

# Consultant Course



## M210 Extended Manufacturing Scenarios 2022 R1

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# How to Use This Course

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This course introduces the Acumatica ERP Manufacturing Edition functionality based on a set of examples that illustrate the extended manufacturing processes, that is, estimating, product configuration, engineering change control, and advanced planning and scheduling, in a midsize company. The course consists of lessons that guide you step by step through the examples and explanations of the processes in Acumatica ERP Manufacturing Edition.

## Which Training Environment Is Needed

All lessons of the course should be completed on an instance of Acumatica ERP 2022 R1 with the *SalesDemo* training dataset preloaded; this dataset provides the predefined settings and entities you will need as you complete the activities of this course.

## What Is in This Guide

The primary content of a guide is implementation and process lessons. Each of the course activities is dedicated to a particular user scenario and consists of steps that you complete.

## What Are the Documentation Resources

The complete Acumatica ERP documentation is available on <https://help.acumatica.com/> and is included in the Acumatica ERP instance. While viewing any form used in the course, you can click the **Open Help** button in the top pane of the Acumatica ERP screen to bring up a form-specific Help menu; you can use the links on this menu to quickly access form-related information and activities and to open a reference topic with detailed descriptions of the form elements.

## Licensing Information

For the educational purposes of this course, you use Acumatica ERP under the trial license, which does not require activation and provides all available features. For the production use of this functionality, you have to activate the license your organization has purchased. Each particular feature may be subject to additional licensing; please consult the Acumatica ERP sales policy for details.

# Lesson 1: Estimating

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## Estimating: General Information

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The estimating functionality of Acumatica ERP Manufacturing Edition provides the ability to create quick or detailed manufacturing estimates for improved estimate accuracy and turnaround times. An estimate is for a single inventory or non-inventory item. You build an estimate from bills of materials, production orders, or other estimates to accurately calculate costs and prices for new or existing parts using material costs, work center rates, overheads, and other cost data. Or you can start by entering just summary cost data and later on start adding the details.

Estimating is designed to supplement and enhance the customer management processes from opportunity, through quoting, to sales order. It also supplements engineering from design, through building a prototype, and final conversion to a standard product with a bill of material.

The estimating functionality is available only when the *Estimating* feature in the *Manufacturing* group of features is enabled on the [Enable/Disable Features](#) (CS100000) form.

## Scenarios

1. Direct Estimate: A user can create an estimate not linked to quote, sales order, or opportunity. The estimate can be linked to an order at any time.
2. Estimates created from a quote or sales order.
3. Estimate created from an opportunity.

## Features

- Estimate data is tracked through revisions.
- Estimate detail can be created by copying an existing Estimate Revision, Bill of Material, or Production Order. After copying a user can edit the details.
- Estimates can be printed.
- Notes and files can be attached to an estimate.
- Estimates can be entered directly or created from an opportunity, quote, or sales order.
- Non-inventory items can be converted to inventory stock or non-stock items.
- Margin or selling price can be altered in a convenient way.
- Various levels and combination of estimate details provides you with ability for quick or detailed entry.
- Estimates can be converted to standard sales order lines.
- A bill of material can be created from an estimate.
- A production order can be created from an estimate or converted sales order line.
- Estimates are not multilevel; that is one estimate cannot be referenced by another estimate.

## Cost Levels and Calculations

Estimate costs can be defined at the following levels: detail, operation, and estimate. The costs for an estimate always update the parent level totals. This includes any changes on the estimate or the estimate operation pages. The concept for calculating the cost types is the same as currently calculated for production planned costs on a

production order with an exception that labor is broken out into fixed and variable. The extended information about the estimate cost levels is the following:

- Detail
  - The lowest level of detail represented by the material, tools, and overhead tabs of the *Estimate Operation* (AM304000) form.
  - Modifying these cost types will have their costs roll up to the parent operation level costs.
  - The detail level cannot exist without an operation level as details are linked to an operation.
- Operation
  - The middle level of an estimate.
  - All detail level costs roll up to the estimate level unless the **Override** check box is selected for a specific cost type.
  - When a cost type has the **Override** check box selected, any value can be entered. No updates will automatically calculate the value that has been overridden.
  - Operations define the labor and machine costs related to the run rates and work center/machine costs.
  - The operation level cannot exist without an estimate level as operations are linked to an estimate.
- Estimate
  - The summary and highest level of an estimate.
  - All operation level costs roll up to the estimate level unless the **Override** check box is selected for a specific cost type.
  - When a cost type has the **Override** check box selected, any value can be entered. No updates will automatically calculate the value that has been overridden.

The summarized order of calculating costs from estimates or estimate operations is the following:

1. For each operation, fixed labor, variable labor, machine, material, tools, and overhead are rolled up and update the operation cost type field if not set to override.
2. Sum each operation cost type and update the estimate cost type fields if not set to override.
3. Sum all cost types to show total cost.
4. Divide total cost by order quantity to set the unit cost field
5. If unit price override is selected: calculate margin percent
6. If unit price override is cleared: calculate unit price
7. If the estimate is referenced on a sales order or opportunity and the estimate reference is not completed or cancelled, then the source order must also have its pricing recalculated using the reference graph.

## Estimating: Implementation Activity

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In the following implementation activity, you will learn how to configure estimating functionality.

### Process Overview

In this activity, you will create an estimate class by using the *Estimate Classes* (AM206000) form. You will also specify the default settings by using the *Estimate Preferences* (AM103000) form; the system will apply these settings to new estimates.

### System Preparation

Before you start configuring estimates, do the following:

1. Launch the Acumatica ERP website, and sign in to a company with the *SalesDemo* dataset preloaded. You should sign in as the system administrator with the *admin* username and the password for this user valid for your instance password.
2. Make sure that the *Estimating* feature in the *Manufacturing* group of features has been enabled on the [Enable/Disable Features](#) (CS100000) form.

## Step 1: Creating an Estimate Class

To create an estimate class that will provide default settings for new estimates, do the following:

1. Open the [Estimate Classes](#) (AM206000) form.
2. Specify the following settings:
  - **Class ID:** DEFAULT
  - **Description:** Default estimate class
  - **Item Class:** MFGFG
  - **Tax Category:** EXEMPT
  - **Engineer:** Empty
  - **Lead Time (Days):** 15
  - **Order Qty:** 1
  - **Labor Markup Pct:** 10
  - **Machine Markup Pct:** 10
  - **Material Markup Pct:** 20
  - **Tool Markup Pct:** 20
  - **Overhead Markup Pct:** 20
  - **Subcontract Markup Pct:** 10
3. On the form toolbar, click **Save**.

## Step 2: Specifying The Default Estimate Settings

To specify default estimate settings, do the following:

1. Open the [Estimate Preferences](#) (AM103000) form.
2. Specify the following:
  - **Estimate Number Sequence:** AMESTIMATE
  - **Default Revision:** A
  - **Default Estimate Class:** DEFAULT
  - **Default Work Center:** WC10
  - **Default Prod. Order Type:** RO
  - **New Revision Is Primary:** Selected
  - **Update All Revisions:** Selected
  - **Update Price Info:** Selected
3. On the form toolbar, click **Save**.

## Estimating: Process Activity

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The following activity will walk you through the estimating-related processes.

### Process Overview

In this activity, to perform processes related to estimates, you will do the following:

1. On the [Estimate](#) (AM303000) form, create an estimate.
2. On the [Estimate Operation](#) (AM304000) form, specify operation details.
3. On the [Create Inventory Items](#) (AM507000) form, create stock items from non-inventory items.
4. On the [Estimate](#) form, create a bill of material based on the estimate.
5. On the same form, create a production order based on the estimate.
6. On the same form, create an estimate and replace its details with the details of another estimate.

### System Preparation

Do the following:

1. Launch the Acumatica ERP website, and sign in to a company with the *SalesDemo* dataset preloaded. You should sign in as the implementation consultant by using the *admin* username and the password for this user valid for your instance.
2. In the info area, in the upper-right corner of the top pane of the Acumatica ERP screen, make sure that the business date in your system is set to today's date. For simplicity, in this activity, you will create and process all documents in the system on this business date.
3. Make sure that the *Estimating* feature in the *Manufacturing* group of features has been enabled on the [Enable/Disable Features](#) (CS100000) form.

### Step 1: Creating an Estimate

To create an estimate, do the following:

1. On the [Estimate](#) (AM303000) form, add a new record.



To open the form for creating a new record, type the form ID in the Search box, and on the Search form, point at the form title and click **New** right of the title.

2. In the Summary area, specify the following:
  - **Revision:** *A*
  - **Inventory ID:** *NEWITEM* (This item does not exist in the system.)
  - **Item Description:** *New Item*
  - **Estimate Class:** *DEFAULT*
3. On the **Totals** tab, make sure that the following has been done:
  - In the **UOM** box of the **Order Qty** section, *EA* has been selected.
  - In the **Markup** section, the box values have been copied from the settings of the *DEFAULT* estimate class.
4. On the **Operations** tab, do the following:

- a. On the table toolbar, click **Add Row**.
- b. In the row, specify the following:
  - **Operation ID:** 010
  - **Work Center:** WC10
  - **Setup Time:** 02:00
  - **Run Units:** 15
  - **Run Time:** 01:00
- c. On the form toolbar, click **Save**.

## Step 2: Specifying Operation Details

To specify operation details, do the following:

1. Open the [Estimate Operation](#) (AM304000) form.
2. In the **Estimate ID** box, select the estimate you created in Step 1.
3. In the **Operation ID** box, make sure that 010 operation is selected.
4. On the **Material** tab, click **Add Row**.
5. In the row, specify the following:
  - **Inventory ID:** WIDGET01
  - **Qty. Required:** 1
  - **Unit Cost:** 0.79
  - **Backflush:** Selected
  - **Warehouse:** RETAIL
6. On the **Material** tab, click **Add Row** to add another material record.
7. In the row, specify the following:
  - **Inventory ID:** NEWMTL (This ID does not exist in the system, so you need to type it in the box.)
  - **Description:** New material
  - **Item Class:** WIDGETS
  - **Qty. Required:** 1
  - **Unit Cost:** 70.00
  - **Backflush:** Cleared
  - **Warehouse:** RETAIL
  - **Non-Inventory:** Selected
8. On the **Overhead** tab, click **Add Row**.
9. In the row, specify the following:
  - **Overhead ID:** ADMIN
  - **Factor:** 1
10. On the form toolbar, click **Save**.

## Step 3: Creating Stock Items for Non-Inventory Items

To create stock items for non-inventory items, do the following:

1. On the [Estimate](#) (AM303000) form, open the estimate you created in Step 1.

- On the More menu, click **Create Inventory Items**. The system opens the [Create Inventory Items](#) (AM507000) form in a new browser window.



You open the More menu by clicking the More button (...) on the form toolbar.

- In the **Estimate ID** box, make sure that the estimate you created in Step 1 is specified.
- In the **Revision** box, make sure that *A* is specified.
- On the form toolbar, click **Process All**.  
The system opens the **Processing** dialog box and creates stock items from non-inventory items.
- Close the **Processing** dialog box.

#### Step 4: Creating a Bill of Material Based on an Estimate

To create a bill of material based on the estimate, while you are still viewing the estimate on the [Estimate](#) (AM303000) form, do the following:

- On the More menu, click **Create BOM**.
- In the **Create BOM** dialog box, which opens, do the following:
  - In the **Revision** box, make sure that *A* is selected.
  - In the **Warehouse** box, select *RETAIL*.
  - Click **Create**. The system opens the [Bill of Material](#) (AM208000) form in a new browser window with the new bill of material and the box values copied from the estimate.
  - On the form toolbar, click **Save**.

#### Step 5: Creating a Production Order Based on an Estimate

To create a production order based on the estimate, while you are still viewing the estimate on the [Estimate](#) (AM303000) form, do the following:

- On the More menu, click **Create Production Order**.
- In the **Create Production Order** dialog box, which opens, do the following:
  - In the **Order Type** box, make sure that *RO* is selected.
  - In the **Warehouse** box, select *RETAIL*.
  - In the **Location** box, make sure that *STORAGE* is specified.
  - Click **Create**. The system creates the production order and opens it on the [Production Order Maintenance](#) (AM201500) form in a new browser window.
- In the **Source** box of the **References** tab (the **Source** section), make sure that *Estimate* is specified. This means that the production order has been created based on an estimate.

#### Step 6: Replacing Estimate Details with the Details of Another Estimate

To replace details of a new estimate by details of another estimate, do the following:

- On the [Estimate](#) (AM303000) form, add a new record.
- In the **Revision** box, make sure that *A* is specified.
- In the **Inventory ID** box, select *MGWIDGET*.
- On the form toolbar, click **Save**.

5. On the More menu, click **Create by Copying**.
6. In the **Copy From** dialog box, which opens, do the following:
  - a. In the **Copy From** box, make sure that *Estimate* is selected.
  - b. In the **Estimate ID** box, select the estimate you created in Step 1.
  - c. In the **Revision** box, select *A*.
  - d. Select the **Override Inventory ID** box.
  - e. Click **Copy**. The system copies the settings of the specified estimate to the current estimate.
7. In the **Inventory ID** box, make sure that `NEWITEM` is selected.

# Lesson 2: Managing Product Configurations

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## Product Configurator: General Information

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The product configurator translates product knowledge into a set of rules to guide an end user through all of the steps necessary to produce a valid product and its options. You can use the configurator both in sales orders and production orders. A configure to order (CTO) item must be a stock inventory item. The [Configuration Maintenance](#) (AM207500) form is used to define configurations.

This functionality is available when the *Product Configurator* feature in the *Manufacturing* group of features is enabled on the [Enable/Disable Features](#) (CS100000) form.

## Revision Control

Configuration definitions are stored as non-date driven configuration revisions. This provides the designer with the ability to work on a new configuration definition for the same inventory item while the active revision is being used by end users.

## Features

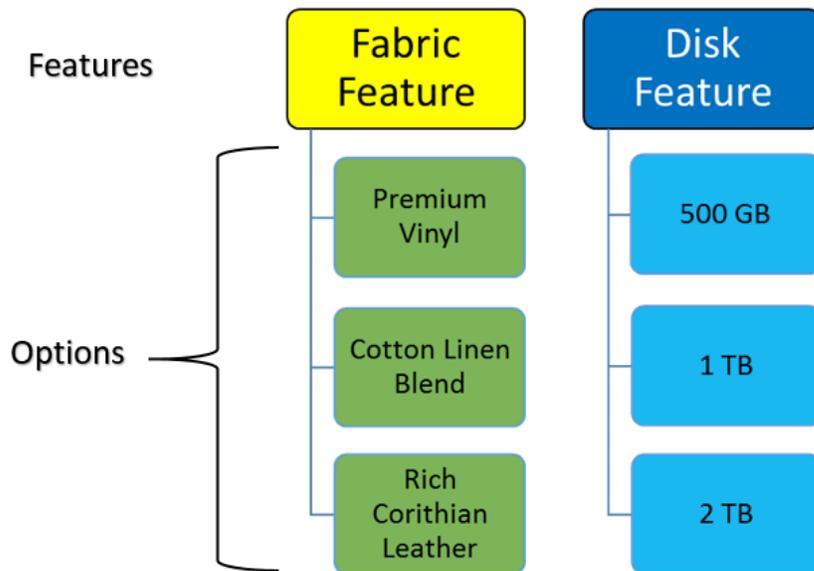
Features are the list of options available for user selection. Labels are used to identify the feature to the user. The user can navigate whatever way they select by using the Features pane on the [Configuration Entry](#) (AM306000) form.

A feature can specify the minimum and maximum options a user can select. Rules are used when an option selected for a feature may restrict the options available for another feature. For example, selecting a fabric option may restrict the options available to select for the color feature. Features can also be hidden when user selection is not required, for example once the options for the color and fabric features are selected, the inventory item to use is determined in a hidden feature.

## Options

Options can be a list of selections or stock and non-stock inventory items. An inventory item associated with an option becomes a material component of the configuration. You can use subassemblies as options and mark an item as phantom; the subassembly, and optionally its routing, is exploded during production order creation and added to the list of components.

In the following diagram, you can see the relationships between options and features.



*Figure: Relationships between features and options*

## Attributes

Attributes are used for multiple purposes. You can add attributes to features and configurations.

- They can be used as selections in a configuration or to enter values. Rules can use attribute values to determine allowable options.
- Attributes can be assigned variables and used in formulas such as a width dimension and a height dimension used to calculate the area of material required.
- Attributes can be used to gather information used in the manufacturing or assembly process, for example, switch settings or dimensions.
- You enter a formula in the list of attributes that you wish to display during configuration entry but not allow data entry.

## Configuration Rules

Configuration rules apply to and drive both quantity (that is, dimensions) and features (that is, options). Rules are used to present the user with option choices based on other options they have selected. For example, the options for fabric change based on the color option selection. Option selection can be enforced by minimum and maximum criteria for the number of options a user can select. Quantity rules can specify minimum, maximum, and lot sizes.

Rules can also be used with attributes to include or exclude features and options.

Rules are optional; a feature might just require a user to select from a list such as storage and memory options.

## Formula Support

Dimensions are handled through formulas on designated fields such as computing the square meters of fabric required based on the linear dimensions entered. Formulas can be expressed for any numeric field including quantities and attributes.

## Configuration Keys

A configuration key identifies what values out of a configuration define its uniqueness compared to other completed configurations of the same configuration ID. A key value is an output of a completed configuration entry which can be preselected before entering a configuration to bring up the same configuration completed in the past using the same key. The key can be a numbering sequence unique to each configuration result or a formula using attribute values.

Additionally, formulas may be used to create a key description and a transaction description.

## Completion

A configuration is completed when all required features have been selected and all rules are validated and the user indicates that they are finished. This provides the user with the ability to save a configuration in progress without having to abandon data entry.

## Output

The output of a configuration consists of the selected features and quantities, attributes and values, and configured item price. The options are combined with the template bill of material of the CTO inventory to build the production order details.

## Product Configurator: Processes and Functions

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In this topic, you will read about processes related to product configuration.

### Defining a Configured Item

Each item to be configured must be setup as a configured item, source of manufacturing, contain a bill of material, and have an active revision configuration definition. Setup of these values can be performed as follows:

1. On the *Bill of Material* (AM208000) form, an active bill of material should be created for an item-warehouse pair. This bill of material will be used as a template to add materials to each of the operations.
2. On the *Configuration Maintenance* (AM207500) form, you should create a configuration with an active revision for the stock item and BOM.
3. On the *Item Warehouse Details* (IN204500) form, you do the following:
  - In the **Inventory ID** box, you select the stock item.
  - In the **Warehouse** box, you select the warehouse.
  - On the **Replenishment** tab, you make sure that *Manufacturing* is selected in the **Replenishment Source** box.
  - In the **Default BOM ID** box on the **Manufacturing** tab, you select the BOM linked to configuration definition.
  - In the **Configuration ID** box on the same tab, you select the configuration to be assigned for the item.

### Labels

You can create labels to make selections more user-friendly. The concept of labels is similar to an ID and CD configuration in the Acumatica ERP database, such as `Inventory ID` and `Inventory CD:Inventory ID` is the database key but the `Inventory CD` can be changed. This concept provides you with the ability to select rules, attributes, and other parameters based on the label value (visible string label) but the stored value in the

database is the ID-like value (non-visible integer value). Due to this you can rename the label while keeping the related data connected without needing to update all necessary tables.

## Formulas

To support dimensional configurations of certain fields by using the [Configuration Maintenance](#) (AM207500) form, you can enter formulas. The formula concept is the same as used in Acumatica Report Designer and general inquiries when building reports and when executing reports. The configuration maintenance provides you with the ability to enter a fixed value or a formula value to be calculated during configuration entry on the [Configuration Entry](#) (AM306000) form. The calculation of formulas in configuration entry is constantly updated when rules are processed and values are changed. Formulas are only visible on the [Configuration Maintenance](#) form and never displayed on the [Configuration Entry](#) form. On the [Configuration Entry](#) form, boxes that contain formulas will always contain a value as a result of the formula execution. The [Formula Editor Dialog Box](#) is used for building formulas. After entering a formula, you should click **Validate** in the editor.

## Rules Processing

Rules are controlled by three types: *Exclude*, *Include*, and *Require*. When rules are processed you only see the available remaining options. You can select attributes, features, and options in any order. For example, one user might select color as an important choice and select it first. Another user might select the fabric first as the importance. For additional information, see [Product Configurator: Rule Processing](#).

## Supplemental Items

Supplemental items are supporting option items selected during configuration entry and indicated as a supplemental item in the configuration definition. When supplemental items are selected and the configuration entry is complete the options will be added to a quote or sales order as a new line item. The concept is a supporting item that is shipped and sold separately from the configured item. These line items cannot be edited by the user in the quote or sales order. Supplemental item price and cost does not get rolled into the configured item. For additional information, see [Product Configurator: Supplemental Items](#).

## Configuration Keys

The concept for configuration keys is to define a completed configuration entry with a selectable value for future configuration. It also supports the selections of subitems when the subitem feature is enabled. Configuration keys are generated at the completion of a configuration and recalculated if adjustments to a configuration entry are made. Completions of configuration entries are made when the user clicks the finish button. A user can select a configuration key before starting a new configuration entry to preload the selections or attributes used from the last completed configuration entry with the same configuration key. Only those features and options not selected to *Results Copy* will not be included in the preloaded configuration.

## Pricing

The [Sales Prices: General Information](#) topic describes how the price of the configured item, its options, and bill of material components is determined. For additional information, see [Product Configurator: Pricing and Cost](#).

## Cost

Factors that impact costing are the same as those used for calculation the cost of produced items. Cost factors are labor, machine, material, tools, and overhead and are not individual, configurable components. These cost factors are attached to the BOM as fixed entries. The only configurable cost factor is material which may vary depending on the configuration results through selected options and multilevel configurations. Cost is determined only when a production order is created.

For more information about costs, see [Production Cost Drivers: General Information](#).

## Production Order Details

When a production order is created for a configured item the *Production Order Details* (AM209000) form displays the operations defined in the bill of material of the configured item. The operations may have materials, steps, overhead, and tools predefined. The materials selected by a configuration are attached to their defined operations.

## Product Configurator: Rule Processing

This topic describes rules that can be used with configurations.

### Types of Rules

You can create rules of the following types: *Exclude*, *Include*, and *Require*. When rules are processed, you can only see the available remaining options. Selection of attributes, features, and options can go in any order. For example, one user might choose color as their first choice. Another user might select the fabric as their first choice.

Rules are triggered by the source feature, any option or a specific option being selected, or the conditional value of an attribute. Then rule type determines what action to take against the target feature and its options as follows:

- *Exclude*: All of the options or specific options of a feature cannot be selected. The options are not displayed unless the user chooses to see them.
- *Include*: All of the options or specific options of a feature are automatically selected.
- *Require*: An option selection must be made for the target feature.
- *Validate*: The attribute value must meet a condition. This type is available only for attributes.

### Rule Examples

#### Example 1: Excluding an Option Based on Another Option

- Feature A has Options A1, A2, and A3
- Feature B has Options B1 and B2. Option B2 must be unavailable for selection when Option A1 is selected.

The rule for Feature A to exclude Option B2 for Feature B is displayed in the following table.

Rule	Source	Target Feature	Target Option
Exclude	A1	Feature B	B2

Because you can select features in any order, you need to have a rule for Feature B also to exclude Option A1 if Option B2 is selected, as shown in the following table.



You can use this rule with the same feature, for example, to make Option A2 unavailable when Option A1 is selected.

Rule	Source	Target Feature	Target Option
Exclude	B2	Feature A	A1



You can use *Include* instead of *Exclude* when an option is to be automatically selected based on the selection of another option.

## Using ANY and ALL

<ANY> is used for the *Source* feature when any option selection will trigger the rule. <ALL> is used to include or exclude all *Target* feature options.

For example, suppose that any option selected for Feature A must exclude Feature B Option B2, as shown in the following table.

Rule	Source	Target Feature	Target Option
Exclude	<ANY>	Feature B	B2

Further suppose that if Option A1 of Feature A is selected, then all options for Feature B must be excluded and Feature B must be unavailable for selection. The following table displays this rule.

Rule	Source	Target Feature	Target Option
Exclude	A1	Feature B	<ALL>

In the example above, if the source were <ANY>, then Feature A and Feature B would be mutually exclusive. If the rule was of the *Include* type, then all options of Feature B would be added when Option A1 of Feature A was selected.

## Including an Option Based on an Attribute Value

When you define attributes on the [Attributes](#) (CS205000) form, you can enter a list of valid values for attributes with the *Combo* and *Multi Select Combo* control types. You can also use attribute values specified in the **Value ID** column in rules.

For example, suppose that you have an attribute with the list of colors (see the following table).

Value ID	Description
R	Rudy Red
B	Baby Blue
G	Lime Green

Based on the color selection, you want to include Option B2 of Feature B when the red color (Value ID = R) is selected. The rule will be the following.

Rule	Condition	Value 1	Target Feature	Target Option
Include	Equals	='R'	Feature B	B2

Attribute values are text fields so they need to be in single quotes to validate by using the `Equal` operation or converted to decimals to validate by using the `Between`, `Greater`, or `Less` operations.

### Validating an Attribute Value

You may need to validate an attribute value. Since attributes are text fields, you need to convert them to decimals in the **Value** boxes by using the `CDec (x)` conversion function. The **Target Feature** and **Target Option** boxes are unavailable for rules of the *Validate* type.

For example, suppose that a user must enter a value between 1 and 5; such as 1, 1.5, 4.33, 5. The rule is the following.

Rule	Condition	Value 1	Value 2	Target Feature	Target Option
Validate	Is Between	CDec (1)	CDec (5)	N/A	N/A

## Rule Concepts

- Rules are triggered by option selection or attribute value changing:
  - Rules for features can be triggered by a single option or any option being selected.
  - Source* and *Target* feature can be same.
  - Rules for attributes can be triggered by the conditional value of the attribute.
  - Rules for features and attributes can target a single option or all options.
- Features and their options can be selected in any order. When defining a configuration you need to account for the dependency of options; that is, if B2 is excluded when A1 is selected, then A1 is excluded when B2 is selected.
- Deleting options will revert all rules previously applied during that deleted options selection.
  - If the option was included from another rules, the parent rule or rules will also need to be reverted.
  - These are most likely include options. The parent and child rules of the include option being deleted will all be reverted as this implementation considers the *Include* rule type to be treated like an include required rule.
- When rules are triggered, the processing of each should be included in a recordable action to allow undo of parent and child processed rules. For example:
  - User selects Option 1 of Feature 1 which has a rule that includes Option 3 of Feature 2.
  - User selects Option 5 of Feature 6 which also has a rule that includes Option 3 of Feature 2.
  - If the user removes Option 3 of Feature 2 from being selected Option 1 of Feature 1 and Option 5 of Feature 6 are also reversed.
  - If Option 3 of Feature 2 had child rules, they would also be removed.
- The rule trigger for features or options is the change in option selections. *Selected* or *Included* to apply rules and *Unselected* or *Excluded* to reverse any previously applied rules.
- The trigger for attribute rules are the change in attribute values.
- Attribute rules are applied before option rules when configuration entry orders are started.
- Options with the **Fixed** check box selected cannot be excluded by any rule. A user could write rules that would attempt to include, exclude, or require this type of option but all rules processing would ignore application to the options with the **Fixed** check box selected.

## Order of Rules

Rules are validated in the following order:

- Selected or cleared option
- Rule type: Exclude, Include, Require (in that order).
- Source option with <ANY> being last
- Sort order of applied feature
- Applied option with <ALL> being last
- Repeat step 1 for each sub rule that needs to be processed as a result of any include or exclude rule previously executed.
- Exclude rules will override include rules when multiple rules are executed against an option.
- Include rules cannot override exclude rules when multiple rules are executed against an option.

9. Rules that exclude/include entire features also run each rule against each option if one exists:
  - Example: Feature 1 was excluded by a rule on Option 2 in Feature 4. Option 1 within Feature 1 has a rule to exclude an option from Feature 2 which needs to be executed when Feature 1 was excluded the same was as if Feature 1 was specifically excluded.
10. Required rules that have an empty applied option (<ALL>) do not get applied to all options like Include or Exclude rules do. Instead, the Required flag is set on the feature forcing a selection of any option while the selection still fits within the selection/quantity requirements.
11. Attribute rules run as they are sorted in the rules grid.
12. Attribute rules only execute if the condition is true. If the condition was previously true and the user changes a value or the overall condition from the result of a formula value is no longer true, all rules are reversed that were previously applied from that rule.
13. Rules processing is chained to each feature/option rule executed from a previous rules execution:
  - Example: Option 1 of Feature 1 has a rule that includes Option 3 of Feature 2. Option 3 also has an exclude on Feature 4. When the rule for including Option 3 execute it also needs to run any rules attached to it such as excluding all of Feature 4.
14. Options within a feature can only be selected once. If a user needs more than 1 of a specific option, the qty required field is used to indicate the number of units required.
15. The Option selection panel is used to include the set of selections.
16. The status of attributes, features, and options are updated at the end of each rules processing.
17. Defaults are applied the first time the configuration entry order is started. The order of execution are attribute defaults and any related rules then the order the options exist on the entry defaults page. Each default processes the rules the same way if a user entered the option selections in that same order.
18. If an option was auto-included from the processing of a rule, the system should prevent a user from removing it and should give a proper message indicating the source selected option.
19. If an option was added by a user, and a user selects an option which makes the previously selected option now excluded, the user should see a message indicating if the selection should continue with the exclusion or cancel the selection.

## Product Configurator: Managing Configurations

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This topic describes ways to manage configurations.

### Managing Configurations and Revisions

Configuration definitions are linked to a single bill of material which in turn makes each definition specific to an inventory item and warehouse. The following rules are applied to configuration definitions:

- You can have multiple bills of material for an inventory item and warehouse.
- You can have multiple configuration definitions for a bill of material.
- Only one configuration definition can be the default for a stock item and warehouse but you can change the default to another active configuration definition.

A configuration definition revision can have the following statuses:

- *Pending*: This is the status for a new configuration. You can test the configuration but it cannot be used in sales orders or production orders and it cannot be the default configuration for an inventory item. You can only delete configuration definitions with this status.
- *Active*: This is the only status allowed for configuration entry and specified as a default.

- *Inactive*: This configuration definition cannot be used for new sales orders and production orders. However, you can reconfigure existing orders that are using this configuration and revision.

There can be only one revision with the *Active* status, one revision with the *Pending* status, and multiple revisions with the *Inactive* status. You change revision statuses as follows:

- Before creating a new revision, you must change the status of the current revision with the *Pending* status to *Active* or *Inactive*.
- If you want to change the revision status to *Active* or *Pending*, you must first change the status of the current revision with the *Active* or *Pending* status to *Inactive*.

The following table displays the possible status changes for revisions of a configuration definition.

Status From/To	Pending	Active	Inactive
<i>Pending</i>	N/A	Allowed	Allowed
<i>Active</i>	Allowed	N/A	Allowed
<i>Active with orders</i>	Not Allowed	N/A	Allowed
<i>Inactive</i>	Allowed	Allowed	N/A

## Fixing Incorrectly Configured Orders

Each configuration result has the configuration ID and revision level used, and although the configuration definition may be inactive, you can reconfigure the order and that definition and revision will be used. On the **References** tab of the [Production Order Maintenance](#) (AM201500) form, you can view the configuration ID and revision. At this time, you can only delete and reenter the sales order line but first delete the production order. For production orders, you can delete and recreate if no activity has occurred, or if in process, correct the production details for any incorrect materials similar to adjusting the order because the bill of material was incorrect.

## Copying Sales Documents with Configured Items

Additional columns have been added to the **Details** tab of the [Sales Orders](#) (SO301000) form to display information about configurable items. These include a column to identify if an item is configurable and if the configuration is complete and columns to link any supplemental items to their parent configured items. In the latter, if you delete the line for a configured item, the supplemental items are deleted also; deletion of a supplemental item is disabled.

When you copy a sales order with configurable items by using the **Copy Order** command on the More menu of the [Sales Orders](#) form, you select the **Copy Configurations** check box in the **Copy To** dialog box that opens. The system will copy configuration and any supplemental items appropriately and you can configure the copied lines.

## Product Configurator: Supplemental Items

Supplemental items are supporting option items selected during configuration entry and indicated as a supplemental item in the configuration definition. When supplemental items are selected and the configuration entry is complete the options will be added to a quote, sales order, or opportunity as a new line item. The concept is a supporting item that is shipped and sold separately from the configured item. Supplemental item price and cost do not get rolled into the configured item price. The sales order lines for supplemental items are linked to and controlled by the sales order line for the configured item:

- The sales order line quantity ordered for supplemental item is the quantity required for the option times the quantity ordered for the configured line.

- The sales order line) for supplemental items are deleted if the sales order line for the configured item is deleted. You may have to refresh the details table or save the order to see the updated lines.
- A change to the configuration, whether in the sales order or in an associated production order will add or remove the sales order lines for any supplemental items associated with the configured sales order line and recalculate the order quantity.
- Changing the order quantity for the configured item will not change the order quantity for the associated supplemental items.
- You can change the quantity, warehouse, price, and other parameters for supplemental items.

## Examples

Consider supplemental items as materials not required to build the configured item but are selected based on the configured item and should be shipped with it:

- A desktop computer where the monitor and keyboard are separate inventory items that must be picked and shipped with the sales order. The monitor and keyboard selections may affect the configuration of the computer components but they are components themselves for the production order for the computer.
- Accessories such as power cords, cables, installation CD's, and manuals for equipment that are included with the configured item.
- Miscellaneous charges for rush orders, extra fees for services, or packaging and shipping charges.

You indicate supplemental items on the [Configuration Maintenance](#) (AM207500) form by selecting the material type for an option of a feature. Since supplemental items will not be components on a production order, the operation number is not required. All other capabilities such as calculation of the quantity required and rules are available.

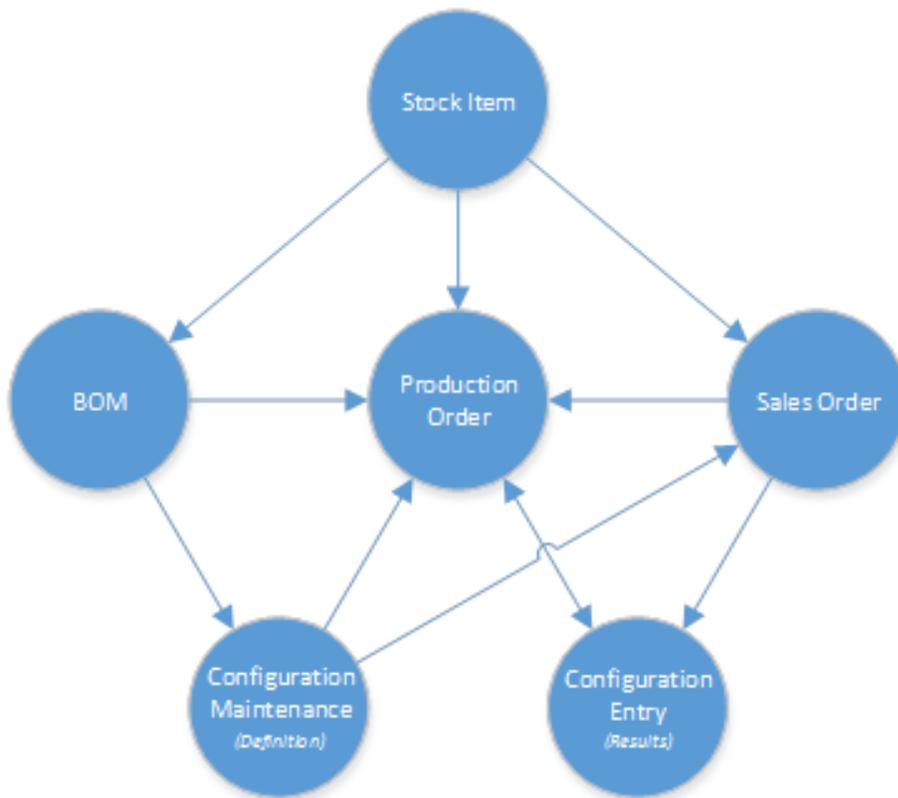
## Product Configurator: Production Management Integration

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Production orders are used to build the configured product. The production order can be created directly from a sales order, as described in [Production Processing: Production for Sales](#), or directly by using the [Production Order Maintenance](#) (AM201500) form. Production orders can also be created from the [MRP Display](#) (AM400000) form or by using the [Critical Materials](#) (AM401000) form. However, they will only contain the template bill of material and must be configured by using the [Configuration Entry](#) (AM306000) form that can be accessed by clicking the **Configure** button on the **References** tab of the [Production Order Maintenance](#) form.

You can plan bills of material, as described in [Planning Bills of Material](#), for configure to order (CTO) inventory items.

The following diagram displays how production orders are integrated with the order management functionality and other parts of the Manufacturing edition.



**Figure:** Relations between production orders and other entities and documents

The process of creating production order combines the template bill of material with the material options selected during the configuration process. As with standard bills of material, a material option can be a phantom and accordingly the components of the phantom replace the phantom in the production order details and optionally insert the operations of the phantom.

## Product Configurator: Implementation Activity

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In the following implementation activity, you will learn how to implement the product configuration functionality.

### Process Overview

In this activity, you will do the following:

1. On the [Configurator Preferences](#) (AM104000) form, review the default settings of production configuration functionality.
2. On the [Configuration Maintenance](#) (AM207500) form, create a new revision of an existing configuration and add rules.
3. On the [Configuration Entry](#) (AM306000) form, test the configuration.

### System Preparation

Before you start implementing the product configuration functionality, do the following:

1. Launch the Acumatica ERP website, and sign in to a company with the *SalesDemo* dataset preloaded. You should sign in as the system administrator with the *admin* username and the password for this user valid for your instance.
2. Make sure that the *Product Configurator* feature in the *Manufacturing* group of features has been enabled on the [Enable/Disable Features](#) (CS100000) form.

## Step 1: Reviewing Default Settings of Product Configurator

To review default settings of the product configurator, do the following:

1. Open the [Configurator Preferences](#) (AM104000) form.
2. In the **General** section, make sure that the following settings are specified:
  - **Config. Numbering Sequence:** *AMCONFIG*
  - **Default Revision:** *A*
  - **Config. Key Format:** *No Keys* (that is, a configuration key is not required)
  - **Default Key Number Sequence:** Empty
  - **Completion Required Before Production:** Selected (that is, a user will have to complete the configuration before creating a production order)
3. In the **Price** section, make sure that the following settings are specified:
  - **Hide Price Details:** Cleared (that is, the price details will be displayed when a user configures items)
  - **Rollup:** *Children All* (that is, the system will calculate the selling price as the rolled up selling price of each option, including all fixed materials in the bill of material)
  - **Override Default on Configuration:** Selected (that is, the user can override the calculated price rollup for a configuration)
  - **Calculate:** *After Selection* (that is, the system calculates the selling price each time the user selects an option or enters a quantity)
  - **Override Default on Configuration:** Selected (that is, the user can override the calculation method of a selling price for a particular configuration)
4. In the **Order Fields** section, make sure that all check boxes are selected. This means that the corresponding boxes of a sales order line will be available for editing.

## Step 2: Setting Up a Configuration

To set up a configuration, do the following:

1. Open the [Configuration Maintenance](#) (AM207500) form.
2. In the **Configuration ID** box, select *AMC000002*, which is the configuration for the *AMDOORDH01* item.
3. In the **Revision** box, type *B* to add a new revision of the configuration and be able to change the details.
4. On the form toolbar, click **Save**.
5. On the **Features** tab, add rules to features as follows:
  - a. Click the row with the *JAMB* feature and on the **Rules** tab of the lower table, add the rules listed in the following table.

Rule	Source Option	Target Feature	Target Option
Include	F/J Pine, 18x90 2 Piece	ARCHITRAVE	FJ Pine Ex 40x25 Profiled

Rule	Source Option	Target Feature	Target Option
Include	FJ Pine 115x30 Arkline	ARCHITRAVE	FJ Pine Ex 75x25 Pro- filed
Exclude	FJ Pine 115x30 Arkline	ARCHITRAVE	FJ Pine Ex 100x25 Pro- filed
Require	Undershot Jamb	HARDWARE	AMDOORHDSS

- b. Click the row with the *ARCHITRAVE* feature and on the **Rules** tab of the lower table, add the rules listed in the following table.

Rule	Source Option	Target Feature	Target Option
Exclude	FJ Pine Ex 100x25 Pro- filed	DOORS	Horizon SQ10 1980 x 510
Include	FJ Pine Ex 75x25 Pro- filed	HARDWARE	AMDOORHDE1
Require	FJ Pine Ex 40x25 Pro- filed	HARDWARE	AMDOORHDE2

- c. Click the row with the *DOORS* feature and on the **Rules** tab of the lower table, add the rules listed in the following table.

Rule	Source Option	Target Feature	Target Option
Exclude	EPS S/C	HARDWARE	AMDOORHDD2
Exclude	Solid Core	JAMB	J2P38/90 Set A

6. On the form toolbar, click **Save**.
7. On the **Attributes** tab, add rules to attributes according to the following table.

Rule	Condition	Value 1	Value 2
<b>Label:</b> Jamb thickness, <b>Attribute ID:</b> Units			
Validate	Is Between	=Cdbl(1.25)	=Cdbl(3)
<b>Label:</b> Height waste, <b>Attribute ID:</b> Units			
Validate	Is Greater Than or Equal To	=Cdbl(0)	
<b>Label:</b> Width waste, <b>Attribute ID:</b> Units			
Validate	Is Greater Than or Equal To	=Cdbl(0)	

Rule	Condition	Value 1	Value 2
<b>Label:</b> Architrave height, <b>Attribute ID:</b> Units			
Validate	Is Greater Than or Equal To	=Cdbl(0)	
Validate	Is Less Than or Equal To	=Cdbl(180)	
<b>Label:</b> Architrave height waste, <b>Attribute ID:</b> Units			
Validate	Is Greater Than or Equal To	=Cdbl(0)	
<b>Label:</b> Architrave width waste, <b>Attribute ID:</b> Units			
Validate	Is Greater Than or Equal To	=Cdbl(0)	

- On the form toolbar, click **Save**.

### Step 3: Testing the Configuration

To test the configuration, do the following:

- While you are still viewing the configuration on the [Configuration Maintenance](#) (AM207500) form, on the More menu, click **Test Configuration**.



You open the More menu by clicking the More button (...) on the form toolbar.

- In the [Configuration Entry](#) (AM306000) form, which opens in the popup window, do the following:
  - On the Features pane, click *JAMBS*.
  - On the **Options** tab, select the unlabeled check box in the row with the *FJ Pine 115x30 Arkline* option. The system displays this option under the *JAMB* feature on the Features pane.
  - Make sure that the system added the *FJ Pine Ex 75x25 Profiled* option under the *ARCHITRAVE* feature because of the *Include* rule you added for the *JAMB* feature and the *FJ Pine 115x30 Arkline* option.
  - Make sure that the system also added the *AMDOORHDE1* option under the *HARDWARE* feature according to the rule you added for the *ARCHITRAVE* feature and the *FJ Pine Ex 75x25 Profiled* option.
  - On the Features pane, click *DOORS*.
  - On the **Options** tab, select the unlabeled check box in the row with the *Horizon SQ10 1980 x 760* option. The system displays this option under the *DOORS* feature on the Features pane.
  - On the **Attributes** tab, view the warning message displayed for the *Jamb thickness* attribute. According to the rule for this attribute, its value must be between 1.25 and 3 but the value of the attribute is 5.
  - Change the value of the attribute to 3. Make sure that the warning message disappeared.
  - On the form toolbar, click **Finish** to indicate that you finished testing, and close the form.

You have successfully implemented the product configuration.

## Product Configurator: To Create a Sales Order with a Configurable Item

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The following activity will walk you through the process of creating a sales order with a configurable item.

### Process Overview

In this activity, you will do the following:

1. On the [Order Types](#) (SO201000) form, you will review the settings of the SO order type to make sure that the settings required for adding configurable items and creating production orders have been specified.
2. On the [Sales Orders](#) (SO301000) form, you will create a sales order and add a configurable item to the order. You will also select the needed options for features of the item on the [Configuration Entry](#) (AM306000) form.
3. On the same form, you will create a production order for the item and on the [Production Order Details](#) (AM209000) form, you will make sure that the options you selected have been added as materials.

### System Preparation

Before you start creating a sales order with a configurable item, do the following:

1. As a prerequisite activity, in the company to which you are signed in, be sure you have set up the product configuration as described in [Product Configurator: Implementation Activity](#).
2. Launch the Acumatica ERP website, and sign in to a company with the *SalesDemo* dataset preloaded. You should sign in as the system administrator with the *admin* username and the password for this user valid for your instance.
3. Make sure that the *Product Configurator* feature in the *Manufacturing* group of features has been enabled on the [Enable/Disable Features](#) (CS100000) form.
4. In the info area, in the upper-right corner of the top pane of the Acumatica ERP screen, make sure that the business date in your system is set to today's date. For simplicity, in this activity, you will create and process all documents in the system on this business date.

### Step 1: Reviewing Settings of the SO Order Type

To make sure that the SO order type has the settings needed for creating sales orders with configurable items, do the following:

1. Open the [Order Types](#) (SO201000) form.
2. In the **Order Type** box, select *SO*.
3. On the **General** tab (the **Manufacturing Settings** section), make sure that the following check boxes are selected:
  - **Allow Production Orders - Approved**
  - **Allow Production Orders - Hold**
  - **Allow Configuration Entry**

This means that you can assign production orders to sales orders of this type and add configurable items to the orders.

### Step 2: Creating a Sales Order

To create a sales order with the configurable item, do the following:

1. On the [Sales Orders](#) (SO301000) form, create a new record.



To open the form for creating a new record, type the form ID in the Search box, and on the Search form, point at the form title and click **New** right of the title.

2. In the Summary area, specify the following:
  - **Order Type:** *SO*
  - **Customer:** *ABCSTUDIOS*
  - **Description:** *Sale of a configurable item*
  - **Requested On:** Today's date

3. On the table toolbar of the **Details** tab, click **Add Row**.

4. In the row, specify the following:

- **Branch:** *PRODWHOLE*
- **Inventory ID:** *AMDOORDH01*
- **Warehouse:** *WHOLESALE*
- **Quantity:** *1*

Notice that the system selected the check box in the **Configurable** column of the line, which indicates that the item is configurable.

5. On the form toolbar, click **Save**.
6. On the table toolbar, click **Configure**. The system opens the [Configuration Entry](#) (AM306000) form in the popup window and displays the list of features for the *AMDOORDH01* item on the Features pane.
7. Select the option for the *JAMB* feature as follows:
  - a. On the Features pane, click *JAMB*.
  - b. On the **Options** tab, select the check box in the **Included** column of the *FJ Pine 40x10 19 Single BevelF* row.
8. Select the option for the *ARCHITRAVE* feature as follows:
  - a. On the Features pane, click *ARCHITRAVE*.
  - b. On the **Options** tab, select the check box in the **Included** column of the *FJ Pine Ex 50x25 Profiled* row.
9. Select the option for the *DOORS* feature as follows:
  - a. On the Features pane, click *DOORS*.
  - b. On the **Options** tab, select the check box in the **Included** column of the *Horizon SQ10 1980 x 510* row.
10. Select the option for the *HARDWARE* feature as follows:
  - a. On the Features pane, click *HARDWARE*.
  - b. On the **Options** tab, select the check box in the **Included** column of the *AMDOORHDB2* row.
11. On the form toolbar, click **Save**.
12. On the form toolbar, click **Finish** to complete the configuration, and close the form.

### Step 3: Creating a Production Order

To create a production order from the sales order, do the following:

1. While you are still viewing the sales order on the [Sales Orders](#) (SO301000) form, on the More menu, click **Create Production Orders**.



You open the More menu by clicking the More button (...) on the form toolbar.

2. In the **Production Orders** dialog box, which opens, select the check box in the unlabeled column of the only row and click **Create**. The system creates a production order, closes the dialog box, and displays the reference number of the production order in the **Production Nbr.** column of the line on the **Details** tab.
3. On the [Production Order Details](#) (AM209000) form, open the created production order to review its details.
4. In the Operations table, click each operation row from *0010* to *0040* and on the **Materials** tab of the lower table, make sure that the options you selected in Step 2 have been added as materials.

You have created a sales order with the configurable item and created a production order for this item.

# Lesson 3: Performing Engineering Change Control

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## Engineering Change Control: General Information

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Engineering change control (ECC) is an essential requirement for maintaining control of manufacturing master data in a rapidly changing world. The primary purpose of ECC is to control changes to bills of material. For a rapidly changing or heavily regulated manufacturing company, ECC will assist and monitor the process of changing a bill of material (BOM) and gaining approval if required.

You can use engineering change control functionality only if the *Engineering Change Control* feature in the *Manufacturing* group of features is enabled on the [Enable/Disable Features](#) (CS100000) form.

In this topic, you will read about ECC in Acumatica ERP Manufacturing Edition.

## ECC Functionality

Engineering change control provides the following abilities:

- Automates, controls, and organizes all change requests, plans, and actual changes to a bill of material.
- Full control from an engineering change request (ECR) to an engineering change order (ECO) to updating the bill of material.
- The ability to create multiple engineering change orders from multiple approved engineering change requests with the option to merge ECRs for the same bill of material and revision to a single ECO.
- The ability to use approval and assignment maps to control the approval process for both change requests and change orders. You can specify if approvals are required for either or both ECRs and ECOs.
- Create notification templates on the [Notification Templates](#) (SM204003) form to inform users of the statuses of an ECR, ECO, and bill of material updates.

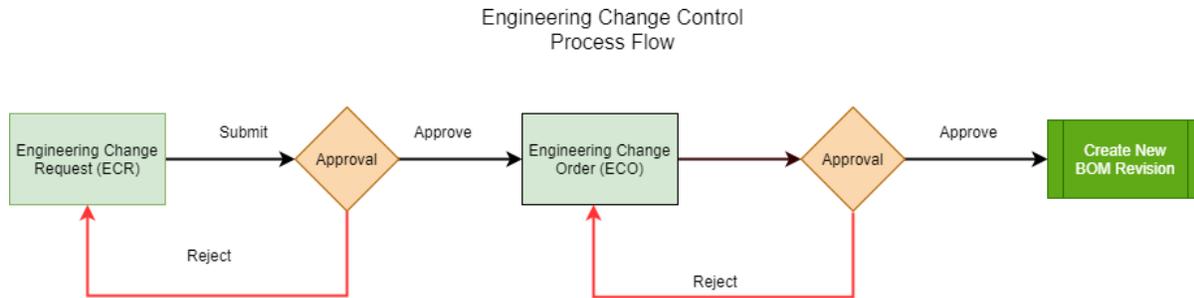
The following restrictions apply if the **Require ECR/ECO for New BOM Revisions** check box is selected on the [BOM Preferences](#) (AM101000) form:

- You cannot select the *Hold* check box for a bill of material (BOM) to edit it directly. You must use the ECR or ECO process to update BOMs once an ECR is created for the BOM.
- You can optionally forbid manual creation of a new revision for a bill of material and force all new revisions to be created by the ECC process.

## ECC Workflow

In the following diagram, you can view the workflow of engineering change control with the following settings on the [BOM Preferences](#) (AM101000) form:

- **Require ECR Before Creating ECO:** Selected
- **ECR Require Approval:** Selected
- **ECO Require Approval:** Selected



**Figure: Workflow of engineering change control**

To initiate changes in an existing bill of material, you perform the following steps:

1. Create an ECR by using the [Engineering Change Request](#) (AM210000) form. The ECR status is *On Hold*.
2. Submit the ECR. The ECR status is changed to *Pending Approval*.
3. Acting as an approver, approve the ECR. The ECR status is changed to *Approved*.
4. Initiate the creation of the ECO based on the ECR. The ECR status is changed to *Completed*.
5. Open the created ECO on the [Engineering Change Order](#) (AM215000) form.
6. Review the ECO details and submit the ECO. The ECO status is changed to *Pending Approval*.
7. Acting as an approver, approve the ECO. The ECO status is changed to *Approved*.
8. Initiate the creation of the bill of material revision from the ECO. The ECO status is changed to *Completed*.

## Engineering Change Control: Implementation Activity

In the following implementation activity, you will learn how to configure engineering change control.

### Process Overview

In this activity, you will review the settings related to engineering change control by using the [BOM Preferences](#) (AM101000) form.

### System Preparation

Before you start implementing the product configuration functionality, do the following:

1. Launch the Acumatica ERP website, and sign in to a company with the *SalesDemo* dataset preloaded. You should sign in as the system administrator with the *admin* username and the password for this user valid for your instance.
2. Make sure that the *Engineering Change Control* feature in the *Manufacturing* group of features has been enabled on the [Enable/Disable Features](#) (CS100000) form.

### Step: Reviewing ECC Settings

To review the default settings of engineering change control, do the following:

1. Open the [BOM Preferences](#) (AM101000) form.
2. On the **General** tab, make sure that the following settings related to engineering change control have been specified:

- **ECR Numbering Sequence:** *AMECR*
  - **ECO Numbering Sequence:** *AMECO*
  - **Require ECR Before Creating ECO:** Selected  
With this setting, a user must create an engineering change request first and then create an engineering change order based on the request.
  - **Require ECR/ECO for New BOM Revisions:** Cleared  
With this setting, a user can create new revisions of bills of material based on ECR or ECO directly on the [Bill of Material](#) (AM208000) form.
3. On the **ECR Approval** tab, make sure that the following has been specified:
    - The **ECR Require Approval** check box is selected.
    - The *Engineering Change Request* approval map has been added to the table.
  4. On the **ECO Approval** tab, make sure that the following has been specified:
    - The **ECO Require Approval** check box is selected.
    - The *Engineering Change Order* approval map has been added to the table.

## Engineering Change Control: Process Activity

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The following activity will walk you through the process of making changes in a bill of material by using engineering change control.

### Process Overview

In this activity, you will do the following:

1. On the [Engineering Change Request](#) (AM210000) form, you will create an engineering change request for changes in the bill of material and approve the request.
2. On the [Engineering Change Order](#) (AM215000) form, you will create an engineering change order based on the engineering change request and approve the order.
3. On the same form you will commit changes from the engineering change order to the bill of material.

### System Preparation

Before you start making changes to a bill of material by using engineering change control, do the following:

1. Launch the Acumatica ERP website, and sign in to a company with the *SalesDemo* dataset preloaded. You should sign in as the system administrator with the *admin* username and the password for this user valid for your instance.
2. Make sure that the *Engineering Change Control* feature in the *Manufacturing* group of features has been enabled on the [Enable/Disable Features](#) (CS100000) form.
3. In the info area, in the upper-right corner of the top pane of the Acumatica ERP screen, make sure that the business date in your system is set to today's date. For simplicity, in this activity, you will create and process all documents in the system on this business date.

### Step 1: Creating an Engineering Change Request

To create an engineering change request for changes in a bill of material, do the following:

1. On the [Engineering Change Request](#) (AM210000) form, add a new record.



To open the form for creating a new record, type the form ID in the Search box, and on the Search form, point at the form title and click **New** right of the title.

2. In the **BOM ID** box of the Summary area, select *BOM000001*.
3. In the **Description** box, enter Assemble Printed Circuit Board with inspection.
4. On the form toolbar, click **Save**.
5. On the table toolbar of the **Operations** tab, click **Add Row**.
6. In the row, specify the following:
  - **Operation ID:** 0030
  - **Work Center:** *WC100*
  - **Run Units:** 10
  - **Run Time:** 01:00
7. Make sure that all other values of time boxes (except **Machine Time**) are 00:00.
8. Make sure that the value of the **Change Status** is *Inserted*.
9. On the form toolbar, click **Save**.
10. On the form toolbar, click **Submit** to confirm that you completed making changes in the request.
11. On the form toolbar, click **Approve** to approve the changes made in the request.

## Step 2: Creating an Engineering Change Order

To create an engineering change order based on the engineering change request, do the following:

1. While you are still viewing the engineering change request on the [Engineering Change Request](#) (AM210000) form, on the form toolbar, click **Create ECO**. The system opens the [Engineering Change Order](#) (AM215000) form for the new order and copies details from the request.
2. On the form toolbar, click **Save**.
3. On the form toolbar, click **Submit** to confirm the order details.
4. On the form toolbar, click **Approve** to approve the order.

## Step 3: Committing Changes to BOM

To commit changes from the engineering change order to the bill of material, do the following:

1. While you are still viewing the engineering change order on the [Engineering Change Order](#) (AM215000) form, on the form toolbar, click **Commit Changes to BOM**. The system opens the [Bill of Material](#) (AM208000) form with the new revision of the *BOM000001* bill of material.
2. In the **Revision** box, make sure that the system specified *E* as the revision identifier.
3. In the **Status** box, make sure that the status of the revision is **Active**.
4. On the form toolbar, click **Save**.

You have successfully created a new revision of a bill of material by using engineering change control.

# Lesson 4: Performing Advanced Planning and Scheduling

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## Advanced Planning and Scheduling: General Information

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Advanced planning and scheduling (APS) provides the first elements of finite scheduling. This gives you a competitive and operational advantage if it is implemented and executed correctly. This functionality is available only when the *Advanced Planning and Scheduling* feature in the *Manufacturing* group of features is enabled on the [Enable/Disable Features](#) (CS100000) form.

In this topic, you will read about implementation of advanced planning and scheduling and the related processes.

### APS Implementation

You need to do the following to prepare the system to using APS:

1. In the **Block Size** box on the [Production Preferences](#) (AM102000) form, select the size of the schedule block size.
2. If you want to schedule machines, select the **Machine Scheduling** check box.
3. If you want to schedule tools, select the **Tool Scheduling** check box.
4. On the [Work Calendar](#) (CS209000) form, create work calendars to use for each work center and machines.
5. On the [Shifts](#) (AM205000) form, create shifts to use for each work center.
6. On the [Machines](#) (AM204500) form, create machines to be used in each work center.
7. On the [Tools](#) (AM205500) form, create tools to be used for operations.
8. On the [Work Centers](#) (AM207000) form, add the shifts and calendars and specify the basis for capacity for each of your work centers.
9. Add the machines to the work centers if machine scheduling is used in your organization.
10. On the [Bill of Material](#) (AM208000) form, specify the setup time, run units, and run time for each operation in your bill of material. The units and time depend on the basis for capacity specified for each work center.
11. Specify the tools required for each operation.
12. On the [APS Maintenance Process](#) (AM512000) form, run the APS maintenance process to build the work center schedules.

### Maintenance Process

The purpose of the advanced planning and scheduling maintenance process is to rebuild and refresh work center schedules. To run the process, you use the [APS Maintenance Process](#) (AM512000) form.

You run this process in the following cases:

- During the first implementation of advanced planning and scheduling after you have defined work centers and their capacities.
- When you changed the calendar working hours, added shifts, added break times, or changed calendar exception days for work centers. Currently it does not remove break times from the work center, but it will add new ones.
- When you have changed the schedule block size on the [Production Preferences](#) (AM102000) form.
- Periodically to clean and remove old schedules.

The process will fill the empty schedule days for each work center for the next 180 days and adjust the schedule time blocks. This process can be scheduled to run automatically using automation schedules.

## Rough Cut Planning Process

The rough cut planning process finite schedules open and planned production orders.

The system loads and schedules orders in the following sequence:

- By the dispatch priority ascending
- By the constraint date ascending
- By the production order number ascending

The availability of material is considered. Supply orders (that is, purchase orders, transfer orders, and production orders) that are allocated to the order being scheduled constrain the order start date as follows:

- If a supply order line is allocated to the production order, then the supply order promise date is the first day an order can be scheduled.
- If material is not already allocated, then allocate available material as *Production Demand Prepared*.
- Finally, look for supply orders without allocations and use their promise date as a start date constraint. The supply orders are not allocated to the production order.

To run rough-cut planning, you use the [Rough Cut Planning](#) (AM501000) form and select the orders you wish to schedule. The system will only schedule orders that can be manufactured, if there is a material shortage or some other issue the order will not be scheduled. Once scheduled the items will remain on the [Rough Cut Planning](#) form.

For more information about advanced scheduling, see [Advanced Planning and Scheduling: Scheduling Details](#).

For details about defining capacity, see [Advanced Planning and Scheduling: Capacity Definition](#).

## Advanced Planning and Scheduling: Capacity Definition

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This topic explains how capacity is calculated for work centers in Acumatica ERP Manufacturing Edition.

### Working Calendars

A working calendar defines the starting and ending times for each working day and break times, such as lunch. A work calendar can have exceptions for days not worked, such as holidays or shutdown periods, or non-working days that are work days, such as unplanned overtime on a weekend not normally worked. You create working calendars by using the [Work Calendar](#) (CS209000) form.

Each work center can have multiple shifts and each shift has a working calendar. You specify a working calendar for each shift of a work center in the **Calendar ID** column of the **Shifts** tab on the [Work Centers](#) (AM207000) form.

When you create machines on the [Machines](#) (AM204500) form, you need to specify a working calendar for machine operation in the **Calendar ID** box. The system uses this calendar during scheduling when the **Machine Scheduling** check box is selected on the [Production Preferences](#) (AM102000) form.

### Work Centers

The daily capacity for a work center is the total number of working hours for all shifts. The value of the **Basis for Capacity** box on the **General** tab of the [Work Centers](#) (AM207000) form determines which settings the system uses when scheduling operations in each work center. In this box, you can select either of the following values:

- *Crew Size*: The system uses the crew size and efficiency specified in the **Crew Size** and **Efficiency** boxes on the **Shifts** tab of the [Work Centers](#) form; it also uses the run time and run units specified in the **Run Time** and **Run Units** columns, correspondingly, of the Operations table on the [Bill of Material](#) (AM208000) form.

- *Machines*: The system uses the machine time and machine units specified in the **Machine Time** and **Machine Units** columns, respectively, of the Operations table of the *Bill of Material* form.



If multiple work centers are set up with the *Machines* basis for capacity and the same machine has been added to the settings of more than one of these work centers, the system will not schedule operations for those work centers at the same time.

## Schedule Blocks

To simplify the scheduling process and to accommodate different types of manufacturing, schedule blocks are used in finite scheduling. The size of the schedule block is defined on the *Production Preferences* (AM102000) form and applies to all work centers. The block size can be as small as 5 minutes or as large as 1 hour with options for 10, 15, and 30 minutes.

## Advanced Planning and Scheduling: Scheduling Details

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In this topic, you will read about scheduling details.

### Scheduling Method

In conjunction with the constraint date, this determines the sequence by which the operations of the production order are scheduled. You can select any of the following scheduling methods in the **Scheduling Method** box on the **General** tab of the *Production Order Maintenance* (AM201500) form:

- *Finish On*: The operations are scheduled backwards from the constraint date. Production orders created from a sales order, or orders created as linked orders from a parent order, has this value selected by default. For sales orders, the constraint date is one day earlier than the scheduled ship date.
- *Start On*: The operations are scheduled forward from the constraint date.
- *User Dates*: This value provides you with the ability to define the start and end dates of the production order. This is a way for the user to override the manufacturing lead times or to use any calendar dates including non-working days.

### Constraint Date

This is a particular date by which the production order is needed or needs to be started. It is only entered when the scheduling method is either *Finish On* or *Start On*.

You specify the constraint date on the **General** tab of the *Production Order Maintenance* (AM201500) form.

### Dispatch Priority

This is only used in APS to load the production orders and operations in priority sequence. Orders with the same priority are loaded by the constraint date. Orders with the highest priority are scheduled first. One (1) is the highest priority and ten (10) is the lowest.

You specify the dispatch priority on the **General** tab of the *Production Order Maintenance* (AM201500) form.

### Infinite Capacity Planning

Production order operations starting and ending dates are calculated solely on the basis of operation duration. MRP planned orders always use this method. For more details about calculating operation and production order dates, see *MRP Configuration: System Settings*.

## Finite Capacity Planning

Production orders can be scheduled and rescheduled respecting the capacity and current load of work centers, machine, and tools and the availability of materials. If the scheduling method is *Finish On*, the operations are scheduled backwards until the calculated operation start date is in the past. From that point the sequence is reversed and the operations are forward-scheduled.



You have the option to exclude the validation for available materials as follows:

- For an entire production order type by clearing the **Check for Material Availability** check box on the [Production Order Types](#) (AM201100) form.
- For specific materials by clearing the **Check for Material Availability** check box on the **Manufacturing** tab of the [Stock Items](#) (IN202500) form.

Operations are always scheduled in contiguous blocks skipping over non-working hours and schedule breaks. See the following example:

- A work center has capacity available today starting at 11 am with a noon to 1 pm lunch break and a shift ending at 5 pm; so 5 hours remaining capacity and 8 hours available tomorrow.
- The schedule blocks are 1 hour.
- An operation has a duration of 9 hours.

The following table shows the schedule blocks consumed by the operation.

Schedule Date	Schedule Blocks	Start Time	End Time
Today	1	11:00 AM	12:00 PM
Today	Lunch Break	12:00 PM	01:00 PM
Today	4	01:00 PM	05:00 PM
Tomorrow	4	08:00 AM	12:00 PM

Finite scheduling may result in the following issues:

- Gaps may appear between operations when a resource is not available on the desired time slot. For example, an operation requires 8 hours of a resource and a contiguous block of time is not available for the next operation. This may not be the desirable when the next operation must be started immediately after completion of the previous operation.
- The calculated finish date of the production order may be after the required date for a sales order or linked production order.
- If all material is not available for the order, either in stock or allocated from a supply order, the order will not be scheduled.
- If machine scheduling is used, the machine may not be available although the work center is available.
- If tool scheduling is used, the tools required may not be available although the work center is available and the machine is available.

For more information about the calculation of the duration of operations, see [Advanced Planning and Scheduling: Operation Lead Time](#).

## Firm Scheduling of Production Orders

You can prevent a production order from being rescheduled if strict production dates are important for the production order (for example, due to the commitment with the customer). You can firm the order—that is, fix the

production dates. When you run finite scheduling of production orders, the system does not reschedule the firmed production orders.

To firm any number of production orders, on the [Rough Cut Planning](#) (AM501000) form, you do the following:

1. Select the check box in the unlabeled column of each row that contains a production order to be firmed.
2. In the **Action** box of the Selection area, select *Firm*.
3. Click **Process** on the form toolbar. The system firms the dates of the processed production orders and changes the schedule status of the orders to *Firm*.

To undo firm for a production order, you perform the same steps but select the *Undo Firm* action.

Firm production orders are hidden from the [Rough Cut Planning](#) form by default—that is, the **Exclude Firm Orders** check box in the Selection area is selected—but you can display these orders by clearing the check box.

You can also firm production orders by using the [Production Schedule Board](#) (AM215555) form.

## Advanced Planning and Scheduling: Process Activity

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The following activity will walk you through the process of advanced scheduling production orders.

### Process Overview

In this activity, you will do the following:

1. On the [Production Order Maintenance](#) (AM201500) form, you will create a production order to be scheduled.
2. On the [APS Maintenance Process](#) (AM512000) form, you will run the maintenance process of advanced planning and scheduling.
3. On the [Rough Cut Planning](#) (AM501000) form, you will schedule the created production order.
4. On the [Work Center Schedule](#) (AM000001) form, you will view how the system scheduled the production order considering other open production orders.

### System Preparation

Before you start making changes to a bill of material by using engineering change control, do the following:

1. Launch the Acumatica ERP website, and sign in to a company with the *SalesDemo* dataset preloaded. You should sign in as the system administrator with the *admin* username and the password for this user valid for your instance.
2. Make sure that the *Advanced Planning and Scheduling* feature in the *Manufacturing* group of features has been enabled on the [Enable/Disable Features](#) (CS100000) form.
3. In the info area, in the upper-right corner of the top pane of the Acumatica ERP screen, make sure that the business date in your system is set to today's date. For simplicity, in this activity, you will create and process all documents in the system on this business date.

### Step 1: Creating a Production Order

To create a production order to be scheduled, do the following:

1. On the [Production Order Maintenance](#) (AM201500) form, add a new record.



To open the form for creating a new record, type the form ID in the Search box, and on the Search form, point at the form title and click **New** right of the title.

2. In the **Inventory ID** box of the Summary area, select *MGWIDGET*.
3. In the **Qty. to Produce** box on the **General** tab, enter 5.
4. On the form toolbar, click **Save**.
5. Memorize or write down the number in the **Production Nbr.** box. You will need this value in the following steps.

## Step 2: Performing APS Maintenance

To update work center schedule and clean up history before running scheduling, do the following:

1. Open the [APS Maintenance Process](#) (AM512000) form.
2. In the Selection area, select the following check boxes:
  - **Update Work Center Schedule from Calendar**
  - **Cleanup History**
3. On the form toolbar, click **Process**. Wait till the system performs maintenance. On the **Process History** tab, the system updates the dates and user logins in the **Work Center Schedule** and **History Cleanup** sections.

## Step 3: Scheduling the Production Orders

To schedule the production order, do the following:

1. Open the [Rough Cut Planning](#) (AM501000) form.
2. In the Selection area, make sure that the **Release Orders** check box is cleared.
3. Make sure that the **Exclude Planning Orders** and **Exclude Firm Orders** check boxes are selected.
4. Schedule the production order you created in Step 1 as follows:
  - a. Select the check box in the unlabeled column of the row for the production order.
  - b. In the **Action** box of the Selection area, make sure that *Schedule* is selected.
  - c. On the form toolbar, click **Process**.

The system opens the **Processing** dialog box and runs the process of the production order scheduling.

- d. Close the **Processing** dialog box.

## Step 4: Viewing Work Center Schedule

To review the schedule of work centers where the *MGWIDGET* will be produced, do the following:

1. Open the [Work Center Schedule](#) (AM000001) form.
2. In the Selection area, select the following:
  - **Order Type:** *RO*
  - **Production Nbr.:** The number of the production order you created in Step 1.

In the table, the system displays only rows related to the selected production order.

3. In the row for the *WC10* work center, make sure that the system scheduled 5 blocks (30 minutes each) and specified the start and end time of the operation.

4. In the row for the *WC100* work center, make sure that the system scheduled 3 blocks (30 minutes each) and specified the start and date time of the operation

You have scheduled the created production order by using advanced planning and scheduling.