots that are unique. All sublots added to a pallet container are available at any time. During binding, each sublot on the pallet is considered.

In this exercise, you create two new independent containers to hold hazelnuts.

1. Expand the **Material Storage Configuration** folder, right-click the **Independent Containers** folder, and then select **New Material Storage Container**. The **Create Material Storage Container** dialog box opens.
2. In the **Name** box, type **NUT_BIN3**.
3. In the **Description** box, type **Hazelnut storage**.

4. In the **Capacity** box, type **10000**.
5. In the **Heel** box, type **200**.
6. In the **Engineering Unit** box, type **KG**.
7. In the Container Type area, select **Plug Flow**.



Leave the **State** at the default of **Ready to Use** and **Controller ID** at **0** (zero). Leaving **Controller ID** at zero forces the Material Editor to assign the next available number.

8. Click **OK**.
9. Add a second independent container:
   - Name: **NUT_BIN4**
   - Description: **Hazelnut storage**
   - Capacity: **10000**
   - Heel: **200**
   - Engineering Units: **KG**
   - State: **Ready_to_Use**
   - Container Type: **Plug Flow**
10. Click **OK**.

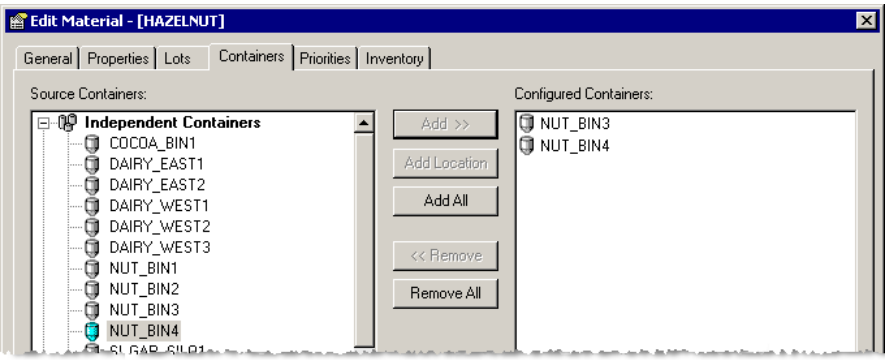
Associating materials with containers

Now that you have defined the two new materials and containers, you need to associate them with each other.

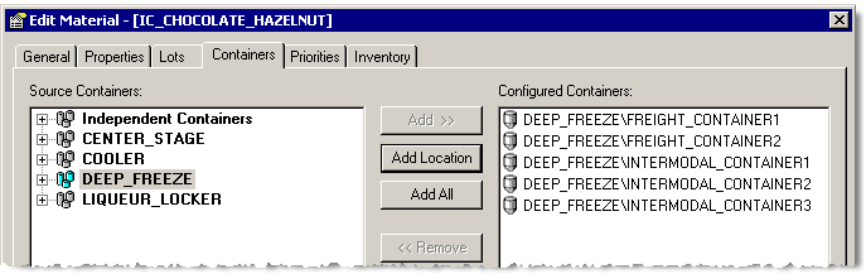
In this exercise you associate the HAZELNUT material with two independent containers and the IC_CHOCOLATE_HAZELNUT material with all the containers in a storage location.

1. Expand the **Materials** folder, right-click **HAZELNUT**, and then select **Properties**. The **Edit Material** dialog box opens to the **General** tab.
2. Select the **Containers** tab, expand the **Independent Containers** folder, select **NUT_BIN3**, and then click the **Add** button.

3. Add **NUT_BIN4** in the same manner.



4. Click **OK**.
5. Double-click IC_CHOCOLATE_HAZELNUT. The **Edit Material** dialog box opens to the **General** tab.
6. Select the **Containers** tab, select the **DEEP_FREEZE** storage location, and then click the **Add Location** button. All the containers in the Deep_Freeze storage location are added to the Configured Containers area.



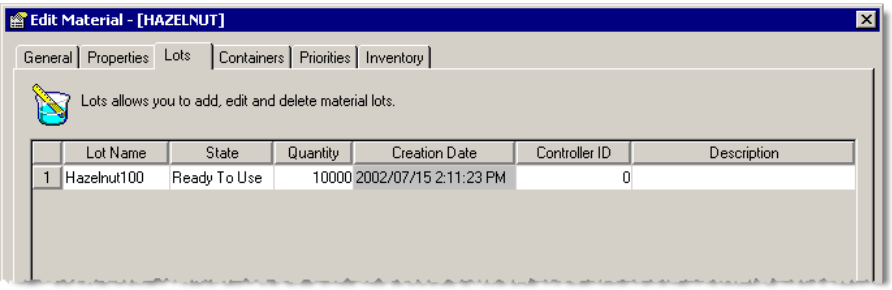
7. Click **OK**.

Creating lots

The material that you created is merely a logical definition of a material. The actual physical material is a lot. Each lot inherits the characteristics and properties of the material and also includes a physical quantity and a controller ID to identify the lot. There can be multiple lots of a single material. Each lot is uniquely identified by its lot name.

In this exercise, you create a lot for the latest shipment of hazelnuts, which is 10,000 KG.

1. Expand the **Materials** folder, right-click **HAZELNUT**, and then select **Properties**. The **Edit Material** dialog box opens to the **General** tab.
2. Select the **Lots** tab, and then click the **New Lot** button.
3. In the **Lot Name** box, type **Hazelnut100**.
4. In the **Quantity** box, type **10000**.



Leave **State** at the default of **Ready to Use** and **Controller ID** at **0** (zero). Leaving **Controller ID** at zero forces the Material Editor to assign the next available number.

5. Click **Apply**.

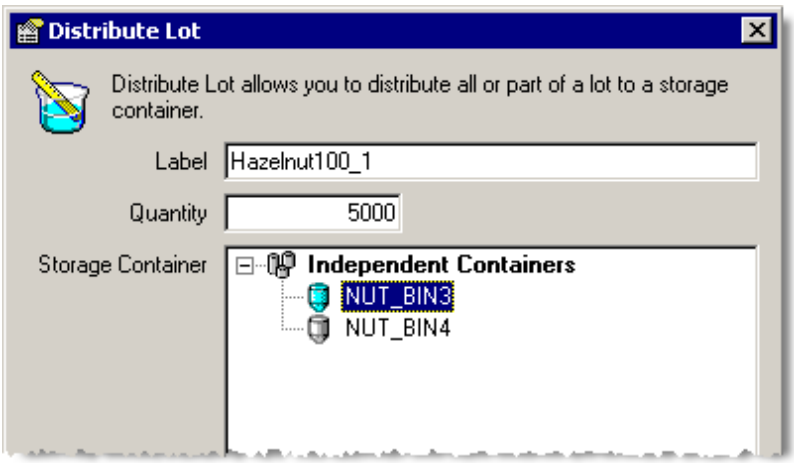
Distributing lots to containers

Now that you've defined the containers and the lots, you need to distribute the lots to the containers. When you distribute a lot, you create a sublot that is identified by a label.

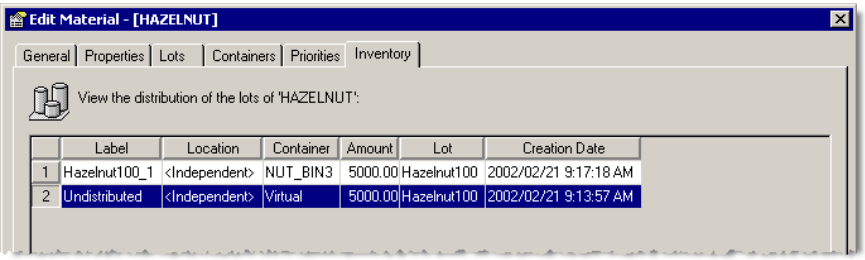
- A **sublot** is a quantity of a lot stored in a container. Sublots inherit the properties and values from lots. The sublot is the basis for tracking all material movement, production and consumption.
- A **label** is the only property unique to a sublot. Generally a label is thought of as a barcode, assigned to a specific sublot. The concept is easy to follow on a pallet that holds many pre-measured bags (sublots) of a material, each with an identifying barcode (label).

In this exercise, you distribute the lot of hazelnuts into two sublots that are stored in two separate containers.

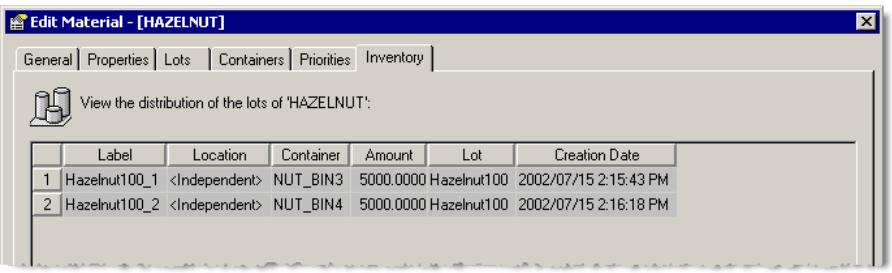
1. With the **Edit Material** dialog box still open, select the **Inventory** tab. The lot you added in the previous exercise displays as undistributed.
2. Click the row number to select the lot record, and then click the **Distribute** button. The **Distribute Lot** dialog box opens.
3. In the **Label** box, type **Hazelnut100_1**.
4. In the **Quantity** box, type **5000**.
5. Expand the **Independent Containers** folder. All independent containers that are possible storage locations for hazelnuts display.
6. Select **NUT_BIN3**.



7. Click **OK**. One-half of the lot is distributed and the remainder appears on a new line as undistributed.



8. Distribute the remaining lot of hazelnuts to NUT_BIN4 with the label of **Hazelnut100_2**.



9. Click **OK**.

Exiting the Material Editor

You have entered the information necessary to build your new recipe, so exit the Material Editor. From the **File** menu, select **Exit**. Click **Yes** to confirm the exit.

Summary

In this chapter, you:

- Started the Material Editor
- Added Material States
- Added Material Types
- Added a Material Class
- Added a Material
- Added Containers
- Associated Materials with Containers
- Created Lots
- Distributed Lots to Containers
- Exited the Material Editor

This chapter provided a brief overview of the capabilities of the Material Editor. See the *FactoryTalk Batch Material Editor User Guide* for more information on the Material Editor.

Introducing material-enabled phases

After you define the material and either the container or storage location information, you are ready to reconfigure your area model to accommodate material-enabled phases. A material-enabled phase is a phase that is enabled to support the specification of a material as a means to find the appropriate equipment and then bind to that equipment in a control recipe.

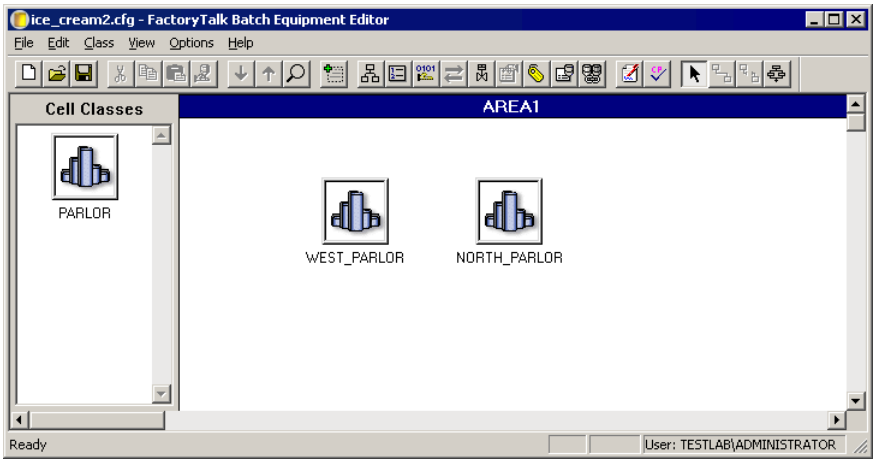
In this chapter you modify the *icecream_2.cfg* file to accommodate the new containers you added.

Open the area model

1. Select **Start > Rockwell Software > Equipment Editor**.

IMPORTANT Administrator privileges are required to perform this procedure.

2. Select **File > Open**.
3. From the **Open** dialog box, navigate to **SampleDemo2\Recipes**, select **ice_cream2.cfg**, and then click **Open**. The area model opens with the WEST_PARLOR and NORTH_PARLOR process cells displayed.



- The WEST_PARLOR process cell is a standard FactoryTalk Batch configuration with recipes that create different flavors of ice cream.
- The NORTH_PARLOR process cell demonstrates the application of material tracking to create the same ice cream flavors.

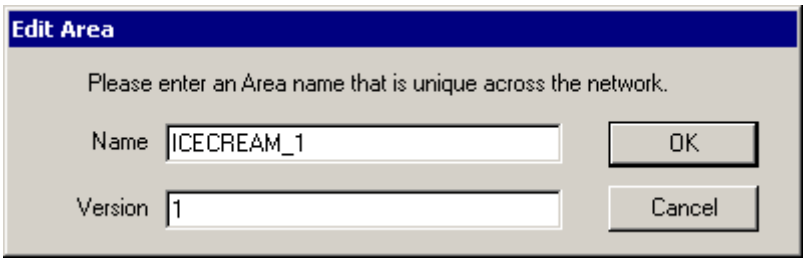
Naming the area

At startup, the FactoryTalk Batch Server clears the information in the Material Server database according to the Area name specified for the area model that is selected in the **Server Options** dialog box. If there are multiple FactoryTalk Batch Servers in your system, it is very important that you assign unique Area names.

IMPORTANT If you have duplicate Area names in a system with multiple FactoryTalk Batch Servers, you could experience batch failures. Each Area name must be unique.

The default Area name is AREA1, you need to change it to a unique name.

1. From the **Edit** menu, select **Area**. The **Edit Area** dialog box opens.
2. In the **Name** field, type **ICECREAM_1**.



3. Click **OK**.

Viewing enumeration sets

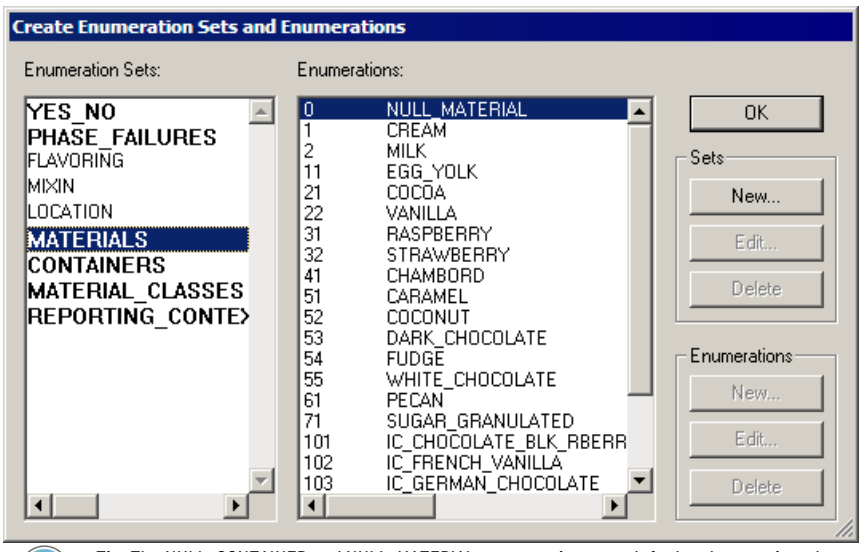
Material Manager automatically creates three enumeration sets: MATERIALS, CONTAINERS, and MATERIAL CLASSES that represent the configured materials, containers, and material classes and their respective controller IDs within the material database. The Material Server populates these enumeration sets when you start the FactoryTalk Batch Equipment Editor, FactoryTalk Batch Recipe Editor and FactoryTalk Batch Server.

You can view the MATERIALS, CONTAINERS, and MATERIAL CLASSES enumeration sets from within the Equipment Editor but you must use the Material Editor to make any changes.

Tip: Some changes to the area model requires that you validate all recipes and then restart the FactoryTalk Batch Server, especially if it is set to Cold Restart. Since the MATERIALS, CONTAINERS, and MATERIAL CLASSES enumeration sets originate from data in the material database, any change you make in the Material Editor that affects the enumeration sets also requires that you validate all recipes and then restart the Batch Server. For this reason, it is very important that you design your material database to require as little maintenance as possible.

1. From the **Edit** menu, select **Enumeration Sets**. The **Create Enumeration Sets and Enumerations** dialog box opens.
2. Select **MATERIALS**. The list of materials displays in the **Enumerations** box in numerical order by Controller ID.

3. Scroll down to see the two materials you added in the Material Editor.



Tip: The NULL_CONTAINER and NULL_MATERIAL enumerations are default values assigned to each enumeration set by the Equipment Editor. The other listed enumerations belong to the *ice_cream2.cfg* area model.

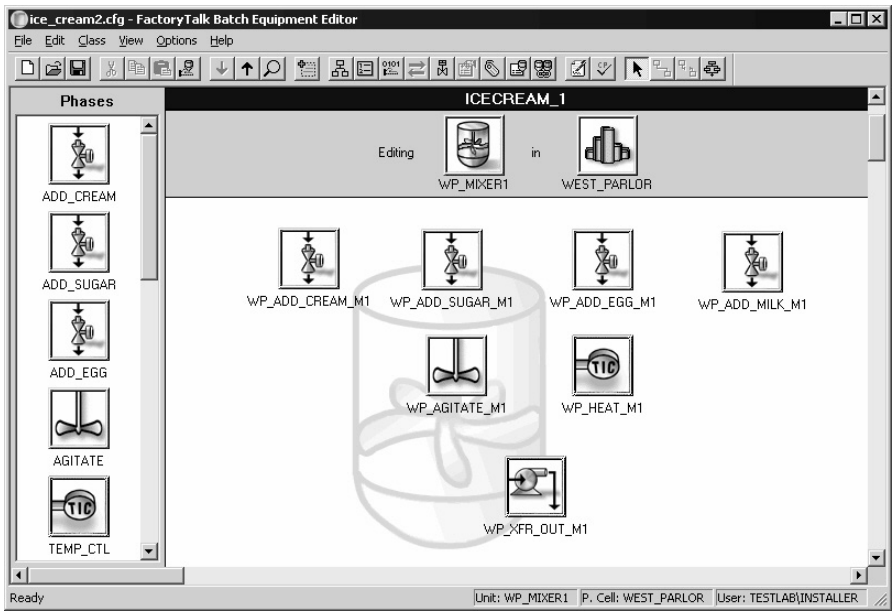
4. Select **CONTAINERS**. The list of containers displays in the **Enumerations** box.

   The CONTAINERS enumeration set contains only independent containers and storage locations, **not** containers within storage locations. In this way changes made to containers within storage locations do not change the area model.

5. Select **MATERIAL_CLASSES**. The list of material classes displays in the **Enumerations** box.
6. Click **OK** to close the dialog box.

Creating material-enabled phases

Without Material Manager, you need to create a phase for each material in a recipe. In this example, phases are needed for each material used in the recipe: ADD_CREAM, ADD_EGG, ADD_SUGAR, and ADD_MILK.

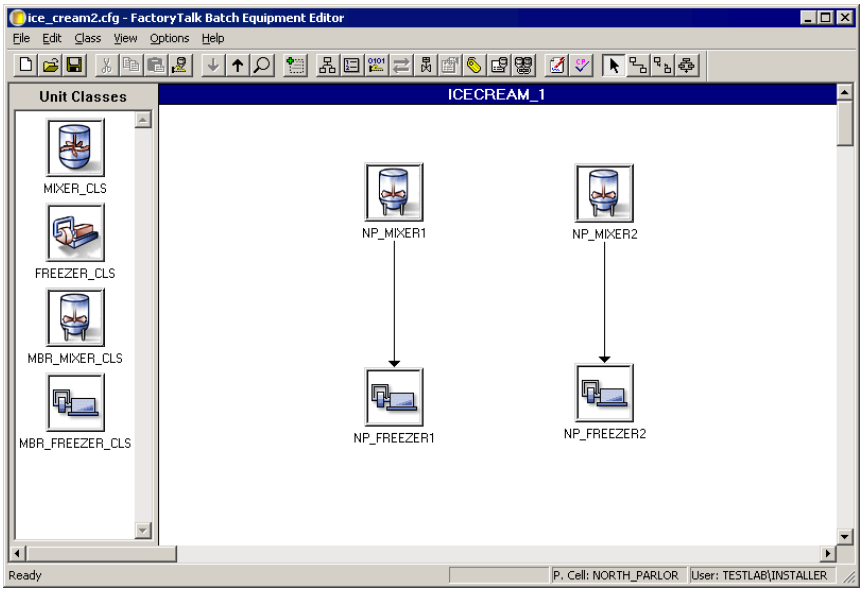


It is even more complicated if there is more than one container for each material. For example, if cream is stored in five different containers, you would need five phases, five equipment modules, and five recipes to get cream from the appropriate container. The operator then has to choose the recipe to run based on where the cream is stored. Imagine the permutations of recipes required when sugar, eggs and milk are stored in different containers as well.

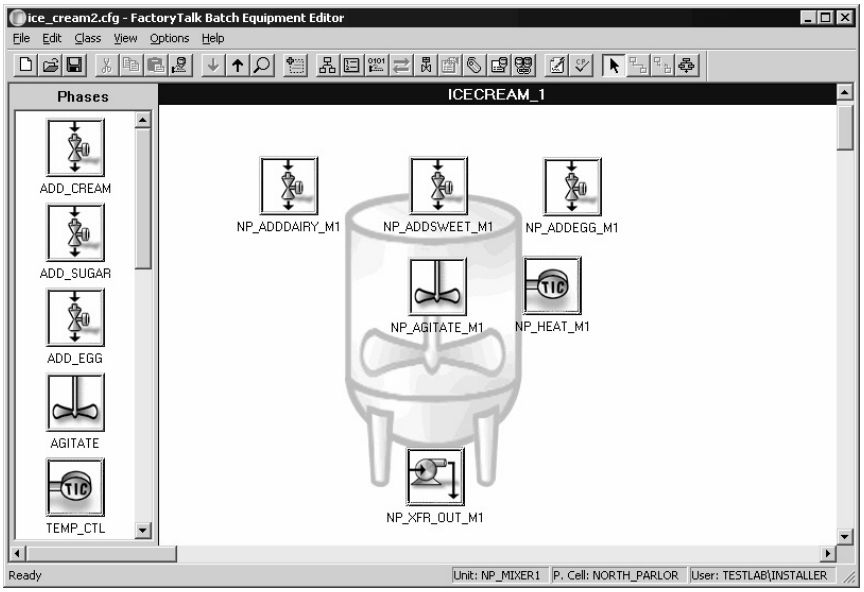
With Material Manager, you can replace all of these phases with one material-enabled phase. In this case, these material-enabled phases move material into the process cell and are therefore designated as **material additions**. The other type of material-enabled phase moves material away from the process cell and are therefore designated as **material distributions**. It is possible for a material-enabled phase to support both actions.

Tip: Material Manager currently tracks the transfer of materials on Addition and Distribution Feeds. Material enabled phases do not track material transfers between units or phases.

1. Double-click **NORTH_PARLOR**. The unit level displays. The NORTH_PARLOR process cell contains two units, which are identical. Units that contain material-enabled phases are configured the same as standard units — create a unit class and then create instances of the unit class.



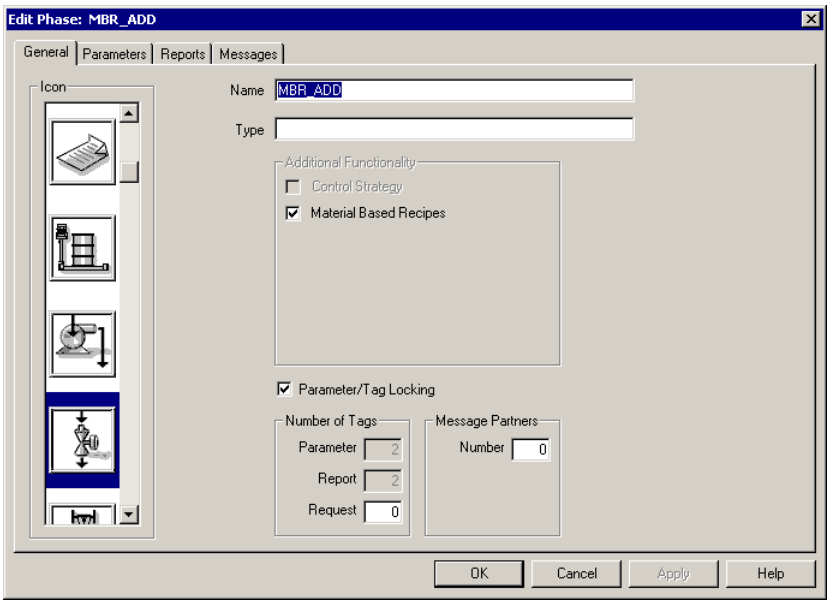
2. Double-click **NP_MIXER1**. The equipment phases and modules display.



3. Select **NP_ADDDAIRY_M1**, select **NP_ADDSWEET_M1**, and then select **NP_ADDEGG_M1**. Notice how the MBR_ADD phase is selected for each instance.

   With Material Manager, you can create multiple equipment modules from a single phase. Notice that the phases ADD_CREAM, ADD_SUGAR, ADD_EGG and ADD_MILK from the previous example are replaced by a single material-enabled phase, MBR_ADD. The selection of the correct equipment module is determined as the batch runs, based on the configuration of the step in the recipe.

4. In the **Phases** list, double-click **MBR_ADD**. The **Edit Phase** dialog box opens to the **General** tab.



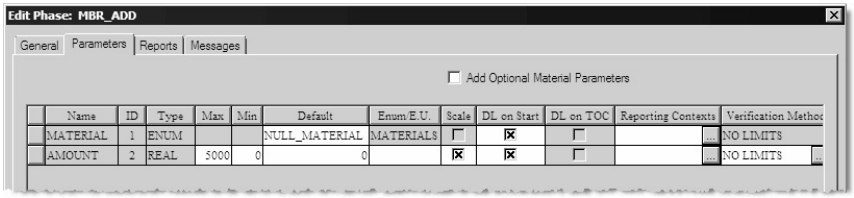
   Selecting **Material Based Recipes** marks the phase as supporting materials and automatically configures the parameters and reports

needed to run a material-enabled phase. It also implies that equipment modules based on this phase must be programmed to follow a protocol so the FactoryTalk Batch and Material Servers can track material usage. (See: Programming a material-enabled phase on page 53).

Adding material-enabled phase parameters

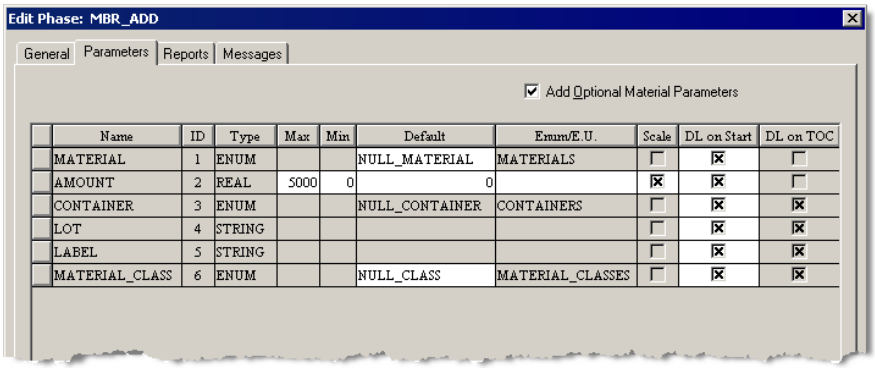
Material Manager automatically adds two parameters to each material-enabled phase: MATERIAL and AMOUNT. There are three optional parameters built in to Material Manager: CONTAINER, LOT, and LABEL. Custom parameters can also be created and used.

1. Select the **Parameters** tab.



- The **MATERIAL** parameter defines the minimum material specification required to query the material database for containers to consider as binding candidates for a material-enabled phase.
- The **AMOUNT** parameter is the set point, or target, for the quantity of MATERIAL for the equipment module. Material additions are expressed as zero or a positive value. Material distributions are expressed as zero or a negative value. The minimum/maximum range of valid values should reflect the possible use of the phase. If the phase is to handle both a material addition and distribution, the range should span positive and negative values.

2. Select **Add Optional Material Parameters**, and then click **Yes**. The optional material parameters display.



- The **CONTAINER** parameter has the FactoryTalk Batch Server store the container to which a material phase step is bound at run time, which makes the container value available for downloading to the phase logic.
- The **LOT** parameter for material **additions** is part of the material specification used to query the material database for containers to be considered as binding candidates for a material phase. For material **distributions**, it is the name of the lot assigned to the inventory to be distributed.

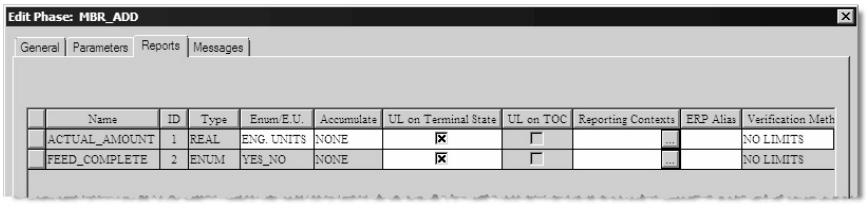
- The **LABEL** parameter for material **additions** is part of the material specification used to query the material database for containers to be considered as binding candidates for a material phase. For material **distributions**, it is the name of the label assigned to the inventory to be distributed.
- The **MATERIAL_CLASS** parameter has the FactoryTalk Batch Server present a dialog box to the operator when a batch is added to the batch list so the operator can select the material to use in the recipe.
- All Material Manager parameters support the Automatic Upload/Download functionality.

3. Disable **Add Optional Material Parameters**, and then click **Yes**.

Adding material-enabled phase report parameters

Each material-enabled phase has two required material report parameters: ACTUAL_AMOUNT and FEED_COMPLETE. You also can create custom report parameters.

1. Select the **Reports** tab.



- The **ACTUAL_AMOUNT** report parameter holds the amount of material the equipment module consumed (material addition) or produced (material distribution). Material additions are expressed as zero or a positive value. Material distributions are expressed as zero or a negative value.
- The ACTUAL_AMOUNT does not have to equal the AMOUNT parameter value but should have a sign that agrees with the feed type of the recipe phase step.
- The **FEED_COMPLETE** report parameter is a signal to the FactoryTalk Batch Server that the addition or distribution completed successfully. A lack of material, lack of storage capacity, phase failure, or stopping a phase could all result in the interruption of a material addition or distribution. When this occurs, the phase logic sets FEED_COMPLETE to false, so that batch execution is held until the phase can rebind to another container.

All Material Manager report parameters support the Automatic Upload/Download functionality.

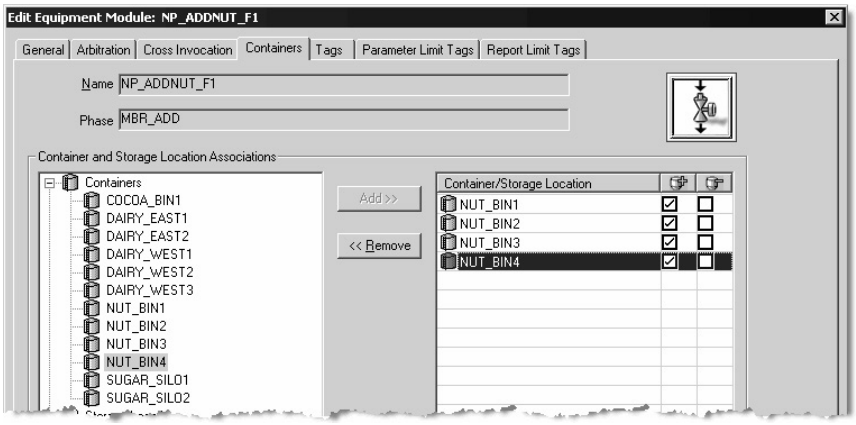
2. Click **Cancel**.

Defining equipment modules

You can create multiple equipment modules from a single material-enabled phase. The material specification, material, and optionally, the lot and label are configured on a material-enabled phase step in the FactoryTalk Batch Recipe Editor. The FactoryTalk Batch Server uses this information to find containers and the associated equipment modules to bind to a recipe.

In this exercise, you associate the two new containers with the existing NP_ADDNUT_F1 and NP_ADDNUT_F2 equipment modules.

1. Click the **Go Up** button to return to the unit level.
2. Double-click **NP_FREEZER1**. The equipment phases and modules display.
3. Double-click **NP_ADDNUT_F1**. The **Edit Equipment Module** dialog box opens to the **General** tab.
4. Select the **Containers** tab, and then expand the Containers folder. The **Containers and Storage Location Associations** box lists the containers in the material database. The area on the right displays the containers associated with the phase.
5. Select **NUT_BIN3**, and then click the **ADD** button.
6. To indicate this container adds material to the recipe, select the check box in the **Addition** column.
7. Add **NUT_BIN4** in the same manner.



Now the NP_ADDNUT_F1 equipment module is associated with the four containers that hold nuts in this plant. If any of these containers is holding inventory that matches the material specification of an MBR_ADD phase in a recipe, the equipment module could then be bound as the means for getting that inventory added to the batch.

8. Click **OK**.
9. Click the **Go Up** button.
10. Add NUT_BIN3 and NUT_BIN4 with addition feed types to the NP_ADDNUT_F2 equipment module in NP_FREEZER2.
11. Save the *ice_cream2.cfg* file, and then exit the Equipment Editor. If you are prompted to enter comments for auditing, type **Updated material containers**, and click **OK**.

Restart the FactoryTalk Batch server

Since you have made modifications to the area model, you must restart the FactoryTalk Batch Server.

1. Select **Start > Rockwell Software > Batch Service Manager**. The FactoryTalk Batch Service Manager opens.

   IMPORTANT Administrator privileges are required to perform this procedure.

2. From the **Service** list, select **FactoryTalk Batch Server**.

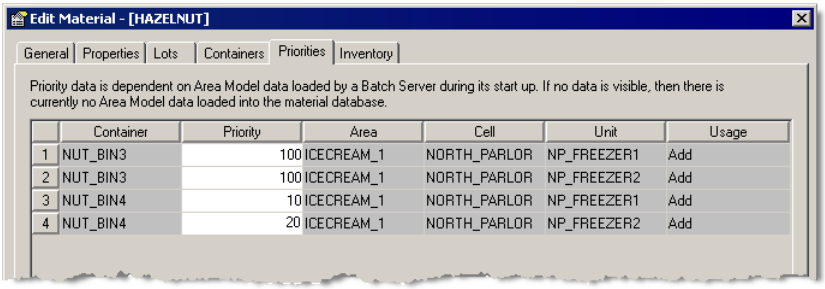
3. Click the **Stop** button. Wait until the Service State areas displays STOPPED.
4. Click the **Start/Continue** button. The Service State area changes from STOPPED to START IS PENDING. After a few moments, RUNNING displays and the light changes to green.
5. Click **Close** to close the FactoryTalk Batch Service Manager.

Setting material container priorities

Container priorities define the order in which containers are considered as candidates for binding a specific material. For example, a container holding the oldest material may need to be used before containers with newer quantities.

You want hazelnuts added to the batch from NUT_BIN3 as long as there is enough material to fulfill the material requirements. Only when the inventory in NUT_BIN3 is depleted should the batch pull from NUT_BIN4. To achieve this configuration, set the priority for NUT_BIN3 to a smaller number than NUT_BIN4 to indicate that NUT_BIN3 has a higher priority.

1. Start the Material Editor.
2. Expand the **Materials** folder, and then double-click **HAZELNUT**. The **Edit Material** dialog box opens.
3. Select the **Priorities** tab. The containers you added to the area model display.
4. In the **Priority** boxes for NUT_BIN3, type **10**.
5. In the **Priority** boxes for NUT_BIN4, type **20**.



	Container	Priority	Area	Cell	Unit	Usage
1	NUT_BIN3	100	ICECREAM_1	NORTH_PARLOR	NP_FREEZER1	Add
2	NUT_BIN3	100	ICECREAM_1	NORTH_PARLOR	NP_FREEZER2	Add
3	NUT_BIN4	10	ICECREAM_1	NORTH_PARLOR	NP_FREEZER1	Add
4	NUT_BIN4	20	ICECREAM_1	NORTH_PARLOR	NP_FREEZER2	Add

6. Click **OK**.

Programming a material-enabled phase

To maintain inventory levels within the material database and record inventory in the Batch Event Journal, follow this protocol when writing phase logic.

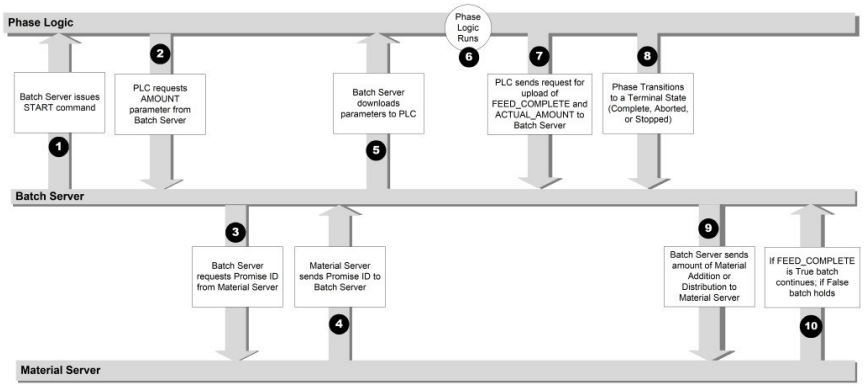
- The phase logic must request a download of the AMOUNT parameter from the FactoryTalk Batch Server.
- The phase logic must upload the ACTUAL_AMOUNT and FEED_COMPLETE report parameters to the FactoryTalk Batch Server before entering a terminal state (COMPLETE, STOPPED or ABORTED)

  You can use the Automatic Upload/Download functionality in FactoryTalk Batch to meet this protocol requirement. The FactoryTalk Batch Server downloads the AMOUNT parameter before the equipment module is commanded to start and uploads the

ACTUAL_AMOUNT and FEED_COMPLETE report parameters after the phase logic runs to a terminal state.

- The sign of the value in the ACTUAL_AMOUNT report parameter must match the configured feed type. Additions are positive or zero. Distributions are negative or zero

This figure illustrates the sequence of events that occur when a material-enabled phase is executed within a recipe.



Summary

In this chapter, you:

- Opened an area model
- Named an area model
- Viewed enumeration sets
- Created a material-enabled phase
- Restarted the FactoryTalk Batch Server
- Set container priorities

This chapter provided a brief overview of the capabilities of the Equipment Editor. (See the *FactoryTalk Batch Equipment Editor User Guide* for more information.)

Introducing material-based recipes

Once you have defined your material data and modified your area model, you can begin to modify your master recipes in the FactoryTalk Batch Recipe Editor. The process of creating material-based recipes is not too different than creating standard recipes. In fact, material-enabled phase steps are added to an operation as standard phase steps.

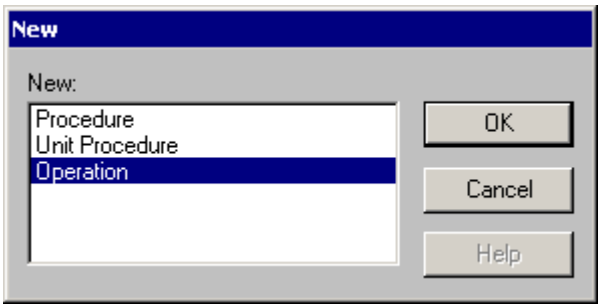
In this chapter, you create a new material-based operation that adds cocoa and hazelnuts to the sweetcream mixture, which is the basis for all the ice cream produced in the plant.

Create a material-based operation

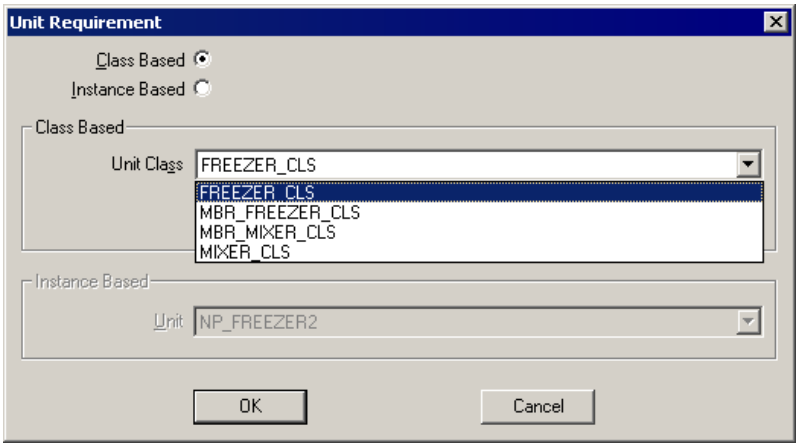
1. Select **Start > Rockwell Software > Recipe Editor**. If the **Recipes Requiring Verification** dialog box opens, click **Cancel**.

IMPORTANT Administrator privileges are required to perform this procedure.

2. Select **File > New Top Level**. The **New** dialog box opens.

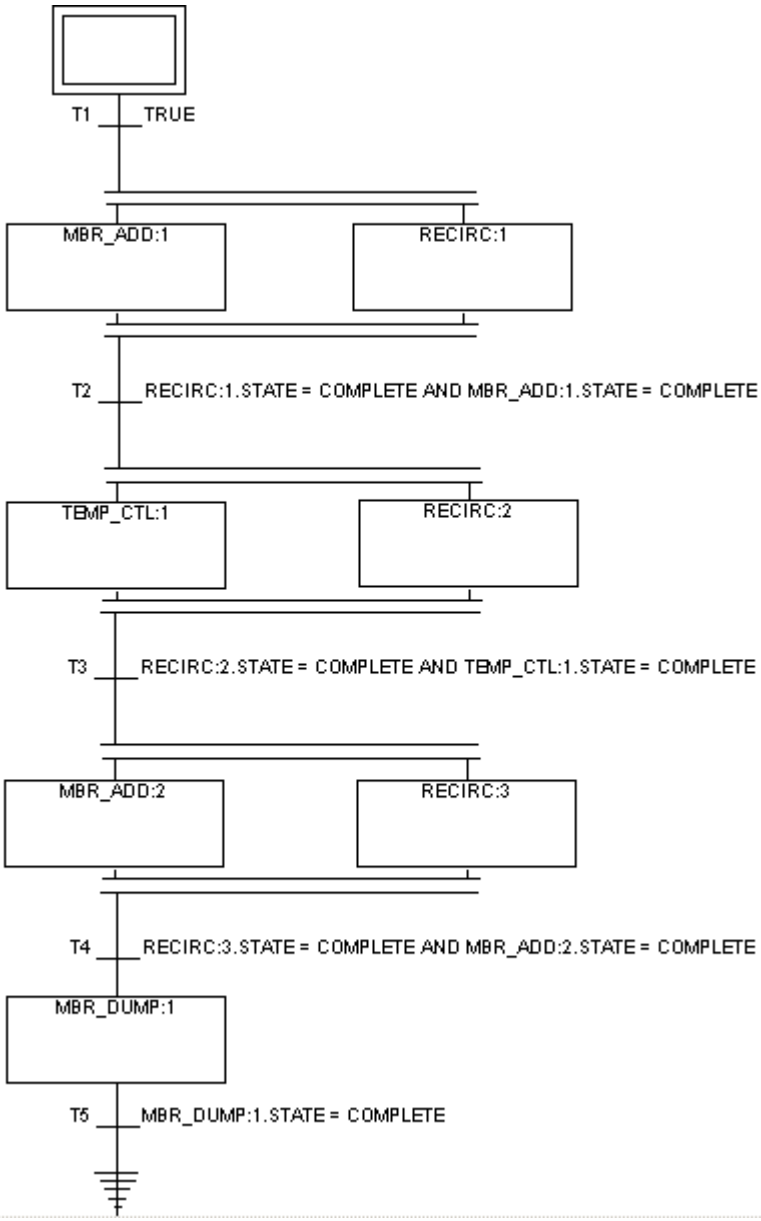


3. Select **Operation**, and then click **OK**. The **Unit Requirement** dialog box opens.



You want the recipe to run on both units in the process cell.

4. Select **Class-Based**, select **MBR_FREEZER_CLS**, and then click **OK**. The initial and final steps of the new operation display in the SFC View.



5. Select the initial step, and then click the **Add Step** button, select **MBR_ADD**, and then click **OK**.
6. Click the **Add Parallel** button, select **RECIRC**, and then click **OK**.
7. Select the last transition, click the **Add Step** button, select **TEMP_CTL**, and then click **OK**.
8. Click the **Add Parallel** button, select **RECIRC**, and then click **OK**.
9. Select the last transition, click the **Add Step** button, select **MBR_ADD**, and then click **OK**.
10. Click the **Add Parallel** button, select **RECIRC**, and then click **OK**.
11. Select the last transition, click the **Add Step** button, select **MBR_DUMP**, and then click **OK**.
12. Select **Recipe > Header Data**, and then enter the following:

- Procedure Identifier: **MCLS_CHOCOLATE_HAZELNUT_OP**
- Author: **Your Name**
- Product Name: **CHP-100**
- Batch Size Default: **5000**
- Batch Size Max: **10000**
- Units of Measure: **KG**
- Estimated Duration: **55**
- Procedure Description: **Chocolate Hazelnut Premium Ice Cream**

13. Click **OK**, and then click **Proceed**. If prompted, enter auditing comments, if desired, and then click **OK**.

Creating recipe formula parameters

Because you want to defer the amounts of the materials at this level in the recipe, you need to add formula parameters. You will enter default amounts at the procedure level and the operator will have an opportunity to change the amount when the batch is added to the batch list.

1. From the **Recipe** menu, select **Recipe Parameters/Reports**. The **Procedure Properties** dialog box opens.
2. Click the **Add Parameter** button.
3. In the **Name** box, type **COCOA_AMT**.
4. In the **Max** box, type **500**.
5. In the **Enum/EU** box, type **KG**.
6. Select **Scalable**.
7. Click the **New** button, and then add **HAZELNUT_AMT** with the same values.

Name	Type	Min	Default	Max	Enum/EU	Scalable	ERP Alias
COCOA_AMT	Real	.00	.00	500.00	KG	☒	
HAZELNUT_AMT	Real	.00	.00	500.00	KG	☐	

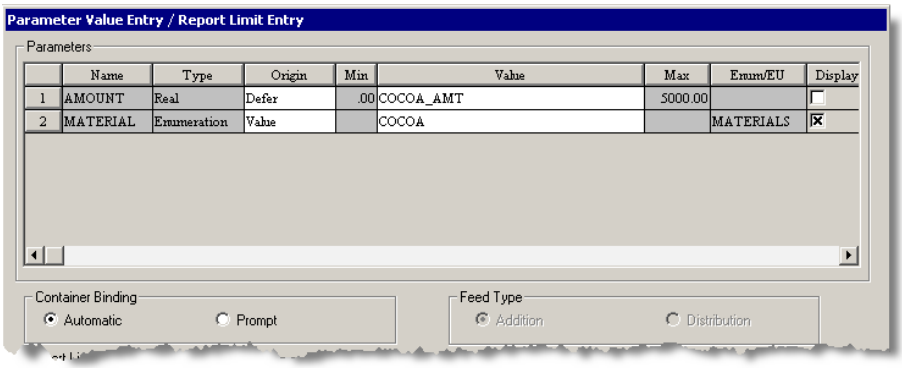
8. Click **OK**.

Assigning formula values

For this recipe, you defer the actual amounts of the materials and enable automatic binding.

1. Select **MBR_ADD:1**, and then click the **Value Entry** button. The **Parameter Value Entry/Report Limit Entry** dialog box opens.
2. For AMOUNT, select **Defer** from the **Origin** list, and then select **COCOA_AMT** from the **Value** list.

3. For MATERIAL, select **COCOA** from the **Value** list, and enable **Display**.



Container Binding is set to **Automatic**, which is the default. You set the **Feed Type** to **Addition** in the Equipment Editor.

4. Click **OK**. The SFC is updated to show COCOA MATERIALS for MBR_ADD:1.
5. Enter formula parameters for the remaining steps as indicated in this table. Use the default values for all other entries.

Step	Parameter	Origin	Value	Display
RECIRC:1	RECIRC_RATE	Value	50	Yes
TEMP_CTL:1	HOLD_TIME	Value	5	No
	TEMP_SP	Value	25	Yes
RECIRC:2	RECIRC_RATE	Value	30	Yes
MBR_ADD:2	AMOUNT	Defer	HAZELNUT_AMT	No
	MATERIAL	Value	HAZELNUT	Yes
RECIRC:3	RECIRC_RATE	Value	20	Yes
MBR_DUMP:1	AMOUNT	Value	-5000	Yes
	MATERIAL	Value	IC_CHOCOLATE_HAZELNUT	No

6. From the **View** menu, select **Table**. Your finished operation should be similar to this.

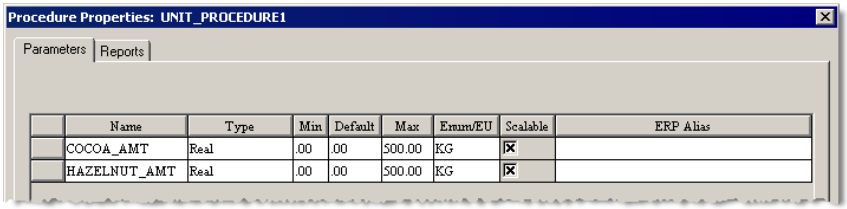
		STEPS	MATERIAL	AMOUNT
1		MBR_ADD:1	COCOA	Deferred
2		RECIRC:1	50.00	
3		TEMP_CTL:1	25.00	5.00
4		RECIRC:2	30.00	
5		MBR_ADD:2	HAZELNUT	Deferred
6		RECIRC:3	20.00	
7		MBR_DUMP:1	IC_CHOCOLATE_HAZ	-5000.00

7. From the **View** menu, select **SFC**.
8. Save the operation.

Creating a unit procedure

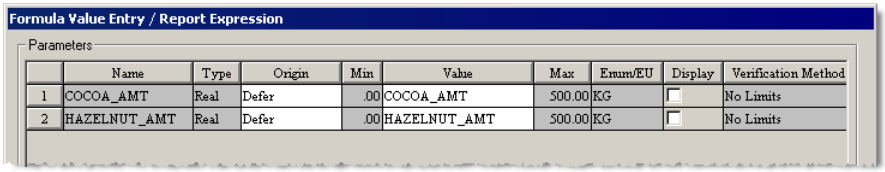
The next step to creating the chocolate hazelnut recipe is to create a unit procedure, which is going to have only one operation.

1. From the **File** menu, select **New Top Level**. The **New** dialog box opens.
2. Select **Unit Procedure**, and then click **OK**. The **Unit Requirement** dialog box opens.
3. Select **Class Based**, select **MBR_FREEZER_CLS**, and then click **OK**. The initial and final steps of the new unit procedure display in the SFC View.
4. Select the initial step, and then click the **Add Step** button. The **Operation Select** dialog box opens.
5. Select **MCLS_CHOCOLATE_HAZELNUT_OP**, and then click **OK**.
6. From the **Recipe** menu, select **Recipe Parameters/Reports**. The **Procedure Properties** dialog box opens. Enter recipe formula parameters as indicated in this figure.



	Name	Type	Min	Default	Max	Enum/EU	Scalable	ERP Alias
	COCOA_AMT	Real	.00	.00	500.00	KG	☒	
	HAZELNUT_AMT	Real	.00	.00	500.00	KG	☒	

7. Select **MCLS_CHOCOLATE_HAZELNUT_OP**, click the **Formula Values** button, and then enter formula values as shown in this figure.



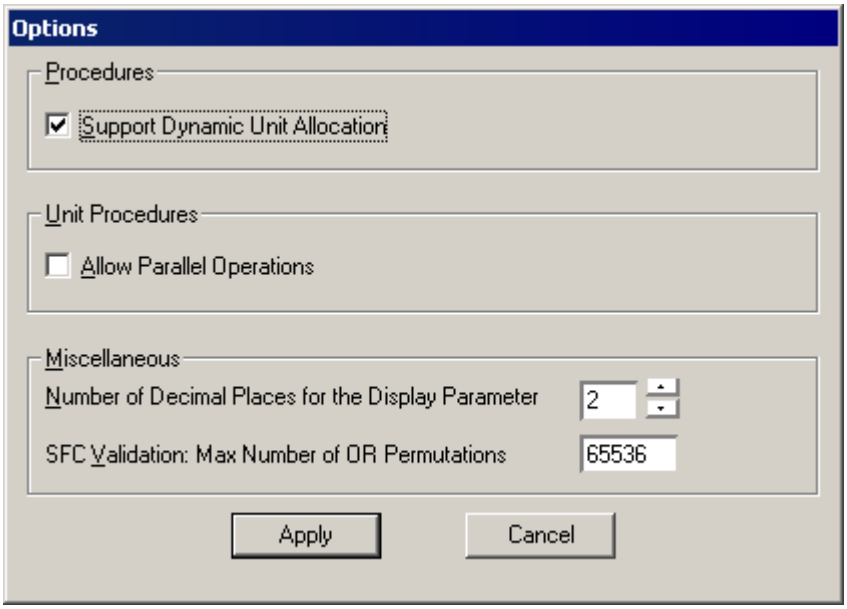
	Name	Type	Origin	Min	Value	Max	Enum/EU	Display	Verification Method
1	COCOA_AMT	Real	Defer	.00	COCOA_AMT	500.00	KG	☐	No Limits
2	HAZELNUT_AMT	Real	Defer	.00	HAZELNUT_AMT	500.00	KG	☐	No Limits

8. From the **Recipe** menu, select **Header Data**, and then enter the following:
   - Procedure Identifier: **MCLS_CHOCOLATE_HAZELNUT_UP**
   - Author: **Your Name**
   - Product Name: **CHP-100**
   - Batch Size Default: **5000**
   - Batch Size Max: **10000**
   - Units of Measure: **KG**
   - Estimated Duration: **55**
   - Procedure Description: **Chocolate Hazelnut Premium Ice Cream**
9. Click **OK**, and then click **Proceed**. If prompted, enter auditing comments, if desired, and click **OK**.
10. Save the unit procedure. If prompted, enter auditing comments, if desired, and click **OK**.

Enabling dynamic unit allocation

To support the flexibility of the two units within NORTH_PARLOR process cell, you want to enable dynamic unit allocation, which will provide more binding options.

1. From the **View** menu, select **Options**. The **Options** dialog box opens.

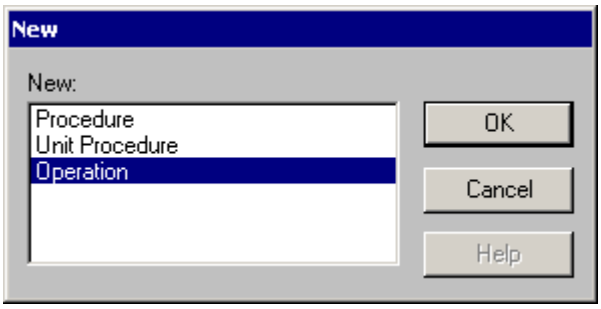


2. If necessary, enable **Support Dynamic Unit Allocation**, and then click **Apply**.
3. Save the unit procedure. If prompted, enter auditing comments, if desired, and click **OK**.

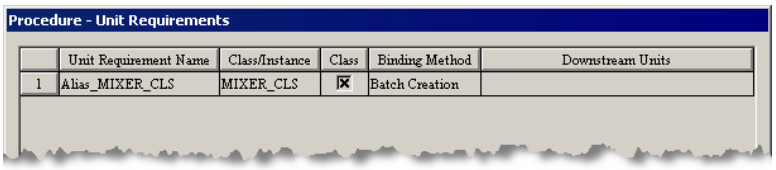
Create a procedure

The last step in building your recipe is to create a procedure. Because **Dynamic Unit Allocation** is enabled, you must define the equipment requirements and binding method before you can build the recipe procedure.

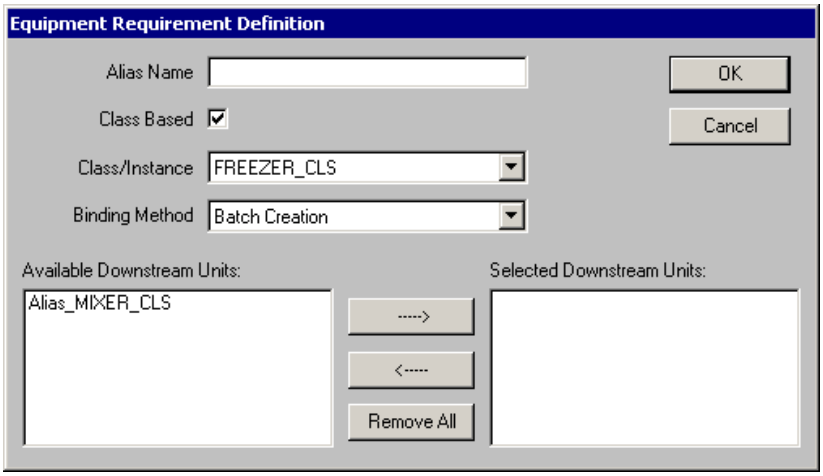
1. Select **File > New Top Level**. The **New** dialog box opens.



2. Select **Procedure**, and then click **OK**. The **Procedure - Unit Requirements** dialog box opens.



3. Click the **Add Unit Requirement** button. The **Add Unit Requirement** dialog box opens.

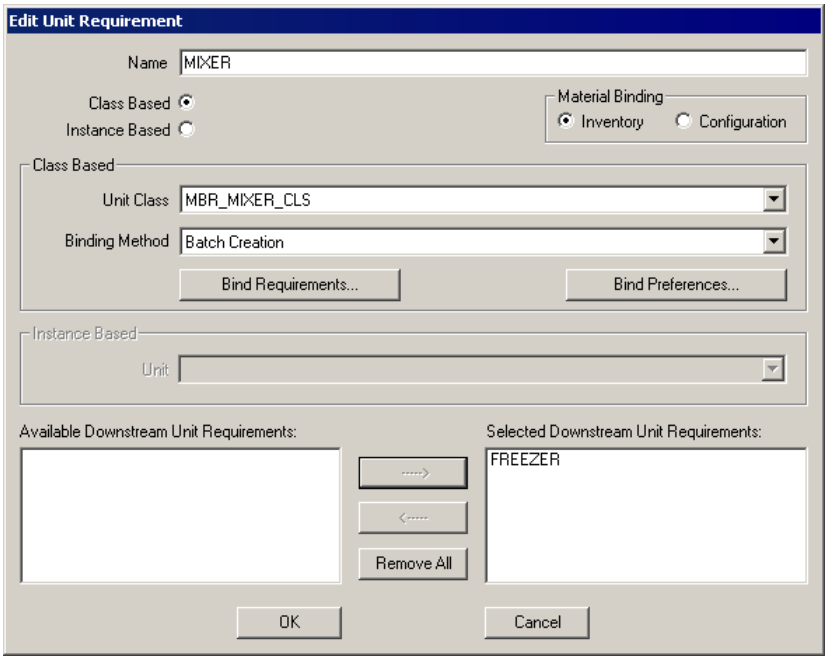


4. In the **Name** box, type **FREEZER**.

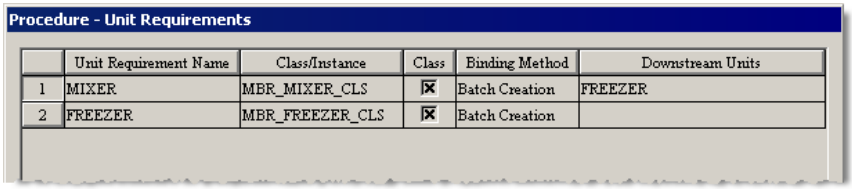
   The unit requirement Name is a label and acts like a lookup table for the FactoryTalk Batch Server. When a recipe is put on the Batch List and the FactoryTalk Batch Server encounters the unit requirement name, the Server looks up all the unit classes or instances that are mapped to the unit requirement name.
   North_Parlor has two units that can make chocolate hazelnut ice cream. In the area model, there are two unit instances (NP_MIXER_1 and NP_MIXER_2) based on the MBR_MIXER_CLS unit class and two unit instances (NP_FREEZER_1 and NP_FREEZER2) based on the MBR_FREEZER_CLS unit class. You want the operator to select which mixer and freezer to use when the batch is created. To achieve this, you need to create a unit requirement name (MIXER) that is configured to the MBR_MIXER_CLS unit class and a unit requirement name (FREEZER) that is configured to the MBR_FREEZER_CLS unit class. You also want to select the batch creation binding method.

5. If the Class Based section is not enabled, select the **Class Based** option.
6. From the **Class Based** area, select **MBR_FREEZER_CLS** from the Unit Class list, and then click **OK**.
7. Select **Alias_MIXER_CLS** from the **Procedure - Unit Requirements** dialog box, and then click the **Edit Unit Requirement** button.
8. In the **Name** box, type **MIXER**.
9. From the **Class Based** list, select **MBR_MIXER_CLS**.

10. In the **Available Downstream Units** box, select **FREEZER**, and then click the right-arrow button.



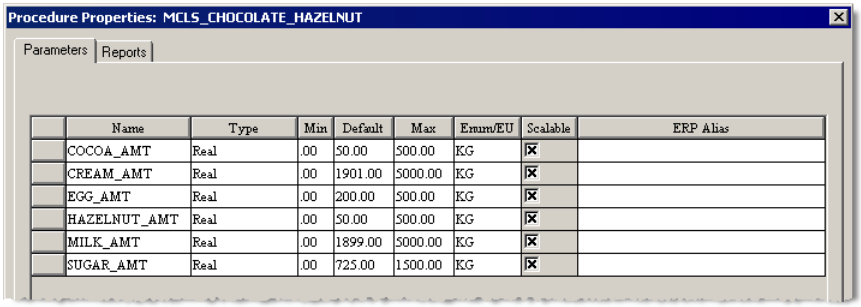
11. Click **OK**.



When the recipe is put on the Batch List, the FactoryTalk Batch Server encounters the MIXER unit requirement name, which specifies the equipment required for the recipe, looks for all unit instances of the unit class with the MIXER unit requirement name, and then prompts the operator to select either NP_MIXER_1 or NP_MIXER_2. The same process occurs for the FREEZER unit requirement name.

12. Click **Close**.
13. From the **Recipe** menu, select **Header Data**, and then enter the following:
    - Procedure Identifier: **MCLS_CHOCOLATE_HAZELNUT**
    - Author: **Your Name**
    - Product Name: **Chocolate Hazelnut Premium**
    - Product Code: **CHP-100**
    - Batch Size Min: **3000**
    - Batch Size Default: **5000**
    - Batch Size Max: **7000**
    - Units of Measure: **KG**
    - Estimated Duration: **55**
    - Procedure Description: **Chocolate Hazelnut Premium - class based/material based**

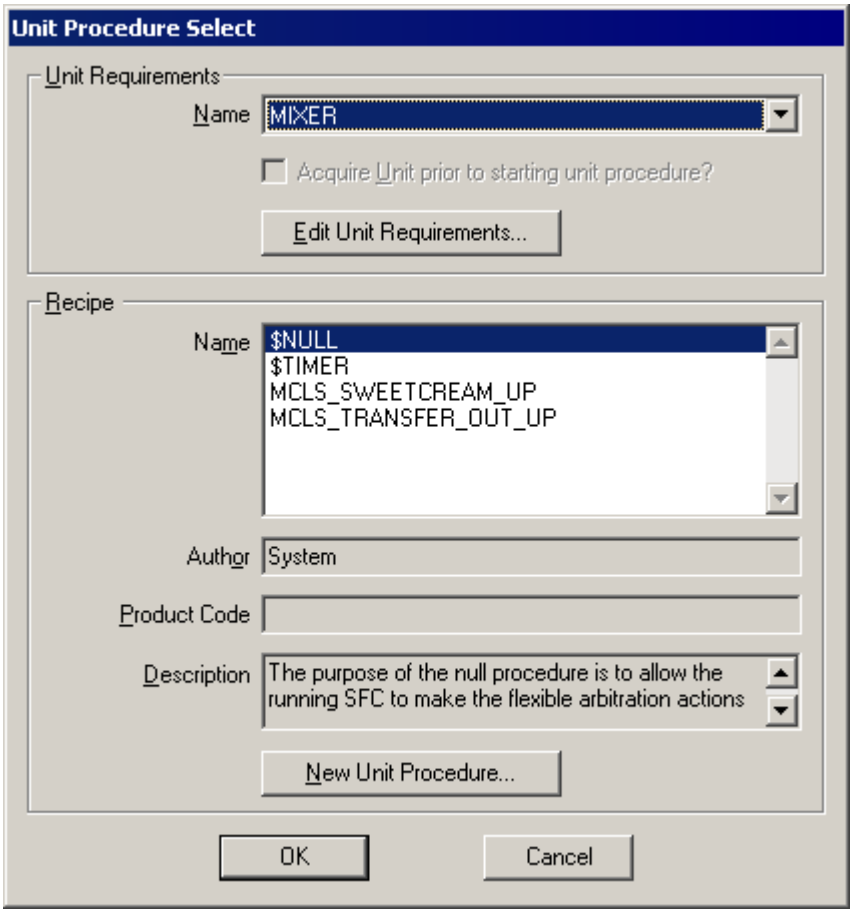
14. Enable **Released to Production** so this recipe displays when adding a batch to the batch list in the FactoryTalk Batch View.
15. Click **OK**.
16. Enter recipe formula parameters as indicated in this figure.



	Name	Type	Min	Default	Max	Enum/EU	Scalable	ERP Alias
	COCOA_AMT	Real	.00	50.00	500.00	KG	☒	
	CREAM_AMT	Real	.00	1901.00	5000.00	KG	☒	
	EGG_AMT	Real	.00	200.00	500.00	KG	☒	
	HAZELNUT_AMT	Real	.00	50.00	500.00	KG	☒	
	MILK_AMT	Real	.00	1899.00	5000.00	KG	☒	
	SUGAR_AMT	Real	.00	725.00	1500.00	KG	☒	

These default values are presented to the operator during batch creation. Since the formula values are deferred, the operator can change the default values.

17. Select the initial step, and then click the **Add Step** button. The **Unit Procedure Select** dialog box opens.



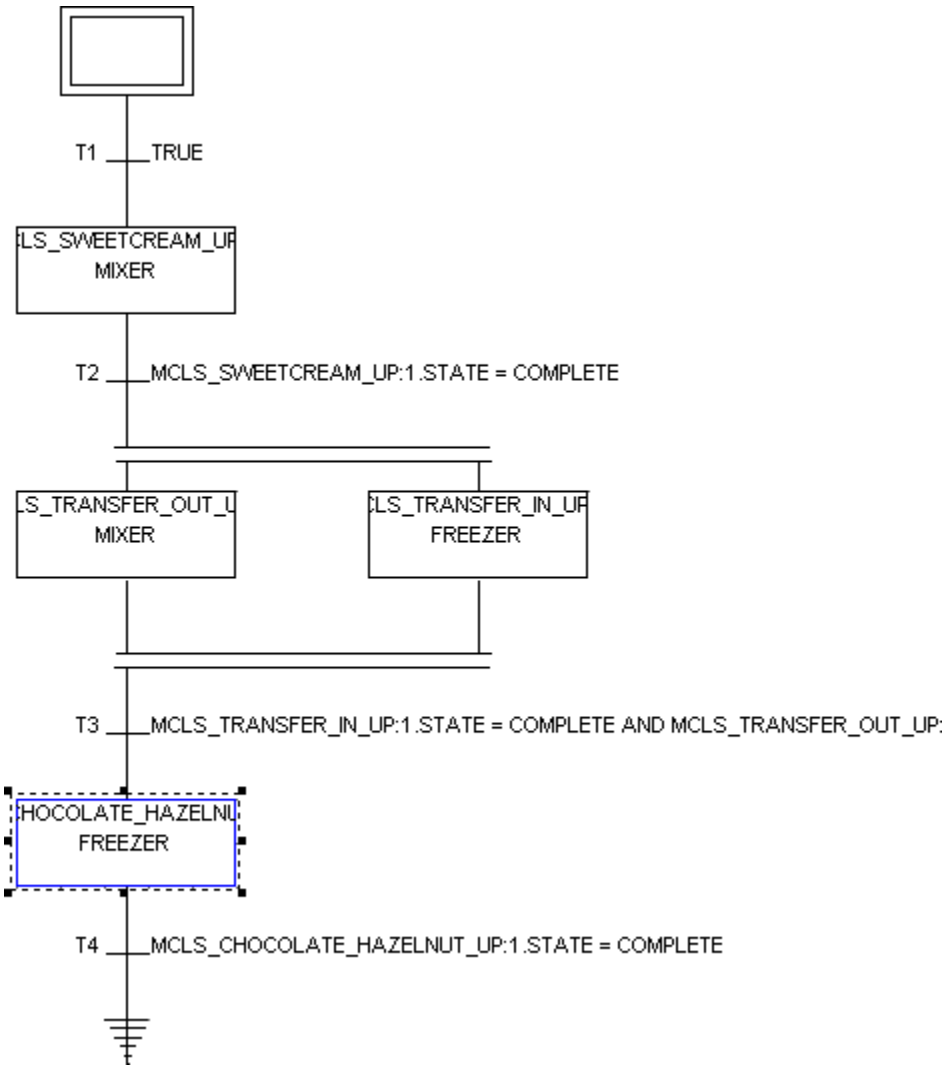
18. From the **Unit Requirements Name** list, select **MIXER**.
19. From the **Recipe Name** list, select **MCLS_SWEETCREAM_UP**, and then click **OK**.
20. Add MCLS_TRANSFER_OUT_UP in the same manner.

So far you have placed the ingredients into the mixer to produce the sweet cream base for the ice cream and added the step to transfer the

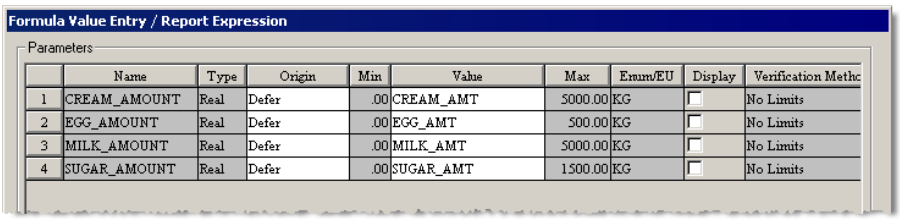
mixture out of the mixer. Next, add the step to transfer the sweetcream base into the freezer.

21. Click the **Add Parallel** button. The **Unit Procedure Select** dialog box opens.
22. From the **Unit Requirements Name** list, select **FREEZER**.
23. From the **Recipe Name** list, select **MCLS_TRANSFER_IN_UP**, and then click **OK**.
24. Select the final transition, click the **Add Step** button, and then add MCLS_CHOCOLATE_HAZELNUT_UP with FREEZER as the equipment requirement.

    Your recipe should be similar to the following figure.



25. Select **MCLS_SWEETCREAM_UP:1**, click the **Formula Values** button, add formula values as shown in this figure, and then click **OK**.

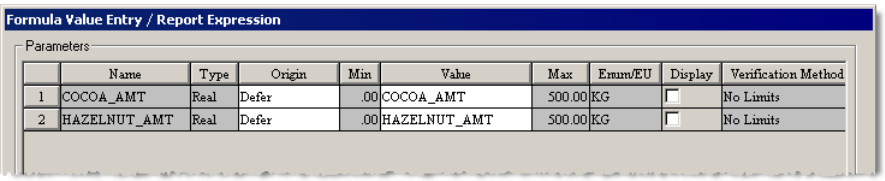


Formula Value Entry / Report Expression

Parameters

	Name	Type	Origin	Min	Value	Max	Enum/EU	Display	Verification Metho
1	CREAM_AMOUNT	Real	Defer	.00	CREAM_AMT	5000.00	KG	☐	No Limits
2	EGG_AMOUNT	Real	Defer	.00	EGG_AMT	500.00	KG	☐	No Limits
3	MILK_AMOUNT	Real	Defer	.00	MILK_AMT	5000.00	KG	☐	No Limits
4	SUGAR_AMOUNT	Real	Defer	.00	SUGAR_AMT	1500.00	KG	☐	No Limits

26. Select **MCLS_CHOCOLATE_HAZELNUT_UP:1**, click the **Formula Values** button, and then add formula values as shown in this diagram.



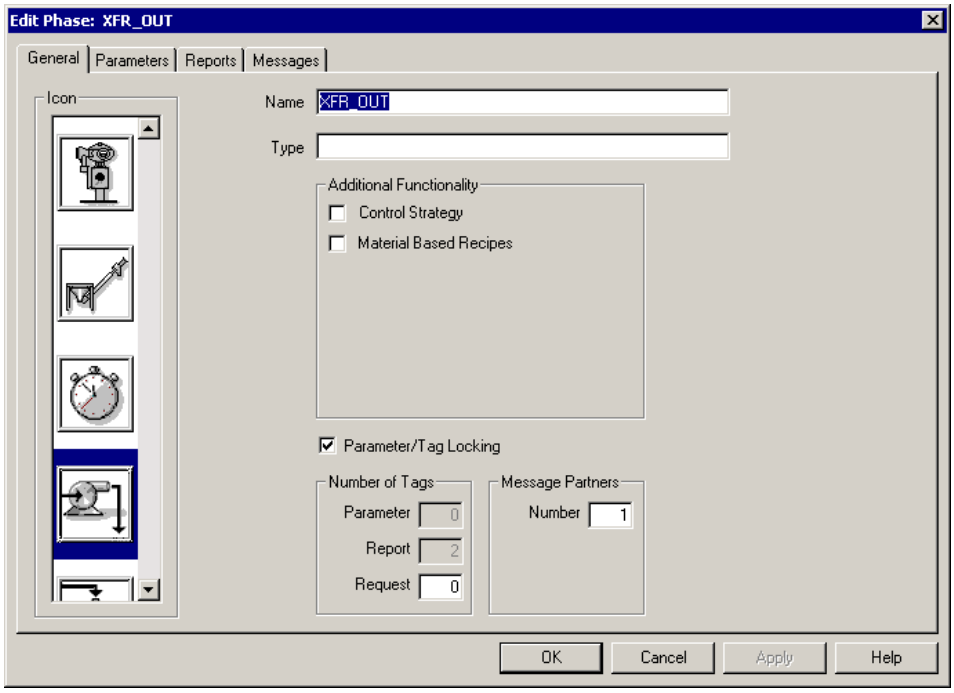
	Name	Type	Origin	Min	Value	Max	Enum/EU	Display	Verification Method
1	COCOA_AMT	Real	Defer	.00	COCOA_AMT	500.00	KG	☐	No Limits
2	HAZELNUT_AMT	Real	Defer	.00	HAZELNUT_AMT	500.00	KG	☐	No Limits

The origin of the formula values is deferred so the parameters display when a batch is added to the batch list to give the operator a chance to enter the values.

27. Save the procedure. If prompted, enter auditing comments, if desired, and click **OK**.

Linking phase groups

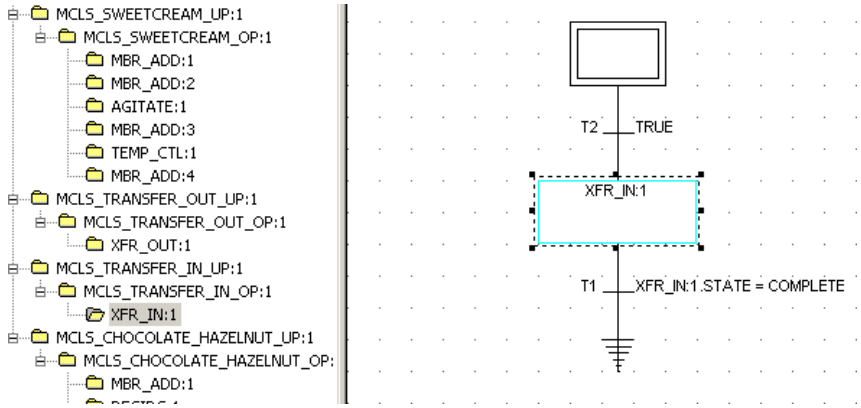
Use phase link groups to identify phases that communicate and work together, such as the XFR_OUT and XFR_IN phases that transfer the sweetcream mixture from the mixer to the freezer. In the Equipment Editor, both the XFR_OUT and XFR_IN phases are configured with one message partner, which indicates that these phases must communicate with one other phase to work properly.



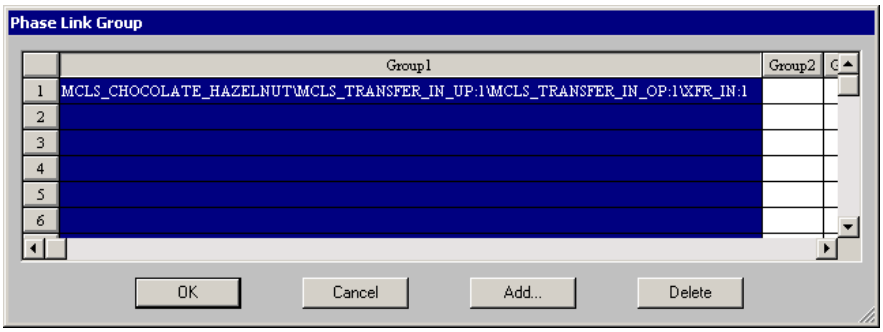
Equipment Editor: Phase Message Partners

In the Recipe Editor, you must create a phase link group at the procedure level to complete the association.

1. Select **XFR_IN:1** in either the Procedure Hierarchy or the SFC view.



2. From the **Link** menu, select **Link Groups**. The **Phase Link Group** dialog box opens.
3. Click the Group 1 column heading to select the Group 1 column, and then click the **Add** button.



4. Click **OK**.
5. Click **XFR_OUT:1**.
6. From the **Link** menu, select **Link Groups**. The **Phase Link Group** dialog box opens.
7. Select the Group 1 column, click the **Add** button, and then click **OK**.

Verifying the recipe

Once you have added all the material-enabled phases to the recipe, verify the recipe before the recipe is ready to run.

1. From the **File** menu, select **Verify All Recipes**.

   If you are prompted to save, click **Yes**.
2. When the verification is complete, click **Accept**, and then click **Close**. If prompted, enter auditing comments, if desired, and click **OK**.
3. Exit the FactoryTalk Batch Recipe Editor.

Summary

In this chapter, you:

- Created a material-based operation
- Created recipe formula parameters
- Assigned formula values
- Created a unit procedure
- Linked phase groups

This chapter provided a brief overview of the capabilities of the Recipe Editor when used with Material Manager. (See the *FactoryTalk Batch Recipe Editor User Guide* for more information on creating material-based recipes, unit binding, and linking phase groups.)

Running material-based recipes

Running a material-based control recipe offers more flexibility in the binding process and the capability to track inventory. The FactoryTalk Batch Server and FactoryTalk Batch Material Server work together to pull the necessary information from the material database so either FactoryTalk Batch or the operator can select the appropriate containers to supply materials to the recipe.

In this chapter, you run a material-based recipe using the FactoryTalk Batch Phase Simulator. The Phase Simulator supplies the ACTUAL_AMOUNT and FEED_COMPLETE parameters to enable the batch to run. This data normally is supplied by the phase logic in the process-connected device (PCD).

Run in simulation mode

Running a recipe in simulation mode is a good way to test the recipe. In this section, you use the *.sim* file for the *ice_cream2.cfg* file, which is already configured to run the Chocolate Hazelnut recipe.

1. Select **Start > Rockwell Software > Simulator**.

   IMPORTANT Administrator privileges are required to perform this procedure.

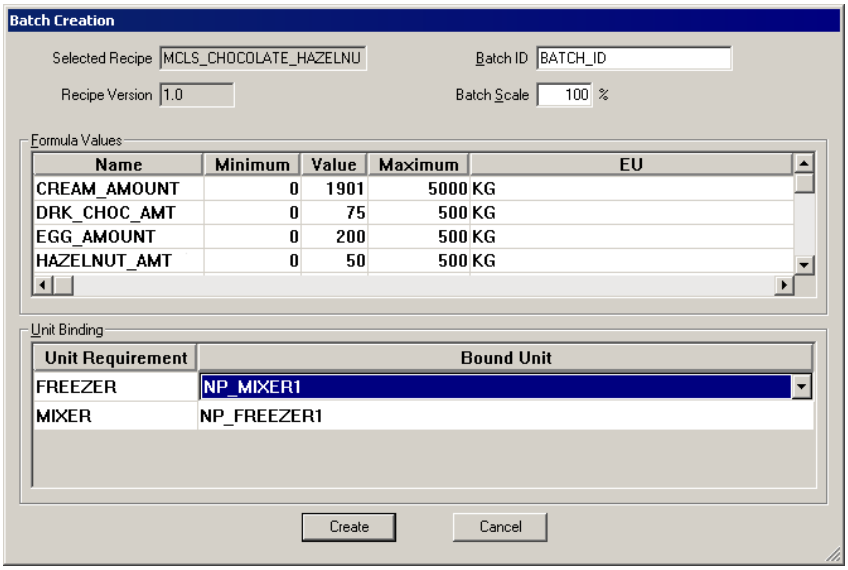
2. Select **File > Open**. The **Open Simulator Configuration File** dialog box opens.
3. From the **Look in** list, open the *c:\Program Files\RockwellSoftware\Batch\SampleDemo2\ Recipes* folder. Select the *ice_cream2.sim* file, and then click **Open**.
4. Minimize the **Phase Simulator** window.

Running a material-based recipe

1. Select **Start > Rockwell Software > View**.

   IMPORTANT Administrator privileges are required to perform this procedure.

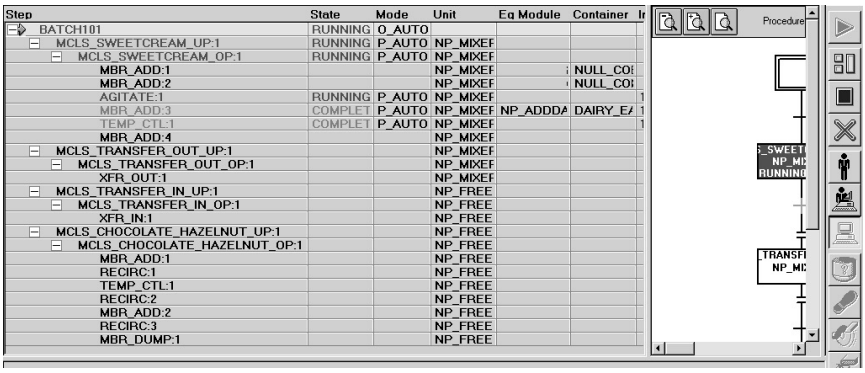
2. Click the **Add Batch** button, select **MCLS_CHOCOLATE_HAZELNUT**, and then click **OK**. The **Batch Creation** dialog box opens.



The deferred the formula parameters display in the **Batch Creation** dialog box with the default settings. You can change the values if you need to adjust the recipe.

In the Unit Binding area, the two alias names you defined are displayed. You can select which units to bind to the recipe. Because there is enough material in all the containers you are presented with both units.

3. In Unit Binding area, select **NP_MIXER1** and **NP_FREEZER1** if not already selected.
4. In the **Batch ID** box, type **BATCH101**, and then click the **Create** button.
5. Select the batch, click the **Start Batch** button, and then click **Yes** to start the batch.
6. Click the **Procedure as SFC** button. Adjust the panes, if necessary so you can see the Container column to watch as the FactoryTalk Batch Server binds to containers.



7. When the recipe reaches MBR_ADD:2 under MCLS_CHOCOLATE_HAZELNUT_OP:1 notice that the batch binds to NUT_BIN3 and the priority of 10 shows in the Index column. After the phase is complete, the Container setting changes to NULL_CONTAINER.

8. Let the batch run to completion.

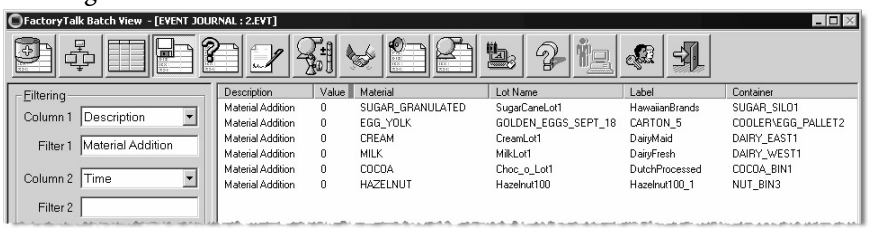
Checking inventory levels

When a batch is complete, the FactoryTalk Batch Server sends the inventory consumed or distributed to the Material Server where it is then added to the material database. You can view the inventory levels in the Material Editor. If the Material Server goes down and you are forced to run a material-based recipe without it, you must update the inventory in the material database manually.

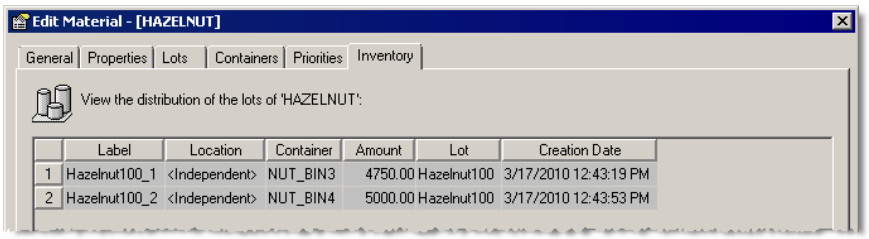
In this exercise you view the inventory consumed during a batch and then verify that consumption in the Material Editor.

1. When the batch is complete, click the **Event Journal** button, and then click the **Journal** button. The **Event Data Files** dialog box opens.
2. Select **BATCH101**, and then click **OK**.
3. In the **Column 1** box, select **Description**, type **Material Addition** in the **Filter 1** box, and then click **Refresh**.

   You have to collapse a few columns to get this display, otherwise you can scroll left and right to see which containers were selected for binding for each material and how much was consumed.



4. Start the Material Editor, expand the **Materials** folder, double-click **Hazelnut**, and then select the **Inventory** tab. The Material Editor shows that 250 KG was consumed out of NUT_BIN3.



   To update the inventory levels manually, select the lot, and then click the **Edit Distribution** button. The **View Lot Distribution** dialog box opens. Change the inventory level in the **Quantity** box, and then click **OK**.

Using manual phase control

Use FactoryTalk Batch View to command a material-based phase using manual phase control in **Equipment**.

WARNING: If communication with the Material Server fails while in Equipment, and the material policy option is configured for Switch to Manual, all containers associated with the phase display. The list is not filtered by the selected material. Use extreme caution when operating without the Material Server. Failure to select the correct container or phase pair could result in a hazardous situation, depending on the material.

To command a material-based phase using manual control

1. Select **Equipment**.
2. Select the material-enabled phase to acquire and select **Acquire** .
3. If prompted, confirm the command.

   Tip: The manual phase control session requests ownership of the phase (and OPERATOR will appear in the phase's Needed By list). The phase must be released by the control recipe, and then the operator acquires the phase.

4. Select **Start** .
5. If prompted, confirm the command.
6. If the phase is configured as both a material distribution and addition, from the **Feed Type** list, select the type for the phase.

   Tip: If the phase is not configured as both a material distribution and addition, the configured **Feed Type** for the material phase cannot change.

7. Select a material to use from the **Material** list, and select **Continue**.
8. Enter a unique batch ID.
9. (optional) If a phase has a control strategy, select the strategy from the **Control Strategy** box.
10. Select a container, and select **OK**. The batch state displays *DOWNLOADING*.

    Tip: If the phase has automatic uploads and downloads, **Prompts** shows the prompt(s) to acknowledge.

11. If prompts generate for the phase, select **Prompts**.

    Tip: If prompts are present, an **x Prompts** link displays in the left sidebar navigation. Selecting the **Prompts** link goes to the **Prompts** list, displaying only the prompts for that phase.

12. In **Prompts**, select the prompt, enter the appropriate value, and select **Acknowledge** .
13. Once the phase completes, select the phase, and then select **Reset** .
14. With the phase still selected, select **Release** .

Material Phase Binding

Material phase binding is the process of either:

- Binding unbound material-enabled phase steps to a material phase and associated container
- Rebinding a previously bound material-enabled phase step within a control recipe

When configuring an operation recipe's step that references a material phase class, the operator can select one of the three types of binding:

- **A specific material phase and container**. The operator chooses a specific phase and container pair from the list.
- **Automatic**: The FactoryTalk Batch Server selects the equipment phase associated to the highest-priority container.
- **Prompt**. The operator must select a phase/container while the recipe is running.

To perform material binding, these criteria must be true:

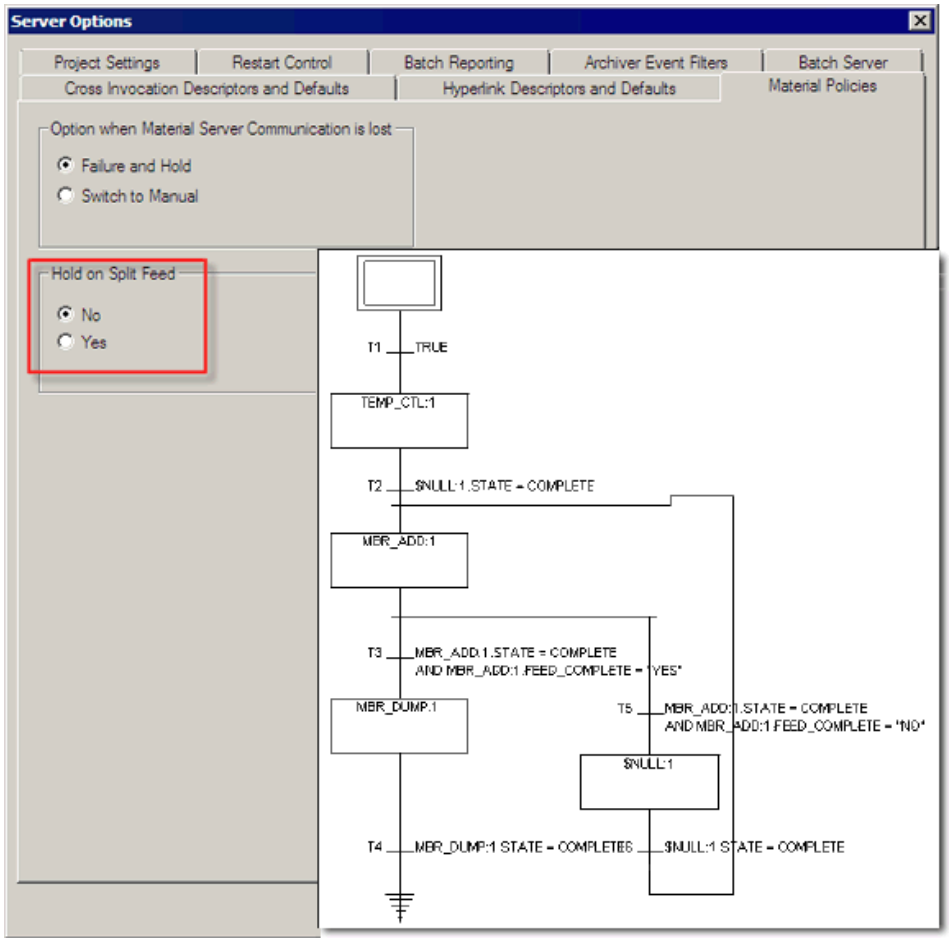
- The step is associated with a material-enabled phase class in the recipe.
- The step is inactive or has a status of BINDING.

Handling split feeds

Split feeds occur when a material phase step does not add or distribute all of the material configured by the step. By default, the batch is HELD and the Material Server calculates and sends new AMOUNT parameters to the FactoryTalk Batch Server. To resume processing, the operator must perform an active step change away from the unfinished step, manually rebind the unfinished step, perform an active step change back, and then restart the batch.

If you want the batch to automatically process a split feed, change **Hold on Split Feed** on the **Material Policies** tab in the **Server Options** dialog box (in the Equipment Editor) to **No** and create a loop in the recipe so that the binding process can select another container for material additions. You can easily add a material loop to your recipe with the **Create Material Loop** button in the FactoryTalk Batch Recipe Editor.

For material distributions, the Material Server does not attempt to decide whether or not a container might be full. To use the same recipe loop, you need an independent application to update the container selection priority so that a full container is not selected again.



Running material-based recipes (Summary)

In this chapter, you:

- Ran a material-based recipe
- Checked inventory levels
- Used manual phase control
- Bound a phase manually

(See Binding material-based recipes on page 87 in this guide, or the *FactoryTalk Batch View User Guide* for more information on running material-based recipes.)

Using custom code insertion points

Insertion points are function calls that a product makes into a customizable function library. FactoryTalk Batch Material Manager uses insertion points to support customization by making the standard processing call code, which users can change.

When would I customize an insertion point?

For material tracking, insertion points are provided in three general areas of processing performed by the Material Server:

- Combining sublots inside a composite container
- Updating inventory quantities
- Initializing lots as they are created

Combining sublots inside a composite container can require customization. Without customization, sublots added into a composite container already holding a sublot of a different lot will become part of that other lot. Often it is more appropriate for a new lot to be created. If this is the case, how should a new lot name be selected? This question can be applied to the label of the sublots as well as the attributes of the sublots. The correct processing can be dependent on many factors that are specific to a plant or process.

Updating inventory quantities can require customization. As sublots are produced and consumed, customers can find it useful to trigger other applications to perform processing. Insertion points provide a place for users to create points of integration between applications. For example, insertion points added around inventory quantity updates are used by one application to help manage container selection priorities for binding. When a sublot within a container is changed, the container selection priorities get recalculated.

Initializing lots as they are created can require customization. Creation of a new lot can involve standard operating procedures that are specific to one site. Insertion points allow for custom initialization of lot attributes and the calculation of a lot state.

What library can be customized?

The *RAMSCustom.dll* is the compiled version of the insertion point DLL for the Material Server and is where custom rules are defined. *RAMSCustom.dll* is required for operation of the Material Server, resides in the *Batch\bin* directory, and is registered during the installation of Material Manager.

A Visual Basic project is provided on the FactoryTalk Batch Material Manager installation CD, in a folder called *Custom*, so you can create a custom version of the *RAMSCustom.dll*.

Creating a custom ramscustom.dll

1. Copy the entire *Custom* folder, including all subdirectories, to the local hard drive, leaving the structure intact.

   The following files are contained in the *Custom* folder:

   - *Ramscustom.vbp*
     The Visual Basic project file.
   - *Ramaterialservercustom.cls*
     The Visual Basic class module that implements the custom interface. Located in the *Custom\Classes* folder.

2. Open *Ramaterialservercustom.cls* using a text Editor such as Notepad.
3. Modify the code as needed. (See Material manager insertion points on page 77).
4. Save the file and then exit the text editor.
5. Double-click *RAMSCustom.vbp*. The Visual Basic project opens. If you see message boxes, click **Yes** through all until you see the message that Visual Basis is unable to set the version compatible component. Click **OK**.
6. From the **Project** menu, select **References**. The **References** dialog box opens.
7. There are several files that are required for references used in the Visual Basic project. These references must be set manually within the Visual Basic IDE.
8. From the **Available References** list, select the following references:

   - **COM+ Services Type Library**
     The COM+ Runtime library supports the *COMSVCS.dll*, that is needed for COM+ functionality. If this file is not on your system use *MTXAS.dll.*
   - **Microsoft ActiveX Data Objects 2.0 Library**
     The Microsoft Active Data Objects support the DLL, *MSADO20.tlb*, that is used for any database functionality implemented in the insertion DLL.
   - **OLE Automation**
     OLE Automation supports the DLL, *STDOLE32.tlb*, which is usually a standard Visual Basic reference.

9. Click **OK**.
10. From the **Project** menu, select **RAMSCustom Properties**. The **Project Properties** dialog box opens.
11. Select the **Component** tab, and then select **Binary Compatibility**.

    IMPORTANT Not selecting **Binary Compatibility** in this step could break compatibility and cause issues with creating custom code. If this option is not selected, you may need to recover and update *ramscustom.dll* and/or uninstall and reinstall
    FactoryTalk Batch Material Manager.

12. Click the browse button, locate *Program Files/Rockwell Software/Batch/bin/RAMSCustom.dll*, and then click **Open**.
13. Click **OK**.
14. From the **File** menu, select **Make RAMSCustom.dll**. The **Make Project**

dialog box opens.

15. Click **OK**. A message box displays a compile error stating the user-defined type is not defined. For the project to compile successfully, you need to select one other reference that was not available previously when you selected references.
16. Click **OK**, and then close the project window.
17. From the **Project** menu, select **References**. The **References** dialog box opens.
18. From the **References** list, select **materialserverinsertion 1.0 Type Library**, and then click **OK**. Your project should now compile successfully.
19. From the **File** menu, select **Make RAMSCustom.dll**. The **Make Project** dialog box opens.
20. Click **OK**.

Material manager insertion points

The following sections present the customizable FactoryTalk Batch Material Manager insertion points. Each section explains why you might want to customize that routine. Information on how and when the routine is used by the Material Server is included.

- OnGenerateCustomLotName on page 77
- OnGenerateCustomLabelName on page 78
- AfterSubLotInsert on page 79
- AfterSubLotDelete on page 80
- AfterLotInsert on page 81
- AfterCombinedLotInsert on page 81

OnGenerateCustomLotName

Problem to be solved

Composite containers can hold only one sublot at a time. If the composite container holds a sublot of LOT_A and a sublot of LOT_B is added to the container, the sublots are assumed to be mixed together and become a single sublot. What lot should the mixture belong to?

This insertion point allows you to define the lot to which a sublot formed by combining sublots of different lots will belong. This can be an existing lot or a new lot.

Specifics about this routine

This insertion point is only called when sublots of different lots are being combined by a composite container. These are the parameters for this function:

Param Name	Data Type	Direction	Description
DistributionAmount	Double	In	Amount of the distribution
MaterialName	String	In	Name of Material
DistributionLotName	String	In	Lot name given to the distribution

Param Name	Data Type	Direction	Description
AreaName	String	In	Area Name
StepName	String	In	Step Name
ProcessCell*	String	In	Process Cell
UnitName*	String	In	Unit Name
BatchID	String	In	Batch ID
EqModule	String	In	Equipment Module
RecipePath	String	In	Recipe Path
ContainerName	String	In	Container name of the distribution
ExistingLotName	String	In	Lot name that exists in the Container
CustomLotName	String	Out	Returned value from the event This value represents what the custom Lot name will be based on in the insertion code.

Related insertion points

Other insertion points that could work with this function include:

- OnGenerateCustomLabelName
- AfterSublotDelete
- AfterSublotInsert
- AfterCombinedLotInsert

OnGenerateCustomLabelName

Problem to be Solved

Composite containers can hold only one sublot at a time. If the composite container holds a sublot with the label "LABEL_1" and a sublot with the label "LABEL_2" is added to the container, the sublots are assumed to be mixed together and become a single sublot. What label should the mixture be assigned?

This insertion point allows the customer to define the label to be assigned to a sublot when two sublots with different labels are combined by a composite container.

Specifics About this Routine

This insertion point is only called when sublots with different labels are being combined by a composite container. These are the parameters to this function:

Param Name	Data Type	Direction	Description
DistributionAmount	Double	In	Amount of the distribution
MaterialName	String	In	Material Name

Param Name	Data Type	Direction	Description
DistributionLabelName	String	In	Label name given to the distribution sublot
AreaName	String	In	Area Name
StepName	String	In	Step Name
ProcessCell*	String	In	Process Cell Name
UnitName*	String	In	Unit Name
BatchID	String	In	Batch ID
EqModule	String	In	Equipment Module
RecipePath	String	In	Recipe Path Name
ContainerName	String	In	Container name of the distribution
ExistingLabelName	String	In	Label name that exists in the Container
CustomLabelName	String	Out	Returned value from the event This value represents what the custom Label name will be based on the business rules in the insertion code.

Related insertion points

Other insertion points that could work with this function include:

- OnGenerateCustomLotName
- AfterSublotDelete
- AfterSublotInsert

AfterSubLotInsert

Problem to be solved

How can an external application be notified that a new sublot has been created?

This insertion point is a signal that a new sublot has been created and has been inserted into the database. Customers can code any notifications they need to their own applications within this insertion point.

For example, an application that could use this insertion point is a service that monitors inventory levels and characteristics and adjusts container selection priorities. A new sublot added to a container is a trigger to reevaluate the current priorities.

Specifics about this routine

This insertion interface is called after the insertion of a new sublot into the database. These are the parameters to this function:

Param Name	Data Type	Description
Area	String	Area Name

Param Name	Data Type	Description
ProcessCell	String	Process Cell Name
Unit	String	Unit Name
MaterialID	Long	Material ID of the Material this SubLot is derived from
ContainerID	Long	Container ID of the Container this SubLot is stored in
SubLotID	Long	Pkid of the SubLot record in the database This is provided so the customer can retrieve the record by ID for further processing.

The values Area, ProcessCell, and Unit will not be attainable in every instance from which these insertion calls are made. If these values are not available, a wildcard value (represented by **%ALL%**) is substituted for any solid value.

Related insertion points

Other insertion points that could work with this function include:

- AfterSublotDelete

AfterSubLotDelete

Problem to be solved

How can an external application be notified that a new sublot has been deleted?

This insertion point is a signal that a sublot has been deleted from the database. For example, an application that could use this insertion point is a service that monitors inventory levels and characteristics and adjusts container selection priorities. A sublot being deleted from a container is a trigger to reevaluate the current priorities.

Specifics about this routine

This insertion interface is called after the deletion of a sublot from the database. These are the parameters to this function:

Param Name	Data Type	Description
Area	String	Area Name
ProcessCell	String	Process Cell Name
Unit	String	Unit Name
MaterialID	Long	Material ID of the Material this SubLot is derived from
ContainerID	Long	Container ID of the Container this SubLot is stored in
SubLotID	Long	Pkid of the SubLot record in the database

The values Area, ProcessCell, and Unit will not be attainable in every instance from which these insertion calls are made. If these values are not available, a wildcard value, represented by **%ALL%**, is substituted for any solid value.

Related insertion points

Other insertion points that could work with this function include:

- AfterSublotInsert

AfterLotInsert

Problem to be solved

This insertion point provides a way for the customer to initialize properties and attributes of a new lot. For example, the assignment of an initial lot state could involve a calculation of several variables. This insertion point provides a place to do this calculation to assign the correct lot state.

Specifics about this routine

This insertion interface is called after a new lot is created in the database, with the exception of a new lot created as the result of combining sublots of different lots in a composite container. These are the parameters to this function:

Param Name	Data Type	Description
LotName	String	Lot Name
CreationDate	Date	Creation Date of the Lot
MaterialID	Long	Material ID for the Material this Lot is derived
LotID	Long	Pkid of the Lot record in the database

This event is not fired for the insertion of a lot when a lot combination event occurs. In that event the **AfterCombinedLotInsert** event is fired. This event is only called when a plain generic insertion of Lot is performed.

Related insertion points

Other insertion points that could work with this function include:

- AfterCombinedLotInsert

AfterCombinedLotInsert

Problem to be solved

A composite container can only hold one sublot at a time. When two different sublots of two different lots are combined within this type of container the OnGenerateCustomLotName on page 77 insertion point is called. Assume that a new lot name is returned. The Material Server will create a new lot, but how should the lot attributes and custom properties be initialized?

A different insertion point is provided for initializing this new lot to provide an initialization routine that has access to the data of the two lots being combined.

Specifics about this routine

This insertion point is called when sublots of different lots are combined within a composite container and the name of the lot for the new sublot does not exist within the database.

These are the parameters for this function:

Param Name	Data Type	Description
DistributedLotName	String	Lot Name specified for the distribution
ExistingLotName	String	Lot Name of existing Lot in the Composite Container
CombinedLotName	String	Custom Lot Name derived from the OnGenerateCustomLotName insertion call
LotMaterialName	String	Material Name that the Lot is derived from
LotMaterialID	Long	Material ID for the Material This is provided so the insertion code author has the fully qualified key to retrieve the Lot information (LotName + MaterialID).

This event is fired only during the execution of the **DistributeSubLot** and **MaterialDistributionComplete** methods. These are the only two places within the Material Server that a combination of Lot and/or Label can occur.

Related insertion points

Other insertion points that could work with this function include:

- OnGenerateCustomLotName
- AfterLotInsert

Developing an implementation plan

Planning is crucial to the success of the FactoryTalk Batch Material Manager implementation. This section provides an overview of the subjects that can be included within a Material Manager implementation plan. Use this as a starting point for your own implementation plan, adding and/or removing sections as required.

You should address the following subjects in your Material Manager implementation plan:

- System Requirements
- Configuring Material Manager
- Configuring FactoryTalk Batch

Determining the system requirements

The system requirements for a Material Manager implementation are determined by the FactoryTalk Batch system configuration. A FactoryTalk Batch system is a group of networked computers on which one or more FactoryTalk Batch components run. Material Manager can be implemented in a number of different configurations: with FactoryTalk Batch, with eProcedure, and with various combinations of each of these. Each of these configurations represents a FactoryTalk Batch system.

The system requirements will include the number and type of computers you need, operating systems required on each computer, and the security scheme to be implemented.

Configuration requirements

There are some constraints in the way the FactoryTalk Batch components can be combined in a FactoryTalk Batch system. For example, you cannot install the Material Manager Server components on the FactoryTalk Batch Server computer, but you can install the Material Client components on the FactoryTalk Batch Server computer. You need to review the configuration constraints and decide on the most appropriate configuration for your purpose.

Hardware and operating systems requirements

There are restrictions on the hardware and operating systems that can be used in a FactoryTalk Batch system. For more information, see the *FactoryTalk Batch Components Installation and Upgrade Guide*.

Security requirements

The FactoryTalk Batch components have been developed to take advantage of Windows' built-in security features. Material Manager supports two types of security schemes – Domain or Workgroup. Each of these schemes are also supported in the security defined within the Material Server's database security scheme. There are a number of procedures involved in the implementation of Material Manager security, some of which must be

performed prior to the installation and implementation of Material Manager. Review your facility's security requirements and determine the most appropriate security scheme for your implementation. You should include a detailed list of security requirements within your implementation plan. (Refer to the *FactoryTalk Batch Material Manager Administrator Guide* for complete information on supported security schemes.)

Questions to ask about system requirements

Some of the questions you will want to answer before you move forward in the planning phase are:

1. Which FactoryTalk Batch components will be included in the Material Manager implementation?
   - FactoryTalk Batch
   - FactoryTalk eProcedure
2. How many computers will be required to support the selected FactoryTalk Batch system configuration?
3. Do you already own the computers, or will you need to buy more?
4. Which operating systems will need to be installed on each computer?
5. On which computers will you install each of the FactoryTalk Batch components?
6. What security scheme will be used?
   - Domain
   - Workgroup
7. Which Users and/or User Groups need to be added to the new Material Manager User Groups?

Questions to ask about the material database

Some of the questions you will want to answer before you move forward in the planning phase are:

1. Does the current material data include the following characteristics?
   - States
   - Types
   - Classes
   - Materials
   - Properties
   - Lots/Sublots
   - Locations
   - Independent containers
2. How will the data fields be mapped from the existing data to the material database?
3. In what form is the material data?
   - Doesn't exist
   - Paper
   - Electronic
4. Will the data be entered manually or programmatically?
5. What method of synchronization will be used?

Questions to ask about equipment data

1. Are there phases that move inventory into or out of a process cell? These could be modeled as material-enabled phases.
2. Do you have the need for people to manually add or distribute inventory? These could be instruction-based equipment modules and Material Manager can be used to tell them what container to be drawing materials from or moving materials into.
3. Will your phase logic need to be able to download an identifier for the container that a material addition or distribution is working with? If so, you will want to add the optional Material Manager parameters to that phase.
4. Will you ever need to specify the exact lot or barcode of some inventory that will be used in a batch? If so, you will want to add the optional Material Manager parameters to that phase.
5. What are the associations between containers and equipment modules?
6. What feed type, addition (adding inventory to a batch) or distribution (moving inventory out of a batch) will the equipment module be supporting for each container with which it is associated?

Questions to ask about master recipe data

1. What material will be used by each material-enabled phase step?
2. What feed type, if selectable, is required for each material-enabled phase step?
3. What type of binding will each material-enabled phase step require?

Binding material-based recipes

Before running a material-based recipe, we should review the binding process that FactoryTalk Batch uses to find equipment and materials to use in a batch. When a material-based recipe is placed on the batch list, the FactoryTalk Batch Server makes a request to the Material Server for containers that can support the **material requirement**. The Material Server then returns a list of binding candidates based upon the following rules for binding. If any rule fails, the container is not selected as a binding candidate.

Rules for Selecting Binding Candidates

Rule	Applied To	Rule Description
1	Containers	The container must have a state of READY_TO_USE.
2	Containers	The material specification of an appropriate sublot within a container must match the material specification of a recipe phase step's material requirement. For composite containers, the appropriate sublot is the only sublot in the container. For plug-flow containers, the appropriate sublot is the lowest ordinal sublot in the container. For pallet containers, the appropriate sublot can be any sublot in the container.
3	Lot	The lot and sublot must have a state of READY_TO_USE.
4	Containers	For material additions, the total quantity of inventory in a container must exceed the heel property value of the container. For example, if the heel property value for a plug flow container is 100 gallons and the total inventory of the container is 85 gallons, the container is considered empty and is not considered as a binding candidate.
5	Rules	All rules for selecting a binding candidate must be true.

Together the FactoryTalk Batch and Material Servers apply these rules in a two-step process to bind a material-based recipe automatically or to prepare the list of binding candidates from which the operator can select.

1. **Unit Binding**
   The type of unit binding you select affects how units are selected for binding. Also the FactoryTalk Batch Server analyzes the material requirements presented by the Material Server to select a unit that can satisfy all the requirements. The **material requirement** is based upon the material, the feed type (addition or distribution) and, optionally, the lot and label.

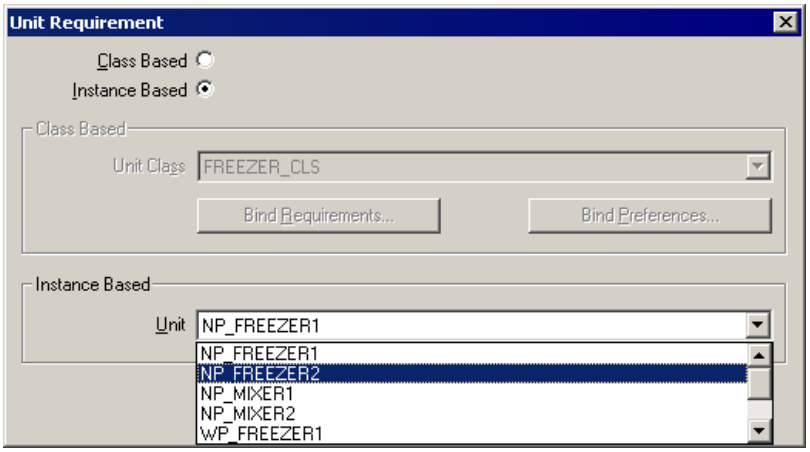
2. **Recipe Phase Binding**
   Once a unit is selected, the FactoryTalk Batch Server further analyzes the status of the containers and equipment modules available within the unit to determine which containers and equipment modules can supply the material to satisfy the recipe's material requirements.

Unit binding

The type of unit binding that you select can affect which units are selected for running a recipe. There are four types of unit binding: Static, Creation, Dynamic Unit Allocation, and Manual.

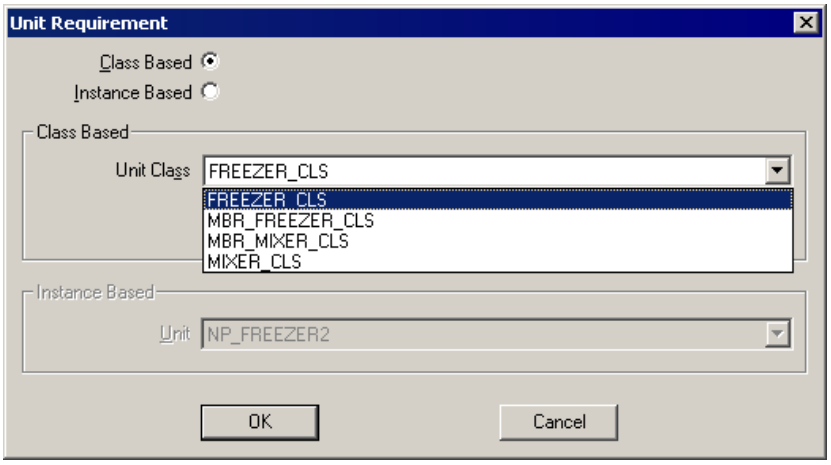
Static binding

If when creating a new operation or unit procedure in the Recipe Editor you select **Instance Based** in the **Unit Requirement** dialog box, you must specify a specific unit to use. During binding, the recipe must bind to that unit. Since the North_Parlor process cell has two units, you don't want to restrict the batch to only one unit so this would not be a good type of unit binding to use.



If you select **Class Based**, then you can select a class of units from which a unit may be selected for binding. In the North_Parlor process cell there are two units. Selecting MBR_FREEZER_CLS enables the FactoryTalk Batch Server or the operator to choose from either NP_FREEZER1 or NP_FREEZER2.

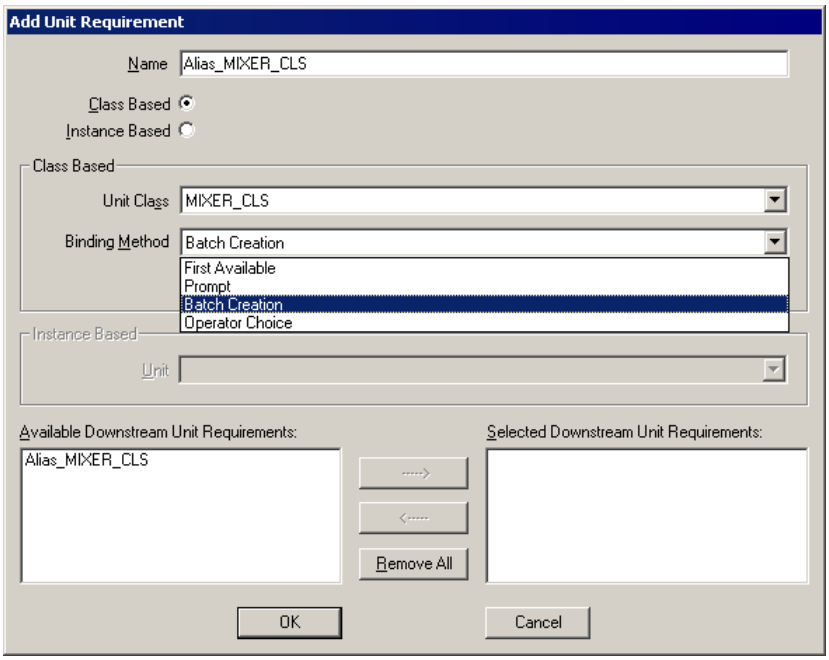
Creation binding



If you enable dynamic unit allocation (*also referred to as Late Binding*) in the Recipe Editor, there are more options available for unit binding when you create a procedure. First you will assign a unit requirement name to all unit instances of a specific unit class. When a recipe is put on the Batch List and

Dynamic unit allocation

the server encounters the unit requirement name, it looks up all the unit classes or instances that are mapped to the unit requirement name. You assign a binding type that applies to each unit instance assigned to the unit requirement.



- **First Available**
  While the batch is running the FactoryTalk Batch Server allocates the first available legal unit to the recipe. Binding occurs when the first unit procedure mapped to the unit requirement name is ready to run. For material phases, if there are multiple equipment modules associated with a container, the first available equipment module is selected. If multiple equipment modules are available, the one with the lowest controller ID is selected. First available binding is also dependent on any binding requirements or preferences in the recipe.
- **Prompt**
  While the batch is running the operator is prompted to bind to a specific unit when the first unit procedure mapped to the unit requirement name is ready to run. For material-based recipes, the operator is prompted to select a material or lot when a recipe phase is about to run.
- **At Batch Creation**
  When the batch is created the operator binds the recipe to a specific unit.
- **Operator Choice**
  When the batch is created, the operator can choose to bind the recipe to a specific unit or choose either the Prompt or First Available binding method.

Manual binding

Manual binding is the process of binding a unit or rebinding a previously bound unit to a step within a class-based recipe without the operator being

prompted. Manual binding is done in the Procedure as SFC or Table window in the FactoryTalk Batch View while a batch is running.

With material-based recipes, the operator can direct a material-based recipe phase to:

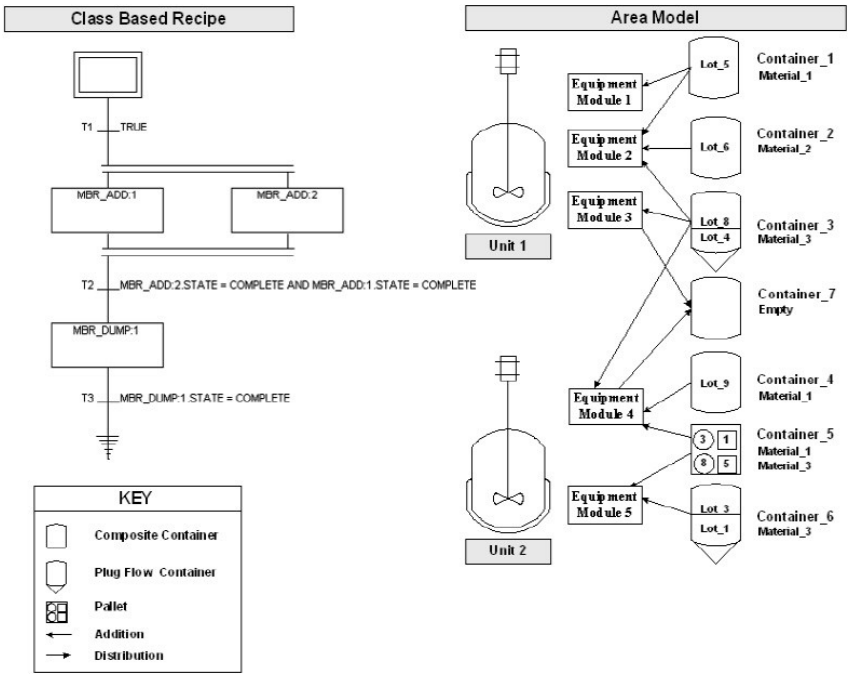
- Bind to a material source or a material destination
- Rebind to a different material source or material destination
- Unbind from a material source or material destination

Material requirements

When using material-based recipes, the FactoryTalk Batch Server also looks at the material requirements when selecting equipment to bind to a recipe. For example, if there are two units (Unit_1 and Unit_2) in the area model and only Unit_1 can draw from a container that holds vanilla, then the FactoryTalk Batch Server selects Unit_1 over Unit_2 for any recipe requiring vanilla.

Tip: If dynamic unit allocation is enabled, the actual material does not have to exist but the capability of meeting the material requirement must exist.

The following examples use the class-based recipe and area model shown in this diagram to explore the different factors that help the FactoryTalk Batch Server determine if material is available.



Tip: In the following examples, all lots and containers are in a Ready to Use state and the container priorities are all equal. Also, it is assumed that there is only one area model. If there is more than one FactoryTalk Batch Server interacting with the Material Server, it is vastly important that the AREA name be unique in each *.cfg* file.

Material requirements: material

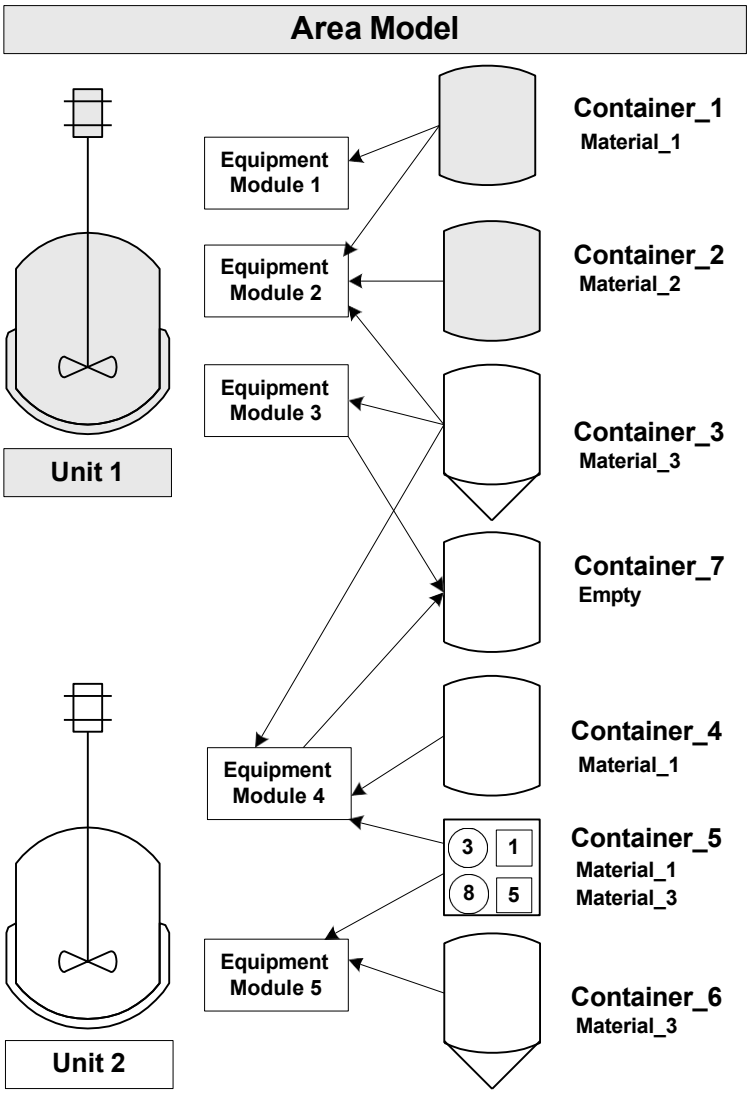
The unit selected to run the recipe can vary depending on the material requirement.

Example

- MBR_ADD:1 requires an addition of Material_1.

- MBR_ADD:2 requires an addition of Material_2.
- MBR_DUMP:1 has no material requirements.

Since Unit_2 does not have the ability to make an addition of Material_2, Unit_1 is selected to bind to the batch.



Material requirements: material and lot

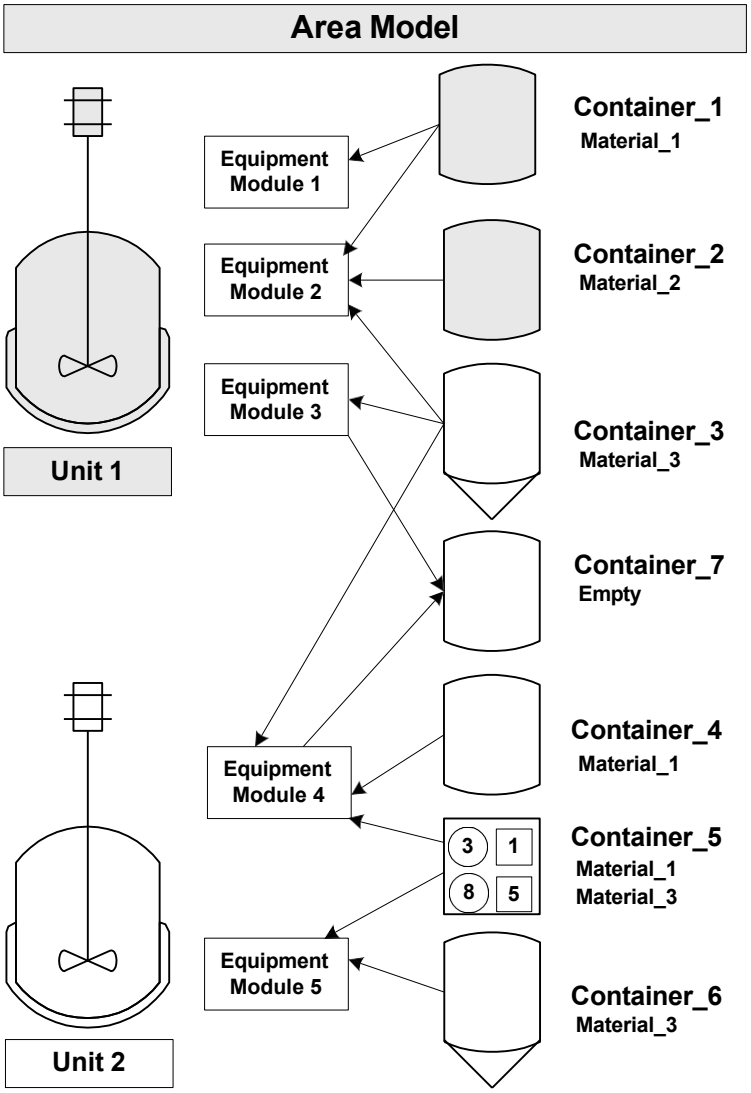
The use of lots in the material requirement further narrows down the unit and equipment modules selected for binding.

Example

- MBR_ADD:1 requires an addition of Material_1, Lot_5.
- MBR_ADD:2 requires an addition of Material_3, Lot_4.
- MBR_DUMP:1 has no material requirements.

Unit 1 is selected because it can draw from the specified lots. Unit_2 can satisfy the materials but not the specified lots.

Container_3 is a plug-flow container so the controller IDs determine which sublot is drawn from the container. Lot_4 has a smaller controller ID than Lot_8 so Lot_4 must be used first.



Container type

The container type can limit the unit and equipment modules selected for binding. Plug-flow containers can hold multiple lots of the same material but lots must be used in the order they were added to the container (first-in/first-out order). Pallet containers also can hold multiple lots of the same material but the order they were added to the container is not considered.

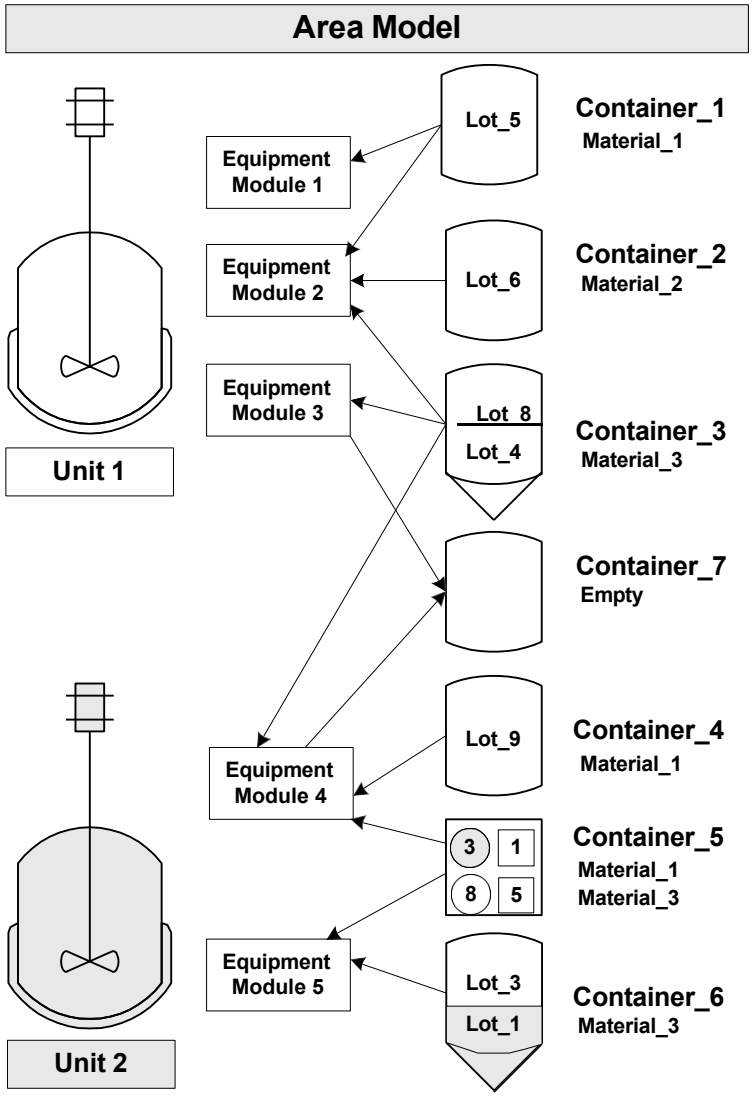
Example

- MBR_ADD:1 requires an addition of Material_1.
- MBR_ADD:2 requires an addition of Material_3, Lot_3.

The recipe binds to Unit_2 because it's the only unit capable of drawing Lot 3.

Container_6 is not selected because it is a plug-flow container and Lot_1 must be depleted before Lot_3 can be used. Container_5 is selected because it is a pallet container and lots are available regardless of the order they were added

to the pallet. Material_1 is pulled from Container_6 because Equipment Module 4 is pulling material from Container_5.



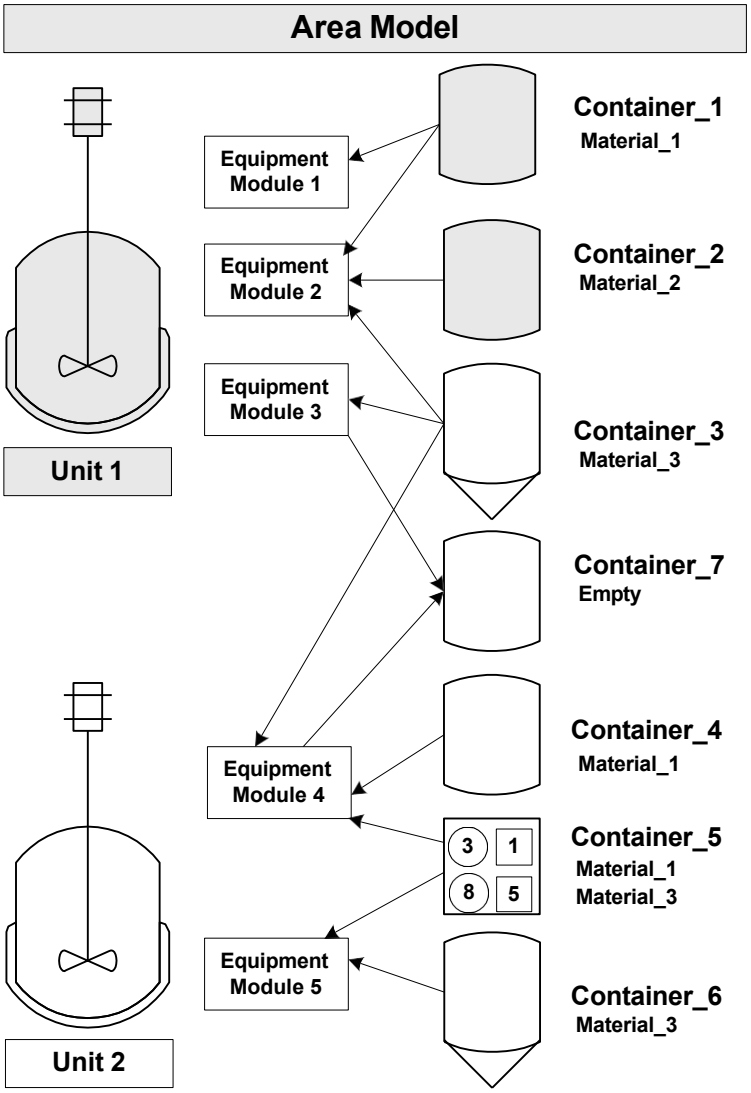
Distributions

If a lot and label are specified in the material requirement for a distribution, the values of the lot and label specification are ignored at unit binding but are assigned to the distributed sublot.

Example

- MBR_ADD:1 requires an addition of Material_1, Lot_5.
- MBR_ADD:2 requires an addition of Material_3, Lot_4.
- MBR_DUMP:1 requires a distribution of Material_6, Lot_1, Label_234.

Unit 1 is selected because it can draw the materials with the specified lots. The lot and label for MBR_DUMP:1 are ignored until the material is distributed to Container_7. The lot and label are then assigned to the material.

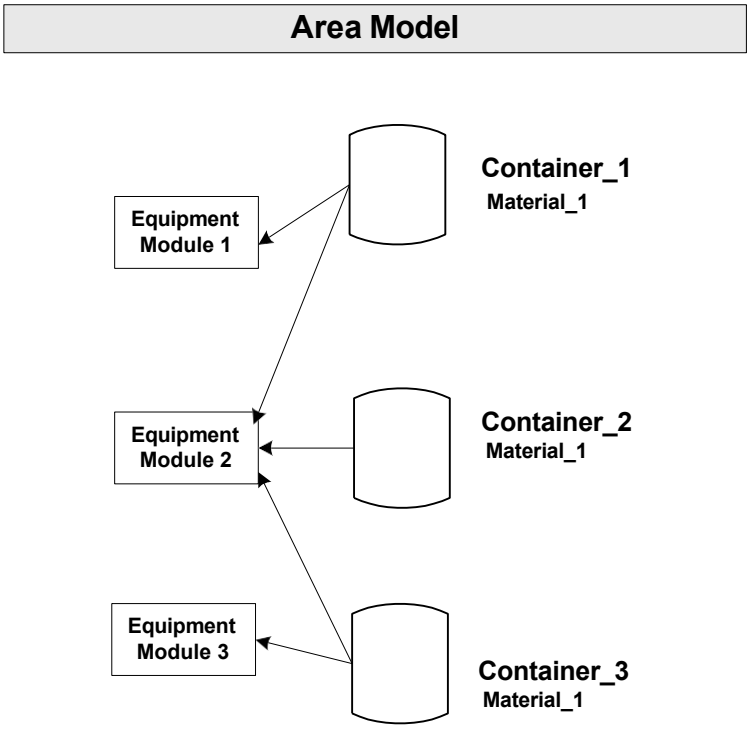


Recipe phase binding

After a unit is selected for binding, the FactoryTalk Batch Server looks for more material specifications to select which container and equipment module to use for binding. This level of binding is referred to as Recipe Phase Binding.

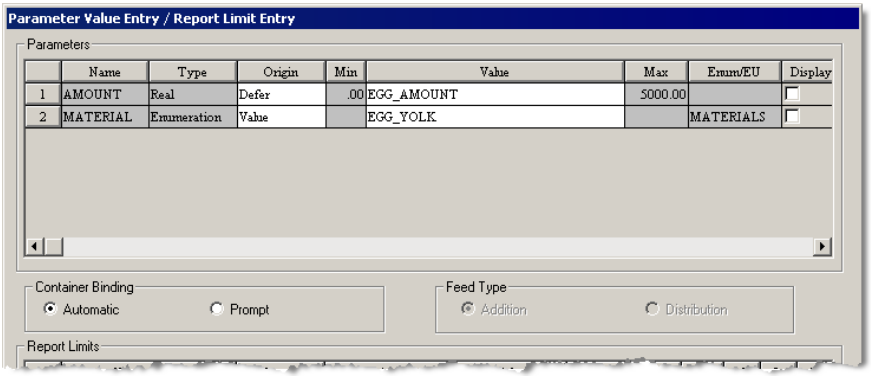
In this area model example, you can see that each container is linked to more than one equipment module. The recipe phase binding process involves identifying a container that can supply or receive the material identified in the recipe, and then selecting an equipment module that is linked to the container and satisfies the recipe. Material Phases can bind to an equipment module/container pair automatically or the operator can be prompted to make a selection.

The material database keeps track of the container used given the unit, material and whether you are adding or distributing material.



Container binding type

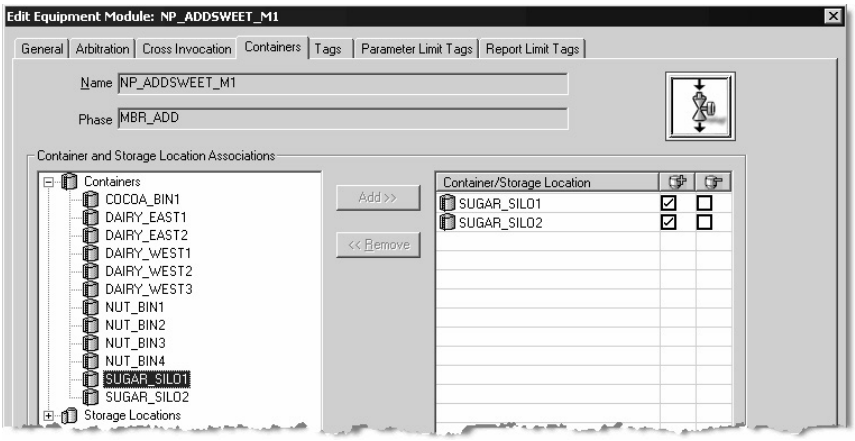
The type of container binding is configured in the Recipe Editor on each material-enabled phase of a recipe. There are two types of container binding, **Automatic** and **Prompt**.



- If **Prompt** container binding is selected, the operator is prompted just before the phase runs to select from a list of all containers that meet the material requirement.
- If **Automati c** container binding is selected, the FactoryTalk Batch Server selects the container based on several criteria just before the phase runs.

Feed type

If **Automatic** container binding is selected, the container feed type adds to the criteria used to select containers for binding. You configured the container feed type (Addition or Distribution or both) in the FactoryTalk Batch Equipment Editor when you linked a container to an equipment module.



It is possible to have a container/equipment module pair configured for both addition **and** distribution. If this is the case, you configure the phase in the Recipe Editor for an addition or distribution as appropriate.

Automatic container binding process

When **Automatic** container binding is selected, the FactoryTalk Batch Server selects the container/equipment module based on the recipe's material requirement. If there is more than one container that meets the material requirement, binding is based first on the *container priority*, second on the *total inventory* for **additions** or the *available space in the container* for **distributions**, and third on the *container controller ID*.

Here are examples to illustrate how a container is selected when there are multiple containers available that satisfy the material requirement.

- **Container Priority (Additions or Distributions)**
  If all containers meet the material requirement, the container with the lowest priority is selected.

  Example: The recipe requires 2,000 KG of material, which all three containers can supply. Container_3 is selected because it has a priority of 20, which is the lowest of the three containers.

Container Name	1st	2nd	3rd
	Priority	Total Inventory	Controller ID
Container_1	100	4,500	62
Container_2	50	5,000	63
Container_3	20	6,000	64

- **Total Inventory (Additions only)**
  If priorities are identical, the container with the greatest amount of inventory is selected. If the Heel value is greater than the total inventory, the container is not considered for binding.

  Example: The recipe requires 2,000 KG of material, which all three containers can supply. The Heel value is less than the total inventory for all three containers. Both Container_2 and Container_3 have a priority of 20. Container_3 is selected because it has more available material (6,000).

Container Name	1st	2nd		3rd
	Priority	Heel	Total Inventory	Controller ID
Container_1	100	100	4,500	62
Container_2	20	100	5,000	63
Container_3	20	100	6,000	64

- **Available Space in the Container (Distributions only)**
  If priorities are identical, the container with the most amount of available space is selected. To calculate available space, subtract the total inventory from the capacity of the container. The Heel value is not applicable to material distributions so it is not involved in determining the available space in the container.

  Example: The recipe requires 2,000 KG of material, which all three containers can supply. Both Container_1 and Container_3 have a

priority of 20. Container_3 is selected because it has more available space (15,000 - 6,000 = 9,000) than Container_1 (10,000-4,500 = 5,500).

Container Name	1st	2nd			3rd
	Priority	Capacity	Total Inventory	Available Space	Controller ID
Container_1	20	10,000	4,500	5,500	62
Container_2	50	15,000	5,000	10,000	63
Container_3	20	15,000	6,000	9,000	64

- **Container Controller ID (Additions or Distributions)**
  If both the priority and material amount/container space are identical, the container with the lowest controller ID is selected.

  Example: The recipe requires 2,000 KG of material, which all three containers can supply. Container_2 and Container_3 both have a priority of 20 and an amount of 5000. Container_2 is selected because its controller ID is lower than Container_3 (64).

Container Name	1st	2nd	3rd
	Priority	Amount of Material	Controller ID
Container_1	100	4,500	62
Container_2	20	5,000	63
Container_3	20	5,000	64

Binding material-based recipes (Summary)

This chapter provided a brief overview of binding material-based recipes. (See the *FactoryTalk Batch Equipment Editor User Guide*, *FactoryTalk Batch Recipe Editor User Guide*, and *FactoryTalk Batch View User Guide* for more information on unit binding.)

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Rockwell Automation support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Knowledgebase	Access Knowledgebase articles.	rok.auto/knowledgebase
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Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	rok.auto/pcdc

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Your comments help us serve your documentation needs better. If you have any suggestions on how to improve our content, complete the form at rok.auto/docfeedback.

Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental information on its website at rok.auto/pec.

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