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# Table of Contents

## About This User Manual

About This User Manual

General ............................................................................................................................................. 15  
User Manual Conventions .................................................................................................................. 15  
  Warning, Caution, Information, and Tip Icons .................................................................................. 15  
Terminology ........................................................................................................................................ 16  
Released User Manuals and Release Notes ....................................................................................... 16  

## Section 1 - Introduction

Section 1 - Introduction

Batch Operation ................................................................................................................................... 19  
Procedure Function Chart .................................................................................................................. 22  
Resource Management ....................................................................................................................... 23  
Batch Production History .................................................................................................................. 25  
  Batch History Information .................................................................................................................. 25  
  Information Management .................................................................................................................. 27  
Online Recipe Editing ......................................................................................................................... 27  
Batch Profile Values ......................................................................................................................... 27  
Shutting Down Batch Server Workstations ......................................................................................... 28  

## Section 2 - Batch Scheduling

Section 2 - Batch Scheduling

Introduction ......................................................................................................................................... 29  
Batch Restart Issues ........................................................................................................................... 29  
Batch Overview Window ..................................................................................................................... 29  
  Column Headings .............................................................................................................................. 31  
    Batch ID ........................................................................................................................................ 32  
    Lot ID .......................................................................................................................................... 33  
    Campaign ID ................................................................................................................................. 33
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recipe ID</td>
<td>34</td>
</tr>
<tr>
<td>Priority</td>
<td>34</td>
</tr>
<tr>
<td>State</td>
<td>34</td>
</tr>
<tr>
<td>Mode</td>
<td>35</td>
</tr>
<tr>
<td>Scheduled Status</td>
<td>35</td>
</tr>
<tr>
<td>Batch Cell</td>
<td>36</td>
</tr>
<tr>
<td>Start Time</td>
<td>37</td>
</tr>
<tr>
<td>End Time</td>
<td>37</td>
</tr>
<tr>
<td>Elapsed Time</td>
<td>37</td>
</tr>
<tr>
<td>Comment</td>
<td>37</td>
</tr>
<tr>
<td>Estimated Time</td>
<td>37</td>
</tr>
<tr>
<td>Button Options</td>
<td>37</td>
</tr>
<tr>
<td>PFC</td>
<td>37</td>
</tr>
<tr>
<td>Status</td>
<td>37</td>
</tr>
<tr>
<td>Input</td>
<td>37</td>
</tr>
<tr>
<td>Add</td>
<td>38</td>
</tr>
<tr>
<td>Find</td>
<td>38</td>
</tr>
<tr>
<td>Cell Filter</td>
<td>38</td>
</tr>
<tr>
<td>Schedule a Batch</td>
<td>38</td>
</tr>
<tr>
<td>Batch Schedule Window</td>
<td>38</td>
</tr>
<tr>
<td>Schedule Tab</td>
<td>39</td>
</tr>
<tr>
<td>Procedure</td>
<td>40</td>
</tr>
<tr>
<td>Batch ID</td>
<td>40</td>
</tr>
<tr>
<td>Lot ID</td>
<td>41</td>
</tr>
<tr>
<td>Campaign ID</td>
<td>41</td>
</tr>
<tr>
<td>Comment</td>
<td>41</td>
</tr>
<tr>
<td>Scheduled Status</td>
<td>41</td>
</tr>
<tr>
<td>Start Time</td>
<td>42</td>
</tr>
<tr>
<td>Estimated Time</td>
<td>42</td>
</tr>
<tr>
<td>Priority</td>
<td>42</td>
</tr>
<tr>
<td>Mode</td>
<td>42</td>
</tr>
<tr>
<td>Batch Cell</td>
<td>42</td>
</tr>
</tbody>
</table>
Table of Contents

Schedule a Campaign ................................................................................................................. 43
Equipment .................................................................................................................................. 45
History Options Tab .................................................................................................................. 45
Scheduled Tab .......................................................................................................................... 47
Sequence Tab ............................................................................................................................ 47
Button Options ......................................................................................................................... 48
  Duplicate ................................................................................................................................. 48
  Parameters .............................................................................................................................. 49
  Apply ..................................................................................................................................... 51
Batch Scheduler Aspect ............................................................................................................. 51
Parameter Dialogs ...................................................................................................................... 52
  Searching a Parameter List ................................................................................................... 52
  Managing the Columns ........................................................................................................ 53
  Sorting .................................................................................................................................. 54
  Filtering ................................................................................................................................ 55

Section 3 - Batch Status

Introduction ................................................................................................................................. 57
Batch Information Window ......................................................................................................... 57
  Status Tab ............................................................................................................................... 59
  Command Tab ......................................................................................................................... 60
  History Options Tab ............................................................................................................... 61
  Events Tab .............................................................................................................................. 62
    Event List Subtab ................................................................................................................ 62
    Advanced Subtab .................................................................................................................. 63
  Tag Data Tab .......................................................................................................................... 64
  Reports Tab ............................................................................................................................. 65
Button Options .......................................................................................................................... 66
  Refresh ................................................................................................................................. 66
  Parameters ............................................................................................................................ 66
  Print ..................................................................................................................................... 66
  Input .................................................................................................................................... 66
  PFC .................................................................................................................................... 67
Section 4 - Procedure Function Charts
Introduction ..................................................................................................................... 69
Top Level PFC .................................................................................................................. 69
PFC Components ......................................................................................................... 70
   Objects .................................................................................................................. 70
   Start and End ...................................................................................................... 72
   Batch Manager Action .................................................................................... 72
   Phase .................................................................................................................. 74
   Procedure ........................................................................................................ 74
   Transition .......................................................................................................... 75
   Branch Start and Branch End .............................................................................. 75
   Parallel Start and Parallel End ............................................................................. 76
Connector Block ......................................................................................................... 77
Colors, Symbols, and Actions on PFC Blocks .......................................................... 78
   PFC Shapes ...................................................................................................... 78
   Actions ........................................................................................................... 81
   States ............................................................................................................. 83
   Modes ............................................................................................................. 87
   Conditions ...................................................................................................... 88
Exception Logic .......................................................................................................... 90
   Operator Display Changes .............................................................................. 91
   Special Exception Handling Functions ............................................................ 92
   Concluding Exception Handling Logic .............................................................. 92
      Active Normal Procedure Processing .......................................................... 92
      Not Active Normal Procedure Processing ................................................ 93
Accessing the PFC ........................................................................................................ 94
Procedure .................................................................................................................... 94
   Input ................................................................................................................. 94
   Batch Overview ............................................................................................... 94
   Parameters ...................................................................................................... 95
   Active Blocks .................................................................................................. 95
   Batch Parameters ............................................................................................ 96
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch Status</td>
<td>96</td>
</tr>
<tr>
<td>Header</td>
<td>96</td>
</tr>
<tr>
<td>Show IDs/Hide IDs</td>
<td>97</td>
</tr>
<tr>
<td>Pick Restart Point</td>
<td>98</td>
</tr>
<tr>
<td>Runtime Edit</td>
<td>99</td>
</tr>
<tr>
<td>Availability</td>
<td>99</td>
</tr>
<tr>
<td>Accessing</td>
<td>99</td>
</tr>
<tr>
<td>Editing</td>
<td>100</td>
</tr>
<tr>
<td>Continue Execution from the Point Where It Stopped</td>
<td>101</td>
</tr>
<tr>
<td>Continue Execution at a Selected Point</td>
<td>101</td>
</tr>
<tr>
<td>Cancel Runtime Edit</td>
<td>102</td>
</tr>
<tr>
<td>Save As</td>
<td>102</td>
</tr>
<tr>
<td>Display SOP</td>
<td>103</td>
</tr>
<tr>
<td>Top</td>
<td>104</td>
</tr>
<tr>
<td>Batch Variables</td>
<td>104</td>
</tr>
<tr>
<td>Change/Edit Variable</td>
<td>106</td>
</tr>
<tr>
<td>Add Variable</td>
<td>106</td>
</tr>
<tr>
<td>Delete Variable</td>
<td>106</td>
</tr>
<tr>
<td>Show GUID</td>
<td>106</td>
</tr>
<tr>
<td>Zoom</td>
<td>107</td>
</tr>
<tr>
<td>Equipment-Reserved</td>
<td>108</td>
</tr>
<tr>
<td>Equipment-Acquired</td>
<td>108</td>
</tr>
<tr>
<td>Equipment-Pending</td>
<td>108</td>
</tr>
<tr>
<td>PFC Block Status Window</td>
<td>108</td>
</tr>
<tr>
<td>Status Tab</td>
<td>110</td>
</tr>
<tr>
<td>Comment Tab</td>
<td>111</td>
</tr>
<tr>
<td>Button Options</td>
<td>111</td>
</tr>
<tr>
<td>Input</td>
<td>111</td>
</tr>
<tr>
<td>Configure</td>
<td>111</td>
</tr>
<tr>
<td>Parameters</td>
<td>112</td>
</tr>
<tr>
<td>Aspects</td>
<td>114</td>
</tr>
<tr>
<td>Faceplate</td>
<td>114</td>
</tr>
</tbody>
</table>
### Table of Contents

User Display ................................................................. 114
Errors .................................................................................. 114
Navigating in Multilevel PFCs.............................................. 116
Preview of Procedures....................................................... 117
  Parameters........................................................................... 117
  Approve Procedure............................................................ 117
  Edit Procedure..................................................................... 117
  Difference Report.............................................................. 117
  Print .................................................................................. 117
  Zoom ................................................................................ 118
Mouse and Keyboard Options........................................... 118

**Section 5 - Batch Monitoring**

Introduction ............................................................................. 121
Graphics .................................................................................. 121
Faceplates ............................................................................... 123
  Acquired/Released Status Indicators ................................. 127
  Mode Indicators ................................................................. 128
  Mode Buttons ...................................................................... 129
  State Indicators .................................................................. 129
  Signal Indicator ................................................................. 130
  Parameters and Attributes .................................................. 130
  Buttons in Element Area..................................................... 131
Optional Faceplate ............................................................... 131
Extended Faceplate Information........................................... 132
  ExInfo Tab (All Control Modules) ...................................... 132
  EquipInfo Tab (Phase Control Modules) ............................. 132
  Interlock Tab (All Control Modules) ................................. 133
  PhaseInfo Tab (Shared Equipment and Unit Control Modules)...... 134
  SysEngr Tab (Shared Equipment and Unit Control Modules) .... 134
Deployment ............................................................................ 135
Redundancy .......................................................................... 136
Phase Does Not Transition to Running ................................. 138
Procedure Does Not Transition to Next Phase .......................................................... 138
Additional Scenarios .................................................................................................... 139
  Scenario One - Phase Start Error ........................................................................ 139
  Scenario Two - Phase Start Error ........................................................................ 140
  Scenario Three - Acquire/Reserve/Select Equipment Error ............................ 140
  Scenario Four - Release/Unreserve/Deselect Equipment Error .................... 141
Server Shutdown ........................................................................................................ 141
Network Breakage ...................................................................................................... 141
  Hardware Failure .................................................................................................. 141
  Temporary Failure ............................................................................................... 142
Other Connectivity Servers ......................................................................................... 142
Batch Services ........................................................................................................... 142
Service Structure & System Status Viewer Representation ................................... 144

**Section 6 - Batch Equipment Status**

Introduction .................................................................................................................. 147
Equipment Overview Window ....................................................................................... 147
  Icons ...................................................................................................................... 148
  Column Headings .................................................................................................. 149
    Name .................................................................................................................. 149
    Batch ID ............................................................................................................ 149
    Lot ID ................................................................................................................ 149
    Campaign ID .................................................................................................... 150
    Status ................................................................................................................ 150
    Op Status ......................................................................................................... 150
    BM Error ......................................................................................................... 151
    Connection State ............................................................................................. 151
    Status - Controller ....................................................................................... 152
    Mode - Controller ......................................................................................... 152
    Batch ID - Controller ..................................................................................... 152
    ExceptionID - Controller ............................................................................ 152
    State - Controller .......................................................................................... 153
  Find Function ........................................................................................................ 153
Change Equipment Status ................................................................. 154

Equipment Information Tab ........................................................... 154
  Equipment .................................................................................. 155
  Controller Type ......................................................................... 155
  Status ..................................................................................... 155
  Operator status ......................................................................... 155
  Active Batch List ....................................................................... 155
  Pending Batch List ..................................................................... 155
  Reserve ................................................................................... 157
  Disable ................................................................................... 157
  Discard ................................................................................... 157

Equipment Attributes Tab ............................................................... 158

Equipment Commands Tab ............................................................ 159
  Equipment ................................................................................ 160
  Mode ...................................................................................... 160
  Current State .......................................................................... 160
  Command Buttons .................................................................... 160

View Procedure Function Chart ...................................................... 160

View Batch Status ......................................................................... 160

View Faceplate ............................................................................. 160

Inactive Equipment ....................................................................... 161

**Section 7 - Batch History Overview**

Introduction ................................................................................ 163

Batch History Overview Window .................................................... 163
  Columns .................................................................................... 164
  Button Options ......................................................................... 165

Batch History Information Window ............................................... 166
  Status Tab ............................................................................... 166
  Events Tab .............................................................................. 167
    Event List Subtab .................................................................... 167
    Advanced Subtab ................................................................... 168
  Tag Data Tab ........................................................................... 169
Reports Tab ........................................................................................................170
Button Options ...................................................................................................170

Appendix A - AC 800M/C Controllers
Introduction ........................................................................................................171

Appendix B - Harmony Connectivity
Introduction ........................................................................................................175
PHASEX Features .................................................................................................176
Debugger ................................................................................................................177
  Breakpoints .......................................................................................................178
  Change Operation ...............................................................................................179
  Change Phase Debugged ....................................................................................179
  Escape Loop .......................................................................................................180
  Find Specific Text ..............................................................................................180
  Go To Specific Line ...........................................................................................180
    Directly ...........................................................................................................180
    Execute Up To Line ........................................................................................180
    Variable Definition .........................................................................................181
  Line Tracking .....................................................................................................181
  Properties ...........................................................................................................181
  Remove Variables from Watch .........................................................................182
  Start Execution ...................................................................................................182
  Step Execution ....................................................................................................182
    Step Section ....................................................................................................182
    Step Level .......................................................................................................182
    Step Same ........................................................................................................183
  Stop Execution ...................................................................................................183
  View and Watch Variables ...............................................................................183
    View Program Variable ...................................................................................183
    Edit Program Variable ....................................................................................183
    Watch Program Variable .................................................................................184
    View Built-In Variable ....................................................................................184
# Table of Contents

Fault Codes................................................................................................................................. 184
Configuration .............................................................................................................................. 185
Runtime Fault Codes................................................................................................................. 186

## Appendix C - AC 870P / Melody Connectivity

Introduction ................................................................................................................................. 191
Error Messages ........................................................................................................................... 191
Protection Command Error Messages ...................................................................................... 193
Automatic Reset of Phases ......................................................................................................... 193
Abort Command .......................................................................................................................... 194
Reset of Stopped Phases ............................................................................................................. 194
Melody SFC Implementations ..................................................................................................... 195
Registry Settings ......................................................................................................................... 195
Additional Registry Settings ....................................................................................................... 197
Phase State Transition Matrix .................................................................................................... 197

## Appendix D - PDL Extractor

Introduction ................................................................................................................................. 201
Installing PDL Extractor ............................................................................................................ 201
Prerequisites ............................................................................................................................... 201
Extracting PDL Data .................................................................................................................. 202
Viewing PDL Extracted File ....................................................................................................... 204

## Appendix E - Simple Batch and Parameter Management

Introduction ................................................................................................................................. 205
Prerequisites ............................................................................................................................... 205
Procedure to Add / Schedule a Batch ...................................................................................... 205
Schedule a Batch from a non-800xA node ................................................................................ 210
Upgrade ....................................................................................................................................... 211

## Revision History

Updates in Revision Index A ........................................................................................................... 213

## Index
About This User Manual

General

Any security measures described in this user manual, for example, for user access, password security, network security, firewalls, virus protection, etc., represent possible steps that a user of an 800xA System may want to consider based on a risk assessment for a particular application and installation. This risk assessment, as well as the proper implementation, configuration, installation, operation, administration, and maintenance of all relevant security related equipment, software, and procedures, are the responsibility of the user of the 800xA System.

This User Manual describes how to operate the Batch Management system software.

User Manual Conventions

Microsoft Windows conventions are normally used for the standard presentation of material when entering text, key sequences, prompts, messages, menu items, screen elements, etc.

Warning, Caution, Information, and Tip Icons

This User Manual includes Warning, Caution, and Information where appropriate to point out safety related or other important information. It also includes Tip to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:

Electrical warning icon indicates the presence of a hazard that could result in electrical shock.
Warning icon indicates the presence of a hazard that could result in personal injury.

Caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard that could result in corruption of software or damage to equipment/property.

Information icon alerts the reader to pertinent facts and conditions.

Tip icon indicates advice on, for example, how to design your project or how to use a certain function.

Although Warning hazards are related to personal injury, and Caution hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, fully comply with all Warning and Caution notices.

Terminology

A complete and comprehensive list of terms is included in System 800xA System Guide Functional Description (3BSE038018*). The listing includes terms and definitions that apply to the 800xA System where the usage is different from commonly accepted industry standard definitions and definitions given in standard dictionaries such as Webster’s Dictionary of Computer Terms.

Released User Manuals and Release Notes

A complete list of all User Manuals and Release Notes applicable to System 800xA is provided in System 800xA Released User Manuals and Release Notes (3BUA000263*).

System 800xA Released User Manuals and Release Notes (3BUA000263*) is updated each time a document is updated or a new document is released. It is in pdf format and is provided in the following ways:

- Included on the documentation media provided with the system and published to ABB SolutionsBank when released as part of a major or minor release, Service Pack, Feature Pack, or System Revision.
• Published to ABB SolutionsBank when a User Manual or Release Note is updated in between any of the release cycles listed in the first bullet.

A product bulletin is published each time *System 800xA Released User Documents (3BUA000263*) is updated and published to ABB SolutionsBank.
Section 1 Introduction

Batch Management, the Batch Management add-on for the 800xA System is a powerful, flexible software used to configure, run, and manage Batch operations.

This instruction describes the operational aspects of Batch Management. Configuration details are provided in the System 800xA Batch Management Configuration (3BUA000146*). Batch Management supports 800xA for AC800M, 800xA for Harmony, 800xA for DCI, 800xA for Melody, and 800xA for MOD 300 connectivities.

Batch Operation

The batch operation functions of Batch Management are accessed from the Batch Overview window. This window provides a summary of all the batches in the production schedule. This window also offers the flexibility to manipulate the batches in the production schedule. Figure 1 shows a Batch Overview window.
Figure 1. Batch Overview Windows

This window lists detailed information about each batch including:

- Batch, lot, and campaign ID.
• Recipe ID.
• Batch priority.
• Batch cell.
• Mode of operation (automatic, manual, or semiautomatic).
• State (running, aborted, stopped, etc.).
• Scheduled status (not scheduled, scheduled, active, input pending).
• Comments.
• Start and end times.
• Procedure hierarchy with direct access to desired procedure level.

The Batch Overview window options include:
• Scheduling a new batch.
• Invoking the status window for a batch or subprocedure.
• Displaying the procedure function chart for a batch or subprocedure.
• Responding to pending messages for a batch.

The Batch Schedule and Batch Information status windows are accessible from the Batch Overview window. The schedule window enables the addition of batches in an efficient and user friendly manner. The Batch Schedule window options include:
• Scheduling a new batch.
• Scheduling a campaign of batches.
• Duplicating an existing batch.

The Batch Information status window provides batch status information and the ability to issue batch commands.
Procedure Function Chart

The procedure function chart is based on ISA S88 standards. Figure 2 shows the graphical representation of a typical procedure. The current status of each step is displayed by a unique combination of colors and symbols.

Figure 2. Procedure Function Chart Window

The procedure function chart window options include:

- Navigating to a higher or lower level of procedure function chart.
Section 1 Introduction

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

Resource Management

The resource management functions of Batch Management are accessed from the Equipment Overview window. This window displays the status of all batch equipment configured in the system as shown in Figure 3. At the overview level, the
following information is provided:

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

The Equipment Information window is accessible from the Equipment Overview window. The Equipment Information window can be invoked for any equipment on
the equipment overview. From this window, the following additional details are presented:

- Controller type.
- Attributes of the equipment including name, value (configured and runtime), engineering units, and description.
- Pending batch list (if applicable) containing batch ID, priority, and reservation time.

**Batch Production History**

A record of the batch alarms and events generated is maintained by the Batch Management software. This record is viewable using the Batch History Overview window. These alarms and events are also sent to the 800xA System event system. Information Management can access and organize this information into many different formats.

**Batch History Information**

Batch server events and tag data can be displayed in the Batch History Information window for each completed or terminated batch (Figure 4). Similar information for
active batches can also be accessed from the Batch Overview window. Batch reports also can be generated using Excel spreadsheets or Crystal Reports™.

Figure 4. Batch History Overview Windows
Information Management

The Production Data Log (PDL) history component of Information Management provides hierarchical history logs of batch data and events. Often when a batch is being produced, the information associations are not time related and cannot be preconcerted or anticipated. Information Management has built-in provisions for the organization, storage, and retrieval of this type of information. Information Management also organizes critical process data such as operator interventions, alarms, events (batch, controller, and system), numeric trend data, equipment usage, and batch start, stop, and duration times.

The information in Information Management is available to Microsoft Access®, Microsoft Excel, and other network-based report packages (e.g. Crystal Reports). Batch Management provides report templates that can be used to create very detailed custom Information Management reports.

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

Online Recipe Editing

System 800xA provides unique online recipe editing flexibility during batch execution. Without stopping the batch, it is possible to modify sequence and equipment assignments as well as recipe parameters. All changes made to the control recipe are automatically saved in the production record.

Batch Profile Values

The procedure editor settings (auto-alignment, snap, grid, etc.) for each user are saved in the Batch Profile Values aspect found in the User Structure\user_name object. This prevents having to reselect settings when working at different workstations.
Shutting Down Batch Server Workstations

The recommended procedure for terminating (shutting down) a Batch Server is to reboot the Batch Server workstation because rebooting properly stops all 800xA services.

If rebooting is not possible or desired, the Windows Batch Service should be stopped followed by the Batch Service in the Service Structure on the Batch Server workstation. To access Windows Batch Service:

Open Control Panel, click Administrative Tools, and then click Services.
Section 2  Batch Scheduling

Introduction

This section discusses the features and capabilities found in the Batch Overview window and the Batch Schedule window.

Batch Restart Issues

It is important to understand that batch commands only affect recipe blocks. The batch restart command for instance, restarts those blocks that can be restarted. Since there is no recipe block representing running equipment, batch cannot restart equipment.

The Start Only If Unit Normal phase configuration option can be used to further limit restart capabilities. Refer to the Equipment Configuration (Batch Advanced Templates) section of the System 800xA Batch Management Configuration (3BUA000146*) instruction for more information about this option.

Batch Overview Window

To access the Batch Overview window, select the Batch Overview aspect. By default a Batch Overview aspect is located in Library Structure\Batch Management\Overviews. However, this aspect can be added to any 800xA System object or a toolbar button can be used to open this window.

The Batch Overview window shows the status of active, scheduled, and unscheduled batches. Depending on the configuration, completed batches may also
be listed. The information is displayed as shown in Figure 5.

![Batch Overview Window](image)

**Figure 5. Batch Overview Window**

Batches can be expanded or contracted by:

- Selecting a closed or open folder.

- or -

- Selecting a folder’s corresponding + or - sign at lower levels.

To view all PFC levels:

1. Select the desired batch.

2. Right click the batch and select **Expand All**.

Refer to **Section 4, Procedure Function Charts** for further details.

At run time, the master recipe is copied to a control recipe. The control recipe is executed when producing a product. Any batch specific changes made by the operator impact the control recipe. Operator actions do not affect the master recipe.
Information displayed in the Batch Overview window can be sorted by a single column (standard Windows functionality), multiple columns, and direction within a column. To sort using multiple columns:

1. Select the heading of the first column to sort the information by. It will display the heading, a number 1, and direction arrows.
2. Select the sort order for the first column by selecting the appropriate arrow.
3. Press Ctrl and select the heading of the second column the information is to be sorted by. It will display.
4. Select the sort order for the second column by pressing Ctrl and selecting the appropriate direction arrow in the second column heading.
5. Repeat Step 3 and Step 4 for the remaining columns to be used to sort information.

To remove a column from the sort order:

1. Press Ctrl and right click the column heading.
2. Select End Sort from the context menu.

To cancel the sort, select a column heading or right click a column heading and select End Sort.

**Column Headings**

Information about each batch is displayed in columns. By default, the batches are sorted by batch ID when the window opens. The sort order, column order, and appearance of this window can be changed using standard Windows methods. The changes made by a user are saved for that user on this workstation.

The column headings are:

- Batch ID.
- Lot ID.
- Campaign ID.
- Recipe ID.
- Priority.
Section 2  Batch Scheduling

- State.
- Mode.
- Scheduled Status.
- Batch Cell.
- Start Time.
- End Time.
- Elapsed Time.
- Comment.
- Estimated Time.

**Batch ID**

Batch ID is a unique string used throughout the system to identify a batch. At a lower PFC level, batch ID indicates the label of the procedure, phase or BMA (batch manager action).

The icon colors (background square and inner circle) indicate the status of the batch or batch component. Refer to Table 1. Refer to the *System 800xA Batch Management Configuration (3BUA000146*) for information about changing the colors.

*Table 1. Default Status Icon Colors*

<table>
<thead>
<tr>
<th>Square Color/Inner Circle Color</th>
<th>Blink</th>
<th>Batch or Batch Component State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light gray/Black</td>
<td>No</td>
<td>Idle</td>
</tr>
<tr>
<td>Light gray/Black</td>
<td>Yes</td>
<td>Connecting¹</td>
</tr>
<tr>
<td>Green/White</td>
<td>No</td>
<td>Running</td>
</tr>
<tr>
<td>Dark gray/Green</td>
<td>No</td>
<td>Complete</td>
</tr>
<tr>
<td>Light green/Black</td>
<td>Yes</td>
<td>Pausing¹</td>
</tr>
<tr>
<td>Light green/Black</td>
<td>No</td>
<td>Paused</td>
</tr>
<tr>
<td>Light blue/Black</td>
<td>Yes</td>
<td>Holding¹</td>
</tr>
</tbody>
</table>
**Table 1. Default Status Icon Colors (Continued)**

<table>
<thead>
<tr>
<th>Square Color/Inner Circle Color</th>
<th>Blink</th>
<th>Batch or Batch Component State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light blue/Black</td>
<td>No</td>
<td>Held</td>
</tr>
<tr>
<td>Green/White</td>
<td>Yes</td>
<td>Restarting(^1)</td>
</tr>
<tr>
<td>Blue/White</td>
<td>Yes</td>
<td>Stopping(^1)</td>
</tr>
<tr>
<td>Blue/White</td>
<td>No</td>
<td>Stopped</td>
</tr>
<tr>
<td>Rust/White</td>
<td>Yes</td>
<td>Aborting(^1,2)</td>
</tr>
<tr>
<td>Rust/White</td>
<td>No</td>
<td>Aborted(^2)</td>
</tr>
<tr>
<td>Red/White</td>
<td>No</td>
<td>Error (for states ending in -ed)</td>
</tr>
<tr>
<td>Yellow/Black</td>
<td>No</td>
<td>Operator entry required (for states ending in -ed)</td>
</tr>
<tr>
<td>Red/Yellow</td>
<td>No</td>
<td>Error and operator entry required (for states ending in -ed)</td>
</tr>
<tr>
<td>Red/Black, White (-ed text), or -ed color/Black</td>
<td>Yes</td>
<td>Error (for states ending in -ing)</td>
</tr>
<tr>
<td>Yellow/Black or -ed color/Black</td>
<td>Yes</td>
<td>Operator entry required (for states ending in -ing)</td>
</tr>
<tr>
<td>Red/Black or Yellow/Black</td>
<td>Yes</td>
<td>Error and operator entry required (for states ending in -ing)</td>
</tr>
</tbody>
</table>

**NOTES:**
1. The blink color for the state is medium gray.
2. The abort state indicated by Batch Management may not reflect the actual S88 state of the phase in the controller.

**Lot ID**

Lot ID is an alphanumeric string used throughout the system to identify the lot of a batch, or campaign of batches.

**Campaign ID**

Campaign ID is a string used throughout the system to identify the campaign of a batch. Multiple batches using the same master recipe and parameter values can be scheduled simultaneously. This is called a batch campaign.
Section 2  Batch Scheduling

Recipe ID
Recipe ID is a name assigned to the recipe for a product during configuration. Usually this is the master recipe (recipe procedure) name. At a lower PFC level, recipe ID indicates the name of the procedure or phase.

Priority
Priority is a value used by the batch manager software to allocate equipment. The priorities are numbered one through 16. One is the highest priority while 16 is the lowest. The higher priority batches run first.

State
State defines the operating state of the active blocks at various levels in a batch. Possible states include idle, connecting, running, complete, pausing, paused, holding, held, restarting, stopping, stopped, aborting, and aborted. Refer to Table 2. N-State indicates a nonconsistent state.

Table 2. Operating States

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aborted</td>
<td>Active blocks are aborted. Aborted is one of the three possible final states of a batch. The others are complete and stopped.</td>
</tr>
<tr>
<td>Aborting</td>
<td>The abort command has been issued and the abort logic is being executed for the active blocks.</td>
</tr>
<tr>
<td>Complete</td>
<td>Execution of the active block has reached a normal conclusion. Complete is one of three possible final states for a batch. The others are aborted and stopped.</td>
</tr>
<tr>
<td>Connecting</td>
<td>Active blocks are trying to connect to the equipment phases.</td>
</tr>
<tr>
<td>Held</td>
<td>Hold logic has completed.</td>
</tr>
<tr>
<td>Holding</td>
<td>A hold command has been issued by the operator and the hold logic is being executed for the active blocks.</td>
</tr>
<tr>
<td>Idle</td>
<td>Active blocks have not started.</td>
</tr>
</tbody>
</table>
Section 2  Batch Scheduling

**Table 2. Operating States (Continued)**

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paused</td>
<td>Active blocks are paused.</td>
</tr>
<tr>
<td>Pausing</td>
<td>Operator has issued a pause command, but not all active blocks have been paused.</td>
</tr>
<tr>
<td>Restarting</td>
<td>A restart command has been issued and the restart logic is being executed for the active blocks.</td>
</tr>
<tr>
<td>Running</td>
<td>Active blocks are executing normally.</td>
</tr>
<tr>
<td>Stopped</td>
<td>Stop logic for the active blocks has completed. This is one of three possible final states for a batch. The others are complete and aborted.</td>
</tr>
<tr>
<td>Stopping</td>
<td>A stop command has been issued and the stop logic is being executed for the active blocks.</td>
</tr>
</tbody>
</table>

**Mode**

Mode defines the operating mode of the active blocks at various levels in a batch. Possible modes include automatic, manual and semiautomatic. Modes can be propagated down to lower levels by enabling the Propagate option. N-Mode indicates a nonconsistent mode. Refer to *Modes* on page 87 for further details.

**Scheduled Status**

Each batch has a status. The statuses are presented here in descending order of priority. The system uses the batch status priority order when determining which status will be displayed if the batch has more than one status simultaneously. A batch can have multiple applicable statuses in a recipe that uses parallel threads. At a lower PFC level, only Error, Input Pending and Breakpoint Reached are indicated. The statuses are Not Scheduled, Scheduled, Error, Input Pending, Breakpoint Reached, Equipment Wait, Partial Equipment Wait, Initial Equipment Wait,
Terminated, Complete and Active. Refer to Table 3.

Table 3. Scheduled Statuses in Descending Order of Priority

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Scheduled</td>
<td>A Batch ID has been assigned, a recipe has been selected, but the status in the Batch Schedule window has not been changed to scheduled.</td>
</tr>
<tr>
<td>Scheduled</td>
<td>A Batch ID has been assigned, the recipe selected, the status scheduled, and a future start time entered.</td>
</tr>
<tr>
<td>Error</td>
<td>A runtime error in the execution of the recipe has been encountered in one or more threads. The thread has stopped execution waiting for operator intervention.</td>
</tr>
<tr>
<td>Input Pending</td>
<td>One or more threads has stopped execution waiting for operator intervention. Intervention consists of answering messages.</td>
</tr>
<tr>
<td>Breakpoint Reached</td>
<td>One or more threads has reached a breakpoint in the recipe. The thread has stopped execution waiting for operator intervention.</td>
</tr>
<tr>
<td>Equipment Wait</td>
<td>All threads of the recipe are blocked waiting for equipment to be allocated.</td>
</tr>
<tr>
<td>Partial Equipment Wait</td>
<td>One thread of the recipe is blocked waiting for an equipment allocation but other threads of the recipe are executing.</td>
</tr>
<tr>
<td>Initial Equipment Wait</td>
<td>Start time of a scheduled batch has been reached, but execution of the first phase has not begun.</td>
</tr>
<tr>
<td>Terminated</td>
<td>Batch has been ended abnormally by the operator from the complete, stopped, aborted, or idle state.</td>
</tr>
<tr>
<td>Complete</td>
<td>Batch has completed normally.</td>
</tr>
<tr>
<td>Active</td>
<td>Batch is operating normally (without error, input pending, etc.).</td>
</tr>
</tbody>
</table>

**Batch Cell**

The batch cell specified when the batch was scheduled.
Section 2 Batch Scheduling

Start Time
Start time defines when the batch begins running or began to run. At a lower PFC level, start time defines when a procedure, phase or BMA began to run.

End Time
End time defines when the batch was completed or terminated. At a lower PFC level, end time is defined when a procedure, phase or BMA is finished.

Elapsed Time
Elapsed Time is the amount of time since the batch was started. At a lower PFC level, elapsed time defines the amount of time the procedure, phase or BMA has been running.

Comment
The comment entered when a batch is scheduled.

Estimated Time
Estimated time is an optional entry defining expected batch run time.

Button Options

PFC
Displays the procedure function chart (PFC) for the selected level of the batch. Refer to Section 4, Procedure Function Charts.

Status
Displays batch status or block status for the selected level of the batch. Refer to Batch Information Window on page 57 and PFC Block Status Window on page 108.

Input
Displays the active messages for the selected batch.
Add
Opens the Batch Schedule window which allows batches and campaigns to be scheduled. Refer to Batch Schedule Window on page 38.

Find
This text box is used to facilitate finding a batch. The Up and Down options specify the direction the find function will search.

Cell Filter
Use this filter to show the batches for a specific batch cell.

Schedule a Batch
Users can schedule a Batch in the following ways:

- Batch Schedule Window
- Batch Scheduler Aspect
- Simple Batch and Parameter Management (Batch Spreadsheet Scheduler)

Batch Schedule Window
The Batch Schedule window is used to schedule a batch and contains three tabs:

- Schedule
- History Options
- Scheduled
- Sequence

To schedule a Batch through a Batch Schedule window:

1. Click Add in the Batch Overview window.
2. Enter the appropriate information in the required Procedure, Batch ID, and Scheduled Status fields on the Schedule tab of the Batch Schedule window. Refer to Schedule Tab on page 39 for more information.
3. If necessary, enter the appropriate information in the remaining optional fields.

4. Select the type and level of details retained for the batches on the History Options tab. Refer to History Options Tab on page 45 for more information.

5. If desired, enter comments or instructions for the batch on the Comments tab.

6. If desired, click Parameters and edit the public procedure values. Refer to Parameters on page 49 for more information.

7. Click Apply to schedule the batch. The batch ID is checked for uniqueness and will not be scheduled if it is not unique. Refer to Apply on page 51 for more information.

Schedule Tab

The following topics describe information that can be specified on the Schedule tab (Figure 6) of the Batch Schedule window.

![Schedule Tab (Batch Schedule Window)](image)

Figure 6. Schedule Tab (Batch Schedule Window)
**Procedure**

The procedure name is a required string used throughout the system to identify the procedure used for a batch. Click the browse button and choose the procedure in the Select Procedure window.

**Batch ID**

Batch ID is a required, unique string used throughout the system to identify a batch. It is assigned by the operator directly (Manual option) or through the use of a configurable algorithm or pattern (Auto option). When using the Auto option, the Batch ID field displays the batch ID that will be used when the selected procedure is scheduled (when **Apply** is clicked).

In some instances (when using time in the pattern for example) the dynamic text used in the configurable pattern cannot be completely finalized until the batch is actually scheduled. In these instances, the Batch ID field contains only an approximation of the actual batch ID that will be used when the batch is scheduled.

After **Apply** is clicked, the batch is scheduled, the batch ID of the scheduled batch is displayed on the Scheduled tab, and the Batch ID field is updated to reflect the ID that will be used by the next scheduled batch.

Click **Auto Gen** to update the Batch ID field to the next ID using the configurable pattern. Refer to the *System 800xA Batch Management Configuration (3BUA000146*) for information about configuring batch ID patterns.

Click **Incr. Seq.** to increment the sequence number or change the sequence number manually on the Sequence tab.

When the batch is scheduled (**Apply** is clicked), the system checks the batch database to ensure that the batch ID is unique.

An asterisk to the left of the Batch ID field indicates a duplicate ID. In this case, manually enter a valid ID (Manual option enabled), click **Incr. Seq.** to increment the sequence number (Auto option enabled), or change the sequence number on the Sequence tab (Auto option enabled). Refer to **Table 4** for naming conventions and restrictions.
Table 4. Naming Conventions

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch ID</td>
<td>Valid characters: upper and lower case alphabetic, numbers 0 through 9, an underscore in lieu of a space. Autogenerated batch IDs will contain spaces if the recipe procedure name contains spaces. Maximum of 31 characters.</td>
</tr>
<tr>
<td>Lot ID</td>
<td></td>
</tr>
<tr>
<td>Campaign ID</td>
<td></td>
</tr>
</tbody>
</table>

Lot ID

Lot ID is an optional alphanumeric string used throughout the system to identify the lot of a batch, or campaign of batches. For naming conventions restrictions, refer to Table 4.

Campaign ID

Campaign ID is an optional string used throughout the system to identify the campaign of a batch. Multiple batches using the same master recipe and parameter values can be scheduled simultaneously. This is referred to as a batch campaign. For naming conventions restrictions, refer to Table 4.

Comment

The Comment option allows comments or instructions to be entered for this batch. Up to 30 characters can be viewed in the text entry box. To view or enter longer comments use the arrow keys to scroll the text or select the Comment tab. A text editor window will be displayed. Text typed in either place will be viewable in both locations.

Scheduled Status

The required scheduled status is used to specify that the batch or campaign is scheduled or not scheduled.

Click **Apply** in the Batch Schedule window to schedule a batch or campaign without first entering a start time different from the current time. The batch becomes active and begins running immediately if the scheduled status is set to scheduled.
Start Time

By default, the optional start time for the batch or campaign is the current time. To change the time, click the text entry window and change the start time which is entered in the format HH:MM:SS MM/DD/YY or click the ... button and select the appropriate start time.

Estimated Time

This optional entry is the amount of time the operator expects the batch to run. The entry must be a constant in the format DD HH:MM:SS.

In addition to the estimated run time displayed on the Batch Overview window representing the entire procedure, each block on the PFC can have its own elapsed time available for display.

Priority

The batch priority is used by the batch manager software to arbitrate between batches when allocating equipment. The batch priority can be specified. The priorities are numbered one through 16, with one having the highest priority. The higher priority batches run first. If a priority is not specified, the default of eight will be used. In a campaign, the same priority is assigned to every batch.

If two batches have the same priority, the one that requests the use of the equipment first will take precedence.

Mode

Mode defines the operating mode of the overall batch. A batch mode can be specified. If a batch mode is not specified, the default of automatic will be used. Possible modes include automatic, manual and semiautomatic. Refer to Modes on page 87 for a detailed description of the modes.

Batch Cell

Many cells can be named during configuration of the plant structure as described in the System 800xA Batch Management Configuration (3BUA000146*). Batch cell selection provides the ability to limit the selected procedure to specific cells.
cells are assigned during procedure configuration, all are available and the procedure can potentially run in any cell if the operator has permission there.

When an operator schedules the procedure, the Batch Management software will review the:

- List of cells available to the procedure.
- List of cells available to the operator’s login account.

The procedure will default to a default batch cell (configured in the default procedure configuration aspect) when it is scheduled if the operator has permission there. If the operator does not have permission in the default cell, the procedure will default to the first cell to which the operator’s login account provides access. This selection can be configured by the user.

If cells were assigned to a procedure during configuration, the operator must have access to at least one of the cells in order to schedule it. The cell in which the procedure is to run is specified in the Batch Cell field.

**Schedule a Campaign**

Multiple batches using the same master recipe and parameter values can be scheduled simultaneously. This is referred to as a batch campaign. A batch campaign is configured by specifying all the batch IDs for the batches in the campaign. The rest of the configuration decisions made using the Batch Schedule window Schedule tab will apply to all the batches in the campaign.

To configure a batch campaign:

1. Click **Add** in the Batch Overview window.
2. Select the procedure used for all the batches in the campaign on the Schedule tab.
3. Click **Campaign**. The Create Campaign (Figure 7) window is displayed.

![Create Campaign Window](image)

**Figure 7. Create Campaign Window**

4. Type the Batch IDs to be used in the campaign in this text box and click **OK**. Alternatively, provide several parameters (refer to Table 5), click **Add**, and the batch manager will assign batch IDs to batches using this information.

**Table 5. Campaign Text Fields**

<table>
<thead>
<tr>
<th><strong>Field</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Batches</td>
<td>Enter the number of batches in the campaign.</td>
</tr>
<tr>
<td>Prefix</td>
<td>Enter the fixed string to be used as the foundation of the batch ID.</td>
</tr>
<tr>
<td>Start</td>
<td>Enter the first number to be appended to the prefix.</td>
</tr>
</tbody>
</table>

5. Enter the appropriate information in the required Scheduled Status field on the Schedule tab.

6. If necessary, enter the appropriate information in the remaining optional fields.

7. Select the type and level of details retained for the batches on the History Options tab. Refer to **History Options Tab** on page 45 for more information.
8. If desired, enter comments or instructions for the batches on the Comments tab.

9. If desired, click Parameters and edit the public procedure values. This will affect all batches in the campaign. Refer to Parameters on page 49 for more information.

10. Click Apply to schedule the batch. The batch IDs are checked for uniqueness and will not be scheduled if it is not unique. Refer to Apply on page 51 for more information.

**Equipment**

All the batches in the campaign are scheduled when configuration of the Batch Schedule window is complete with the scheduled status set to scheduled and OK or Apply is clicked. If the procedure is configured to use only specifically named equipment, the batches will run sequentially based on the order of their IDs in the batch campaign window. If the procedure is configured to use any available equipment from specified groups, then two or more of the batches may run simultaneously, depending on the availability of the equipment.

Other batches not part of the campaign can also be queued to use the equipment.

**History Options Tab**

The History Options tab provides the ability to select the type and level of detailed data to be retained for a batch. Allowing unnecessary data to be discarded means that less disk space will be necessary to store the data. Select the History Options
tab to display the window shown in Figure 8.

Figure 8. History Options Tab (Batch Schedule Window)

Options associated with the following event types allow the retention or removal of information for:

- Operator changes (from Batch Management windows).
- All other Batch Management events (such as procedure starts and ends).

For batch manager actions and phases, option buttons permit the selection of one of the following levels for retaining data:

- None.
- Basic (PFC block name, start time, end time).
- Full (includes parameter values, and start and end times).

If Information Management is included in the system, the information selected in the History Options window will be stored in the production data log (PDL) and
message log on the Information Management server. The message log must be configured using the Information Management Services application. Refer to the appropriate Information Management instruction for more information.

Information Management also enables the viewing of process events and operator changes from sources external to Batch Management as well as attributes of an event (such as second authenticator of an operator change).

**Scheduled Tab**

The Scheduled tab in the Batch Schedule window lists the Batch IDs that have been scheduled. Batch IDs are added to this list after **Apply** is clicked on the Schedule tab. The Scheduled tab is shown in the Figure 9.

![Figure 9. Scheduled Tab](image)

**Sequence Tab**

The Sequence tab in the Batch schedule window is used to set the Sequence number for the Batch ID. While scheduling a Batch, users can set a new Sequence number that can be used while generating the Batch ID. The Sequence tab is shown in the Figure 10.
The three available buttons are:

- **Duplicate**.
- **Parameters**.
- **Apply**.

**Duplicate**

**Duplicate** in the Batch Schedule window copies the scheduling information of an existing batch. The drop-down list contains the existing batch IDs on the Batch Overview window. To copy the batch scheduling information associated with one of the batches, highlight the batch ID. Select the Schedule tab and the window will be...
updated to show the same batch ID, lot ID, campaign ID, comment, recipe ID, start time, estimated time, priority, and batch cell.

The new batch must have a unique batch ID.

**Parameters**

The procedure can be configured to include procedure parameter values that can be assigned when the batch is scheduled. During configuration of the procedure, parameters are defined as private or public. A private parameter value can only be assigned during procedure configuration. Private parameters are not available for the operator to view at run time. A public procedure parameter and its value can be viewed by the operator scheduling or running a batch. Depending on the access level of the procedure parameter, the value of a public procedure parameter can be changed from the default by the operator. Procedure parameter values can be specified using expressions, which can contain variables. Expressions, variables, and procedure parameter configuration are described in the *System 800xA Batch Management Configuration (3BUA000146)*.

If public procedure parameters have been configured as part of the procedure, clicking **Parameters** in the Batch Schedule window will open a window similar to that shown in **Figure 11**.
The public procedure parameters for the procedure will be listed in the window. Depending on access level, the operator can supply a new value (in the Expression column) and access level for any parameter or accept the default.

If the access level is changed to No Access, no user will be able to change the value of the parameter.

If a batch campaign is scheduled, any parameter values specified in the Batch Parameters window will affect all batches in the campaign.

If the access level is Not Configured (the default), it means that there are no restrictions on access. If the level is No Access, it means that the parameter can not be changed at run time.

To check public procedure parameter values, click Check in the Batch Parameters window. The system will check the validity of equipment names and perform range checks on constants. If any special checks were configured for the parameters during procedure configuration, these checks will be executed. If checking is successful, the newly entered values will be displayed in the Value column. Each
checked value will be preceded by an asterisk to distinguish it from the default value. If checking is unsuccessful, a window listing the errors will open.

Refer to the Parameter Dialogs on page 52 for the common operations that you can perform in the Batch, Procedure, Phase, and Block parameter dialog boxes.

Clicking OK in the Batch Parameter window will result in the modified parameter values being checked and the window being closed if checking is successful.

Once the batch is active, procedure parameters should not be changed through the scheduling window. These changes should take place from the operational displays.

Two types of parameters are associated with flexible batch processing using Batch Management. They are procedure parameters that are associated with a specific procedure and phase parameters that are associated with the equipment phase logic. Like procedure parameters, phase parameters can also be defined as public or private. Public phase parameters can be viewed by operators using Parameters on the block status window for a phase object on a PFC. Refer to Section 4, Procedure Function Charts for further details. Depending on the access level assigned to a phase parameter, it may be possible for the operator to change the value.

Apply

When assigning a batch ID, select a procedure, toggle the status button to Scheduled, and click Apply. The batch IDs will be checked for uniqueness and will not be scheduled if they are not unique.

Clicking Apply in the Batch Schedule window without first entering a start time different from the current time, causes the batch to begin running immediately if the schedule status is set to scheduled.

Batch Scheduler Aspect

A Batch can be scheduled using the Batch Scheduler Aspect if it has been configured. For more configuration information, refer to Appendix S: Batch Scheduler Aspect in System 800xA Batch Management Configuration Manual (3BUA000146*).
Figure 12 shows a typical Batch Scheduler Aspect Main View dialog.

![Batch Scheduler Aspect Main View Dialog](image)

**Figure 12. Batch Scheduler Aspect Main View Dialog**

### Parameter Dialogs

The following subsections describe the common operations that you can perform on Batch, Procedure, Phase and Block parameter dialog boxes.

#### Searching a Parameter List

To search any string in the parameter list, enter the search string in the **Search** text box. The search string is searched as soon as you begin to type the string through the visible columns in the active parameter dialog.

The matched strings are highlighted and a total number of matches is displayed. **Previous** and **Next** search buttons are provided to navigate between the search strings found. See **Figure 13**. Note that the special characters are not allowed in the search string.
Section 2  Batch Scheduling

Managing the Columns

To hide a column, right-click on the column and click Hide.

To unhide the column, right-click on any column and click UnHide. List of Available and Visible columns appear.
Once the hidden column (for example, Description column) is moved to the Visible Columns list you can move the column up or down to reorder for the Procedure Parameters window.

To reorder the column, you can even drag the column and reorder.

Use undo / redo to undo or redo your action.

**Sorting**

To sort on a column, click on the column to sort in ascending. Click again, if you want it to sort in descending order.

To remove sorting, right-click on a column and click RemoveSort.
Use \(<\)/\(<\)\) to undo or redo your action.

**Filtering**

To apply filter on any column, enter your filter string in the text box provided on top of the column (for example, *sleep* on **Parameter** column and *integer* on **Type** column).

![Filtering Example](image)

*Figure 16. Filtering columns*

The filtered list of parameters appear.

You can continue to filter on more than one column.

To clear all the filters, right-click and click **Clear Filter**.

Use \(<\)/\(<\)\) to undo or redo your action.

When filtered, paste operation cannot be performed.
Section 3  Batch Status

Introduction

This section covers the options available through the Batch Information window.

Batch Information Window

Additional information about a batch can be displayed through the Batch Information window (Figure 17). The Batch Information window contains six tabs: Status Tab, Command Tab, History Options Tab, Events Tab, Tag Data Tab, and Reports Tab.
To access the Batch Information window, select the desired batch listed in the Batch Overview window and click **Status**.

![Status Tab (Batch Information Window)](image)

*Figure 17. Status Tab (Batch Information Window)*
Status Tab

The Status tab is similar to the Schedule tab in the Batch Scheduler, with the information already filled in. Refer to Schedule Tab on page 39 for detailed information on:

- Batch ID.
- Lot ID.
- Campaign ID.
- Comment.
- Recipe ID.
- Batch Cell.
- Start Time.
- Estimated Time.

Refer to Column Headings on page 31 for details on end time and elapsed time.
Command Tab

Selecting the Command tab opens the window shown in Figure 18.

![Figure 18. Command Tab (Batch Information Window)](image)

This window is used to view the command status of the batch and issue new batch commands. Refer to Column Headings on page 31 and Actions on page 81 for detailed information on:

- Scheduled status.
- Mode.
- State.

The Scheduled Status field can be set to Schedule, Delete, or Terminate. A scheduled status of Schedule means that an added batch will be scheduled to be run. A scheduled status of Delete means that the added or scheduled batch will be
deleted. A scheduled status of Terminate means that the batch in final state (stopped, aborted, idle, or complete) will be deleted. Refer to Schedule Tab on page 39 for detailed information on start time and priority.

**History Options Tab**

This tab is similar to the History Options Tab on page 45 in the Batch Schedule window, with the information already filled in. Refer to Figure 19.

![Figure 19. History Options Tab (Batch Information Window)](image-url)
Events Tab

The Events tab (Figure 20) contains the Event List and Advanced subtabs.

![Events Tab](image)

*Figure 20. Events Tab (Batch Information Window)*

Event List Subtab

The Event List subtab is used to view the event record created automatically during batch executions. No data collected in this part of the window can be modified. This part of the window contains, (in time order), all batch events that have occurred during execution of the batch or during the time range specified on the Advanced subtab. However, the Events tab has a fixed amount of space in which to display the events. When all the events can no longer be displayed on the Events tab, the
message Event List Incomplete - Use Advanced Tab will be displayed. Narrow the time range specified on the Advanced tab to eliminate this message. The types of events recorded include:

- Procedure block start and parameter values.
- Procedure block end.
- Phase block start and parameter values.
- Phase block end.
- Batch manager actions and their results where applicable (for example, selected equipment, operator messages and replies).
- Runtime parameter changes.
- Identity of operator making runtime edits.
- Operator changes to the procedure state and mode.
- Operator comments entered in the block status windows.
- Breakpoint manipulations.
- Recipe errors.
- Block restarts.

**Advanced Subtab**

A time range for the collection of events is specified on this subtab. To view the events for a given time range, enter the start and end time in the following format and click Refresh.

\[
HH:MM:SS \quad MM/DD/YY
\]

The message List is for Time Range per Advanced Tab is displayed.
Tag Data Tab

The tag data portion of the batch database contains points that have one value per tag key name. The Tag Data tab (Figure 21) contains a list of the tag keyed data points and the value for each.

![Figure 21. Tag Data Tab (Batch Information Window)](image)

Data is selectively written into the tag data portion of the batch database through compute and data collection batch manager action (BMA) objects. The compute batch manager action uses the bdbput function to store data as tag data. Data collection batch manager actions that have a collection period of once will also store collected data as tag data.

Some tag names are reserved and automatically filled in by the system. Examples of items that fall into this category are:

- Recipe name and version number.
• SOP.
• Start time, end time and elapsed time.

Each data element in the tag key collected data section consists of:
• Name (tag key data point name).
• Time-stamp of the collection (collection time).
• Value.

To view details of a tag key data point in the list, select the data point and read the History Data Detail area.

**Reports Tab**

A printed batch report can be created containing information about a specific batch ID from this tab. Refer to Figure 22.

![Figure 22. Reports Tab (Batch Information Window)](image)

The Spreadsheet Logs area contains a list of the reports configured by the process engineer. The information in the reports is specified and formatted by the process engineer.
Select the report to print and click Print. A preconfigured Excel spreadsheet will be opened that can be viewed and printed.

**Button Options**

The five button options discussed are:

- **Refresh**
- **Parameters**
- **Print**
- **Input**
- **PFC**

**Refresh**

The **Refresh** button updates the window with current information and is only available from the Events and Tag Data tabs.

**Parameters**

The **Parameters** button is similar to the button located on the Batch Schedule window. For detailed information on parameters, refer to Parameters on page 49.

**Print**

This button allows data to be printed from Excel and is only available from the Events and Reports tabs. Refer to Reports Tab on page 65 for further details.

**Input**

This button provides for viewing pending messages associated with the batch. Clicking **Input** in the Batch Information window will have different effects depending on the quantity of pending messages. If there is only one message (or one set of messages configured to be displayed in the same message presentation window), a message presentation window will open. The format and content of the message presentation window depends on how the message was configured and the type of operator actions.
Messages can be routed to the 800xA System event page as condition events. These messages (events) can then be automatically acknowledged on the 800xA System event page by answering them from a Batch Management window. Refer to miscellaneous batch configuration in the *System 800xA Batch Management Configuration* (*3BUA000146*) for details on the routing of condition events (batch messages, breakpoints, errors, and system events) to the 800xA System event page.

If more than one message (or message sets) relating to the batch is pending, clicking **Input** in the Batch Information window will open the Pending Batch Inputs window shown in Figure 23.

![Pending Batch Inputs Window](image)

*Figure 23. Pending Batch Inputs Window*

The Pending Batch Inputs window contains a list of messages related to the batch that have not yet been displayed and, if necessary, replied to by the operator. To see a message, select the entry for it in the list. A window will open providing access to the full text of the message.

**PFC**

An important difference between the Batch Information window and the Batch Schedule window is that the PFC in the Batch Information window is used to display the top level procedure function chart for the procedure. From the top level PFC, PFCs for all other levels of the procedure can be accessed. The PFC is described in **Section 4, Procedure Function Charts**.
Section 4  Procedure Function Charts

Introduction

This section discusses how to use the procedure function chart (PFC).

Top Level PFC

The progress of an active batch can be monitored by watching a PFC. Refer to Figure 24. As the execution of the batch progresses, objects change color.

Figure 24. Procedure Function Chart
The significance of the objects and their colors are discussed later in this section. In this example, the top level PFC is used to represent a complex series of control actions in a simple format. Each block in the top level PFC represents a lower level PFC depicting a subprocedure, or a batch manager action.

Selecting a block will open up another window providing a more detailed view of the batch process. In turn, other deeper levels of the procedure may be nested within the subprocedures.

**PFC Components**

Each PFC is created especially for the process during configuration. Details concerning the meaning of objects on the PFC display must be provided by the process engineer.

**Objects**

The PFC consists of blocks representing parts of the procedure or batch manager actions. The following are the different types of objects:

- **Start and End**.
- **Batch Manager Action** (BMA).
- **Phase**.
- **Procedure**.
- **Transition**.
- **Branch Start and Branch End**.
- **Parallel Start and Parallel End**.
The left and right mouse buttons are used to navigate through the different levels and information windows of a PFC.

In the PFC, left click on:

- BMA block - opens a Block Status window (refer to PFC Block Status Window on page 108).
- Procedure block - opens the next child level PFC of that object.
- Start block - opens the next higher level PFC (if any).

In the PFC, various windows can be accessed through right click on different blocks:

- Phase block - Parameters window can be accessed. If it is an active phase, the aspect list of the control module and faceplate that represents the equipment phase can also be accessed.
- Procedure block - the Status and Parameter windows can be accessed.

The color of a block is significant and changes as the batch process proceeds. Symbols denoting the status of the block are also included in the blocks. The significance of the colors and symbols in the display is described in Colors, Symbols, and Actions on PFC Blocks on page 78.

Figure 25. PFC Object Types
Start and End

Each PFC and exception object must begin with a START object and end with an END object. Refer to Figure 26.

![Diagram of PFC and Exception Start and End Objects]

Figure 26. PFC and Exception Start and End Objects

When a standard procedure reaches an end object, the procedure stops executing.

An exception procedure may continue to execute repeatedly. Refer to Exception Logic on page 90 for more information on execution of exception procedures.

Batch Manager Action

The BMA object can represent one of many batch manager actions. The label on the BMA object is specified during procedure configuration. The BMA object is shown in Figure 25. The types of BMAs represented by the BMA object are presented in Table 6.

Table 6. Batch Manager Actions

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquire equipment¹</td>
<td>Acquires one or more pieces of equipment for a batch. The equipment will be marked as in use for the specific thread within the batch. No other thread in the batch (or any other batch) can use the equipment. The equipment overview displays the equipment as busy.</td>
</tr>
<tr>
<td>Command</td>
<td>Issues an operating system level command.</td>
</tr>
<tr>
<td>Compute</td>
<td>Assigns values to variables and evaluate expressions. It can also be used to dynamically invoke a procedure as specified during configuration.</td>
</tr>
<tr>
<td>Data collection</td>
<td>Collects data from the global database while running the batch.</td>
</tr>
</tbody>
</table>
### Table 6. Batch Manager Actions (Continued)

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deselect equipment¹</td>
<td>Deselects the equipment selected in the select equipment action. Performs a deselect on the equipment.</td>
</tr>
<tr>
<td>Message</td>
<td>Displays messages to the operator or to get input from the operator. Input may be in the form of a text message.</td>
</tr>
<tr>
<td>Print report</td>
<td>Generates a Batch Management batch report from within a procedure.</td>
</tr>
<tr>
<td>Release equipment¹</td>
<td>Frees equipment that was acquired previously.</td>
</tr>
<tr>
<td>Reserve equipment¹</td>
<td>Reserves a piece of equipment for use within a batch. The equipment will be marked as reserved in the equipment overview and cannot be used by another batch. The same equipment can be reserved multiple times within the same batch. However, each reserve should be paired with an unreserve.</td>
</tr>
<tr>
<td>Schedule job</td>
<td>Schedules the execution of predefined jobs listed in the Schedule Structure. Can be used to generate an Information Management batch report from within a procedure.</td>
</tr>
<tr>
<td>Select equipment¹</td>
<td>Instructs batch manager to select a piece of equipment from an equipment list of batch equipment available at run time based on selection criteria specified by the process engineer during system configuration. Performs a reserve on the equipment.</td>
</tr>
<tr>
<td>Sequence end</td>
<td>Marks the end of a sequence so that the batch manager know what information to download to the control system.</td>
</tr>
<tr>
<td>Sequence start</td>
<td>Downloads a control system with phase information for all phases between the sequence start and sequence end. The batch manager determines what phases are used and therefore what needs to be downloaded in the control system based on the configuration of the recipe. Phases between sequence start and sequence end will be executed without batch manager intervention (sequence completes even if network connection is lost).</td>
</tr>
<tr>
<td>Set SOP section</td>
<td>Sets the SOP section that is applicable to the current portion of the procedure.</td>
</tr>
</tbody>
</table>
Phase

The phase object shown in Figure 25 represents a phase of the procedure that is linked to an equipment phase. The equipment phase is defined during configuration of the equipment database. This phase object is associated with an equipment phase in the control system when the batch runs. By default, the label on the object is the name of the phase assigned to the object unless a different label is specified during procedure configuration.

Procedure

The procedure object shown in Figure 25 represents a subprocedure that is called by the procedure currently on display. If the ISA88 Option has been invoked at the site (described in the System 800xA Batch Management Configuration (3BUA000146*)), the subprocedure assigned to the procedure object must belong to the next lower category.

The various procedure types are given below:

- **Recipe Procedure**
  
  Top level of a procedure. A master recipe is the master copy of a recipe procedure on the system. Operators cannot modify the Master recipes. Instead, a copy of the recipe procedure is made at run time. This copy is known as the control recipe. Any changes to the procedure by the operator (parameter changes for example) impact only the control recipe, not the master recipe. The recipe procedure can contain unit procedures, operations, phases, batch manager actions, and exception procedures.

- **Unit Procedure**

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unreserve equipment¹</td>
<td>Returns one or more pieces of equipment to the pool of available equipment when the batch has finished with them.</td>
</tr>
</tbody>
</table>

NOTE:

1. BMA related to batch equipment allocation

Table 6. Batch Manager Actions (Continued)
Set of operations or phases that can be executed on an equipment. A unit procedure can contain operations, phases, and batch manager actions.

- **Operation**
  Phase or sequence of phase executions within an equipment. This can contain phases and batch manager actions.

- **Exception Procedure**
  This is a special type of subprocedure configured to monitor abnormal conditions. The exception procedure is used in parallel with any other procedure types.

The shape of various PFC blocks are listed in Table 7.

By default, the label on the object is the name of the subprocedure assigned to the procedure object unless a different label is specified during procedure configuration.

**Transition**

The transition object shown in Figure 25 represents a logical expression. When the execution of the procedure reaches a transition object, the batch manager will not allow the procedure to proceed until the expression becomes true.

The transition object can be used in a normal procedure or in an exception procedure. Based on this usage, the procedure execution continues after executing the transition object.

Normally, once the expression represented by the transition object becomes true and procedure execution continues, the transition object expression is not tested again. A transition object is always used as the first object in an exception procedure (after START). It is handled in a specific manner. Refer to Exception Logic on page 90 for details.

**Branch Start and Branch End**

The branch start and branch end (Figure 25) are used to represent the beginning and end of a logical branch in the processing. The branch start is usually followed by a transition object. As the procedure is executed, the processing will follow only the left-most branch that evaluates as true. The other branches will not be executed at all.
Parallel Start and Parallel End

The parallel start and parallel end objects (Figure 25) are used to represent the beginning and end of parallel processing. During parallel processing of normal procedure threads all of the parallel paths (threads) will be executed. Processing of the batch (procedure) will not be continued past the parallel end until all paths of the parallel processing have completed.

When exception logic is built into a procedure, parallel start and parallel end objects are always used to indicate which portion of the procedure has a parallel thread of exception logic (Figure 27). In this case execution of the normal thread is affected by whether or not one of the conditions monitored by the exception procedure becomes true, and then by how the exception logic is configured. Refer to Exception Logic on page 90 for details.

Figure 27. Procedure Function Chart Including Thread for Exception Logic
Connector Block

The connector shown in Figure 28 is used to link the objects in the PFC together. Connections define the sequence of the procedure execution. The direction of the flow of execution is in the direction of the arrow.

![Connector Block](image)

Figure 28. Connector Block

Right-click the Connector Block and the context menu appears (see Figure 29).

![Context Menu of Connector Block](image)

Figure 29. Context Menu of Connector Block

Select **Delete** to delete the connector.
Select **Properties** to format the connector. This includes the pattern, weight, and color of the connector (see Figure 30).

![Format Connector](image)

**Figure 30. Format Connector**

**Colors, Symbols, and Actions on PFC Blocks**

**PFC Shapes**

The main PFC shapes are shown in Table 7.

**Table 7. PFC Shapes**

<table>
<thead>
<tr>
<th>Shape</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Batch Manager Action" /></td>
<td>Batch manager action</td>
<td>Comes to a point in the right margin and contains no blackened corners.</td>
</tr>
<tr>
<td><img src="image" alt="Recipe Procedure" /></td>
<td>Recipe procedure</td>
<td>Contains an R in the right margin and two blackened corners.</td>
</tr>
<tr>
<td><img src="image" alt="Exception Procedure" /></td>
<td>Exception procedure</td>
<td>Contains an X in the right margin and one upper blackened corner.</td>
</tr>
</tbody>
</table>
Table 7. PFC Shapes (Continued)

<table>
<thead>
<tr>
<th>Shape</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="operation.png" alt="" /></td>
<td>Operation</td>
<td>Contains an O in the right margin and one lower blackened corner.</td>
</tr>
<tr>
<td><img src="phase.png" alt="" /></td>
<td>Phase</td>
<td>Contains a P in the right margin and no blackened corner. An asterisk before the P indicates that a pre-compute expression is present. An asterisk after the P indicates that a post-compute expression is present.</td>
</tr>
<tr>
<td><img src="unitprocedure.png" alt="" /></td>
<td>Unit procedure</td>
<td>Contains an U in the right margin and one upper blackened corner.</td>
</tr>
</tbody>
</table>

Four squares are located in each corner of the PFC shapes. Refer to Table 8.

Table 8. PFC Corner Descriptions

<table>
<thead>
<tr>
<th>Shape</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="upperleftcorner.png" alt="" /></td>
<td>Upper left corner</td>
<td>Indicates the operating mode.</td>
</tr>
<tr>
<td><img src="upperrightcorner.png" alt="" /></td>
<td>Upper right corner</td>
<td>Indicates the state.</td>
</tr>
</tbody>
</table>
As the procedure execution proceeds, the colors and symbols (in the corners of the blocks) change as the status of the blocks change. The colors of the blocks are configurable. Refer to the System 800xA Batch Management Configuration (3BUA000146*). The significance of the default colors and symbols are shown later in this section.

The following master recipe levels/control recipe levels can be configured/viewed using the procedure editor/batch manager in strict ISA88 implementation:

- Recipe procedures (which consist of unit procedures and exception procedures).
- Unit procedures (which consist of operations and exception procedures).
- Operations (which consist of phases and exception procedures).

The operations could be skipped. If so, the unit procedures would consist of phases.

The active blocks at each level are indicated by a green border representing batch manager mode. Additionally, phase blocks in local mode are indicated by a red border. In local mode, batch manager commands have no effect. A phase is placed in local mode from the equipment phase faceplate by an operator with the appropriate security.

<table>
<thead>
<tr>
<th>Shape</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Lower left corner" /></td>
<td>Lower left corner</td>
<td>Indicates the skipped, breakpoint set, and breakpoint reached conditions.</td>
</tr>
<tr>
<td><img src="image" alt="Lower right corner" /></td>
<td>Lower right corner</td>
<td>Indicates error and/or operator entry required conditions at a lower level.</td>
</tr>
</tbody>
</table>
**Actions**

It is possible (from the batch manager PFC display) to perform the following actions on a PFC block using the PFC block status window:

1. Use operating mode commands (automatic, manual, or semiautomatic) to change operating mode from any of the procedural elements levels (recipe procedure, unit procedure, operation or phase). If the propagate option is enabled, the mode selection will automatically be applied to all lower levels of the procedure.

2. From any of the procedural element levels (recipe procedure, unit procedure, exception procedure, operation, or phase) use the following state commands to change the state:
   - Start (start at beginning).
   - Stop.
   - Hold.
   - Restart.
   - Abort.
   - Pause.
   - Resume.

The reset command is issued implicitly by the batch manager in the appropriate places. Additionally, continue (continue at next) can be used to go from the current block to the next block if all the lower level procedural elements are in their final state.

In order to use start or continue from an operation or higher level, the PFC must be in the manual mode when these commands cause lower level blocks to be repeated or skipped.

The state commands propagate downward, but not upward. For example, if a command is invoked at the recipe procedure level all active phases will comply. If a command is invoked at the phase level, only that phase will comply.

The acceptable state commands from a higher level procedural element are dictated by the states of the lower level procedural elements.
If all the lower level procedural elements are at the same state, the state commands of the higher level procedural element are based on the allowable Batch Management state commands. Refer to Table 9.

**Table 9. Batch Management State Transition Matrix**

<table>
<thead>
<tr>
<th>Commands</th>
<th>State Transition Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial State</strong></td>
<td><strong>Normal End State</strong></td>
</tr>
<tr>
<td>Idle</td>
<td>Running</td>
</tr>
<tr>
<td>Running</td>
<td>Complete</td>
</tr>
<tr>
<td>Complete</td>
<td>Running(^3)</td>
</tr>
<tr>
<td>Pausing</td>
<td>Paused</td>
</tr>
<tr>
<td>Paused</td>
<td></td>
</tr>
<tr>
<td>Holding</td>
<td>Held</td>
</tr>
<tr>
<td>Held</td>
<td></td>
</tr>
<tr>
<td>Restarting</td>
<td>Running</td>
</tr>
<tr>
<td>Stopping</td>
<td>Stopped</td>
</tr>
<tr>
<td>Stopped</td>
<td>Running(^3)</td>
</tr>
<tr>
<td>Aborting</td>
<td>Aborted</td>
</tr>
<tr>
<td>Aborted</td>
<td>Running(^3)</td>
</tr>
</tbody>
</table>

**NOTES:**
1. This transition is only capable of being initiated from an equipment phase faceplate or interlocking logic for those controllers that require this capability. This is not a Batch Management batch manager initiated transition.
2. Additional transitions not identified in S88.
3. The start command issued from a batch manager window actually follows an implicit reset command issued by the batch manager.
4. The connecting state (not an S88 state) is not shown because it is a transient state that occurs when an active block tries to connect to an equipment phase. Issuing an abort, stop, hold, or pause command to a phase in the connecting state will cause the phase to go to the aborted state with error.
If all the lower level procedural elements are not at the same state, all state commands are allowed from the higher level procedural element. The batch manager will display an error if a command can not be implemented for a specific running phase.

**States**

Procedural elements can be in any of the following states:

- Idle.
- Running.
- Complete.
- Connecting.
- Pausing.
- Paused.
- Holding.
- Held.
- Restarting.
- Stopping.
- Stopped.
- Aborting.
- Aborted.
These states are shown with default colors and symbols in Table 10.

**Table 10. Background and Text Colors by State**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>State</th>
<th>Blink</th>
<th>Default Background Color/Text Color</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Idle" /></td>
<td>Idle</td>
<td>No</td>
<td>Light gray (246)/Black (28)</td>
</tr>
<tr>
<td><img src="image" alt="Connecting" /></td>
<td>Connecting¹</td>
<td>Yes</td>
<td>Light gray (246)/Black (28)</td>
</tr>
<tr>
<td><img src="image" alt="Running" /></td>
<td>Running</td>
<td>No</td>
<td>Green (10)/White (7)</td>
</tr>
<tr>
<td><img src="image" alt="Complete" /></td>
<td>Complete</td>
<td>No</td>
<td>Dark gray (250)/Green (65)</td>
</tr>
<tr>
<td><img src="image" alt="Pausing" /></td>
<td>Pausing¹</td>
<td>Yes</td>
<td>Light green (160)/Black (28)</td>
</tr>
<tr>
<td><img src="image" alt="Paused" /></td>
<td>Paused</td>
<td>No</td>
<td>Light green (160)/Black (28)</td>
</tr>
<tr>
<td><img src="image" alt="Holding" /></td>
<td>Holding¹</td>
<td>Yes</td>
<td>Light blue (6)/Black (28)</td>
</tr>
<tr>
<td><img src="image" alt="Held" /></td>
<td>Held</td>
<td>No</td>
<td>Light blue (6)/Black (28)</td>
</tr>
<tr>
<td><img src="image" alt="Restarting" /></td>
<td>Restarting¹</td>
<td>Yes</td>
<td>Green (10)/White (7)</td>
</tr>
<tr>
<td><img src="image" alt="Stopping" /></td>
<td>Stopping¹</td>
<td>Yes</td>
<td>Blue (75)/White (7)</td>
</tr>
<tr>
<td><img src="image" alt="Stopped" /></td>
<td>Stopped</td>
<td>No</td>
<td>Blue (75)/White (7)</td>
</tr>
<tr>
<td><img src="image" alt="Aborting" /></td>
<td>Aborting¹</td>
<td>Yes</td>
<td>Rust (120)/White (7)</td>
</tr>
<tr>
<td><img src="image" alt="Aborted" /></td>
<td>Aborted</td>
<td>No</td>
<td>Rust (120)/White (7)</td>
</tr>
</tbody>
</table>

**NOTE:**
1. The blink color for the state is medium gray (248).
2. The abort state indicated by Batch Management may not reflect the actual S88 state of the phase in the controller.

Additionally, states can be in the following conditions:
• Error.
• Operator entry required (answer messages).
• Error and operator entry required.

The conditions for the states ending in -ed (and Held) are shown in Table 11. The original state color is shown on the right side of the block.

Table 11. Background and Text Colors for States Ending in -ed

<table>
<thead>
<tr>
<th>Condition</th>
<th>Blink</th>
<th>Default Background Color/Text Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error</td>
<td>No</td>
<td>Red (42)/White (7)</td>
</tr>
<tr>
<td>Operator entry required</td>
<td>No</td>
<td>Yellow (3)/Black (28)</td>
</tr>
<tr>
<td>Error and operator entry required</td>
<td>No</td>
<td>Red (42)/Yellow (3)</td>
</tr>
</tbody>
</table>

These conditions are shown for the states ending in -ing in Table 12 with the colors in the top and bottom row being alternately blinked. The original state color is shown on the right side of the block.

Table 12. Background and Text Colors for States Ending in -ing

<table>
<thead>
<tr>
<th>Condition</th>
<th>Blink</th>
<th>Default Background Color/Text Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error</td>
<td>Yes</td>
<td>Red (42)/Black (28)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or White (7) (-ed text)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-ed color/Black (28) or White (7) (-ed text)</td>
</tr>
<tr>
<td>Operator entry required</td>
<td>Yes</td>
<td>Yellow (3)/Black (28)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-ed color/Black (28)</td>
</tr>
<tr>
<td>Error and operator entry required</td>
<td>Yes</td>
<td>Red (42)/Black (28)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yellow (3)/Black (28)</td>
</tr>
</tbody>
</table>

The state of each procedural element is displayed as the composite state of its current lower level procedural elements. If the states of its current lower level
procedural elements are not consistent (not the same state), the background color of the higher level state indicator is yellow.

The higher level procedural element displays the nonconsistent state of its current lower level procedural elements in the following order of precedence:

1. Aborting.
2. Stopping.
3. Holding.
4. Restarting.
5. Pausing.
6. Connecting.
7. Held.
8. Paused.
9. Running.
10. Aborted.
11. Stopped.
12. Complete.
13. Idle.

If there are no current lower level procedural elements, the higher level element:

• Displays Idle if no lower level procedural element has run.

- or -

• Latches its last current state.

**Modes**

The following modes occur in conjunction with the states (described in States on page 83) and conditions (described in Conditions on page 88). They are depicted
with the symbols shown in Figure 31.

![Operating Mode Symbols]

**Figure 31. Operating Mode Symbols**

In **automatic mode**, procedural elements automatically execute sequentially through the procedure steps when the transition condition following the procedural element is satisfied. Breakpoints can be set on procedural elements to pause the progression of the procedure at a step. Skipping procedural elements is allowed. The operator can change the state of the active procedural elements. When the recipe procedure itself (highest level) is placed into the automatic mode, this command propagates downward to all lower level elements. At other procedure levels, the automatic mode command can be optionally propagated downward to all lower level elements, based on a user configured flag.

In **semi-automatic mode**, procedural elements execute per the sequence of the procedure, but the transition between the procedural elements requires that the transition condition is satisfied and the continue command is entered by the operator. Skipping, breakpoints and re-executing procedural elements are allowed. The operator can change the state of the active procedural elements. The semi-automatic mode command can be optionally propagated downward to all lower level elements, based on a user configured flag.

In **manual mode**, procedural elements execute in the order specified by the operator and not the procedure. Skipping and breakpoints are allowed. The operator can change the state of the active procedural elements. The manual mode command can be optionally propagated downward to all lower level elements, based on a user configured flag.

Additional rules for modes are:

- The recipe procedure (highest level) must be in semi-automatic or manual mode to accept a semi-automatic or manual mode command at any other level.
• If there is a procedural element active that was manually initiated out of sequence, it will not be possible to place the recipe procedure (highest level) in automatic mode or the next higher level of the procedure in automatic or semi-automatic mode.

The mode of each procedural element is displayed. It is not a composite mode. If the modes of the higher level procedural element and its current lower level procedural elements are not consistent, the background color of the higher level operating mode indicator is yellow.

The start symbol indicates the mode of the higher level procedural element encompassing the lower level procedural elements in each PFC display.

Conditions

The following conditions can occur in conjunction with the states described in States on page 83 and Modes on page 87. They are depicted with the symbols shown in Figure 32.

Figure 32. Operating Condition Symbols

The skipped condition symbol is only displayed at the procedural level in which it occurs. The background color of the skipped indicator is white. If a procedural element has been skipped, the procedural element is in the idle state (Refer to Table 10.).

The breakpoint set condition is only displayed at the procedural level where it occurs. The background color of the breakpoint set indicator is white.

The breakpoint reached condition is displayed at the procedural level in which it occurs. It is also displayed on a higher level procedural element when this condition occurs at a lower level procedural element. When a breakpoint is reached at the level being displayed, the background color of the breakpoint indicator is green. When a
breakpoint is reached at a lower level, the background color of the higher level breakpoint indicator is yellow.

A breakpoint is a point in the procedure execution where the batch manager suspends execution of the procedure until the operator tells the system to continue execution by clicking Start at Beginning in the block status window for the object. Breakpoints are set by the operator and are used while troubleshooting. Depending on access level, the operator may be able to specify that in this instance of the procedure, a breakpoint should be inserted before the execution of certain blocks in the procedure chart. The operator can set a breakpoint for an individual block in a procedure chart using the list box in the block status window. Refer to PFC Block Status Window on page 108 for further details.

No breakpoints can be set on phases bounded by a sequence start and sequence end in the PFC.

Breakpoints are strictly a batch manager software action. The control system does not use Batch Management breakpoints. The control system actions during batch operations are affected by breakpoints because the control system can only execute control functions after the instructions to do the functions are received from Batch Management. When the instructions are received is dependent upon the batch manager software, which is affected by breakpoints.

When a breakpoint has been reached, a batch event is recorded in the batch event history database. If a breakpoint has been reached, the procedural element is in the idle state (Refer to Table 10).

The breakpoint reached indicator takes precedence over the breakpoint set indicator (due to the fact that they share the same space). If the breakpoint is removed while the block is in breakpoint reached state, change to breakpoint set indicator is not visible. Once the block is started, the breakpoint set indicator is shown correctly as unchecked.

The **error/operator entry required** condition is displayed at the procedural level in which they occur according to Table 11 and Table 12. The error/operator entry required conditions are displayed on a higher level procedural element with the exclamation symbol when these conditions occur at a lower level procedural element. If there is an error at a lower level, the background color of the higher level error/operator entry indicator is red. If operator entry is required at a lower level, the background color of the higher level error/operator entry indicator is yellow. If there
is an error and operator entry is required at a lower level, the background color of the higher level error/operator entry indicator is red.

**Exception Logic**

A procedure can have several parallel threads executing simultaneously. Among the threads can be one or more containing a special type of subprocedure containing exception logic.

An exception procedure monitors for undesirable product related process conditions and contains exception handling instructions in case the condition occurs. To monitor for a condition, a transition object is always used as the second object in an exception procedure immediately after the start object. If the condition represented by the logical expression associated with the transition object becomes true, then the exception logic following the transition object in the exception procedure is executed.

*Figure 27* shows a procedure that includes exception handling at the procedure level. (Monitoring and responding to abnormal conditions can also be implemented at the control system using fault logic as part of the phase logic.) The parallel threads run between the two sets of parallel bars that are parallel start and parallel end procedure objects.

The subprocedure is represented by the exception procedure block. Unlike normal procedures, exception procedures can contain more than one start and end object. A set of start and end objects is needed for each condition being monitored by the
exception procedure. The procedure in Figure 33 monitors three conditions.

![Figure 33. Exception Procedure](image)

If an expression associated with one of the transition objects on the exception procedure becomes true, the exception handling logic for that one condition will be executed.

**Operator Display Changes**

While the exception procedure is actively monitoring conditions (testing expressions in transition objects), the transition objects on the exception procedure PFC are displayed in green. The object representing the exception procedure on the higher level procedure is also green.

When exception handling logic begins execution due to a monitored condition becomes true, the procedure object representing the exception procedure on the higher level PFC becomes green. The objects below the transition object in the exception procedure PFC is green while active and dark gray when completed. **Table 10** provides additional information about states and colors.
If none of the conditions monitored by an exception procedure ever become true, the objects below the transition object in the exception procedure PFC will remain light gray, even after the parallel normal procedure thread has completed, and the exception procedure has stopped monitoring the expressions in the transition objects.

**Special Exception Handling Functions**

What happens to the execution of the parallel normal procedure threads, as well as to the execution of the other exception threads in the exception procedure, depends upon how the exception handling logic for the currently true condition was written.

Ordinarily, execution of the normal procedure threads, as well as testing of other condition transition object expressions in the exception procedure, will continue without interruption during execution of the exception handling logic in response to a monitored condition becoming true.

However, special exception handling functions such as exkill, exrestart, ex_stop, and ex_abort (refer to the *System 800xA Batch Management Configuration (3BUA000146)*)) can be used to issue commands to the normal procedure threads that are currently executing. When they are issued from the exception handling logic, the execution of the normal procedure threads will be effected.

Monitoring of any other conditions being tested in the exception procedure will also be effected.

**Concluding Exception Handling Logic**

What happens at the conclusion of execution of exception handling logic depends on whether a parallel normal procedure thread is active or not active.

**Active Normal Procedure Processing**

If the normal procedure processing is active, the exception procedure does not complete and exit after the exception handling has reached the exception procedure end object. Instead, the exception procedure returns to the transition object at the beginning and evaluates the expression again. If the expression becomes true again, the exception logic will be executed again. Monitoring and repeated execution of exception logic continues until processing of all items in the normal procedure
threads between the same parallel start and parallel end objects (as the exception procedure) has been completed.

**Not Active Normal Procedure Processing**

If all objects in the normal procedure threads are not active when the exception handling logic reaches its end, execution of the procedure will continue with the object below the parallel end following the exception procedure object.

If all objects in normal procedure threads are not active when execution of the exception procedure reaches the exception procedure end object, processing of the upper level PFC will continue with the object below the parallel end object. This may result in some objects in a parallel normal thread never being executed. Whether or not all objects are executed depends on why normal thread processing is not active and what happened before it became inactive.

**Case 1: All Objects Are Executed Once**

It is possible that normal thread processing is not active because execution of any parallel threads completed while the exception handling logic was executed simultaneously. The normal thread processing was never restarted by the exception handling logic. In this case, all objects in the parallel normal threads were executed once (unless the procedure was configured to loop).

**Case 2: All Objects Are Executed, Some More Than Once**

When normal thread processing is not active because execution of any parallel threads has been completed, it is possible that (prior to this completion) procedure execution was restarted at the parallel start. This restart would have been the result of execution of an exrestart function in the exception handling logic.

In this case, all objects in the parallel normal threads were executed after the restart. However, some of them had already been executed before the restart. As a result, those objects were executed twice. (Again the possibility that the procedure was configured to loop is being ignored.)

**Case 3: Some Objects Are Not Executed**

It is also possible that normal thread processing is not active because it was stopped by an exkill function and never restarted by an exrestart. Before the abnormal condition occurred, processing never got to the objects lower in the normal threads.
Because normal thread processing is not active when the exception logic reaches its end object, processing will resume below the parallel end object. As a result, the objects after the point of the kill (but before the parallel end object) will not be processed.

Accessing the PFC

The top level PFC for a procedure can be accessed from the Batch Overview window shown in Figure 34 using the PFC command button. A number of menu choices are always available by right clicking on the procedure window.

Procedure

With the cursor on a procedure window, right clicking opens a context menu.

Input

Refer to Input on page 66.

Batch Overview

Selecting Batch Overview from the menu calls up the window shown in Figure 34. This window includes all the features of the Batch Overview window as described
in Batch Overview Window on page 29.

**Figure 34. Batch Overview Window**

### Parameters

Selecting **Parameters** calls up the Parameters window (similar to the Batch Parameters window). This window lists all the parameters used by the displayed procedure. When the top level procedure of a batch is displayed, the **Parameters** and **Batch Parameters** options return the same information. For detailed information on parameters, refer to **Parameters** on page 49.

### Active Blocks

Selecting **Active Blocks** from the menu displays the ID, status, and label of all active blocks (executing, in error, and waiting for operator input) in the procedure. Selecting a block ID pans the PFC window to show that block.
Batch Parameters

Selecting **Batch Parameters** from the menu calls up the window shown in Figure 11. This window lists all the parameters used by the top level procedure of the batch no matter which procedure (top level or subprocedure) is displayed. For detailed information on parameters, refer to **Parameters** on page 49.

Batch Status

Selecting **Batch Status** from the menu calls up the Batch Information window shown in Figure 17. For detailed information on batch Status tab, refer to **Batch Information Window** on page 57.

Header

Header is used to display the procedure header. The window that opens when **Header** is selected from the **Procedure** menu is shown in Figure 35. The information in this window is read only. Refer to **Table 13**.

![Figure 35. Procedure Header Tab for Configuration](image)
This item on the context menu toggles between Show IDs and Hide IDs. Show IDs is used to display the unique internal ID numbers assigned by the system during procedure configuration to blocks in the PFCs. These ID numbers are used by the system to create a path to the PFC on display. In the case of a simple procedure that is depicted on a single PFC, the path is the name of the procedure. However, in the case of a layered procedure that may contain several other procedures nested within it, the path takes on a greater significance. The title of the procedure is not enough to identify the route to the currently displayed PFC because there can be multiple instances of the same procedure within the top procedure. This is where the block ID numbers are useful. The block ID numbers are used to describe the path (such as the one in the title bar on a PFC display) to the currently displayed PFC. The path consists of the name of the procedure, followed by the ID of each block that would be selected to get to the currently displayed PFC. The left-most ID number represents the highest level block.

While block ID numbers are on display, the block labels configured by the process engineer are not displayed in the blocks (Figure 36). The ID numbers may not be in the same sequence as the execution of the diagram. There may also be gaps in the numbering sequence. The numbers are assigned as the objects are drawn during
configuration of the PFC. If a block is subsequently deleted prior to completion of the procedure configuration, its ID number is not reassigned.

![Figure 36. PFC with Block IDs Shown](image).

Use **Hide IDs** to restore the block labels to the display.

### Pick Restart Point

During procedure configuration one or more objects in the procedure can be designated as valid restart points. During procedure execution it is possible to select **Procedure > Pick Restart Point**. Each object in the currently displayed PFC that is a valid restart point will be surrounded by a rectangle.

To select a restart point for procedure execution, click the object. A confirmation box will open containing the message **All active blocks on this PFC and on any lower-level PFCs will be terminated. Procedure will be restarted on this block. Continue?**

To restart the procedure at the selected point, click **Yes**. The procedure can only be restarted if all active blocks on the PFC and lower levels are in a final state (stopped, aborted, complete, or idle).

If a procedure object is not designated as being a valid restart point, but the user has permission to edit runtime procedures, select **Runtime Edit** and specify that the
object is a valid restart point. Select **Pick Restart Point**. Refer to **Runtime Edit** on page 99. Phase objects within a sequence and objects that are part of parallel operations can never be defined as valid restart points.

Before restarting a procedure at a restart point, consider the consequences. The user must know the procedure and must be aware of what actions are performed in the blocks that follow the restart point.

For example, when restarting a batch that has already acquired a piece of equipment above the point in the procedure where the equipment is acquired, the procedure will wait for equipment it already has. In this case the solution is to select another restart point lower in the procedure, or to skip the select/acquire blocks in the PFC.

**Runtime Edit**

**Runtime Edit** on the **Procedure** menu edits a control recipe being used for a batch while the batch is running. The control recipe is a copy of the master recipe. The changes made to the control recipe will have no effect on the master version of the recipe. Refer to the *System 800xA Batch Management Configuration (3BUA000146*)* for information about making changes to the master version of the recipe.

Before changing the recipe for an executing batch, consider carefully the consequences. Carelessness can result in damage to equipment and to the batch product.

**Availability**

Only the operators with correct permission can perform a runtime edit. Permission to monitor the batch is required before using this feature. Refer to **Batch Cell** on page 42.

**Accessing**

To edit a control recipe, right click on the procedure window and select **Runtime Edit**. The start object of the subprocedure being edited will turn yellow.

The procedure editor described in the *System 800xA Batch Management Configuration (3BUA000146*)* will be launched. The Procedure Editor window will contain the PFC on display in the operator window when **Edit Procedure** is
selected. The title bar will include the batch ID. What happens to the execution of the procedure depends on whether or not the PFC contains an active block.

If the PFC is for a subprocedure that has not yet begun execution, then execution of the batch will continue, unaffected by the fact that a nested subprocedure has been opened for editing. If the subprocedure is still being edited when execution of the procedure reaches that subprocedure, execution of the procedure thread containing the subprocedure being edited will be halted until the editing is complete. Other threads that do not require synchronization with the thread containing the subprocedure will continue.

If the PFC contains an active block, execution of the active block will be completed. The execution of the procedure will halt until the edit is completed. Other threads that do not require synchronization with the thread containing the subprocedure being edited will continue.

Editing

The editor works as described in the System 800xA Batch Management Configuration (3BUA000146*), but not all procedure editing functions will be available. Refer to Table 14.

Table 14. Procedure Editing Functions

<table>
<thead>
<tr>
<th>Available Editing Functions</th>
<th>Unavailable Editing Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add and delete procedure objects.</td>
<td>Edit currently active block unless it is in the final state (stopped, aborted, complete, or idle).</td>
</tr>
<tr>
<td>Modify object definitions.</td>
<td>Edit procedure parameters.(^1)</td>
</tr>
<tr>
<td>Change order of execution.</td>
<td>Edit the standard operating procedure.(^2)</td>
</tr>
<tr>
<td>Designate valid restart points.</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. In order to edit procedure parameters, ascend to the next higher level and change the parameters by selecting parameters from the procedure block status display and modify the parameters there.
2. This has no affect on the user's ability to add comments to the SOP.

If a new parallel thread is added to an already executed parallel start, the new thread will not be executed unless a restart point above the parallel start is selected, or if the
procedure execution loops back to a point above the parallel start. Refer to Continue Execution at a Selected Point on page 101.

**Continue Execution from the Point Where It Stopped**

Once editing of the procedure is complete, it is possible to:

- Discard the changes by using File > Exit, or right click on the procedure window and select Runtime Edit. Answer Yes in response to the Cancel Runtime Edit of procedure <name> and resume execution? message.

- Save the changes using File > Install Current.

Saving a procedure that was created or last edited in a previous release of Batch Management will save it as a Batch Management procedure in the new editor. This saved procedure cannot be opened in previous versions of Batch Management.

If the procedure was currently being executed when it was opened for editing (or if execution of the higher level procedure containing the subprocedure has caught up with the user), then when the user clicks Yes the PFC that was being edited will begin executing immediately. It will begin at the point where execution was halted by the start of the runtime edit.

If a subprocedure that was not active was being edited, and execution of the higher level procedure has not yet reached the subprocedure being edited, batch processing will continue uninterrupted after Yes is clicked.

Regardless of the point of execution, the Procedure Editor window containing the edited procedure will also close.

**Continue Execution at a Selected Point**

To select the point where execution of the procedure resumes:

1. Designate as a valid restart point, the procedure object where the user wants to restart execution of the procedure.

2. Use the Batch Status window (refer to Section 3, Batch Status) to put all active blocks on the PFC and lower levels in a final state (stopped, aborted, complete, or idle). For the complete state it may be necessary to put the PFC and lower
levels in semiautomatic mode to prevent procedure execution when installing the changed copy of the control procedure.

3. Select **File > Install Current** to save the control recipe.

4. Restart execution of the procedure by selecting **Procedure > Pick Restart Point** as described in **Pick Restart Point** on page 98.

**Cancel Runtime Edit**

Once a runtime edit of a control procedure has begun, the start object in the PFC being edited will turn yellow. This change will be evident at all nodes on the batch system.

Cancel a runtime edit by selecting **File > Exit**, or right click on the procedure window and select **Runtime Edit**. Answer **Yes** in response to the **Cancel Runtime Edit of procedure <name> and resume execution?** message.

Any operator with permission to perform a runtime edit can cancel a runtime edit, not just the operator who is currently editing the procedure.

If execution of the procedure had been halted as a result of the runtime edit in progress, then when the runtime edit is cancelled, execution of the procedure will resume at the point where it left off. None of the changes made to the control recipe during the edit session will be used to run the batch.

**Save As**

This option allows the control recipe currently being executed to be saved as a procedure object with a Development Procedure aspect.

- In order to save the entire control recipe, all PFCs that are part of the batch must also be saved.
- The saved procedure contains original recipe parameter values. Parameter changes made during batch scheduling or execution are not saved.
- Saving a procedure that was created or last edited in a previous release of Batch Management will save it as a Batch Management procedure in the new editor. This saved procedure cannot be opened in previous versions of Batch Management.
The version history is cleared when saving a new version with a new file name using runtime edit (through the **Save As** menu command).

### Display SOP

When the process engineer configured the system, a standard operating procedure may have been incorporated into the online system. If so, the SOP can be displayed using **Display SOP** from the context menu. A sample SOP tab is shown in **Figure 37**. Depending on the configuration of the procedure, the beginning of the SOP may be displayed when the window opens, or a portion of the SOP relevant to the currently executing part of the procedure may be displayed. It is always possible to scroll through the SOP regardless of what is displayed first.

**Figure 37. SOP Tab**

The top part of the tab contains an area for SOP text. To facilitate finding the section of the SOP, use **Find** and the text entry field. Up and Down options can be used to specify which direction the find function will search.

To add a comment to the SOP for the batch, click in the comment box and type the comment. Move the cursor to the spot in the SOP where the comment is to be added and click **Insert Comment**. To save the comment with the other information stored about this batch close the dialog. Once a comment has been saved, the comment can not be changed or deleted. The SOP on view in the SOP window will be updated to include the comment. Included with the comment will be a time and date stamp.
The batch management system can be configured to display the portion of the SOP relevant to the currently executing part of the procedure when the SOP tab is selected. If this is the case, the process may move on to a phase documented by a later part of the SOP while the window is open. If the configuration calls for a different part of the SOP to be displayed while the current phase is executing, Section Changed will be displayed.

**Top**

Ascend to the top level of the procedure.

**Batch Variables**

Depending on the configuration of the system, the operator may be able to change variables associated with the procedure. Clicking **Batch Variables** in the context menu opens a window similar to that shown in Figure 38. The batch ID will be filled in at the top of the screen and the path within the procedure to the block. Additional
information about the path concept is provided in Show IDs/Hide IDs on page 97.

Figure 38. Procedure Variables Tab

This tab contains a list of the variables associated with this procedure and the currently assigned value for each variable.

The Scope options specify which variables are being edited:

- Local variables are used only by this procedure (i.e., variables used by the procedure currently on display).
- Batch variables are used only by this batch.
- Global variables are available for use by any batch in the system.

Information about variables and expressions is provided in the System 800xA Batch Management Configuration (3BUA000146*).
Change/Edit Variable

To edit a variable:

1. Select the variable and click Change. The right portion of the tab (Variable Editor) will be activated, and the name and value of the variable will be displayed.

2. Edit the variable value and click OK.

Add Variable

To add a variable:

1. Click Add. The right portion of the tab (Variable Editor) will be activated.

2. Enter the name and value of the new variable.

3. Enable the appropriate option to specify String or Float.

4. Enable the appropriate option to specify Local, Batch, or Global and click OK.

Delete Variable

To delete a variable:

1. Select the variable.

2. Click Delete (confirmation window will open) and OK.

Show GUID

Variable names and values are the normal and user friendly way of referring to the globally unique IDs (GUIDs) associated with variables used by Batch Management. If it is necessary to view variable GUIDs, enable the Show GUID option. Variable names and values in this window (stored as GUIDs) will be replaced with the corresponding GUIDs. Refer to the System 800xA Batch Management Configuration (3BUA000146*) for more information on GUIDs.
This option provides the abilities to zoom the PFC to fit the preview window, zoom in, zoom out, and display the current zoom level. Scroll operations (Table 15) are used to change the portion of the PFC on display.

**Table 15. Scroll Options**

<table>
<thead>
<tr>
<th>Action</th>
<th>Mouse</th>
<th>Keyboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scroll up one page</td>
<td>N/A</td>
<td>PAGE UP</td>
</tr>
<tr>
<td>Scroll down one page</td>
<td>N/A</td>
<td>PAGE DOWN</td>
</tr>
<tr>
<td>Scroll up</td>
<td>Mouse wheel</td>
<td>N/A</td>
</tr>
<tr>
<td>Scroll down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scroll left</td>
<td>SHIFT + mouse wheel</td>
<td>N/A</td>
</tr>
<tr>
<td>Scroll right</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move upper left corner of PFC to center of preview area</td>
<td>N/A</td>
<td>HOME</td>
</tr>
<tr>
<td>Move lower right corner of PFC to center of preview area</td>
<td>N/A</td>
<td>END</td>
</tr>
<tr>
<td>Zoom In</td>
<td>Ctrl + mouse wheel</td>
<td>N/A</td>
</tr>
<tr>
<td>Zoom Out</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Auto-scrolling.** Auto-scrolling feature is available for the following operations:

- Dragging a block from the Block Palette.
- Selecting a block and moving it to a different position.
- Selecting blocks using the mouse.
  
  Selection of blocks can be done until the blocks are available in the drawing area.
- Selecting blocks for zooming using the Zoom In tool.
Auto-scrolling will function only if the cursor position is within the drawing area while performing the above mentioned operations (The cursor should be near to the edges of the drawing area but not outside the application).

**Equipment-Reserved**

Selecting **Equipment-Reserved** (if applicable) lists the reserved equipment and enables access to the equipment information windows and the aspects of the equipment.

**Equipment-Acquired**

Selecting **Equipment-Acquired** (if applicable) lists the acquired equipment and enables access to the equipment information windows and the aspects of the equipment.

**Equipment-Pending**

Selecting **Equipment-Pending** (if applicable) lists the pending equipment and enables access to the equipment information windows and the aspects of the equipment.

**PFC Block Status Window**

Clicking a block in a PFC opens a window providing information about the block. The format of the window varies, depending on the type of object. The block status window for a batch manager action message block is shown in Figure 39. The block status window for a phase is shown in Figure 40. Inside each window is the Status tab and the Comment tab.

Parameter event messages are truncated if the message body exceeds 2500 characters. Truncated parameter data can be accessed through the block status window or through Information Management where they are stored as PDL task variables.
Figure 39. BMA Block Window
Status Tab

Inside each status tab is the block Type, Name, Start Time, End Time, Elapsed Time, and State fields. The active or complete phase block status window will also show the equipment in which the phase is or has been running.

If one or more errors have been encountered, the error box will contain text. All errors associated with the block can be viewed by clicking the arrows of the vertical and horizontal scroll bars.

The Break/Skip field is provided for viewing, setting and resetting a breakpoint for just this block, as well as for viewing, setting and resetting a skip for this block.

The Mode field is used to view and change the mode of the block. Refer to Modes on page 87 for an explanation of the modes.

The State field is used to view and change the state of the block. Refer to State on page 34 for an explanation of the states.
Comment Tab

The Comment tab can be used to enter a comment that is recorded in the batch historian event record. Enter a comment in the lower text entry box and click OK or Apply.

Button Options

The available button options:

- **Input**
- **Configure**
- **Parameters**
- **Aspects**
- **Faceplate**
- **User Display**

**Input**

The **Input** button available on the block status window for a BMA object is used to display inputs related to the batch. **Input** works the same as described in Input on page 66. If only one message is pending, clicking **Input** will open a window displaying the message. If more than one message is pending, a list window will be displayed. Select the message to be viewed from the list.

**Configure**

The **Configure** button accessible on BMA and transition block status windows is used to make changes to the configuration of the block. If a change is made to the configuration of a currently executing block, which was stopped by an error, **Start at Beginning** in the State list box of the block dialog box must be used for the changes to take effect.

Any configuration changes will be applied only to the control recipe that is currently being executed.
Parameters

The Parameters button is available on phase and procedure blocks, permitting public parameters to be displayed and changed, depending on the user access level. The type of parameters accessible using the Parameters button on a block status window depends on the type of block. A status dialog window for a phase object provides access to the phase parameters associated with the phase logic. A status dialog for a procedure block provides access to procedure parameters associated with the subprocedure represented by the procedure block.

The value of a parameter can be changed depending on the access level assigned to a procedure or phase parameter and on the access level assigned to the operator's login account. The value of a parameter can be specified using an expression, and the expression can include variables. Details concerning expressions and variables are provided in the System 800xA Batch Management Configuration (3BUA000146*). The window accessed with a phases block status Parameters button is shown in Figure 41. The values displayed apply to only this instance of this procedure. Refer to Parameters on page 49 for more information about procedure parameters.

![Batch Phase Parameters Window](image)

*Figure 41. Batch Phase Parameters Window*
When these windows are opened for the first time following the scheduling of a batch, the text entry boxes contain the assignment made during procedure configuration. The default value assigned to each parameter during configuration is displayed briefly in the Value column. The default will immediately be overwritten by the result of the evaluation of the assignment shown in the Expression column.

The Batch ID, Phase, and Equipment columns are filled in when the batch parameters window opens. The name of each parameter is displayed, as well as the default value. The Expression column is provided to change the value of the parameter.

The parameter name, parameter type, the preconfigured description (if any), and the access level required to change the parameter are displayed. If the level is Not Configured (the default) there are no restrictions on access. If the level is No Access, the parameter can not be changed at run time. Depending on the type of the parameter, a list of possible values is presented. In the case of numeric type parameters (float and integer), the range of acceptable values is set by the values in the High Range and Low Range columns.

Depending on the access level assigned to the parameter and the access level of the operator, a new access level can be assigned to a parameter using this window. An operator with a sufficiently high access level can change the value of a parameter and also the access level needed to change a parameter.

If the access level is changed in a procedure or phase parameter to No Access, no users will be able to make any further changes to the parameter for this batch.

Once a new assignment has been entered for a parameter, click Compute to evaluate the parameter assignment. The result will be displayed in place of the previous value. Click OK to evaluate the expression and close the window.

If this window is opened again, the text entry boxes will continue to display the batch-specific assignments (instead of the assignments made during procedure configuration).

All instructions to the control system for phase blocks bounded by sequence start and sequence end blocks are downloaded by the batch manager to the control system at the same time. If phase parameters are changed for an executing block that is between a sequence start and sequence end block, the batch manager can download the new phase parameter values to the control system. For the new
parameters to take effect, the sequence must be stopped and started again at the beginning of the sequence.

You can also perform other operations such as search, filter, hide/unhide columns, and sort on the Batch Phase parameters. Refer to Parameters on page 49 for more information.

**Aspects**

Clicking Aspects from the block dialog for an active phase object displays the aspect list of the control module that represents the equipment phase.

**Faceplate**

Clicking Faceplate from the block dialog for an active phase object displays the faceplate that represents the phase.

**User Display**

Clicking User Display from the block dialog for an active phase object displays the user-configured graphic associated with the phase. Refer to the System 800xA Batch Management Configuration (3BUA000146*) for more information about displaying user graphics.

**Errors**

If an error occurs while a procedure block is being executed, the PFC object representing the block with the error will turn red. To display the errors, click the PFC object to display the block status dialog. The first part of the first error will be displayed in the entry box next to Errors as shown in Figure 42. Using the scroll
bars of the text box allows all errors associated with the block to be viewed.

![Block Status Window Containing Error]

Figure 42. Block Status Window Containing Error

A procedure block error is not indicated when a release equipment Batch Manager Action (BMA) block fails to release the equipment. The block does not turn red and an error is not generated. The procedure continues execution beyond the release equipment BMA block regardless of the success of the release command. The Batch Manager will continue periodic retry communications to the controller to complete the release. Any subsequent procedure block that tries to acquire the unreleased equipment will indicate a failure in the normal way.

If a phase block is acquired and started by the Batch Manager and then it is acquired and unacquired from an EPT HSI faceplate, the phase block runs to completion and then temporarily goes into error (turns red). The Batch Manager then reacquires and resets the phase block and continues execution of the procedure.
The Block Status window displays only a number for some error conditions. Table 16 lists the error codes and a description of each.

Table 16. Block Status Error Codes

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5000</td>
<td>The structure version number does not agree with the system version number. This error indicates an invalid installation of Batch Management software, some of the Batch workstations are at different version levels than the rest, etc.</td>
</tr>
<tr>
<td>-5002</td>
<td>The batch message is no longer pending (the message has already been responded to).</td>
</tr>
<tr>
<td>-5003</td>
<td>The equipment was placed into a failed state using the Disable or Discard command from the Equipment Status window.</td>
</tr>
<tr>
<td>-5004</td>
<td>There is a runtime edit session already in progress on this PFC.</td>
</tr>
<tr>
<td>-5005</td>
<td>The batch manager has tried to restart a procedure that is already running.</td>
</tr>
<tr>
<td>-5006</td>
<td>The batch manager has tried to restart a procedure that does not have any active blocks at the restart point.</td>
</tr>
<tr>
<td>-5007</td>
<td>The batch manager has tried to restart a procedure in which all blocks are not in a final state at the restart point.</td>
</tr>
</tbody>
</table>

Navigating in Multilevel PFCs

If the top level PFC contains procedure blocks representing subprocedures, there are easy ways to navigate between levels.

To descend into a lower level PFC:

- Left click the procedure block to display the lower level or the block status window.
  - or -
- Right click the procedure block and select Descend.
To ascend to the next higher level PFC:
- Left click the start block.
- or -
- Right click the start block and select **Ascend**.

### Preview of Procedures
Selecting a procedure aspect displays the PFC of the procedure in the preview area of the Plant Explorer workplace. Right clicking on the PFC background displays the following option.

#### Parameters
Displays the parameters used by the procedure.

#### Approve Procedure
Use this option to approve the procedure. Refer to the *System 800xA Batch Management Configuration (3BUA000146*)* for more information.

#### Edit Procedure
Use this option to edit (open in the PFC Editor window) the procedure. Refer to the *System 800xA Batch Management Configuration (3BUA000146*)* for more information.

#### Difference Report
Use this option to compare two procedures for differences. Refer to the *System 800xA Batch Management Configuration (3BUA000146*)* for more information.

#### Print
Use this option to print a report of the procedure. Refer to the *System 800xA Batch Management Configuration (3BUA000146*)* for more information.
Zoom

This option provides the abilities to zoom in, zoom out, zoom the PFC to fit the preview area, zoom a selected area to fit the preview area, and zoom to a number of predefined percentages.

Mouse and Keyboard Options

It is possible to zoom and scroll the procedure using mouse and keyboard actions (Table 17).

Table 17. Mouse and Keyboard Options

<table>
<thead>
<tr>
<th>Action</th>
<th>Mouse</th>
<th>Keyboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoom in</td>
<td>CTRL+mouse wheel</td>
<td>+</td>
</tr>
<tr>
<td>Zoom out</td>
<td>CTRL+mouse wheel</td>
<td>-</td>
</tr>
<tr>
<td>Zoom to fit</td>
<td>N/A</td>
<td>=</td>
</tr>
<tr>
<td>Zoom selected area to fit</td>
<td>CTRL+left mouse button and enclose area</td>
<td>N/A</td>
</tr>
<tr>
<td>Scroll in any direction</td>
<td>SHIFT+left mouse button and drag PFC</td>
<td>Arrow keys</td>
</tr>
<tr>
<td>Scroll up one page</td>
<td>N/A</td>
<td>PAGE UP</td>
</tr>
<tr>
<td>Scroll down one page</td>
<td>N/A</td>
<td>PAGE DOWN</td>
</tr>
<tr>
<td>Scroll up</td>
<td>Mouse wheel</td>
<td>N/A</td>
</tr>
<tr>
<td>Scroll down</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scroll left</td>
<td>SHIFT+mouse wheel</td>
<td>N/A</td>
</tr>
<tr>
<td>Scroll right</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move upper left corner of PFC to center of preview area</td>
<td>N/A</td>
<td>HOME</td>
</tr>
<tr>
<td>Move lower right corner of PFC to center of preview area</td>
<td>N/A</td>
<td>END</td>
</tr>
</tbody>
</table>
Section 4  Procedure Function Charts
Section 5  Batch Monitoring

Introduction

This section discusses the graphics capabilities associated with running a batch and redundancy issues related to phase transitions. Batch services are also discussed.

Graphics

When the process engineer sets up the batch operation at the plant, graphics may have been created to represent the hardware (batch equipment) used by the batch operation. These graphics may have been configured to change as the batch operation progresses. For example, as valves open and close they may change color to indicate their state. A picture of a tank may be configured to show the level of
material in the tank. Refer to Figure 43.

Three standard button aspects can be used to place buttons on a display. The BatchPFC aspect creates a button labelled P that displays the PFC for the batch that has acquired, reserved, or selected the equipment. The BatchMessage aspect creates a button labelled M that displays the list of pending messages for the batch that has acquired, reserved, or selected the equipment. The BatchStatus aspect creates a button labelled S that displays the Batch Information window for the batch that has acquired, reserved, or selected the equipment. It is also possible to display batch equipment OPC information using standard graphic display configuration methods. Refer to the System 800xA Batch Management Configuration (3BUA000146*) for more information.

Details of the operator interface at the site must be provided by the process engineer who planned and implemented the batch operation control.

User-created graphics of all sorts can be called up from the PFC phase object by right clicking the object and selecting User Graphic.

Refer to the System 800xA Batch Management Configuration (3BUA000146*) for information about configuring the displaying of user graphics.
Faceplates

Batch Management utilizes faceplates to supervise and control batch execution. Faceplates are available for EPT (equipment procedure template), Batch Advanced Template (default and optional type available), PHASEX (800xA for Harmony), and MSEQ function block (800xA for DCI). Figure 44 through Figure 48 show example extended EPT, Batch Advanced Template (default and optional), PHASEX, and MSEQ faceplates. Opening the faceplate aspect of a MOD_PHASE (MOD300 TCL Sequence Detail aspect) or MOD_UNIT (MOD300 TCL Unit Detail aspect) displays detail window. The MOD_PHASE detail window is shown in Figure 49. Refer to the appropriate Control Builder M, Batch Management, 800xA for Harmony, 800xA for DCI, and 800xA for MOD 300 instructions for more details on the information provided in these faceplates and windows. These faceplates are provided by Batch Management and other functional areas and they (all except the 800xA for MOD windows) function like all other 800xA faceplates except for the following special issues.

The object locking feature may be enabled for the 800xA system but the Object Locking Required option must be disabled in systems that utilize batch phase and equipment objects. Phase and equipment faceplates will not function correctly if object locking is required.
Figure 44. Extended View EPT Faceplate
Section 5  Batch Monitoring

Figure 45. Extended View Batch Advanced Template Faceplate (Default)

Figure 46. Extended View Batch Advanced Template Faceplate (Optional)
Figure 47. Extended View PHASEX Faceplate

Figure 48. Extended View MSEQ Faceplate
Section 5  Batch Monitoring

Acquired/Released Status Indicators

Figure 49. MOD_PHASE Detail Window

Figure 50 shows the special status indicator used in EPT faceplates.

Figure 50. EPT Faceplate Special Status Indicators
Figure 51 shows the special status indicators used in PHASEX and Batch Advanced Template faceplates.

![Special Status Indicators](image)

Figure 51. Batch Advanced Template and PHASEX Faceplate Special Status Indicators

Mode Indicators

Batch Management can underline or overline these indicators in Batch Advanced Template faceplates to indicate special conditions. For units and shared equipment, the yellow underline indicates that the mode of one or more child phases has a mode different than that of the unit or shared equipment. The green and white overline indicates that the mode of the phase is controlled by the parent unit or shared equipment.
Mode Buttons

Figure 52 and Figure 53 show the batch mode buttons that set the mode of the batch control modules. These buttons are used in the Buttons area.

Figure 52. Mode Control Buttons for Units & Shared Equipment

Figure 53. Mode Control Buttons for Phases

State Indicators

Table 18 lists the Batch Management-specific displayed control module state indicators that appear in EPT, Batch Advanced Template, and PHASEX faceplates and what they represent.

Table 18. Batch Management-Specific State Indicators

<table>
<thead>
<tr>
<th>Icon</th>
<th>State</th>
<th>Enumeration</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Idle Icon" /></td>
<td>Idle</td>
<td>0</td>
</tr>
<tr>
<td><img src="image" alt="Running Icon" /></td>
<td>Running</td>
<td>1</td>
</tr>
<tr>
<td><img src="image" alt="Complete Icon" /></td>
<td>Complete</td>
<td>2</td>
</tr>
</tbody>
</table>
Section 5  Batch Monitoring

Table 18. Batch Management-Specific State Indicators (Continued)

<table>
<thead>
<tr>
<th>Icon</th>
<th>State</th>
<th>Enumeration</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Icon: Pausing]</td>
<td>Pausing¹</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Paused</td>
<td>4</td>
</tr>
<tr>
<td>![Icon: Holding]</td>
<td>Holding¹</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Held</td>
<td>6</td>
</tr>
<tr>
<td>![Icon: Restarting]</td>
<td>Restarting¹</td>
<td>7</td>
</tr>
<tr>
<td>![Icon: Stopping]</td>
<td>Stopping¹</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Stopped</td>
<td>9</td>
</tr>
<tr>
<td>![Icon: Aborting]</td>
<td>Aborting¹</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Aborted</td>
<td>11</td>
</tr>
</tbody>
</table>

**NOTE:**
1. Batch Advanced Template and PHASEX faceplates display a dashed border for this state

**Signal Indicator**

The PHASEX faceplate displays a signal indicator that is either LEA or blank. LEA indicates the lead PHASEX. If the PHASEX is a secondary (linked to the lead), this position is blank.

**Parameters and Attributes**

The Batch Parameters button (Figure 54) found on EPT faceplates opens a window that lists the information for all the phase parameters.

![Image: Batch Parameters Button]

Figure 54. Batch Parameters Button
The Batch Equipment button (Figure 55) found on Batch Advanced Template, PHASEX, and MSEQ faceplates opens a window that lists equipment attribute information.

Figure 55. Batch Equipment Button

This window lists all the attributes of the equipment and features a status messages area at the bottom of the window that lists the name of the equipment attribute changed, property of the attribute that changed along with the new and old values. This window also utilizes a color coding system for changed values. Newly changed values (no matter how they were changed) are initially displayed in blue and then fade to black over the next minute. The newly changed value text and background colors are user selectable.

The default value of float, integer, and text attributes that do not have the In Controller AND Constant options enabled cannot be changed in the Runtime Attributes window. This value can be changed in the Plant Explorer by selecting the Batch Equipment aspect (of the batch equipment associated with these attributes) and changing the default value in the window.

Buttons in Element Area

The default Batch Advanced Template faceplate (MainFaceplate aspect) can display additional information about the button by displaying a small S, I, or X on the outside edges of the button. An S in the upper left corner of the button indicates that the control module is not in the correct state for this command to be issued. An I in the upper right corner indicates that some interlock logic is preventing this command from being executed. An X in the lower right corner indicates that some interlock logic is preventing the inhibiting of this command button.

Optional Faceplate

An additional Batch Advanced Template faceplate (MainFaceplate2 aspect) is available for phases and units. It looks and functions the same as the default faceplate except for the following differences:
- All buttons are located in the Buttons area.
- Buttons do not display additional information (described in Buttons in Element Area on page 131).

Extended Faceplate Information

The extended view of a faceplate displays additional information about the control module on the ExInfo, EquipInfo, Interlock, PhaseInfo, and SysEngr tabs.

ExInfo Tab (All Control Modules)

The following exception information is derived from the throw exception function block and displayed on this tab (Figure 56):

- **ID** - 10 character string that specifies the ID of the exception.
- **Descr** - 40 character string that describes the exception.
- **Scope** - Exceptions are handled within this entity.
- **Severity** - The severity of the exception.

![Figure 56. ExInfo Tab](image)

 EquipInfo Tab (Phase Control Modules)

The following information is displayed on this tab (Figure 57):

- **EquipName** - Name of the equipment to which this phase belongs.
• **Batch ID** - ID of the batch currently running.

![EquipInfo Tab](image1)

*Figure 57. EquipInfo Tab*

**Interlock Tab (All Control Modules)**

This tab (Figure 58) displays the status of various interlocks set by logic in the controller. Use the Override Interlocks button to override the interlocks for 30 seconds.

![Interlock Tab](image2)

*Figure 58. Interlock Tab*
PhaseInfo Tab (Shared Equipment and Unit Control Modules)

The state of the phase or phases that utilizes this equipment is displayed on this tab (Figure 59). A check mark next to a state indicates that one or more phases are in that state.

![PhaseInfo Tab](image)

Figure 59. PhaseInfo Tab

SysEngr Tab (Shared Equipment and Unit Control Modules)

The SysEngr tab (Figure 60), which is only available to Systems Engineers, displays the following information:

- **Current Batch ID** - The ID of the batch as determined by the controller.
- **New Batch ID** - In cases where Batch Management and the controller become out of synchronization (batch IDs do not match or are absent), enter the desired batch ID in an attempt to resynchronize Batch Management and the controller.
- **BatchMgr Commands** - Enter the number of the command (8, 10, 15, or 16) to execute that command.
Batch Management advanced control module templates are used to create control module types. These control module types contain various faceplate element and graphic element aspects. All of these aspects must be deployed before the faceplate will function correctly when control module instance is created. Almost all of these aspects are deployed automatically when the control module type is created. However, the Attributes (unit and shared equipment control modules) Aspect must be manually deployed.

To determine if a graphic or faceplate element aspect has been deployed:

1. Select the Aspect.
2. Verify the element is displayed in the 800xA plant explorer workplace. If the element has not been deployed, a message to that effect will be displayed.

To deploy a graphic or faceplate element Aspect:

1. Right click the Aspect.
2. Select **Deploy** on the pop-up menu.

*Figure 60. SysEngr Tab*
Redundancy

It is possible to add the redundancy to the 800xA System. The Batch Server, Connectivity Server or the controller can be optionally installed as redundant. The proper execution of a Batch procedure is dependent in part on the successful communication of commands and status signals between the Batch Server and the Controller through the Connectivity Server. The inclusion of redundancy is a frequently deployed method to increase the availability of the control system.

Batch Redundancy is based on Microsoft SQL Mirroring functionality. The Batch database mode is **High-Safety Mode with Automatic Failover**. For detailed information, click on the following link:


Automatic Failover requires a third Server, the Witness, which resides in separate node in addition to the Primary and the Secondary Node. For Automatic Failover, the Witness node supports by verifying whether the acting Primary Server is up and functioning.

Batch Redundancy using SQL mirroring is 2oo3 redundancy. The first number indicates the number of nodes online. If all the three nodes are online, failure of any single node will not cause a system failure. However, at this state, the Automatic Failover functionality is unavailable.

The operator can see the status of the redundant (primary / secondary) server in various places such as system tray, Batch Overview window, and Alarm and Event List. The system tray is placed in the lower right corner of a monitor. The redundancy status in various nodes are indicated in the system tray as shown in Table 19.

<table>
<thead>
<tr>
<th>Redundancy Status</th>
<th>Primary</th>
<th>Secondary</th>
<th>Client</th>
<th>Witness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Redundant Nodes</strong></td>
<td>![P]</td>
<td>![S]</td>
<td>![C]</td>
<td>![C]</td>
</tr>
<tr>
<td>Primary, Secondary &amp; Witness Running</td>
<td>![P]</td>
<td>![S]</td>
<td>![C]</td>
<td>![C]</td>
</tr>
</tbody>
</table>
Table 19. Batch Management Redundancy Status

<table>
<thead>
<tr>
<th>Redundancy Status</th>
<th>Primary</th>
<th>Secondary</th>
<th>Client</th>
<th>Witness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary, Witness Running &amp; Secondary Stopped</td>
<td>![P]</td>
<td>![S]</td>
<td>![C]</td>
<td>![C]</td>
</tr>
<tr>
<td>Primary, Secondary Running &amp; Witness Stopped</td>
<td>![P]</td>
<td>![S]</td>
<td>![C]</td>
<td></td>
</tr>
<tr>
<td>Primary, Secondary &amp; Witness Running with Mirroring Deactivated</td>
<td>![P]</td>
<td>![S]</td>
<td>![C]</td>
<td>![C]</td>
</tr>
<tr>
<td>Primary &amp; Secondary Stopped</td>
<td>![S]</td>
<td>![S]</td>
<td>![C]</td>
<td>![C]</td>
</tr>
<tr>
<td>Client Stopped</td>
<td>![C]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Single Node System**

| Node Running                                         | ![P]    |           |         |         |

**Non Redundant Multi-Node**

| Primary & Client Running                              | ![P]    | ![C]      |         |         |
| Primary Running & Client Stopped                      | ![P]    |           | ![C]   | ![C]    |

If the secondary server is not available, **Batch Sever is not redundant** message is displayed in the Batch Overview window.

Also the **Alarm and Event List** aspect toggles the State of a specific service between **ACT** (if the service is disables) and **RTN** (if the service is enabled) according to the state of the service.
There are some possible scenarios that may be observed in a running batch. One of them is the transfer of control from the running primary server to the secondary server, as a result of a momentary communication interruption.

In the event of a transfer of control from the primary batch server to the secondary batch server, it is strongly recommended that operating personnel review the current status of all running batch procedures. The following scenarios described below may be observed if a batch procedure was executing a phase transition during the primary to secondary transfer.

**Phase Does Not Transition to Running**

A phase may fail to start. There are two possible conditions that may be observed by the user on the PFC display. One condition is the phase block to be active (designated by a green border around the procedure block) is displaying the idle state. The other condition is the phase block to be active is in error with an error condition of “reconnect to idle phase”. If the operator has confirmed that the process is expecting the start and execution of this phase, it may be started manually.

To manually start the phase:

1. Select the phase to bring up the phase status window.
2. Select Start at Beginning in the State field and click **Apply**.

**Procedure Does Not Transition to Next Phase**

An active control recipe procedure may fail to continue to the next procedure block (i.e. phase) due to two possible conditions:

- The Phase block is active (designated by a green border around the procedure block) but in controller it displays complete state.

- The active Phase block is in error with an error condition “reconnect to idle phase”.

Follow the steps to manually complete the phase and continue processing the next procedure blocks irrespective of the state of current block:

1. Select the phase to bring up the phase status window.
2. Select **Continue at Next** in the State field and click **Apply**.
Additional Scenarios

There are additional (but less common) scenarios that could be observed. They are described in the following text.

Scenario One - Phase Start Error

Connection failed, start failed because the equipment (unit) is not acquired.

The behavior of and recovery from this problem is greatly dependent on the controller type. Some controller implementations (such as the AC 800M/C Batch Advanced Templates control modules) have a concept of unit ownership.

In other controller implementations (such as the AC 800M/C EPT control modules) no such concept exists.

Open the Equipment Overview and confirm batch ownership of the unit.

Case 1: Controllers without unit ownership in the controller:

1. Select the phase to bring up the phase status display.
2. Select Start at Beginning in the State list box and click **Apply**.

Case 2: Controllers with unit ownership in the controller:

Case 2A: Open the controller phase faceplate. If the unit is acquired by the active batch on the controller phase faceplate:

1. Select the phase to bring up the phase status display.
2. Select Start at Beginning in the State list box and click **Apply**.

Case 2B: Open the controller phase faceplate. If the unit is not acquired on the controller phase faceplate:

1. Open the equipment dialog and make note of the Batch IDs in the unit's queue.
2. Discard the unit (this clears the queue and sets the unit to failed).
3. Enable the unit. The status should be Available/Normal.
4. Place the PFC in manual mode and execute the acquire PFC block in the batch recipe.
5. Select the phase to bring up the phase status display.
6. Select Start at Beginning in the State list box and click **Apply**.

7. Place the PFC in Automatic.

8. Go to the Acquire blocks on the PFC of each of the other batches that were in the queue when the unit was discarded. Select Stop or Abort and then Start at Beginning.

**Scenario Two - Phase Start Error**

Connecting failed, **(phase OPC item name)** in **Illegal State** **(state)** for Connect.

In a running process this must be dealt with on a case-by-case basis. The user must have knowledge of the process effect of either running this phase twice in a row, or skipping this phase on the batch. Based on this information it may be better to allow the inconsistent state (such as running) to run to complete, or to intervene and get the phase to the stopped or aborted state.

**Scenario Three - Acquire/Reserve/Select Equipment Error**

If the Acquire/Reserve/Select block is aborted with error, the following actions should be executed:

1. Open the Equipment Overview (the unit may be in error or owned by the batch PFC with the problem).

2. Open the equipment dialog and make note of the Batch IDs in the unit's queue.

3. Discard the unit (this clears the queue and sets the unit to failed).

4. Enable the unit. The status should be Available/Normal.

5. Select the PFC acquire block in error and open the block status display.

6. Select Start at Beginning in the State list box. The batch will now proceed normally.

7. Go to the Acquire blocks on the PFC of each of the other batches that were in the queue when the unit was discarded. Select Stop or Abort and then Start at Beginning.
Scenario Four - Release/Unreserve/Deselect Equipment Error

If the Release/Unreserve/Deselect block is aborted with error, the following actions should be executed.

1. Select the Release block to bring up the block status display.
2. Select Skip in the Skip/Break list box.
3. Select Start at Beginning in the State list box and click Apply.
4. Wait until batch execution resumes.
5. Select None in the Skip/Break list box and click Apply.

Server Shutdown

The proper way to shutdown a batch server is to use the Windows shutdown feature. The proper way to restart the primary batch server is:

1. Use the Windows shutdown feature to shutdown the primary batch server.
2. Verify the batch redundancy monitor (in the system tray) on the former secondary batch server indicates a P.
3. Restart the former primary batch server.

Network Breakage

A network breakage that occurs for an extended period of time (greater than 30 seconds), will cause a redundant configuration to be partitioned into two separate systems, each with its own primary server. Upon restoration of network connections, the two primary servers will detect each other and shutdown. There are two ways to prevent the servers from shutting down.

Hardware Failure

If the network failure is due to a hardware problem (unplugged connector, defective cable, etc.) and is persistent, the system administrator needs to make sure that, once the cause has been removed, one of the two primary servers is shut down BEFORE reestablishing the connection. Failing to follow this procedure will allow both servers to fail.
The primary server to be shut down is normally the one that is separated from the connectivity server (with the AC 800M server).

**Temporary Failure**

In some cases it may not be obvious which primary server has to be shut down. In other cases, the network problem may be temporary, such that the two servers will see each other again prior to the system administrator being able to shut down one of the two. The information in previous topic will not help in these cases. These cases may be prevented by creating a system topology where primary and redundant Batch Management servers are connected in a more secure way (for example, through a switch or with RNRP redundant networking). This will minimize the likelihood of a transient network cabling problem, and will position the two servers in a way such that they will always be seeing the same connectivity servers (with the AC 800M server).

**Other Connectivity Servers**

The current state of the Batch Management servers and that of any running batches should be checked after the failover of any connectivity servers in the 800xA system.

**Batch Services**

It is possible to control (start, stop, pause, etc.) batch services and to report current redundancy status as detected by the node. The services created and used by the Batch Management are controlled by the Batch Service service (on all batch nodes) and the batch service providers defined in the 800xA System Service Structure (for batch servers).

To stop Batch services on a Batch client node:

1. Close all 800xA System windows.
2. Open **Control Panel**, click **Administrative Tools**, and then click **Computer Management**.
3. Double click Services and Applications.
4. Double click Services.
Section 5  Batch Monitoring

5. Right click Batch Service and select Stop.

To stop Batch services on a batch server node:

1. Open an 800xA System plant explorer workplace.
2. Select the Service Structure.
3. Select the Service Provider Definition aspect of the service provider object for this batch server.
4. Select the Configuration tab.
5. Disable the Enabled option and click Apply.
6. Open Control Panel, click Administrative Tools, and then click Computer Management.
7. Double click Services and Applications.
8. Double click Services.
9. Right click Batch Service and select Stop.

If the Batch Primary or Secondary service is disabled, the Process Portal closes automatically in that specific node.

Also it happens in the Client, if the Batch Service is stopped in that client.

To restart Batch services on a Batch client node:

1. Open Control Panel, click Administrative Tools, and then click Computer Management.
2. Double click Services and Applications.
3. Double click Services.
4. Right click Batch Service and select Restart.

To restart Batch services on a Batch Server node:

1. Open an 800xA System plant explorer workplace.
2. Select the Service Structure.
3. Select the **Service Provider Definition Aspect** of the service provider object for this Batch Server.

4. Select the **Configuration** tab.

5. Enable the **Enabled** option and click **Apply**.

If both (primary & secondary) services are stopped already, the user should be cautious while restarting the services.

The last stopped primary service (irrespective of Primary or Secondary server) should be enabled first.

If the server is started in the incorrect order, then the server never starts as it waits for the last stopped primary service to start. This is indicated by a red color “C” icon in the system tray placed in the bottom right corner of the monitor.

### Service Structure & System Status Viewer Representation

Each batch server node (primary and secondary) has two service providers represented in the Service Structure and System Status Viewer. One service provider represents the state of the Batch Service. When the batch services on the batch server primary and batch server secondary nodes are fully operational, the service provider state for both servers is reported as **Service**.

The other service provider (Event Collector Service, Batch) represents the state of the event collector service that is the source of batch events for propagation through the 800xA core system. The batch server node that is running the primary batch services is the exclusive provider of batch events through the 800xA core system. The Event Collector Service for the batch node running as primary service provider is reported as **Service**. The Event Collector Service for the batch node running as secondary service provider is reported as **Synchronizing**. This represents the normal and expected operational state of this service provider because batch events can only be sourced from a single node (the primary). The batch node running as secondary is synchronized with the batch node running as primary. In the event of a
batch primary to secondary transfer event, the batch secondary will assume operations as primary and begin serving batch events to the 800xA core system.

An alarm message stating “Service provider not in Operational State” may be seen. This occurs as and when the Secondary Service is in a state of synchronizing until it becomes the primary.
Section 6  Batch Equipment Status

Introduction

This section discusses the Equipment Overview window and how to manage equipment.

Equipment Overview Window

To access the Equipment Overview window, select the Equipment Overview aspect. By default an Equipment Overview aspect is located in Library Structure\Batch Management\Overviews. However, this aspect can be added to any 800xA System object or a toolbar button can be used to open this window. The Equipment Overview window displays the equipment configured in the equipment database.
Refer to Figure 61.

Figure 61. Equipment Overview Window

- The Equipment Overview window displays show valid information only when the Batch Server can be accessed.

- Information displayed in the Equipment Overview window can be sorted by a single column using standard Windows functionality. How the information in that column is sorted (increasing or decreasing) is also selectable.

**Icons**

- The status of each piece of equipment in the window is indicated by the color of the icon to which it is associated. The colors are:
  - Blue - Not acquired by anything.
  - Green - Acquired by Batch Management.
  - Yellow - Acquired by HSI or other application.
  - Gray - Out of service.
• Red - Has generated an exception report.

**Column Headings**

Information about a piece of equipment is displayed in columns. By default, the pieces of equipment in the Equipment Overview are arranged by equipment name. The sort order, column order, and appearance of this window can be changed using standard Windows methods.

Equipment can be configured as viewable or restricted (based on the AfwID_Operation_BatchRT_ViewEquipment operation access for that equipment). If the equipment is viewable to the current user, it appears in the overview. If it is not viewable, no information about the equipment is displayed. If the equipment is restricted, the Lot ID column displays Restricted and the Campaign ID column is empty. The Batch ID column displays information even if the equipment is restricted. The PFC and Batch Status menu options are disabled if the equipment is restricted.

In the Equipment Overview window, the following columns provide information about each piece of equipment.

**Name**

Icon and name of equipment specified during configuration of the equipment database.

**Batch ID**

Batch currently using the equipment. If a shared equipment module (SEM) is being used by more than one batch, the Equipment Overview window will show the batch IDs of all batches that have acquired the SEM.

**Lot ID**

Batches currently using the equipment. Restricted is displayed if the equipment has been acquired, reserved, or selected by a batch that has been scheduled in a batch cell that an operator is not allowed to access based on the login account of the operator.
**Campaign ID**

Batches currently using the equipment.

**Status**

The current status of the equipment is displayed in this column. The four statuses are Available, Acquired, Reserved, and Error.

Available status indicates the equipment is available for selection, reservation, or acquisition.

Acquired status indicates the equipment has been acquired by a batch.

Reserved status indicates the equipment has been reserved by a batch or an operator or selected by a batch but has not been acquired for use by that batch.

Error status indicates that Batch Management has tried to use the equipment but the equipment cannot be used for the reason listed in the BM Error column. This status will take precedence over the other statuses.

**Op Status**

The Op Status indicates two types of status for the equipment:

1. **Normal** - Normal status indicates the equipment is available for selection, reservation, or acquisition.

2. **Failed** - Failed status indicates the equipment has been disabled or discarded by the operator.

This status may differ from the current status of the equipment.

For example, the operator may know that the equipment is scheduled for routine maintenance. When the operator disables the equipment, all the batches that are currently in the queue to use the equipment will still be permitted to use it when it is placed back into service. However no additional batches will be permitted to join the queue until the operator places the equipment back into service.
The operator can change the status of a piece of equipment using the buttons provided in the Equipment Information window.

**BM Error**

This column details the error condition noted by Error in the Status column. **** indicates OPC bad quality.

**Connection State**

This column indicates the state of the connection to the OPC data or equipment. Table 20 lists the available connection states.

*Table 20. Connection States*

<table>
<thead>
<tr>
<th>Connection State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Startup</td>
<td>Equipment Manager starting. Equipment is identified by the Equipment Manager but the connection process has not yet begun.</td>
</tr>
<tr>
<td>Connecting</td>
<td>Equipment Manager is establishing the OPC connection to the equipment.</td>
</tr>
<tr>
<td>Connected: Wait for good quality</td>
<td>Equipment Manager has established the OPC connection to the equipment and is waiting for all points to report GOOD quality.</td>
</tr>
<tr>
<td>Connect failed</td>
<td>Equipment Manager is unable to successfully connect to the equipment. May be followed by an error message detailing the failure.</td>
</tr>
<tr>
<td>Connected</td>
<td>Equipment Manager has established the OPC connection to the equipment and all points report GOOD quality.</td>
</tr>
<tr>
<td>Disconnecting</td>
<td>Equipment Manager is dropping the OPC connection to the equipment.</td>
</tr>
<tr>
<td>Connected: Acquiring</td>
<td>Equipment Manager is connected to the equipment and is processing an acquire request.</td>
</tr>
<tr>
<td>Connected: Releasing</td>
<td>Equipment Manager is connected to the equipment and is processing a release request.</td>
</tr>
</tbody>
</table>
Status - Controller
This column displays the state of the equipment as reported by the controller. The state can be:

- BM - Equipment acquired by Batch Management.
- HSI - Equipment acquired by HSI.
- APPL - Equipment acquired by other applications.
- empty string - Equipment not acquired.
- **** - Bad OPC quality.
- N/A - Not applicable to this type of equipment.

Mode - Controller
This column displays the S88 mode of the equipment as reported by the controller. The modes are:

- Auto - Batch Management controls the equipment.
- Manual - Manual input from the operator controls the equipment.
- **** - Bad OPC quality.
- N/A - Not applicable to this type of equipment.

Batch ID - Controller
This column displays the ID of the batch using the equipment as reported by the controller. Batch ID can be:

- A batch ID - This batch is using the equipment in some way.
- **** - Bad OPC quality.
- N/A - Not applicable to this type of equipment.

ExceptionID - Controller
This column displays the ID of the exception generated by the equipment as reported by the controller. Exception ID can be:
Section 6  Batch Equipment Status

- An exception ID - ID of the exception.
- **** - Bad OPC quality.
- N/A - Not applicable to this type of equipment.

**State - Controller**

This column displays the state of the controller as reported by the controller. Controller states can be:

- Idle.
- Running.
- Pausing.
- Paused.
- Holding.
- Held.
- Restarted.
- Stopping.
- Stopped.
- Aborting.
- Aborted.
- OutOfService.
- ****.
- N/A.

**Find Function**

User can search and find the equipment name using the **Find** function.

1. Enter the equipment name.
2. Select the direction of the search (Up or Down).
The search starts at the selected equipment and end at the top (Up) or bottom (Down) of the list according to the selected direction.

3. Click **Find** and scroll through the list to see the equipment found (highlighted). A message is displayed if no matching equipment name is found.

**Change Equipment Status**

To change the equipment status, right click the required equipment in the **Equipment Overview** window and select **Equipment Status** from the context menu.

Equipment Status window has three tabs:

- Equipment Information (**Figure 62**).
- Equipment Attributes (**Figure 63**).
- Equipment Commands (**Figure 64**).

**Equipment Information Tab**

![Figure 62. Equipment Information Tab](image)

This tab contains the following information.
Section 6  Batch Equipment Status

**Equipment**

Equipment name.

**Controller Type**

Controller type configured for the equipment.

**Status**

Status of the equipment as set by the batch software. The status can be:

- Available.
- Busy (equipment has been acquired).
- Reserved (equipment has been selected or reserved).

**Operator status**

Status of the equipment as set by the operator. The status can be:

- Normal (equipment is enabled).
- Failed (equipment has been disabled or discarded).

**Active Batch List**

Active batch list (if any) of all the batches that have acquired, reserved, or selected the equipment.

**Pending Batch List**

If a piece of equipment is busy, or if a shared equipment module is already being used by the maximum number of batches specified in the equipment database, other batches can be queued to use the equipment. Batches are placed in the queue when a procedure executes a batch manager action to request that a piece of equipment be selected, reserved, or acquired. The queue for the equipment is displayed in the pending batch list.
Entries in the equipment queue can have their priority within the queue rearranged. Select the appropriate batch from the Batch Overview window and enter a new priority.

A single batch may be queued for more than one equipment that performs the same function. When procedure execution reaches a select equipment BMA, the system will enter the batch in the queue for every equipment that meets the configured selection criteria. When the batch acquires one of the reserved pieces of equipment, the batch will be removed from the queue for the other equipment that perform the same function.

Various buttons used to change the status of the equipment are provided below the list of batches.

There are three ways that the operator can take a piece of equipment out of service. Each of these methods is designed to provide varying levels of effect on the running batches.

![Warning]

Do not **Release** or **Discard** a unit (equipment) that has active batches with active recipe phases.

Follow the steps to remove an active recipe from the batch:

1. Open the **Equipment Status** window to see the list of active and pending recipes for the unit.
2. Stop or abort the recipes in the pending list and keep them in safe state. This prevents these recipes becoming active when the active recipe is removed.
3. Force the active recipe to an end state (Stopped, Aborted, Complete, or Idle) using the **Stop** or **Abort** command in the **Batch Status** window.
4. Terminate the recipe. This removes the recipe from the active list and makes the unit free to accept the next Batch.

Users need to use the **Start at Beginning** command for the active recipes that were put in a safe state.
Reserve
The operator can reserve the equipment. The operator will be entered in the queue at the highest priority. This guarantees the operator to gain control of the equipment when it is free from the currently active batch. The equipment will not be given to another procedure until the operator releases it. During this time new procedures may request reservation of the equipment and will be placed in the queue. A typical use for this type of control is to schedule a brief repair cycle. Use **Release** to unreserve a piece of equipment.

Disable
The operator can disable a piece of equipment. This operation blocks any new entries from being placed into the queue and the operator status will change to Failed. This type of action is good for a non emergency type of repair or maintenance where it is allowable to let the currently queued set of batches complete, but new batches will not be allowed. Use **Enable** to return a piece of equipment to service.

Discard
If a piece of equipment is discarded, the batch manager will remove all entries from the queue including the running batch. The equipment will be removed from the list of available equipment and the operator status will change to Failed. No new batch will be able to select the equipment. If an active phase is stopped, aborted, complete or idle the batch manager will release the equipment when the discard command is issued. If an active phase is in any other state, the batch manager will not release the equipment. Use **Enable** to return a piece of equipment to service. Re-enabled equipment must be reacquired by the batch in order to continue.

The discard command should only be used as a last resort.

The condition where Batch Advanced Templates equipment (acquired by the Batch Manager in the controller) cannot be discarded can happen in a number of cases. The equipment must be brought to the unacquired and idle state using the following procedure before the discarded function will work correctly:

1. Select the SysEngr tab on the expanded equipment faceplate for the equipment.
2. Issue the 15-Reset/Release command
   - or -
   Issue the 8-Reset command and then the 10-Release command.
   This procedure can also be used in the batch manager. It terminates the batch but the equipment control module does not get released in the controller.

**Equipment Attributes Tab**

The equipment information window also contains an Equipment Attributes tab used to access the window shown in Figure 63. The equipment attributes, their values, engineering units, description, high and low limit (if applicable), access level, and the default value (defined during the equipment configuration) will be displayed.

If an attribute is writable, a new value can be specified by entering the value into the text field at the bottom of the window and clicking **Apply**. The runtime value will be changed but the default value (defined during equipment configuration) will not be changed. If an attribute is read-only (access level of No Access) or the user does not have a sufficient access level, the **Apply** button will be disabled.

This defines the runtime access level to the attribute. The Batch manager has the highest access level. Therefore, a recipe can write to any equipment attribute that has an access level other than no access (using unitattput/unitattputs commands). A recipe can also write the values to the attribute with the Access Level of "**No Access**" for the following attribute types/fields:

- OPC properties (OPC Datapoint, OPC Float, OPC Integer and OPC Text)
- In Controller

A recipe cannot write the values to no access Local attributes (Float, Integer and Text).
Section 6  Batch Equipment Status

Equipment Commands Tab

This tab (Figure 64) is available for equipment that was configured using the PCEquipmentLib and BatchAdvTemplates libraries and it contains the following information and command buttons.
**Equipment**

Equipment name.

**Mode**

Mode of the equipment.

**Current State**

Current state of the equipment.

**Command Buttons**

These buttons change the state of the equipment and are available when the equipment is in Auto mode and Batch Management has acquired it.

**View Procedure Function Chart**

The procedure function chart of the batch that has acquired, selected, or reserved the equipment can be viewed by right clicking the equipment (in the Equipment Overview window) and selecting PFC.

**View Batch Status**

The status of the batch that has acquired, selected, or reserved the equipment can be viewed by right clicking the equipment (in the Equipment Overview window) and selecting Batch Status.

**View Faceplate**

The batch advanced template faceplate of the equipment can be viewed by right clicking the equipment (in the Equipment Overview window) and selecting Faceplate.
Inactive Equipment

Equipment that has been made inactive will not be listed in the Equipment Overview or any other Batch Management window. To change the status of equipment:

1. Select the Batch Unit Activation aspect of the Library Structure\Batch Management\Configuration object.

2. Enable or disable the desired equipment.
Section 7  Batch History Overview

Introduction

This section describes the batch history overview. The batch history overview is a short term history tool to view only the current batch records.

The Information Manager for System 800xA is the dedicated historian, which provides the integrated records of batch, process, and event data. Information Manager has the fully integrated reporting, archiving, and restoring capabilities.

Information Manager and the use of batch Production Data Logs (PDL) are explained in the *System 800xA Information Management Configuration (3BUF001092*) manual.

Batch History Overview Window

To access the Batch History Overview window, select the Batch History Overview aspect. By default a Batch History Overview aspect is located in Library Structure\Batch Management\Overviews. However, this aspect can be added to any 800xA System object or a toolbar button can be used to open this window.

The batch database contains the information related to batches run on the system. Access to this information is keyed to the batch ID. The data can be automatically recorded by the system, specified to be gathered during procedure configuration, entered by the operator, or gathered as events as the batch processing was executed. The batch database contains two sections of data per batch:

- Batch event history.
- Tag key collected data.
The Batch History Overview window shown in Figure 65 provides access to the batch data. This batch data can be viewed on the display and/or printed out in a report.

![Batch History Overview Window](image)

**Figure 65. Batch History Overview Window**

The Batch History Overview window contains a list of completed and terminated batches that have not been deleted. This list is limited to the last 1000 batches. Use the Refresh button to update the information.

Active batches do not appear in the Batch History Overview window. Active batches are listed and accessed from the Batch Overview window (Figure 34).

**Columns**

Information about each batch is displayed on a single line. By default when the window opens, the batches are sorted by batch ID. The sort order, row order, and appearance of this window can be changed using standard Windows methods.

The column headings are:

- Batch ID.
Section 7 Batch History Overview

- Lot ID.
- Campaign ID.
- Recipe ID.
- State.
- Scheduled Status.
- Batch Cell.
- Start Time.
- End Time.
- Elapsed Time.

**Button Options**

The Batch History Overview window contains five buttons which are described in Table 21.

*Table 21. Batch History Overview Buttons*

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFC</td>
<td>Click <strong>PFC</strong> to display the procedure function chart (PFC) for the batch. Refer to Section 4, Procedure Function Charts.</td>
</tr>
<tr>
<td>PDL PFC</td>
<td>Click <strong>PDL PFC</strong> to retrieve a PFC for a batch that has been sent to and stored in the Information Management PDL. The batch must be deleted from the Batch Management historian in order to display a PFC for that batch. The PFC must have been exported from PDL to a known hard disk location in order to retrieve the PFC. Refer to Appendix D, PDL Extractor.</td>
</tr>
<tr>
<td>Status</td>
<td>Click <strong>Status</strong> to display Batch Historian Information window. Refer to Batch History Information Window on page 166.</td>
</tr>
<tr>
<td>Find</td>
<td>A text box is used to facilitate finding a batch. The Up and Down options specify the direction the find function will search.</td>
</tr>
<tr>
<td>Cell Filter</td>
<td>This function can be used to show the batches for a specific batch cell.</td>
</tr>
</tbody>
</table>
Batch History Information Window

To access the Batch History Information window, highlight the desired batch and click **Status**. The Batch History Information window displays the following tabs.

**Status Tab**

The Status tab (**Figure 66**) is shown by default when the Batch History Information window opens. The information contained in this window is: Batch ID, Lot ID, Campaign ID, Recipe ID, State, Scheduled Status, Batch Cell, Start Time, End Time, and Elapsed Time.

![Figure 66. Status Tab (Batch History Information Window)]
Events Tab

The Events tab (Figure 67) contains the Event List and Advanced subtabs.

![Figure 67. Events Tab (Batch History Information Window)](image)

Event List Subtab

The Event List subtab is used to view the event record created automatically during batch executions. No data collected on this tab can be modified. This part of the tab contains, in time order, all batch events that occurred during the batch or during the time period specified on the Advanced subtab. However, the Events tab has a fixed amount of space in which to display the events. When all the events can no longer be displayed on the Events tab the message Event List Incomplete - Use Advanced Tab will be displayed. Narrow the time range specified on the Advanced subtab to eliminate this message.

The types of events recorded include:

- Procedure block start and parameter values.
- Procedure block end.
• Phase block start and parameter values.
• Phase block end.
• Batch manager actions and their results where applicable (for example, selected equipment, operator messages and replies).
• Runtime parameter changes.
• Identity of operator making runtime edits.
• Operator changes to the procedure state and mode.
• Operator comments entered in the block status windows.
• Breakpoint manipulations.
• Recipe errors.
• Block restarts.

**Advanced Subtab**

A time range for the collection of events is specified on this subtab. To view the events for a given time range, enter the start and end time in the following format and click **Refresh**.

```
HH:MM:SS   MM/DD/YY
```

The message **List is for Time Range per Advanced Tab is displayed.**
Tag Data Tab

The tag data portion of the batch database contains points that have one value per tag key name. The Tag Data tab (Figure 68) contains a list of the tag names and the collection time.

![Figure 68. Tag Data Tab (Batch History Information Window)](image)

Data is selectively written into the tag data portion of the batch database through compute and data collection batch manager action (BMA) objects. The compute batch manager action uses the bdbput function to store data as tag data. Data collection batch manager actions that have a collection period of once will also store collected data as tag data.

Some tag names are reserved and automatically filled in by the system such as:
- Recipe name and version number.
- SOP.
- Start time, end time, elapsed time.

Each data element in the tag key collected data section consists of:
- Name (tag key data point name).
• Time-stamp of the collection (collection time).
• Value.

To view details of a tag key data point in the list, select the data point and read the History Data Detail area.

Reports Tab

A printed batch report can be created containing information about a specific batch ID. A report for a batch can be printed from the Reports tab (Figure 69).

![Figure 69. Reports Tab (Batch History Information Window)](image)

The Spreadsheet Logs area contains a list of the reports configured by the process engineer. Select the report to be printed and click Print. A preconfigured Excel spreadsheet will be opened that can be viewed and printed.

Button Options

The Reports tab contains two buttons.

Click Print (on the Events and Reports tabs) to print the data. Refer to Reports Tab on page 170 for further details.

Click PFC to display the procedure function chart (PFC) for the batch. Refer to Section 4, Procedure Function Charts.
Appendix A  AC 800M/C Controllers

Introduction

The AC 800M and AC 800C controllers are supported by Batch Management through the OPC™ server that is part of the 800xA system connectivity server. OPC standard communication is used.

One method of batch to controller communication uses the AC 800M/C phase driver (in Batch Management) which utilizes the S88 state model and controls the downloading of parameters to the controller. State change information is sent from the controller to the phase driver. The Control Builder M equipment procedure template controls the execution of equipment procedure elements (sequential function charts (SFCs) and IEC 1131 modules) in the controller. Figure 70 shows an
overview of AC 800M/C OPC communications using equipment procedure templates.

Figure 70. AC 800M/C OPC Communications (Equipment Procedure Templates)

A second method of batch to controller communication uses the AC 800M/C Advanced phase driver (in Batch Management) which utilizes the S88 state model and controls the downloading of parameters to the controller. State change information is sent from the controller to the phase driver. The Control Builder M phase control modules control the execution of equipment procedure elements (sequential function charts (SFCs) and IEC 1131 modules) in the controller. Figure 71 shows an overview of AC 800M/C OPC communications using advanced
equipment and phase templates.

![Diagram of AC 800M/C OPC Communications (Advanced Equipment and Phase Templates)]

*Figure 71. AC 800M/C OPC Communications (Advanced Equipment and Phase Templates)*

For detailed information on AC 800M/C controller operation, refer to the appropriate AC 800M/C instructions.
Appendix B  Harmony Connectivity

Introduction

This appendix discusses the PHASEX function code features, debugger, and fault codes. It lists the differences between PHASEX and the traditional batch sequence (BSEQ) function code. PHASEX allows for greater flexibility and ease of use over BSEQ. The interactive faceplate allows the active equipment phase to be accurately monitored and controlled. Refer to Figure 72.

Figure 72. Harmony Communications
**PHASEX Features**

Batch processing with the Harmony subsystem uses the PHASEX function block. Although PHASEX is similar to the traditional batch sequence (BSEQ) function block used to run process control sequences, PHASEX incorporates some important features needed to achieve flexible batch process control. PHASEX differs from the BSEQ function block in its phase by phase interface with the batch management system, and other enhancements as outlined below.

PHASEX functionality matches BSEQ functionality except for the following items:

1. PHASEX is an exception reporting block. Exception reports pass data from the Harmony controller and allow operator control at the Process Portal workstation. Data included in the exception report of PHASEX are current phase name, state, fault code, alarm, batch program ID and batch program timestamp.

2. PHASEX receives the operational commands and phase data from the Batch Management, which includes the phases to execute and phase parameters. The BSEQ receives phases, and parameters to execute from the recipe file permanently located in the Harmony controller. The BSEQ receives operational commands from other function blocks as input connections to the BSEQ block.

3. PHASEX requires that enough memory be allocated to support phase data used. The lead PhaseX function block generally acts as the Unit with the B90 program in memory for all the secondary PhaseX function blocks that will be utilized. The S12 memory value of the lead PhaseX function block should be set to the value specified in the Batch Data Manager (BDM) times the maximum number of phases to be run in any sequence for that unit.

4. The phase that is executed as the emergency shutdown phase is configured as the abort phase in the B90 program for the PHASEX block. The abort phase is executed when a phase is aborted from the PHASEX faceplate, a recipe from is aborted from Batch Management, or interlock logic defined in the Harmony controller triggers the abort. The BSEQ block B90 program does not require the configuration of a specific phase for emergency shutdown. However, the user must assign a phase number 0 in the sequence defined in the BSEQ recipe file. Phase 0 is always executed as e-stop for the BSEQ block.
5. PHASEX activates the B90 program when it is acquired, and the program remains active until PHASEX is released. The BSEQ activates the B90 program when a recipe is started and the program remains active until the batch is complete.

6. During execution of a batch recipe, a new version of the B90 program can be utilized. PHASEX utilizes a new B90 program when it receives an initialize hot or initialize cold command. Initialize commands are allowed when phases running in PHASEX are in an inactive state (held, stopped, aborted, complete, and idle). The BSEQ activates the B90 program file on a held to running transition.

During normal batch operations the operator does not need to use the PHASEX faceplate. Knowledge of the PHASEX faceplate is useful for handling abnormal conditions.

**Debugger**

The batch debugger allows the execution of the program to be controlled. By executing the program in pieces or even one step at a time, progress can be closely monitored allowing the causes of errors to be more easily found. The values of program and built in variables can be viewed. Program variables can be put on watch and monitored while the program executes. Program variables can be
changed when program execution is stopped. Refer to Figure 73.

Figure 73. Batch Debugger Window

**Breakpoints**

Breakpoints are pointers that stop program execution. They are useful when debugging because they allow programs to be executed in user defined pieces. The dynamic debugger allows two individual breakpoints to be active at one time.

To set or edit breakpoints from the batch debugger using the **Debug** menu:
1. Verify the program window is the active window.
2. Select **Debug > Breakpoint....**
3. Enter a new first breakpoint (source code line number).
4. If desired, enter a new second breakpoint.
5. Click **OK**.

To clear both breakpoints at the same time, click **Clear All**. To jump to a line of source code containing the breakpoint, click **Go To** below the line number field.

**Change Operation**

Changing the operation transitions the active phase to the complete state when using single phase execution mode for a PHASEX batch program.

To change the operation being executed from the batch debugger:

1. Verify the program window is the active window.
2. Select **Debug > Change Operation....**
3. Click **Next**, **Previous**, or enter the number of the desired operation and click **OK**.

**Change Phase Debugged**

There are no parallel phases running in a PHASEX function block.

To change to a parallel phase whose source code is being debugged from the batch debugger:

1. Verify the program window is the active window.
2. Select **Debug > View Phase....**
3. Click **Next**, **Previous**, or select the phase to be viewed from the list of phases and click **OK**.
Escape Loop

Use this functionality to exit a loop when it is not practical to wait for the loop to process or if an infinite loop is encountered. To escape a loop, select **Debug > Escape Loop** from the Batch Debugger window.

Find Specific Text

To find specific text in the batch debugger:

1. Verify the program window is the active window.
2. Select **Search > Find...** and enter the text to be searched for.
3. Select the case matching option, search direction, and click **Find Next**.

The cursor will indicate the line of code containing the specified text.

Go To Specific Line

There are three ways to go to a specific line.

**Directly**

To go to the first, last, or a specific line of the source code:

1. Verify the program window is the active window.
2. Select **Search > Go To Line...**.
3. In the go to line dialog box, enter the desired line number and click **OK** (specified line), **Home** (first line), or **End** (last line).

**Execute Up To Line**

To go to the first, last, or a specific line of the source code and continue execution from the program window of the batch debugger:

1. Right click a variable name appearing in the program code and select **Go To Line...**.
2. In the go to line dialog box, enter the desired line number and click **OK** (specified line), **Home** (first line), or **End** (last line).
Variable Definition
To go to the line of code that defines a variable from the program window of the batch debugger:
1. Right click a variable name appearing in the program code.
2. Select Go To Definition... from the pop-up menu.

Line Tracking
To highlight the active line of code in the batch debugger:
1. Verify the program window is the active window.
2. Select Debug > Line Tracking.

The last debugger session setting is the default setting for the next session.

Properties
The properties of the debug session include:
- Program name, creation date and time, and size.
- BSEQ, PHASEX, or UDF function block status.
- Program status.
- Debug status.
- Indication of the disable program fault or hold logic state.
- Fault information.
- Recipe name, creation data and time, size, and ID (BSEQ batch programs only).
- The operation and phase being executed (BSEQ batch programs only).
- Unit name, creation date and time, and size (unit relative batch programs only).
- Loop, PCU, controller, and function block address of the program (unit relative batch programs only).

To view or edit the properties of a debug session from the batch debugger:
1. Verify the program window is the active window.
2. Select **Debug > Properties...**
3. Edit or view (if the current user has access) the desired properties and click **OK**.

**Remove Variables from Watch**

To remove a variable from the watch box of the batch debugger window:
1. Select the name of the variable in the watch box.
2. Select **Debug > Remove Watch** or press **Delete**.

**Start Execution**

To start the execution of a program in a controller from the batch debugger:
1. Verify the program window is the active window.
2. Select **Debug > Go**.

**Step Execution**

It is possible to execute programs one statement at a time (after stopping the program) using **Step Section**, **Step Level**, and **Step Same** from the **Debug** menu.

**Step Section**

To execute the current statement and stop from the Batch Debugger window, select **Debug > Step Section**.

The next executable statement (regardless of section boundaries) will be highlighted.

If the statement is a monitor or function subroutine call, the entire subroutine is executed normally.

**Step Level**

To execute the first statement of a monitor or function subroutine from the Batch Debugger window, select **Debug > Step Level**.
If the next statement to be executed is a function or monitor subroutine, the step level function will cause the debugger to execute the next executable statement within the monitor or function subroutine. From within a subroutine, the step level function executes exactly like the step same function.

**Step Same**

To execute the current statement and stop at the next executable statement within the current program section (function calls, monitor calls, continuous logic, sequential logic, etc.), select **Debug > Step Same** from the Batch Debugger window.

The next executable statement within the program section will be highlighted. The step same function will not execute out of program section. Execution of statements will stop after the last statement.

**Stop Execution**

To stop the execution of a program in a controller from the batch debugger:

1. Verify the program window is the active window.
2. Select **Debug > Stop**.

**View and Watch Variables**

It is possible to view or edit the value of program and built-in variables. It is also possible to put program variables (except constant and constant string variables) in a watch box so they can be monitored during program execution.

**View Program Variable**

To view the value of a program variable from the batch debugger:

1. Verify the program window is the active window.
2. Right click the variable name in the program code and select **Inspect...**
3. View the current value and click **OK**.

**Edit Program Variable**

To edit the value of a program variable from the batch debugger:
1. Verify the program window is the active window.
2. Select **Debug > Stop**.
3. Right click the variable name in the program code and select **Inspect....**
4. Enter a new value and click **Change** in the dialog box.

**Watch Program Variable**

To put a program variable into the watch box from the batch debugger:

1. Verify the program window is the active window.
2. Right click the variable name in the program code and select **Inspect....**
3. Click **Add Watch** in the dialog box.
4. Click **Close**.

**View Built-In Variable**

To view the value of a built-in variable from the batch debugger:

1. Verify the program window is the active window.
2. Select **Debug > Stop**.
3. Select **Debug > Builtin Variables**.
4. Select the desired variable from the list.
5. View the current value or enter (depending on variable type) a new value and click **Change** in the dialog box.
6. Click **OK** and **Close**.

**Fault Codes**

The PHASEX fault codes are configured in the Process Portal system definition object. The phase execution (PHASEX) function block executes a series of diagnostic tests that detect errors that cannot be detected by the compiler.
The PHASEX fault codes are listed in the indexed text tab. Figure 74 is an example of the Indexed Text tab.

![Figure 74. PHASEX Fault Code Text View](image)

The Harmony PHASEX fault code item has to be selected in the selection box to view the fault codes. Beside the text type selection box is a set of buttons to scroll through the table. Pressing the outer buttons of this control immediately moves the table to the beginning or the end. The other two buttons scroll through each table entry. The text field beside this control displays the record number that has focus out of the total number of records in the table.

The text entry fields at the bottom of the tab are used to edit and add user defined text. Only text indexes that have been added to the list can be edited.
To add a text index:

   
   Select the pin icon to hold the Configuration Browser window open.

2. Open the list for the text box and choose Object Type Structure.

3. Open the System Definition folder and select appropriate file.

4. Select the Indexed Text tab.

5. Click the add text icon. An empty text index is added at the bottom of the table.

6. Enter the index number in the provided field.

   This index number is unique to the selected server type.

7. Select the Harmony Server type. The selection of a server type assigns the index to that server type. This allows multiple text entries for the same index for each type of server.

8. Enter the text that is associated with the index number.

**Runtime Fault Codes**

The fault codes can be seen using:

- The PHASEX faceplate.
- The Fault tab in the extended view for the PHASEX faceplate.
- The batch debugger.
- The PHASEX block output (\(N+2\)).

The errors are only detectable while the controller is in execution and are, therefore, called runtime errors. Table 22 lists the possible error codes and an explanation of each.
**Appendix B  Harmony Connectivity**

**Table 22. PHASEX Runtime Fault Codes**

<table>
<thead>
<tr>
<th>Fault Codes</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any positive number</td>
<td>This number (any positive number) is assigned by the user in the batch language program and is used to indicate what type of fault has occurred. There is no limit to the number of fault codes the user may assign.</td>
</tr>
<tr>
<td>-3.0 Stack overflow</td>
<td>Contact ABB.</td>
</tr>
<tr>
<td>-4.0 Error reading object file</td>
<td>No batch program exists in the NVRAM memory that matches the number indicated in specification S9 of the PHASEX function block. Normally this means that the batch object file has not been downloaded to the controller or specification S9 of the PHASEX function block references an undefined program number.</td>
</tr>
<tr>
<td>-5.0 Object file exceeds memory allocation</td>
<td>The batch program size exceeds the amount of controller volatile memory specified by specification S11 of the PHASEX function block. Correct this problem by increasing specification S11.</td>
</tr>
<tr>
<td>-6.0 Phase data message exceeds memory allocation</td>
<td>The send phase data message can not fit in the memory allocated by specification S12 of the PHASEX function block. Correct this problem by increasing specification S12 and resending the phase data.</td>
</tr>
<tr>
<td>-7.0 Phase data size exceeds memory allocation</td>
<td>The amount of data used by a phase exceeds the amount of memory specified by specification S12 of the PHASEX function block. To correct, increase the value of specification S12 in the PHASEX function block. Fault data - The block number of the lead PHASEX function block with the problem.</td>
</tr>
<tr>
<td>-8.0 Recipe refers to undefined phase subroutine</td>
<td>The recipe contains a phase subroutine name that is not contained within the batch program. This situation can happen when a batch program is edited so that a phase subroutine is removed, but the corresponding recipes are not changed. To correct, add the undefined phase subroutine or remove the called (undefined) phase subroutine from the recipe. Fault data: 0 = no phase data message was received. 1 = message received.</td>
</tr>
<tr>
<td>-9.0 Batch directory error</td>
<td>Format controller and reload necessary programs, recipes, and data files.</td>
</tr>
<tr>
<td>-10.0 Recipe error</td>
<td>Contact ABB.</td>
</tr>
</tbody>
</table>
### Table 22. PHASEX Runtime Fault Codes (Continued)

<table>
<thead>
<tr>
<th>Fault Codes</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>-12.0 Illegal parameter type</td>
<td>There is an argument data type conflict between the recipe and the batch program. To correct, recompile the batch program and/or fix the recipe. Then, download the recompiled batch program and rerun the phase. Fault data - The position (starting with I) of the illegal parameter in the recipe.</td>
</tr>
<tr>
<td>-13.0 ESTOP/ Aborting from block input</td>
<td>The abort phase was triggered by the specification 5 input of the PHASEX function block. The fault is triggered when the abort phase is activated. Clear the fault by issuing a reset when the PHASEX function block is in the aborted state.</td>
</tr>
<tr>
<td>-16.0 Bad function block reference</td>
<td>In the batch data declaration sections of the batch language, the program is trying to reference a function block that does not exist or one whose type does not match the function code type in the declaration. The batch debugger will provide the function block number within the batch data section that is making the reference. To correct, change the function block number to a valid one, erase the reference from the program, or correct the type to match the function block in the controller.</td>
</tr>
<tr>
<td>-17.0 Array error</td>
<td>An array subscript is out of bounds. Normal logic is suspended and execution of fault logic begins. It is possible to inspect the value of the fault code to detect when this fault has occurred.</td>
</tr>
<tr>
<td>-18.0 BCODE revision mismatch</td>
<td>The batch program was compiled using firmware that does not match the firmware in the controller. Recompile the batch program with the compiler that matches the firmware within the controller.</td>
</tr>
<tr>
<td>-20.0 Invalid number of parameters in phase data</td>
<td>The recipe contains the wrong number of phase parameters as compared to the target program. To correct, fix the recipe or the program (normally the recipe).</td>
</tr>
<tr>
<td>-21.0 Invalid online program change</td>
<td>The attempted execution of a new program that differs from the previous one because of a change in the batch data area or the local declaration section of the active phase subroutine. Such online changes are not permitted.</td>
</tr>
</tbody>
</table>
## Table 22. PHASEX Runtime Fault Codes (Continued)

<table>
<thead>
<tr>
<th>Fault Codes</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>-25.0 Bad block reference in phase data</td>
<td>The recipe used contains a reference to an incorrect or nonexistent block. Correct the block number in the recipe. Fault data - The position (starting with I) of the bad function block reference in the recipe.</td>
</tr>
<tr>
<td>-27.0 Bad block reference in Unit Data</td>
<td>A function block declaration in the unit data file does not match the controller configuration (either the function block address or the function code type are in error). Resolve any discrepancies and recompile the unit data file against the batch program.</td>
</tr>
<tr>
<td>-28.0 Bad CSEQ reference in Unit Data</td>
<td>A CSEQ reference in the unit data file does not match the program. Resolve any discrepancies and recompile the unit data file against the batch program.</td>
</tr>
<tr>
<td>-29.0 Unit Data does not match B90 program</td>
<td>The unit data file does not match the batch program structurally (the number or type declarations do not match). Resolve any discrepancies and recompile the unit data file against the batch program.</td>
</tr>
<tr>
<td>-30.0 Error reading UNIT.DEF file</td>
<td>No unit data file exists in the NVRAM memory that matches the number indicated by specification S9 of the PHASEX function block. Normally this means that the unit data object file has not been downloaded to the controller.</td>
</tr>
<tr>
<td>-32.0 String subscript error</td>
<td>The string position specified in the program is negative or larger than the maximum size of the string. This error occurs during program execution and transfers the program to fault logic.</td>
</tr>
<tr>
<td>-35.0 Illegal parameter name</td>
<td>The recipe parameter name does not match the parameter name of the selected phase in the program file. Check the recipe and program file and edit the names to match. Fault data - The position (starting with I) of the illegal parameter in the recipe.</td>
</tr>
<tr>
<td>-36.0 Abort phase not defined</td>
<td>The batch program file does not contain a phase named Abort. Edit the batch program to contain the Abort phase, recompile, and download the program file.</td>
</tr>
</tbody>
</table>
Table 22. PHASEX Runtime Fault Codes (Continued)

<table>
<thead>
<tr>
<th>Fault Codes</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>-37.0 Phase data receipt error</td>
<td>Phase data as received by the PHASEX function block is out of order. Send the phase data again.</td>
</tr>
<tr>
<td>-38.0 Program not active</td>
<td>The command was accepted as an allowable command for the present state but the program was not active. The command could not be executed successfully by the PHASEX function block. Activate (initialize or acquire) the program and issue the command again.</td>
</tr>
</tbody>
</table>
Appendix C  AC 870P / Melody Connectivity

Introduction

The runtime connection between Batch Management and 800xA for AC 870P / Melody is provided by a Melody phase driver incorporated into the Batch Management product. The Melody phase driver has been designed to operate with both the Sequential Function Chart and the SFC-Phase object types. The Melody phase driver operates the Melody phases according to the standard operating modes of Batch Management and effectively bridges any gaps where the Melody phases are unique in their behavior.

Error Messages

Several Batch Management error messages are unique to Melody. In addition, all standard Batch Management error messages may also be seen by a Melody user (Table 23).

Table 23. Error Messages

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command Not Valid For Current State</td>
<td>Generated when the command is not valid for the current state of the phase. For example, when an Abort command is issued to a phase in the Held state.</td>
</tr>
<tr>
<td>Command Invalid for Phase Type</td>
<td>Generated when an invalid command is issued for the phase type. For example when a Pause command is issued to a Sequential Function Chart phase.</td>
</tr>
</tbody>
</table>
Table 23. Error Messages (Continued)

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command Not Allowed for Phase Type</td>
<td>Generated when a command is not allowed by the registry settings. For example the Melody Allow Hold Command is set to false and the user selects the Hold command in the Block Status dialog.</td>
</tr>
<tr>
<td>Reconnect to Idle Phase</td>
<td>Generated when Batch Manger reconnects to a phase that is expected to be in the Running or Complete state and the phase is found to be in the Idle state.</td>
</tr>
</tbody>
</table>
Protection Command Error Messages

Table 24. Protection Command Errors

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection Held</td>
<td>Generated when the Protection Hold command is issued for a phase.</td>
</tr>
<tr>
<td>Protection Stop</td>
<td>Generated when the Protection Stop command is issued for a phase.</td>
</tr>
<tr>
<td>Protection Abort</td>
<td>Generated when the Protection Abort command is issued for a phase.</td>
</tr>
<tr>
<td>Start Failed: Protection</td>
<td>Generated when a Restart command is issued for the phase when phase is in</td>
</tr>
<tr>
<td>condition active</td>
<td>Protection Held or Protection Stopped or Protection Abort condition.</td>
</tr>
<tr>
<td>Invalid Command</td>
<td>Generated when a Abort command is issued for the phase while in “Protection</td>
</tr>
<tr>
<td></td>
<td>Stopped” state and registry key “AllowAbortOnProtectionStop” is False.</td>
</tr>
</tbody>
</table>

Automatic Reset of Phases

By default, Melody SFC phases automatically reset back to the Idle state once a final state (Complete, or Aborted) has been attained. This behavior can be changed through Melody Composer.

Refer to the 800xA for AC870P / Melody Configuration (3BDD011741*) instruction for more detailed information.

Leaving the Melody phases operating with automatic reset enabled will have no effect on the normal operation of the batch. This behavior is only causes problems in the event of a Batch Management server failover or if the Batch Management server is offline. Both Batch Management servers are offline for a short period during a redundancy failover. A phase which completes and resets back to Idle while the Batch Management server is offline will appear to the Batch Management server to be in an unexpected state and the Reconnect to Idle Phase error will be generated.
Abort Command

By default, SFC phases only accept the Abort command when the phase is Stopped. Batch Management normally allows the Abort command for Running phases because this is allowed by S88. Therefore, the Abort command will be available in the Block Status display. For Melody, the Abort command will be blocked with the Command Not Valid for Current State error.

SFC phases can be configured to allow Abort commands to a Running phase. A registry setting (Melody Allow Abort from Running) must also be set to make Batch Management aware of this change. Enabling this registry setting allows an Abort command to be sent when the phase is in Running, Holding, and Held states.

SFC-Phase phases support all S88 transitions. Therefore, the Abort is valid when the phase is in Running, Held, or Holding states.

Reset of Stopped Phases

Melody SFC phases do not allow a Reset command to a phase in the Stopped state. Batch Management normally allows a Reset command to be issued to a phase in the Stopped state because this is allowed by S88. The Melody phase driver has been designed to recognize the Stopped phase and inject an Abort command before attempting to issue the Reset command.

The injected Abort command can be prevented by setting the Melody Auto Abort before Reset from Stopped registry setting to FALSE.

If the injected Abort command is disabled, certain operations from the Block Status display will be affected when the phase is in the Stopped state:

- **Start At Beginning** - this command will result in a Phase "..." is NOT Idle error when issued to a Stopped phase. The faceplate of the phase must be used to Abort and then Reset the phase before normal 800xA Batch Management operation can be resumed.

- **Continue At Next** - this command will leave the phase in the Stopped state and a Phase "..." is NOT Idle error will be seen next time a batch encounters this phase. The faceplate of the phase must be used to Abort and then Reset the phase before normal Batch Management operation can be resumed.
Melody SFC Implementations

Melody SFC implementations can optionally remove any of the SFC legs making additional commands invalid. Batch Management provides registry settings (Melody Allow Command) to disallow any command from actually being sent to the Melody phases. When these registry settings are set to FALSE, the command will generate an immediate Command Not Valid For Phase Type error and the command is not issued to the SFC.

Registry Settings

Table 25 describes 800xA Batch Management registry settings for Melody. These settings must be set the same on all nodes in the 800xA system.

Table 25. Registry Settings

<table>
<thead>
<tr>
<th>Registry Settings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melody Allow Abort from Running</td>
<td>True to allow issuing the abort command to a running phase.</td>
</tr>
<tr>
<td>Melody Auto Abort before Reset from Stopped</td>
<td>True to issue abort command to stopped phase before attempting reset command.</td>
</tr>
<tr>
<td>Melody Allow Command Abort</td>
<td>When set to FALSE the command is not issued to the SFC and the Command Not Valid For Phase Type is generated.</td>
</tr>
<tr>
<td>Melody Allow Command Pause</td>
<td></td>
</tr>
<tr>
<td>Melody Allow Command Resume</td>
<td></td>
</tr>
<tr>
<td>Melody Allow Command Restart</td>
<td></td>
</tr>
<tr>
<td>Melody Allow Command Hold</td>
<td></td>
</tr>
<tr>
<td>Melody Allow Command Stop</td>
<td></td>
</tr>
<tr>
<td>Melody Output Parameter Boolean True</td>
<td>Text returned by boolean output parameter in representation of the TRUE state.</td>
</tr>
<tr>
<td>Melody Output Parameter Boolean False</td>
<td>Text returned by boolean output parameter in representation of the FALSE state.</td>
</tr>
</tbody>
</table>
Table 25. Registry Settings (Continued)

<table>
<thead>
<tr>
<th>Registry Settings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melody Float Param Compare Method</td>
<td>Method of performing readback comparison of float parameters. Default = 1&lt;br&gt;-1) System default. No Melody specific comparison will be used.&lt;br&gt;0) Disables readback comparison of float parameters.&lt;br&gt;1) Default method; epsilon is calculated from configured low/high range of the parameter&lt;br&gt;2) Process Portal B method. Uses Absolute Range, Absolute Error, Relative Error settings in registry.</td>
</tr>
<tr>
<td>Melody Float Param Absolute Range</td>
<td>When method 2 is selected, parameter values less than this range use Absolute Error and values greater than this range use Relative Error. Default = 1.0.</td>
</tr>
<tr>
<td>Melody Float Param Absolute Error</td>
<td>When method 2 is selected, parameter values less than Absolute Range use Absolute Error. Default = 0.005.</td>
</tr>
<tr>
<td>Melody Float Param Relative Error</td>
<td>When method 2 is selected, parameter values greater than Absolute Range use Relative Error. Default = 0.005.</td>
</tr>
</tbody>
</table>

Normally, Batch Management will ensure that all phase parameters are written correctly before issuing the Start command to the phase. For Melody phases, this readback of the parameter value uses the configured OPC Datapoint Out setting.

Readback comparison of parameter values can be disabled for individual parameters by NOT defining the OPC Datapoint Out setting for the parameter. In addition, float parameter readback comparison can be further controlled using the Melody Float Param Compare Method, Melody Float Param Absolute Range, Melody Float Param Absolute Error, and Melody Float Param Relative Error registry settings.
Additional Registry Settings

Table 26 describes additional registry settings (located in HKLM\SOFTWARE\ABB\Produce IT\5.0\Settings) that must be set for Batch Management for Melody to function correctly.

These settings must be set the same on all nodes in the 800xA system.

Table 26. Additional Registry Settings

<table>
<thead>
<tr>
<th>Registry Settings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALLOW_TERMINATE_STOPPED_BATCH</td>
<td>When set to FALSE, this setting prevents the Batch Status dialog (Batch Information) from presenting the Terminate command to the user when the status of the batch is Stopped. The default value is TRUE to maintain consistent product behavior because this setting is not limited to 800xA for AC 870P / Melody controlled batches. The recommended setting is FALSE for 800xA for AC 870P / Melody systems.</td>
</tr>
<tr>
<td>ALLOW_ABORT_ON_PROTECTION_STOP</td>
<td>Default value is ‘FALSE’. When set to FALSE, this setting prevents Abort command for Melody phases while in “Protection Stopped” state. If set to TRUE, allows the Abort command.</td>
</tr>
</tbody>
</table>

Phase State Transition Matrix

The phase state transitions for Melody phases differ slightly from the standard Batch Management phase state transitions, which are based on S88 state transitions.
(Figure 75).

![Status Transition Matrix](image_url)

**Figure 75. Phase State Transition Matrix**

Table 27 lists the Matrix keys for the items described in Figure 75.

**Table 27. Matrix Key**

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aborting if PARA.R0STP=0 (In Symbatch projects probably =1).</td>
</tr>
<tr>
<td>2</td>
<td>Not from Batch manager.</td>
</tr>
<tr>
<td>3</td>
<td>Supported by Batch manager.</td>
</tr>
<tr>
<td>4</td>
<td>Project setting to automatically return to idle or remain in complete until batch manager, trigger the transition to idle.</td>
</tr>
<tr>
<td>5</td>
<td>PST not supported by batch manager, application only.</td>
</tr>
</tbody>
</table>
### Table 27. Matrix Key (Continued)

<table>
<thead>
<tr>
<th>Number /Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Light green</td>
<td>Reset command in Stopped state needs to be blocked for symbatch SFC. Refer to <em>800xA Engineering AC 870P/Melody - Function Blocks Control (2PAA101127)</em>.</td>
</tr>
<tr>
<td>7 Purple</td>
<td>Pause not possible in symbatch - return error immediately.</td>
</tr>
<tr>
<td>8 Orange</td>
<td>Registry settings to disable command and immediately return error. Deviation from standard if ROSTP application signals are set to 0 (not by Batch Management application).</td>
</tr>
<tr>
<td>8 Red</td>
<td>Supported in a future release. Same as S88. Refer to <em>800xA Engineering AC 870P/Melody - Function Blocks Control (2PAA101127)</em>.</td>
</tr>
</tbody>
</table>
Appendix D  PDL Extractor

Introduction

This appendix describes the functionalities of the PDL Extractor. PDL stands for Production Data Log.

The PDL Extractor is used to extract archived Batch Recipe PFC information from the Information Manager into a file. This file is used in the History Overview as a display option for the PDL PFC.

Installing PDL Extractor

PDL Extractor is bundled with the Information Manager.

1. Double click **ABB Inform IT - PDL Browser Light.msi**.
2. Follow the installation procedures given in the installation wizard and install the PDL Extractor.

PDL Extractor utility can be launched by navigating to **ABB Start Menu > ABB Industrial IT 800xA > Production Management > Utilities > ABB Batch Procedure Extractor**.

Prerequisites

The following setup is required to save the PFC displays in the Information Manager:

- The IM server must be running in the system.
- PDLMSGLOG object needs to be created and activated in the system.
- Select the **Use 800xA Historian** check box in the **History Options** tab of the Miscellaneous Configuration aspect.
• Ensure that the **HS_CLIENT_DATA** for the Environment System Variable is set in the IM server node.

• Both Batch servers should have the EH_Transfer directory shared. The shared folder permissions must be set to *IndustrialIT Admin*.

• At the IM server, a shared directory needs to be set up. For more details, refer *Setting Up Storage of Batch Procedures in PDL* section of *System 800xA Information Management Data Access and Reports (3BUF001094*)

To view the Batch data in the PDL Extractor, Batches should be scheduled after the PDL extractor configuration.

### Extracting PDL Data

Follow the procedure to extract PDL data:

1. Launch PDL Batch Procedure Extractor.

   ![PDL Batch Procedure Extractor](image)

   **Figure 76. PDL Batch Procedure Extractor**

2. Select the Start Date and then click **Query Data**.

3. Use the **Drill** button to drill down to the recipe level.
The **Show RPD** button is displayed when the correct level is reached.

![Figure 77. PDL Batch Procedure Extractor with Show RPD Button](image)

There can be multiple recipes with the same name. These recipes represent the recipes at the start of the batch, during the batch (only if online changes were made) and the completion of the batch.

Always ensure that the most recent and completed batch PFC is selected for extracting.

All the PFC files have `.pfc` extension.

4. Click **Extract Selected Item**.

A dialog box opens where the user is prompted to save the PFC file.
Viewing PDL Extracted File

Follow the procedure to view the PDL Extracted file:

Before viewing the PDL Extracted file, ensure that there is no batch recipes with duplicate names exist in the Batch History Overview.

1. Click the **PDL PFC** button in the Batch History Overview.
   
   The buttons in the Batch History Overview are explained in Table 21.

2. In the opened dialog window, browse to the required PFC file and select it.

3. Click **Open** to display the selected PFC on the screen.
Appendix E  Simple Batch and Parameter Management

Introduction

This appendix describes the process of adding and scheduling batches using the Batch Spreadsheet Scheduler aspect.

Simple Batch and Parameter Management offers the user an optional way to schedule batches and manage formula parameter information without the need to access the Batch Overview. Using Microsoft® Excel, an operator is able to add or schedule Batch procedures. In addition, formula worksheets can be added to the Excel workbook to manage parameter lists.

Prerequisites

The macro security setting of Microsoft® Excel must be set to Enable all Macros. Enabling Macros in Microsoft® Excel is explained in the System 800xA Batch Management Configuration (3BUA000146*) manual.

Procedure to Add / Schedule a Batch

The below mentioned steps should be performed by the Operators.

1. In the Plant Explorer, browse to the structure where the Batch Spreadsheet Scheduler is configured and open the Main View of the Batch Spreadsheet Scheduler aspect.
The File Download dialog window is displayed as shown in Figure 78.

![File Download](image)

*Figure 78. Batch Spreadsheet Scheduler Download Screen.*

2. Click **Open**.

The Microsoft® Excel workbook will be positioned on the BatchScheduler sheet. This sheet contains the functionality to add or schedule Batches. It is shown in Figure 79.
3. Choose the required **Procedure type**.

The **Procedure Type** drop-down allows the operator to limit the associated procedures drop-down to the type selected. The following are the choices in Procedure Types drop-down:

- Recipe Procedure - Only recipe procedures will be included.
- Unit Procedure - Only unit procedures will be included.
- Operation Procedure - Only operation procedures will be included.
Appendix E  Simple Batch and Parameter Management

- Formula Procedure - Only the procedures that have corresponding formula sheets configured for them will be included (*these can be recipe, unit or operation procedures*).
- Procedure - All recipe, unit, and operation procedures will be included.

![Image](image.png)

**Figure 80. List of Procedures**

The default Procedure Type is set by the engineer during configuration of the workbook and normally will not need to be changed by the operator.

4. Choose the required **Procedure name** from the drop-down. Parameters specific to the procedure will be populated in the parameter cells. The batch cells drop-down will be populated as well.

5. If a formula sheet exists for the selected procedure, then the formula names present in the formula sheet will be loaded into the Formula drop-down.

6. Select the **Formula name**. The formula values from the selected formula will be written to the Formula column of the Parameter cells section displayed on the lower half of the sheet.

7. Select **Scheduled** or **Not Scheduled** from the Schedule Status drop-down. Based on the selection, the toggle button displays **Schedule Batch** or **Add Batch**.

8. Fill the remaining fields in the upper section as per requirement.

BatchID field is a unique Batch Identifier. If left blank, the system auto generates the ID using the Batch ID aspect. Unit and operation procedure types do not have a Batch ID aspect on them when created. This aspect will need to be added to these procedure types when the auto generate Batch ID functionality is desired.
In Batch Spreadsheet Scheduler, Batch cell drop-down lists only the Selected cells of the selected procedure. If there are no cells selected for the Procedure, then the drop-down will be empty. If the Batch cell field is left empty, then the Batch will be scheduled in the Default cell.

9. The lower section displays all of the parameters defined for the selected procedure. The user can override the value to be written by entering a value in the **New Value** field. The value to be written will be displayed in the **Values to be Written** column. If entered, this value will be the New Value. If not, it will be the Formula Value, if the parameter is included on the formula sheet. If not, it will be the Default Value as defined on the procedure.

Based on the Allow override and access level security defined in the formula sheet, the respective new value cell will be enabled or disabled accordingly for a specific parameter. For more information on parameter levels, refer to the **Table 28**.

10. Click the **Add Batch** or **Schedule Batch** button to add or schedule the Batch. The Batch ID and the status of the add/schedule command will be displayed in the middle section of the sheet.

The time range allowed for the Start Time in Batch Spreadsheet is from the Current Time to “01-Jan-2031 12:00:00 AM”.

The parameter levels accessible by various users are listed in the below table:

**Table 28. Different Parameter Levels**

<table>
<thead>
<tr>
<th>User</th>
<th>Permissions</th>
<th>Parameter Access</th>
<th>Schedule Batch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrator</td>
<td>Full Permission</td>
<td>All Operator level, All Engineer Level, All Supervisor Level, Not Configured</td>
<td>Yes</td>
</tr>
<tr>
<td>800xA Installer</td>
<td>Full Permission</td>
<td>All Operator level, All Engineer Level, All Supervisor Level, Not Configured</td>
<td>Yes</td>
</tr>
<tr>
<td>800xA Service</td>
<td>Full Permission</td>
<td>All Operator level, All Engineer Level, All Supervisor Level, Not Configured</td>
<td>Yes</td>
</tr>
<tr>
<td>Operator 1</td>
<td>Operate</td>
<td>All Operator Level, Not Configured</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Schedule a Batch from a non-800xA node

The users are now provided with the flexibility of using the Spreadsheet Scheduler from a non-800xA node.

On a standalone system (non-800xA node), Spreadsheet Scheduler will work without any dependency of the File Viewer Aspect.

Ensure the Windows time of the non-800xA node should be the same as that of the 800xA system. If there is a lead or lag in the Windows time of the non-800xA node, then the Batch gets scheduled with a time difference or immediately (*based on the time difference*).

Users with operate permission can use the configured Batch Scheduler Spreadsheet to schedule a Batch.

For more information, refer to Appendix Q: Scheduling Batch from a Non-800xA Node in System 800xA Batch Management Configuration Manual (3BUA000146*).

<table>
<thead>
<tr>
<th>User</th>
<th>Permissions</th>
<th>Parameter Access</th>
<th>Schedule Batch</th>
</tr>
</thead>
<tbody>
<tr>
<td>App Eng 1</td>
<td>Operate, Configure</td>
<td>All Operator level, All Engineer Level, Not Configured</td>
<td>Yes</td>
</tr>
<tr>
<td>App Eng 2</td>
<td>Configure</td>
<td>All Engineer Level, Not Configured</td>
<td>No</td>
</tr>
<tr>
<td>Sys Eng 1</td>
<td>Operate, Supervise</td>
<td>All Operator level, All Supervisor Level, Not Configured</td>
<td>Yes</td>
</tr>
<tr>
<td>Sys Eng 2</td>
<td>Supervise</td>
<td>All Supervisor Level, Not Configured</td>
<td>No</td>
</tr>
</tbody>
</table>
Upgrade

The existing Batch Spreadsheet works with the existing functionality without an upgrade.

The users can upgrade the customized Scheduler Aspects present in the Functional structure to the newer version. The upgrade can be done using the Upgrade Spreadsheet utility. To access the utility:

Navigate to **ABB Start Menu > ABB Industrial IT 800xA > Production Management > ABB Batch Upgrade Spreadsheets**.

The Upgrade Spreadsheet utility tool provides an interface for the users to upgrade the Batch Scheduler Spreadsheets to the latest version. The tool when invoked, automatically scans the system and identifies the Batch Spreadsheet Scheduler Aspects that require an upgrade.

User modified VB code and physical changes to the Spreadsheet will *not* be upgraded automatically. Users will need to manually make these changes to the latest Spreadsheet (if desired).

The users can then selectively upgrade the Batch Spreadsheets or Select All and click **Upgrade** as shown in the **Figure 81**. All the formula sheets are copied to the latest version of the Batch Spreadsheet.
Figure 81. Upgrade Batch Scheduler Spreadsheets window
Revision History

This section provides information on the revision history of this User Manual.

The revision index of this User Manual is not related to the 800xA 6.0 System Revision.

<table>
<thead>
<tr>
<th>Revision Index</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>First version published for 800xA 6.0</td>
<td>August 2014</td>
</tr>
<tr>
<td>A</td>
<td>Updated for 800xA 6.0.3</td>
<td>September 2016</td>
</tr>
</tbody>
</table>

Updates in Revision Index A

The following table shows the updates made in this User Manual for 800xA 6.0.3.

<table>
<thead>
<tr>
<th>Updated Section/Subsection</th>
<th>Description of Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 2 - Batch Scheduling</td>
<td>Updated the following subsection for Parameter Modernization features:</td>
</tr>
<tr>
<td></td>
<td>- Batch Overview &gt; Batch Overview &gt; Parameters</td>
</tr>
</tbody>
</table>
Numerics
800xA for DCI faceplate  123
800xA for Harmony faceplate  123
800xA for MOD 300 faceplate  123

A
AC 800M/C controllers (OPC subsystem)  171
Access
  Batch history information window  166
  Batch history overview window  163
Active equipment  161

B
Batch advanced template faceplate  123
Batch history information window
  Access  166
  Button (print)  170
  Events tab  167
  Reports tab  170
  Status tab  166
  Tag data tab  169
Batch history overview window  25
Batch history overview window access  163
Batch information window
  Button options
    Input  66
    Parameters  66
    PFC  67
    Print  66
    Refresh  66
  Command tab  60
  Events tab  62
  History options tab  61
  Reports tab  65
  Status tab  59

Tag data tab  64
To access window  58
Batch overview window
  Button options
    Add  38
    Cell filter  38
    Find  38
    Input  37
    PFC  37
    Status  37
  Buttons
    Cell filter  165
    Find  165
    PDL PFC  165
    PFC  165, 170
    Status  165
  Column headings
    Batch cell  36
    Batch ID  32
    Campaign ID  33
    Elapsed time  37
    Estimated time  37
    Lot ID  33
    Mode  35
    Priority  34
    Recipe ID  34
    Scheduled status  35
    Start time  37
    State  34
    To access window  29
    To contract PFC levels  30
    To view PFC levels  30
  Batch procedure function chart  22
  Batch restart issues  29
  Batch schedule window
Index

Button options
   Apply 51
   Parameters 49
Campaigns 43
Duplicate button 48
History options tab 45
Schedule tab 47
   Batch cell 42
   Batch ID 40
   Campaign ID 41
   Comment 41
   Estimated time 42
   Lot ID 41
   Mode 42
   Priority 42
   Procedure 40
   Scheduled status 41
   Start time 42
Batch services 142

C
Changing equipment status
   Equipment attributes tab 158
   Equipment commands tab 159
   Equipment information tab 154
Continue execution
   At selected point 101
   From where stopped 101

D
Debug session properties 181
Display SOP (standard operating procedure) 103
Duplicate 48
Dynamic debugger
   Change
      Operation 179
      Phase 179
   Dynamic debugger properties 181
   Edit program variable 183
   Escape loop 180
   Find text 180
   Go to line 180
   Line tracking 181
   Remove watch variables 182
   Start execution 182
   Step level 182
   Step same 183
   Step section 182
   Stop execution 183
   Use breakpoints 178
   View built-in variable 184
   View program variables 183
   Watch program variable 184

E
EPT faceplate 123
Equipment
   Acquired 108
   Disable 157
   Discard 157
   Pending 108
   Reserve 157
   Reserved 108
Equipment activity status 161
Equipment overview window
   Column headings
      Batch ID 149
      Batch ID - Controller 152
      BM Error 151
      Campaign ID 150
      Connection State 151
      ExceptionID - Controller 152
      Lot ID 149
      Mode - Controller 152
      Name 149
      Op status 150
      State - Controller 153
      Status 150
      Status - Controller 152
   Find function 153
Index

Introduction 23
View batch status 160
View faceplate 160
View procedure function chart 160
Equipment overview window access 147
Equipment status
  Acquired 150
  Available 150
  Reserved 150
Errors 114
Exception handling
  Concluding logic 92
  Special functions 92
Exception logic 90

Faceplates
  800xA for DCI 123
  800xA for Harmony 123
  800xA for MOD 300 123
  Batch advanced template 123
  EPT 123
Fault codes 184
  Configuration 185
  Runtime fault codes 186
Filtering 55

Graphics 121
GUIDs 106

Harmony connectivity 175
Harmony subsystem (PHASEX features) 176

IDs
  Hide 97
  Show 97
Inactive equipment 161

Melody connectivity 191

Online editing 27
Operation 19
Operator status
  Failed 150
  Normal 150

PFC (procedure function chart)
  Active blocks 95
  Batch overview 94
  Batch parameters 96
  Batch status 96
  Batch variables 104
Colors, symbols and actions
  Actions 81
  Conditions 88
  Modes 87
  PFC shapes 78
  States 83
Header 96
Input 94
Objects
  Batch manager action 72
  Branch start and branch end 75
  Connector object 77
  Parallel start and parallel end 76
  Phase 74
  Procedure 74
  Start and end 72
  Transition 75
Parameters 95
Pick restart point 98
Procedure 94
Top level PFC 69
PFC block status window
  Aspects button 114
Comment tab 111
Configure button 111
Faceplate button 114
Input button 111
Parameters button 112
Status tab 110
User Display button 114

PHASEX
Configure fault codes 184
Debugger 177
Breakpoints 178
Change operation 179
Change phase debugged 179
Escape loop 180
Find specific text 180
Go to specific line 180
Line tracking 181
Properties 181
Remove variable from watch 182
Start execution 182
Step execution 182
Stop execution 183
View and watch variables 183

procedure function chart 22
Production history 25

R
Resource management 23
Restarting batches 29
Runtime edit
Accessing 99
Availability 99
Cancel 102
Editing 100
Runtime fault codes 186

S
Save as (control recipe) 102
Scheduled status
Active 36

Breakpoint reached 36
Complete 36
Equipment wait 36
Equipment wait (initial) 36
Equipment wait (partial) 36
Error 36
Input pending 36
Not scheduled 36
Scheduled 36
Terminated 36
Start Only If Unit Normal option 29

T
Tabs
Batch history information window
Events 167
Reports 170
Status 166
Tag data 169
Batch information window
Command tab 60
Events tab 62
History options tab 61
Reports tab 65
Status tab 59
Tag data tab 64
Batch schedule window
Campaigns 43
History options tab 45
Schedule tab 39, 47
Equipment information window
Equipment attributes tab 158
Equipment commands tab 159
Equipment information tab 154
PFC block status window
Comment tab 111
Status tab 110
To access
Batch information window 58
Batch overview window 29
Equipment overview window 147

V

View batch status 160
View faceplate 160
View procedure function chart 160