



Critical
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an ASM PT company

Recipe Management

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Recipe Management

Estimated time to read: 14 minutes

As manufacturing relies on increasingly more complex equipment, the management of the recipes that the equipment will use for a certain process becomes increasingly important. This type of management is a basic requirement to ensure that the right recipe, with the right parameters, is used for the right process.

The **Recipe Management** module provides capabilities to manage, download, upload, resolve and instantiate recipes.

Info

Recipe Management is a separately licensed module.

This document will guide you through the setup and usage of the **Recipe Management** module functionalities.

Overview

A **Recipe** defines the equipment information required for processing a given **Material** in a **Step**. **Recipe Management** is a critical functionality for complex industries, and it ensures that a **Material** is correctly processed at an equipment.

Concepts

The table below describes the main concepts related to **Recipe Management**.

Concept	Description
Parameter	An equipment variable to be controlled.
Recipe Parameter	A Recipe Parameter qualifies the value of the parameter in the Recipe.
Sub-Recipe	A Sub-Recipe provides a hierarchical structure to assemble recipes to any depth in order to promote re-usability of Recipes.
Recipe Body	A Recipe Body can be human readable or not. It is often in a binary form, only understandable by the equipment.

Table: Recipe Management main concepts

The Recipe Management object model is shown in the figure below.

```
graph LR
    C1[Recipe Parameter Overrides Context] --- Main[Recipe]
    L1[Recipe Body] --- Main
    C2[Recipe Context] --- Main
    L2[Recipe Parameter] --- Main
    C1 --- L2
```

```

A1[Parameter] --- L2
Main --- L3[Recipe Instance]
L3 --- L4[Recipe Instance Parameter]
Main ---- L5[SubRecipe]
L5 ----|SubRecipe| Main
Main --- L6[SubRecipe Parameter]
L6 --- A1

classDef mermaid_title color:#000, fill:#fafafa, stroke:#fafafa, stroke-width:0x, font-size:100%, font-weight:200;
classDef mermaid_start color:#000, fill:#fafafa, stroke:#fafafa, color:#fafafa, stroke-width:0x, font-size:100%, visibility: hidden;
classDef mermaid_businessdata color:#000, fill:#65CDE8, stroke:#65CDE8, stroke-width:0px, font-size:100%;
classDef mermaid_nonbusinessdata color:#000, fill:#B7DEE8, stroke:#B7DEE8, stroke-width:0px, font-size:100%;
classDef mermaid_entity color:#000, fill:#FB9F53, stroke:#FB9F53, stroke-width:0px, font-size:100%;
classDef mermaid_entitylinked color:#000, fill:#FCD5B5, stroke:#FCD5B5, stroke-width:0px, font-size:100%;
classDef mermaid_context color:#000, fill:#B9CDE5, stroke:#B9CDE5, stroke-width:0px, font-size:100%;
classDef mermaid_optional color:#000, fill:#B7DEE8, stroke:#65CDE8, stroke-width:1px, font-size:100%, stroke-dasharray: 5 5;
class Main mermaid_entity
class A1,A2,A3,A4,A5,A6,A7,A8,A9,A10 mermaid_businessdata
class L1,L2,L3,L4,L5,L6 mermaid_entitylinked
class C1,C2,C3,C4,C5,C6 mermaid_context
class N1,N2,N3,N4,N5,N6 mermaid_nonbusinessdata

click Main "../../userguide/business-data/recipe"
click A1 "../../userguide/business-data/parameter"
click C1 "../../userguide/administration/tables/smart-tables/recipeparameteroverridecontext"
click C2 "../../userguide/administration/tables/smart-tables/recipecontext"
click L5 "../../userguide/business-data/recipe"

```

The MES Recipe object model is based on SEMI E139, as shown in the table below. The SEMI E139 Recipe and Parameter Management is a standard developed to specify the cooperative interaction between the factory information and control system (*FICS*) and the equipment in order to manage the specifications of equipment processing (for instance, equipment recipes).

The PDE – Process Definition Element translates from the SEMI E139 into a **Recipe** in Critical Manufacturing, with the following element matching:

SEMI E139	Critical Manufacturing	Description
uid – universally unique identifier	Id	Recipe Id
Name	Name	Recipe Name
Description	Description	Recipe Description
type	Type	Recipe Type
executable	IsExecutable	Defines if a Recipe is executable or not.
userInfo	UserInfo	Recipe User Information
supplierInfo	SupplierInfo	Recipe Supplier Information
author	CreatedBy	The User who created the Recipe.

SEMI E139	Critical Manufacturing	Description
Specification (PDEBody or PDEBodyReference)	Body	Recipe Body
specificationChecksum	Checksum	Recipe Body Checksum
{PDEHeader/PDEParameter}	{ RecipeParameter }	Recipe Parameters
{PDEHeader/PDEParameter/ relatedParameters}	{ SubRecipeParameter }	Recipe Sub-Recipe Parameters

Table: SEMI E139 and Critical Manufacturing MES concepts

Setting Up a Recipe

The necessary steps to set up a Recipe shall be explained over the next sections.

Create a Parameter

A Parameter provides an abstraction to Resource specific variable names which have the same meaning at the MES/human level. A Recipe can contain static or dynamic Parameters.

To create a Parameter to be used in a Recipe, the properties listed in the table below need to be defined.

Property	Description
Scope	It needs to be defined as Recipe or EDC_SPC_Recipe.
Data Type	The Parameter Data Type.
Format	The defined Format will influence the value input and display. For more information about the Parameter Formats, please refer to the Create Parameter section.
Units	The Units of the Parameter to be displayed.
Minimum Value	A minimum value for the Parameter, only for numeric Parameters.
Maximum Value	A maximum value for the Parameter, only for numeric Parameters.
Lookup Table	A Lookup Table to be used as a source of values for the Parameter. The Lookup Table values must match the Data Type of the Parameter.

Table: Parameter creation wizard properties

Create a Recipe

To create a Recipe there are configurations regarding its Parameters, Sub-Recipes and Body that need to be defined.

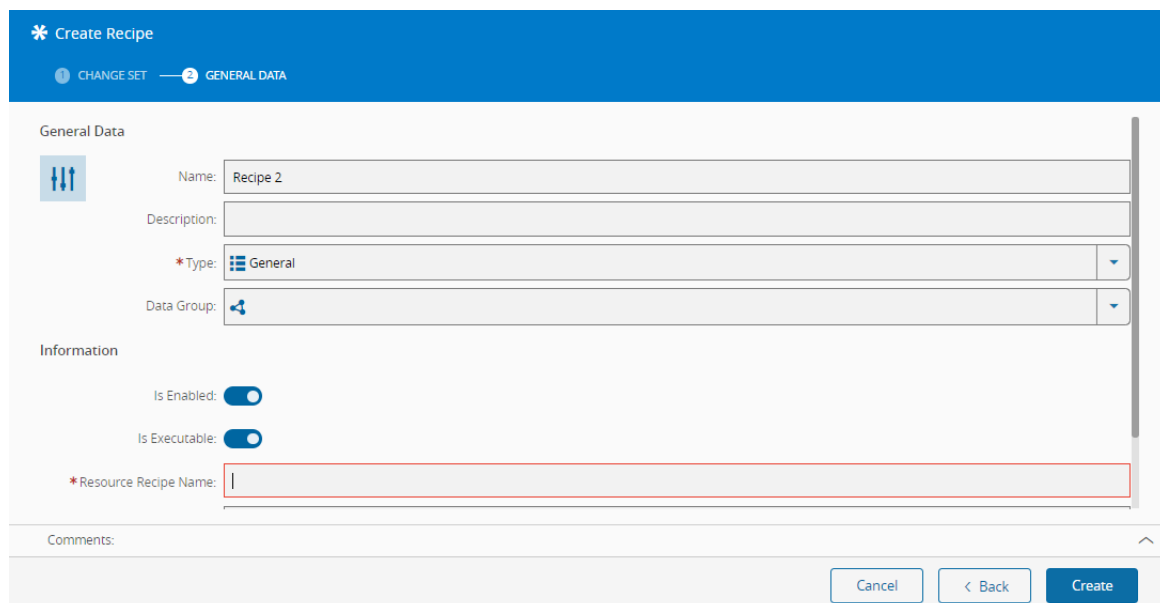
The next table describes the properties that need to be taken into consideration when creating a Recipe, the first step of the Recipe creation.

i Info

The *IsEnabled* and *IsExecutable* properties are contained in the global data components of the Recipe, i.e. without Change Control required.

Property	Description
IsEnabled	Defines if a Recipe is enabled or not. A disabled Recipe cannot be used to create a Recipe instance.
IsExecutable	Defines if a Recipe is executable or not. An Executable Recipe can be used as the Recipe for a Material, whereas a non-Executable Recipe can only be used as a Sub-Recipe.
Resource Recipe Name	The Resource Recipe Name should match the local Recipe Name in the equipment.

Table: Recipe creation wizard properties



*** Create Recipe**

1 CHANGE SET — 2 GENERAL DATA

General Data

Name: Recipe 2

Description:

*Type: General

Data Group:

Information

Is Enabled:

Is Executable:

*Resource Recipe Name:

Comments:

Cancel < Back Create

To manage the Recipe Parameters, the User must access the *Manage Parameters* wizard in the Recipe page, as shown in the table and figure below.

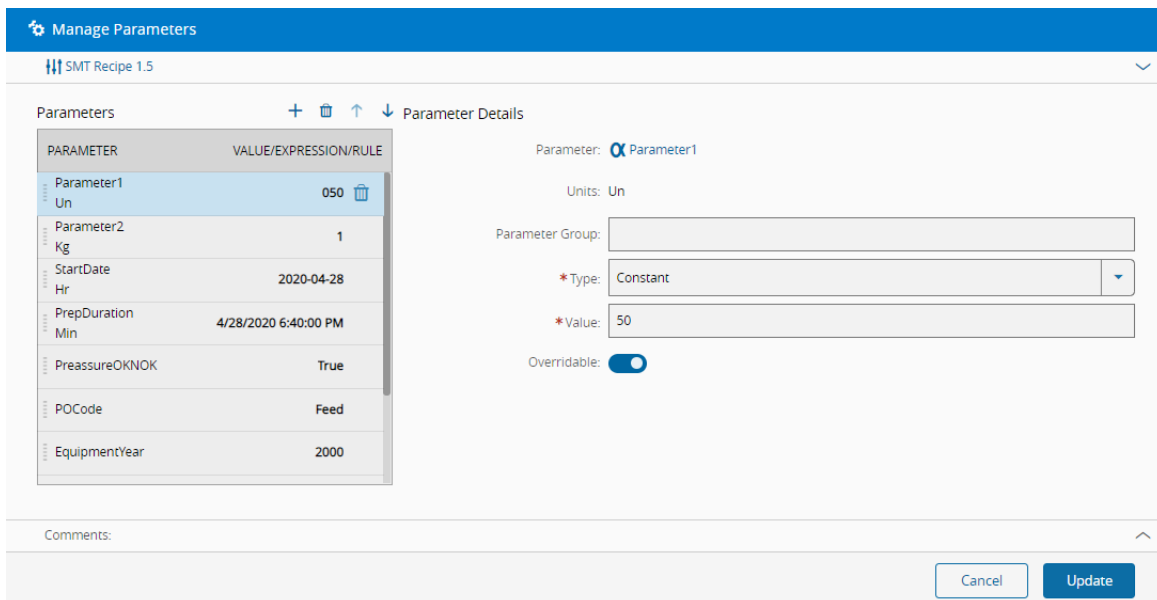
Property	Description
Parameter Group	Defines the Parameter Group name for display purposes.

Property	Description
Type	The following options are available: - Constant : a constant value - Expression : an Expression that calculates the Parameter value based on other Parameters. Parameters referred by the Expression must be defined before adding the Expression Parameter - Input : a value provided by the User or supplied by the parent Recipe - Rule : a Rule to be used to evaluate the Parameter value
Value	The value of the Parameter if the Type is Constant or Input .
Expression	The Expression to be used to calculate the Parameter if the type is Expression. For more information about the Expression syntax, please refer to the Expression Evaluator section.
Rule	The Rule to be used to evaluate the Parameter value. The Rule must have the scope defined as <i>Recipe Management</i> .
Overridable	Defines if a Parameter is Overridable. An Overridable Parameter may have its value changed depending on the Recipe Parameter Override Context Smart Table configuration.

Table: Parameter management wizard properties

Info

If a Parameter has Minimum or Maximum values defined, values outside this interval cannot be defined on the Value property.



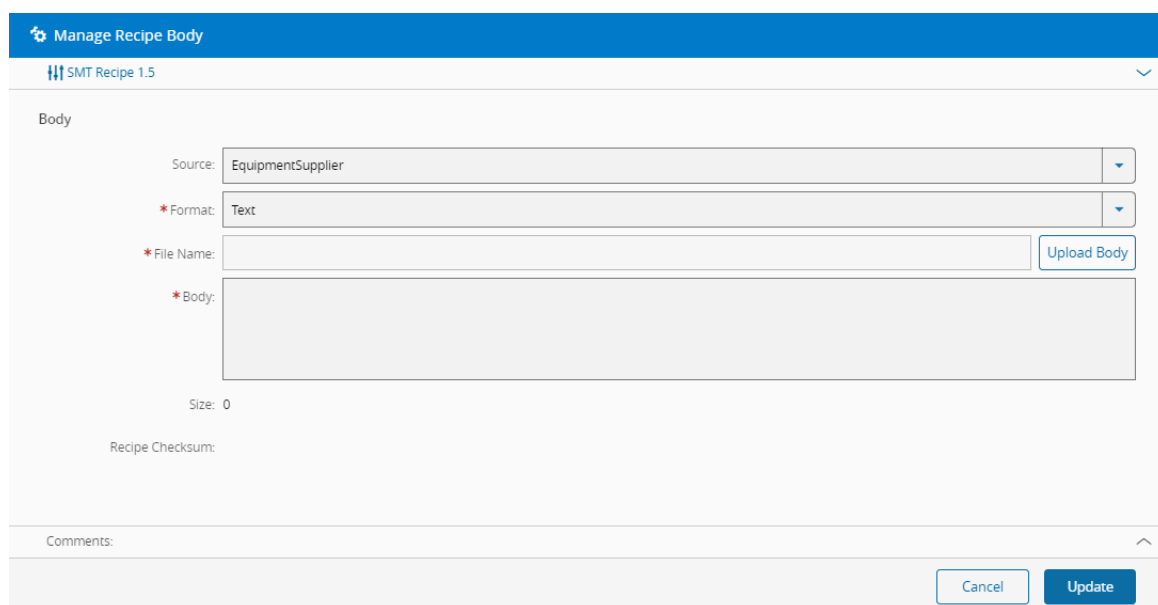
The screenshot displays the 'Manage Parameters' wizard for 'SMT Recipe 1.5'. On the left, a table lists parameters with their values or rules. On the right, the 'Parameter Details' for 'Parameter1' are shown, including units, group, type (Constant), value (50), and an 'Overridable' toggle switch.

To manage the Recipe Body, the User must access the *Manage Recipe Body* wizard in the Recipe page, as shown in the table and figure below.

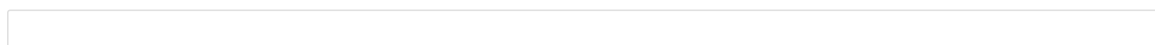
Property	Description
----------	-------------

Property	Description
Source	The Source of the Recipe. The following options are available: <ul style="list-style-type: none"> - DownloadedFromEquipment: MES will retrieve the Recipes from a Resource whose <i>RecipeManagement</i> property is enabled and whose automation mode is online and that supports Recipe download - EquipmentSupplier - HumanEdited - None
Format	The Recipe Format. The following options are available: <ul style="list-style-type: none"> - Binary: always set when the Recipe is <i>DownloadedFromEquipment</i> and available for selection for the <i>EquipmentSupplier</i> and <i>HumanEdited</i> Sources - Text: available for selection for the <i>EquipmentSupplier</i> and <i>HumanEdited</i> Sources - URL: available for selection for the <i>EquipmentSupplier</i> and <i>HumanEdited</i> Sources
Download From:	Selection of a Resource, if the selected Source is <i>DownloadedFromEquipment</i> .
Resource Recipe:	Selection of a Resource Recipe, if the selected Source is <i>DownloadedFromEquipment</i> .
Recipe Checksum:	It is used to ensure Recipe integrity since Recipes are often locally modified at the equipment.
File Name:	If the selected Format was <i>URL</i> , then the User must provide a <i>URL</i> . If the selected Format was <i>Binary</i> , then the User must provide a file. If the selected Format was a <i>Text</i> then the User can choose to load a file and edit the contents manually.

Table: Manage Recipe Body wizard properties

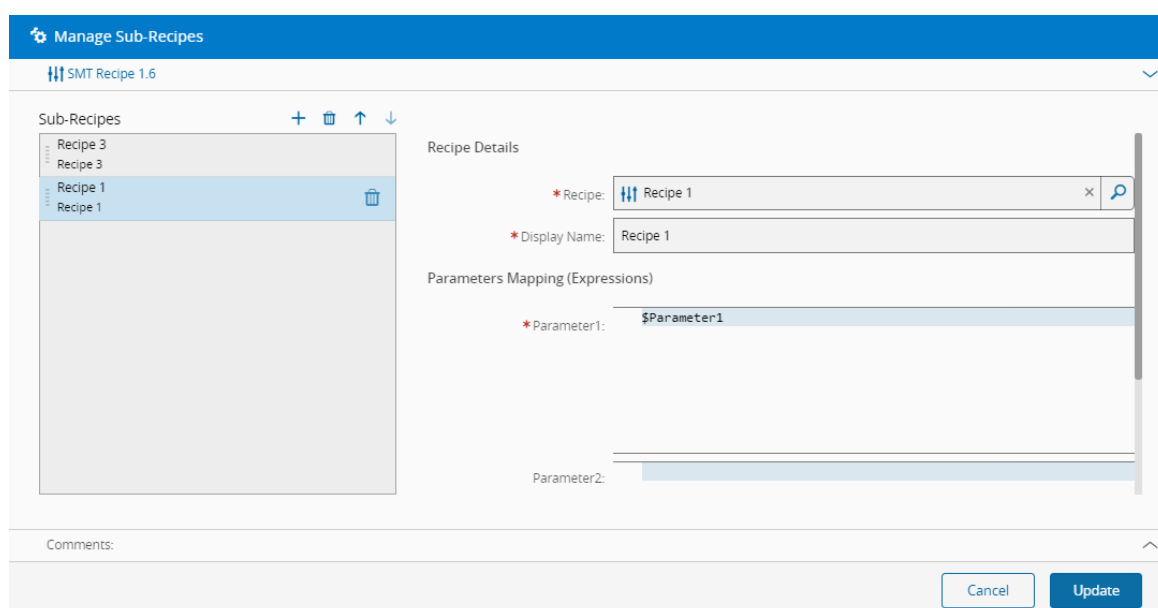


To manage the Recipe Sub-Recipes, the User must access the *Manage Sub-Recipes* wizard in the Recipe page, as shown in the table and figure below.



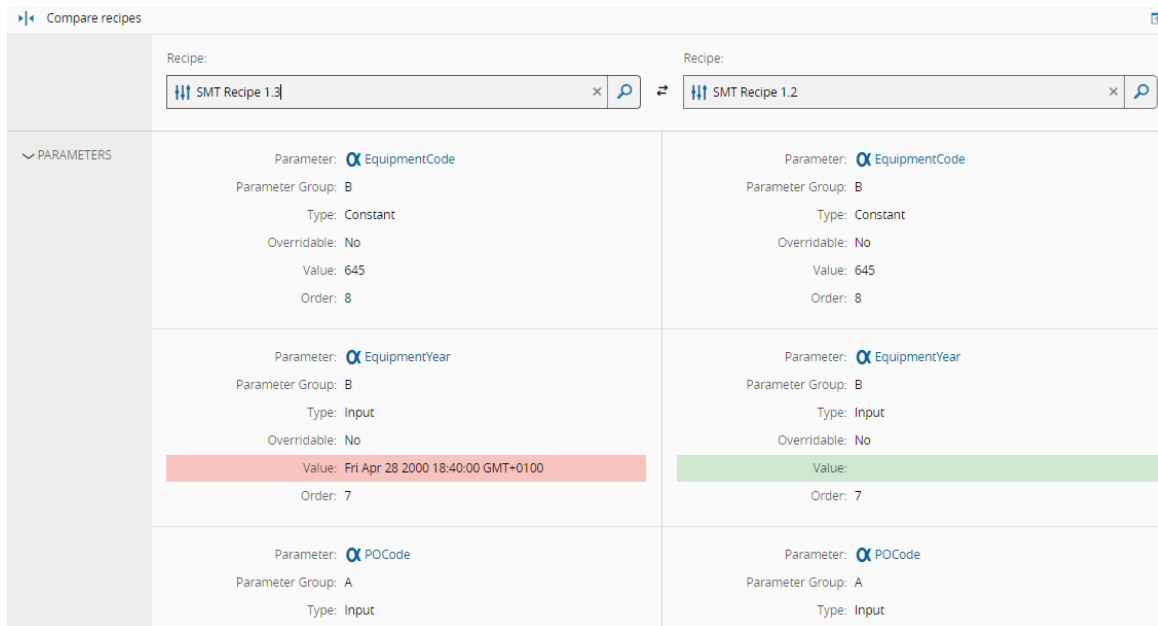
Property	Description
Recipe	The Recipe to be defined as a Sub-Recipe.
Display Name	The Recipe display Name.
Parameter Mapping	For each Sub-Recipe, it is mandatory to define the Parameter mapping for the Sub-Recipe Parameters which are of type Input and have no default value. For the Sub-Recipe Parameters which are Overridable, it is possible (but not mandatory) that the Sub-Recipe Parameters mappings are defined as well. A Parameter mapping is based on an expression that refers to the Parent Recipe Parameters.

Table: Manage Sub-Recipes wizard properties



Compare Recipes

The *Compare Recipes* page provides the functionality to verify not only changes in Recipe Versions, but also to compare different Recipes, as shown on the figure below.

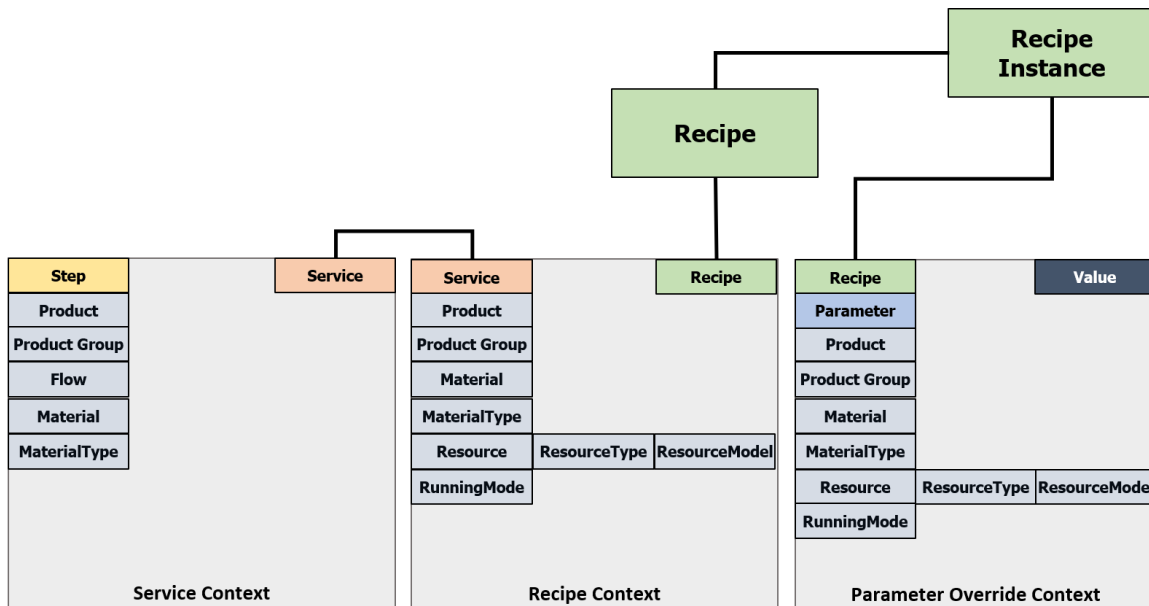


Recipe Context Resolution and Recipe Instance Creation

A Material requires a Service at a Step, as defined in the *Service Context* Smart Table, and this Service is provided by a Resource. For this Service, in order to provide the necessary setup and configuration information to process a Material in a Resource, the *Recipe Context* is defined.

For a particular Material Context, the MES creates a Recipe Instance when performing a Material track-in. The Recipe Instance stores the used Recipe Version and Parameter information for traceability and analysis purposes.

The relationship between the above presented concepts can be found in the figure below.



Manage Recipe Context

A Recipe is configured for processing a Material in a Step and Resource through the Service defined in the *Recipe Context* table, as detailed in the table and figure below.

Info

A Recipe needs to be marked as *Executable* to be referenced on the *Recipe Context* table.

Property	Description
Service	The Service which requires the Recipe.
Running Mode	The Running Mode provides an additional flexibility degree in maintaining and resolving Recipes in the case that the Recipe to be used depends on a particular Resource configuration. The Running Mode can be defined on the <i>Resource Running Mode</i> Smart Table.

Table: Add Recipe Context Record

+ Add Recipe Context Record(s)

RecipeContext (Active)
▼

Record(s) + 🗑

Record #1	🗑
Service: Solder Printing Service	

Recipe Context

- * Service: ✕ 🔍
- Product: 🔍
- Product Group: 🔍
- Flow: 🔍
- Material: 🔍
- Material Type: ▼
- Resource: 🔍
- Resource Type: ▼

Comments: ^

Manage Parameter Overrides Context

To promote Recipe reusability and to support a dynamic resolution of Parameters during runtime, a Parameter can be marked as Overridable.

Info

A Parameter needs to be marked as Overridable on the Recipe Parameters to be referenced on the *Recipe Parameter Override Context* table.

Property	Description
Parameter	The Parameter to be overridden.
Value	The Value to be considered for the Parameter on the defined context.

Table: Add Parameter Overrides Context Record

+ Add Parameter Overrides Context Record(s)

RecipeParameterOverrideContext (Active)

Record(s)

Record #1
Parameter: Parameter1

Recipe Parameter Override Context

*Parameter:

Product:

Product Group:

Flow:

Material:

Material Type:

Resource:

Resource Type:

Comments:

Experiment Definition

An Experiment Definition allows the User to carry out controlled variations of the production process. A typical use case for this situation is the creation of an Experiment Definition in order to test a new Recipe. This can be configured by defining the Action *SetRecipe* at the Track-in Event for an Experiment Definition Material Group, as shown in the figure below.

Edit Experiment Definition Step

GENERAL DATA MATERIAL GROUPS ACTIONS

Step Material Group Actions

MATERIAL GROUPS	1
1 2 actions	Hold Processed
2 No actions	SetRecipe Trackin

Action Details

*Action:

*Event:

SetRecipe Details

*Recipe:

Comments:

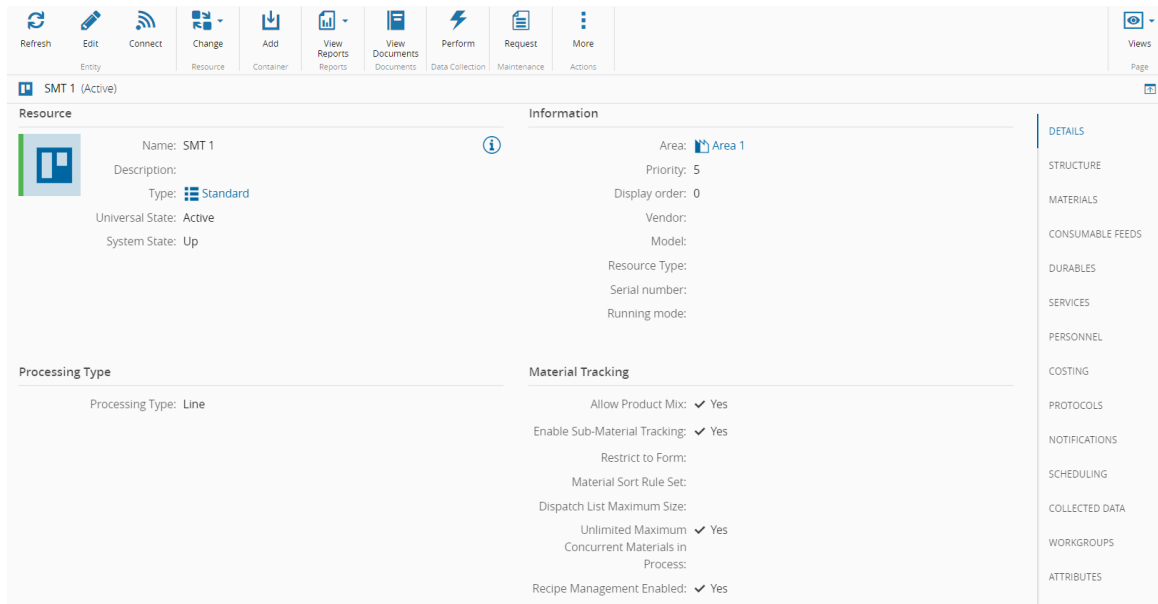
For more information about the Experiment Definition, please refer to the [Create Experiment Definition](#) section.

Using a Recipe

Over the next sections it is detailed how a Recipe can be used in MES.

Resource Configuration

In order to use Recipe Management for a particular Resource, it is necessary to set the property *Recipe Management Enabled* to true, as shown in the figure below.



Set Resource Recipe

When the setup is performed manually, the User can access the *Set Recipe* wizard in order to select the Recipe to be set on the Resource, as shown in the figure below.

If the option *Validate Recipe Context* is set to True, then only Recipes that are defined on the Recipe Context are displayed.

After selecting the Recipe, it is set as the Current Recipe and the Current Recipe Source is set as User.

In this wizard it is also possible to clear the Resource Current Recipe, by selecting *Clear* and then *Set*.

Info

When a Recipe is set manually, it can only be reset manually as well.

Info

The Resource must have the property *Recipe Management Enabled* set to True.

Set Resource Recipe

Mixer-01 (Up) / SEMI E10 = Standby

Validate Recipe Context:

Recipe: Baking Cookies [A]

Recipe Description: Baking Temperature sub-recipe
Resource Recipe Name: Temperature

Recipe Parameters (1)

PARAMETER	TYPE	EXPRESSION	RULE	VALUE	UNITS	OVERRIDABLE
OVEN SETTINGS						
Temperature	Constant			400	°C	✓

Rows per Page: 25 Page 1 of 1 (1 Records)

Comments:

If the **Resource** has lanes configured and Is Multilane Active enabled, you will have to select a valid Lane of the **Resource** for your recipe.

Set Resource Recipe

Mixer with Lanes (Up)

Validate Recipe Context:

Lane: Mixer Lane 1

Recipe: Baking Cookies [A]

Recipe Description: Baking Temperature sub-recipe
Resource Recipe Name: Temperature

Recipe Parameters (1)

PARAMETER	TYPE	EXPRESSION	RULE	VALUE	UNITS	OVERRIDABLE
OVEN SETTINGS						
Temperature	Constant			400	°C	✓

Rows per Page: 25 Page 1 of 1 (1 Records)

Comments:

For more information, see [Set Resource Recipe](#).

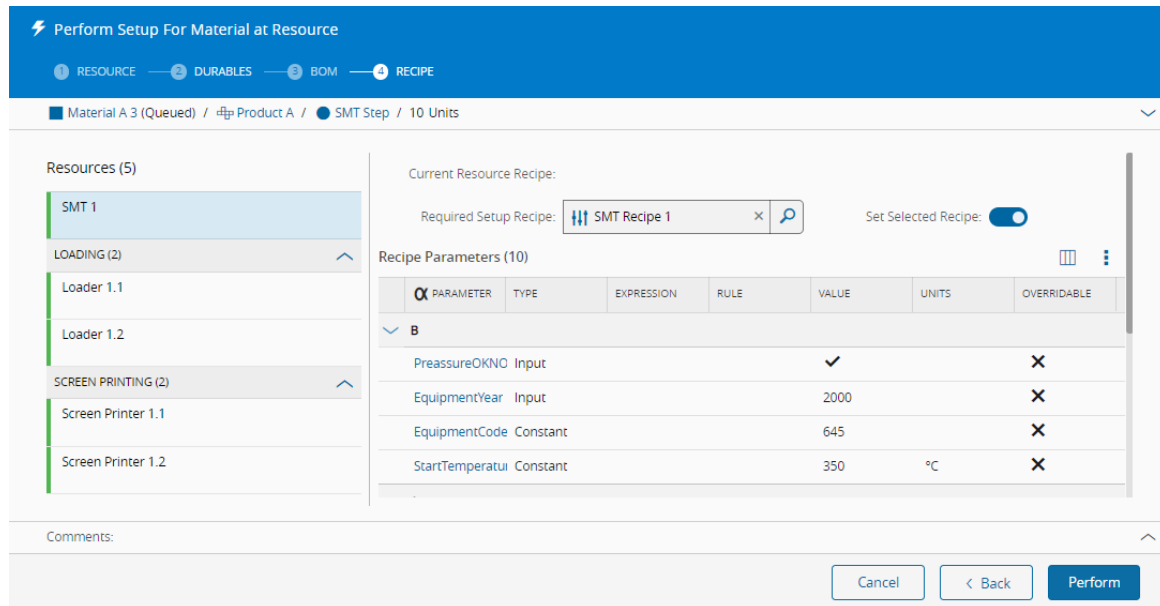
Perform Resource Setup

Before tracking-in a Material in a Resource it is possible to perform the Resource setup. The *Perform Setup For Material at Resource* wizard is available on the Resource view after selecting a Material, as shown in the figure below.

Info

Only Recipes that are defined on the Recipe Context are displayed.

If the option *Set Selected Recipe* is set to True, then the User has the option to set it manually at the Resource. The selected Recipe is set as the Resource Current Recipe and Current Recipe Source is set as User.

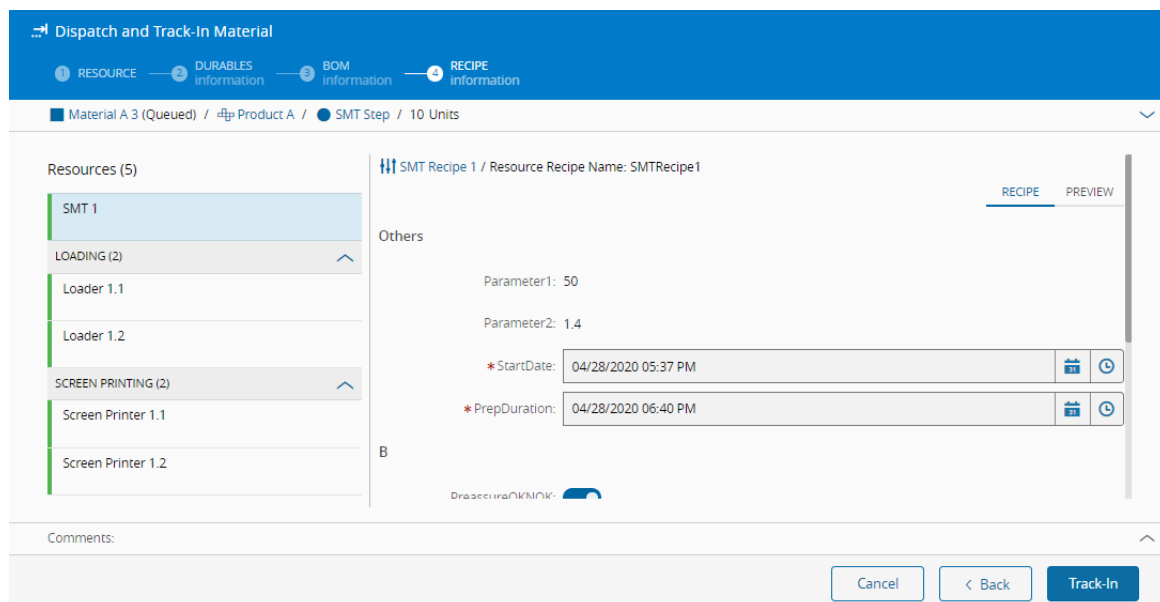


PARAMETER	TYPE	EXPRESSION	RULE	VALUE	UNITS	OVERRIDABLE
B						
PreassureOKNO	Input			✓		✗
EquipmentYear	Input			2000		✗
EquipmentCode	Constant			645		✗
StartTemperatu	Constant			350	°C	✗

Material Track-in

When a Material is tracked-in, the Recipe defined in the *Recipe Context* is displayed, as shown in the figure below.

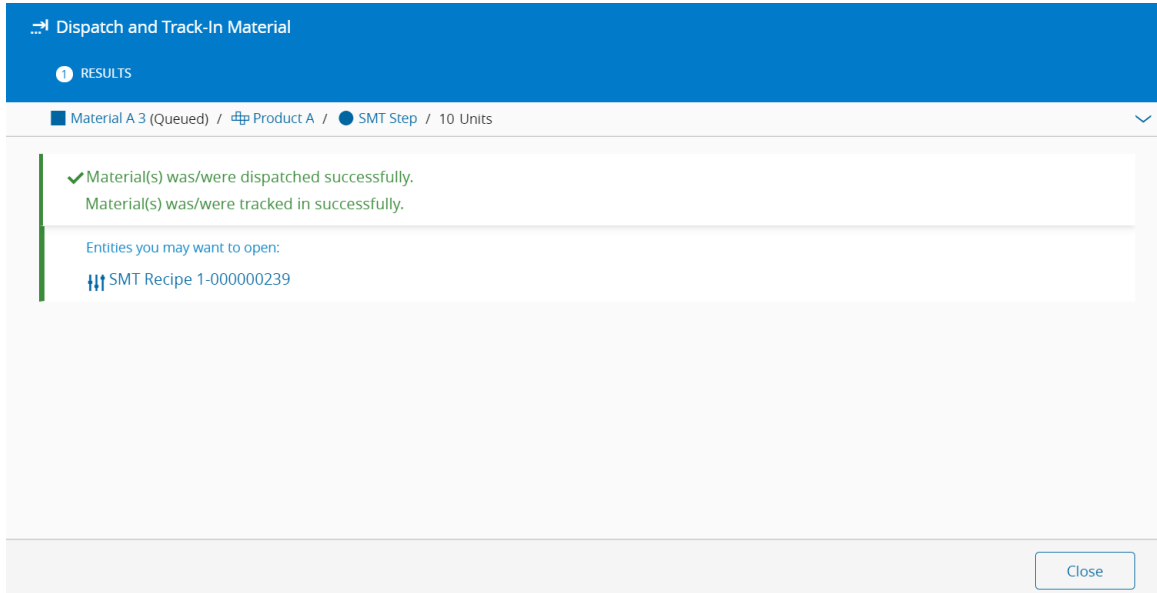
For the Recipe Input Parameters, it is possible to specify their values.



i Info

The Resource property *Verify Material Recipe at Track-In* defines whether the System will validate if the Resource Current Recipe matches the defined Recipe Context when tracking-in material. If the *Verify Material Recipe at Track-In* is set to False and the Current Recipe Source is System, then it is possible to track-in the Material even if the Resource Current Recipe does not match the defined *Recipe Context*.

After performing the track-in, the resolved Recipe is set as the Resource Current Recipe, if not already, in which case the Current Recipe Source is set as System, and a Recipe Instance is created, as shown in the figure below.



Dispatch and Track-In Material

RESULTS

Material A 3 (Queued) / Product A / SMT Step / 10 Units

✓ Material(s) was/were dispatched successfully.
Material(s) was/were tracked in successfully.

Entities you may want to open:

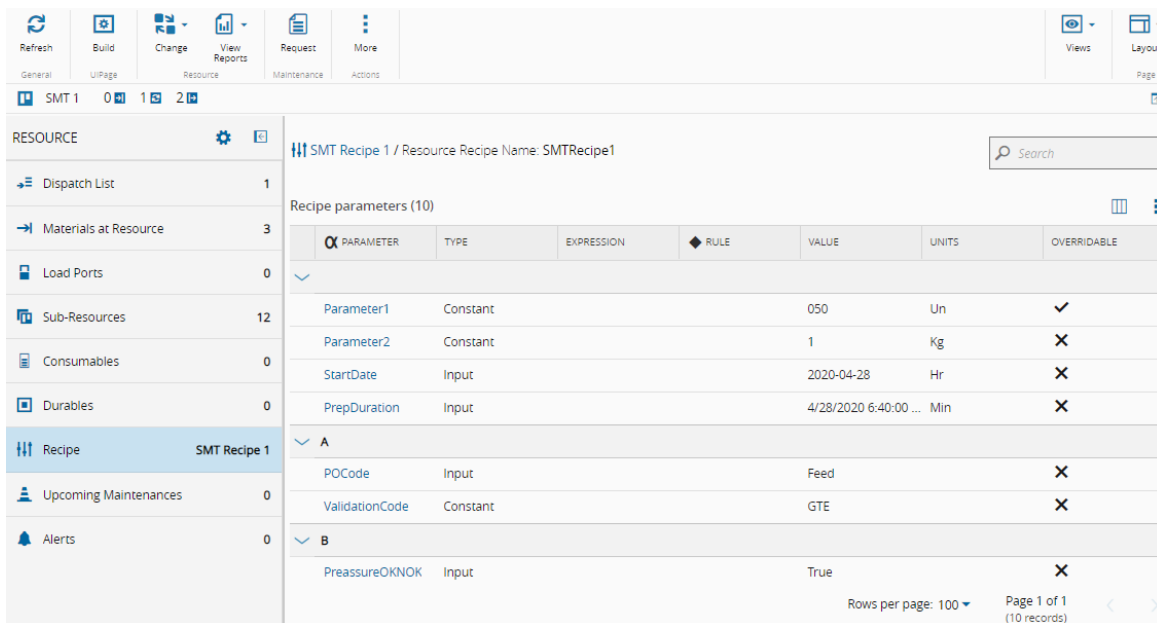
- SMT Recipe 1-000000239

Close

Info

If the track-in is performed in a Line Resource, then the Recipe Instances are also created for the Resources of the Line Flow which provide the Services resolved, using the Service Context, and for which the Recipe Management is enabled.

The Recipe set for the Resource can be viewed on the Resource View Recipe tab, as shown in the figure below.



RESOURCE

SMT Recipe 1 / Resource Recipe Name: SMTRecipe1

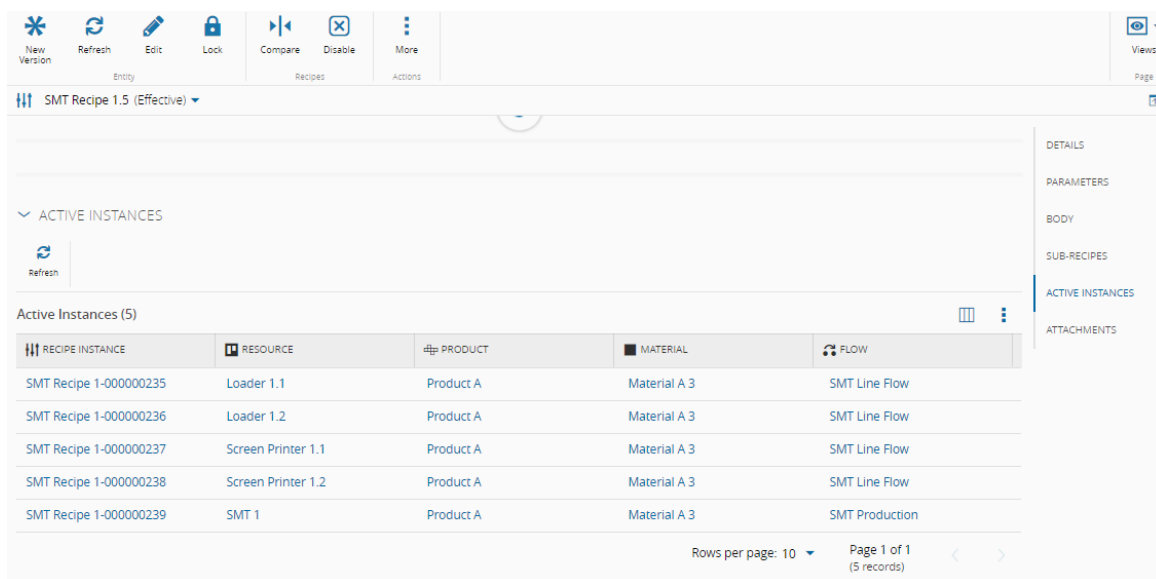
Recipe parameters (10)

PARAMETER	TYPE	EXPRESSION	RULE	VALUE	UNITS	OVERRIDABLE
Parameter1	Constant			050	Un	✓
Parameter2	Constant			1	Kg	✗
StartDate	Input			2020-04-28	Hr	✗
PrepDuration	Input			4/28/2020 6:40:00 ...	Min	✗
A						
POCode	Input			Feed		✗
ValidationCode	Constant			GTE		✗
B						
PressureOKNOK	Input			True		✗

Rows per page: 100 Page 1 of 1 (10 records)

Recipe Active Instances

All active instances of the Recipe can be found on the *Active Instances* section of the Recipe page, as shown in the figure below.



The screenshot shows the 'SMT Recipe 1.5 (Effective)' page. The 'ACTIVE INSTANCES' section is expanded, showing a table with 5 records. The table columns are RECIPE INSTANCE, RESOURCE, PRODUCT, MATERIAL, and FLOW. The records are as follows:

RECIPE INSTANCE	RESOURCE	PRODUCT	MATERIAL	FLOW
SMT Recipe 1-000000235	Loader 1.1	Product A	Material A 3	SMT Line Flow
SMT Recipe 1-000000236	Loader 1.2	Product A	Material A 3	SMT Line Flow
SMT Recipe 1-000000237	Screen Printer 1.1	Product A	Material A 3	SMT Line Flow
SMT Recipe 1-000000238	Screen Printer 1.2	Product A	Material A 3	SMT Line Flow
SMT Recipe 1-000000239	SMT 1	Product A	Material A 3	SMT Production

At the bottom of the table, it indicates 'Rows per page: 10' and 'Page 1 of 1 (5 records)'.



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