



# FactoryTalk Batch PhaseManager User Guide

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## 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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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

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**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

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### **IMPORTANT**

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

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

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**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.

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**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

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**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

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### About this manual

This manual provides usage instructions for integrating FactoryTalk Batch and PhaseManager. 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 \(PCDC\)](#).

### Intended audience

The information in this guide is for FactoryTalk Batch system designers, process engineers, and control engineers who are using PhaseManager to develop a batch automation system with FactoryTalk Batch and Logix Designer to develop phase logic for Logix 5000 controllers.

PhaseManager can also be used by Logix Designer users who do not use FactoryTalk Batch and only want to create sequence routines and develop code for a specific piece of equipment that may be incorporated into a FactoryTalk Batch system. In this case, see the Logix Designer online help for information on how to use Logix Designer with PhaseManager outside the context of a Batch system.

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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.
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.

Resource	Description
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.
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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## PhaseManager

PhaseManager is a collection of features that integrates the FactoryTalk® Batch software with the Studio 5000 Logix Designer™ application and the Logix 5000™ family of controllers. The integration of these products simplifies the configuration and maintenance of the FactoryTalk Batch automation system, provides a superior means of 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 the Logix 5000 controller.

### Software requirements

There are no specific software requirements to run PhaseManager in controller PAC firmware.

- FactoryTalk Batch version 8.00 or later (to integrate PhaseManager with FactoryTalk Batch)
- Firmware version 18 or later on ControlLogix 5570 and CompactLogix 5370 family of controllers (to support PhaseManager programs and routines)
- Firmware version 32 or later on ControlLogix 5580 and CompactLogix 5380 family of controllers (to support PhaseManager programs and routines)
- Logix Designer version 18 or later - to edit PhaseManager programs and routines, and for synchronization with FactoryTalk Batch Equipment Editor (to edit PhaseManager programs and routines)



Tip: Software Platform\Hardware Compatibility Matrix: For the latest compatibility information for the Rockwell Automation software suite of products, consult Rockwell Automation Product Compatibility and Download Center.

### What is PhaseManager?

In FactoryTalk Batch Equipment Editor, create a phase class to represent a group of equipment that performs a minor processing activity in a manufacturing plant, and create a phase when a specific instance of a phase is added to a unit.

PhaseManager is a collection of features in FactoryTalk Batch, Logix Designer, and an addition of capabilities in the Logix 5000 family of controllers that extend the concept and definition of phases to the Logix Designer software and the Logix 5000 family of controllers.

An equipment phase is a special program. A state machine built into the program manages the state of the equipment phase. The state specifies which routine the phase executes. The phase can be commanded to change states, and change the routine it is executing. Equipment phase programs have input and output parameters. Parameters can be configured as **Sequencing** parameters, marking these tags as requiring data to be supplied from an internal sequencer (Equipment Sequence Manager) or external sequencer (FTBatch).

PhaseManager adds an equipment phase object to the Logix 5000 family of controllers and gives the ability to create equipment phases in the Logix Designer programming software. Create or update equipment phases in Logix Designer by adding or modifying them directly in the project, or by synchronizing the project with an area model that contains PhaseManager phases. Likewise, create or update phases in the area model by synchronizing with a Logix Designer project file that contains PhaseManager equipment phases.

## FactoryTalk Batch features

PhaseManager adds these features to the FactoryTalk Batch software:

- **Common Industrial Protocol (CIP) support**

The FactoryTalk Batch Server can sequence equipment phases in Logix 5000 controllers using the industry standard CIP (Common Industrial Protocol). In FactoryTalk Batch Equipment Editor, add a Logix5000 CIP data server for each Logix 5000 controller that contains PhaseManager equipment phases.

- **Equipment phase synchronization**

Synchronize the area model in FactoryTalk Batch Equipment Editor with the project file in Logix Designer. Create or update an equipment phase once in either application and add or update it to the other application by synchronizing the FactoryTalk Batch area model with its corresponding Logix Designer project file.

- **Navigation from FactoryTalk Batch Equipment Editor to phase logic in a Logix Designer project**

Directly navigate from a phase in FactoryTalk Batch Equipment Editor to corresponding phase logic in the Logix Designer project file.

## Logix Designer features

PhaseManager adds these features to the Logix Designer programming software:

- **Equipment phase as a type of program**

Add equipment phases to Logix Designer projects.

- **PHASE data type**

Use the PHASE data type to link equipment phases to higher-level systems.

- **Special instructions for equipment phases**

Use instructions in phase logic provided specifically for interacting with the FactoryTalk Batch Server and sequencing a PhaseManager equipment phase.

## Logix 5000 Controller features

PhaseManager adds these features to the Logix 5000™ family of controllers:

- **Equipment phase objects**

Equipment phase objects in the Logix 5000 family of controllers communicate with the FactoryTalk Batch Server through direct Common Industrial Protocol (CIP) messaging. The equipment phase objects embed the Phase Logic Interface (PLI) capabilities into all Logix 5000 controllers, eliminating the need for separate PLI code in the project.

- **Equipment Phase State Model**

Modularize and organize equipment phase logic by developing the code for each S88 state in a routine. Using this programming structure provides consistency of implementation throughout the project.

## How PhaseManager works in a FactoryTalk Batch system

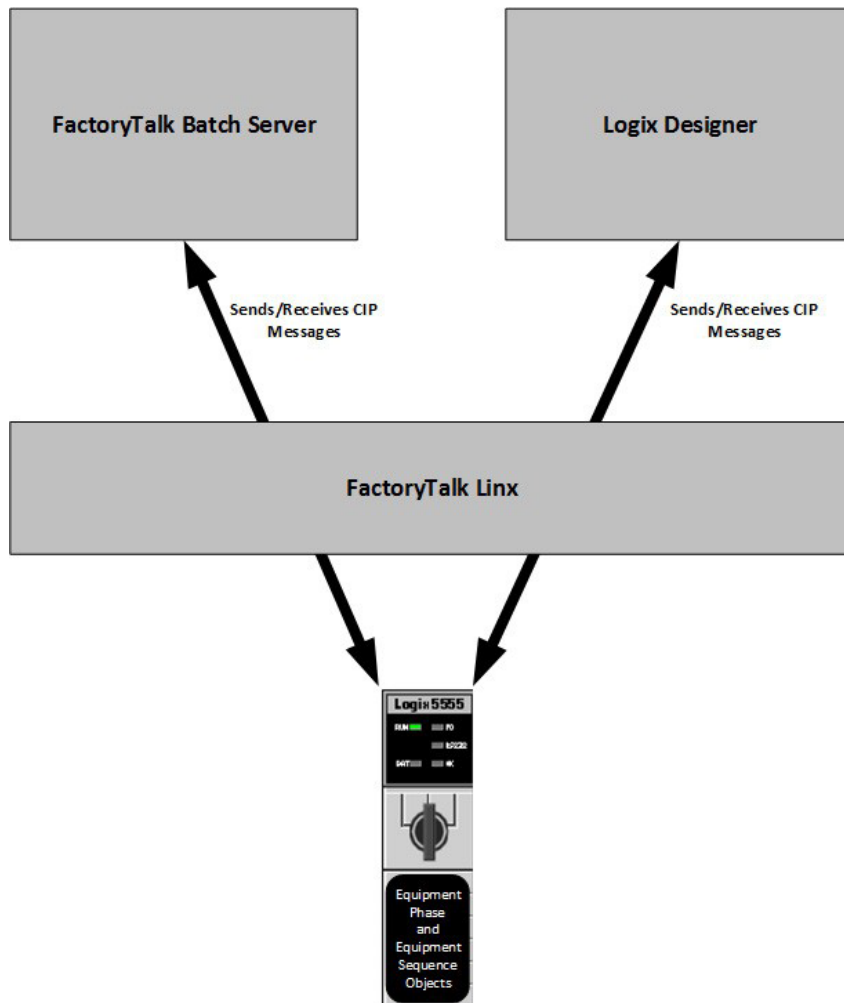
PhaseManager features work together to provide a seamless workflow that improves the designing, troubleshooting, and commissioning phases of the development life cycle. This discussion includes some background information about the components of FactoryTalk Batch systems and how FactoryTalk Batch terminology and concepts are implemented in FactoryTalk Batch and Logix Designer.

In a FactoryTalk Batch system using PhaseManager, the FactoryTalk Batch Server provides batch control, including recipe execution, allocation and arbitration of equipment, binding of resources, and generation of journals. Use FactoryTalk Batch Equipment Editor and FactoryTalk Batch Recipe Editor to configure the FactoryTalk Batch system. Use Logix Designer to program the phase logic code that defines the behavior of equipment phase states, including Running, Stopping, Aborting, Holding, Restarting, and Resetting. PhaseManager links a phase in FactoryTalk Batch Equipment Editor to a corresponding equipment phase and its phase logic in Logix Designer.

## Common Industrial Protocol (CIP)

PhaseManager uses the Common Industrial Protocol (CIP) as the communication mechanism between the FactoryTalk Batch Server and the Logix 5000 controller. In FactoryTalk Batch, each Logix 5000 controller is represented as a CIP data server that was added and configured in FactoryTalk Batch Equipment Editor. Logix5000 CIP data servers require

FactoryTalk® Linx™ for the CIP communications from the FactoryTalk Batch Server to the controller.



The FactoryTalk Batch Server and Logix Designer communicate with the Logix 5000 controller by sending and receiving CIP (Common Industrial Protocol) messages through FactoryTalk Linx.

## Equipment phases in Logix Designer

FactoryTalk Batch Equipment Editor provides the ability to create a model of the equipment in a manufacturing plant. The phases defined in FactoryTalk Batch Equipment Editor define the capabilities of a piece of equipment, or what the equipment can do. When adding an instance of a phase class to a specific unit, create a phase. Each phase represents a unique piece of equipment that can perform the processing activity described by the phase.

Using Logix Designer with PhaseManager, can also create equipment phases in Logix 5000 controllers. An equipment phase in Logix Designer is a type of program that represents both the specific piece of equipment and its capabilities, or the processing activity it performs. The Logix Designer equipment phase is a combination of the FactoryTalk Batch phase and the phase it was created from. PhaseManager adds special Relay Ladder Logic



(RLL) and Structured Text instructions to Logix Designer used when developing phase logic to interact with the FactoryTalk Batch Server, and for internally manipulating the equipment phase objects in the Logix 5000 controller.

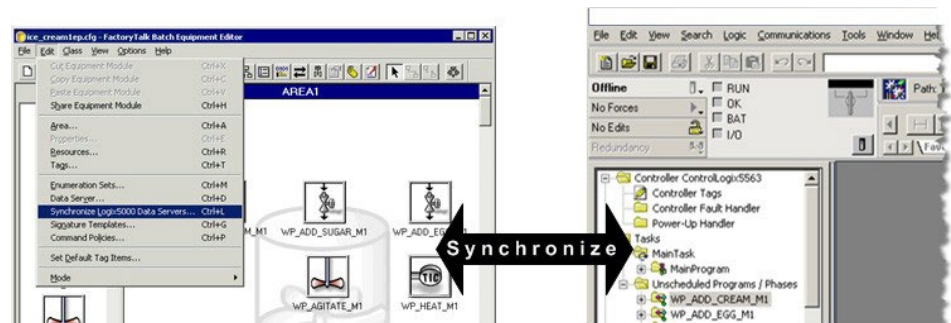
## Equipment phase synchronization

With PhaseManager, create a phase in FactoryTalk Batch Equipment Editor or edit the definition of equipment phases, including parameters and reports, in either FactoryTalk Batch Equipment Editor or in Logix Designer and synchronize them in FactoryTalk Batch Equipment Editor. FactoryTalk Batch Equipment Editor contains the tools to view synchronization status and manage the synchronization process.



Tip: These types of phases must be initially created and edited in FactoryTalk Batch Equipment Editor and added to Logix Designer through the synchronization process:

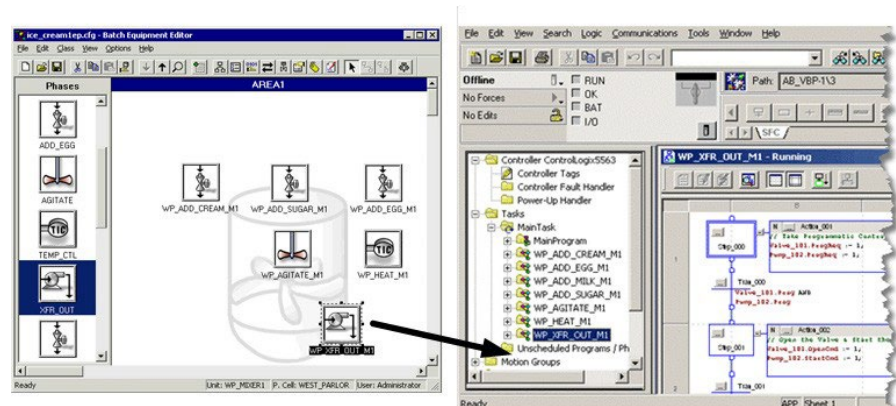
- Material phases
- Phases that contain control strategies
- Phases that contain parameter deviations



## Integration of FactoryTalk Batch Equipment Editor with Logix Designer

PhaseManager adds the ability to double-click a phase in FactoryTalk Batch Equipment Editor and open its corresponding equipment phase in Logix Designer to view and edit its phase logic.

Place the pointer over a phase that is assigned a CIP data server, the pointer changes to the Logix Designer equipment phase symbol, indicating to double-click to open Logix Designer.



## Benefits of using PhaseManager and CIP instead of OPC

### Reduced phase logic programming

PhaseManager improves existing functionality, and how using PhaseManager and the Common Industrial Protocol (CIP) differs from using FactoryTalk Batch with the OPC communication protocol.

Without PhaseManager, a control engineer must implement the Phase Logic Interface (PLI), which is a set of ladder logic (RLL) routines that provides the controller interface to the FactoryTalk Batch Server and executes the command handshake protocol required by the server to communicate with the controller. This communication protocol is implemented using OPC and communication tags or other memory locations in the controller to hold commands, requests, and other data needed by the PLI. When OPC is used, the FactoryTalk Batch Server is compatible with any type of controller, including Logix 5000 controllers, PLC-5s, or controllers manufactured by any vendor.

In Logix Designer with PhaseManager, the functionality associated with the PLI is embedded into the Logix 5000 controller by means of equipment phase objects and instructions. Since PhaseManager implements the PLI functionality in the Logix 5000 controller, do not implement PLI routines when using PhaseManager to create and maintain equipment phases in the FactoryTalk Batch system.

With PhaseManager, the FactoryTalk Batch Server communicates with the Logix 5000 controller through direct CIP (Common Industrial Protocol) messaging targeted at the new objects in the Logix 5000 controller. CIP messaging provides a faster and more reliable communication mechanism, a preferred connectivity path, and increased throughput. The combination of embedding the PLI functionality in the Logix 5000 controller and using CIP messaging for communication provides a seamless integration between FactoryTalk Batch, RSLogix5000, and the Logix 5000 family of controllers.

All commands previously supported from the FactoryTalk Batch Server to the controller, such as sending a parameter value to the controller, are also supported by PhaseManager. Likewise, all requests from the controller to the FactoryTalk Batch Server, such as the controller requesting a new parameter value, are also supported by PhaseManager. How these commands are sent is different when PhaseManager is used, due to the use of CIP messaging.

### Eliminates duplicate equipment phase and tag configuration

In a FactoryTalk Batch system using the OPC communication protocol and the Logix Designer programming software, manually enter communication tag data for each of the ten standard tags and for each parameter, report, and additional request tag on each phase in FactoryTalk Batch Equipment Editor. In Logix Designer, manually create the corresponding tags. Each **Tag Name** entered in Logix Designer must match the **Tag Item Name** entered in

FactoryTalk Batch Equipment Editor. Additionally, in Logix Designer manually create the tags required for the PLI and FactoryTalk Batch Server communications.

In a FactoryTalk Batch system using Logix Designer with PhaseManager, the FactoryTalk Batch Server communicates directly to the equipment phase objects in the Logix5000 controller; therefore, it is not necessary to enter any communication tag data in either application. In FactoryTalk Batch Equipment Editor, tag names that match the parameters and reports defined on the phase are automatically created for each phase.

PhaseManager creates phases in FactoryTalk Batch Equipment Editor or equipment phases in Logix Designer, and synchronizes the FactoryTalk Batch area model with the Logix Designer project file. When synchronizing the area model with the project file, data types and tags are automatically created for each equipment phase and for all parameters and reports in Logix Designer. It is not necessary to enter this information twice, in FactoryTalk Batch and in Logix Designer, as is required if OPC data servers are used with FactoryTalk Batch.

Any new equipment phases added in Logix Designer, or modifications to existing equipment phases in Logix Designer, can also be transferred to the FactoryTalk Batch area model when the FactoryTalk Batch phases are synchronized with the Logix Designer project.

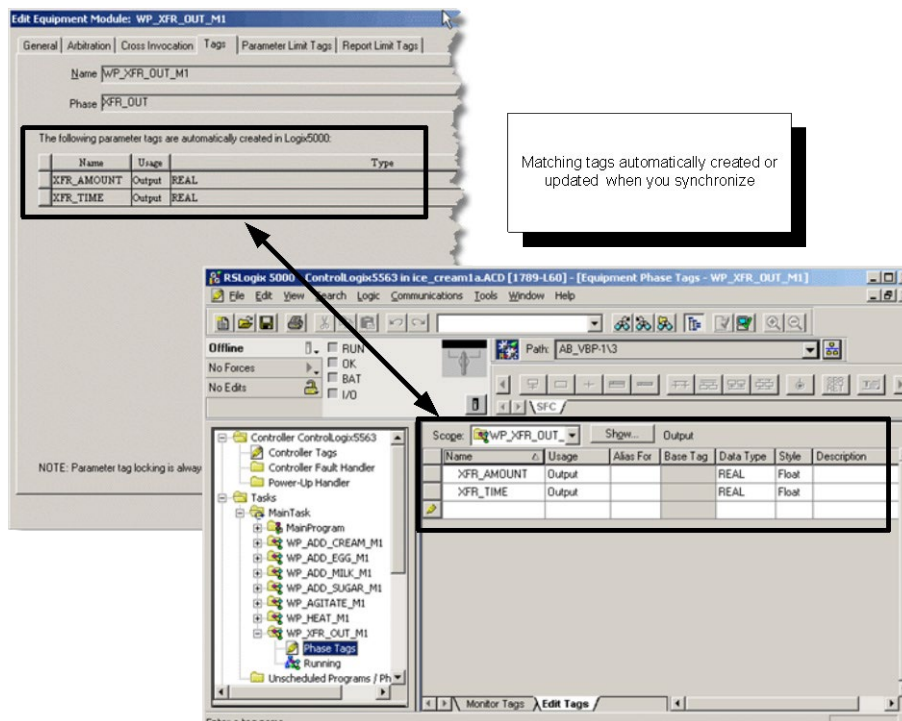


Unsigned data types introduced in Logix5000 version 32.00 are not supported by FactoryTalk Batch. Configuring a FactoryTalk Batch tag to reference a controller tag of any unsigned data type (USINT, UINT, UDINT, ULINT) will result in bad communication. If you attempt to run batches referencing any tags that include one of these data types a communication failure occurs at the point when the tag is used. Use FactoryTalk Batch Tag Verify to produce a report that identifies any issues with the tag(s).

## Compatible tag data types

The data types of the input and output parameter tags defined in Logix Designer must be compatible with the data types supported in FactoryTalk Batch Equipment Editor. These data types are supported:

Logix Designer Data Type	Corresponding FactoryTalk Batch Equipment Editor Data Types
Real	Real
DINT	Integer
DINT	Enumeration
String	String



Unsigned data types introduced in Logix5000 version 32.00 are not supported by FactoryTalk Batch. Configuring a FactoryTalk Batch tag to reference a controller tag of any unsigned data type (USINT, UINT, UDINT, ULINT) will result in bad communication. If you attempt to run batches referencing any tags that include one of these data types a communication failure occurs at the point when the tag is used.

Use FactoryTalk Batch Tag Verify to produce a report that identifies any issues with the tag(s).

## Open phase logic in Logix Designer from FactoryTalk Batch Equipment Editor

PhaseManager gives the ability to double-click a phase in FactoryTalk Batch Equipment Editor and directly view and edit its phase logic in Logix Designer. Logix Designer opens to the equipment phase in the project file that corresponds to the phase selected in FactoryTalk Batch Equipment Editor. It is not necessary to manually open Logix Designer and navigate to the equipment phase to view or edit the phase logic for a phase in FactoryTalk Batch.

- If the phase has a corresponding equipment phase in Logix Designer with existing phase logic, Logix Designer opens the project file to the Running routine of the equipment phase.
- If the phase has a corresponding equipment phase in Logix Designer, and the phase logic has not been developed yet, Logix Designer opens the project file to the equipment phase.
- If the phase does not have a corresponding equipment phase in Logix Designer, Logix Designer opens the project file for the CIP data server that is assigned to the phase.



Tip: To open the Logix Designer project file from FactoryTalk Batch Equipment Editor, the correct revision of Logix Designer must be installed on the same computer as FactoryTalk Batch Equipment Editor with an activation for each product.

The PhaseManager activation is included in the Logix Designer Professional Version, but other versions of Logix Designer require a separate PhaseManager activation to enable the PhaseManager features in Logix Designer.

## Improved implementation of phase logic routines

Logix Designer with PhaseManager improves the implementation of equipment phases in Logix 5000 controllers. Using OPC and the PLI, a phase is typically executed in a single relay ladder logic (RLL) routine that implements logic for all of the active states defined by the S88 standard. These active states include Stopping, Starting, Running, Holding, Aborting, and Restarting.



Tip: PhaseManager also provides an additional active state in Logix Designer, Resetting, which can be used for other types of projects not based on the S88 standard.

PhaseManager supports a modularized approach to developing state routine logic by facilitating the development of each active state in its own routine. PhaseManager represents an equipment phase as a type of program in Logix Designer. Since programs can contain multiple routines, develop a separate routine for each active state required for the equipment phase. Developing separate routines for each active state also provides the ability to develop each routine in different programming languages.

Use other Logix Designer program features when developing equipment phase logic. These features include the ability to use timing diagnostics information, Max and Last Scan, for debugging equipment phases in Logix Designer, and the ability to configure a fault routine for the equipment phase.





## Area model PhaseManager configuration

Use FactoryTalk Batch with PhaseManager to configure the area model in FactoryTalk Batch Equipment Editor, or develop the phase logic in Logix Designer. If designing an entire FactoryTalk Batch system, use FactoryTalk Batch Equipment Editor to create an area model that describes the capabilities of the equipment, down to the phase level, and optionally use the synchronization feature to create corresponding equipment phases in the Logix Designer project file.

This section describes how to configure data servers and phases in FactoryTalk Batch Equipment Editor so these PhaseManager features can be used:

- CIP for FactoryTalk Batch Server communications to the Logix5000 controller
- Synchronization of phases in the FactoryTalk Batch area model with the Logix Designer project file
- Ability to open phase logic in Logix Designer from the phase in FactoryTalk Batch Equipment Editor



Tip: To fully use the PhaseManager features, install FactoryTalk Batch Equipment Editor and Logix Designer on the same computer.

To configure the FactoryTalk Batch system with PhaseManager:

- Add Logix5000 CIP data servers
- Assign a Logix5000 CIP data server to PhaseManager phases

After these configuration tasks are completed, if the Equipment Phases in Logix Designer have not already been created, synchronize the FactoryTalk Batch area model with the Logix Designer project file.

### Add a Logix5000 CIP data server

Add data servers either before creating the rest of the elements in the area model, or after defining the process cells, unit classes, phase classes, operation sequence classes, and resources in the area model. Define at least one data server before creating the specific phases from the phase classes or specific operation sequences from the operation sequence classes.

If possible, create the project file in Logix Designer before adding a Logix5000 CIP data server. Specify the project file when adding a Logix5000 CIP data server to detect errors more easily when designing the system.

## Prerequisites

- Configure device shortcuts in the FactoryTalk Administration Console for all controllers that FactoryTalk Batch communicates with PhaseManager or SequenceManager objects.
- Install and configure FactoryTalk Linx. (For more information, refer to FactoryTalk Linx Help.)
- Create an Application in the FactoryTalk Directory. (For more information, refer to FactoryTalk Help in the FactoryTalk Administration Console.)
- Add a FactoryTalk Linx data server to the FactoryTalk Application. Adding a data server to an application provides a link between a hardware device containing tags and the FactoryTalk Directory. (For more information, refer to FactoryTalk Help in the FactoryTalk Administration Console.)

## To add a Logix5000 CIP data server

1. Select **Start > Rockwell Software > Equipment Editor**.
2. Select **Edit > Data Server** to open the **Data Servers** dialog box.
3. Select **Add** to open the **Add Data Server** dialog box.
4. In the **Name** box, type a name for the data server.
 

Tip: The name should easily identify the Logix 5000 controller that this data server represents. Using the type of Logix 5000 controller and its location in the chassis as the name, or the unit that this controller connects to in the plant as the name, may help to easily identify the controller.

When synchronizing the area model with the Logix Designer project, this name displays in the Synchronize Logix5000 Data Servers dialog box. Choose which data server to synchronize by selecting the name.
5. Select **Logix5000 CIP** for the **Type**.
6. (optional) To create phases or operation sequences in the area model before completing the remaining information in this dialog box, select **OK** to close this dialog box. Finish adding information about the data server later.
7. To enable synchronization between the **.acd** file and the area model, select **Browse**, navigate to a project **.acd** file that contains the phase for the controller this data server represents. The file's revision and controller type display in the boxes.
 

Tip: The Logix Designer project file must be revision 16.0 or higher.

To resolve any error messages that appear when selecting a project file, see Select a project file - error messages.
8. In the **FactoryTalk Linx Controller Shortcut** box, select **Browse** to locate the device shortcut for communicating with the specified controller.
 

Alternatively, type the path to the shortcut using this format:

```
RNA://Global/UsersApplicationName/FTLinxAreaName/FactoryTalkLinx/ShortcutName
```
9. (optional) Select **More** to display the **Timeout** and **Retries** boxes.

10. The default values are the recommended settings for these boxes.

Adjust these values for the speed of the network.

Name	Value
Timeout	How often the FactoryTalk Batch Server attempts to contact the controller. The range of valid values is 500 milliseconds to 100000 milliseconds. The default is 8000 milliseconds.
Retries	The number of times the FactoryTalk Batch Server tries to contact the controller before dropping the connection. The valid values appear in the list. The default is 4.
Timeout * Retries = Length of time the FactoryTalk Batch Server attempts to contact the controller before losing the connection.	

11. Select **OK** to close the **Add Data Server** dialog box.

12. Select **OK** to close the **Data Servers** dialog box.

## Select a project file - error messages

If error messages display when selecting a Logix Designer, use this table to troubleshoot the issue.

Error Message	Action to Take
The specified Logix Designer project file was not found.	The file may have been renamed, moved, or deleted after it was selected in the Select Project File dialog box. In Windows Explorer, navigate to the file selected in the Select Project File dialog box, and verify that it still exists with the same name in the selected location.
No revision of Logix Designer is installed.	Logix Designer is not installed on the same computer as FactoryTalk Batch Equipment Editor. Install Logix Designer revision 16.0 or higher on the same computer as FactoryTalk Batch Equipment Editor.
The revision of Logix Designer required to open the project is not installed.	The installed revision of Logix Designer does not support PhaseManager functionality. Upgrade the current installation of Logix Designer to revision 16.0 or higher.
The Logix Designer project file must be converted. The revision is too old.	The revision of the selected Logix Designer project file is lower than revision 16.0. Open the selected project file in Logix Designer revision 16.0 or higher to convert the file to this revision.
The specified file is not a valid Logix Designer project file. The file format is not recognized or has been corrupted.	Try to open the selected project file in Logix Designer. If it does not open, the file format has been corrupted.
The Logix Designer project file is read-only and cannot be opened.	Disable the Read-Only Attribute for the selected project file. In Windows Explorer, navigate to the selected file in the Select Project File dialog box. Open the Properties dialog box for the file and verify that the Read-Only Attribute is not selected.
The Logix Designer project file revision does not support phases. Use revision 16.0 or greater.	The installed revision of Logix Designer and the selected project file is lower than revision 16.0. Upgrade the revision of Logix Designer to 16.0 or higher. Open the selected project file in Logix Designer to convert the file to the upgraded revision.

## Edit a Logix5000 CIP data server

Use these instructions to edit a Logix5000 CIP data server.

### To edit a Logix5000 CIP data server:

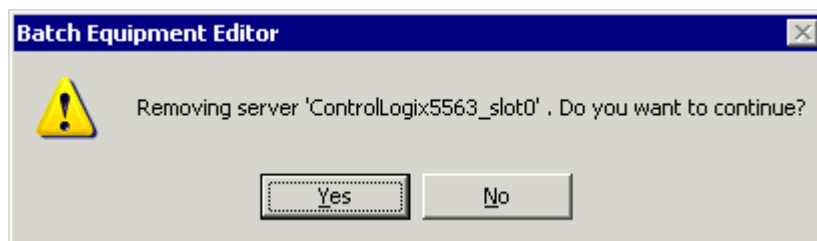
1. Select **Edit > Data Server**. The **Data Servers** dialog box opens.
2. Select the data server definition to be edited, and select **Edit**. The **Edit Data Server** dialog box opens.
3. Make any required changes and select **OK** to return to the **Data Servers** dialog box.



Tip: After adding a data server as a Logix5000 CIP type data server, the type cannot change. No other data server types appear in the Type selection list when editing. To change the Type, delete the data server and add a new one.

4. (optional) To delete a data server, select the data server to delete and select **Remove**.

- If the data server is not assigned to any phases, this message displays:



- If the data server is assigned to phases, the **Remove Server** dialog box opens, displaying these phases and unit tags associated with the data server.

The displayed unit tags and phases, as well as their parameter, report, and limit tags are deleted when the data server is removed.

- Select **Yes** to delete the data server and remove all associated phases and tags.

## Assign a Logix5000 CIP data server to a phase or sequence

After adding a Logix5000 CIP data server, assign it to each phase or sequence that represents a piece of equipment connected to the controller specified in the controller network path of the Logix5000 CIP data server.

### To assign a Logix5000 CIP data server to a phase or sequence:

1. Select **Start > Rockwell Software > Equipment Editor**.
2. Select the phase or sequence icon in the **Design View** area and select **Edit > Properties**. The **Edit Phase** dialog box, **General** tab displays.
3. From the **Data Server** list, select the Logix5000 CIP data server that represents the controller connected to the piece of equipment defined by this phase or sequence.

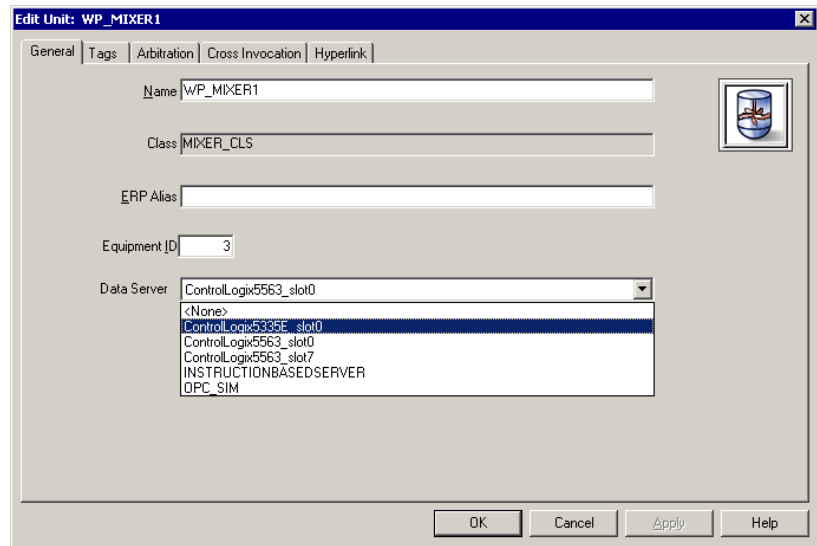
4. Select **OK**.

## Assign a data server to all phases in a unit

When creating a unit, assign a data server to the unit. This data automatically assigns to all phases subsequently created in that unit.

### To assign a data server to all phases in a unit:

1. Select the unit icon in the **Design View** area and select **Edit > Properties**. The **Edit Unit** dialog box, **General** tab displays.
2. From the **Data Server** list, select the Logix5000 CIP data server that represents the controller connected to all phases created in this unit.



3. Select **OK**.





## FactoryTalk Batch phases in Logix Designer

After the Logix5000 data servers are added and assigned to phases, create the same phases in the Logix Designer programming software by synchronizing the area model with the Logix Designer project file.

This section describes how to synchronize the FactoryTalk Batch area model with the Logix Designer project file when the phases in FactoryTalk Batch Equipment Editor are created and corresponding equipment phases in Logix Designer are needed. Phases based on these types of phases must be initially created in FactoryTalk Batch Equipment Editor and added to Logix Designer through the synchronization process:

- Material-based recipe phases
- Phases that contain control strategies
- Phases that contain parameter deviations

The features to configure these types of complex phases are unique to the FactoryTalk Batch product. Logix Designer does not have the configuration features to enable material phases, control strategies, or parameter deviations. For that reason, configure these phase classes and phases in FactoryTalk Batch first, and then follow the instructions in this chapter to synchronize the area model with the Logix Designer project file. When corresponding equipment phases in Logix Designer are synchronizing, the appropriate configuration of parameters, reports, and tags on these complex phases are automatically created on the equipment phases in Logix Designer.



Tip: Phases are created in Logix Designer as equipment phases.

After equipment phases are created in the Logix Designer project, begin developing phase logic for them in Logix Designer.

### Synchronize the area model with the project file

Use these instructions to synchronize the area model with the project file.

#### Before you begin:

- Install Logix Designer and FactoryTalk Linx on the same computer as FactoryTalk Batch Equipment Editor.
- Create phases in FactoryTalk Batch Equipment Editor and assign a Logix5000 CIP data server.
- Create a project file in Logix Designer.

- Specify this project file in the **Add or Edit Data Server** dialog box for the appropriate data server.

### To synchronize the area model with the project file:

1. Save the area model and select a data server to synchronize.
2. Select the phases to create in the Logix Designer project.
3. Synchronize, review the results, and save the project.

All synchronization steps are completed in FactoryTalk Batch Equipment Editor.

## Save the area model and select a data server

Use these steps to begin synchronizing the area model with the Logix Designer project.

### To save the area model and select a data server:

1. From the **Edit** menu, select **Synchronize Logix5000 Data Servers**. The **Save Before Synchronization** dialog box opens.
2. Select **Save** to save the area model file now, or select **Continue Without Saving**.
  - If **Save** is selected, the **Save As** dialog box opens. Save the area model with its existing name or give it a different name.
  - After saving or continuing, the **Synchronize Logix5000 Data Servers** dialog box opens.
3. Select the data server that was added for the new Logix5000 controller.



Tip: Select any column headings to sort the list of data servers.

---

**IMPORTANT** The data server selected must have the project file specified.

---

4. Select **Continue**. The **Synchronize with Logix5000: <data server name>** dialog box opens.
5. Select the phases to create in the area model. Continue to **Select phases**.

## Select phases and synchronize

Select phases on the **Synchronize with Logix5000: <data server name>** dialog box.

### To select phases and synchronize:

1. The left pane of the **Synchronize with Logix5000: <data server name>** dialog box displays the units in the area model that contain phases assigned to the selected data server. Only units that contain phases

different from the equipment phases in Logix Designer display.

Expand a unit by selecting the plus sign next to it, to view the phases it contains.

2. Select a unit. The phases it contains display in the right pane. Only phases different from the equipment phases in the Logix Designer project display.
3. Select a phase to create in the Logix Designer project.
4. Select the **Resolution** box for the selected phase and select **Create in Project**.



Tip: If the only Resolution available is Cannot Synchronize, select Details to see a message that explains why the phase cannot be synchronized.

5. (optional) To view the selected phase configurations in FactoryTalk Batch and in Logix Designer, select **Details** to open the **Equipment Phase Synchronization Details** dialog box.

This dialog box shows any differences that exist between the phase in FactoryTalk Batch Equipment Editor and the corresponding equipment phase in Logix Designer.

In this example, the parameters and reports configured for the phase in FactoryTalk Batch display in the **Batch Configuration** area on the left. Since this phase only exists in FactoryTalk Batch Equipment Editor, the Logix Designer side is blank.



Tip: Although the report limit tags are defined as Input tags in Logix Designer, they display with the reports on the Equipment Phase Synchronization Details dialog box. Other reports are defined as Output tags in Logix Designer.

6. Select **Close** when finished viewing the phase details.
7. Repeat steps 3 - 5 for each phase in the selected unit to be created in the Logix Designer project.
8. Repeat steps 2 - 6 for each unit that contains phases to be created in the Logix Designer project.
9. On the **Synchronize with Logix5000: <data server name>** dialog box, select **Synchronize**. The **Synchronization Results Summary** dialog box opens.

The phases selected are created in the Logix Designer project. Next review the results of the synchronization and save the Logix Designer project file.

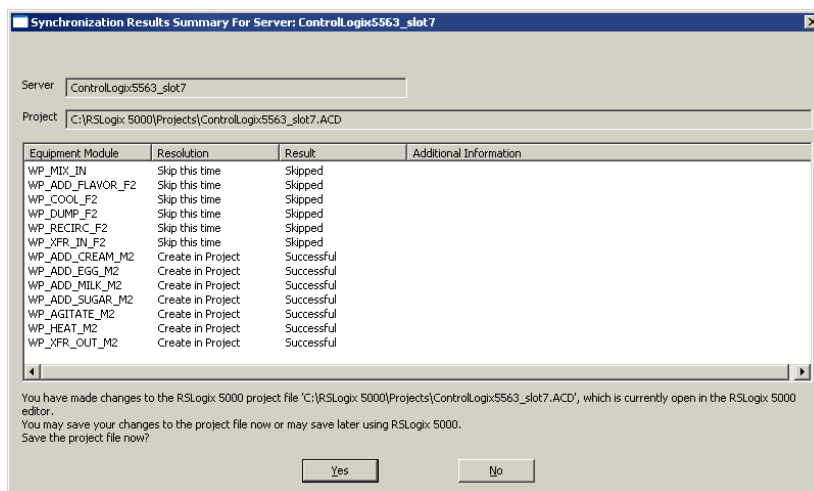
Continue on to **Review results and save files**.

## Review results and save files

Use these instructions to review results and save files.

### To review results and save files:

1. On the **Synchronization Results Summary for Server: <data server name>** dialog box, review the displayed results of the synchronization. Phases with a **Result** of **Successful** created in the Logix Designer project. If satisfied with the results, select **Yes** to save the Logix Designer project file.



Tip: If Failed displays in the Result column, the reason displays in the Additional Information column.

If not satisfied with the results, select No. The synchronization changes displayed are not saved in the Logix Designer project file.

The time and status of the synchronization displays in the **Synchronize Logix5000 Data Servers** window.

Status of Last Synchronization	Description
Complete	All results were Successful, and Yes was selected to save the project file.
Incomplete	Some results were Failed or Skipped, or No was selected and did not save the project file.
Never Synchronized	Never been an attempt to synchronize the data server.



Tip: The Status of Last Synchronization column only displays the result of the last synchronization attempt, if one was made. It does not indicate whether the data server is currently synchronized. Changes may have been made since the last synchronization attempt.

2. Select a data server and select **Continue** to begin the synchronization process again, or if finished synchronizing, select **Close**.

When **Close** is selected, the **Save After Synchronization** dialog box opens if changes were made to the area model.

3. Select **Save** to save the area model, overwrite the area model, or save it with a different name.

After creating the equipment phases in the Logix Designer project, begin developing phase logic for them in Logix Designer.

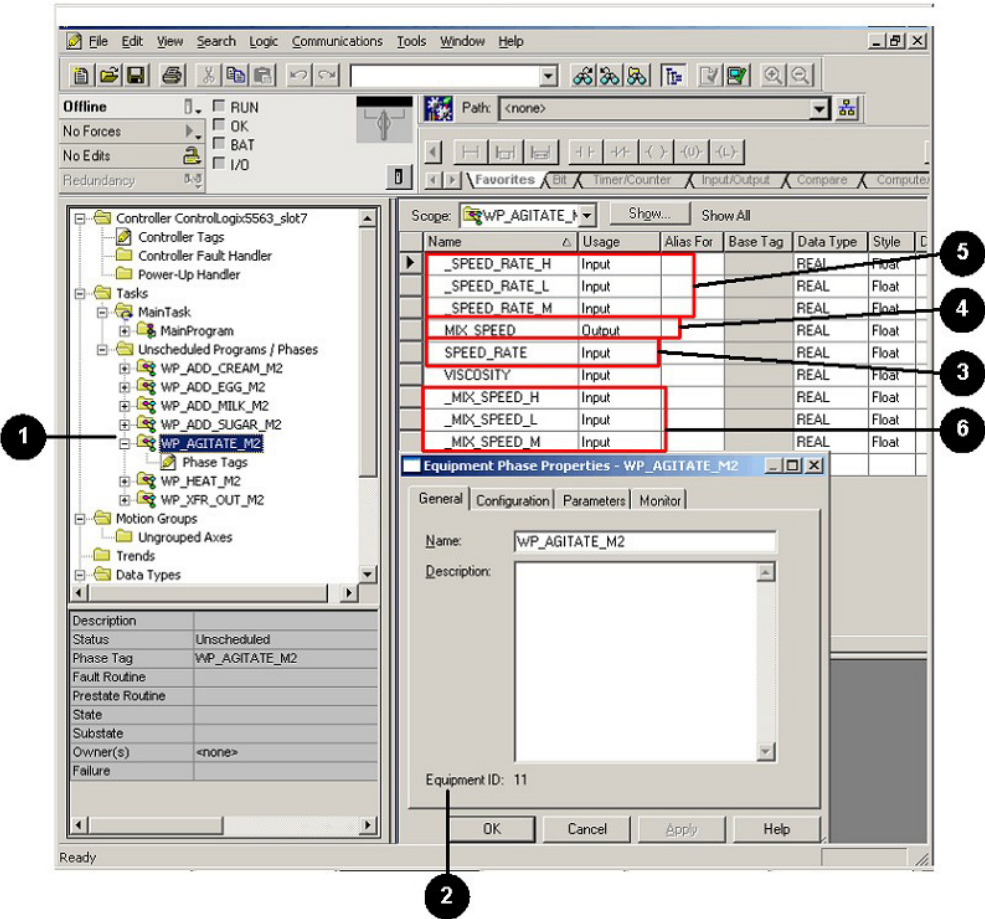
Results of creating equipment phases in a project by synchronizing

When synchronizing the area model with the Logix Designer project file and creating equipment phases in the project, several items are created in the project. This table shows how the elements of a phase are created for a corresponding equipment phase in the Logix Designer project:

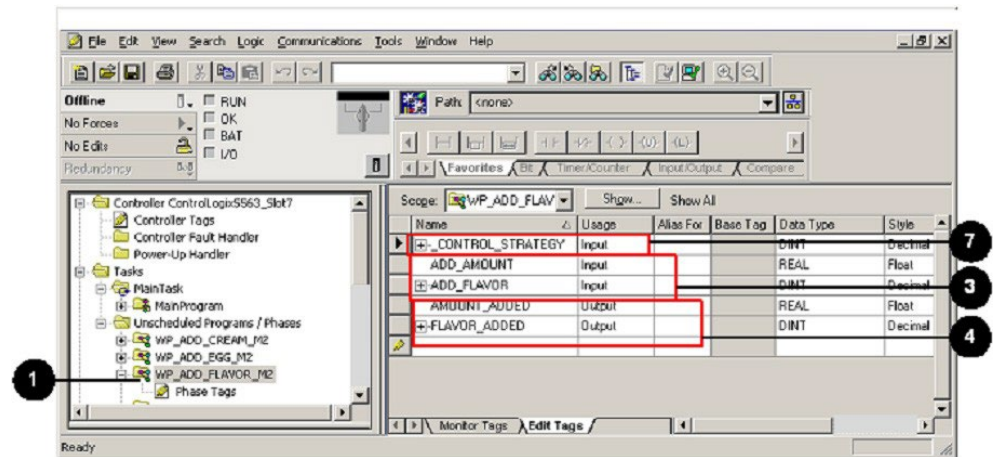
**IMPORTANT**

Do not edit the phase tags containing a leading underscore( ) in the Logix Designer project. If the Name, Usage, or Data Type of these phase tags in Logix Designer are changed, synchronization cannot be used to apply changes to the area model.

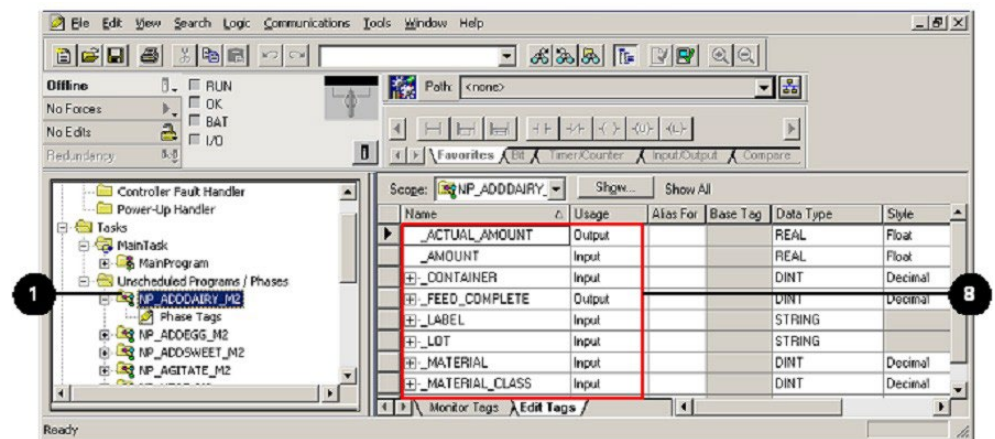
Equipment phase with parameter and report limit tags



## Equipment phase with control strategies



## Material-enabled equipment phase



Item Number in Picture	In FactoryTalk Batch Equipment Editor	In Logix Designer Project	Notes
1	Controller Program Name	Equipment Phase Name	Created in the Unscheduled Programs / Phases folder.
2	Equipment ID	Equipment ID	Displayed on Equipment Phase Properties dialog box, General tab.
3	Parameters	Phase Tags with Usage of Input	Data Type matches the Type in FactoryTalk Batch. Enumerations in FactoryTalk Batch are created as Integers in the project.
4	Reports	Phase Tags with Usage of Output	Data Type matches the Type in FactoryTalk Batch. Enumerations in FactoryTalk Batch are created as Integers in the project.
5	Parameter Limit Tags	Phase Tags with a Usage of Input	An underbar ( _ ) prepends to the tag name.
6	Report Limit Tags	Phase Tags with a Usage of Input	An underbar ( _ ) prepends to the tag name.



7	Control Strategies	Phase Tag named _CONTROL_STRATEGY with a Usage of Input.	Data Type is DINT.
---	--------------------	--	--------------------

Item Number in Picture	In FactoryTalk Batch Equipment Editor	In Logix Designer Project	Notes
8	Material-based Phases	Adds these Phase Tags with a Usage of Input:	
		• _MATERIAL	Data Type is DINT.
		• _AMOUNT	Data Type is REAL.
		Adds these Phase Tags with a Usage of Input if these optional parameters exist on the phase in the area model:	
		• _CONTAINER	Data Type is DINT.
		• _LOT	Data Type is STRING.
		• _MATERIAL_CLASS	Data Type is DINT.
		• _LABEL	Data Type is STRING.
		Adds these Phase Tags with a Usage of Output:	
		• _ACTUAL_AMOUNT	Data Type is REAL.
		• _FEED_COMPLETE	Data Type is DINT.

## Open an equipment phase in Logix Designer from FactoryTalk Batch Equipment Editor

Now that equipment phases in the Logix Designer project are created, open those equipment phases in Logix Designer from their corresponding phases in FactoryTalk Batch Equipment Editor.

### To open an equipment phase in Logix Designer from FactoryTalk Batch Equipment Editor:

1. In FactoryTalk Batch Equipment Editor, place the pointer over a phase that was just created in the Logix Designer project. The pointer changes to the Logix Designer equipment phase symbol.
2. Double-click the equipment phase symbol over the phase. Logix Designer opens to the selected equipment phase in the project.
3. Next, develop phase logic for the equipment phases created in the Logix Designer project.

## Project file equipment phase changes

If the phases in FactoryTalk Batch Equipment Editor are changed and the corresponding equipment phases in the Logix Designer project need to be updated, synchronize the area model with the project file to detect and make the appropriate changes to the phases.

For example, if a parameter or report changes on the phase class that a phase was created from in FactoryTalk Batch, synchronization will apply the change to the corresponding equipment phases in the Logix Designer project.

However, do not attempt to delete an equipment phase from the project file by synchronizing the area model with the project. If you deleted a phase from the area model in FactoryTalk Batch Equipment Editor, you should also manually delete the corresponding equipment phase from the project in Logix Designer.

Synchronization can transfer these types of changes from the area model phase in FactoryTalk Batch Equipment Editor to the corresponding equipment phase in your Logix Designer project:

- Phase name in area model
- Equipment ID
- Addition, deletion, or modification of parameters on the phase class that the phase is associated with
- Addition, deletion, or modification of reports on the phase that the phase is associated with
- Enabling, disabling, or changing the parameter or report limit tags on the phase
- Enabling or disabling Control Strategy or Material Based Recipe functionality for the phase class that the phase is associated with



Tip: Since synchronization matching is based on matching the Controller Program Name property in the area model with the Equipment Phase Name property in the Logix Designer project, changing either name will create a mismatch.

This mismatch will appear to the synchronization logic as both a new phase in the area model and a new equipment phase in the Logix Designer project.

During the synchronization process, you will have the option to resolve the mismatch by creating a new phase in the area model, creating a new equipment phase in the Logix Designer project, creating both new phases, or skipping synchronization of those items and resolving the name

mismatch by ensuring that the Controller Program Name in the area model and the Equipment Phase Name in the Logix Designer project match.

After changes to the area model in FactoryTalk Batch Equipment Editor are made, transfer these changes to the equipment phases in the Logix Designer project.

## Synchronize to update equipment phases in the project file

Use these instructions to synchronize to update equipment phases in a project:

### To synchronize to update equipment phases in the project file:

1. Save the area model and select a data server to synchronize. See **Save the area model and select a data server** for more information.
2. In the **Synchronize with Logix5000: <data server name>** dialog box, select the phases to update in the Logix Designer project file.



Tip: Only phases different from the equipment phases in the Logix Designer project display in the Synchronize with Logix5000: <data server name> dialog box.

In the **Location** column, FactoryTalk Batch Equipment Editor and the Logix Designer symbols display to indicate that this phase exists in both places.

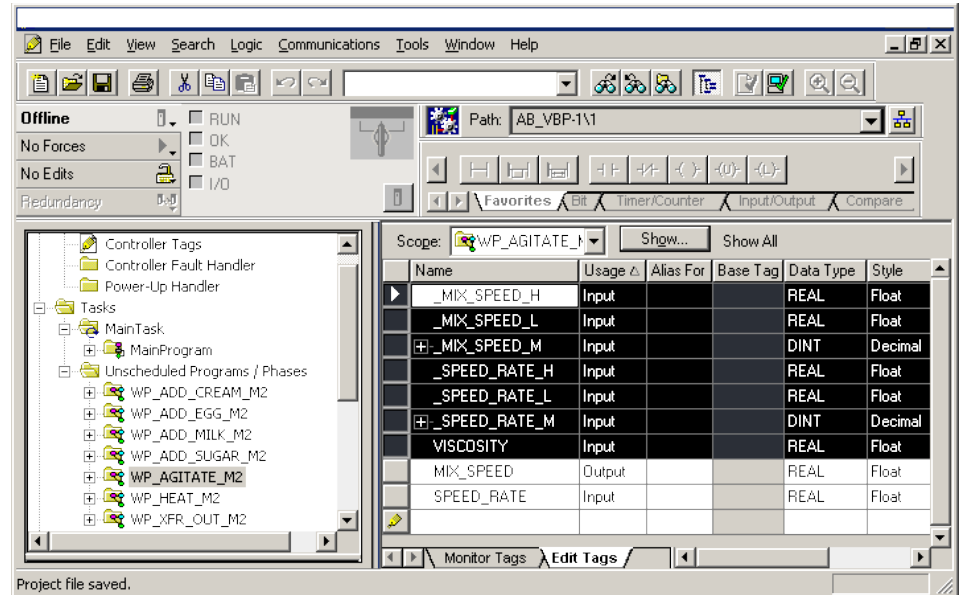
3. (optional) To view the configuration details of the selected phase, select the phase and select **Details** to open the **Equipment Phase Synchronization Details** dialog box.
4. In the **Equipment Phase Synchronization Details** dialog box, select **Close**.
5. In the **Resolution** box, select **Update Project** for each phase to update in the Logix Designer project.
6. When finished selecting a **Resolution** for each phase to update, select **Synchronize**.
7. Review the results, and save the project and area model files. See **Review results and save files** for more information.



Tip: If Failed displays in the Result column, the reason displays in the Additional Information column.

## Updated project file

When the updated project file in Logix Designer opens, a new Phase Tag was created for each new parameter or report that was added to the equipment phase in the project as a result of the synchronization. Input tags are created for parameters. Output tags are created for reports.



In this example, these new Phase Tags were added to the WP\_AGITATE\_M2 equipment phase:

- VISCOSITY

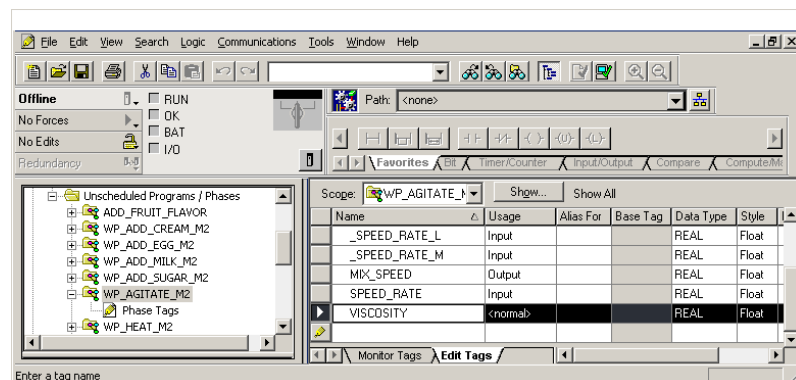
The Usage of this new Phase Tags is Input because it corresponds to the VISCOSITY parameter in the area model.

- \_SPEED\_RATE\_H, \_SPEED\_RATE\_L, and \_SPEED\_RATE\_M
- \_MIX\_SPEED\_H, \_MIX\_SPEED\_L, and \_MIX\_SPEED\_M

Parameter and report limit tags are created with a Usage of Input, because they represent data being sent from the FactoryTalk Batch Server to the controller.

## Deleted parameters and reports

When a parameter or report is deleted from a phase in the FactoryTalk Batch area model and synchronized to update the project, the Phase Tag remains in the Logix Designer project, but the Usage changes to <normal>.



## View synchronization issues

Under certain circumstances, a FactoryTalk Batch phase or a Logix Designer equipment phase cannot be synchronized. When this occurs, the **Synchronize with Logix5000:<data server name>** dialog box displays a **Resolution of Cannot Synchronize**.

### To view synchronization issues:

1. Select the phase that cannot be synchronized.
2. Select **Details** to see a message that explains why the phase cannot be synchronized. For a list of messages, see **Cannot Synchronize messages - create or update area model**.

## Cannot Synchronize messages - create or update project

This table lists the **Cannot Synchronize** messages in the Equipment Phase Synchronization Details dialog box for phases that exist in the FactoryTalk Batch area model:

Message	Description	How To Resolve
Batch phase name length exceeds Logix Designer limits.	The FactoryTalk Batch phase name is more than 40 characters.	Change the phase name in the area model to contain no more than 40 characters. Try synchronizing again.
Logix Designer equipment phase name cannot contain consecutive underbars.	Even though phase names can contain two or more consecutive underbars, these names cannot be created as equipment phases in Logix Designer through the synchronization process. For example, NP_ADD_FLAVOR, is not a valid name.	Change the phase name in the area model, removing the consecutive underbars, and then try synchronizing again. For example, the name NP_ADD_FLAVOR is a valid name because it contains only single underbars.
Batch parameter/report name exceeds Logix Designer limits	The name of a parameter or report on the Batch phase that the phase was instantiated from, is greater than 40 characters.	Change the parameter or report name in the area model to contain no more than 40 characters. Try synchronizing again.
Logix Designer parameter/report name cannot contain consecutive underbars.	Even though parameter and report names can contain two or more consecutive underbars, these names cannot be created as equipment phases in Logix Designer through the synchronization process. For example, ADD_AMOUNT, is not a valid name.	Change the phase name in the area model, removing the consecutive underbars, and then try synchronizing again. For example, the name ADD_AMOUNT is a valid name because it contains only single underbars.
Logix Designer name must contain only ASCII characters.	Logix Designer does not support the use of non-ASCII characters for the names of equipment phases, parameters, and reports. If a FactoryTalk Batch phase, parameter, report, or recipe phase the phase was created from, contains non-ASCII characters, cannot be synchronized.	Change the phase class, phase, parameter, or report name in the area model to contain only ASCII characters, and then try synchronizing again.







## Logix Designer equipment phases in the area model

To add a machine to an existing FactoryTalk Batch control system, create equipment phases for the machine in Logix Designer, and develop phase logic within those equipment phases. Test and validate the new machine before incorporating it into the FactoryTalk Batch system. Synchronize the Logix Designer project file with the area model to create corresponding phases in the FactoryTalk Batch area model.

After creating phases in the FactoryTalk Batch area model, integrate the new machine into the plant, bring the Logix5000 controller online with the updated Logix Designer project, and perform a warm restart of the FactoryTalk Batch Server to include the phases in the FactoryTalk Batch control system.

**IMPORTANT:** Starting in FactoryTalk Batch 15.00, the **Controller Program Name** property of a phase in the area model is used to link the area model phase with a specific **Equipment Phase** program in a Logix Designer project. When the Logix Designer project and the area model are synchronized the Controller Program Name determines which Equipment Phase in the Logix Designer project is used for comparison and synchronization. An area model phase and Logix Equipment Phase are considered to be the same (synchronized) when the following items match:

Logix Equipment Phase	Batch Area Model
Equipment Phase Name	Controller Program Name
Input Tag Name	Parameter Tag Name
Input Tag Type	Parameter Tag Type
Output Tag Name	Report Tag Name
Output Tag Type	Report Tag Type

This section describes how to synchronize the FactoryTalk Batch area model with the Logix Designer project file when equipment phases are created in Logix Designer and corresponding phases need to be created in FactoryTalk Batch Equipment Editor.

### Synchronize to create phases in the area model

Use these instructions to synchronize the area model to create phases.

#### Before you begin:

- Install Logix Designer and FactoryTalk Linx on the same computer as FactoryTalk Batch Equipment Editor.

- If the new phase is not added to an existing unit, create a unit to contain the new phase in FactoryTalk Batch Equipment Editor. Create a project file in Logix Designer and define equipment phases.
- In the area model, define a Logix5000 CIP data server for the Logix5000 controller that is connected to the new machine, and specify this project file. (See **Add a Logix5000 CIP data server** for more information.)
- In the area model, configure a unit instance to add the new phase to and a Logix5000 CIP data server for the controller specified in the project file.

### To synchronize to create phases in the area model:

1. Save the area model and select a data server to synchronize.
2. Select the phases to create in the area model.
3. Select a phase class and unit for the new phase and synchronize.

#### OR

Create a new phase class for the phase, select a unit, and synchronize.

All synchronization steps are completed in FactoryTalk Batch Equipment Editor.

## Save the area model and select a data server

Use these steps to begin synchronizing the area model with the Logix Designer project.

### To save the area model and select a data server:

1. From the **Edit** menu, select **Synchronize Logix5000 Data Servers**. The **Save Before Synchronization** dialog box opens.
2. Select **Save** to save the area model file now, or select **Continue Without Saving**.
  - If **Save** is selected, the **Save As** dialog box opens. Save the area model with its existing name or give it a different name.
  - After saving or continuing, the **Synchronize Logix5000 Data Servers** dialog box opens.
3. Select the data server that was added for the new Logix5000 controller.



Tip: Select any column headings to sort the list of data servers.

---

**IMPORTANT** The data server selected must have the project file specified.

---

4. Select **Continue**. The **Synchronize with Logix5000: <data server name>** dialog box opens.
5. Select the phases to create in the area model. Continue to **Select phases**.

## Select phases

Select phases on the **Synchronize with Logix5000: <data server name>** dialog box.

### To select phases:

1. The left pane of the **Synchronize with Logix5000: <data server name>** dialog box displays the phases in the project assigned to the selected data server. Only phases that exist in the Logix Designer project, but not in the area model display under **Logix Designer-only Equipment Phases**.



Tip: If other phases assigned to the selected data server exist in the area model but not in the project file, or are different from those in the project file, they also display in the left pane beneath the area model name, within their units.

2. Select a phase to create in the area model.
3. Select the **Resolution** box for the selected phase and select **Create in Area Model**.



Tip: If the only Resolution available is Cannot Synchronize, select Details to see a message that explains why the phase cannot be synchronized. (See View synchronization issues for more information.)

4. (optional) To view the selected phase configuration in FactoryTalk Batch and in Logix Designer, select **Details** to open the **Equipment Phase Synchronization Details** dialog box.  
Select **Close** when done viewing the phase details.
5. Repeat steps 2 - 4 for each phase in the area model.
6. On the **Synchronize with Logix5000:<data server name>** dialog box, select **Synchronize**. The **Select Phase and Unit** dialog box opens.
7. Name the new phase instance. You can use an existing phase class or provide a name for a new phase class and then select a unit to assign the new phase instance

Next, associate the new phase with an equipment phase and select a unit to contain it in the area model. Select an existing phase class in the area model or create a new one.

- To associate the phase with a phase that exists in the area model, continue on to [Select a phase and unit to synchronize](#).
- To create a new phase in the area model to associate with the phase, skip to [Create a new phase and select a unit](#).

## Select a phase and unit to synchronize

Use these instructions to select a phase and unit.

### To select a phase and unit to synchronize:

1. In the **Phase Classes** box, select a phase class to associate with the new phase. Select a phase class to display a list of units in the **Units** box.



Tip: The new phase is an instance of the phase class selected. Therefore, only phase classes that have the same parameters and reports as the new phase display.

2. In the **Units** box, select a unit to contain the new phase.



Tip: Only units that do not contain a phase based on the selected phase class are displayed, unless the selected phase is a material-based phase. A unit can only contain one phase based on a specific phase class, with the exception of material-based phase classes. Multiple phases based on a specific material-based phase class can be added in one unit.

3. Select **Continue**. If selected a **Resolution of Create in Area Model** for more than one phase, the **Select Phase and Unit** dialog box displays again for the next phase.

Repeat steps 1 - 3 or skip to **Create a new phase and select a unit** to create a new phase for the next phase.

When synchronization of all selected phases is complete, the **Synchronization Results Summary For Server: <data server name>** dialog box opens.



Tip: If Failed displays in the Result column, the reason displays in the Additional Information column.

4. Review the displayed results of the synchronization. Phases that have a **Result of Successful** were created in the area model. Additionally, the phase name selected for the phase and the new Equipment ID are returned to the Logix Designer project file.
5. If satisfied with the results, select **Yes** to save the Logix Designer project file.



Tip: If not satisfied with the results, select No. The synchronization changes are not saved in the Logix Designer project file.

The time and status of the synchronization displays in the **Synchronize Logix5000 Data Servers** window.

Status of Last Synchronization	Description
Complete	All Results were Successful, Yes was selected to save the project file.
Incomplete	Some Results Failed, Skipped, or No was selected to not save the project file.
Never Synchronize	Never been an attempt to synchronize the data server.

6. Select a data server and select **Continue** to begin the synchronization process again, or if finished synchronizing, select **Close**.

When **Close** is selected, the **Save After Synchronization** dialog box opens if changes were made to the area model.

7. Select **Save** to open the **Save As** dialog box and save the area model. Overwrite the area model or save it with a different name.

The phase has been added to the area model. View the new phase by navigating to the unit selected in step 2.

## Create a new phase class, phase, and select a unit

Use these instructions if you want to create a new phase class, phase, and select a unit instead of associating the phase with a phase class that exists in the area model.

## To create a new phase class, phase, and select a unit:

1. In the box beneath the **Phases** list, enter a name for the new phase class. A list of units displays in the **Units** box.
2. Select an icon to represent the new phase.
3. In the **Units** box, select a unit to contain the new phase.



Tip: Only units that do not contain a phase based on the selected phase class are displayed, unless the selected phase class is a material-based phase class. A unit can only contain one phase based on a specific phase class, with the exception of material-based phase classes. Multiple phases based on a specific material-based phase class can be added in one unit.

4. Select **Continue**. If selected a **Resolution** of **Create in Area Model** for more than one phase, the **Select Phase and Unit** dialog box displays again for the next phase.

Repeat steps 1 - 4 or see **Select a phase and unit** to select an existing phase class for the next phase.

When synchronization of all selected phases is complete, the

**Synchronization Results Summary For Server:<data server name>** dialog box opens.



Tip: If Failed displays in the Result column, the reason displays in the Additional Information column.

5. Review the displayed results of the synchronization. Phases that have a **Result** of **Successful** were created in the area model. Additionally, the phase name selected for the phase and the new Equipment ID are returned to the Logix Designer project file.
6. If satisfied with the results, select **Yes** to save the Logix Designer project file.



Tip: If not satisfied with the results, select No. The synchronization changes are not saved in the Logix Designer project file.

The **time** and **status** of the synchronization displays in the

**Synchronize Logix5000 Data Servers** window.

Status of Last Synchronization	Description
Complete	All Results were Successful, and Yes was selected to save the project file.
Incomplete	Some Results were Failed, Skipped, or No was selected to not save the project file.
Never Synchronized	Never been an attempt to synchronize the data server.

7. Select a data server and select **Continue** to begin the synchronization process again, or if finished synchronizing, select **Close**. The **Save After Synchronization** dialog box opens if changes were made to the area model.
8. Select **Save** to open the **Save As** dialog box and save the area model. Overwrite the area model or save it with a different name.
9. The phase class and new phase are added to the area model. View the new phase by navigating to the unit selected in step 3.

From this new Logix5000 CIP phase in FactoryTalk Batch Equipment Editor, open the corresponding equipment phase in Logix Designer to view and edit the phase logic. (See **Open an equipment phase in Logix Designer from**

**FactoryTalk Batch Equipment Editor** for more information.)

## Phases in the area model

If changes are made to equipment phases in the Logix Designer project and the corresponding phases in the area model need to be updated, synchronize the area model with the project file.

For example, if a phase tag is added or changed on the equipment phase in the Logix Designer project, apply the change to the corresponding phase classes and phases in the area model.

You cannot delete a phase by synchronizing the area model with the project. If an equipment phase is deleted in Logix Designer, you must manually delete the corresponding phase in FactoryTalk Batch Equipment Editor. Likewise, if a phase is deleted in FactoryTalk Batch Equipment Editor, you must manually delete the corresponding equipment phase in Logix Designer.

These types of changes to the equipment phase in the Logix Designer project can be transferred to the corresponding phase classes and phases in the area model through synchronization:

- Addition and removal of phase tags
- Changing the usage of a phase tag to Input or Output

**Note:** Starting with FactoryTalk Batch 15.00 you cannot change the equipment phase name through synchronization.

After any of these changes to the project file in Logix Designer are made, complete the steps in these sections to transfer these changes to the area model in FactoryTalk Batch Equipment Editor.

---

**IMPORTANT** Do not edit the phase tags containing a leading underscore (\_) in the Logix Designer project. If the Name, Usage, or Data Type of these phase tags in Logix Designer are changed, synchronization cannot be used to apply changes to the area model.

---

## Synchronize to update phases in the area model

Use these instructions to synchronize to update phases in the area model.



Tip: Only Logix Designer phases different from the phases in the area model display in the Synchronize with Logix5000: <data server name> dialog box.

### To synchronize to update phases in the area model:

1. Save the area model and select a data server to synchronize. See **Save the area model and select a data server** for more information.
2. Select the phase to update in the area model. See **Select phases and synchronize and FactoryTalk Batch phases in Logix Designer** for more information.

In this example, a phase tag was added to the NP\_AGITATE\_M2 equipment phase in the Logix Designer project. In the **Location** column, FactoryTalk Batch Equipment Editor and the Logix Designer

- symbols display for NP\_AGITATE\_M2, indicating that this phase exists in both places.
- (optional) To view the configuration details of the selected phase, select the phase and select **Details** to open the **Equipment Phase Synchronization Details** dialog box.
  - When finished, select the **Details**. After reviewing, select **Close**.
  - In the **Resolution** list, select **Update Area Model** for the phase to update the area model with the information from the Logix Designer project.
  - Repeat steps 2 - 4 for each phase to update.
  - Select **Synchronize**.

The **Affected Equipment Phases for Phase:<phase name>** opens if the area model contains other phases based on the same phase class as the phase being updated.

- Select **Continue** to apply the synchronization changes to all the phases listed.



Tip: If you want to cancel synchronization, select Skip.

The **Synchronization Results Summary For Server:<data server name>** opens.



Tip: If a Result Failed, the reason displays in the Additional Information column.

- Select **Close**. The **Save After Synchronization** dialog box opens if changes were made to the area model.
- Select **Save** to open the **Save As** dialog box and save the area model. Overwrite the area model or save it with a different name.

## View synchronization issues

Under certain circumstances, a FactoryTalk Batch phase or a Logix Designer equipment phase cannot be synchronized. When this occurs, the **Synchronize with Logix5000:<data server name>** dialog box displays a **Resolution of Cannot Synchronize**.

### To view synchronization issues:

- Select the phase that cannot be synchronized.
- Select **Details** to see a message that explains why the phase cannot be synchronized. For a list of messages, see **Cannot Synchronize messages - create or update area model**.

## Cannot Synchronize messages - create or update area model

This table lists the **Cannot Synchronize** messages in the **Equipment Phase Synchronization Details** dialog box for equipment phases that exist in Logix Designer:



Message	Description	How To Resolve
The configuration of this Logix Designer-only equipment phase contains values that can only be defined by FactoryTalk Batch Equipment Editor.	The equipment phase was originally created in the project file by synchronizing a FactoryTalk Batch phase that was configured with control strategies, material-based functionality, or limit tags. The corresponding FactoryTalk Batch phase class no longer exists in the area model.	Recreate the Phase Class in the area model with matching configuration and tags. Match the Phase Class name to the Recipe Phase name. Tip: See the Details of the Logix Equipment Phase for the recipe phase and parameter names. Then synchronize again, selecting the Create in Area Model Resolution.



## Data from FactoryTalk Batch Server

**IMPORTANT** The information in this section only applies to programming phase logic for PhaseManager phases assigned to a Logix5000 CIP data server.

PhaseManager phases created with a Logix5000 CIP data server, use the PXRQ instruction provided in Logix Designer as a means for the phase logic to request data or services from the FactoryTalk Batch Server. Much of the work involved with writing phase logic centers around defining a sequence of steps for a phase. Some of these steps require interaction with the FactoryTalk Batch Server. For example, the phase logic for a charge phase may perform these steps to add material to a unit:

STEP	Interacts with
Download target amount	FactoryTalk Batch Server
Acquire pump PM102	FactoryTalk Batch Server
Reset totalizer	Basic Control
Open valve FV101	Basic Control
Start pump PM102	Basic Control
Wait for totalizer to reach target	Basic Control
Stop pump PM102	Basic Control
Close valve	Basic Control
Release pump PM102	FactoryTalk Batch Server
Unload actual amount	FactoryTalk Batch Server

### Phase Logic programming model

This sequence describes the programming model that the phase logic typically needs to follow:

1. Prepare for request (set reports, for example).
2. (optional) Set any request parameters.
3. Set the request.
4. Wait for the Process Complete (.PC) bit to be set to one.



Tip: Allowing the phase logic to transition the phase to a terminal state (STOPPED, ABORTED, COMPLETE) without first verifying that the Process Complete (.PC) bit has been set to 1 (one) by the FactoryTalk Batch Server can result in future executions of the phase logic receiving faulty parameter data and can also result in the phase logic failing to release needed equipment.

### Download parameters (input parameters) request

During batch execution, phase logic can send a request to the FactoryTalk Batch Server to download all input parameter values, a single input parameter value, or a range of input parameter values, including phase parameter limits that exist.

The parameter values may be specified when adding a phase to a recipe using FactoryTalk Batch Recipe Editor. If the phase parameter value is not specified

when the recipe is built, the FactoryTalk Batch Server sends FactoryTalk Batch View a request for the value when a **Download Input Parameters** or **Download Input Parameters Subset** request is received from the phase. FactoryTalk Batch View requests the phase parameter value from the operator by way of an Unacknowledged Prompt.

Phase parameter tags array

When an equipment phase creates in the process controller, the input parameter tags defined in the area model are viewed by the FactoryTalk Batch Server as a logical array. When processing a download request, the phase parameter values write into the phase parameter array.

In the phase logic, identify a specific parameter by its parameter ID.

Types of download parameter requests

Using the PXRQ instruction, specify the **Download Input Parameters** external request for these types of requests:

- Download all parameters (input parameters)
- Download a range of parameters (input parameters)
- Download a single parameter (input parameter)

Specify the **Download Input Parameters Subset** external request for these types of requests:

- Download the parameters configured for download on start
- Download the parameters configured for download on transfer of control

The Data Values specified for the **Download Input Parameters** or the **Download Input Parameters Subset** request determine the type of request.

Download all parameters (input parameters)

Configure the PXRQ instruction in Logix Designer to download values for all configured input parameters to the input parameter array:

External Request	Data Value Array Element	Value
Download Input Parameters	DINT[0]	0

If control strategies are enabled, only those parameters assigned to the recipe’s control strategy will be downloaded. The control strategy parameter is Parameter1.

## Download a range of parameters (input parameters)

Configure the PXRQ instruction in Logix Designer to download values for a range of input parameters:

External Request	Data Value Array Element	Value
Download Input Parameters	DINT[0]	Parameter ID of the first parameter Example: 4
	DINT[1]	Number of parameters to download Example: 3

The FactoryTalk Batch Server downloads the range of parameter values, starting with the value associated with the requested parameter ID and the values of the phase parameters with incrementally higher parameter IDs, until the number of parameters downloaded matches the number of parameters requested. The parameter IDs need not increase sequentially.

In this example, three parameter values would be downloaded, beginning with parameter ID 4 and including these two parameters with sequentially higher parameter IDs.

If a phase parameter with the requested parameter ID has not been configured when receive a download request, the parameter ID increments by one and the phase parameter configured with that ID is obtained. This process repeats until the originally requested ID has been incremented up to 999. If the requested number of phase parameters is not found after the parameter ID increments to 999, the phase request fails. In the phase logic, use the PFL instruction to fail the batch if desired when a phase request fails.

If the phase associated with the parameter has enabled Control Strategies, only those parameters belonging to the enabled Control Strategy are included in the download.

## Download a single parameter (input parameter)

Configure the PXRQ instruction in Logix Designer to download the value for a single input parameter:

External Request	Data Value Array Element	Value
Download Input Parameters	DINT[0]	Parameter ID

The FactoryTalk Batch Server downloads a single value for the recipe parameter associated with the parameter ID and stores the value to the phase parameter array at the element specified by array index 1. If, when receives a download request, a phase parameter with the requested parameter ID has not been configured, the parameter ID increments by one and obtains the phase parameter configured with that ID. This process repeats until the originally requested ID increments up to 999. If the requested number of phase parameters is not found after the parameter ID increments to 999, the phase request failed. In the phase logic, use the PFL instruction to fail the batch if desired when a phase request fails.

## Download the parameters configured for download on start

To download values for input parameters configured for download on start:

External Request	Data Value Array Element	Value
Download Input Parameters Subset	DINT[0]	1

If the phase associated with the parameters has control strategies enabled, only those parameters belonging to **both** the enabled control strategy and the specified subset are included in the download.

## Download the parameters configured for download on transfer of control

To download values for input parameters configured for download on transfer of control:

External Request	Data Value Array Element	Value
Download Input Parameters Subset	DINT[0]	2

If the phase associated with the parameters has control strategies enabled, only those parameters belonging to **both** the enabled control strategy and the specified subset are included in the download.

## Download report limits

During batch execution, phase logic can send this request to the FactoryTalk Batch Server to download report limits information for all reports or for a single report.



Tip: A report in the FactoryTalk Batch software is an output parameter in the Logix Designer application.

Take corrective action if a report value is outside the configured limits.

The limit configuration consists of the report's verification method and each configured range of limits. The verification methods are written as values to the phase's phase tags. The values for the verification methods are:

Verification Method	Value
No_Limits	0
High / Low	1
High-High / Low-Low	2
High-High-High / Low-Low-Low	3

## Types of download report limits requests

Using the PXRQ instruction, specify the Download Output Parameters external request for these types of requests:

- Download all output parameter limits information
- Download the output parameter limits configuration for a single report

The Data Values specified for the Download Output Parameters request determine the type of request.

## Download all report limits information

To download all output parameter limits information to equipment phase tags:

External Request	Data Value Array Element	Value
Download Output Parameter Limits	DINT[0]	0

The FactoryTalk Batch Server downloads the entire phase's report limit configuration to the phase's limit tags.

## Download limits configuration for a single report

To download the limits configuration for a single report (output parameter):

External Request	Data Value Array Element	Value
Download Output Parameter Limits	DINT[0]	Report ID

The FactoryTalk Batch Server responds to the request by writing the verification method and report limits to the limit tags.

## Upload report overview

During batch execution, phase logic can send this request to the FactoryTalk Batch Server to upload all report values, a single report value, or a range of report values.



Tip: Reports are output parameters in Logix Designer.

## Report array

When an equipment phase creates in the process controller, the phase report parameter tags defined in the area model are viewed by the FactoryTalk Batch Server as a logical array.

When processing an upload request, the phase report values write into the phase report array.

In the phase logic identified a specific report by its report ID.

## Electronic batch record entries

The report values are combined with this information and written as entries into the electronic batch record. They are also stored in memory so they can be referenced by transition expressions.

- Batch ID
- Time/Date
- Phase Name
- Recipe Name
- Unit ID
- Engineering Units
- Process Cell
- Area
- Report Description

## Types of upload report requests

An output parameter is the result of the execution of a sequence or procedure. Use the PXRQ instruction to specify the **Upload Output Parameters** external request for these types of requests:

- Upload all output parameters (reports)
- Upload a range of output parameters (reports)
- Upload a single output parameter (report)

Specify the **Upload Output Parameters Subset** external request for these types of requests:

- Upload the output parameters configured for upload load on terminal state
- Upload the output parameters configured for upload on transfer of control

The Data Values specified for the **Upload Output Parameters** request determine the type of request.

## Upload all reports (output parameters)

Configure the PXRQ instruction in Logix Designer to upload values for all configured reports to the report array:

External Request	Data Value Array Element	Value
Upload Output Parameters	DINT[0]	0

If control strategies are enabled, only those reports assigned to the recipe's control strategy are uploaded.

## Upload a range of reports (output parameters)

Configure the PXRQ instruction in Logix Designer to upload values for a range of reports:

External Request	Data Value Array Element	Value
Upload Output Parameters	DINT[0]	Report ID of the first report Example: 4
	DINT[1]	Number of reports to download Example: 3

The FactoryTalk Batch Server uploads the range of parameter values, starting with the value associated with the requested report ID and the values of the



report with incrementally higher report IDs until the number of reports for which values are uploaded matches the number of reports requested. The report IDs need not increase sequentially.

In the example shown above, three report values would be uploaded, beginning with report ID 4 and including these two reports with sequentially higher report IDs.

If, when receiving an upload request, a phase report with the requested report ID not configured, the report ID increments by one and obtains the phase report configured with that ID. This process repeats until the originally requested ID increments up to 999. If the requested number of phase reports has not been found after the report ID increments up to 999, the phase request fails. In the phase logic, use the PFL instruction to fail the batch if desired when a phase request fails.

If the phase associated with the report has enabled Control Strategies, only those reports belonging to the enabled Control Strategy are included in the upload.

## Upload a single report (output parameter)

Configure the PXRQ instruction in Logix Designer to upload the value for a single report:

External Request	Data Value Array Element	Value
Upload Output Parameters	DINT[0]	Report ID

The FactoryTalk Batch Server downloads a single value for the report associated with the report ID and stores the value to the phase report array at the element specified by array index 1. The report ID assigns at the time a report creates within a phase in FactoryTalk Batch Equipment Editor. The report ID is a positive integer.

Requests to upload a report value refer to the report using a report ID. If, when receiving an upload request, a report with the requested report ID not configured, the report ID increments by one and obtains the report configured with that ID. This process repeats until the originally requested ID increments up to 999. If the requested number of reports is not found after the report ID incremented up to 999, the phase request failed. In the phase logic, use the PFL instruction to fail the batch if desired when a phase request fails.

## Upload the reports configured for upload on transfer of control

Configure the PXRQ instruction in Logix Designer to upload values for reports configured for upload on transfer of control:

External Request	Data Value Array Element	Value
Upload Output Parameters Subset	DINT[0]	2

Assign reports to this subset in FactoryTalk Batch Equipment Editor.

If the phase associated with the report parameters enabled control strategies, only those report parameters belonging to **both** the enabled control strategy and the specified subset will be included in the upload.

## Upload the reports configured for upload on terminal state

Configure the PXRQ instruction in Logix Designer to upload values for reports configured for upload on terminal state:

External Request	Data Value Array Element	Value
Upload Output Parameters Subset	DINT[0]	1

Reports are assigned to this subset in FactoryTalk Batch Equipment Editor.

If the phase associated with the reports enabled control strategies, only those reports belonging to **both** the enabled control strategy and the Upload on Terminal State subset will be included in the upload.

## Send message to the operator and clearing message requests

The set of possible messages that may be sent by the phase logic is configured when the associated phase is defined in the area model using FactoryTalk Batch Equipment Editor. Each operator message is configured with a message ID, a positive integer. Requests to send a message refer to the message using the message ID. During batch execution, phase logic can make a request to the FactoryTalk Batch Server to send a message to the FactoryTalk Batch View and place the message into the electronic batch record.

A **Send Message to Operator** request displays a message to the operator. In FactoryTalk Batch View, it displays on the **Phase Summary** screen. This type of request does not provide a mechanism to solicit information from the operator.

The phase logic can also be configured to send a **Clear Message to Operator** request. This request clears the currently displayed message.

## Send message to operator values

Configure the PXRQ instruction in Logix Designer to display a message to the operator in the FactoryTalk Batch Client:

External Request	Data Value Array Element	Value
Send Message to Operator	DINT[0]	Message ID

## Clear currently displayed message to operator values

Configure the PXRQ instruction in Logix Designer to clear the currently displayed message:

External Request	Data Value Array Element	Value
Clear Message to Operator	DINT[0]	0

## Acquire resource request

During batch execution, phase logic can issue a request to the FactoryTalk Batch Server to acquire a pre-configured resource. Each resource configured with FactoryTalk Batch Equipment Editor has an equipment ID, which is a positive integer. Requests to acquire a resource refer to the resource using the equipment ID.

Resources acquire when the Acquire Resources request issues. Acquired resources release either by the Release Resources phase request or when removed the phase step from the set of active steps in the recipe.

## Types of acquire requests

Using the PXRQ instruction, to specify the **Acquire Resources** external request for these types of requests:

- Acquire a Single Resource
- Acquire Multiple Resources

The data values specified for the **Acquire Resources** request determine which resources are acquired.

## Acquire a single resource value

Configure the PXRQ instruction in Logix Designer to acquire a single resource:

External Request	Data Value Array Element	Value
Acquire Resources	DINT[0]	Equipment ID

Acquire up to 99 resources with this request.

## Acquire multiple resource values

Configure the PXRQ instruction in Logix Designer to acquire multiple resources:

External Request	Data Value Array Element	Value
Acquire Resources	DINT[0]	Equipment ID
	DINT[1]	Equipment ID
	DINT[2]	Equipment ID

## Release resources

During batch execution, phase logic can issue a request to the FactoryTalk Batch Server to release a resource. Each resource configured with FactoryTalk Batch Equipment Editor has an equipment ID, a positive integer. Requests to release a resource refer to the resource using the equipment ID. Only resources that were previously acquired with an **Acquire Resources** phase request can be released using the **Release Resources** phase request.

## Types of release requests

Using the PXRQ instruction, specify the **Release Resources** external request for these types of requests:

- Release a Single Resource
- Release Multiple Resources
- Release All Currently Acquired Resources

The data values specified for the **Release Resources** request determine which resources are released.

## Release a single resource values

Configure the PXRQ instruction in Logix Designer to release a single resource:

External Request	Data Value Array Element	Value
Release Resources	DINT[0]	Equipment ID

The FactoryTalk Batch Server releases the resource specified by the equipment ID if the phase had previously acquired the resource through an **Acquire Resources** request.

## Release multiple resource values

Configure the PXRQ instruction in Logix Designer to release multiple resources:

External Request	Data Value Array Element	Value
Release Resources	DINT[0]	Equipment ID
	DINT[1]	Equipment ID
	DINT[2]	Equipment ID

Release up to 99 resources with this request. The FactoryTalk Batch Server releases the resources associated with the equipment IDs if this phase previously acquired the resources through an **Acquire Resources** request.

## Release all currently acquired resources values

Configure the PXRQ instruction in Logix Designer to release all currently acquired resources:

External Request	Data Value Array Element	Value
Release Resources	DINT[0]	0

The FactoryTalk Batch Server releases the resources associated with the equipment IDs if the resources had been previously acquired by this phase through an **Acquire Resource** request.

## Phase communication

Phases controlled by phase steps that belong to a synchronization group are able to communicate with each other. In fact, this defines the role of the synchronization group. Messages are sent between the phase steps within the synchronization group. Each message has a unique message ID, a positive integer. Requests to send a message to another phase through the synchronization group refer to the message using the message ID and the number of phases that will receive the message.

Phase communication can be used for these purposes:

- **Synchronization** - Ensures that multiple phases are in agreed upon states before they proceed. Since the phases can execute synchronization through this messaging function, no additional phase synchronization is implemented in the phase, unit, or batch executives.



Tip: Synchronization cannot be used in conjunction with FactoryTalk Batch's Transfer of Control feature.

- **Permissive** - Ensures that one phase of the synchronization group has passed a certain point in its phase logic before other phases can proceed.
- **Data transfer** - Moves data from one phase to another.

## Completion of messages

A **Send Message Wait** and a **Receive Message Wait** request pair is complete only if the message IDs for each of the calls are identical. This prevents messages from being routed to the improper request. Additionally, the **Send Message Wait** call must specify the number of receives confirmed as a parameter. This number allows for synchronization groups with more than two members.

## Process send and receive messages

Upon receiving the **Send Message** call, the FactoryTalk Batch Server stores the message into the message list and actively responds to outstanding or incoming **Receive Message Wait** calls from other phases within the synchronization group. When receiving a **Receive Message Wait** call from a phase of the synchronization group, the Server checks the message ID and completes the message if appropriate. Upon completion of the message transfer, the Server removes the message from the message list.

## Types of messages to other phases

Use the PXRQ instruction to specify the **Send Message to Linked Phase** external request for this type of request:

- Send a message to one or more linked phases

Specify the **Send Message to Linked Phase and Wait** for this type of request:

- Send a message to one or more linked phases and wait for a response

## Send a message to one or more linked phase values

Configure the PXRQ instruction in Logix Designer to send a message to one or more linked phases:

External Request	Data Value Array Element	Value
Send Message to Linked Phase	DINT[0]	message ID
	DINT[1]	number of phases to receive message
	DINT[2]	message value

The data value array can contain up to 97 message values.

## Send message to one or more linked phases and wait values

Configure the PXRQ instruction in Logix Designer to send a message to one or more linked phases and wait for a response:

External Request	Data Value Array Element	Value
Send Message to Linked Phase and Wait	DINT[0]	message ID
	DINT[1]	number of phases to receive message
	DINT[2]	message value

The data value array can contain up to 97 message values.

The receiving partners must issue a request before the data is sent. The sending partner may send the data at anytime. The sending phase waits for confirmation of the responses from the total number of receivers before continuing. The data is cached in the FactoryTalk Batch Server until the receiving partner(s) makes a request to receive the data.

## Message removal

The **Send Message to Linked Phase** call can be canceled by the phase logic that sent the message. The phase logic can remove the message by using the **Cancel Message to Linked Phase** request. Upon receiving the **Cancel Message to Linked Phase** request, the FactoryTalk Batch Server removes the message from the message queue and clears the request on the phase.

Use the PXRQ instruction to specify the **Cancel Message to Linked Phase** external request for these types of requests:

- Cancel a single message
- Cancel all messages

## Cancel a single message

Configure the PXRQ instruction in Logix Designer to cancel a single message that was sent to another phase:

External Request	Data Value Array Element	Value
Cancel Message to Linked Phase	DINT[0]	message ID

The FactoryTalk Batch Server cancels the message associated with the message ID. The message was previously issued using a **Send Message to Linked Phase** request.

## Cancel all messages

Configure the PXRQ instruction in Logix Designer to cancel all messages that were sent to another phase:

External Request	Data Value Array Element	Value
Cancel Message to Linked Phase	DINT[0]	0

The FactoryTalk Batch Server cancels all messages that were previously issued with a **Send Message to Linked Phase** request.

## Receive message from linked phase request

The **Receive Message from Linked Phase** request allows phase logic to notify the FactoryTalk Batch Server that it is prepared to receive a message or a set of messages from a linked phase. The Server scans the synchronization group for pending messages with matching message IDs. Configure the PXRQ instruction in Logix Designer to send a request to wait for a message from a linked phase:

External Request	Data Value Array Element	Value
Receive Message from Linked Phase	DINT[0]	message ID
	DINT[1]	message value
	DINT[2]	message value

The data value array can contain up to 97 message values. The Server copies the messages to the receiving phase from the phase(s) that issued the **Send Message to One or More Linked Phases and Wait** request or the **Send Message to One or More Linked Phases** request.



Tip: In certain scenarios, a PXRQ instruction that terminates (stops scanning) prior to completion may no longer function properly unless logic to handle the abnormal termination conditions is provided. To detect and handle abnormal termination of a PXRQ request, create logic in the equipment phase Resetting state routine.

For a description of scenarios that cause the PXRQ instruction to terminate abnormally, along with symptoms of the problem and instructions on how to implement the necessary Resetting logic, see the Abnormal Termination of PXRQ Instruction TechNote available on the Rockwell Automation KnowledgeBase.

## Download batch data values

While a batch processes, batch data may be downloaded to a specific parameter. The request must specify the parameter ID to which the batch data is to be downloaded.



**IMPORTANT** The 7600/17600 and 7700/17700 requests are exceptions to the rest of the requests in this category in that they do NOT require specifying the tag to which the data will be stored. Instead, the parameter Min and Max values are downloaded to the actual controller tags associated with the parameters on the phase itself. Note that the Min and Max values are downloaded for ALL the parameters on the phase without exception (including Strings and Enumerations).

The data type of the requested item must match the data type of the specified parameter.

Configure the PXRQ instruction in Logix Designer to download FactoryTalk Batch data to a specific parameter in the process controller:

External Request	Data Value Array Element	Value	Description
Download Batch Data	DINT[0]	1	Download customer-assigned or automatically-generated batch ID to specified tag number. FactoryTalk Batch Server downloads an ASCII - String value.
	DINT[1]	parameter ID in which to store the value	
Download Batch Data	DINT[0]	2	Download unique batch ID to specified tag number. FactoryTalk Batch Server downloads an Integer value.
	DINT[1]	parameter ID in which to store the value	
Download Batch Data	DINT[0]	3	Download phase equipment ID to specified tag number. FactoryTalk Batch Server downloads an Integer value.
	DINT[1]	parameter ID in which to store the value	
Download Batch Data	DINT[0]	4	Download a value to the specified tag number indicating whether the phase is under recipe control or manual phase control. FactoryTalk Batch Server downloads: 0 = Recipe Control 1 = Manual Phase Control
	DINT[1]	parameter ID in which to store the value	
Download Batch Data	DINT[0]	5	Download a value to the specified tag number indicating the current mode of the requesting phase. FactoryTalk Batch Server downloads: 0 = P-Auto 1 = O-Auto
	DINT[1]	parameter ID in which to store the value	
Download Batch Data	DINT[0]	6	Download all phase parameter MIN values to the controller tags associated with those parameters.
Download Batch Data	DINT[0]	7	Download all phase parameter MAX values to the controller tags associated with those parameters. This request actually downloads values for parameters that do not have Max and Min values, as defined in FactoryTalk Batch Equipment Editor> For example, parameters of type String and type Enumeration. For string parameters, the request downloads empty strings. For enumeration parameters, the request downloads a value of zero (0).

## Generate an electronic signature request

During batch execution, phase logic can issue a request to the FactoryTalk Batch Server to generate a Signature Request. Each Signature Template is

assigned a unique ID, which is a positive integer. Requests to generate a Signature specify the desired Signature Template ID. Configure the PXRQ instruction in Logix Designer to generate an electronic signature request:

External Request	Data Value Array Element	Value
Generate E Signature	DINT[0]	signature template ID
	DINT[1]	Defines if signature is able to be canceled: 0 = No non-zero = Yes

## PXRQ instruction values

This table displays a list of all the requests the phase logic can issue to the FactoryTalk Batch Server with the PXRQ instruction:

External Request	Data Value Array Element	Value	Description
Download Input Parameters	DINT[0]	0	Download all input parameters
Download Input Parameters	DINT[0]	Parameter ID	Download a single input parameter
Download Input Parameters	DINT[0]	Parameter ID of the first parameter	Download a range of input parameters
	DINT[1]	Number of parameters to download	
Download Input Parameters Subset	DINT[0]	1	Download input parameters configured for download on start
Download Input Parameters Subset	DINT[0]	2	Download input parameters configured for download on transfer of control
Download Output Parameter Limits	DINT[0]	0	Download all report limits
Download Output Parameter Limits	DINT[0]	Report ID	Download the report limits configuration for a single report
Upload Output Parameters	DINT[0]	0	Upload all reports
Upload Output Parameters	DINT[0]	Report ID	Upload a single report
Upload Output Parameters	DINT[0]	Report ID of the first report	Upload a range of reports
	DINT[1]	Number of reports to download	
Upload Output Parameters Subset	DINT[0]	1	Upload reports configured for upload on terminal state
Upload Output Parameters Subset	DINT[0]	2	Upload reports configured for upload on transfer of control
Send Message to Operator	DINT[0]	Message ID	Send a message to the operator. In the FactoryTalk Batch View, the message displays in the Phase Summary window.
Clear Message to Operator	not applicable	not applicable	Clears the currently displayed message
Acquire Resources	DINT[0]	Equipment ID	Acquire a single resource
Acquire Resources	DINT[0]	Equipment ID	Acquire multiple resources
	DINT[1]	Equipment ID	
	DINT[2]	Equipment ID	
Release Resources	DINT[0]	Equipment ID	Release a single resource
Release Resources	DINT[0]	Equipment ID	Release Resources
	DINT[1]	Equipment ID	
	DINT[2]	Equipment ID	
Release Resources	DINT[0]	0	Release all currently acquired resources

External Request	Data Value Array Element	Value	Description
Send Message to Linked Phase	DINT[0]	message ID	Send a message to one other phase or multiple phases
	DINT[1]	number of phases to receive message	
	DINT[2]	message value	
Send Message to Linked Phase and Wait	DINT[0]	message ID	Send a message to one or more linked phases and wait for a response
	DINT[1]	number of phases to receive message	
	DINT[2]	message value	
Receive Message from Linked Phase	DINT[0]	message ID	Send a request to wait for a message from another phase
	DINT[1]	message value	
	DINT[2]	message value	
Cancel Message to Linked Phase	DINT[0]	message ID	The FactoryTalk Batch Server cancels the message associated with the message ID. The message was previously issued using a Send Message to Linked Phase request.
Cancel Message to Linked Phase	DINT[0]	0	The FactoryTalk Batch Server cancels all messages that were previously issued with a Send Message to Linked Phase request.
Download Batch Data	DINT[0]	1	Download customer-assigned or automatically-generated batch ID to specified tag number. FactoryTalk Batch Server downloads an Integer value.
	DINT[1]	parameter ID in which to store the value	
Download Batch Data	DINT[0]	2	Download unique batch ID to specified tag number. FactoryTalk Batch Server downloads an Integer value.
	DINT[1]	parameter ID in which to store the value	
Download Batch Data	DINT[0]	3	Download phase ID to specified tag number. FactoryTalk Batch Server downloads an Integer value.
	DINT[1]	parameter ID in which to store the value	
Download Batch Data	DINT[0]	4	Download a value to the specified tag number indicating whether the phase is under recipe control or manual phase control. FactoryTalk Batch Server downloads: 0 = Recipe Control 1 = Manual Phase Control
	DINT[1]	parameter ID in which to store the value	
Download Batch Data	DINT[0]	5	Download a value to the specified tag number indicating the current mode of the requesting phase. FactoryTalk Batch Server downloads: 0 = P-Auto 1 = O-Auto
	DINT[1]	parameter ID in which to store the value	

External Request	Data Value Array Element	Value	Description
Download Batch Data	DINT[0]	6	Download all phase parameter MIN values to the controller tags associated with those parameters. This request actually downloads values for parameters that do not have Max and Min values as defined in the Equipment Editor, parameters of type String and type Enumeration for example. For String parameters, the request downloads empty strings. For Enumeration parameters, the request downloads a value of zero (0).
Download Batch Data	DINT[0]	7	Download all phase parameter MAX values to the controller tags associated with those parameters. This request actually downloads values for parameters that do not have Max and Min values as defined in the Equipment Editor, parameters of type String and type Enumeration for example. For String parameters, the request downloads empty strings. For Enumeration parameters, the request downloads a value of zero (0).
Generate E Signature	DINT[0]	signature template ID	Generate an electronic signature request.
	DINT[1]	Defines if signature is able to be canceled: 0 = No non-zero = Yes	

## How phase tag requests map to PXRQ requests

This table shows how the phase tag requests (PHASE\_RQ, PHASEQ01, PHASEQ02, PhaseQ03) correspond to the requests that can be made with the PXRQ instruction. Phase tag requests are used in the phase logic for OPC phases to request data and services from the FactoryTalk Batch Server. The PXRQ instruction is provided in Logix Designer for requesting data and services from the FactoryTalk Batch Server for PhaseManager equipment phases.

Since Parameter/Tag Locking is on for PhaseManager phases, the PXRQ instruction does not provide a way to make indirect requests.

Tag-Based Request (OPC)		PhaseManager PXRQ Request	
PHASE_RQ Phase Tag	PHASEQnn Data Values	External Request	Data Values
11000		Download Input Parameters	DINT[0] - 0

Tag-Based Request (OPC)		PhaseManager PXRQ Request	
PHASE_RQ Phase Tag	PHASEQnn Data Values	External Request	Data Values
11100	PHASEQ01 - Parameter ID of 1st phase parameter PHASEQ02 - Index into the phase parameter array PHASEQ03 - Number of values	Download Input Parameters	DINT[0] - parameter ID DINT[1] - number of values
11200	PHASEQ01 - Parameter ID	Download Input Parameters	DINT[0] - parameter ID
11500	PHASEQ01 - 1(Start) or 2(TOC)	Download Input Parameters Subset	DINT[0] - 1(Start) or 2(TOC)
11600		Download Output Parameter Limits	DINT[0] - 0
11601	PHASEQ01 - Parameter ID	Download Output Parameter Limits	DINT[0] - parameter ID
12000		Upload Output Parameters	DINT[0] - 0
12100	PHASEQ01 - Report ID of 1st report PHASEQ02 - Index into the phase parameter array PHASEQ03 - Number of values	Upload Output Parameters	DINT[0] - 0
12200	PHASEQ01 - Report ID	Upload Output Parameters	DINT[0] - report ID
12500	PHASEQ01 - 1(Terminal State) or 2(TOC)	Upload Output Parameters Subset	DINT[0] - 1(Terminal State) or 2(TOC)
13000	PHASEQ01 - Message ID	Send Message to Operator	DINT[0] - message ID
13100		Clear Message to Operator	
14000	PHASEQ01 - Equipment ID	Acquire Resources	DINT[0] - equipment ID
141NN (NN=number of resources to acquire)	PHASEQ01 - Equipment ID PHASEQ02 - Equipment ID PHASEQ03 - Equipment ID	Acquire Resources	DINT[0] - equipment ID DINT[1] - equipment ID DINT[2] - equipment ID
14200	PHASEQ01 - Equipment ID	Release Resources	DINT[0] - equipment ID
143NN (NN=number of resources to release)	PHASEQ01 - Equipment ID PHASEQ02 - Equipment ID PHASEQ03 - Equipment ID	Release Resources	DINT[0] - equipment ID DINT[1] - equipment ID DINT[2] - equipment ID
14400		Release Resources	DINT[0] - equipment ID
15000	PHASEQ01 - Message ID PHASEQ02 - Number of receivers PHASEQ03 - Message Value	Send Message to Linked Phase	DINT[0] - Message ID DINT[1] - Number of receivers DINT[2] - Message Value
15100	PHASEQ01 - Message ID PHASEQ02 - Number of receivers PHASEQ03 - Message Value	Send Message to Linked Phase and Wait	DINT[0] - Message ID DINT[1] - Number of receivers DINT[2] - Message Value
15500	PHASEQ01 - Message ID PHASEQ02 - Message Value 1 PHASEQ03 - Message Value 2	Receive Message from Linked Phase	DINT[0] - Message ID DINT[1] - Message Value 1 DINT[2] - Message Value 2
15300	PHASEQ01 - Message ID	Cancel Message to Linked Phase	DINT[0] - Message ID
15400		Cancel Message to Linked Phase	DINT[0] - 0

Tag-Based Request (OPC)		PhaseManager PXRQ Request	
PHASE_RQ Phase Tag	PHASEQnn Data Values	External Request	Data Values
171NN (NN = Tag number)		Download Batch Data	DINT[0] - 1 DINT[1] - tag number
172NN (NN = Tag number)		Download Batch Data	DINT[0] - 2 DINT[1] - tag number
173NN (NN = Tag number)		Download Batch Data	DINT[0] - 3 DINT[1] - tag number
174NN (NN = Tag number)		Download Batch Data	DINT[0] - 4 DINT[1] - tag number
175NN (NN = Tag number)		Download Batch Data	DINT[0] - 5 DINT[1] - tag number
17600 <sup>1</sup>		Download Batch Data	DINT[0] - 6
17700 <sup>1</sup>		Download Batch Data	DINT[0] - 7
17900	PHASEQ01 - signature template ID PHASEQ02 - Defines if signature is able to be canceled: 0 = No non-zero = Yes	Generate E Signature	DINT[0] - signature template ID DINT[1] - Defines if signature is able to be canceled: 0 = No non-zero = Yes

1. This request actually downloads values for parameters that do not have Max and Min values as defined in FactoryTalk Batch Equipment Editor, parameters of type String and type Enumeration for example.

For String parameters, the request downloads empty strings. For Enumeration parameters, the request downloads a value of zero (0).



## Data from the Material Server

Most of the data within FactoryTalk Batch Material Manager's material database is made available to the phase logic programmer for reading, some for writing, through the PXRQ instruction provided in Logix Designer. Access to the data requires two things: the controller ID for the database entity and the index of the data on that entity.

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**IMPORTANT** The information in this guide only applies to programming phase logic for PhaseManager phases assigned a Logix5000 CIP data server.

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The three classifications of data in the material database are materials, lots, and containers.

A lot is a description of an instance of a material. This description inherits the properties of the material it belongs to and assigns actual values to any properties having configured ranges.

A lot holds all of the static information about the lot, such as lot identifier, material type, lot state, engineering units, and controller ID value. A lot has a parent relationship to sublots, which contain the actual distributed quantity of the lot in a container.

There are two types of data for each classification:

- **Standard Attributes:** Standard attributes are materials, lots and containers.
- **Custom Attributes:** Custom attributes are the properties of the materials, containers, and lots defined in the material database. The priority used to select containers for use can also be accessed. Container priorities are runtime data dependent on the area model data uploaded into the database by the FactoryTalk Batch Server. They help the FactoryTalk Batch Server select a container to use given the material required, its feed type (addition or distribution), the unit and finally the container. This data is accessed with separate PCD interfaces from those used for standard attributes and custom attributes.

All of the data is accessible by an attribute ID which specifies a field.

When PhaseManager material phases are created with a Logix5000 CIP data server, use the PXRQ instruction provided in Logix Designer as a means for the phase logic to request data from the Material Server.



## Standard attributes

Standard attributes are attributes that exist by default on a data entity. The attribute ID for a standard attribute is the index.

## Material standard

Material standard attributes include:

## attributes

Name	Description	Data Type	Index	PLI Access
ID	Unique Primary Key for a material	Integer	1	Read
Name	Material name	String	2	Read
Controller ID	Integer ID for phase logic programmer to reference this material	Integer	3	Read
Description	Material description	String	4	Read/Write
EU	Engineering Units for measuring the material	String	5	Read
Inventory Key	Optionally used for storing an identifier for this material; used by third-party inventory control systems	String	6	Read
Last Edited By	The user ID (Windows logon) of the last user who changed material data	String	7	Read
Last Modification Date	The time a change was made to this material data	String	8	Read
Label Usage	Specifies that the selection of a container holding this material may be filtered by an assigned label. Labels used are: 1 - Batch ID 2 - Product Name 3 - Custom Name	String	9	Read
Classification	Designation of this material belonging to a particular class of materials. Classification is the ordinal of the Classification enumeration as defined by the Material Editor.	Integer	10	Read
MaterialGroupID	Primary key of the Material Group assigned to the material	Integer	11	Read
DefaultLotState ID	Primary key to the Lot State assigned to the material	Integer	12	Read

Lot standard attributes include:

## Lot standard attributes

Name	Description	Data Type	Index	PLI Access
ID	Unique Primary Key for a lot	Integer	1	Read
Name	Lot name	String	2	Read
Controller ID	Integer ID for phase logic programmer to reference this lot	Integer	3	Read
Description	Lot description	String	4	Read/Write
EU	Engineering Units for measuring the material. Note that this data actually resides on the Material and not the Lot. The Material Server business rules are expected to return the correct value.	String	5	Read
Inventory Key	Optionally used for storing an identifier for this lot; used by third-party inventory control systems	String	6	Read

Last Edited By	The user ID (Windows logon) of the last user who changed this material data	String	8	Read
Creation Date	Time this lot was entered into the database	String	8	Read
Depletion Date	The time when this lot was completely consumed	String	9	Read



Name	Description	Data Type	Index	PLI Access
Material	Material ID value	Integer	10	Read
State	The state of the lot 1 - Lot Available for Use	Integer	11	Read/Write
Quantity	Amount of material in the lot	Real	12	Read

## Container standard attributes

Container standard attributes include:

Name	Description	Data Type	Index	PLI Access
ID	Unique Primary Key for a container	Integer	1	Read
Name	Container name	String	2	Read
Controller ID	Integer ID for phase logic programmer to reference this container	Integer	3	Read
Description	Container description	String	4	Read/Write
EU	Engineering Units for measuring the material	String	5	Read
Capacity	The container's maximum capacity	Real	6	Read/Write
ContainerType	Container Type defines what type of container the user is dealing with. The possible values are: 1=Composite Container 2=Plug-Flow Container 3=Pallet Container	Integer	7	Read
StateID	The ID value that represents the current State of the Container. ID values correlate to the tbContainerState table.	Integer	8	Read/Write
Storage Location	The ID value for the Storage Location (zero if the container is not part of a storage location).	Integer	9	Read
Heel	The value (quantity) of the Container Heel (the amount of inventory that remains in a container after the accessible inventory has been removed).	Real	10	Read/Write

## Custom attributes

Custom attributes are user-defined properties of materials, lots or containers. Custom attributes can be accessed in addition to the standard attributes. Each property that is added in the FactoryTalk Batch Material Manager material database has a controller ID, which begins at 1000 and increments by 10. Several types of data are made available for each attribute, which are indexes.

The attribute ID of the custom attribute calculates from the controller ID plus the index.

	Field ID = 1	Field ID = 2	Field ID = 3	Field ID = 4	Field ID = 5
	ID	Name	Maximum	Minimum	EU
Controller ID = 1000	75394	pH- Factor	5.5	6.25	pH
Controller ID = 1010	58367	Density	154	165	grams/cm3

Maximum pH- Factor attribute ID is  $1000 + 3 = 1003$

Minimum Density attribute ID is  $1010 + 4 = 1014$

## Material custom attribute

Material custom attributes include:

Name	Description	Data Type	Index	PLI Access
ID	Unique Primary Key for a material attribute	String	1	Read
Name	Material property name of the	String	2	Read
Controller ID	The ID for this attribute	Integer	3	Read
Description	Material attribute description	String	4	Read/Write
EU	Engineering Units for measuring the material	String	5	Read
Data Type	The data type of the maximum and minimum values: Real = 0, Integer = 1, and String = 2	Integer	6	Read
Maximum	Maximum of the range of values acceptable for this material.	Real, Integer or String	7	Read
Minimum	Minimum of the range of values acceptable for this material	Real, Integer or String	8	Read

## Lot custom attribute

Lot custom attributes include:

Name	Description	Data Type	Index	PLI Access
ID	Unique Primary Key for a lot attribute	String	1	Read
Name	Lot property name	String	2	Read
Controller ID	The ID for this attribute	Integer	3	Read
Description	Lot attribute description	String	4	Read/Write
EU	Engineering Units for measuring the material	String	5	Read
Data Type	The data type of the maximum and minimum values: Real = 0, Integer = 1, and String = 2	Integer	6	Read
Maximum	Maximum of the range of values acceptable for this material.	Real, Integer or String	7	Read
Minimum	Minimum of the range of values acceptable for this material	Real, Integer or String	8	Read
Value	The attribute value.	Real, Integer or String	9	Read/Write

## Container custom attributes

Container custom attributes include:

Name	Description	Data Type	Index	PLI Access
ID	Unique Primary Key for a container attribute	String	1	Read
Name	Container property name	String	2	Read
Controller ID	The ID for this attribute	Integer	3	Read
Description	Container attribute description	String	4	Read/Write
EU	Engineering Units for measuring the contents of the container	String	5	Read
Data Type	The data type of the maximum and minimum values: Real = 0, Integer = 1, and String = 2	Integer	6	Read
Value	The attribute value.	Real, Integer or String	7	Read/Write

## Considerations for writing material phase logic

Writing phase logic for a material phase requires some additional consideration. The FactoryTalk Batch Server requires that a simple protocol be followed by the phase logic programmer to ensure that inventory levels are properly maintained within the material database and that the FactoryTalk Batch Event Journal contains entries identifying the inventory that was produced or consumed.

Protocol:

- The phase logic must request a download of the AMOUNT parameter.
- Before entering a terminal state (COMPLETE, STOPPED or ABORTED), the phase logic must upload the ACTUAL\_AMOUNT and FEED\_COMPLETE report parameters. 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. Deviating from this results in an error and the batch being HELD.
- The Automatic Upload/Download functionality can be used to meet this protocol requirement. When used, the AMOUNT parameter downloads by the FactoryTalk Batch Server before the phase starts and the ACTUAL\_AMOUNT and FEED\_COMPLETE report parameters uploads after the phase logic runs to a terminal state. This simplifies the writing of phase logic.

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**IMPORTANT** Uploading data into the material database has two constraints:

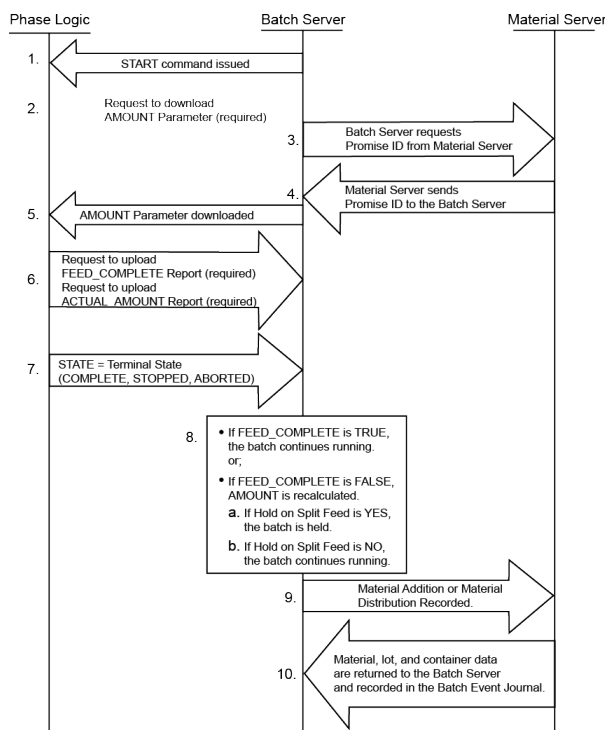
- Some fields are only editable at configuration time. Only fields that may be changed at runtime will support uploading values.
  - Security may limit the set of users allowed to modify the database. The FactoryTalk Batch Server service must have adequate permissions to store to the material database.
-



Tip: When the Automatic Upload function is enabled, the FactoryTalk Batch Server automatically uploads the appropriate report values when the batch transitions to a terminal state. If the FactoryTalk Batch Server stops while a material enabled phase uploads its report parameters, these report parameters upload again during a Warm or Warm All Batch Server Restart. This also occurs when a material enabled phase transitions to External while the report parameters are being uploaded. When the material enabled phase transitions back to Program mode, the report parameters are uploaded a second time. Sometimes this generates an error that puts the batch in Hold. Issue a clear failures command, restart the batch, and execution will proceed normally. To avoid this, disable the Automatic Upload function and perform report parameter uploads using phase logic requests.

## Phase process diagram

This diagram is an example of a phase process:



1. The command to START the phase is issued from the FactoryTalk Batch Server. The RUNNING program eventually begins.
2. The phase logic sends a request to download the AMOUNT parameter from the FactoryTalk Batch Server.
3. The FactoryTalk Batch Server requests a Promise ID from the Material Server. This establishes an accounting data entity for tracking the inventory used.
4. The Material Server returns SUCCESS for the Promise ID to the FactoryTalk Batch Server. This is used by the FactoryTalk Batch Server during warm restarts to restore the state of a batch if the FactoryTalk Batch Server failed as the batch was running.
5. The FactoryTalk Batch Server downloads the parameters to the phase logic. The PCD runs its program to perform a material addition or distribution.
6. The FEED\_COMPLETE and ACTUAL\_AMOUNT parameters are uploaded to the FactoryTalk Batch Server.

7. The phase logic transitions to a terminal state.



8. The value returned in the FEED\_COMPLETE report parameter, and the Hold on Split Feed configuration determine what recipe execution will do next:



Tip: Hold On Split Feed is set in the Material Policy tab in the Server Options dialog box in FactoryTalk Batch Equipment Editor.

- If FEED\_COMPLETE is TRUE, the batch continues running.
  - If FEED\_COMPLETE is FALSE, and Hold on Split Feed is YES, the batch is held.
  - If FEED\_COMPLETE is FALSE, and Hold on Split Feed is NO, the batch continues running.
9. The amount of the material addition or distribution is sent to the Material Server. The inventory levels in the material database are updated, and for material additions, the subplot or sublots of inventory used are identified.
10. Material, lot, and container data are returned to the FactoryTalk Batch Server and recorded in the FactoryTalk Batch Event Journal.

## FEED\_COMPLETE report parameter values

This table describes FEED\_COMPLETE report parameter values:

FEED_COMPLETE	HoldOnSplitFeed	Explanation
TRUE	N/A	The addition or distribution of the step completes so the SFC continues running.
FALSE	YES	The addition or distribution is not complete. The recipe is HELD to prevent the next step in the SFC from beginning to execute. The step must be rebound to proceed. The operator must perform an active step change away from the unfinished step, rebound the step manually, active step change back and restart the batch.
FALSE	NO	The addition or distribution is not complete. In the recipe, the material phase step should have been built within a loop with the transitions testing the value of the FEED_COMPLETE report as well as the value of the step.state attribute. When FALSE, the branch looping around to rerun the phase should be taken.

## Recipe execution requests

Use the PXRQ instruction in the phase logic to request these types of data available or meaningful only during Batch execution:

- Download Material Manager Data Container in Use
- Upload Material Manager Data Container in Use
- Download Container Binding Priority
- Upload Container Binding Priority
- Download Sufficient Material

These commands give the phase logic programmer access to the data of the material entities the phase logic interacts with.

The attribute ID for a standard attribute is the index. The attribute ID for a custom attribute is the sum of the controller ID and the index.

Summary of these recipe execution requests:

External Request	DINT[0]	DINT[1]	DINT[2]	Description
Download Material Manager Data Container in Use	1	Attribute ID	Array Index	Download data about the container currently in use.
Download Material Manager Data Container in Use	2	Attribute ID	Array Index	Download data about the current material inside the container currently in use.
Download Material Manager Data Container in Use	3	Attribute ID	Array Index	Download data about the current lot inside the container currently in use.
Upload Material Manager Data Container in Use	1	Attribute ID	Array Index	Upload data about the container currently in use.
Upload Material Manager Data Container in Use	2	Attribute ID	Array Index	Upload data about the current material inside the container currently in use.
Upload Material Manager Data Container in Use	3	Attribute ID	Array Index	Upload data about the current lot inside the container currently in use.
Download Container Binding Priority	Array Index			Download the current binding's container priority.
Upload Container Binding Priority	Array Index			Upload a new container priority for the current binding.
Download Sufficient Material	Array Index			Download data about sufficient material for step.

## Download data from container currently in use

Configure the PXRQ instruction to download material data from the container the phase currently runs against:

External Request	Data Value Array Element	Value
Download Material Manager Data Container in Use	DINT[0]	1
	DINT[1]	Data to download (attribute ID).
	DINT[2]	The phase parameter tag number the value downloads into.

## Upload container data into container currently in use

This request fails (without notice) if the data is read-only

Configure the PXRQ instruction to upload container data about the container the phase is currently running against.

External Request	Data Value Array Element	Value
Download Material Manager Data Container in Use	DINT[0]	1
	DINT[1]	Data to upload into (attribute ID).
	DINT[2]	Report tag address of the value stored in the material database.

## Download data from material in container currently in use

Configure the PXRQ instruction to download material data from the container the phase currently runs against:

External Request	Data Value Array Element	Value
Download Material Manager Data Container in Use	DINT[0]	2
	DINT[1]	Data to download (attribute ID).

External Request	Data Value Array Element	Value
	DINT[2]	The phase parameter tag number the value downloads into.

## Upload material data into material in container currently in use

This request fails (without notice) if the data is read-only.

Configure the PXRQ instruction in Logix Designer to upload material data about the current material inside the container the phase currently runs against.

External Request	Data Value Array Element	Value
Upload Material Manager Data Container in Use	DINT[0]	2
	DINT[1]	Data to upload into.
	DINT[2]	Report tag address of the value stored in the material database.

## Download data from lot in container currently in use

This request will not download a list of data.

### Identifying the lot

The LOT formula parameter does not need to be configured on the phase of the running phase. If the LOT formula parameter is used, it must have the lot name stored in it (either before or after binding occurred). This ensures that the correct lot is referenced. If the lot name is invalid or the material does not exist, the batch is held according to the configured hold propagation setting.

Finding the exact lot from which to get the information is simple for composite and plug-flow containers because only one subplot is accessible at a time. Pallets allow random access to sublots, so that when more than one lot of a material is stored on a pallet, the FactoryTalk Batch Server does not know which lot to retrieve data from unless there is only one lot on the pallet or the LOT formula parameter is specified.

Configure the PXRQ instruction to download lot data from the current material and current lot within the container the phase is currently running against.

External Request	Data Value Array Element	Value
Download Material Manager Data Container in Use	DINT[0]	3
	DINT[1]	Data to download (attribute ID).
	DINT[2]	The phase parameter tag number the value downloads into.

## Upload lot data into lot in container currently in use

This request fails if the data is read-only.

## Identifying the lot

The LOT formula parameter does not need to be configured on the phase of the running phase. If the LOT formula parameter is used, it must have the lot name stored in it (either before or after binding occurred). This ensures that the correct lot is referenced. If the lot name is invalid or the material does not exist, the batch is held according to the configured hold propagation setting.

Finding the exact lot from which to get the information is simple for composite and plug-flow containers because only one subplot is accessible at a time. Pallets allow random access to sublots, so that when more than one lot of a material is stored on a pallet, the FactoryTalk Batch Server does not know which lot to retrieve data from unless there is only one lot on the pallet or the LOT formula parameter is specified.

Configure the PXRQ instruction in Logix Designer to upload lot data into the current lot of the current material inside the container the phase currently runs against.

External Request	Data Value Array Element	Value
Upload Material Manager Data Container in Use	DINT[0]	3
	DINT[1]	Data uploads into (attribute ID).
	DINT[2]	Report tag address of the value stored in the material database.

## Download a container selection priority for the current binding

Configure the PXRQ instruction in Logix Designer to download the container selection priority for the material, container, feed type, and unit currently in use by this phase.

External Request	Data Value Array Element	Value
Download Container Binding Priority	DINT[0]	Phase parameter tag number.
	DINT[1]	
	DINT[2]	

The value is stored into a specified tag.

## Upload a container selection priority for the current binding

Configure the PXRQ instruction in Logix Designer to upload a new container selection priority for the material, container, feed type and unit currently in use by this phase.

External Request	Data Value Array Element	Value
Upload Container Binding Priority	DINT[0]	Report tag address of priority to be assigned.
	DINT[1]	
	DINT[2]	

## Download sufficient material data

Configure the PXRQ instruction in Logix Designer to download information regarding the availability of sufficient material, across all the valid binding candidates, to complete the addition before starting the material addition for the step.

External Request	Data Value Array Element	Value
Download Sufficient Material	DINT[0]	Phase parameter tag address of priority to be assigned.
	DINT[1]	
	DINT[2]	

The FactoryTalk Batch Server downloads one of these values about sufficient material for step:

Value	Description
0	Insufficient material was available across the valid binding candidates at the time the binding query was performed.
1	Sufficient material was available across the valid binding candidates at the time the binding query was performed.



Tip: When the FactoryTalk Batch Server runs without the Material Server, it returns a '0' or '1' depending on when communication is lost.

## Material database requests

Use the PXRQ instruction in the phase logic to request material data within the material database. These requests provide a means for accessing or storing a value to or from the material database. This provides the greatest flexibility for customization of phase logic and use of the database.



Tip: The data type in the controller must match the data type of the parameter or report ID specified in the data value array element DINT[1].

This is a summary of the material database requests:

External Request	DINT[0]	DINT[1]	DINT[2]	DINT[3]	DINT[4]	Description
Download Material Database Data	0	Parameter ID	Controller ID	Attribute ID		Download Material Attributes
Download Material Database Data	1	Parameter ID	Controller ID	Attribute ID		Download Lot Attributes
Download Material Database Data	3	Parameter ID	Controller ID	Attribute ID		Downloaded Container Attributes
Download Material Database Data	4	Parameter ID	Material ID	Container ID	Feed Type: 1-Addition 2-Distribution	Downloading Container Priority Assignments
Download Material Database Data	5	Report ID	Controller ID	Attribute ID		Uploading Material Attributes

Download	6	Report ID	Controller ID	Chapter 6	Data from the	Material Server
Material						Lot
Database						Attributes
Data						

External Request	DINT[0]	DINT[1]	DINT[2]	DINT[3]	DINT[4]	Description
Download Material Database Data	8	Report ID	Controller ID	Attribute ID		Uploading Container Attributes
Upload Material Database Data	9	Report ID	Material ID	Container ID		Uploading Container Priority Assignments

## Download one attribute of a material

Configure the PXRQ instruction in Logix Designer to download one attribute of a material to a specified tag. The attribute identified by the attribute ID downloads into the parameter ID specified.

External Request	Data Value Array Element	Value
Download Material Manager Database Data	DINT[0]	0
	DINT[1]	Parameter ID material data will be downloaded to.
	DINT[2]	Material Controller ID
	DINT[3]	Attribute ID



Tip: The data type in the controller must match the data type of the parameter ID specified in the data value array element DINT[1].

## Upload one attribute of a material

Configure the PXRQ instruction in Logix Designer to upload one attribute of a material from a specified report ID. The attribute identified by the attribute ID uploads from the specified tag into the database if security and write-protections allow. Only one value may be uploaded at a time.

External Request	Data Value Array Element	Value
Upload Material Manager Database Data	DINT[0]	5
	DINT[1]	Report ID material data uploads from.
	DINT[2]	Material Controller ID
	DINT[3]	Attribute ID



Tip: The data type in the controller must match the data type of the report ID specified in the data value array element DINT[1].

## Download lot attributes

Configure the PXRQ instruction in Logix Designer to download one attribute of a lot to a specified tag. The attribute identified by the attribute ID downloads into the parameter ID specified. Only one value may be downloaded at a time.

External Request	Data Value Array Element	Value
Download Material Manager	DINT[0]	1





	DINT[2]	Lot Controller ID
	DINT[3]	Attribute ID



Tip: The data type in the controller must match the data type of the parameter ID specified in the data value array element DINT[1].

## Upload lot attributes

Configure the PXRQ instruction in Logix Designer to upload one attribute of a lot from a specified report ID. The attribute identified by the attribute ID uploads from the specified tag into the database if security and write-protections allow. Only one value may be uploaded at a time.

External Request	Data Value Array Element	Value
Upload Material Manager Database Data	DINT[0]	6
	DINT[1]	Report ID lot data uploads from.
	DINT[2]	Lot Controller ID
	DINT[3]	Attribute ID



Tip: The data type in the controller must match the data type of the report ID specified in the data value array element DINT[1].

## Download container attributes

Configure the PXRQ instruction in Logix Designer to download one attribute of a container to a specified parameter ID. The attribute identified by the attribute ID downloads into the tag specified. Only one value may be downloaded at a time.

External Request	Data Value Array Element	Value
Download Material Manager Database Data	DINT[0]	3
	DINT[1]	Parameter ID container data downloads to.
	DINT[2]	Container Controller ID
	DINT[3]	Attribute ID



Tip: The data type in the controller must match the data type of the parameter or report ID specified in the data value array element DINT[1].

## Upload container attributes

Configure the PXRQ request in Logix Designer to upload one attribute of a container from a specified report ID. The attribute identified by the attribute ID uploads from the specified report ID into the database if security and write-protections allow. Only one value may be uploaded at a time.

External Request	Data Value Array Element	Value
Upload Material Manager Database Data	DINT[0]	8
	DINT[1]	Report ID that container data uploads from.
	DINT[2]	Container Controller ID
	DINT[3]	Attribute ID



Tip: The data type in the controller must match the data type of the report ID specified in the data value array element DINT[1].

## Download container priority assignments

Configure the PXRQ instruction in Logix Designer to download the Selection Priority of a container and load that value to a specified parameter ID. A container's selection priority is assigned given a material, container, feed type, and unit.

Feed type is the part of a material specification that defines how a material is to be used from the perspective of a batch. Material additions add material to a batch. Material distributions remove material from a batch. In the area model, the association between a phase and a container also defines the feed types supported between the two. In the master recipe, the feed type is defined as part of configuring a material addition or distribution step. A material phase step within a recipe may only be configured as an addition or a distribution, never both.

The first three parameters are defined by values in the request registers. The unit is restricted to the unit the phase is currently running in. Only one value may be downloaded at a time.

External Request	Data Value Array Element	Value
Download Material Manager Database Data	DINT[0]	4
	DINT[1]	Parameter ID that container's priority downloads to. Tag data type = Integer.
	DINT[2]	Material Controller ID
	DINT[3]	Container Controller ID
	DINT[4]	Feed Type: 1 = Addition. 2 = Distribution



Tip: The data type in the controller must match the data type of the parameter ID specified in the data value array element DINT[1].

## Upload container priority assignments

Configure the PXRQ instruction in Logix Designer to upload a Selection Priority for a container from a specified report ID. A container's selection priority is assigned given a material, container, feed type and unit. The first three parameters are defined by values in the request registers. The unit is restricted to the unit the phase is currently running in. Only one value may be uploaded at a time.

External Request	Data Value Array Element	Value
Upload Material Manager Database Data	DINT[0]	9
	DINT[1]	Report ID that container's priority uploads from.
	DINT[2]	Material Controller ID
	DINT[3]	Container Controller ID
	DINT[4]	Feed Type: 1 = Addition. 2 = Distribution.



Tip: The data type in the controller must match the data type of the parameter or report ID specified in the data value array element DINT[1].

## How phase tag requests map to PXRQ requests

This table shows how the phase tag requests (PHASE\_RQ, PHASEQ01, PHASEQ02, PHASEQ03) correspond to the requests that can be made with the PXRQ instruction. Phase tag requests are used in the phase logic for OPC and FactoryTalk Live Data (FTD) phases to request data and services from the FactoryTalk Batch Server, Material Server, or material database. The PXRQ instruction is provided in Logix Designer for requesting data and services from the FactoryTalk Batch Server, Material Server, or material database for PhaseManager equipment phases.

Since Parameter/Tag Locking is always on for PhaseManager phases, the PXRQ instruction does not provide a way to make indirect requests.



Tip: The data type in the controller must match the data type of the parameter or report ID specified in the data value array element DINT[1].

Tag-Based Request (OPC and FTD)		PhaseManager PXRQ Request	
PHASE_RQ Phase Tag	PHASEQnn Data Values	External Request	Data Values
17801	PHASEQ01 - Attribute ID PHASEQ02 - Index into the phase parameter array	Download Material Manager Data Container in Use	DINT[0] - 1 DINT[1] - Attribute ID DINT[2] - Index into the phase parameter array
17802	PHASEQ01 - Attribute ID PHASEQ02 - Index into the phase parameter array	Download Material Manager Data Container in Use	DINT[0] - 2 DINT[1] - Attribute ID DINT[2] - Index into the phase parameter array
17803	PHASEQ01 - Attribute ID PHASEQ02 - Index into the phase parameter array	Download Material Manager Data Container in Use	DINT[0] - 3 DINT[1] - Attribute ID DINT[2] - Index into the phase parameter array

Tag-Based Request (OPC and FTD)		PhaseManager PXRQ Request	
PHASE_RQ Phase Tag	PHASEQnn Data Values	External Request	Data Values
17811	PHASEQ01 - Attribute ID PHASEQ02 - Index into the phase parameter array	Upload Material Manager Data Container in Use	DINT[0] - 1 DINT[1] - Attribute ID DINT[2] - Index into the phase parameter array
17812	PHASEQ01 - Attribute ID PHASEQ02 - Index into the phase parameter array	Upload Material Manager Data Container in Use	DINT[0] - 2 DINT[1] - Attribute ID DINT[2] - Index into the phase parameter array
17813	PHASEQ01 - Attribute ID PHASEQ02 - Index into the phase parameter array	Upload Material Manager Data Container in Use	DINT[0] - 3 DINT[1] - Attribute ID DINT[2] - Index into the phase parameter array
17821	PHASEQ01 - Index into the phase parameter array PHASEQ02 - Any value greater than 0. Currently not used by FactoryTalk Batch Server. Reserved for future use.	Download Container Binding Priority	DINT[0] - Index into the phase parameter array
17822	PHASEQ01 - Index into the phase parameter array PHASEQ02 - Any value greater than 0. Currently not used by FactoryTalk Batch Server. Reserved for future use.	Upload Container Binding Priority	DINT[0] - Index into the phase parameter array
17831	PHASEQ01 - Index into the phase parameter array PHASEQ02 - Any value greater than 0. Currently not used by FactoryTalk Batch Server. Reserved for future use.	Download Sufficient Material	DINT[0] - Index into the phase parameter array
180NN NN=Parameter ID	PHASEQ01 - Material controller ID PHASEQ02 - Attribute ID PHASEQ03 - Any value greater than 0. Currently not used by FactoryTalk Batch Server. Reserved for future use.	Download Material Manager Database Data	DINT[0] - 0 DINT[1] - Parameter ID DINT[2] - Material Controller ID DINT[3] - Attribute ID
181NN NN=Parameter ID	PHASEQ01 - Lot Controller ID PHASEQ02 - Attribute ID PHASEQ03 - Any value greater than 0. Currently not used by FactoryTalk Batch Server. Reserved for future use.	Download Material Manager Database Data	DINT[0] - 1 DINT[1] - Parameter ID DINT[2] - Lot Controller ID DINT[3] - Attribute ID

183NN NN=Parameter ID	PHASEQ01 - Container Controller ID PHASEQ02 - Attribute ID PHASEQ03 - Any value greater than 0. Currently not used by FactoryTalk Batch Server. Reserved for future use.	Download Material Manager Database Data	DINT[0] - 3 DINT[1] - Parameter ID DINT[2] - Container controller ID DINT[3] - Attribute ID
Tag-Based Request (OPC and FTD)		PhaseManager PXRQ Request	
PHASE_RQ Phase Tag	PHASEQnn Data Values	External Request	Data Values
184NN NN=Parameter ID	PHASEQ01 - Material ID PHASEQ02 - Container ID PHASEQ03 - Feed Type: • 1 - Addition • 2 - Distribution	Download Material Manager Database Data	DINT[0] - 4 DINT[1] - Parameter ID DINT[2] - Material ID DINT[3] - Container ID DINT[4] - Feed Type: • 1 - Addition • 2 - Distribution
185NN NN=Report ID	PHASEQ01 - Material Controller ID PHASEQ02 - Attribute ID PHASEQ03 - Any value greater than 0. Currently not used by FactoryTalk Batch Server. Reserved for future use	Upload Material Manager Database Data	DINT[0] - 5 DINT[1] - Report ID DINT[2] - Material controller ID DINT[3] - Attribute ID
186NN NN=Report ID	PHASEQ01 - Lot Controller ID PHASEQ02 - Attribute ID PHASEQ03 - Any value greater than 0. Currently not used by FactoryTalk Batch Server. Reserved for future use	Upload Material Manager Database Data	DINT[0] - 6 DINT[1] - Report ID DINT[2] - Lot controller ID DINT[3] - Attribute ID
188NN NN=Report ID	PHASEQ01 - Container Controller ID PHASEQ02 - Attribute ID PHASEQ03 - Any value greater than 0. Currently not used by FactoryTalk Batch Server. Reserved for future use.	Upload Material Manager Database Data	DINT[0] - 8 DINT[1] - Report ID DINT[2] - Container controller ID DINT[3] - Attribute ID
189NN NN=Report ID	PHASEQ01 - Material ID PHASEQ02 - Container ID PHASEQ03 - Feed Type: • 1 - Addition • 2 - Distribution	Upload Material Manager Database Data	DINT[0] - 9 DINT[1] - Report ID DINT[2] - Material ID DINT[3] - Container ID DINT[4] - Feed Type: • 1 - Addition • 2 - Distribution





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Rockwell Otomasyon Ticaret A.Ş. Kar Plaza İş Merkezi E Blok Kat:6 34752, İçerenkÖy, İstanbul, Tel: +90 (216) 5698400 EEE Yönetmeliğine Uygundur

Connect with us.    

rockwellautomation.com — expanding human possibility™

AMERICAS: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

EUROPE/MIDDLE EAST/AFRICA: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

ASIA PACIFIC: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846