RUExpressionSIMATIC BATCH: BatchML sample files

Description of sample files for BatchML support by SIMATIC BATCH

Brief description of the document

Batch Markup Language (BatchML) is an XML implementation of the ANSI/ISA-88 and offers a set of XML type and element definition. This document contains brief information for each sample file included in the BatchML sample package. The sample files are provided additionally to the document „SIMATIC BATCH BatchML", which is the basic documentation for the BatchML functionality supported by SIMATIC BATCH.

Each sample file is a valid and complete BatchML representation of a master recipe. Each sample shows a dedicated set of functionalities. Depending on the use case, different scenarios occur regarding how basic recipes are represented with BatchML. The scenarios mentioned in this document will only give an insight into the various possible configurations. Each chapter will have a first topic „Important aspects", that describes which aspect of the overall functionality will be shown in this sample package.

The basic PCS 7 project used for the sample files is the „Getting started V8.2" project, which is available online: https://support.industry.siemens.com/cs/ww/de/view/109751834

Structure of the document

Each chapter is related to a dedicated sample file. The title of the chapter is exactly the name of the sample file as it is provided in the download package.

For each sample file (i.e. each chapter), one or several images of the corresponding master recipe in the SIMATIC BATCH recipe editor is contained. Please note that these images are only showing the graphical representation in the SIMATIC BATCH system. In other systems the representation may be different.

In addition to the sample files, a dedicated backup file „SB_BatchML_Samples.sbb" is included. This file contains all master recipes that are provided as BatchML. By restoring the complete backup file, the corresponding master recipes can be explored in SIMATIC BATCH master recipe editor application.

Usage of the samples

Each sample file (*.xml) contained in the archive represents a single master recipe. If these files are imported in the SIMATIC BATCH system, the resulting master recipes can be examined using SIMATIC BATCH recipe editor application.

Additionally, the provided backup file „SB_BatchML_Samples.sbb" can be used (BatchCC command „Options„ > „Restore"). This backup file also contains all master recipes; thus, no import is necessary.

Disclaimer of Liability
We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Table of contents

1 Changes of PCS7 Getting Started project

For importing and using the BatchML export sample files with the SIMATIC BATCH Getting Started project some modifications are required. The following chapters cover these changes.

1.1 UnitClasses

Precondition:
SIMATIC Manager is open.

Procedure:

1. Open the SIMATIC BATCH Getting Started project.
2. Add an enumeration „UnitClass" to the enumerations of the shared declarations. The enumeration must contain the values „Oven", „Pan" and „Pot".
3. Create an equipment property of type „UnitClass" in all relevant units „Pan", „Pot 1", „Pot_2", „Pot 3" and „Oven" with the corresponding value in the plant hierarchy.
   The units „Pot 1", „Pot 2" and „Pot 3" are known and can be used for dynamic unit binding.

1.2 Unit Mixer added for using a parameter step

To use parameter steps in a master recipe, a prepared unit is necessary.
To import the BatchML master recipe sample file „MR_0010_RUP_ROP_RPH_PAS_AND_PG_BML", follow the steps below to add the unit „Mixer" including their parameters. The parameters and their assignments to the two parameter groups „PG1" and „PG2" are listed in the following table.

Name	Data type	Parameter group
Date	String	None
Mixing_Time	Real	PG1
FirstIngredient	PI	PG1/PG2
SecoundIngredient	PI	PG1
Mixer_Level	DI	PG1
Mixing_Speed	Enumeration slow/fast/very fast	PG2
Product	PO	PG1/PG2
Mixer_State	Boolean	PG2

Table1: Parameter groups and their parameters

1.2.1 Add unit to plant hierarchy

Precondition:
SIMATIC Manager is open.

Procedure:

1. Create an enumeration „ParamGroup" containing the following values:
   - „PG1" with value „0"
   - „PG2" with value „1"
2. Open properties of „ParamGroup".
3. Activate „control strategy".
4. Create new folder „Mixer_Param" of type unit in plant hierarchy.
5. Place CFC „Unit_MixerParam" in folder „Mixer_Param".
6. Open CFC „Unit_MixerParam".
7. Insert the following blocks from the batch block library into CFC „Unit_MixerParam":
   - Unit_PLC „Unit_MixerParam"
   - IEPAR_ENUM „IEPAR_ParamGroup"
   - One „IEPAR-Block" for each element in the table above with their corresponding name

and type.

8. Open properties of Block „ParamGroup”.
9. Select enumeration „ParamGroup”.

1.2.2 Make changes available for current batches

Precondition:
SIMATIC Manager is open.

Procedure:

1. Compile and load charts folder to PLC.
2. Compile the OS.
3. Open Batch Engineering.
4. Generate Batch types.
5. Compile instances.
6. Open unit „Mixer_Param“.
7. Set parameter groups corresponding to the table above.
8. Load Batch data.

2 BatchML_Kitchen_PCell.xml

2.1 Key aspects

This file contains a BatchML representation of the pcell provided with the “Getting started” sample project, which is available here: https://support.industry.siemens.com/cs/ww/de/view/109751834

This file is only provided for completeness. It can be obtained any time by using the SB-API method “GetObjectData”. For details of this method we refer to the SB-API documentation provided with SIMATIC BATCH.

3 MR_0000_MR_EMPTY_BML.xml

3.1 Key aspects

This sample is intended to show an empty recipe, which does not contain any logic. This could be seen as a “minimum” recipe.

3.2 Corresponding recipe in backup file

The backup file provided does not contain a corresponding recipe. It can be created using the command “Recipe”->”New”->”Hierarchical recipe” in recipe editor application.

3.3 Graphical representation

The following image shows an empty recipe as it will be shown in the SIMATIC BATCH recipe editor.

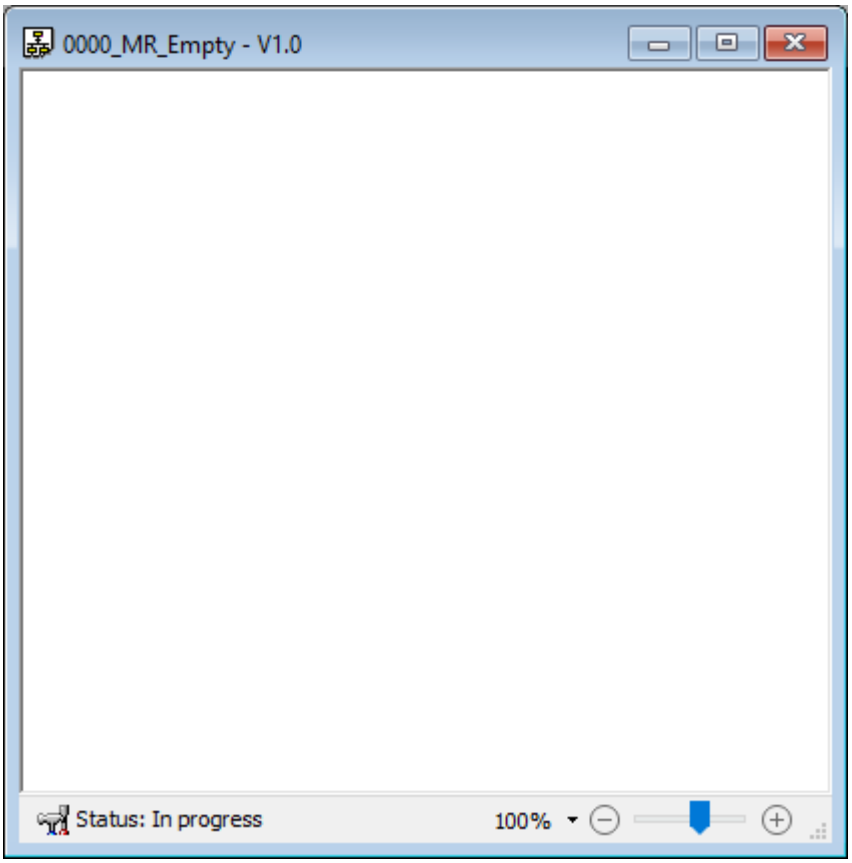

Figure 1: Empty hierarchical recipe

4 MR_0001_RUP_NOP_AND_IN_AND_EASY_BML

4.1 Key aspects

This sample is intended to show nested simultaneous branches. No other important aspects are contained in this sample.

4.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

"GS_RUP_NOP_AND_IN_AND_EASY V1.0".

4.3 Graphical representation

The following image shows a recipe with nested simultaneous branches as it will be shown in the SIMATIC BATCH recipe editor.

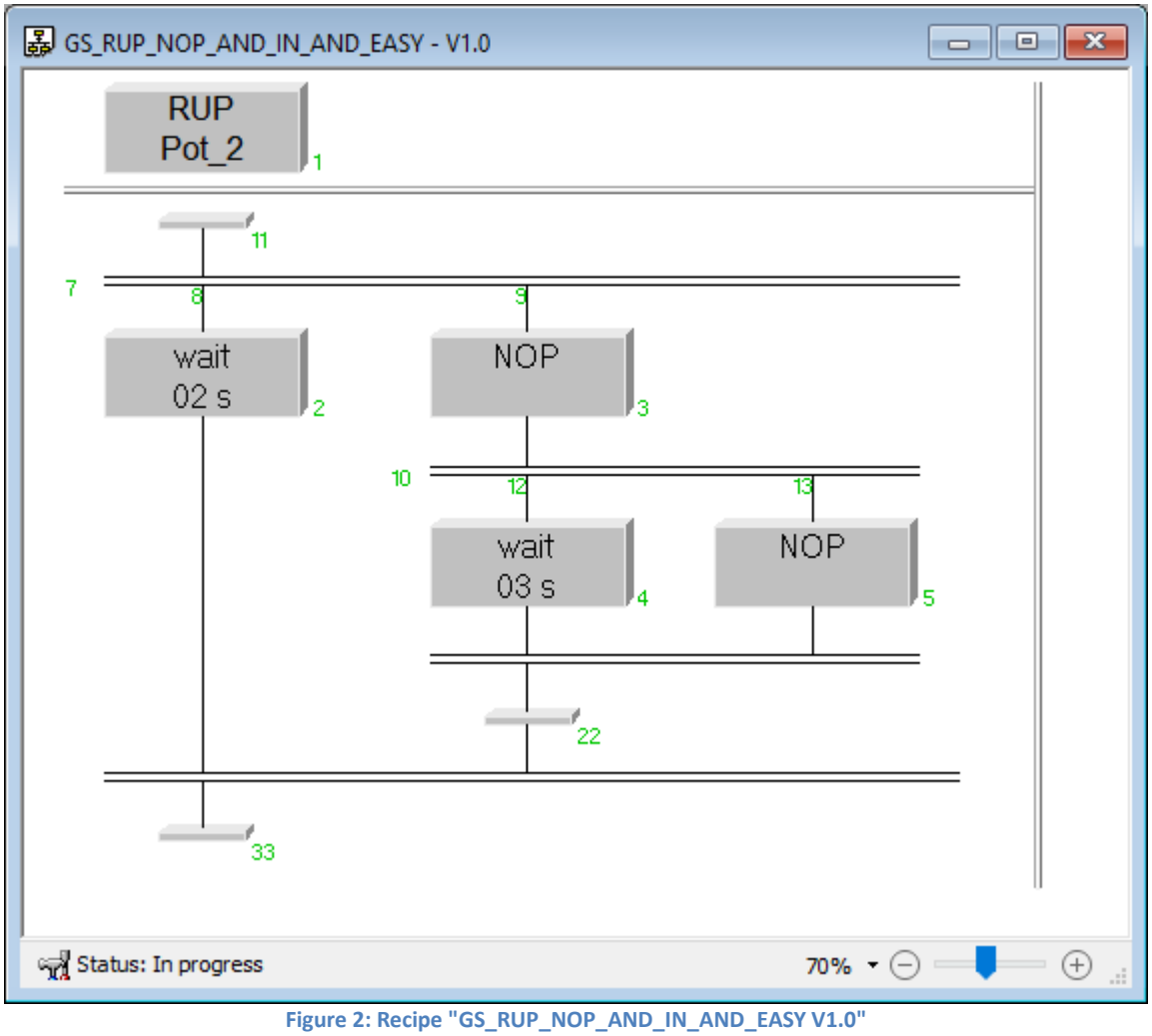

Figure 2: Recipe "GS_RUP_NOP_AND_IN_AND_EASY V1.0"

5 MR_0002_RUP_NOP_OR_IN_OR_BML

5.1 Key aspects

This sample is intended to show nested alternative branches. No other important aspects are contained in this sample.

5.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

"GS_RUP_NOP_OR_IN_OR V1.0".

5.3 Graphical representation

The following image shows a recipe with nested alternative branches as it will be shown in the SIMATIC BATCH recipe editor.

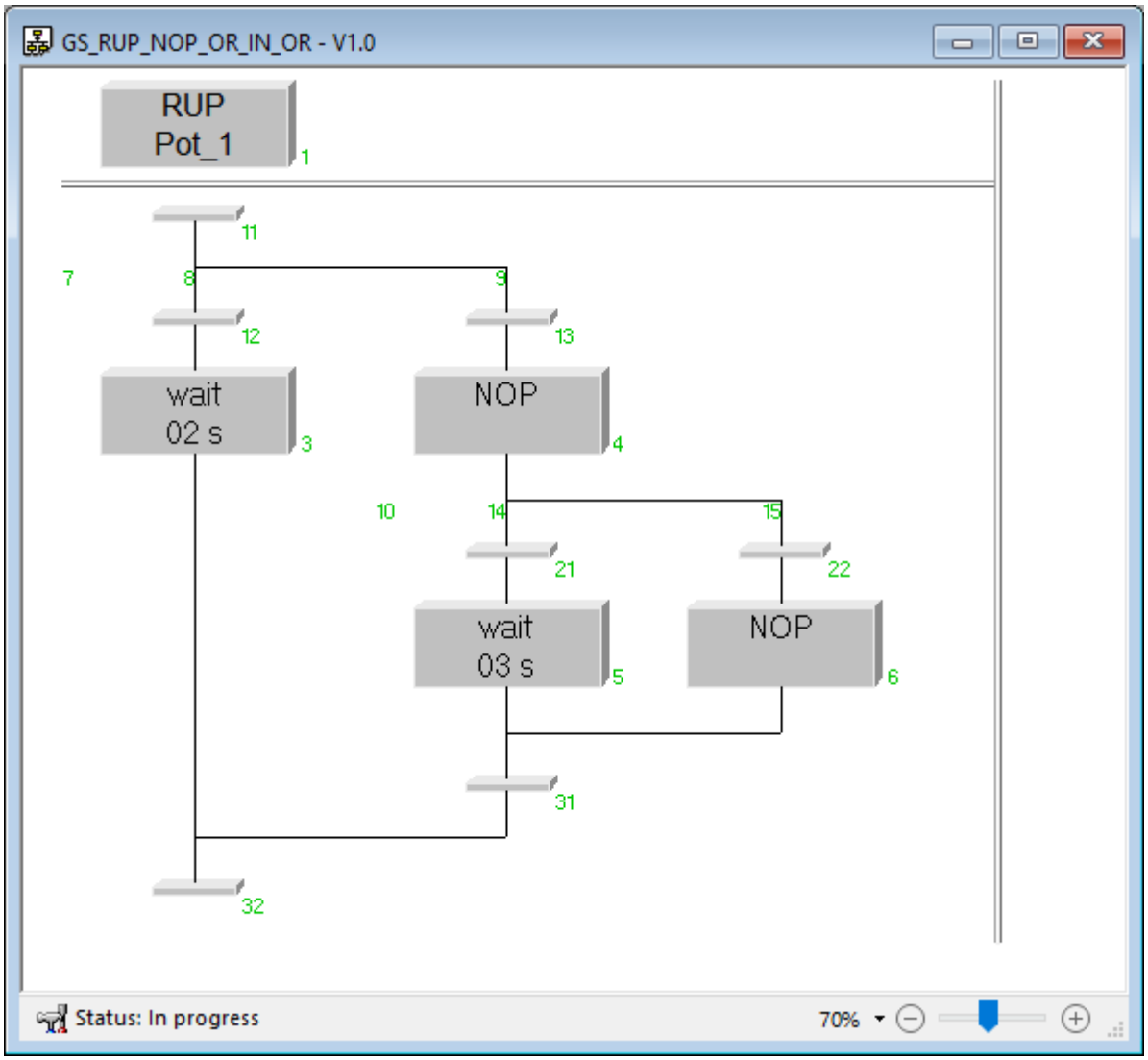

Figure 3: Recipe "GS_RUP_NOP_OR_IN_OR V1.0"

6 MR_0003_RUP_NOP_LOOP_IN_LOOP_BML

6.1 Key aspects

This sample is intended to show nested loops. No important aspects are contained in this sample.

6.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

“GS_RUP_NOP_LOOP_IN_LOOP V1.0”.

6.3 Graphical representation

The following image shows a recipe with show nested loops as it will be shown in the SIMATIC BATCH recipe editor.

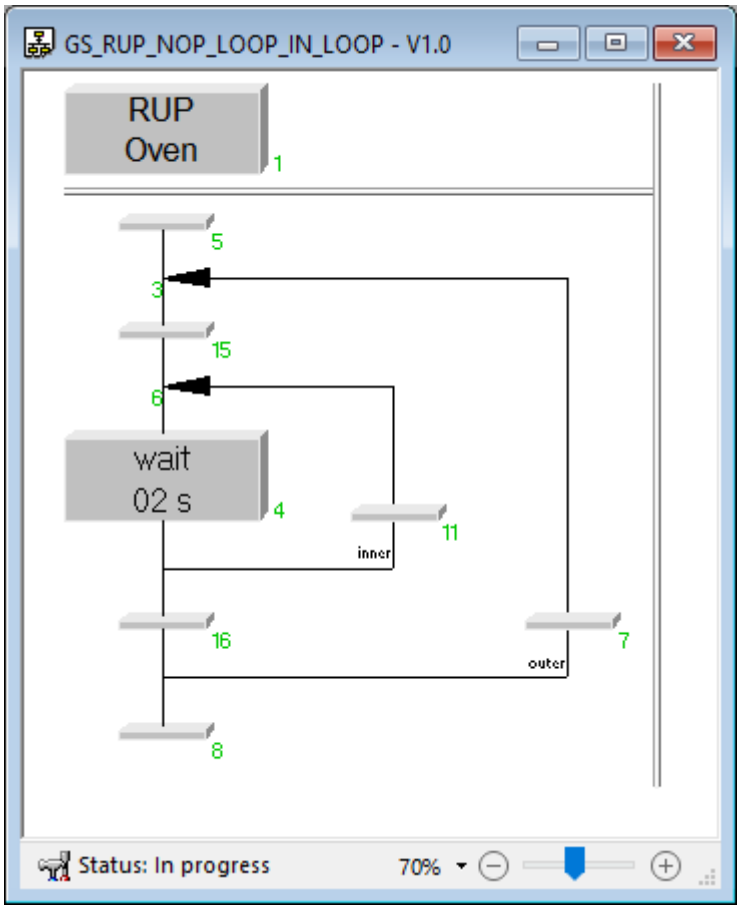

Figure 4: Recipe "GS_RUP_NOP_LOOP_IN_LOOP V1.0"

7 MR_0004_RUP_SYNC_NOP_BML

7.1 Key aspects

This sample is intended to show complex synchronization lines between different recipe unit procedures.

7.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

“GS_RUP_SYNC V1.0”.

7.3 Graphical representation

The following image shows recipe which synchronizes different recipe unit procedures as it will be shown in the SIMATIC BATCH recipe editor.

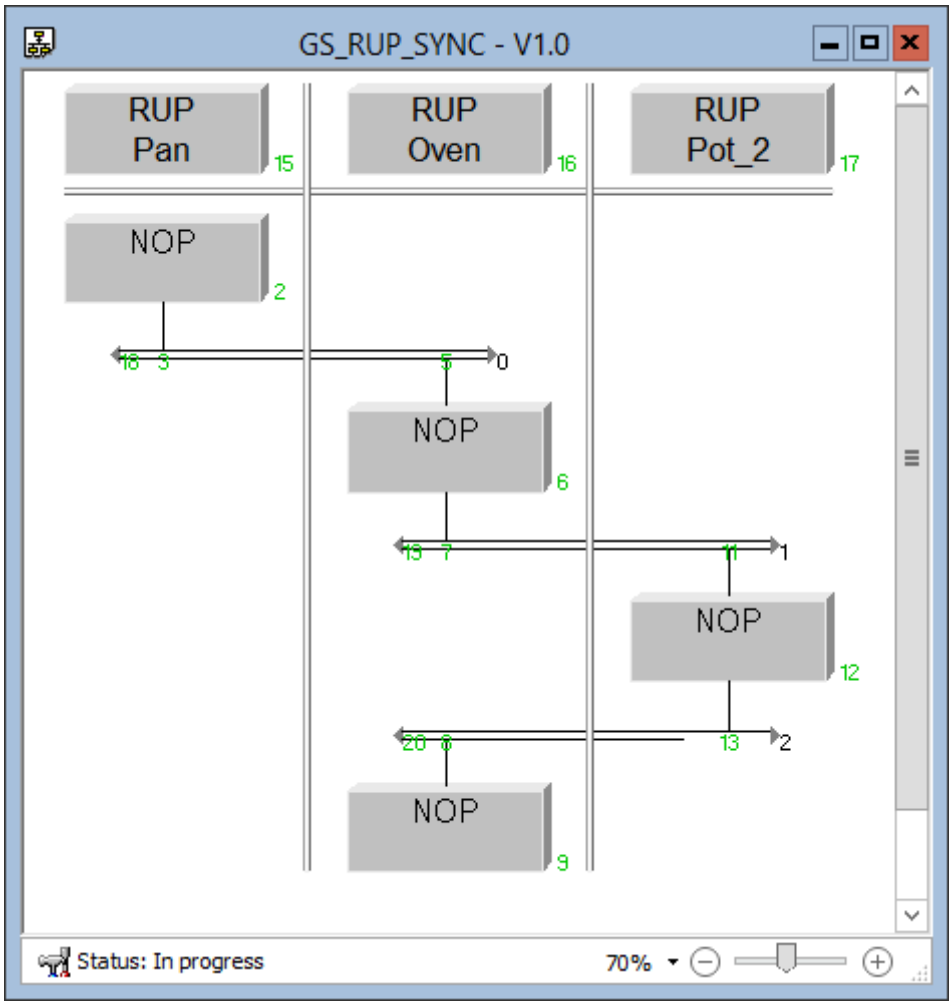

Figure 5: Recipe "GS_1150_RUP_SYNC V1.0"

8 MR_0005_RUP_SYNC_INTERN_BML

8.1 Key aspects

This sample is intended to show the usage of synchronization lines within a recipe unit procedure in a simple example.

8.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

“GS_RUP_SYNC_INTERN V1.0”.

8.3 Graphical representation

The following image shows recipe which synchronizes different recipe unit procedures as it will be shown in the SIMATIC BATCH recipe editor.

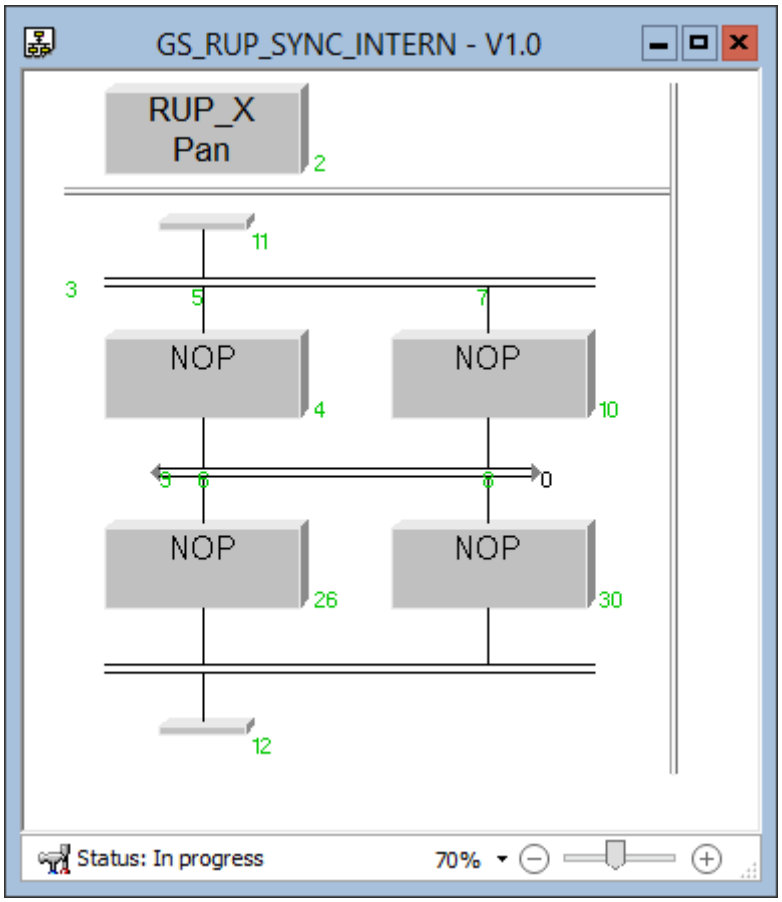

Figure 6: Recipe "GS_1161_RUP_SYNC_INTERN V1.0"

9 MR_0006_RUP_ROP_ALLOC_CONSTRAINS_BML

9.1 Key aspects

This sample is intended to show dynamic unit allocation using constrains within the recipe unit procedure 2 with three possible candidates. The second recipe unit shows a more complex example for a unit allocation with constraints using dynamic and static properties.

9.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

" GS_RUP_ROP_RPH_ALLOC_CONSTRAINS V1.0".

9.3 Graphical representation

The following image shows recipe which uses unit allocation by constrains as it will be shown in the SIMATIC BATCH recipe editor.

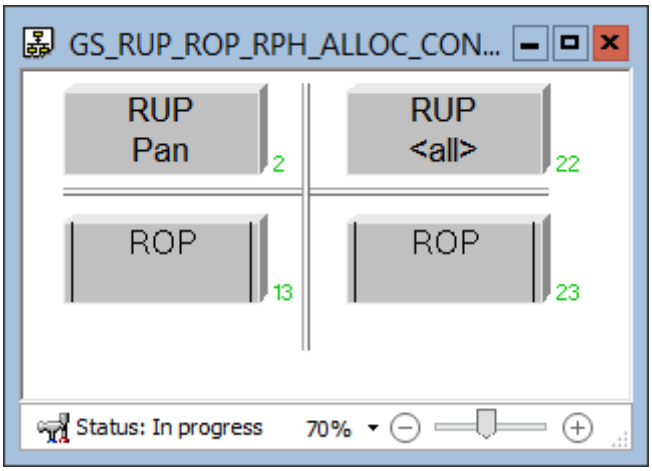

Figure 7: Recipe "GS_RUP_ROP_RPH_ALLOC_CONSTRAINS V1.0"

9.4 Allocation conditions

The following tables are showing the used allocation strategies and conditions

Allocation strategy operator selection

TRP_22			
Unit	=	Pan	NAND
Unit	<>	Pot_1	
First_Ingredient	=	PG2	OR
UnitClass	available		
Mixing_Time	<>	fast	AND

Table2: Conditions for unit allocation operator selection

Allocation strategy process parameter - RP_UNIT_SELECTION

TRP_2			
Unit	=	Pan	OR
Unit	=	Oven	
Unit	=	Pot_1	

Table3: Conditions for unit allocation selection via process parameter

10 MR_0007_RUP_ROP_RPH_DEFERING_TARGET_BML

10.1 Key aspects

This sample is intended to show parameter deferring. In this example the parameter simutime was deferred to all levels (ROP->RUP->RP). The input material kg_quantity was deferred (source and target deferring) to the batch header. Although the special use case of deferring a parameter of type "unit" was shown, because there is a datatype conversation from ENUM to STRING necessary. The input material was deferred as target to the RP and from RP as source to the phase.

10.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

"GS_RUP_ROP_RPH_DEFERING_TARGET V1.0".

10.3 Graphical representation

The following image shows recipe with target deferring from RPH to ROP as it will be shown in the SIMATIC BATCH recipe editor.

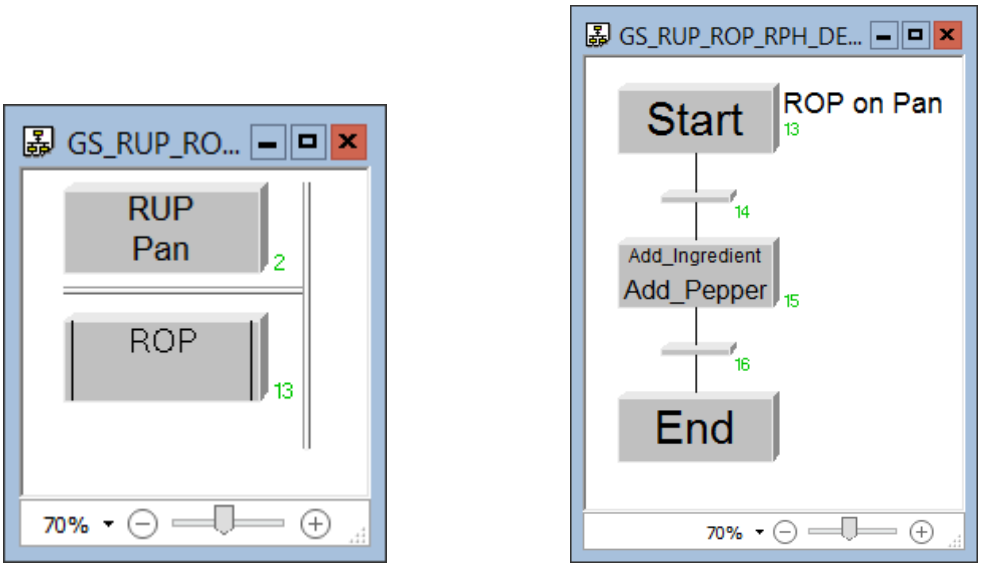

Figure 8: Recipe "GS_RUP_ROP_RPH_DEFERING_TARGET V1.0"

10.4 Parameter interconnection

The following image shows the basic interconnections between parameters.

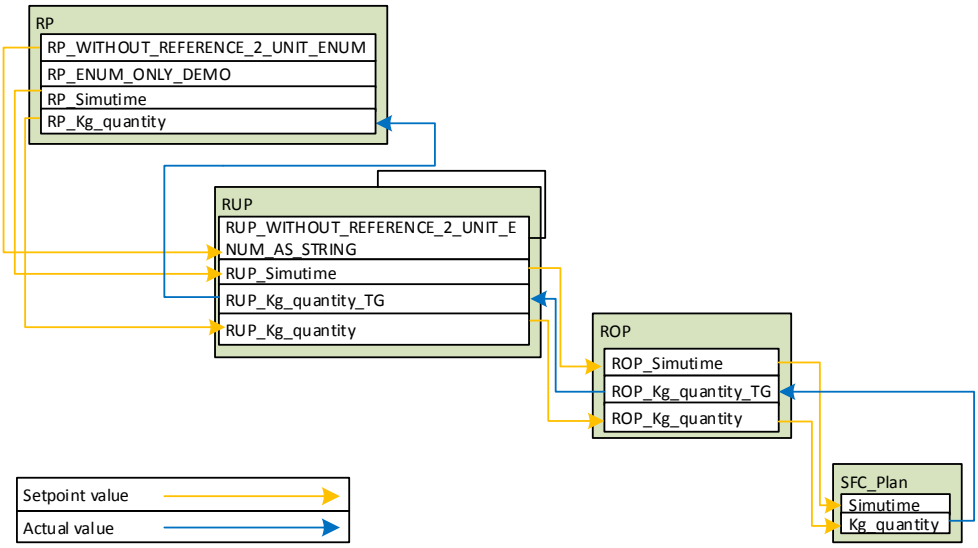

Figure 9: Parameter interconnection

11 MR_0008_RUP_ROP_OPD_BML

11.1 Key aspects

This sample is intended to show an activated and blocking operation dialog. The operator dialog belongs the recipe phase Add Ingredient using the control strategy with one parameters and one input material.

11.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

“GS_RUP_ROP_RPH_OPD V1.0”.

11.3 Graphical representation

The following image shows recipe containing an OPD as it will be shown in the SIMATIC BATCH recipe editor.

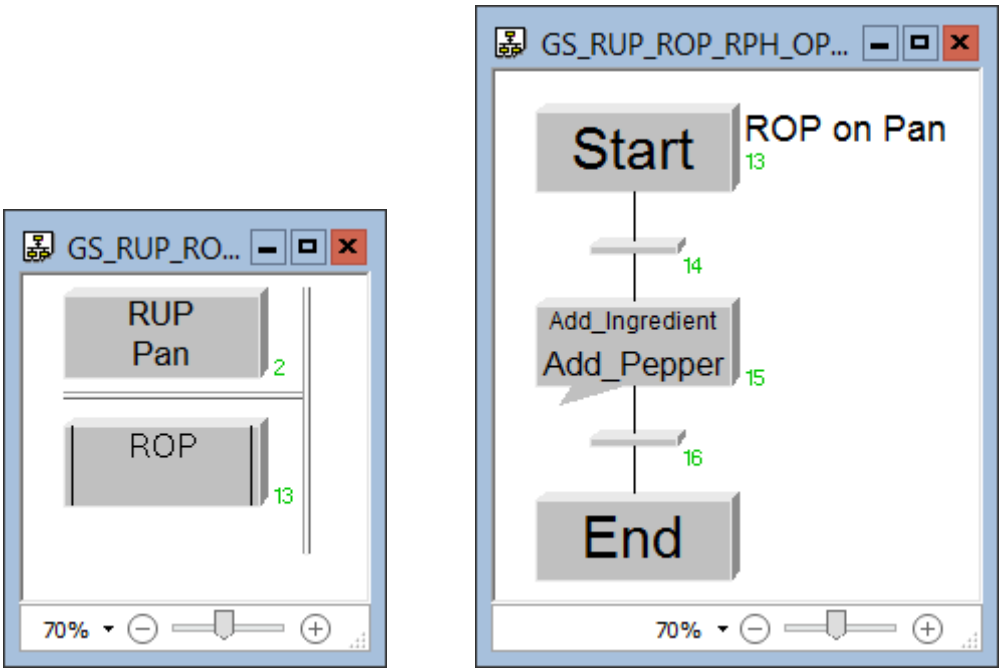

Figure 10: Recipe "GS_RUP_ROP_RPH_OPD V1.0"

12 MR_0009_RUP_ROP_OPD_EXPRESSION_BML

12.1 Key aspects

This sample is intended to show an operation dialog using an expression. For the parameter simutime the expression

```
(Kg_quantity + 44.4) * 2 / ROP::ROP_EXPRESSION_QUOTIENT
```

is used.

12.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

"GS_RUP_ROP_RPH_OPD_EXPRESSION V1.0".

12.3 Graphical representation

The following image shows recipe containing an OPD as it will be shown in the SIMATIC BATCH recipe editor.

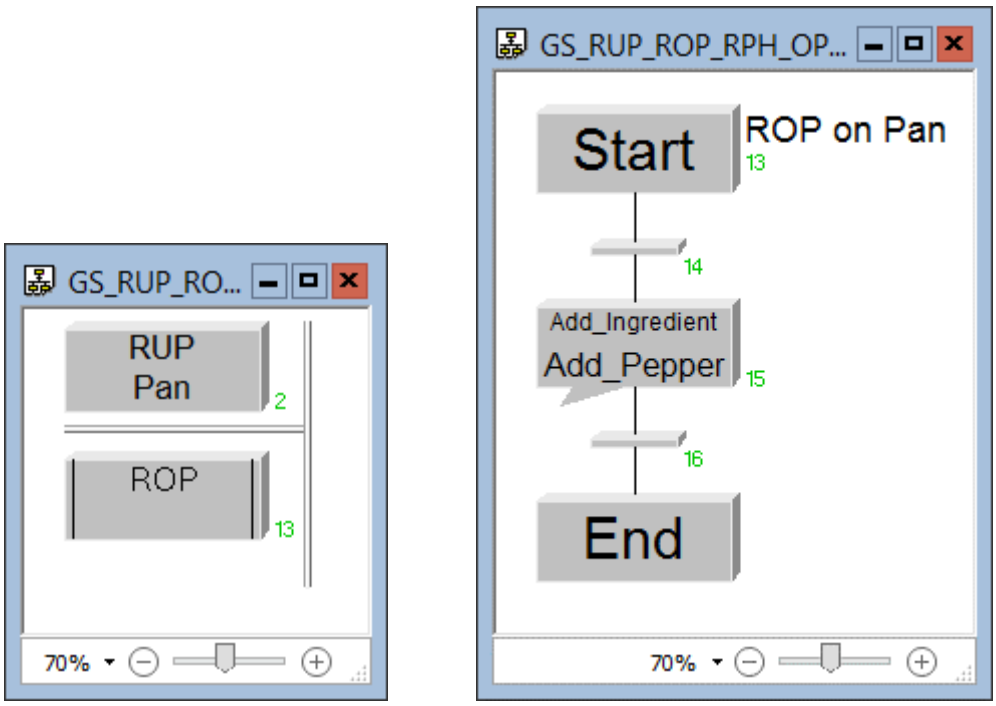

Figure 11: Recipe "GS_RUP_ROP_RPH_OPD_EXPRESSION V1.0"

13 MR_0010_RUP_ROP_RPH_PAS_AND_PG_BML

13.1 Key aspects

This sample is intended to show parameter steps using parameter groups. Another aspect is the usage of the recipe phase <<Add Ingredients>> with different control strategies.

13.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

"GS_RUP_ROP_RPH_PAS_AND_PC V1.0".

13.3 Graphical representation

The following image shows recipe containing parameter steps using parameter groups as it will be shown in the SIMATIC BATCH recipe editor.

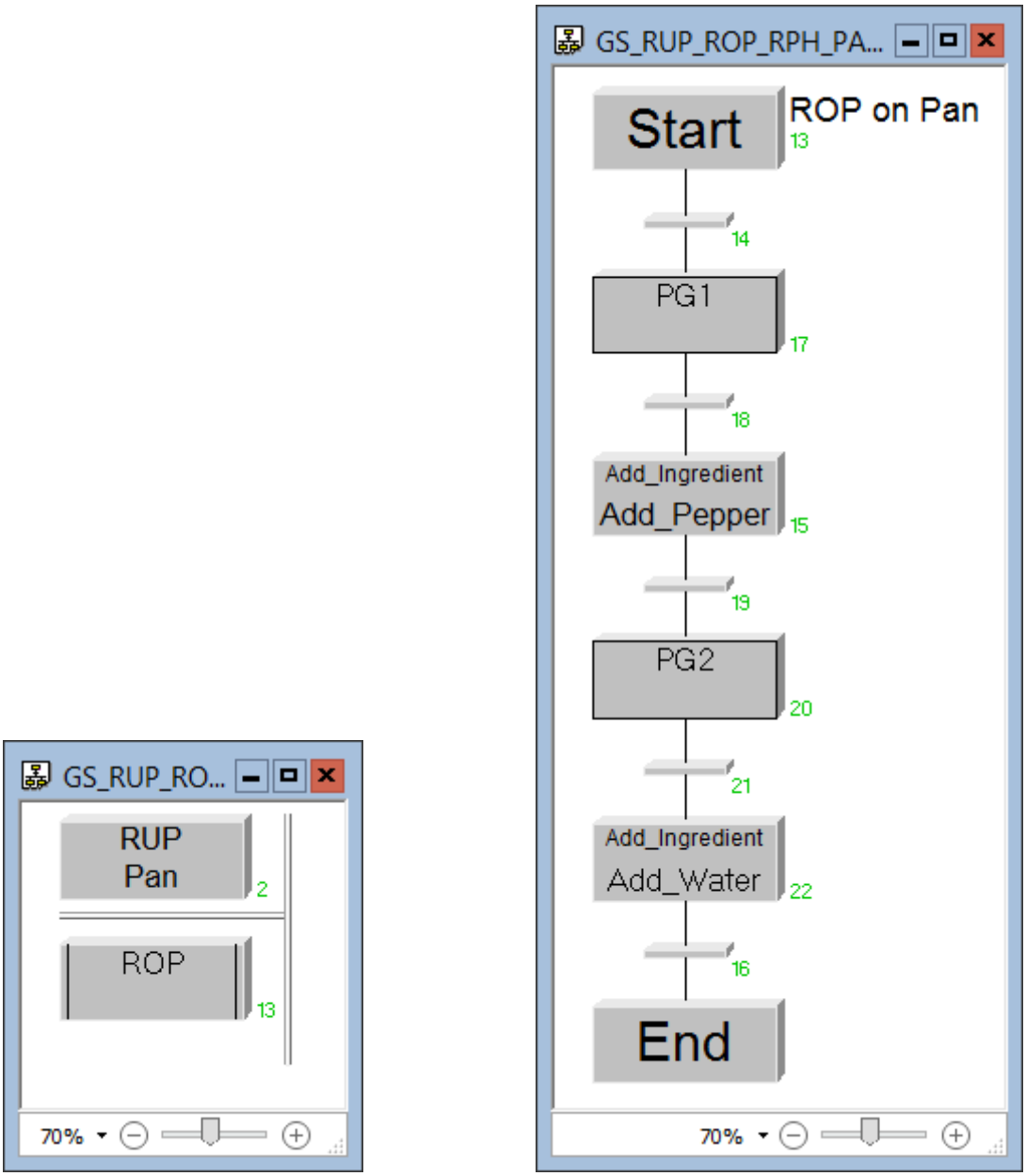

Figure 12: Recipe "GS_RUP_ROP_RPH_PAS_AND_PC V1.0"

13.4 Parametergroups and its parameters

Name		Low recipe limit	Low limit	Value	High recipe limit			High limit	Data type	Parametergroup
Sec_Ingredient	Spaghetti	8	0	4		88	94	100	PI	PG1
First_Ingredient	Spaghetti piquant	17	0	22		42	88	100	PI	PG1/PG2
Product	Tomato Sauce piquant	10	0	1.3		77	97.7	100	PO	PG1/PG2
Mixing_Speed				slow					Speed	PG2
Mixer_Level	0	3		33	88		100		Integer	PG1
Mixing_Time	0	1.8		22.22	99.99		100		Floating-point number	PG1
Date									Text	-
Mixer_state				False					Boolean	PG2

Table4: Parameter groups and its parameters with default values

14 MR_0011_RUP_ROP_TRANS_BML

14.1 Key aspects

This sample is intended to show a transition. The transition contains different kinds of conditions in this sample.

14.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

"GS_RUP_ROP_RPH_TRANSITION CONSTRAINS V1.0".

14.3 Graphical representation

The following image shows recipe containing transition as it will be shown in the SIMATIC BATCH recipe editor.

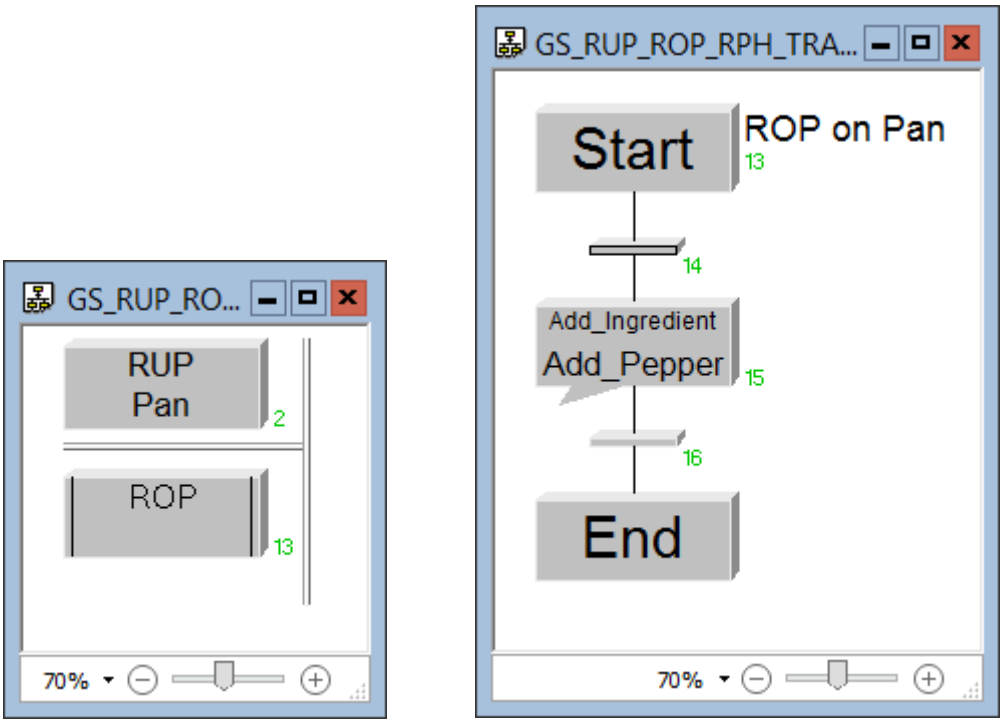

Figure 13: Recipe "GS_RUP_ROP_RPH_TRANSITION CONSTRAINTS V1.0"

14.4 Transition conditions

Effective immediately	Variable	Operator	Variable or value	Effective immediately	Unit of measurement	Logical operator	
X	GS_RUP_ROP_RPH_TRANSITION_CONSTR/RUP_2:ExState	does not contain	Run marker	-	-	AND	
X	GS_RUP_ROP_RPH_TRANSITION_CONSTR/RUP_2/ROP_13: State	=	ROP_Parameter _STATE	-	-	AND	
X	Simutime : Add_Ingredient @ RUP_2 (Pan)	<>	42 (Linear)	-	sec	AND	NOR
X	RealMess : PCellAlloc @ Process cell	<	12.34 (Squared)	-	degC		
-	ROP_Parameter_PP_MATERIAL	<>	Spaghetti	-	-	AND	
-	ROP_Product	=	47.12 (Linear)	-	kg	AND	
-	ROP_Parameter_CS	=	Add_Oil	-	-	NOR	
-	ROP_Parameter_UNITCLASS	=	Pan	-	-	AND	

Table4: transition conditions

15 MR_0012_RUP_ROP_MONITOR_CMD_BML

15.1 Key aspects

This sample is intended to show a command step within a monitoring area. The command step send the command “Hold” to all elements which are in the state running. Transition conditions are not used.

15.2 Corresponding recipe in backup file

The corresponding recipe in the provided backup file is:

“GS_RUP_ROP_MONITOR_CMD V1.0”.

15.3 Graphical representation

The following image shows a recipe containing a monitor using a command step as it will be shown in the SIMATIC BATCH recipe editor.

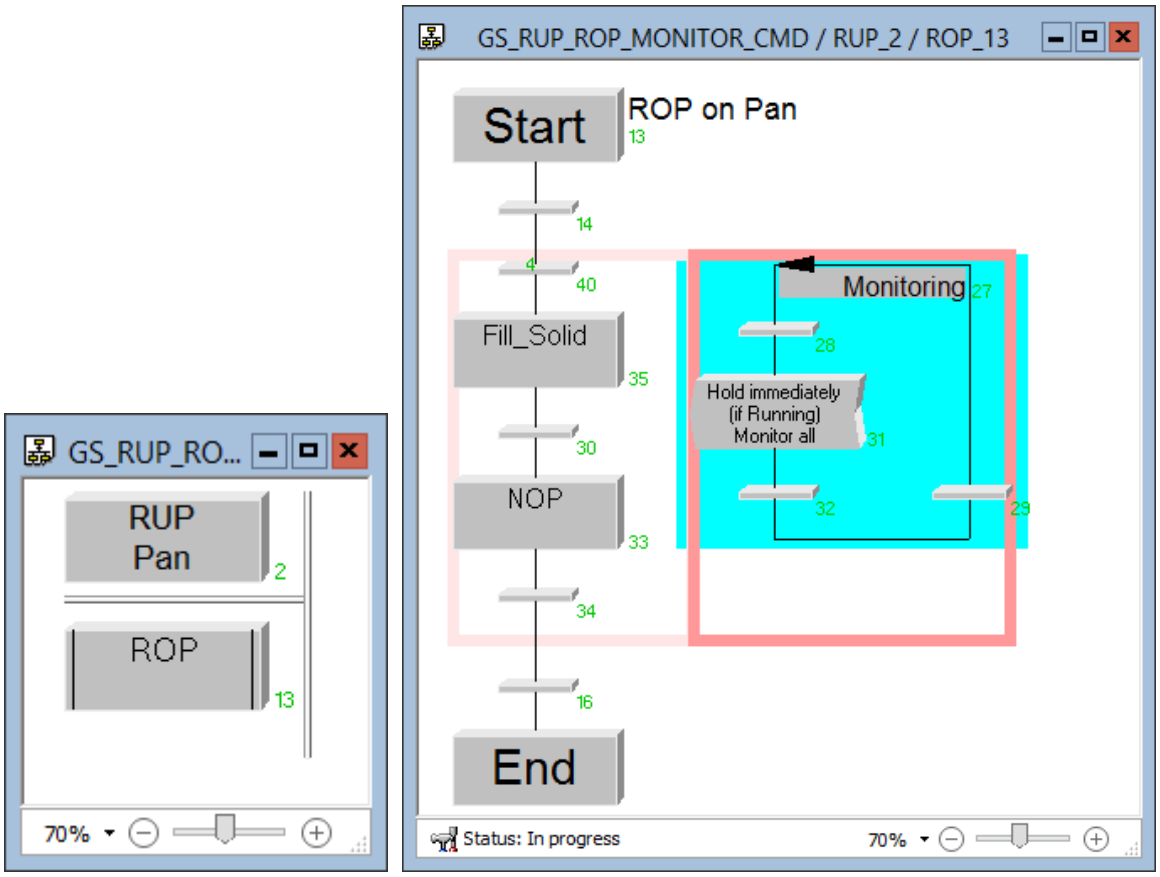

Figure 14: Recipe "GS_RUP_ROP_MONITOR_CMD V1.0"