

SIEMENS

SIMATIC

Process Control System PCS 7 SIMATIC BATCH V8.0 Getting Started

Getting Started

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Legal information

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Preface

Purpose of the Manual

BATCH Getting Started gives you an overview of the SIMATIC BATCH software package in combination with the SIMATIC PCS 7 process control system and allows you to familiarize yourself with the functions of the batch process control.

Getting Started is intended for new users of SIMATIC BATCH.

Required Knowledge

General knowledge in the area of automation engineering and process control engineering is required to understand this documentation.

It is assumed that the reader knows how to use PCs or other equipment similar to PCs (such as programming devices) operating under Windows operating systems approved for SIMATIC PCS 7.

SIMATIC BATCH uses the basic software SIMATIC PCS 7. You should already have experience with the configuration. The entire SIMATIC PCS 7 documentation is available to you free of charge and in multiple languages as a manual collection in MyDocumentationManager via the following Internet page:

Complete SIMATIC PCS 7 documentation: (<http://www.siemens.com/pcs7-documentation>)

Scope of the Documentation

This documentation applies to the software package SIMATIC BATCH V8.0 in combination with the process control system SIMATIC PCS 7 V8.0.

Additional Support

If you have questions about using the products described in this manual that are not answered in this document, please contact your local Siemens representative.

Contact partners: (<http://www.siemens.com/automation/partner>)

You can find a guide to the collection of technical documentation for individual SIMATIC products and systems at:

SIMATIC technical documentation: (<http://www.siemens.com/simatic-tech-doku-portal>)

You can find the online catalog and the online ordering system at:

Industry Mall - Siemens: (<http://www.siemens.com/automation/mall>)

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We offer relevant training courses to help you to become familiar with the SIMATIC PCS 7 process control system. Please contact your regional training center or the central training center in 90327 Nuremberg, Germany.

Training center: (<http://www.siemens.com/sitrain>)

Technical Support

You can reach Industry Online Support for all A&D products via the support request Web form.

Industry Online support request: (<https://www.siemens.com/automation/support-request>)

You can find more information about our Technical Support online at

General information on technical online support: (<http://support.automation.siemens.com>)

Industry Online Support on the Internet

As well as providing you with a range of documentation, we also share our expertise with you on the Internet.

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Here you will find:

- Our newsletter, which will keep you constantly up-to-date with the latest information concerning your products
- Exactly the right documents for you, using our search facility.
- A forum, on which users and specialists from around the world can pool their experience
- Your local Automation & Drives representatives
- Information relating to on-site service, repairs and spare parts. A wealth of other information also awaits you under "Services".

Introduction in Batch processes

2.1 Classification of Batch processes

Classification of technical processes

	Manufacturing process "Transformation"	Distribution process "Transport"	Storage process "Saving"
Process engineering	Refinery, Chemical Reactions	Gas distribution, Pipeline	Tank, Bunker
Production engineering	Turning, Milling	Assembly line, Packaging	Storage

Differentiation between process and production automation

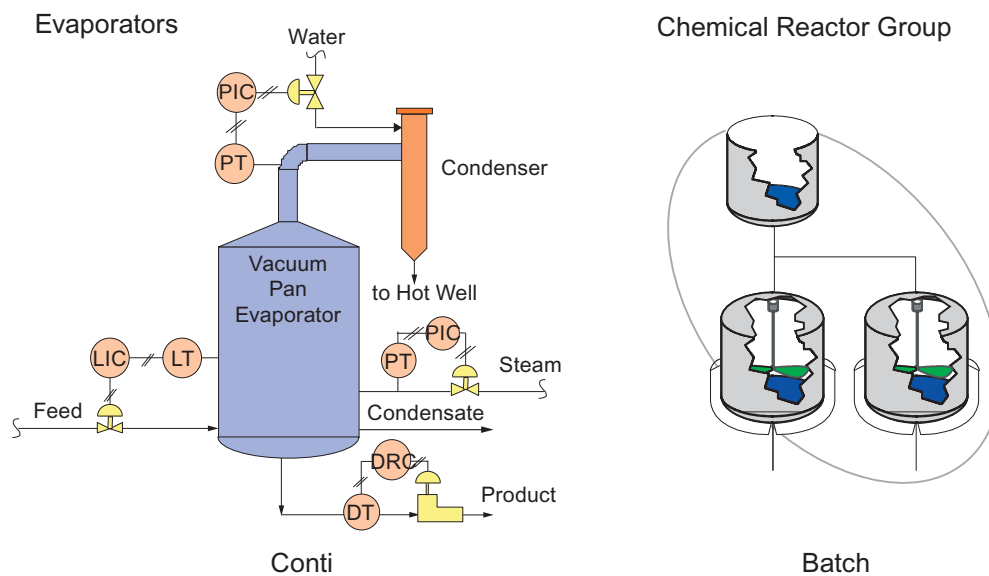
- Process technology usually handles the production of liquid or solid materials.
 - Physical / chemical / biological processes
 - Safety, control of the (dangerous) process
 - Undefinable
 - Cannot be interrupted
- Production processes handle the production of packages such as screws or computers.
 - Mechanical processes
 - Throughput, speed
 - Definable
 - Can be interrupted

Definitions within the technological processes

- Continuous process (below "Conti process" or only "Conti")
 - Started and operated continuously over longer period of time.
 - Synonym: Flow process
 - Examples: Ammonia synthesis, ethylene production
- Discontinuous process (Process (below "charge process", "batch process" or only "batch" or "charge".))
 - Produces the product in separate batches
 - Synonym: Batch process
 - Examples: Production of synthetic resin, dyestuff and fertilizers

2.2 Properties of Continuous and Batch processes

Comparison of continuous and batch processes



	Conti		Batch
✓	Continuous flow of products	✓	Limited product quantities
✓	Large-scale production	✓	Small-scale production
✓	Setpoint activated	✓	Recipe activated
✓	Rare changes to the plant	✓	Frequent changes to the plant
✓	Single-product unit	✓	Different products on the same plant
✓	Equilibrium	✓	Often only with partial automation -> operator intervention
✓	Rare operator intervention	✓	The recipes contain the production know-how.
✓	The automation system contains the production know-how		

The main difference between Batch and Conti is the production method.

The product quantities in a batch process are concluded and cannot be clearly identified for this reason.

Recipes contain the setpoints for the relevant process variables and product quantities and also describe the method or procedure deployed to manufacture the product.

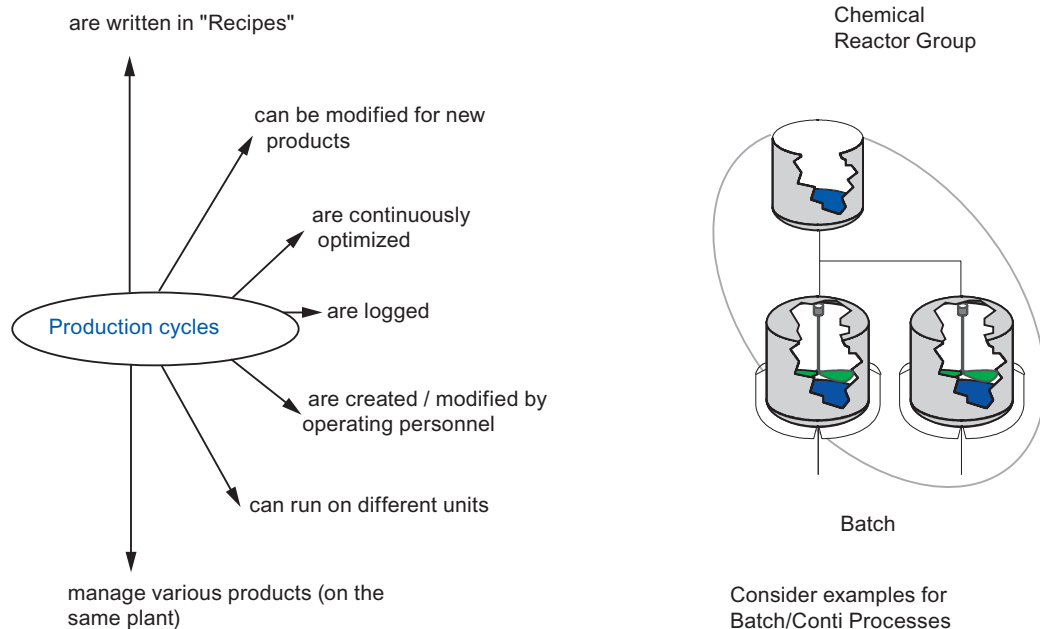
The units within a Conti process are dedicated to specific tasks.

The same unit is used for multiple tasks within the Batch process, that is, it is used for different batches. Shared resources

A commonly deployed setup is the interactive combination of Batch and Conti processes, or the handling of small portions of a batch process on a continuously operated interim unit.

2.3 Practice: Where is this Used?

Production sequences



The production sequences are described in the recipes which represent a mapping of the production methods. By contrast to typical Conti applications or applications for the production process, the production sequence is described in the "recipe" instead of being reflected by the automation solution.

The production sequences can be converted for new products. Automated production processes do not always return the same product and can return finished products by means of manufacturing methods which are reflected in different recipes. These recipes are subject to continuous optimization in terms of parameter settings and runtime.

Reproducible logging of process runtime usually forms a vital aspect of production. These reports are essential for quality assurance (QA) and for the detection of faults.

The customized, in-house conversion of production sequences for different products, including the introduction of new products or the modification of existing sequences form decisive factors for many end users.

Plant operators should also be able to handle these tasks without having to consult system specialists. The automation system as such should not be modified. The conversion of sequences should be handled by means of recipes which map the production process.

A production sequence which is described in a recipe and which is used specifically for a certain product often raises the question: "Where do I produce?" The factory usually features several production components which are capable of handling the same production sequence (several identical production lines, for example). It should therefore be possible to distribute the production sequences to different production components. This should also be a system functionality which does not require any modification to the automation program.

2.4 Branches for SIMATIC BATCH

Typical business sectors with integrated BATCH automation



Biotechnology



Food and
Luxury Stuffs



Pharmaceuticals



Washing and
Cleaning Agents



Paint / Dye



Plastic /
Adhesive



Fertilizer /
Pesticides

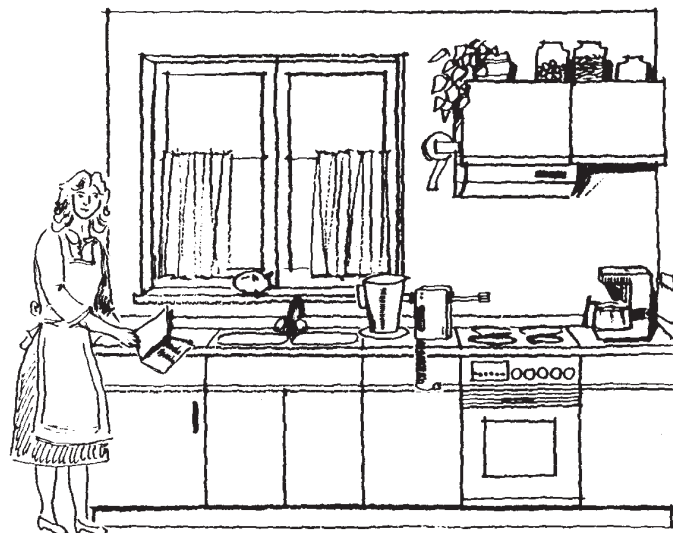


Chemical and
Mineral Fiber

Typical business sectors with integrated batch processes are mentioned above. Example: Beer production in the Food and Beverages segment.

2.5 Origins of Batch Production: The Kitchen

Production unit "Kitchen"



The best example from daily life is the "Kitchen" production plant.

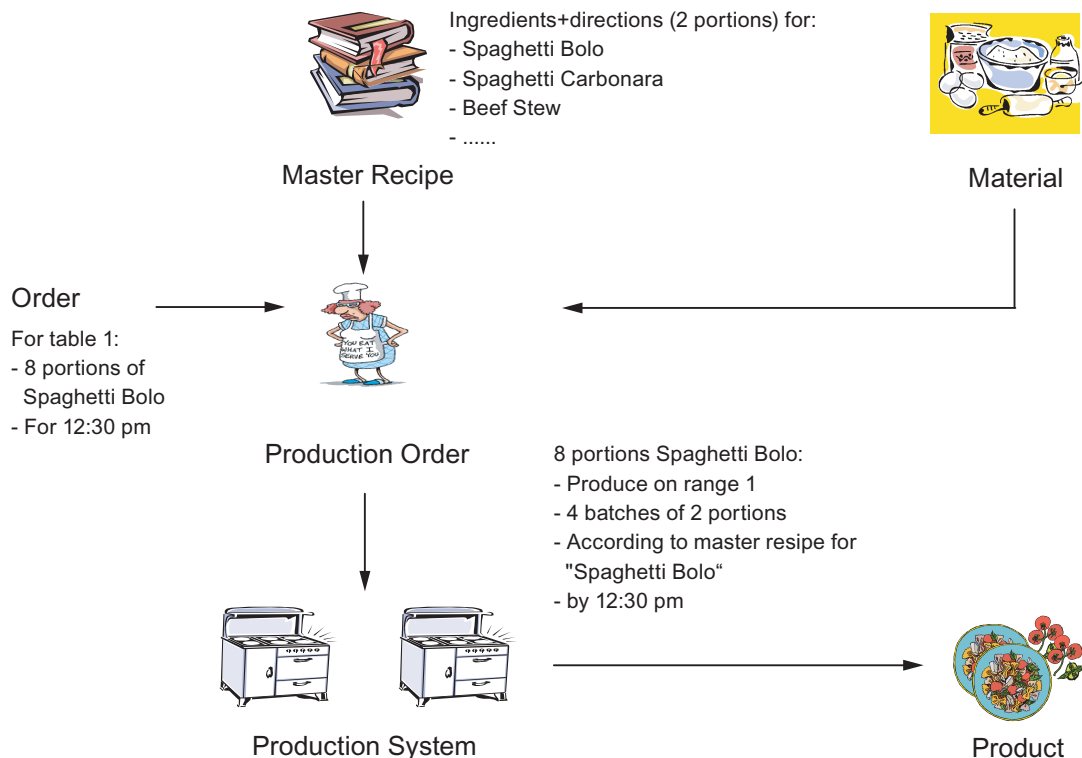
Various products are created here. The production method is described in recipes. These can be constantly optimized and improved and completely new recipes are added. The chef is perfectly capable of doing this alone without help from the kitchen manufacturer. The recipe is often "secret" and contains the know-how for the production of a dish.

When cooking, cooks want to be able to decide which equipment will be used to implement a recipe. If there are several kitchens (for example in an industrial kitchen), the user can decide which kitchen will be used to make the recipe. Regardless of the kitchen selected, the same product should result and the actual production location should only be decided during production scheduling.

It may be important to record the production sequence (for example, QA for health authorities, and for guests who want to know how the product they are consuming was actually produced).

2.6 The Cook - Working Environment and Working Procedures

Working Environment and Working Procedures



The section below describes the working environment of the chef. The chef is in possession of recipes which contain the instructions and a list of ingredients and quantities. These recipes are known as master recipes.

Specific materials must be made available for production.

The production process is initiated by an order. This purchase order defines the product, the quantities and the time schedule for production.

The chef handles the job in accordance with the corresponding recipe. He also allocates cooking resource such as the kitchen stove. Certain production units may be in use and are currently not available as it is usual procedure to handle several jobs in parallel.

The result of this sequence is the finished product.

2.7 Batch Terminology

Important Batch Terminology

- **Master recipe**
Recipe level that takes into account the capabilities of the equipment and contains information specific to the process cell.
- **Control recipe**
A type of recipe which, through its execution, defines the manufacture of a single batch of a specific product.
- **Batch**
Apparatus-dependent quantity of a product, which is manufactured discontinuously in a defined production cycle.
- **Process**
A sequence of chemical, physical, or biological activities for the conversion, transport, or storage of material or energy.

Up to now, we have used terms taken from everyday language. Such terms are, however, liable to subjective interpretation. The same word may mean different things to different people. This is particularly the case when people with different occupations talk to each other (for example system engineers, chemists, production engineers). A chemist might understand a recipe to be the chemical composition of a product (which should not be revealed at any cost), whereas the system engineer interprets it as an automated sequence (for example, a sequencer).

To create a production facility that operates as desired, people from various walks of life must be able to work together. Therefore, it is important that everyone speaks the same "language". NAMUR (an international user association of automation technology in process industries) and ISA 88 (a standard for charge-oriented procedures) have set themselves the task of defining and standardizing the terms.

We will gradually replace everyday language with the terminology from the standard.

In our kitchen we can derive a control recipe from the "Spaghetti" recipe for Fred's kitchen which determines the production sequence for producing a batch of spaghetti.

This illustrates that the control recipe derived from the master is responsible for production. The control recipe must therefore know which production facilities it will be using while the master recipe remains neutral in this respect.

2.8 The Kitchen: Master Recipes – Header Data

Master recipes – Header data

Language of the Cook		S88 Terms
Meal	Spaghetti Bolognese	Product
Number of persons	4 (standard servings)	Reference quantity
Ingredients	1 kg ground beef 100 g mushrooms 1 kg pasta pinch of salt 1 onion 4 tomatoes : :	Input materials

What do master recipes contain in detail? Typically, they contain two parts:

- A recipe header which provides general information about the product such as its name, reference quantity, ingredients and quantities.
- Instructions or procedural rules for production. This is known as a recipe procedure.

The recipe does not yet contain any information which defines the unit where it is going to be used.

2.9 The Kitchen: Master Recipes – Procedure (Procedural Rules)

Master Recipes – Procedure (procedural rules)

Instructions		Procedural Rules
1. Make the Bolognese sauce		Unit recipe 1
	Chop onions and tomatoes, place in pan, weigh ground beef and add to pan	ROP 1: Prepare
		ROP 2: Heat
	Heat pan with level 6	
		ROP 3: Simmer
	Simmer for 1 hour with lid on pan	
2. Cook pasta		Unit recipe 2
	...	
3. Season	Pot	Unit recipe 3
		
		
4. Taste	Pan	Sample

The recipe procedure forms the instructions for production. It is divided into various sections (unit recipes). The unit recipes themselves are made up of recipe operations (ROPs).

We could, for example describe the production of Bolognese sauce required to produce Spaghetti Bolognese in a unit recipe for Bolognese. We can further refine this procedure by detailing the steps in recipe operations. In the unit recipe for Bolognese sauce, we would, therefore, start with the "Prepare" recipe operation. During the preparation, the input materials onions and tomatoes are chopped, ground meat is weighed and put in a pan.

At this stage, use of the term pan or pot is still generalized. These are references to the production facilities that will be required. In the language of the standard, these are known as unit classes. The master recipe itself is nevertheless "neutral" in terms of the units; that is, there is still no mention of the unit that will actually be used for production (for example, Fred's kitchen and Fred's favorite pot).

2.10 The Kitchen: What is Required of the Automation

Requirements for BATCH processes

The "Kitchen" example is an analogy for the characteristics of Batch processes. The automation system for such processes must meet the following requirements.

Requirements	Implementation in the "Kitchen" example
BATCH processes are described in "recipes"	Spaghetti recipes.
BATCH processes can be converted for new products.	The chef must create new dishes
BATCH processes are continuously optimized.	Refinements and resultant recipe adaptations.
Production processes are logged. Proof of the production process	The production of foodstuffs should be recorded and be reproducible.
Process sequences may only be created or edited by authorized persons.	Recipes are developed by the chef, not by the appliance supplier
BATCH processes can be distributed to several units.	Recipes can be used in different kitchens.
Different recipes produce different products in the same process cell.	Final product in the kitchen, for example: Spaghetti, schnitzel or baked potatoes.

2.11 The Kitchen: Automation Concept

Requirements of an Automation Concept

Requirements	Solution
BATCH processes are described in "recipes"	Possible with STL, SCL, SFCs, WinCC, though highly complex
BATCH processes can be converted for new products.	The programming method (STL, SCL, SFC) could be adapted.

Requirements	Solution
BATCH processes are continuously optimized.	The programming method (STL, SCL, SFC) could be adapted.
Production processes are logged.	The programming method (STL, SCL, SFC) could be adapted.
Process sequences may only be created or edited by authorized persons.	Not possible.
BATCH processes can be distributed to several units.	Not possible.
Different recipes produce different products in the same process cell.	Possible with STL, SCL, SFCs, WinCC, though highly complex

What do these requirements mean when formulating an automation concept?

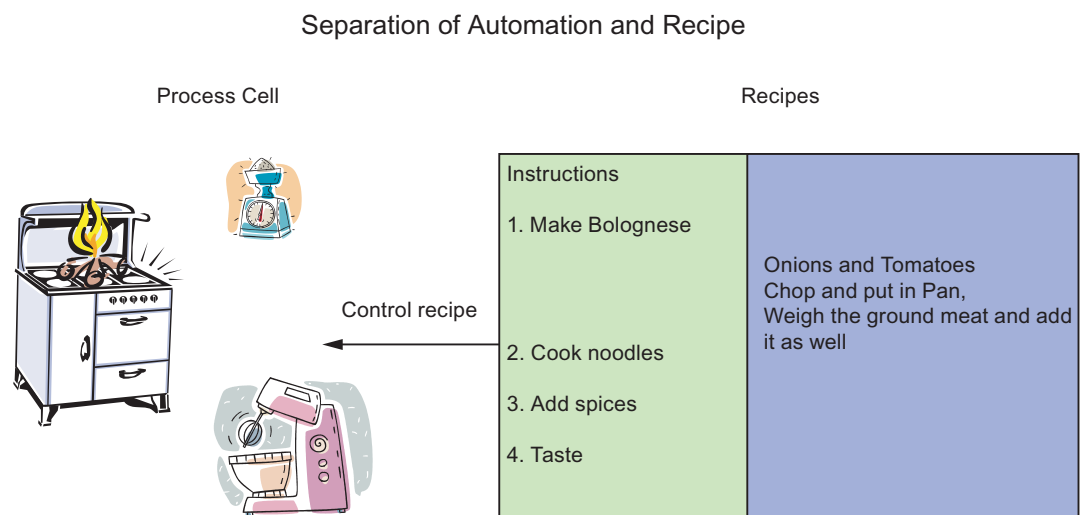
Let's look at SIMATIC PCS 7 as system platform. How can we describe the production sequences in recipes ? – It is conceivable to structure all possible sequences using CFC and SFC and to map these to "recipes" using parameters stored, for example, on the OS. Structuring the sequences could, however, be extremely complex since all possibilities must be taken into account. It should also be possible to modify the recipes or to create new recipes. This could mean that the automation program (CFC, SFC) would have to be changed. The operating personnel would not be capable of doing this and the automation technician would have to be called in.

It would be possible to log the sequences using messages output on the OS in the form of reports. This would have to be implemented separately for each specific project. New and modified recipes would once again cause problems.

The complexity of the automation solution increases yet again if the sequences also need to be adapted for various units. This would mean that the SFCs would also have to determine which units are to be used.

2.12 Automation Concept - New Approach

New Automation Concept Approach



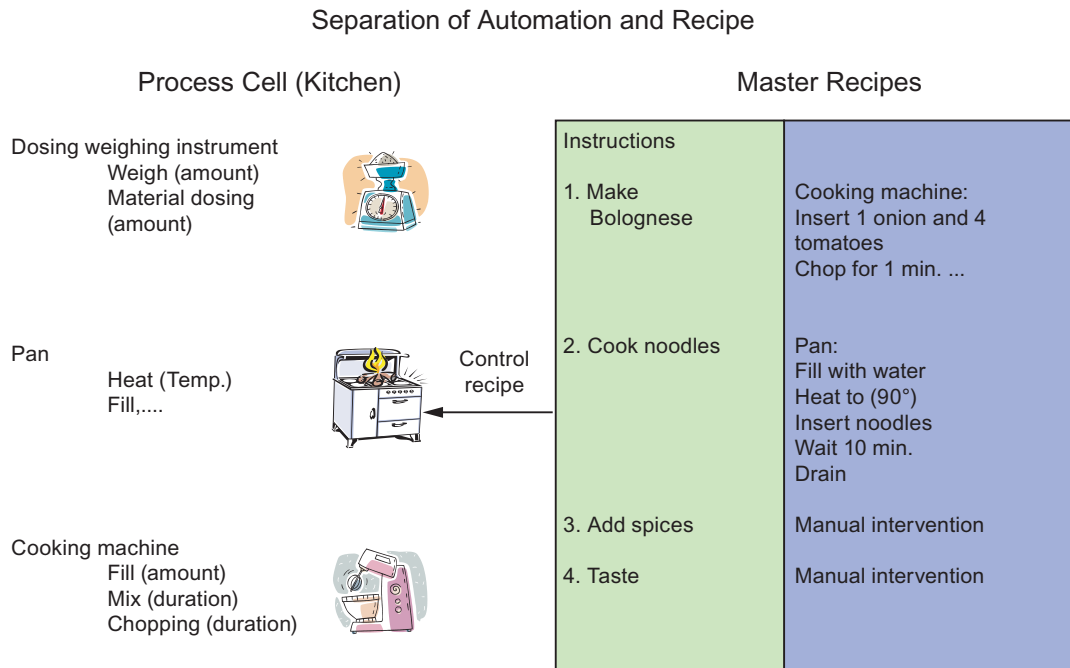
This opens a new solution for resolving complexity by separating the automation and recipe levels.

We shall presume that the hardware structure of the process cell is retained and that only the sequences will change. Let us implement the process cell-specific elements of the automation system and map the sequences to a "recipe system" which can be handled by the process. The master recipes are created and stored in this system.

The control recipes are derived from the mater recipes and address the automation system.

2.13 Separation of the Automation Level and Recipe Level

Structure of the Process Cell



A structure consisting of units (scale, pan, mixer, etc.) can be designed in the process cell. These units are organized by technological functions such as weighing or dosing. The technological functions can be assigned parameters such as "quantity" of the technological functions "dosing".

All of this functionality is mapped to the AS. Here, the term process cell model is used. It represents the "tool box" for the engineer who designs the master recipe.

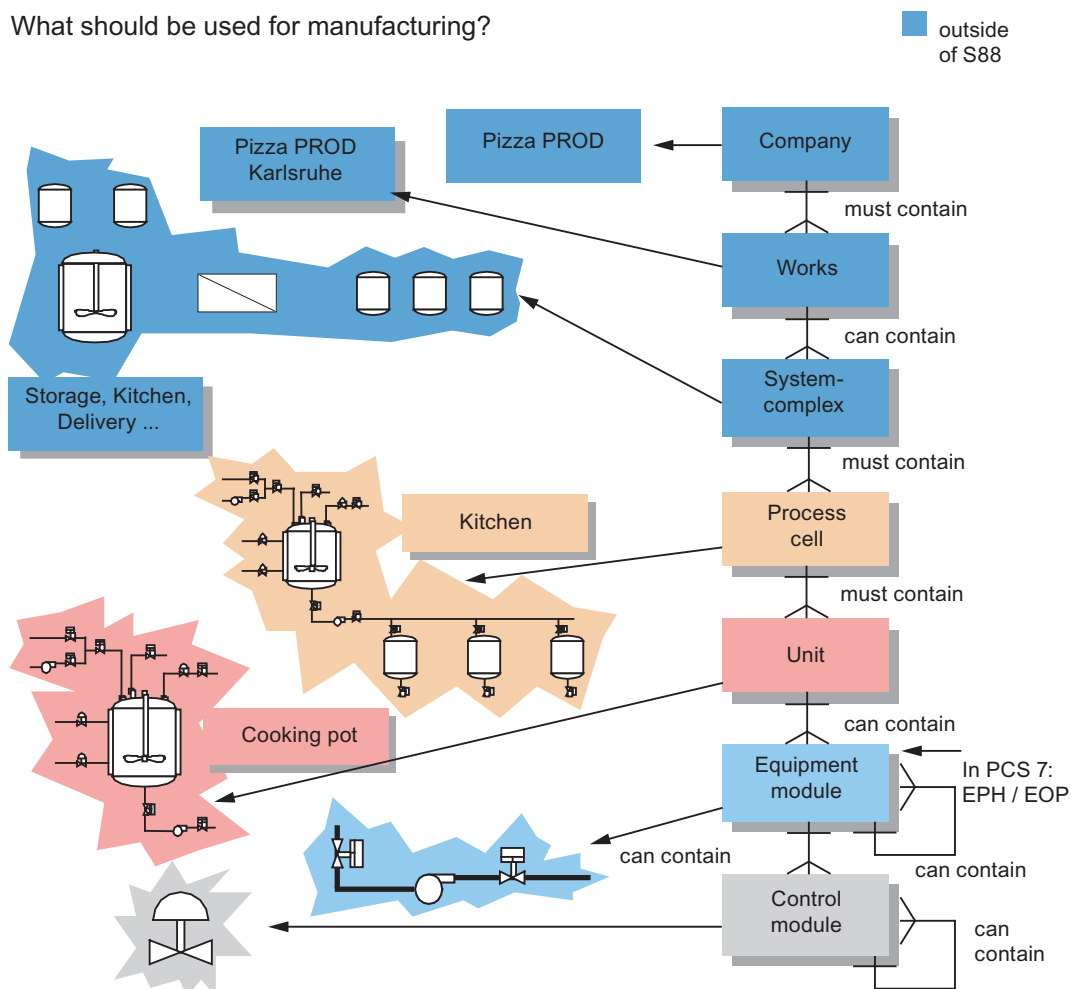
In the master recipe, these units with their equipment phases are used to compose the sequence.

Based on the example of Bolognese sauce, this means that the mixer is needed. This contains the equipment phases filling, mixing, chopping. An onion is added in the first step. Then four tomatoes are added, for example, and everything is chopped for one minute.

2.14 ISA-88 - Physical Model

Process cell models and their structural layers

What should be used for manufacturing?



The hierarchical structure is shown once again in the figure above.

The model has seven levels. The top three levels are not dealt with in the standard since these go beyond the framework of batch control.

The lower four levels are also known as the process cell model.

An equipment phase (heating, dosing, weighing, etc.) serves as an equipment module (heating) in this case.

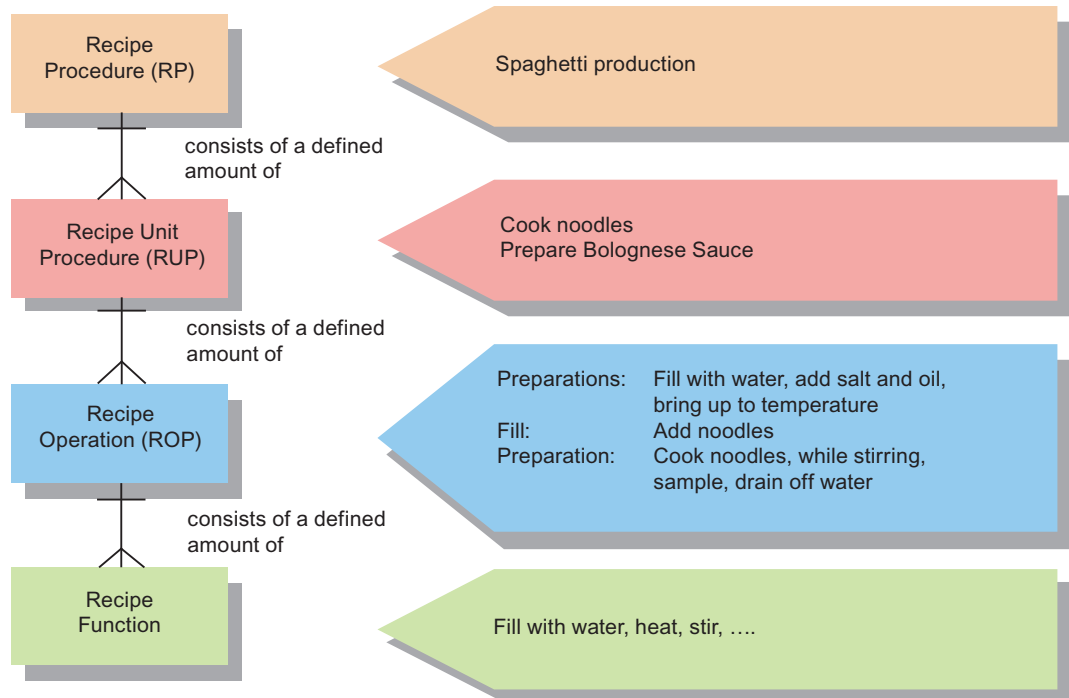
The term "EPH (equipment phase)" is used in the PCS 7 environment.

2.15 Procedural Control Model

Hierarchic model

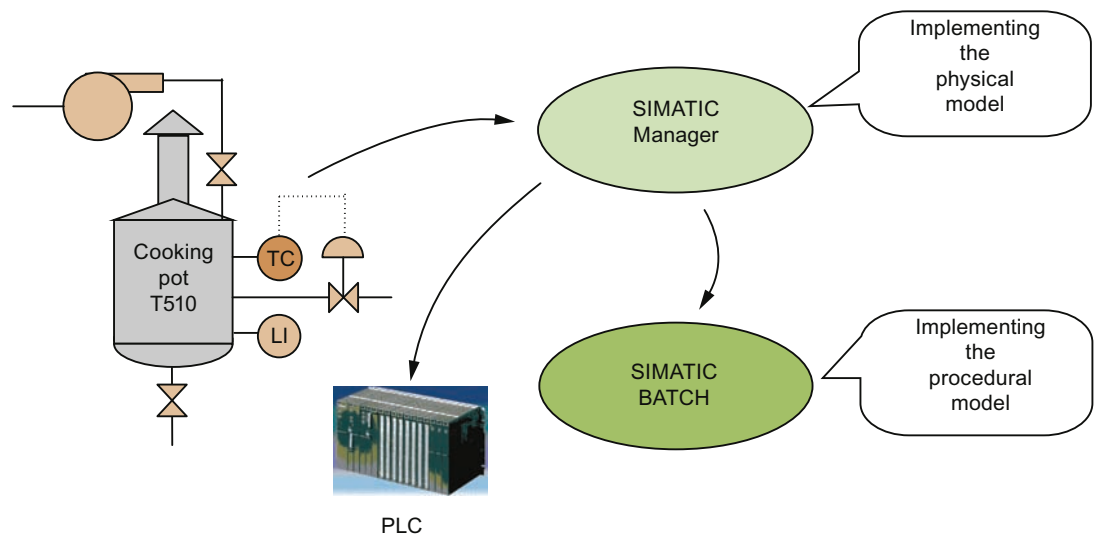
In keeping with the physical model, a hierarchical model to describe the procedures is specified.

How should it be produced?



2.16 Implementation – Physical and Procedural Model

Model

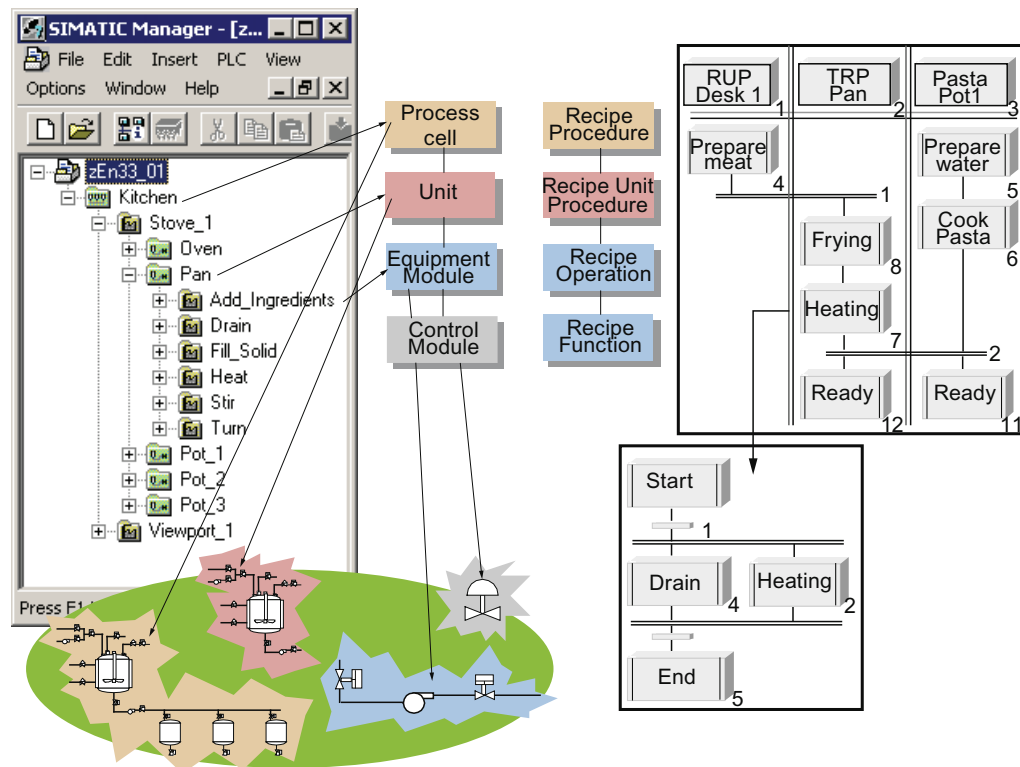


Both models are mapped to the architecture of SIMATIC PCS 7 as the picture shows. The hardware model is implemented in SIMATIC PCS 7 Engineering. The resulting program structures are executed in the AS.

The procedural model is implemented in SIMATIC BATCH. The control recipes are executed in SIMATIC BATCH and in the AS program structures.

2.17 The ISA-88 model in PCS 7

Models in SIMATIC PCS 7 and SIMATIC BATCH



ISA S88.01 describes various models that can be fully covered with SIMATIC PCS 7 and SIMATIC BATCH.

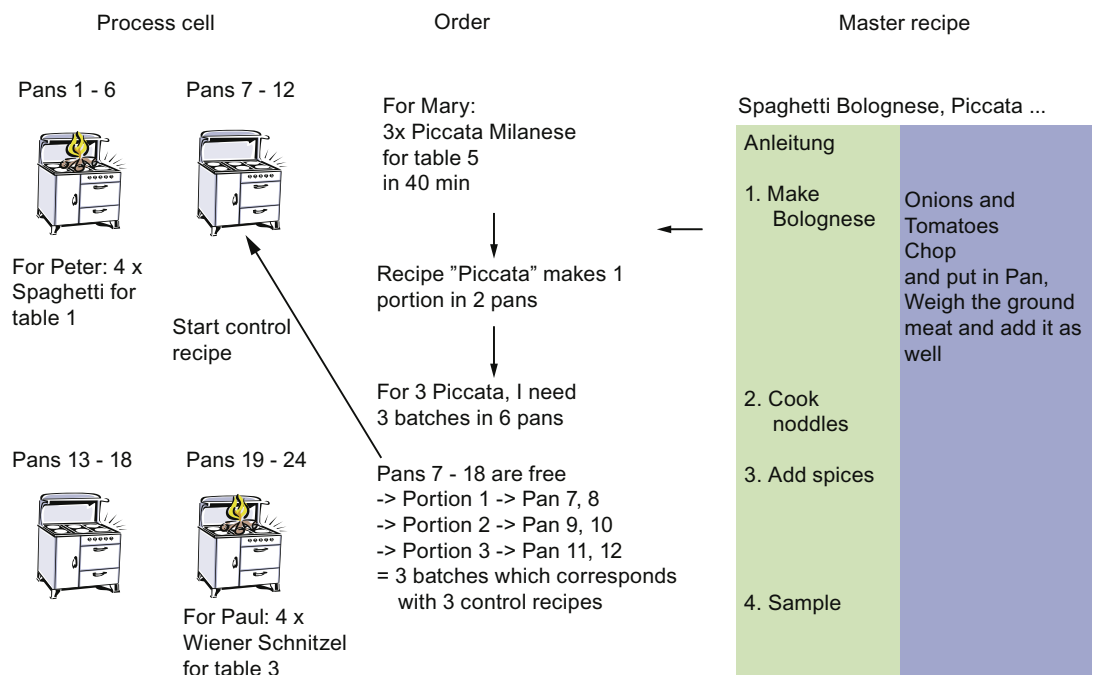
The process cell model describes the process cell, unit, equipment module and control module level that is mapped using the plant hierarchy in the Plant view of the SIMATIC Manager.

The process cell model is prepared for SIMATIC BATCH so that the procedural model in the form of recipes can be mapped to the process cell model.

- A recipe procedure runs on a process cell to control a process and to create a batch of a product.
- A recipe unit procedure runs on a unit to control a recipe stage. A unit can only be allocated to one batch at any one time.
- A recipe operation or a recipe phase runs in an equipment module to perform an industrial process task or equipment phase.
- The device control level is not within the framework of the Batch system and is addressed over the equipment module. The device control level is located completely within AS.

2.18 Workflow in the Kitchen: Order - Master Recipe - Process Cell

Order - master recipe - process cell



Charlie orders three portions of Piccata Milanese. The order was placed for table 5 and should be delivered within 40 minutes.

The "Piccata" master recipe is available for production. The recipe describes the process for a single portion.

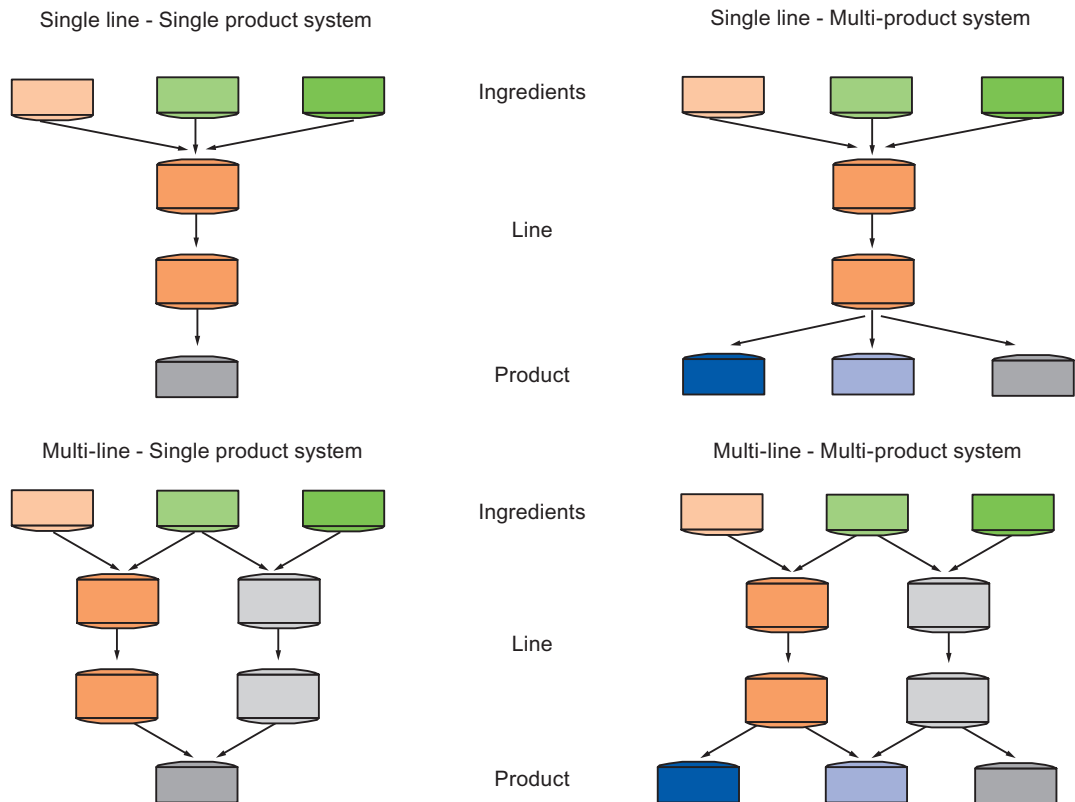
The chef needs two frying pans per portion. He needs six frying pans in order to produce three portions in parallel. He creates three control recipes, each for three frying pans. Each control recipe produces one batch of Piccata.

All three control recipes can be started in parallel as shown in the picture, provided all six frying pans are available.

The three batches would have to be produced in sequential order if only two pans are available.

2.19 Classification of Batch Process Cells

Criteria for Categorizing Batch Process Cells

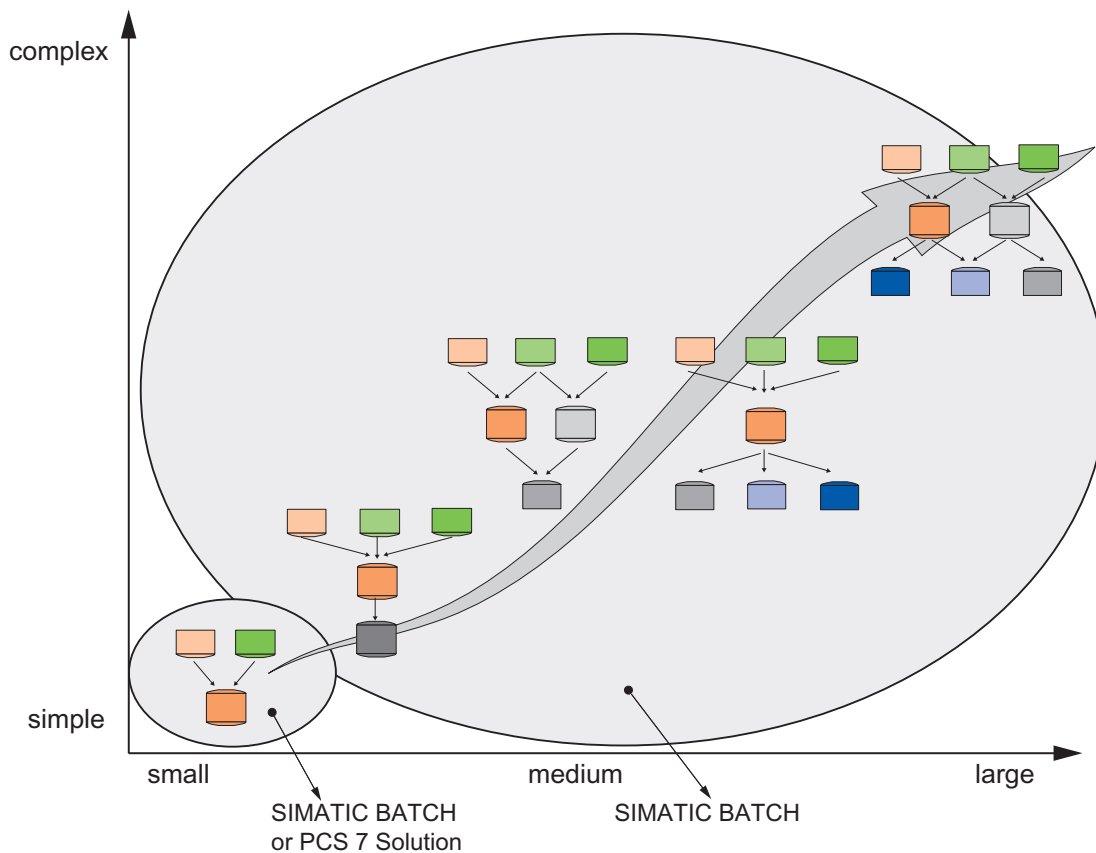


The number of products produced on the process cell represents the first classification criterion.

- Single-product process cells
- Multiple product process cells

The number of routes which support the parallel product flow forms the second criterion.

- Single-route structure
- Multiple-route structure
- Network structure with totally flexible routes



The scaling capability of SIMATIC BATCH makes it suitable for small-scale process cells and for large-scale quantity frameworks.

Complexity increases in proportion to the number of products and routes. SIMATIC BATCH supports the automation of multiple routes for multi-product process cells.

The assessment of smaller process cells for which only a few products or routes are required should be focused on licensing and engineering costs accrued by the solution with SIMATIC BATCH.

2.20 SIMATIC BATCH: Customer benefits

Customer benefits derived from the implementation of SIMATIC BATCH

- The production sequences are described in master recipes which can always be created / edited by operating personnel.
- Greater production flexibility, reduced "time to market".
- Unit allocation can be planned. The allocation planning can be changed right up to the actual allocation. SIMATIC BATCH supports automatic unit selection.

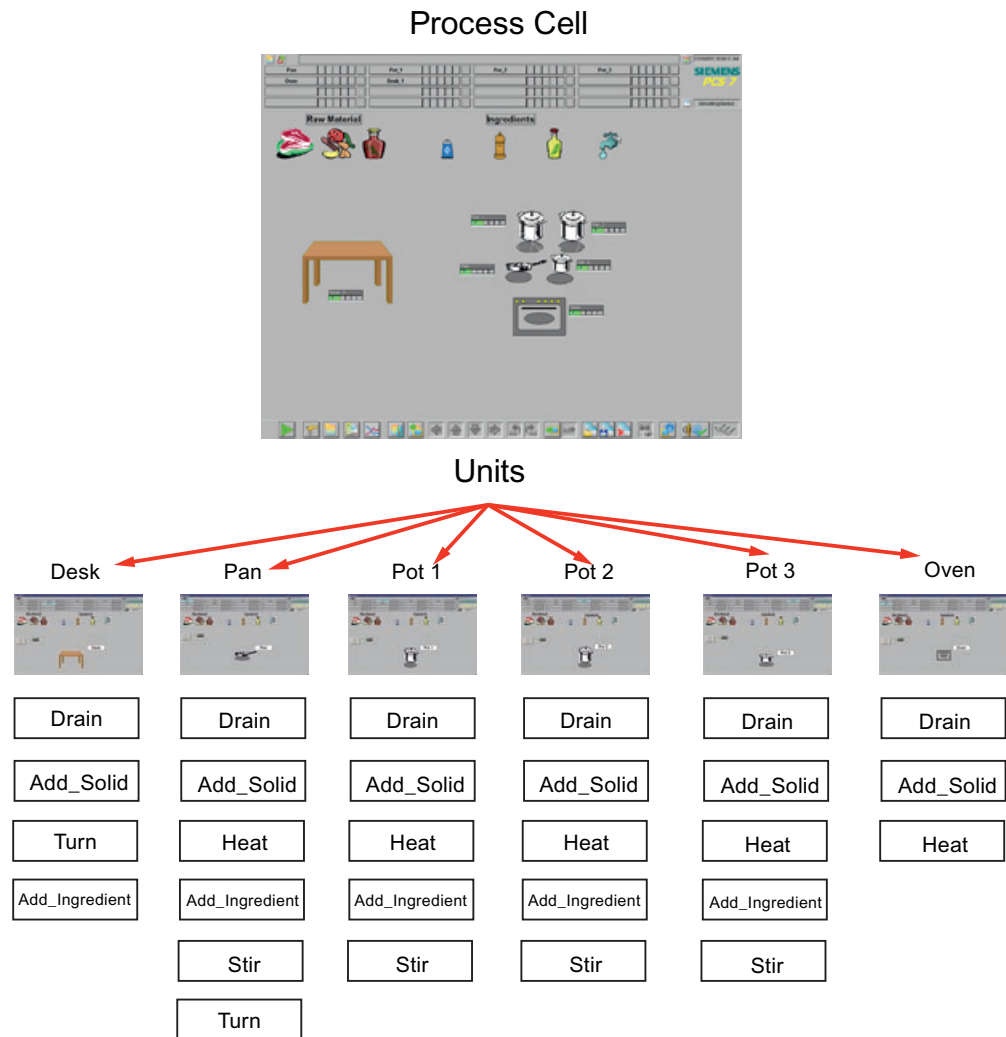
- Improved utilization of resources
- Production sequences are documented in a batch log (paper or electronic). The production sequences are reproducible by using recipes with procedures.
- Easy quality management
- Of particular interest if validation is required to FDA (Food and Drug Administration) guidelines:
 - Version control
 - Access control
 - Audit Trails (21CFR Part11)
- Low costs of validation, as changes to recipes can be reproduced.
- Implementation of a standard Siemens product
- Reduced operation and life-cycle costs

Configuring the "Kitchen" training project

3.1 Basics

3.1.1 Description of the Model

Overview of the process cell model



3.1.2 Plant Hierarchy View in SIMATIC Manager

Process Cell Model in the SIMATIC Manager

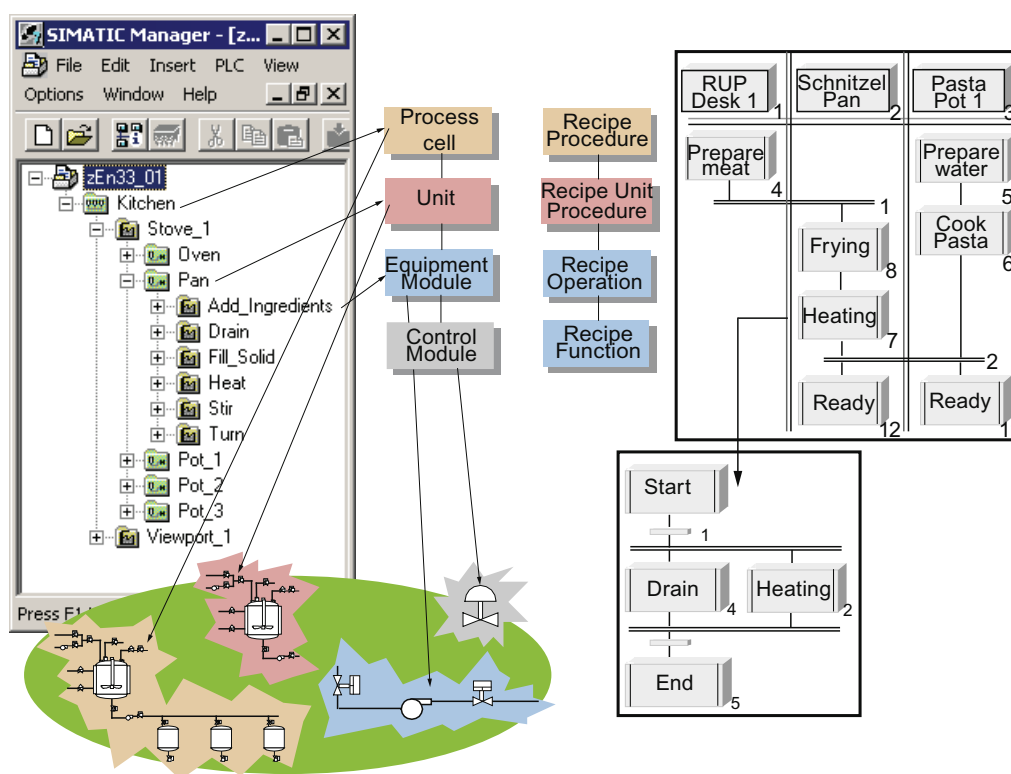
The process cell model in SIMATIC BATCH is used to represent the procedural model of the recipe.

A recipe procedure controls a process in a process cell to create a batch of a product.

A recipe unit procedure runs on a unit to control a recipe stage. To avoid collisions, a unit can only be allocated to one batch at any one time.

A recipe operation or a recipe phase performs an industrial process task or equipment phase in an equipment module.

The device control level is not within the focus of the Batch system and is addressed over the equipment module. The device control level is located completely within the AS system.



3.1.3 Hardware and software requirements

Prerequisites for the SIMATIC BATCH Getting Started

You need the hardware and software described below.

Hardware requirements

- A PC which is configured in accordance with the minimum requirements defined in the "PCS 7 Readme" file
- Network adapter

Software requirements

Installation of SIMATIC PCS 7 V8.0 with the following programs:

- PCS 7 Engineering
- BATCH Engineering
- BATCH Single Station
- OS Client for BATCH
- SIMATIC Logon V1.5
- S7-PLCSIM V5.4 SP5 Update 1

3.2 Configuration

3.2.1 Retrieving the project

Introduction

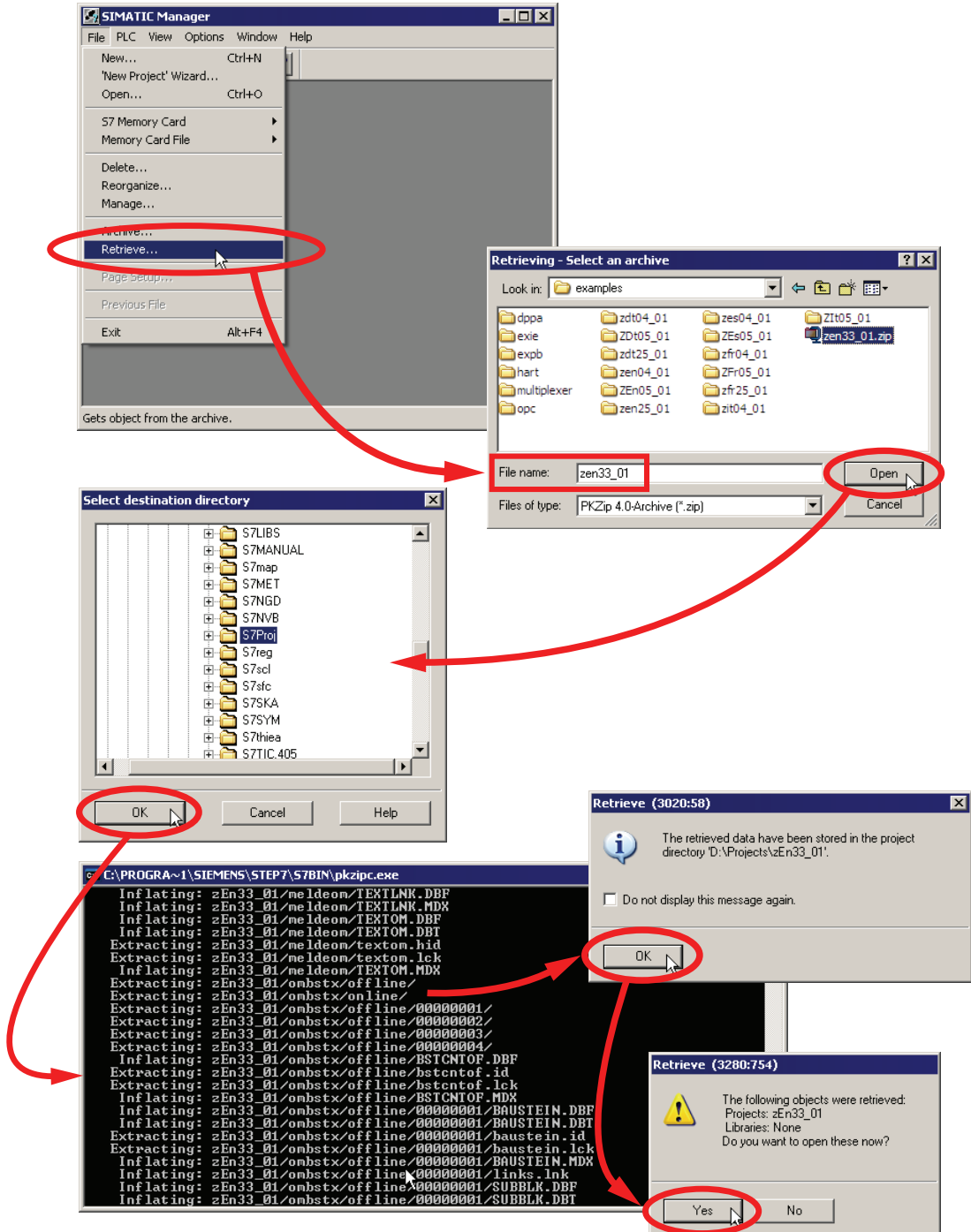
Unzip the enclosed sample project "zen33_01.zip".

Requirements

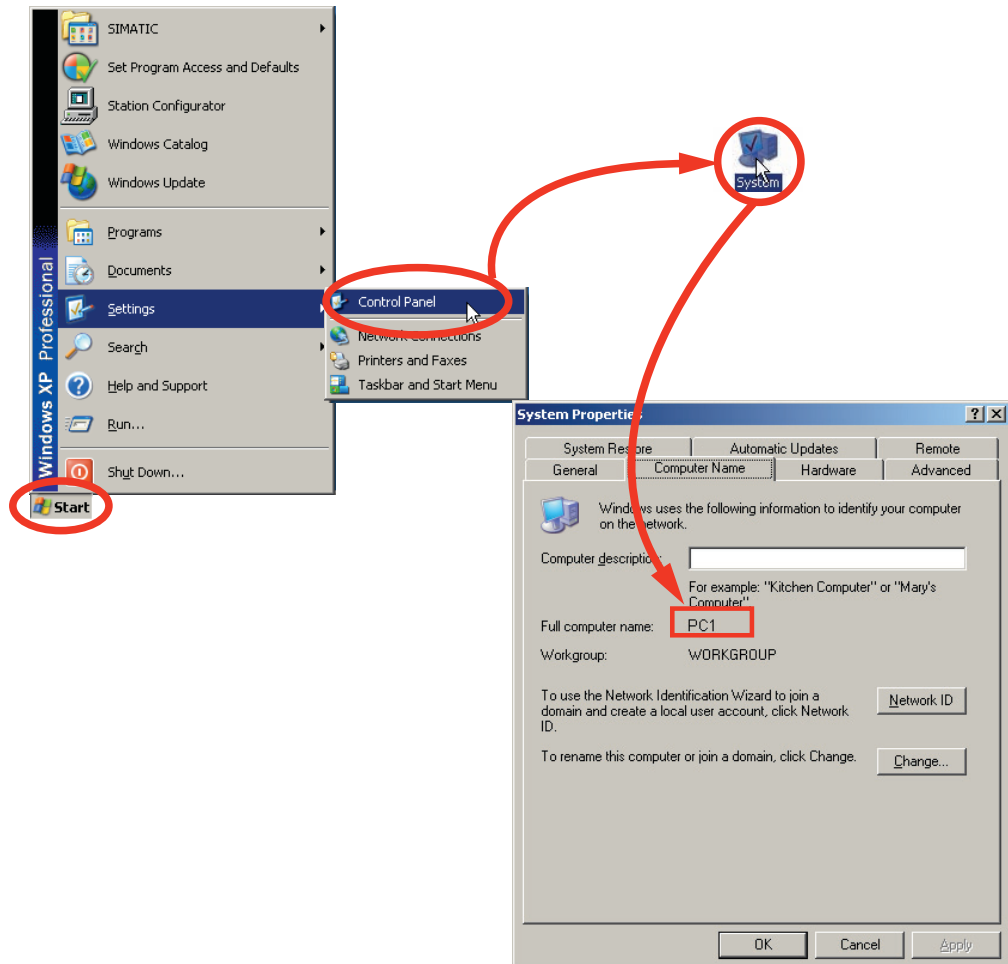
- The archived project file is called "zen33_01.zip" and the associated recipe database is called "sb_gs1_b.sbb". Both files are available for download via the About button on the Web page for this Getting Started in the Siemens Industry online support portal.
- Copy both files to the following local folder on your PC: "..\SIEMENS\STEP7\examples".
- SIMATIC Manager is open.

Procedure

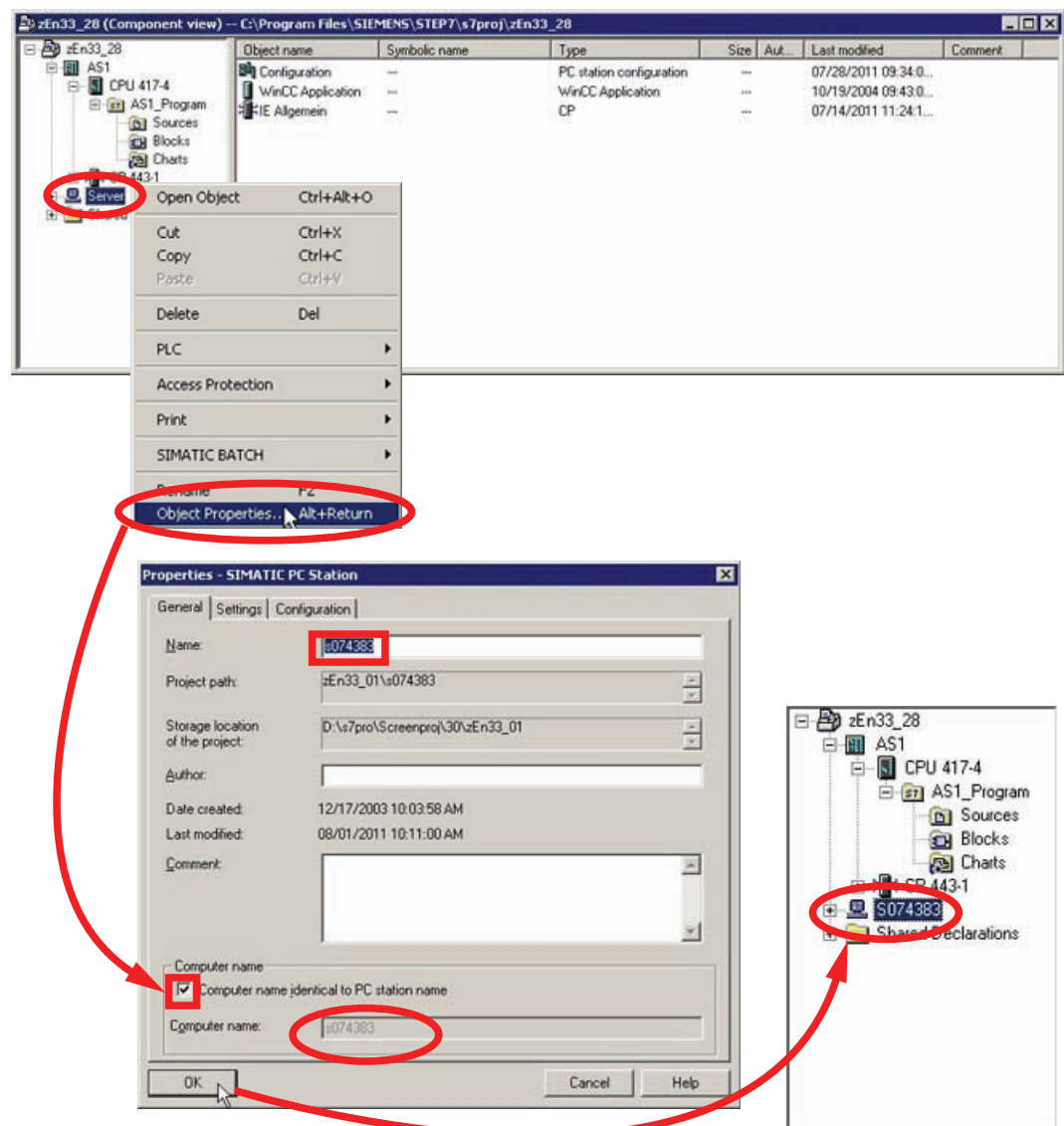
1. Retrieve the project and save it under ...\\Siemens\\STEP7\\S7Proj.



2. Select the "Server" PC station in the component view and open the object properties. Go to the "Name:" field and enter the computer name of your PC. You can find out the name of your PC as follows:

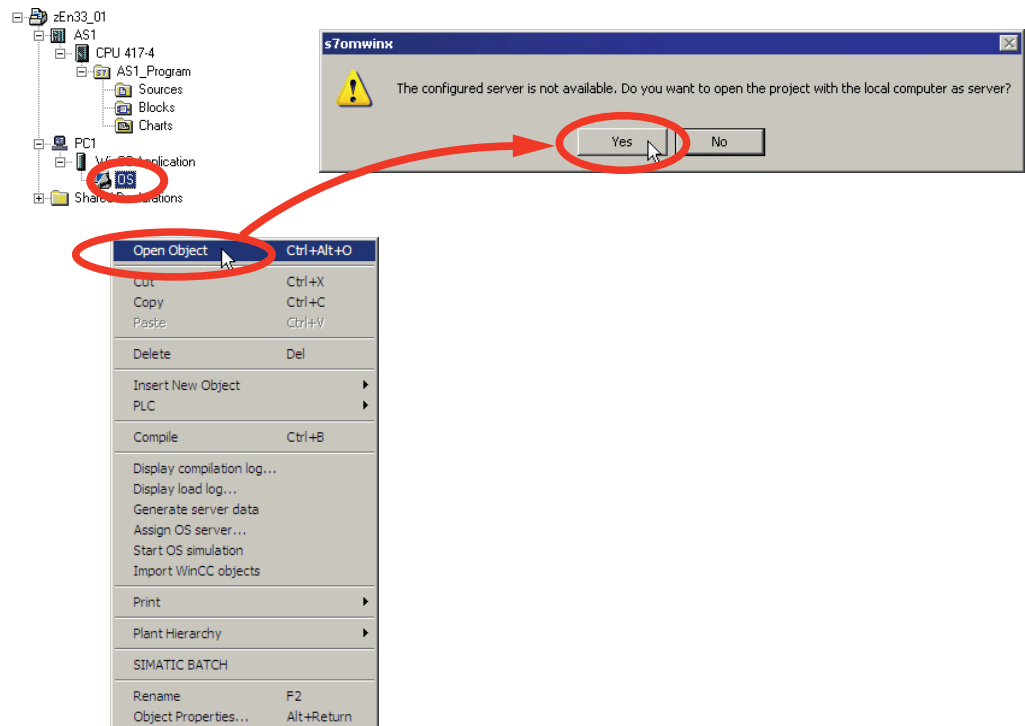


3.2 Configuration

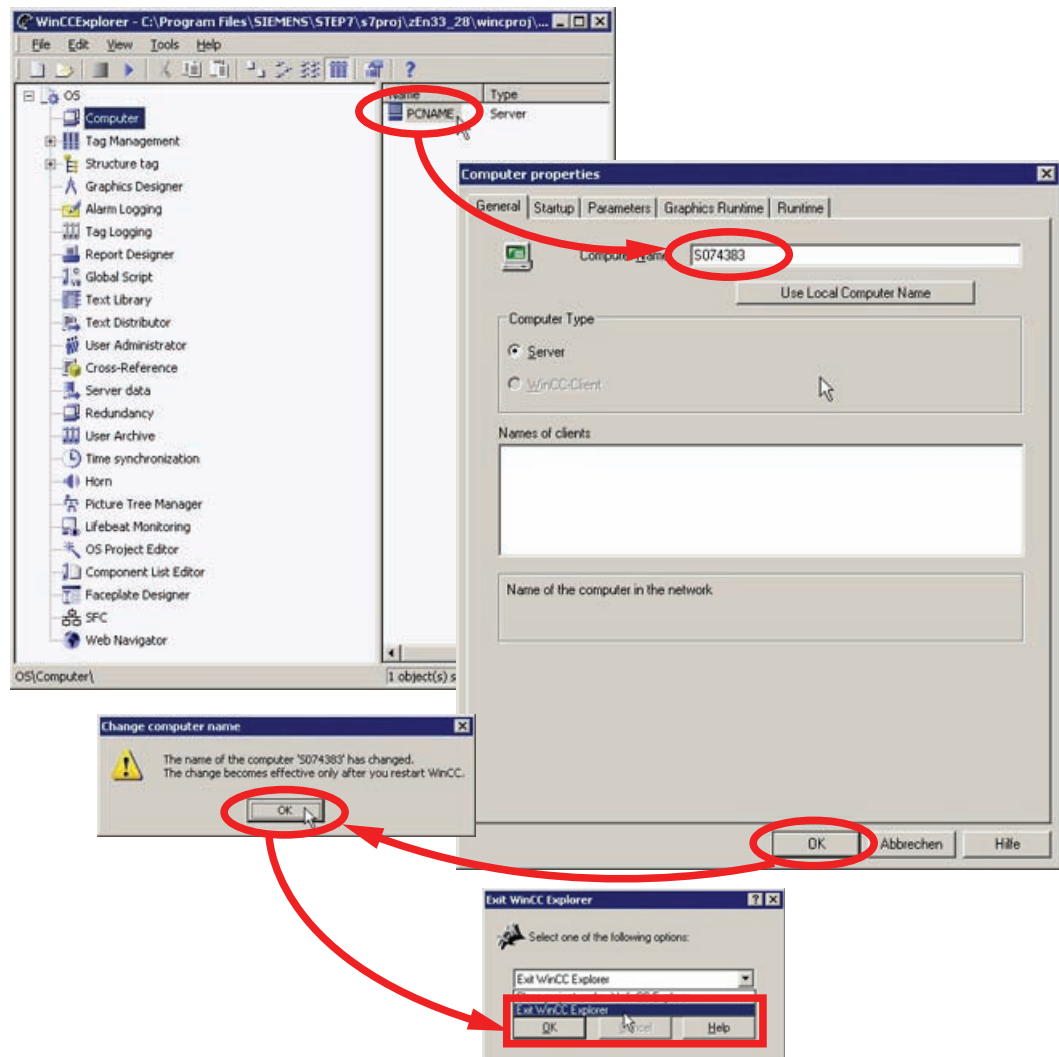


3. Save and activate the name by confirming the entry with "OK".

4. Open the WinCC Explorer on the OS.



5. Change the computer name in WinCC Explorer to the name of your PC.



6. Close the WinCC Explorer.

3.2.2 Configuring the BATCH Server and BATCH Client

Introduction

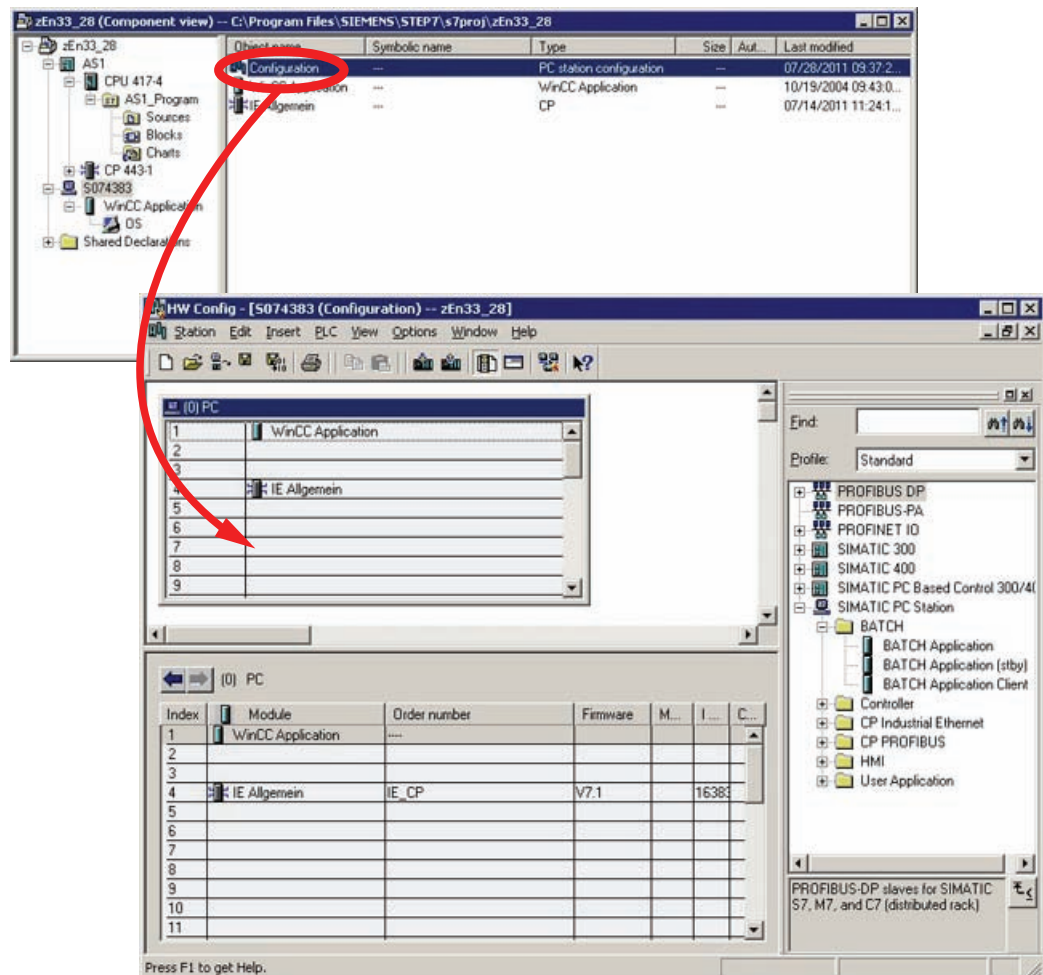
The section below specifies the requirements and procedures to be followed when configuring a BATCH Server and Client.

Requirements

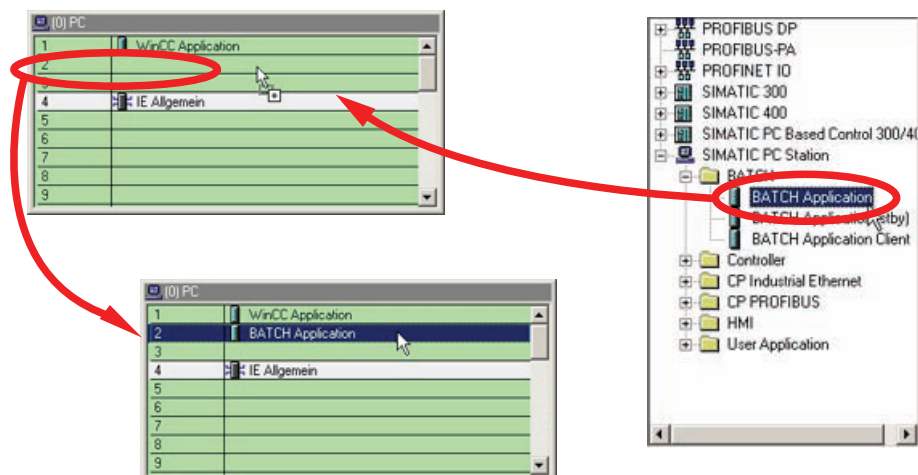
- A SIMATIC PC station must be configured with a "BATCH application" in HW Config for every computer on which a BATCH server application runs.
- You only need one PC station to work locally on the ES PC with BATCH Server/Clients (single-project engineering). The BATCH Server application is set up on this PC station. The Runtime computer name either remains blank, or you enter the name of your local PC.

Procedure

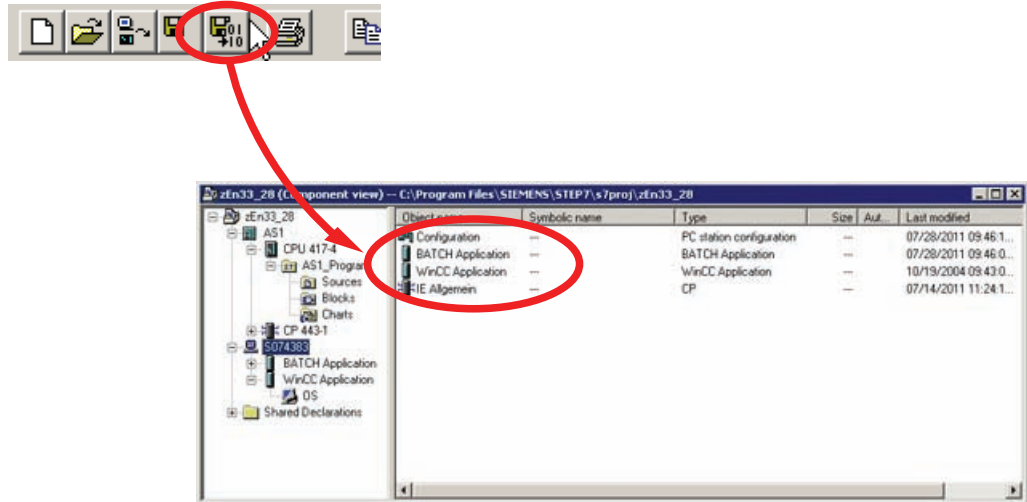
1. Select the PC station in the Component view and open the Configuration object.



2. Select the "BATCH application" and insert or drag-and-drop it in Index 2.



3. Save and compile the hardware configuration of the PC station with the newly added BATCH application.

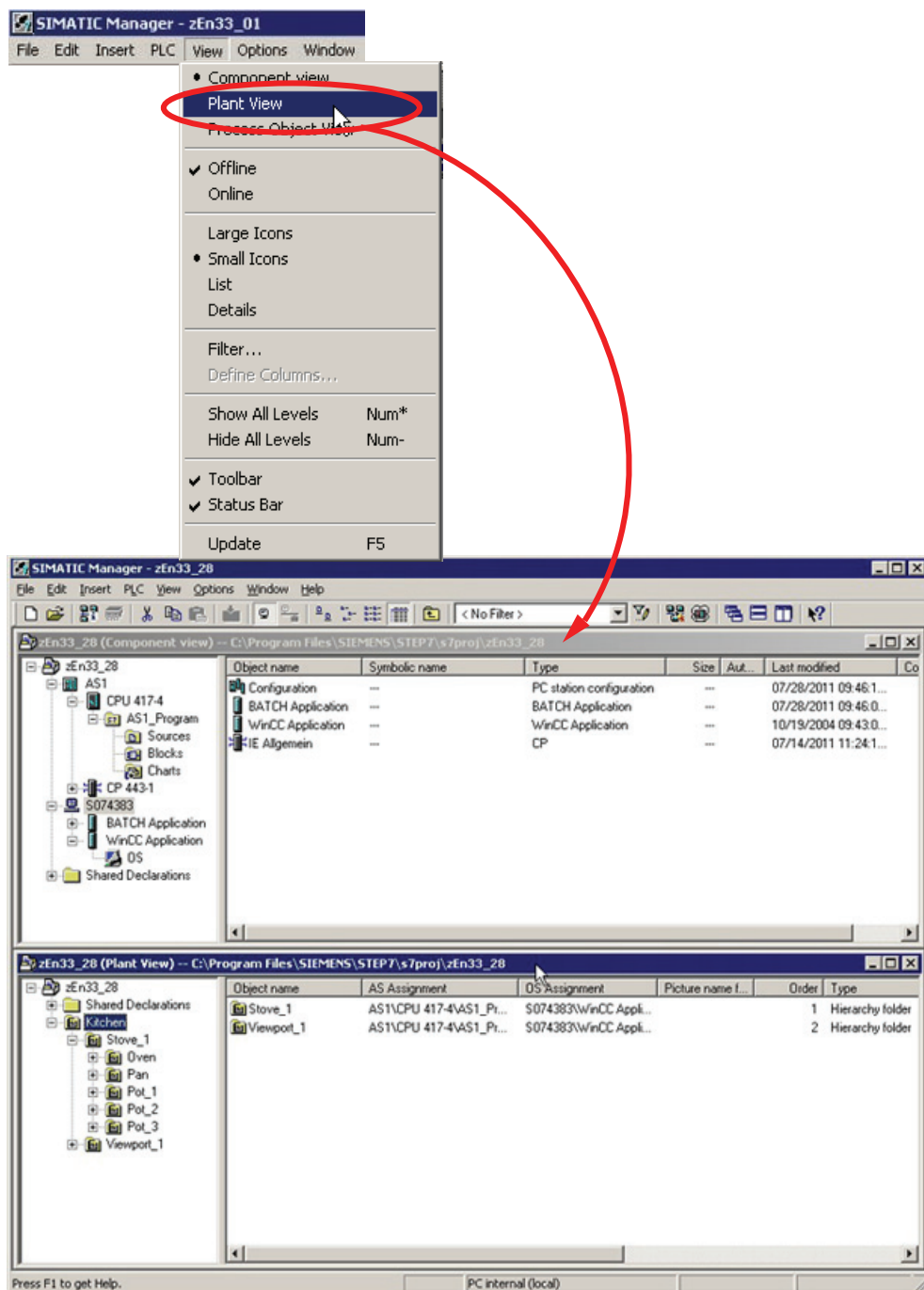


4. Close HW Config.

3.2.3 Opening the plant view

Procedure

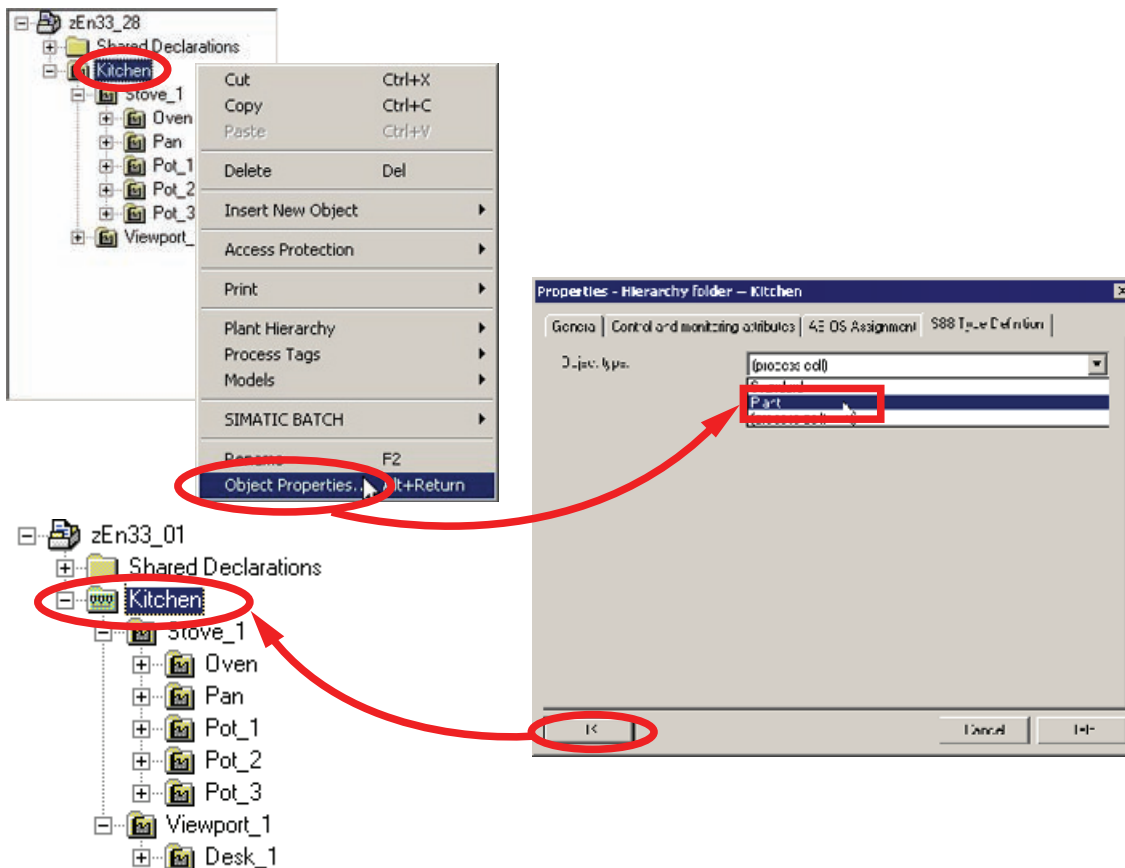
In addition to the component view, open the plant view of the project in SIMATIC Manager and arrange these views side-by-side.



3.2.4 Creating the Batch process cell

Procedure

Assign the "process cell" S88 type definition to the "Kitchen" hierarchy folder. The "Kitchen" folder then becomes green and has the "process cell" type according to ISA S88.

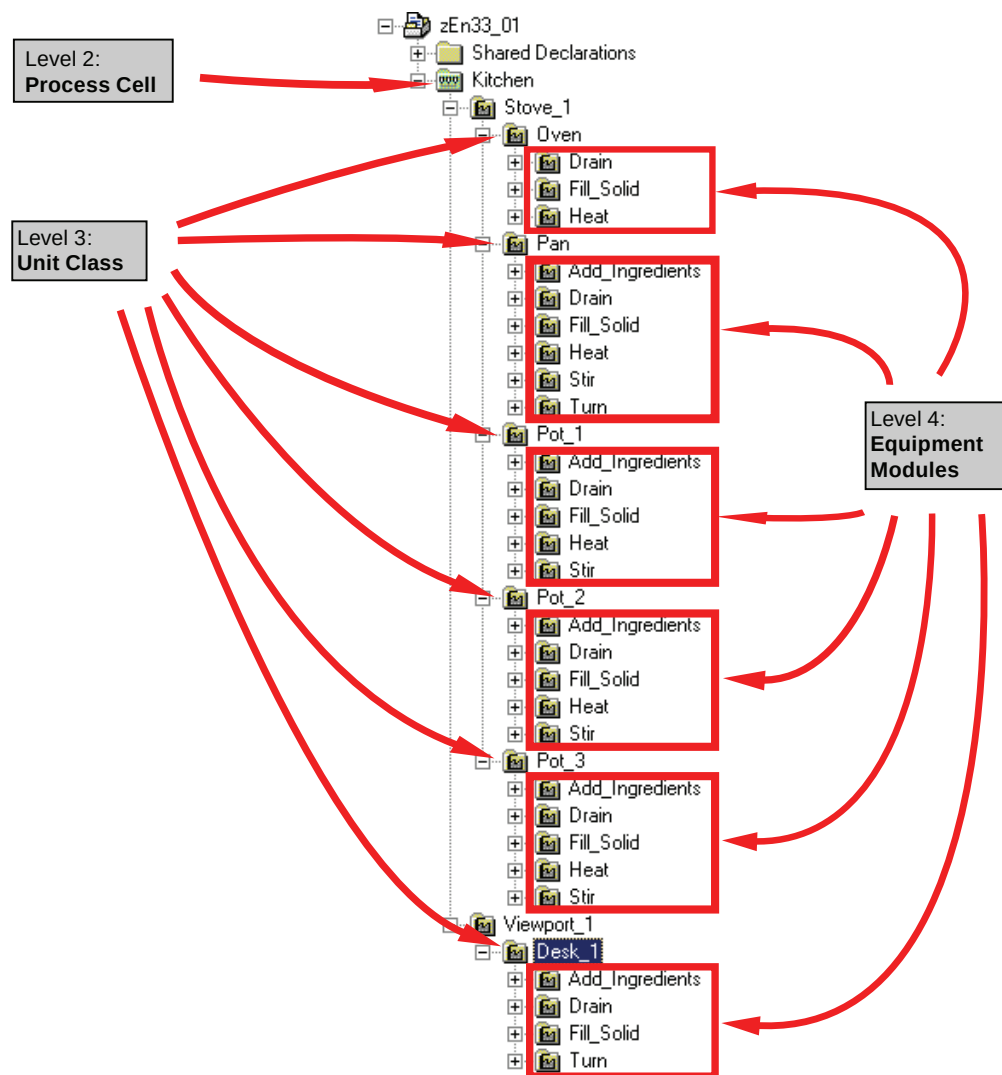


3.2.5 Type definition of the plant hierarchy to ISA -88

Introduction

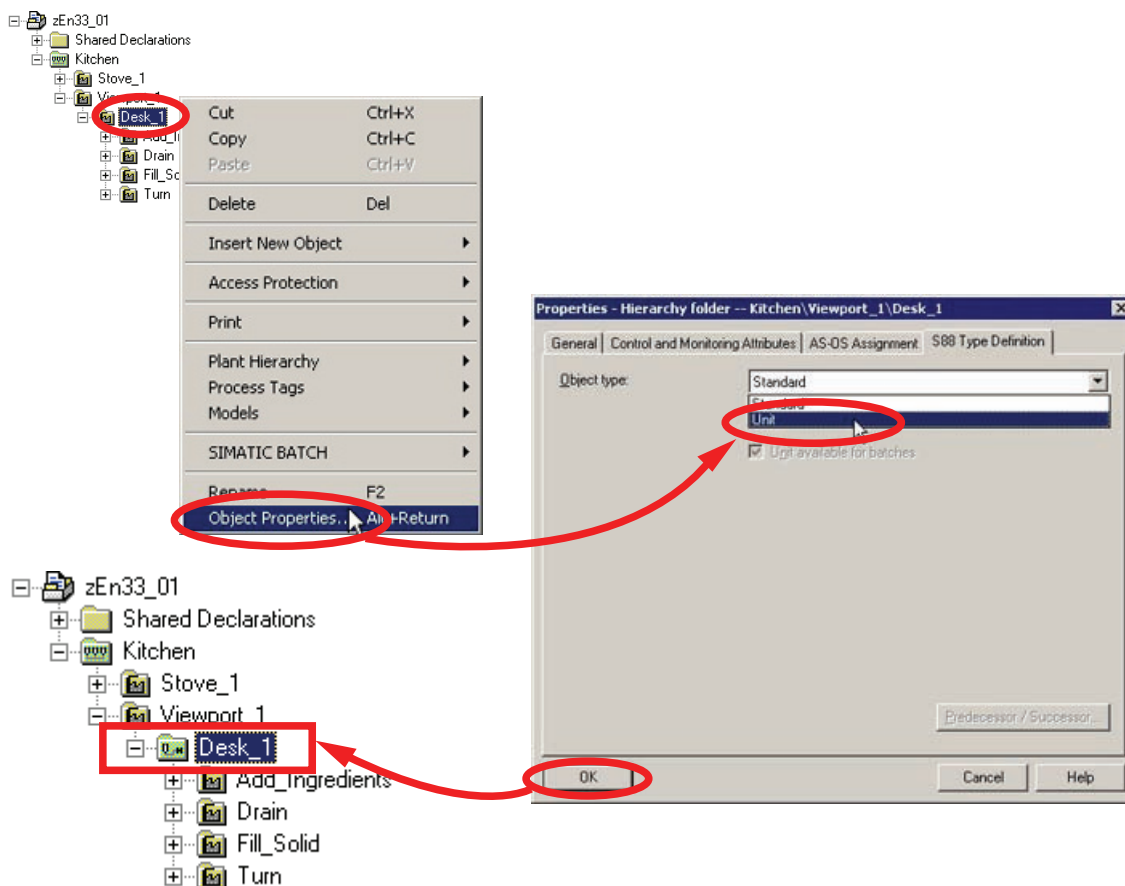
Assign the S88 type definitions "Unit" and "Equipment module" to the existing hierarchy folders.

3.2 Configuration

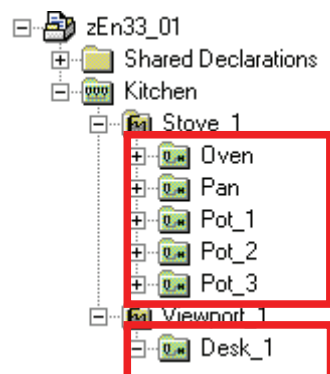


Procedure

1. Assign the "Desk_1" hierarchy folder the object type "Unit" in the S88 type definition. The "Desk_1" folder is then displayed green identifying it as a unit according to the ISA S88.01 standard.
2. Do not touch the hierarchy folders Stove_1 and Viewport_1; the identifier remains neutral.



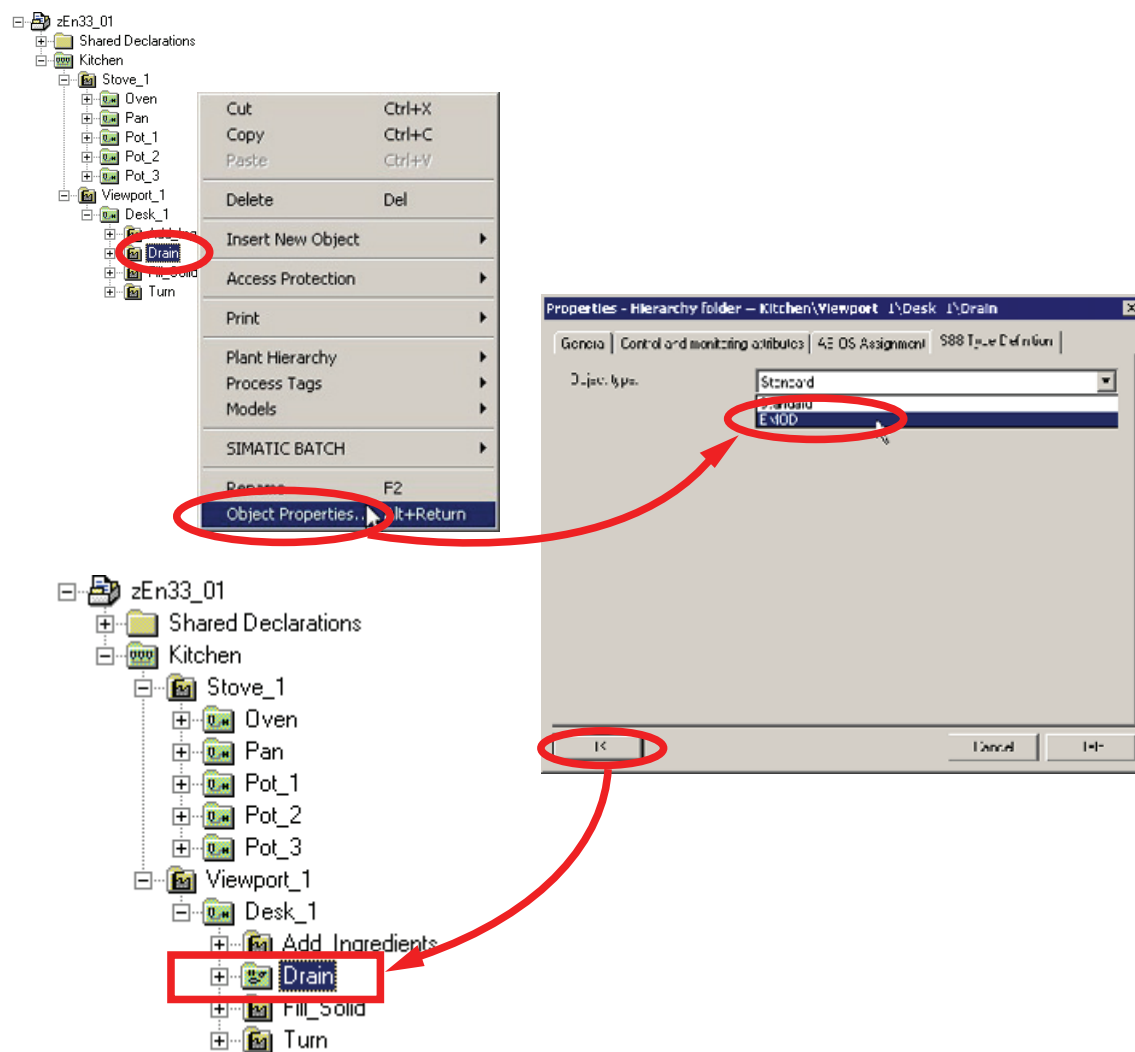
3. Assign the "Unit" object type to the hierarchy folders "Oven", "Pan", "Pot_1", "Pot_2" and "Pot_3", as described in step 1 of S88 type definition.



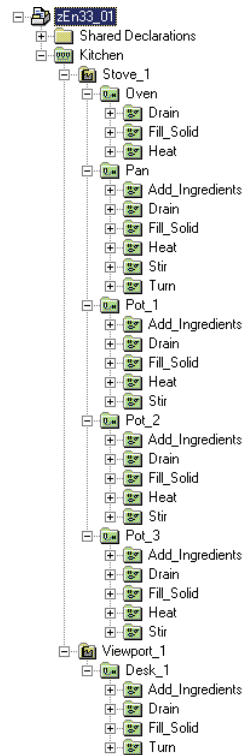
3.2 Configuration

- Assign the object type "Equipment module" to the "Drain" hierarchy folder at Kitchen/Stove_1/Oven, S88 type definition. The "Drain" folder is then identified in green color as an equipment module in accordance with the ISA standard S88.01.

The equipment module level contains CFCs and the instances of SFC types. You can also use SFCs in combination with the CFCs and their Batch interface blocks (IEPH, IEPAR_XXX).



5. Assign the hierarchy folders identified at the beginning of this chapter as "Level 4: Equipment module" the object type "Equipment module" at the S88 type definition.



3.2.6 Assigning the Batch category "EPH"

SFC types used

These instructions contain equipment phases with and without autostop functionality. This property is set by default at the following SFC types.

- With autostop: Drain, Fill_Solid, Turn and Add_Ingredient
- Without autostop: Stir and Heat

The SFC types used can be used in runtime of the Getting Started BATCH project. Check the particular configuration data of other BATCH projects in which you may want to use these SFC types with due care.

The block contact "Ready_TC" reports the end of the RUN sequence within equipment phases without autostop. Such a equipment phase waits for an external command input either by an operator or by SIMATIC BATCH.

Note

Step condition by external command

Set Ready_TC = 1 to prevent your sequencer from waiting for external command input.

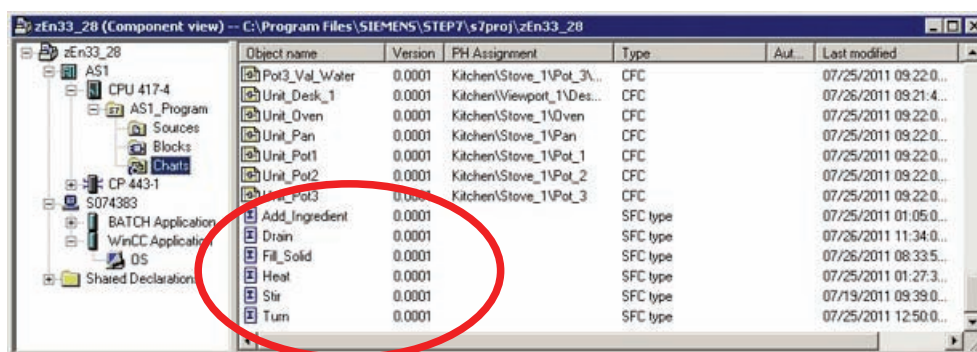
However, always make provisions for correct step conditions in the successive transitions.

For detailed information on equipment phases, refer to the SIMATIC BATCH Online Help.

Assigning the "EPH" Batch Category to SFC Types

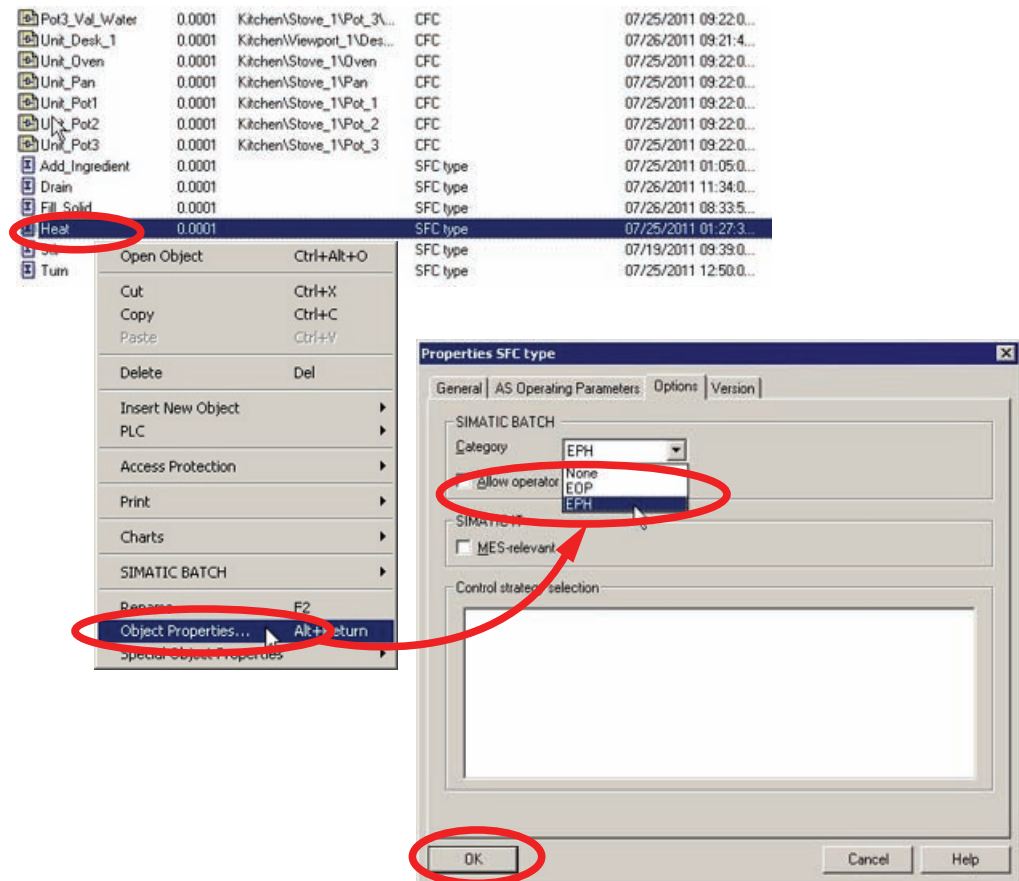
Assign the "EPH" Batch category to the existing SFC types. With the "EPH" category, the SFC type is classified as a phase type. As a result, the information relevant to S88.01 is created automatically during subsequent type generation.

You can find the existing SFC types (Heat, Stir, Drain, Fill_Solid, Turn and Add_Ingredient) in the Component view in the chart folder of the AS.



Procedure

1. Open the object properties of SFC type "Heat" and assign it the "EPH" batch category in the Options tab.
2. Select the "Operator instruction" check box.



3. In the same manner, assign the "EPH" batch category to the remaining SFC types "Stir", "Drain", "Fill_Solid", "Turn" and "Add_Ingredient".

3.2.7 Generating the type definition in the Batch types

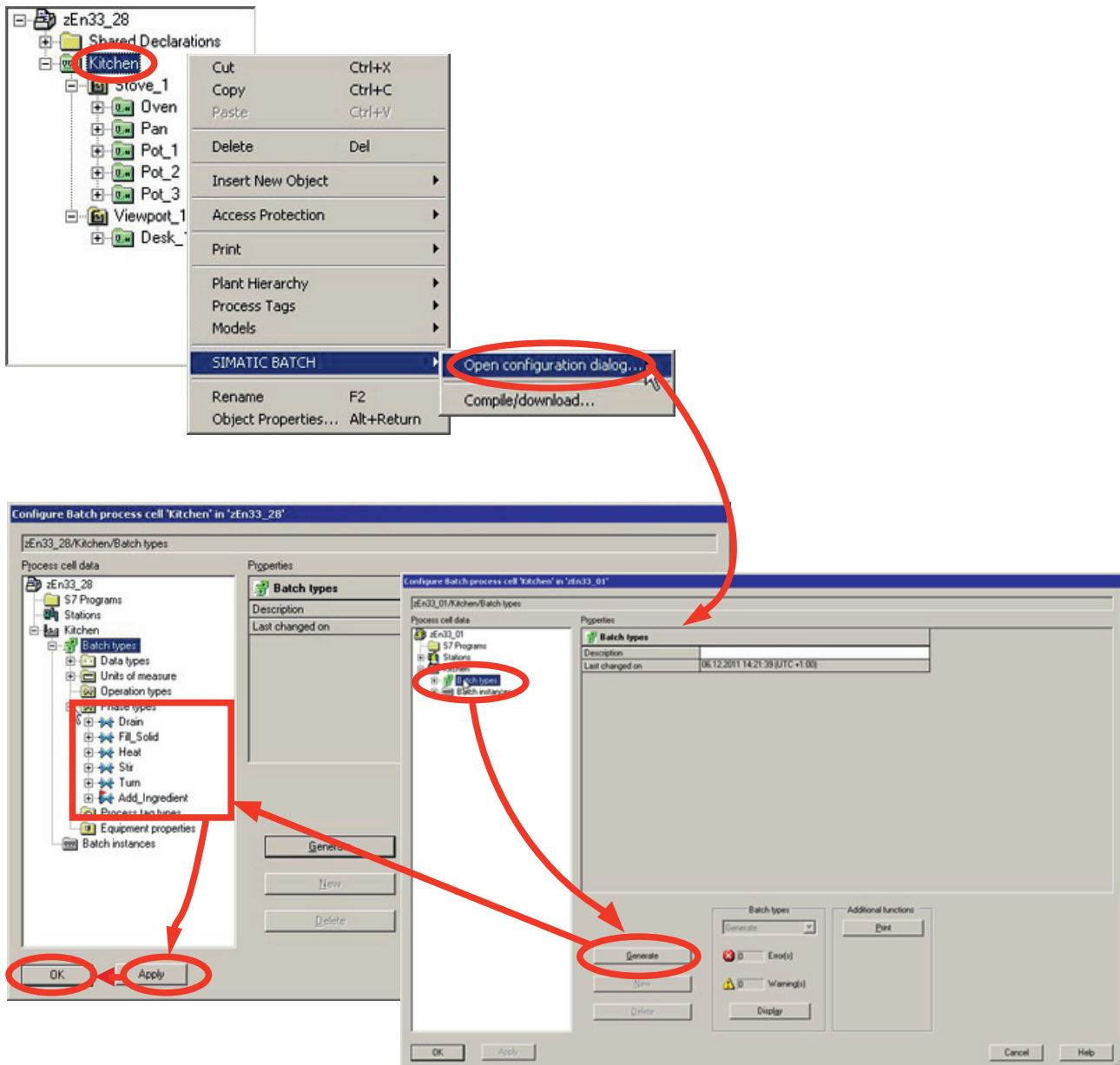
Introduction

As the basis for creating recipes in SIMATIC BATCH, the type description of the process cell must be generated and synchronized with the block instances of the CFC charts.

Type	Editing Options and Results
Data types	The system specifies the standard data types floating point number, integer, string, input material, output material, material (V4), and Boolean. You can also create custom data types and edit their properties.
Units of measure	You can create new units of measure and edit their properties.
Operation types, phase types and process tag types	To allow recipe creation purely on the basis of types, types must be specified without the block instances for them existing. 1. Operations types: Type information for the equipment operations (EOP) 2. Phase types: Type information for the equipment phases (EPH) 3. Process tag types: Type information of the TAG_Coll blocks Operation types, phase types and process tag types can be assigned control strategy parameters.
Equipment properties	Create new equipment properties in the "Equipment properties" folder such as the size of the unit (capacity of a silo) or the material composition of the silo shell. Equipment properties are assigned to units in the ES configuration and then requested as conditions when creating recipes.

Procedure

1. Open the BATCH configuration dialog via SIMATIC BATCH > Open configuration dialog and select "Batch types".
Note: A format conversion may be necessary for projects created with an older version of CFC/SFC. You can only open the configuration dialog after you have completed the conversion.
2. Then generate the Batch types, apply them and exit the window with "OK".



Note

Protocol for basic data

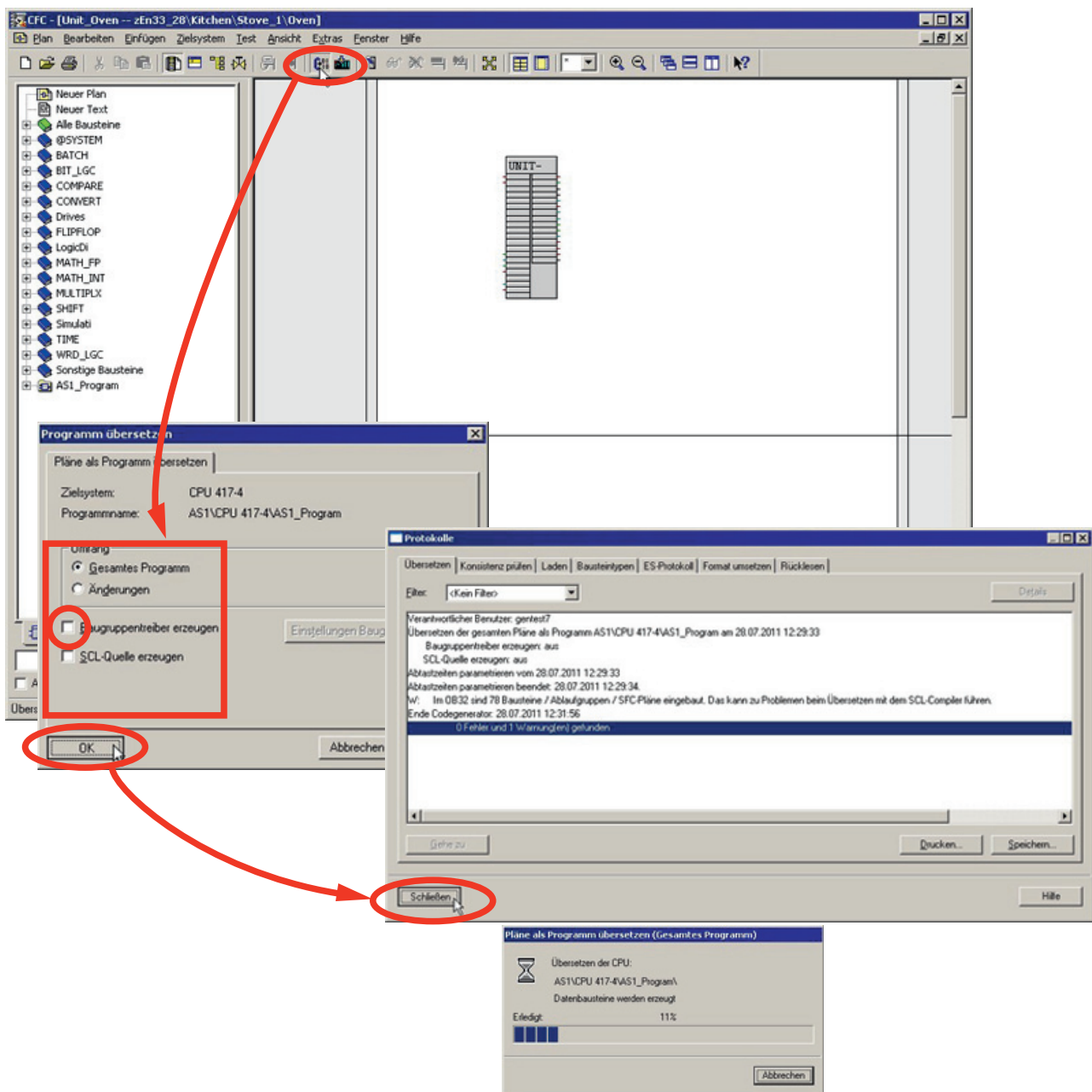
As the information on the memory configuration of the AS and for the allocation of the recipe logic for PC-based operation is not required, a corresponding warning message is output for your plant.

3.2.8 Compiling and downloading the AS, OS and Batch process cell data

Procedure

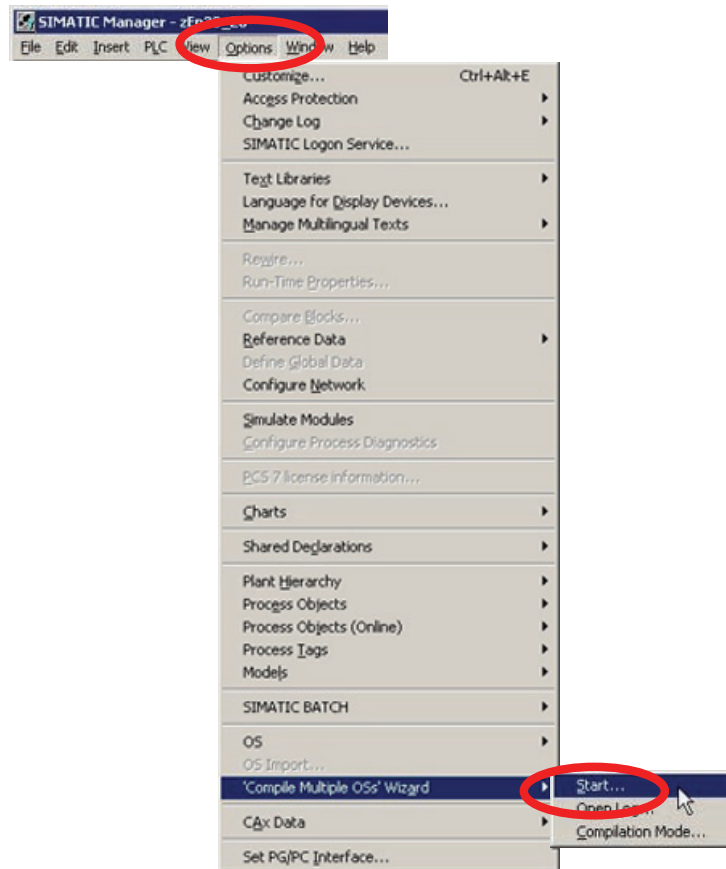
1. Open any CFC chart.
2. Check the total number of blocks installed per runtime group or OB and increase their number to 100, if this is not already set. This prevents the output of warnings during compilation.
The corresponding setting is made by selecting **Options > Settings > Compile/Download** in the CFC Editor.

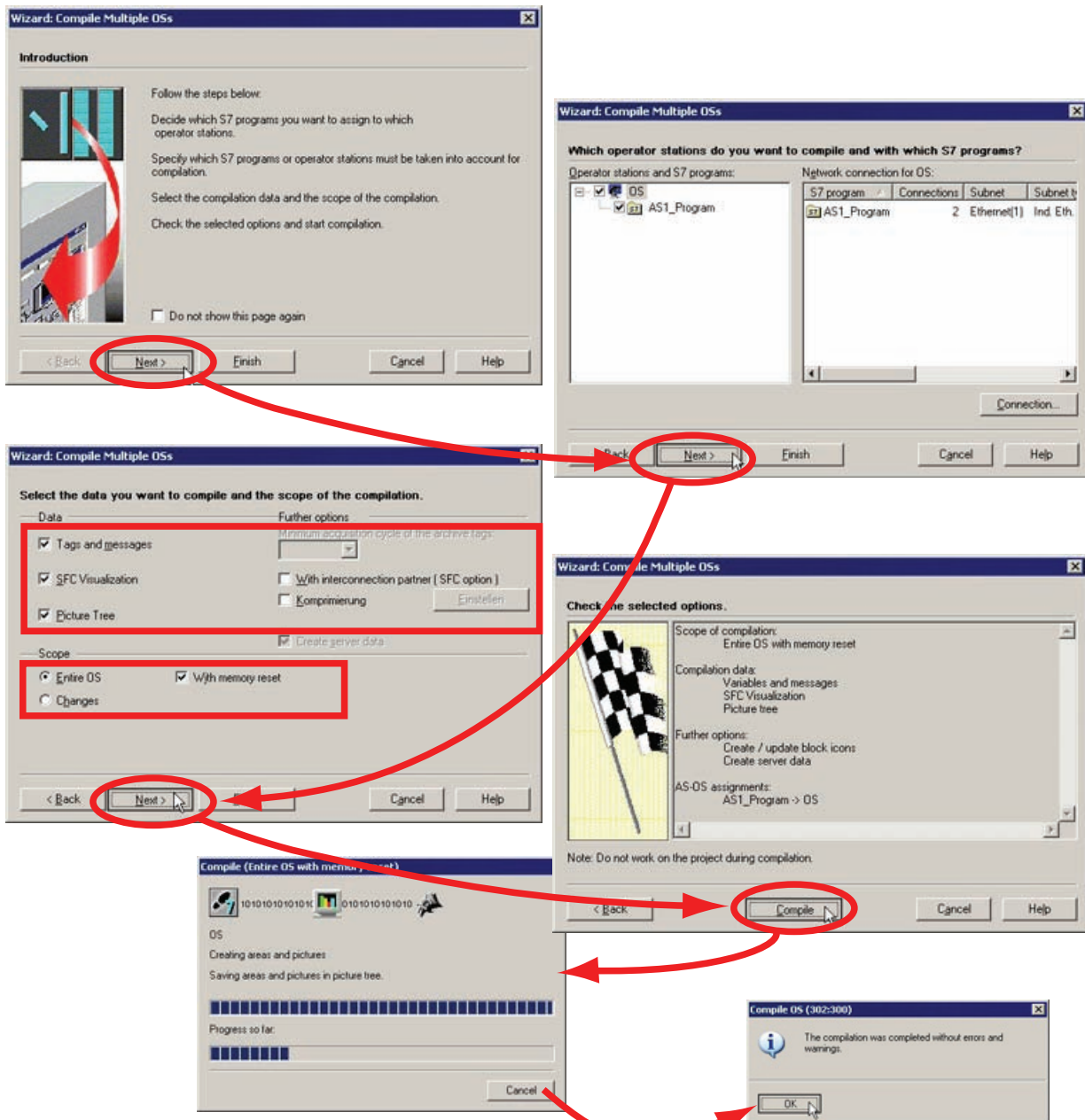
3. Compile the complete AS program.



4. Close the CFC Editor with the menu command Chart > Close.

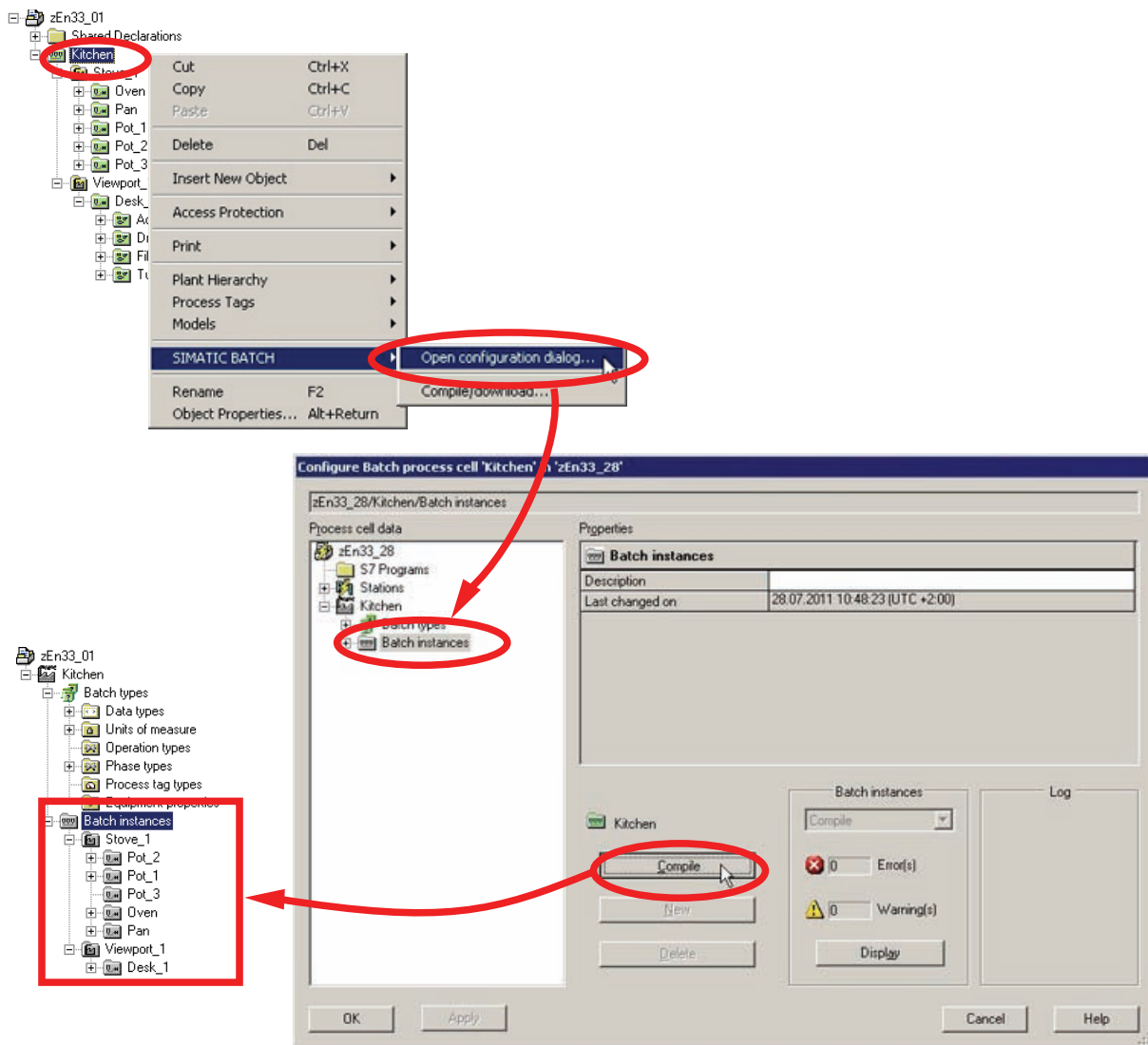
5. Compile the entire OS with memory reset.





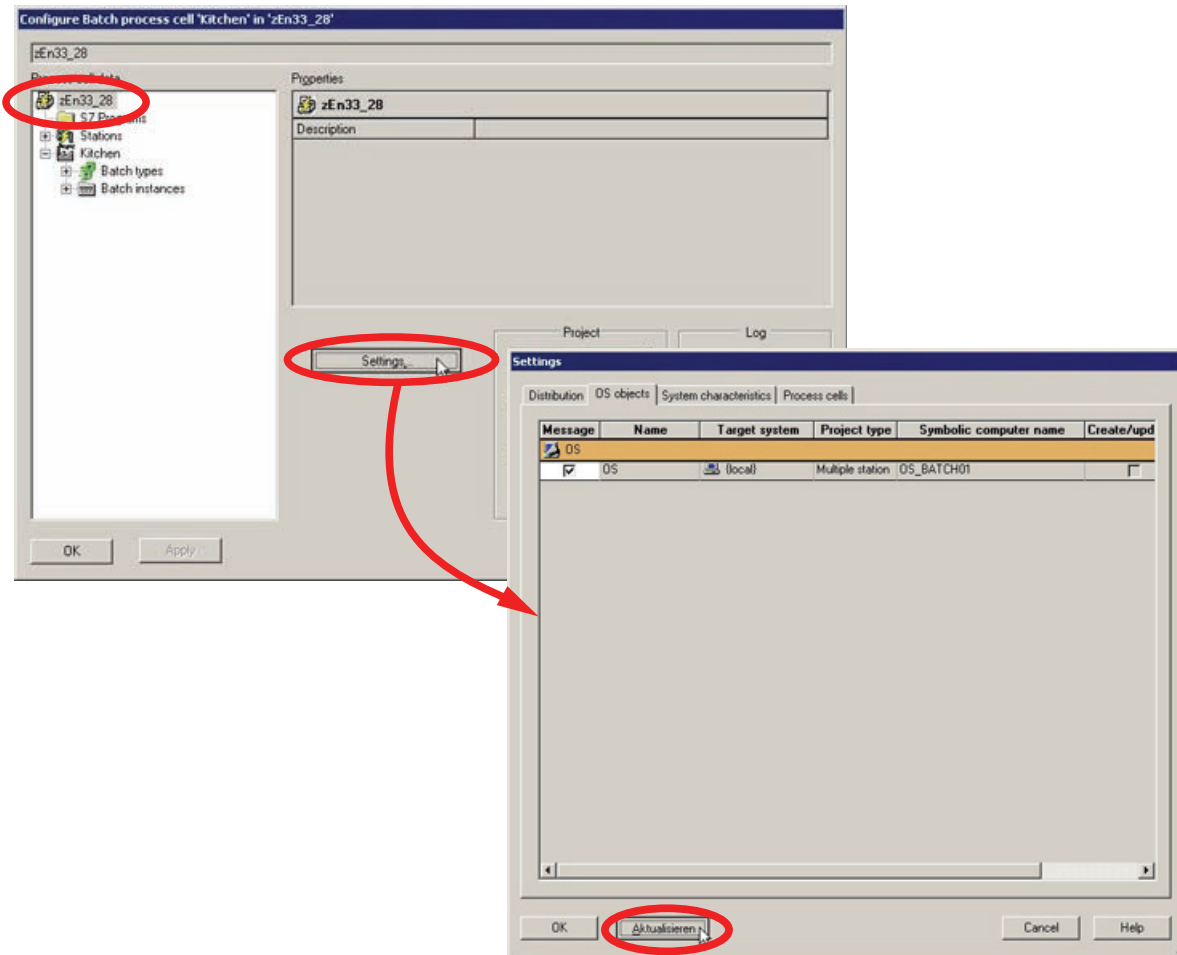
3.2 Configuration

6. Compile the Batch process cell data. To do this, select your project (Kitchen) in the plant view and then select **SIMATIC BATCH > Open configuration dialog > Batch instances > Compile**.



7. Select the entire plant (Batch process cell).

8. Update the plant status by selecting the **Settings > OS Objects > Update** command.
9. Close the view by clicking OK.



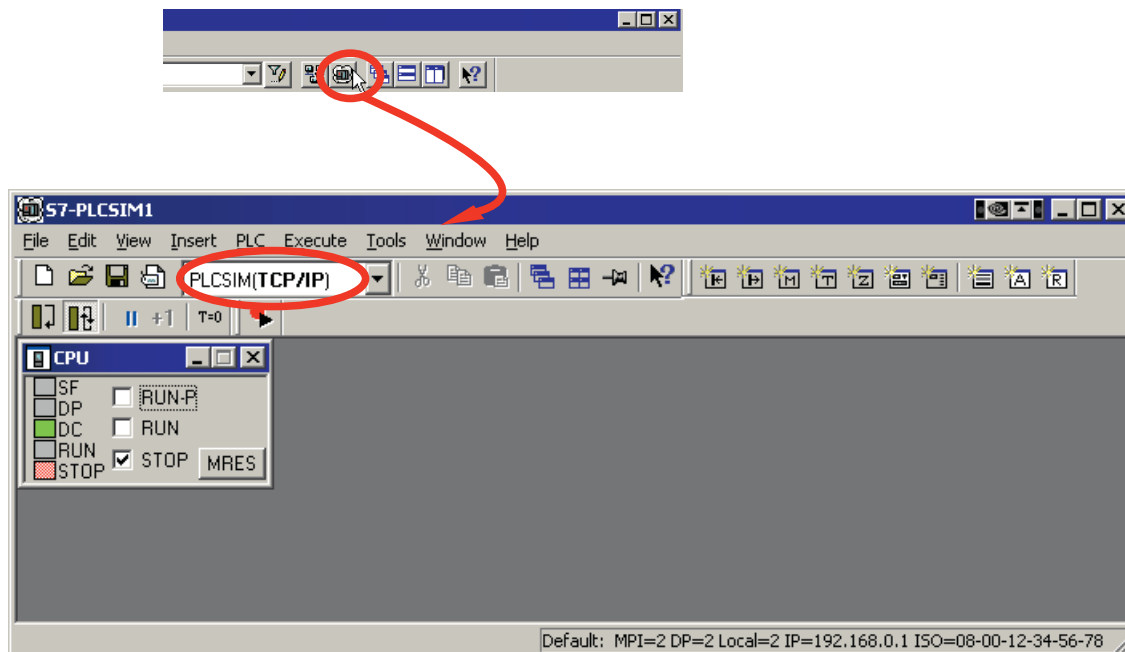
3.2.9 Downloading the AS to PLCSIM

Introduction

Open SIMATIC Manager to download the compiled AS data to the "PLCSim" simulation program.

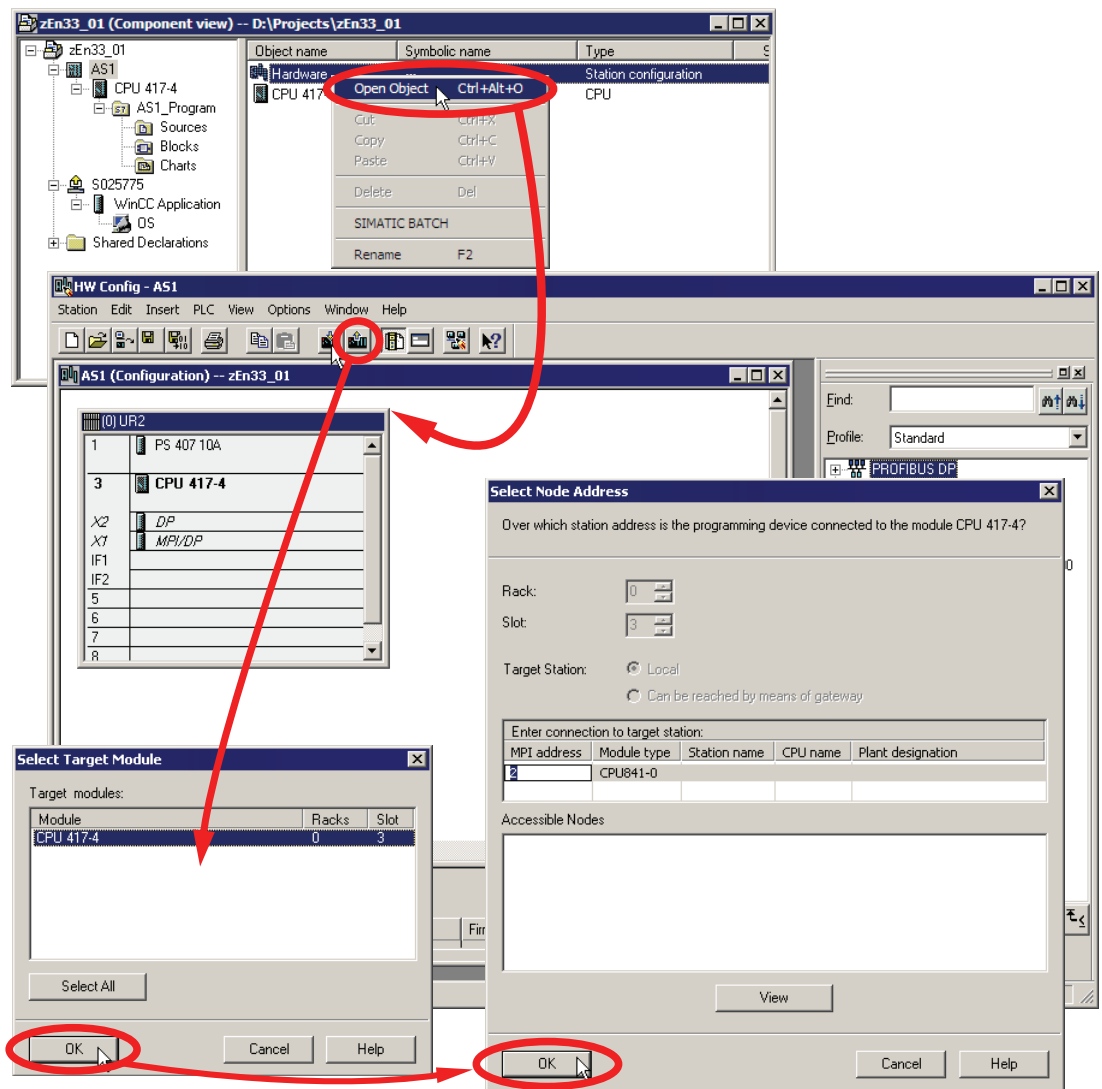
Procedure

1. Open PLCSim in SIMATIC Manager.



2. If it is not already set, use the interface parameter assignment "PLCSIM (TCP/IP)" for the connection between the PC and the simulated PLC. You have thus set the PG/PC interface and "PLCSIM(TCP/IP)" is displayed as interface in the status bar in SIMATIC MANAGER.

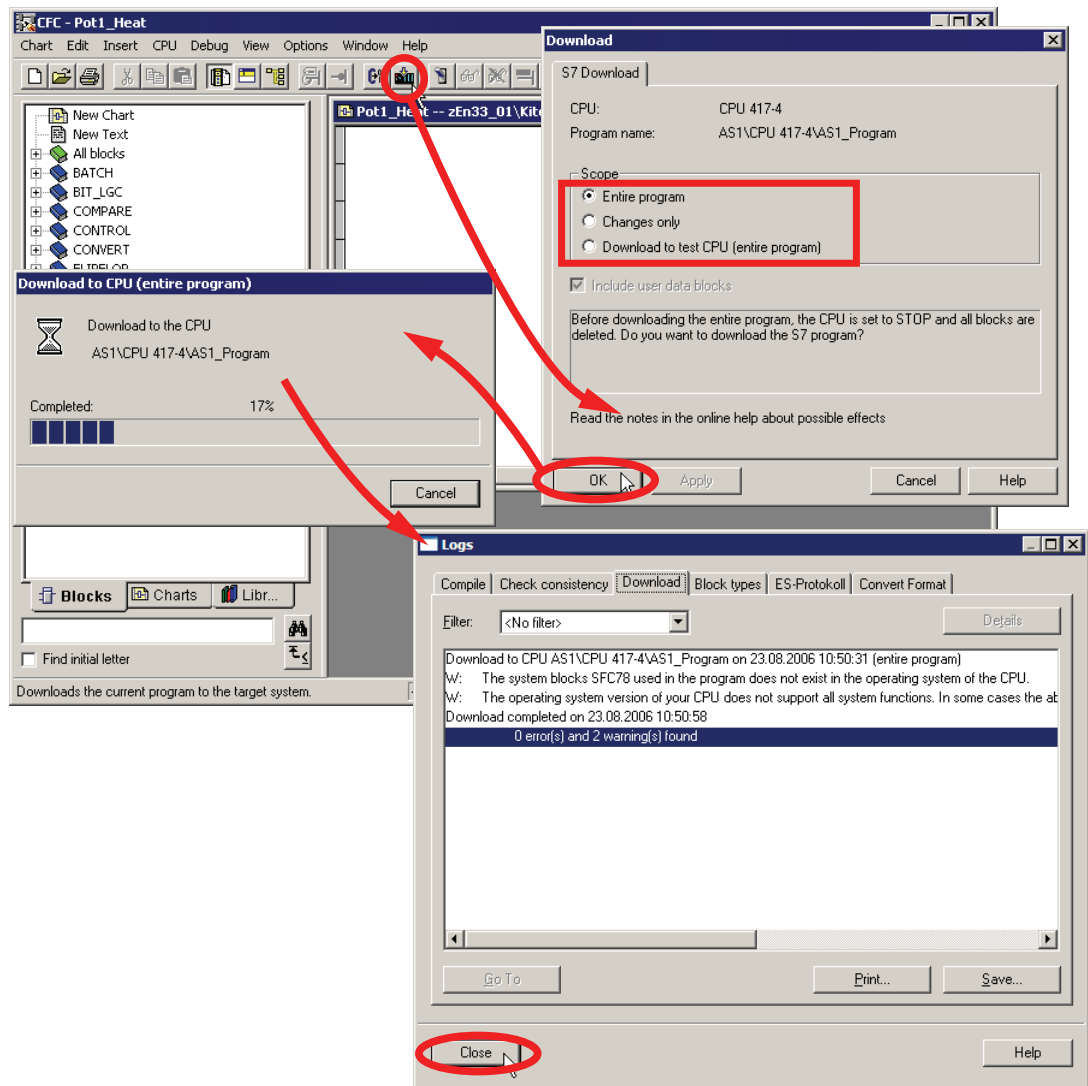
3. Download the HW configuration to PLCSIM.



4. Close HW Config.

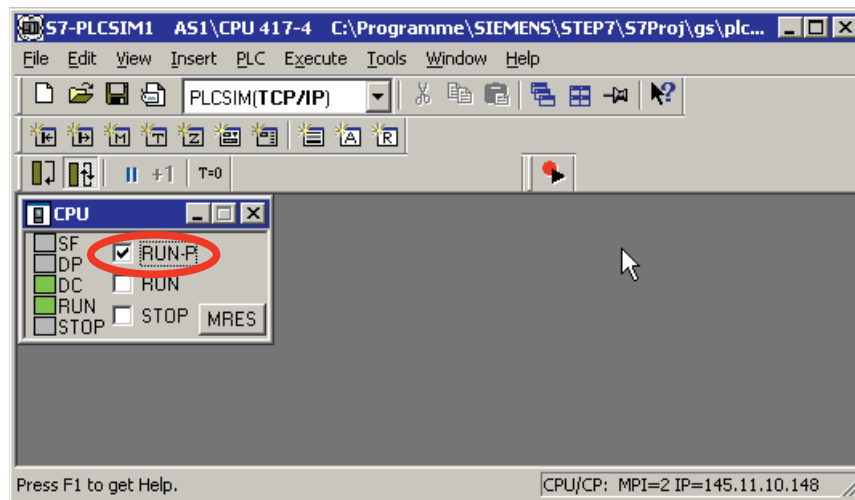
- Open any CFC chart from the chart folder of your project in the component view and load the complete program to PLCSIM.

Note: If the dialog "Download S7 - Read Back" is displayed, press "No". This means that parameters from the AS will not be read back before loading.



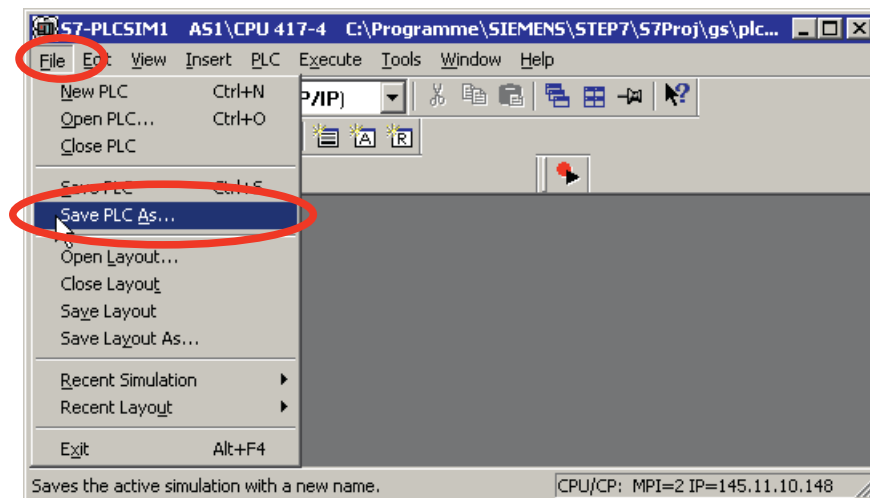
- Close the CFC Editor.

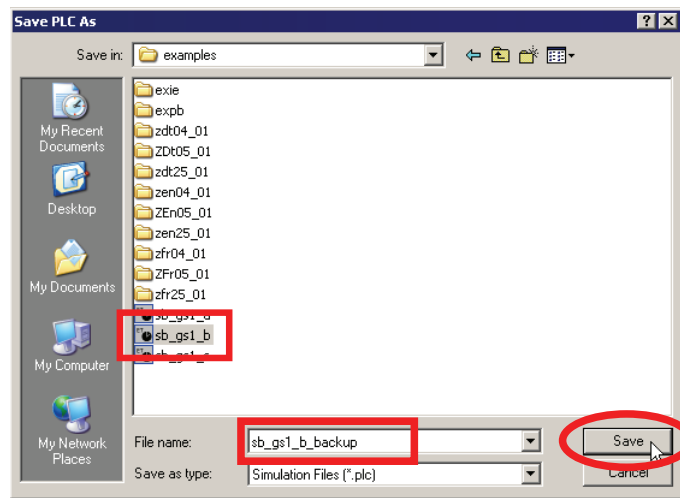
7. Start PLCSIM by setting "RUN-P".



8. Save the simulation data you downloaded in order to prevent its loss after you exit PLCSIM.

Steps 1 to 5 must be repeated the next time you open a PLCSIM session after having closed PLCSIM without saving the data. Saved simulations can be activated directly in "Run" mode by opening the corresponding file.

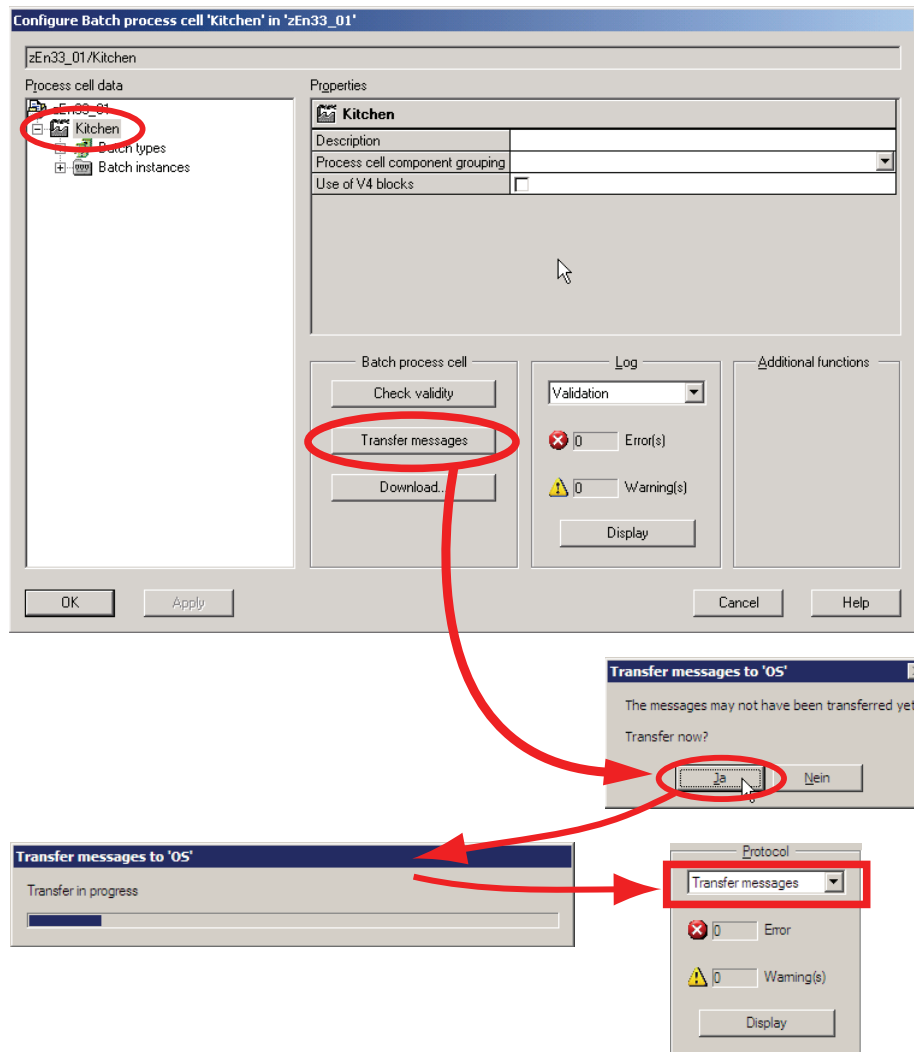




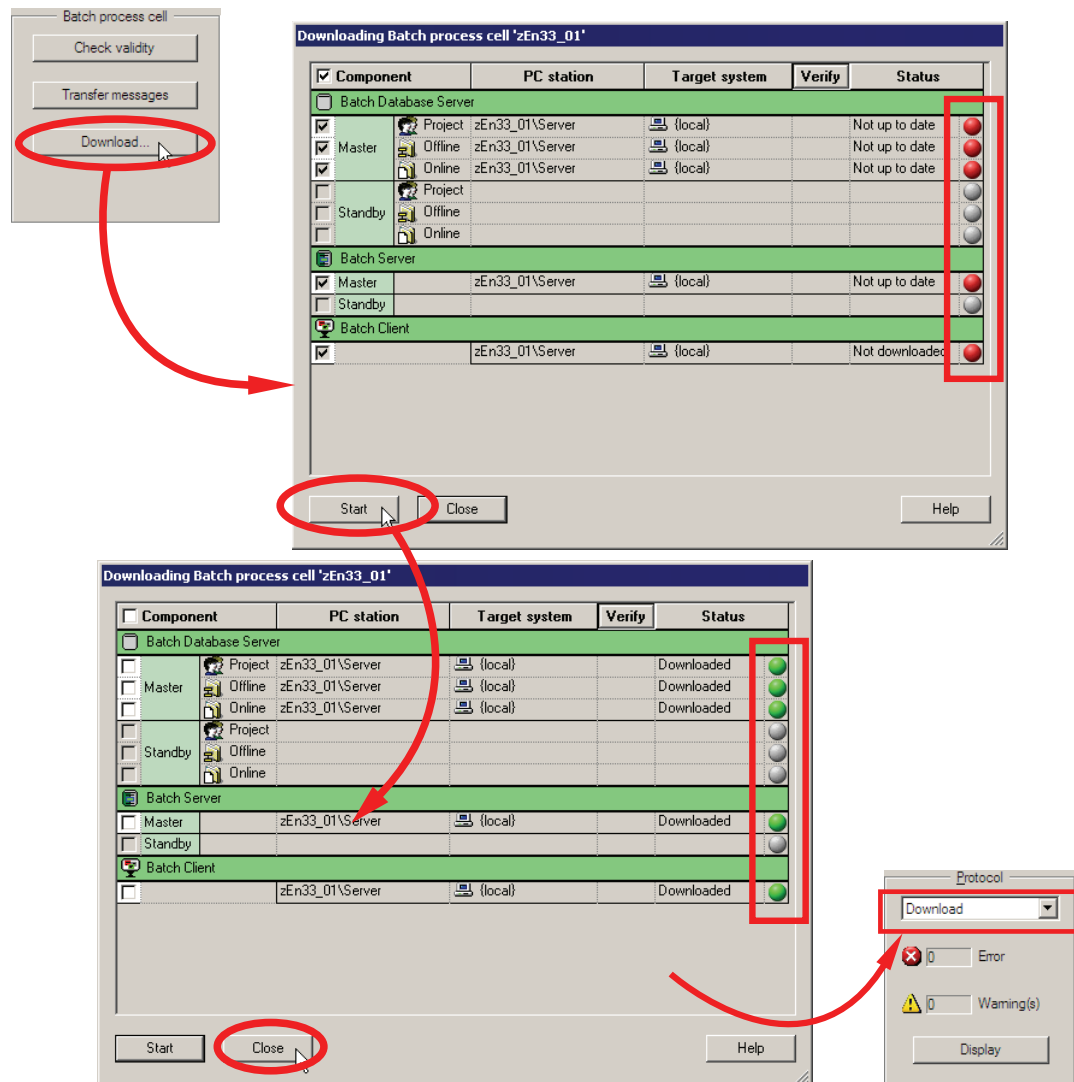
3.2.10 Downloading Batch process cell data

Procedure

1. Transfer the Batch-relevant data (ISA S88.01) to the OS. The compilation of the Batch data can take several minutes because the Batch OS messages are generated and transferred.



- Download the Batch process cell data you generated on the ES to the BATCH Server and Client. The BATCH Server and Client in your configuration are operated on a single PC.



- Click OK to exit the BATCH configuration dialog.

Note

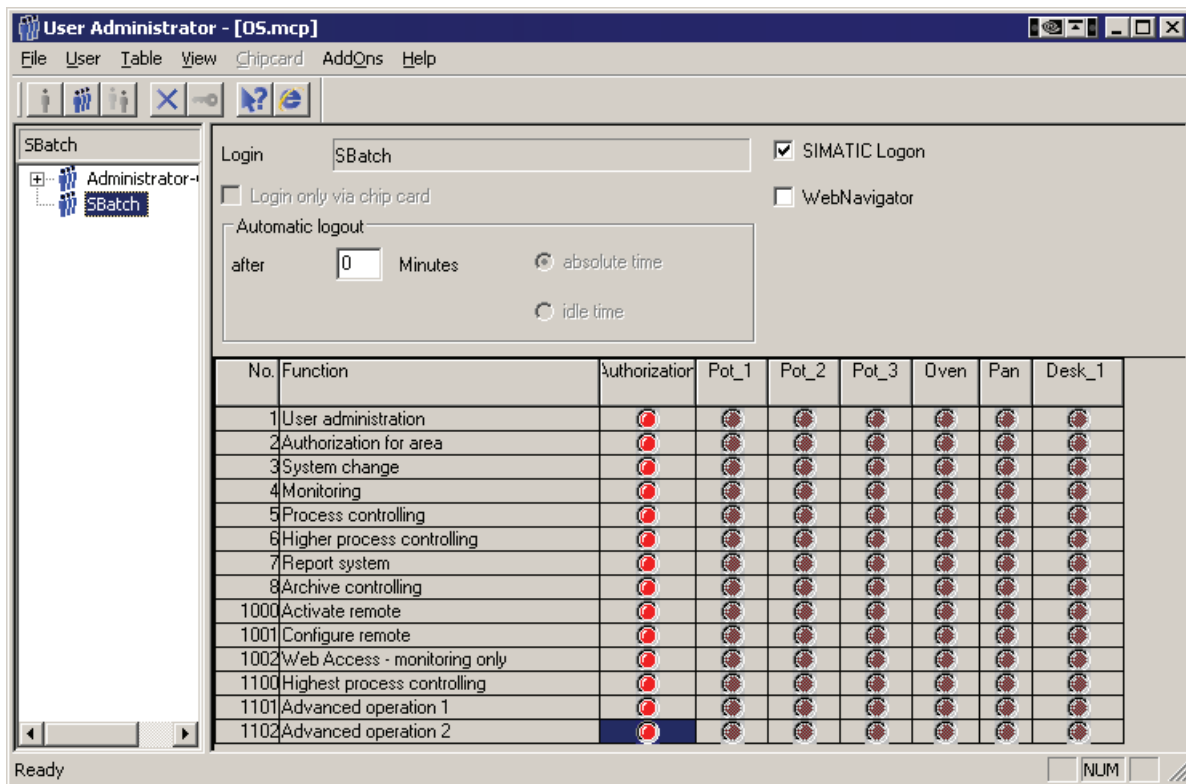
Messages in other languages

Message output in languages other than German / English is only available if project data was configured, compiled and downloaded in the corresponding regional language.

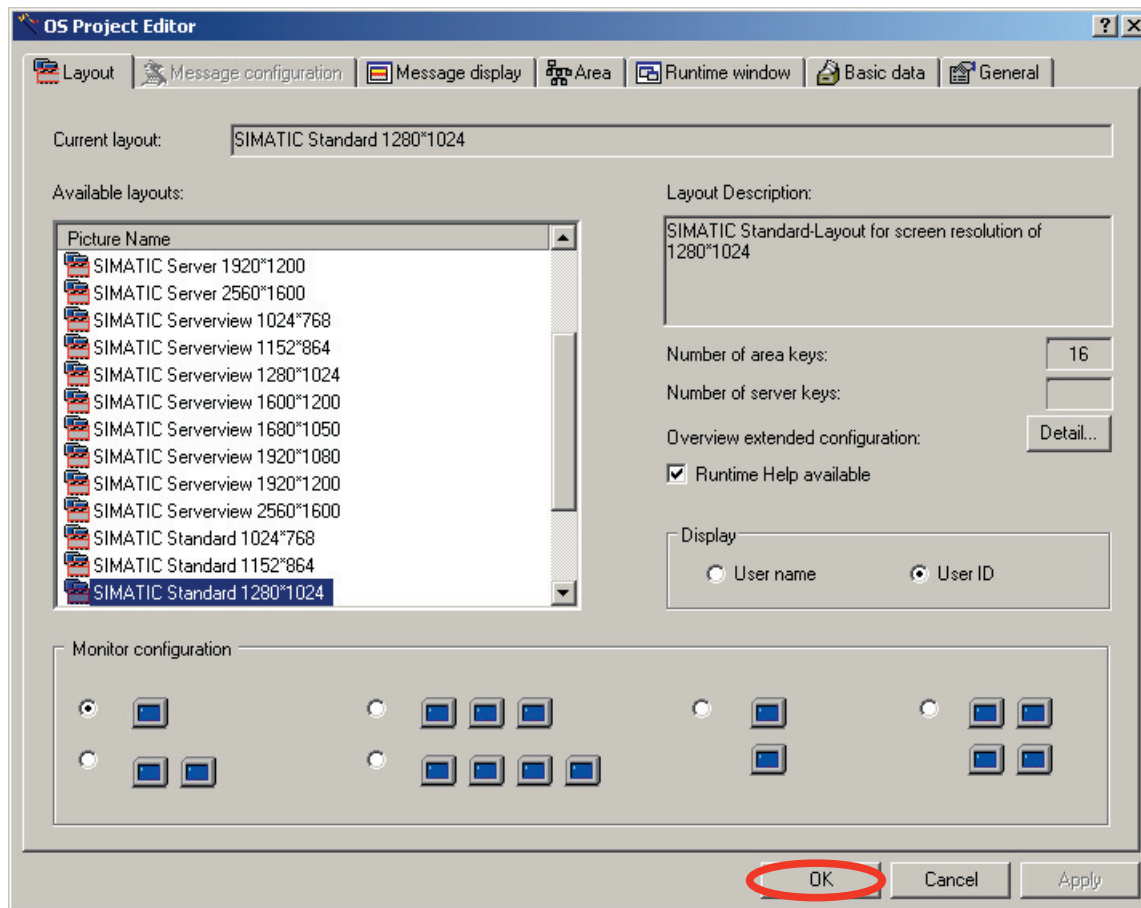
3.2.11 Starting the OS

Procedure

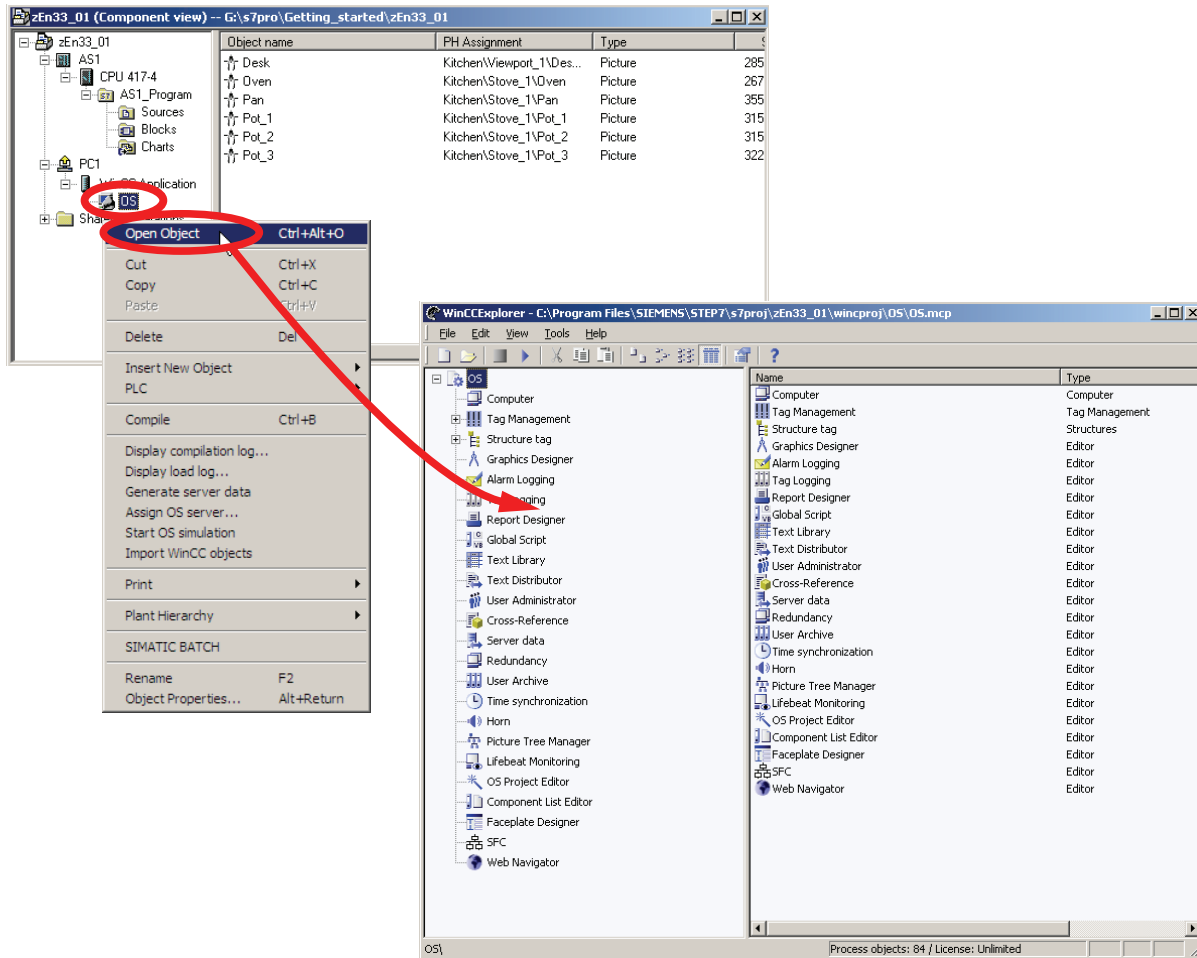
1. In the Windows Computer Management, create a new user with user name and password. In our example, the user is "SBGettingStarted".
2. Then, create a new Windows group. In our example, this is the "SBatch" group.
3. Add the new Windows user to the "SBatch" group and the existing "Logon_Administrator" group.
4. Open the WinCC Explorer of the OS.
5. Create the "SBatch" Windows group you just created again in "User Administrator" with unrestricted rights.
6. Select the "SIMATIC Logon" check box. Close the User Administrator.



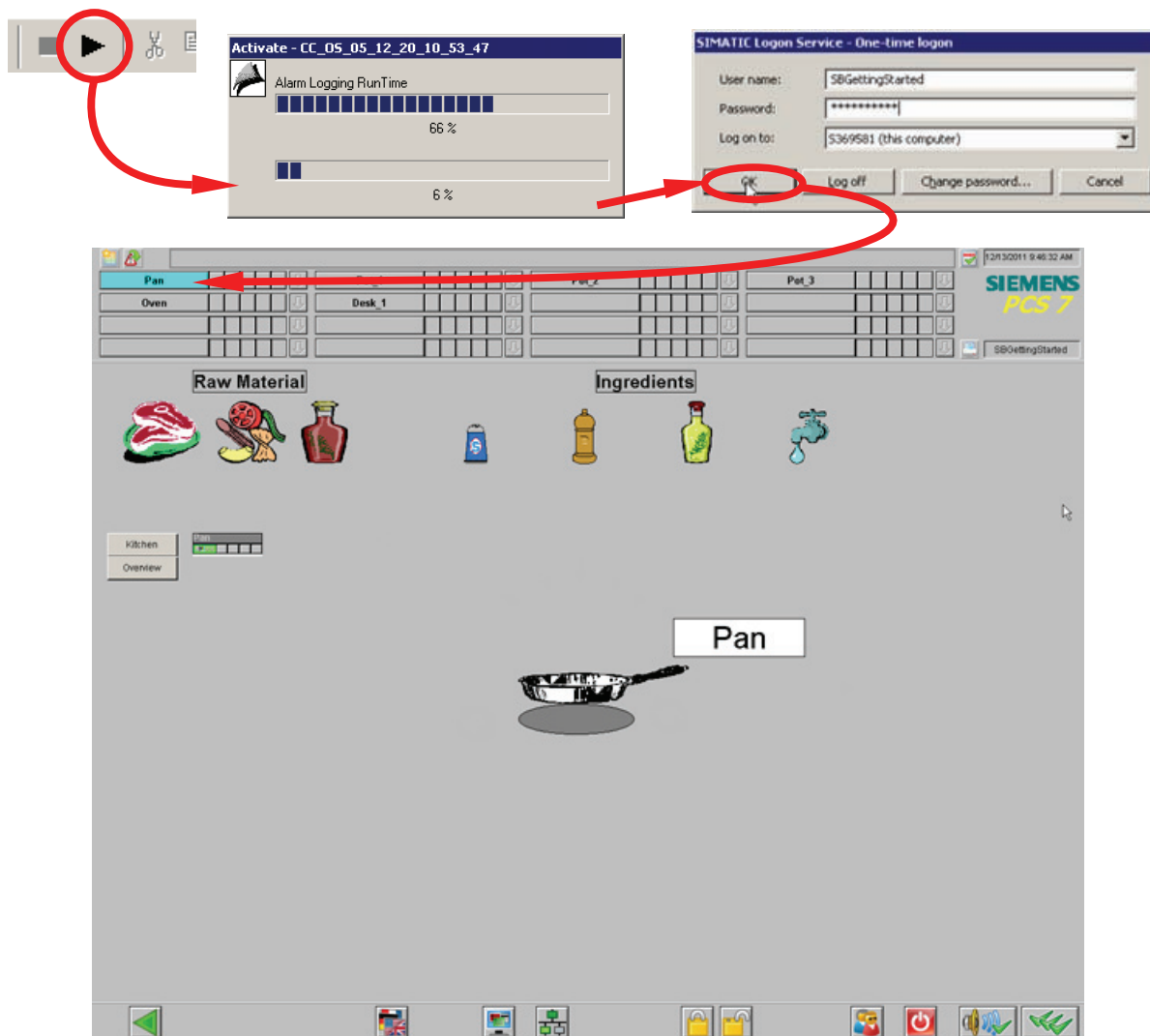
7. Open the OS Project Editor and click "OK". This function is used to configure the WinCC Runtime user interface and the alarm system. This operation may take a few minutes.



8. Start Runtime on the OS. An initial startup may take a few minutes. Log in with the user logon data you just created.

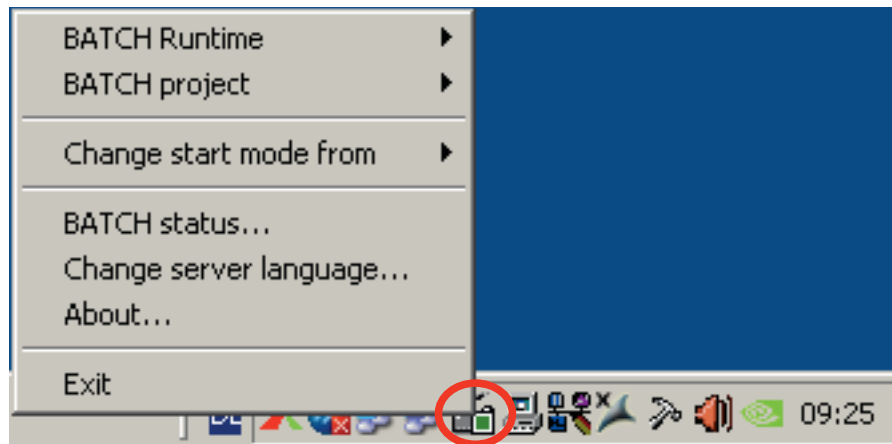


3.2 Configuration



3.2.12 Starting the BATCH Launch Coordinator

The BATCH Start Coordinator is visible as a symbol in the taskbar in the bottom right on your desktop. You make operator input in a shortcut menu which you open by right-clicking on the symbol.



The start mode of the BATCH Launch Coordinator is set to "automatic" as standard. This means that the BATCH Launch coordinator starts the BATCH project and BATCH Runtime after successfully starting WinCC Runtime.

If the BATCH Launch Coordinator was ended, you have the possibility of restarting it from the Windows Start menu in the folder BATCH > BATCH Launch Coordinator.

If the start mode is set to "manual", you have to start both the BATCH project and BATCH Runtime yourself in the shortcut menu of the Launch Coordinator. Please note that the start mode of the BATCH Launch Coordinator can only be set or changed by users who are logged on with administrator rights.

3.2.13 Loading the recipes and materials included in the package

Introduction

Load the supplied recipe database "sb_gs1_b.sbb" for the "Kitchen" process cell. In addition to objects for batch control, information on users, groups and role assignments is saved in the restore file.

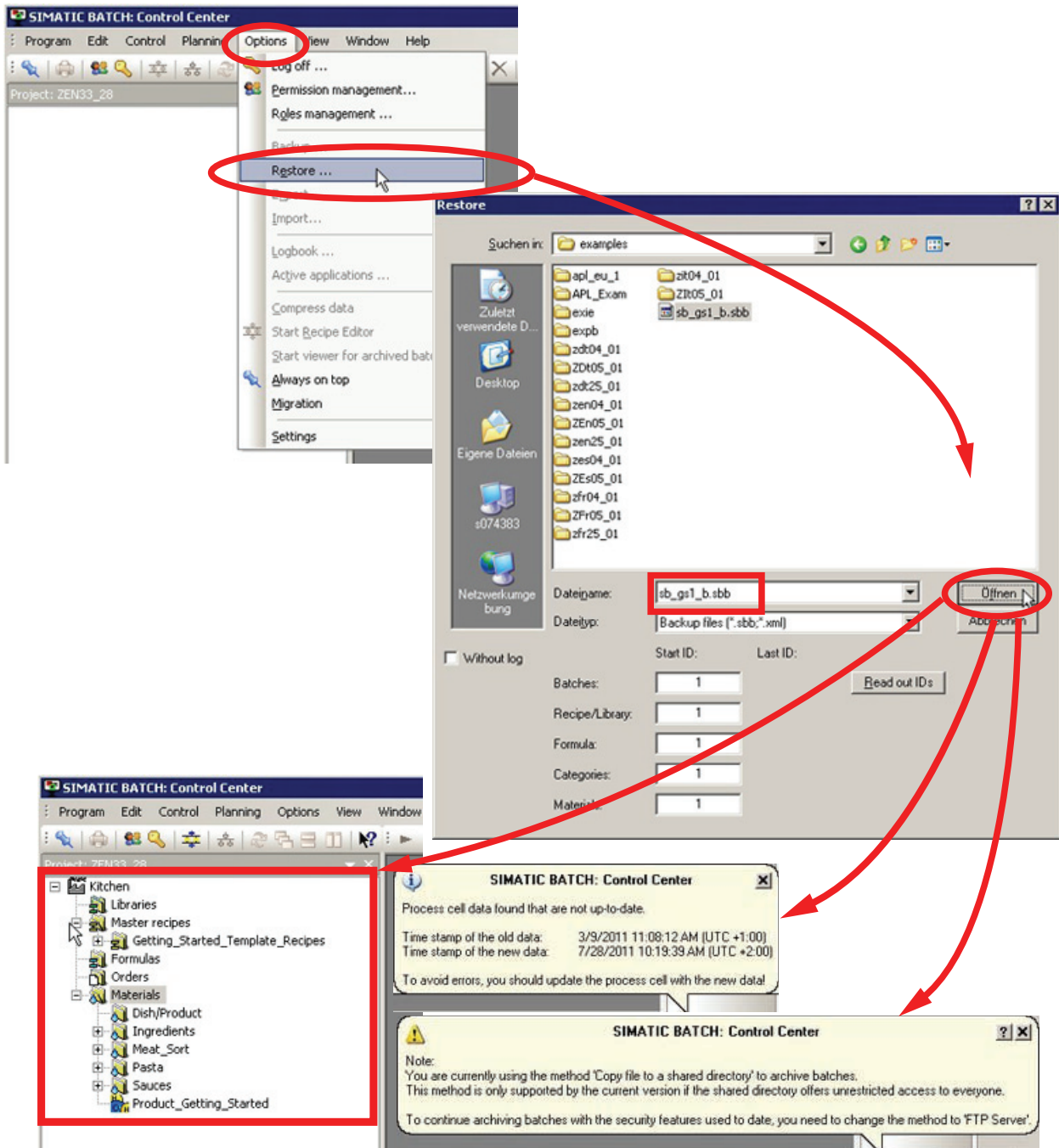
BATCH Control Center

The BATCH Control Center (BatchCC) is the central component for:

- Batch scheduling
- Batch control
- Management of all BATCH data
- For libraries, master recipes, formulas, materials and management of rights and roles

Procedure

1. Open the BATCH Control Center.
2. In the BATCH Control Center, execute a "Restore" of the SBB file included in the package. This SBB file is available at "..\Siemens\STEP7\examples\sb_gs1_b.sbb".



Note

Restore not possible

If the "Kitchen" process cell is already in the BATCH Control Center, you can longer use the "Restore" command. The associated recipe database has already been created and loaded. However, you can perform all other configuration tasks. Assign new names to objects such as materials, recipes or batches.

3.2.14 Setting up roles management in SIMATIC Logon

Introduction

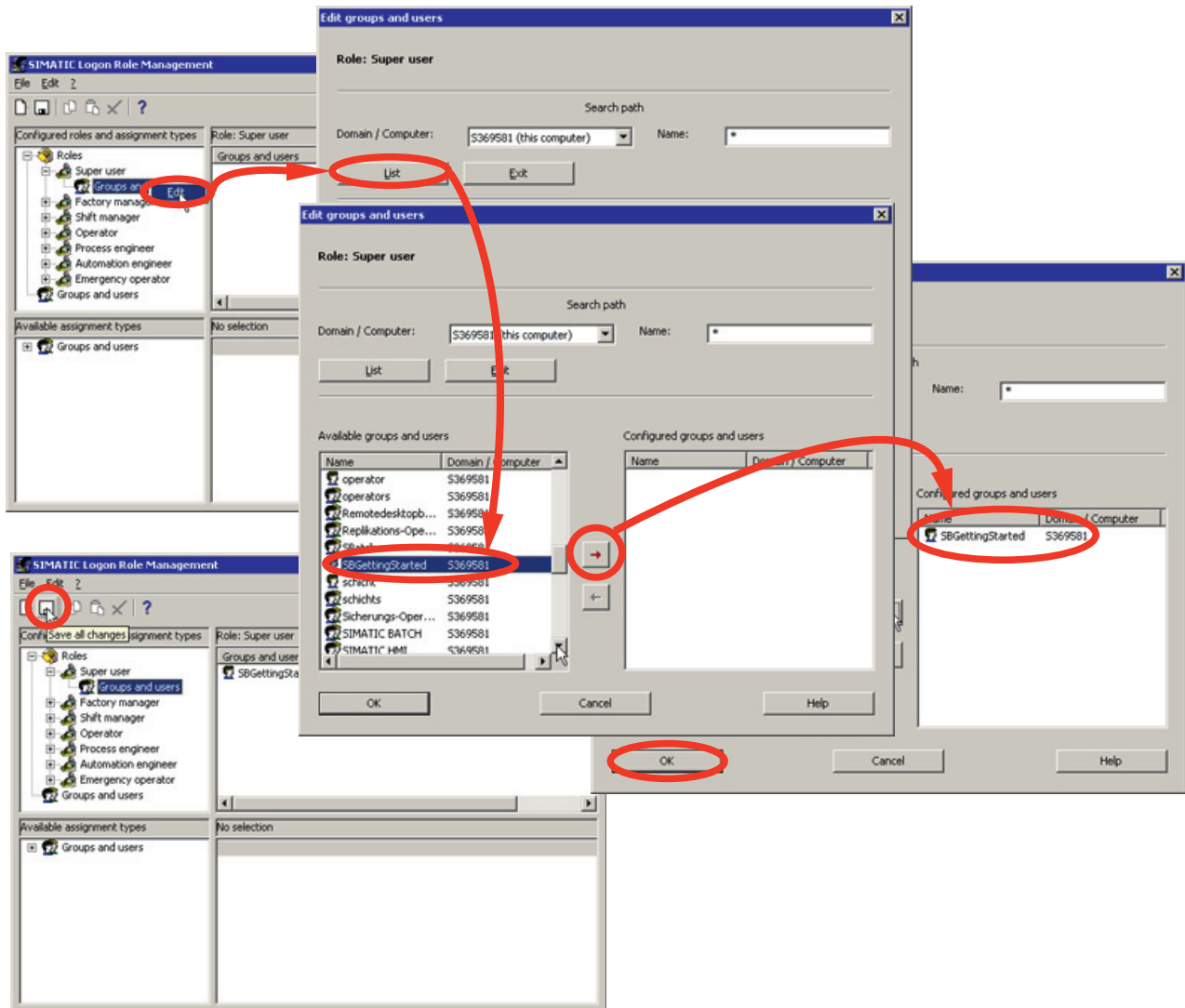
In order to also obtain unrestricted access to BatchCC with the user logged on in WinCC Runtime, the logged on user is added to the "Superuser" role in the SIMATIC Logon roles management.

Note

Information on role assignment in the restore file is related to the PC on which the backup file was created. We therefore generally recommend that you always perform the role assignment again in the SIMATIC Logon roles management.

Procedure

1. Open the roles management via the menu command Options > Roles management in the BATCH CC and add the Windows user "SBGettingStarted" to the "Superuser" role.

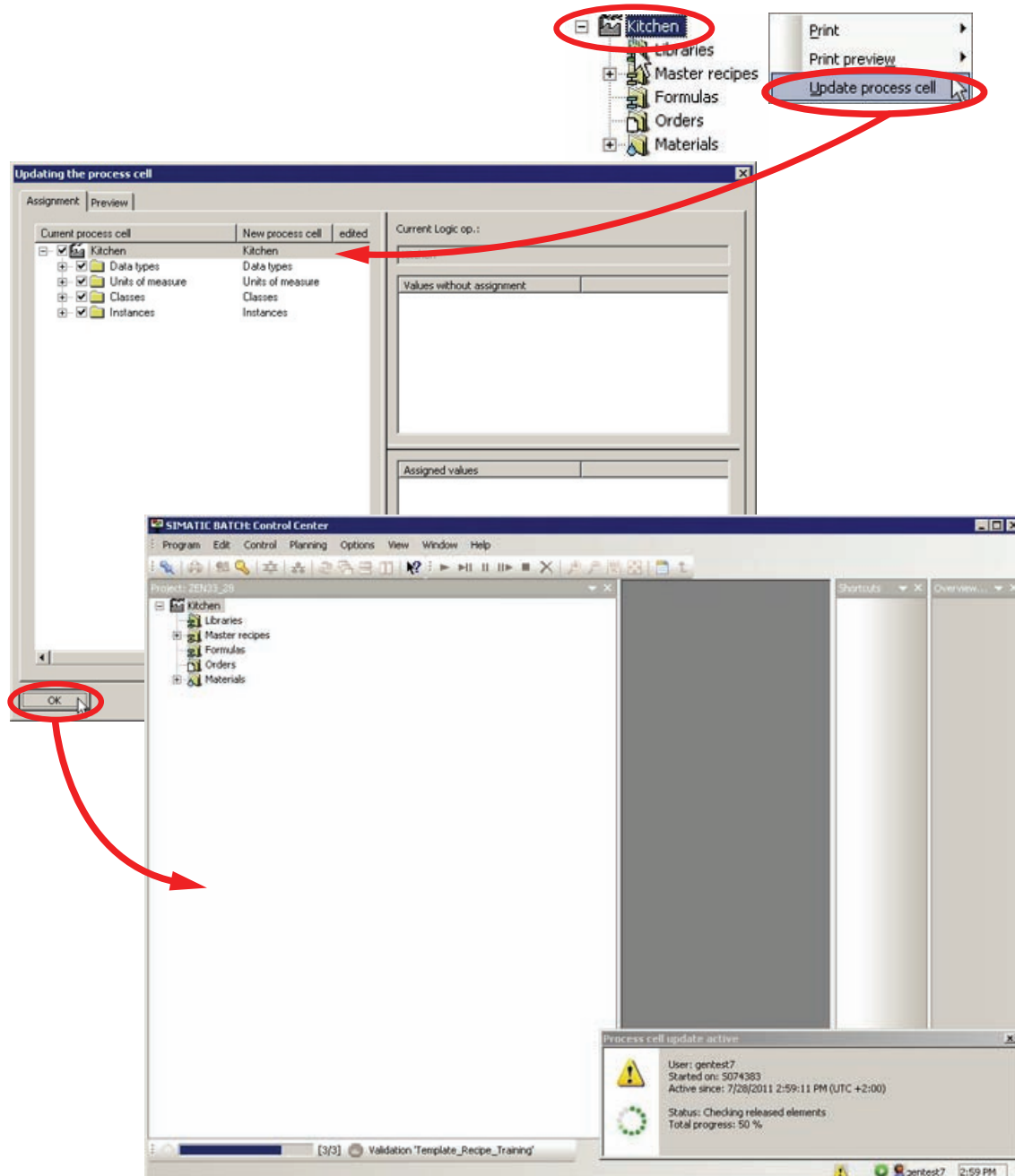


2. Exit the roles management

3.2.15 Updating downloaded Batch process cell data

Procedure

Open the Batch Control Center to update the Batch process cell data you downloaded.



3.2.16 The Recipe for Pasta Piccata Milanese

Recipe

Meal	Piccata Milanese
Quantity	2.9 kg (reference quantity)
Ingredients	100 ml oil 1.9 kg pasta 50 g salt 1 l tomato sauce

Instructions		Editing Options and Results
1	Prepare water	Fill a pot with 3 liters of water, add 100 ml of oil and a pinch of salt, heat to 100°C
2	Cook pasta	Put 1.9 kg of pasta in the boiling water and cook for 6 minutes.
3	Prepare sauce (while cooking pasta)	Pour 1 liter of tomato sauce in a pot. Heat for 5 minutes at 40 ° C while stirring
...	...	
4	Completed	Add salt and/or pepper to flavor. Serve the pasta and sauce

3.2.17 Setting up the base materials

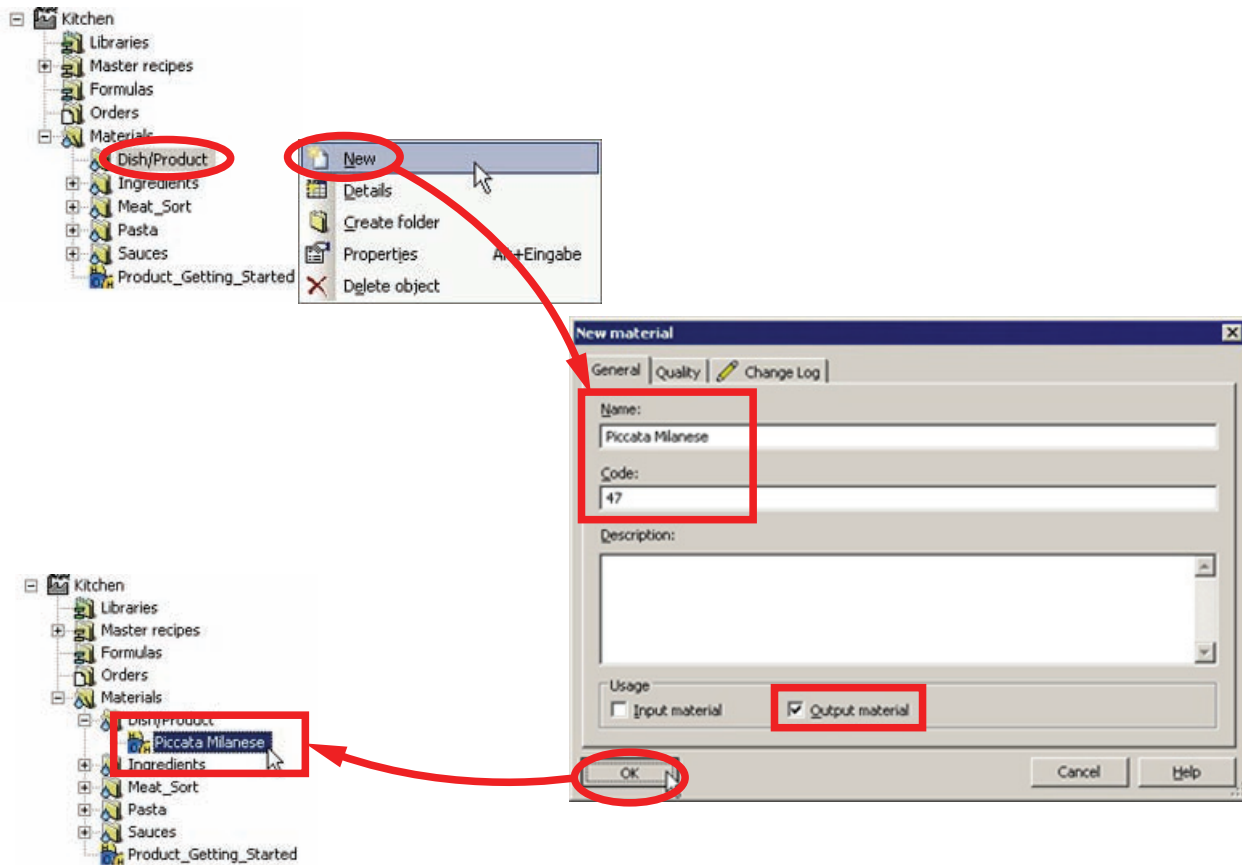
Defining output materials

At the beginning, you must define the materials and as an option the qualities for input materials/output material for SIMATIC BATCH once.

You define the materials in the list boxes displayed in the subsequent dialogs for recipe creation and batch planning. Materials and qualities must also be assigned a unique code (for example an internal company code). This code can, for example, be used to specify setpoint output and process value input at the interface blocks or SFC types to identify the material or product. In order to write recipes, material information needs to be defined. Input and output materials with various qualities can be created. These are created in the BatchCC in the Materials folder in the process cell you have loaded.

Setting up the base materials

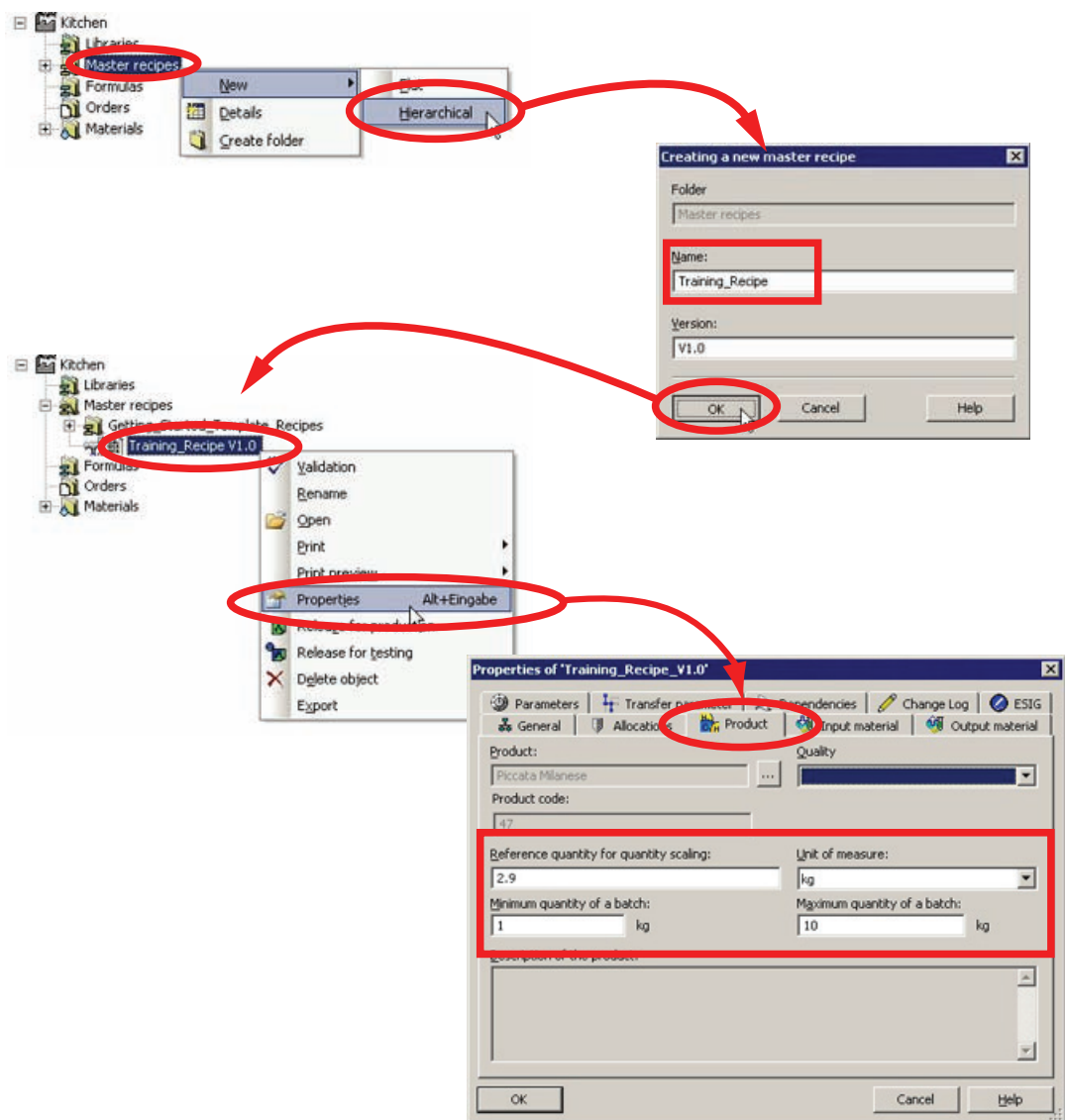
Create a new output material with the name "Piccata Milanese" and the material code "47" and place it in the "Dish/Product" folder.



3.2.18 Creating a master recipe in BatchCC

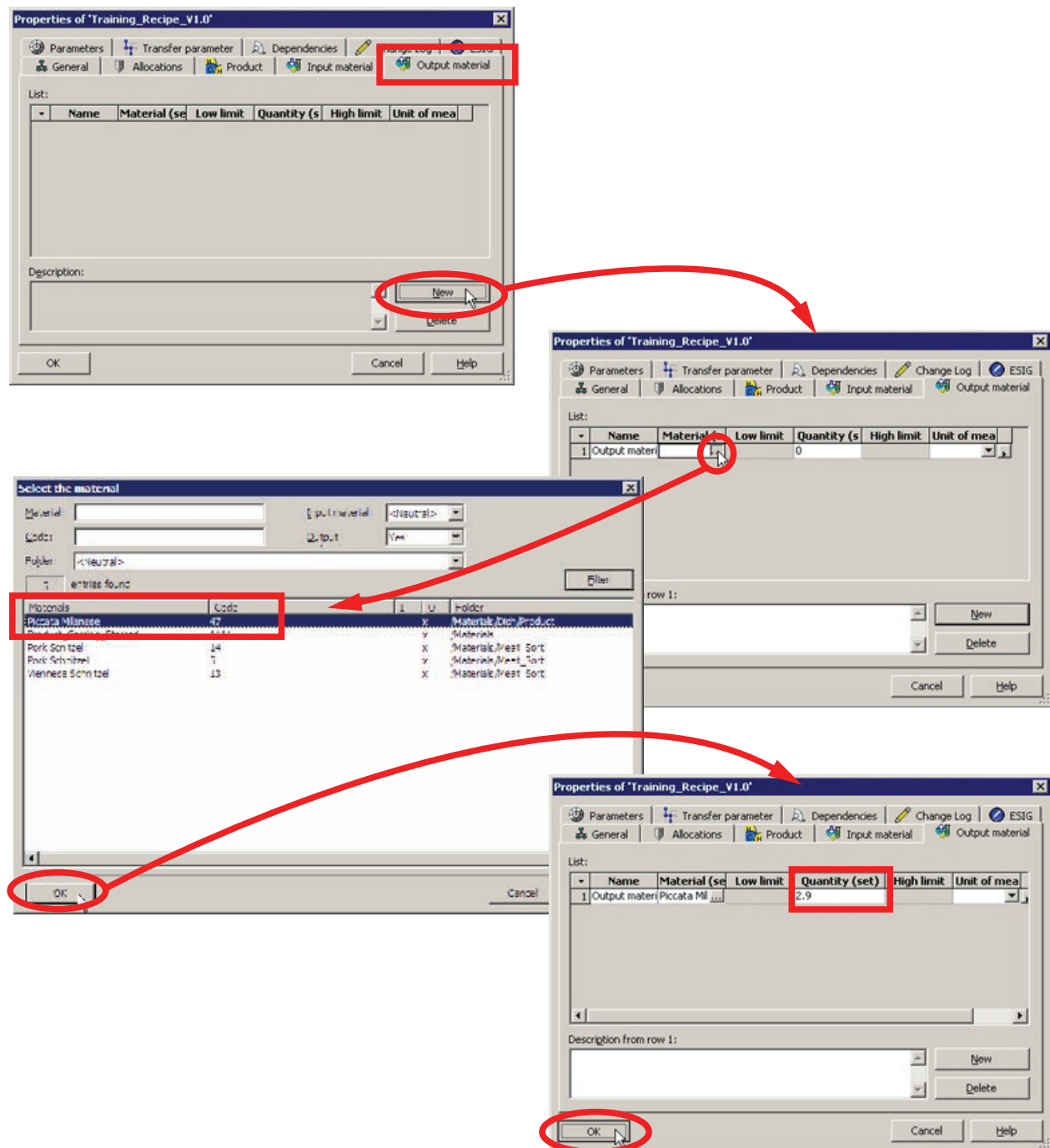
Procedure

1. Create a new hierarchical master recipe with the name "Training_Recipe" for the product "Piccata Milanese" with the reference quantity 2.9 kg (all other information in the recipe for "Piccata Milanese" refers to this amount). The minimum quantity for production is 1 kg and the maximum quantity 10 kg (maximum and minimum quantity that can be cooked in this process cell, in our case the kitchen).



3.2 Configuration

2. Define the main product (= Piccata Milanese) as material output.

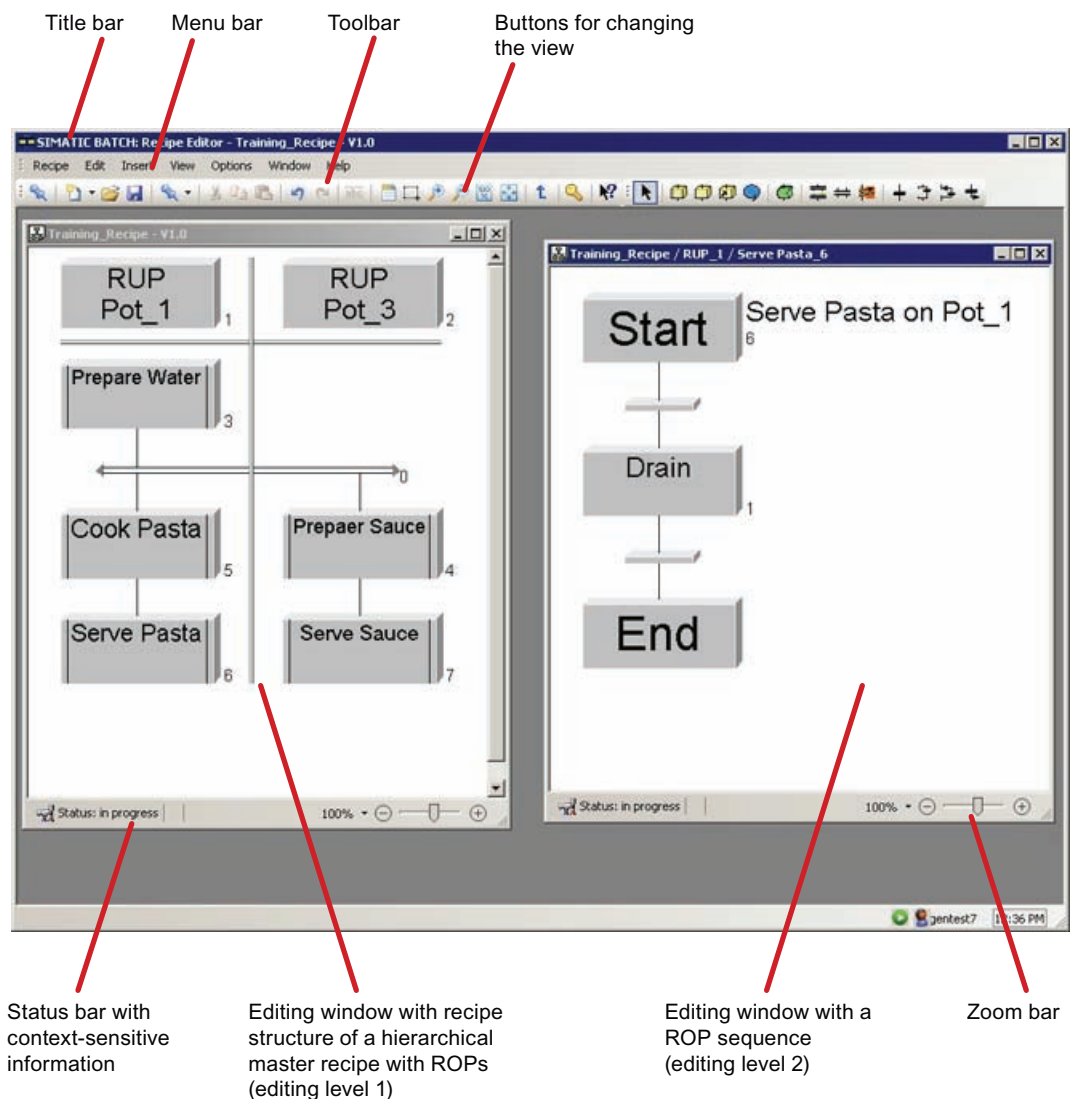


3.2.19 Setting up a recipe structure in the recipe editor

3.2.19.1 Introduction of the Recipe Editor

Layout of the Main Window in the Recipe Editor

The basic layout of the user interface of the BATCH Recipe Editor is shown in the figure below which illustrates an example of a hierarchical recipe. You can create or modify recipes in the editing windows Using the structure elements of the "Insert" menu.



Basic integration of the hierarchy in the BATCH Recipe Editor

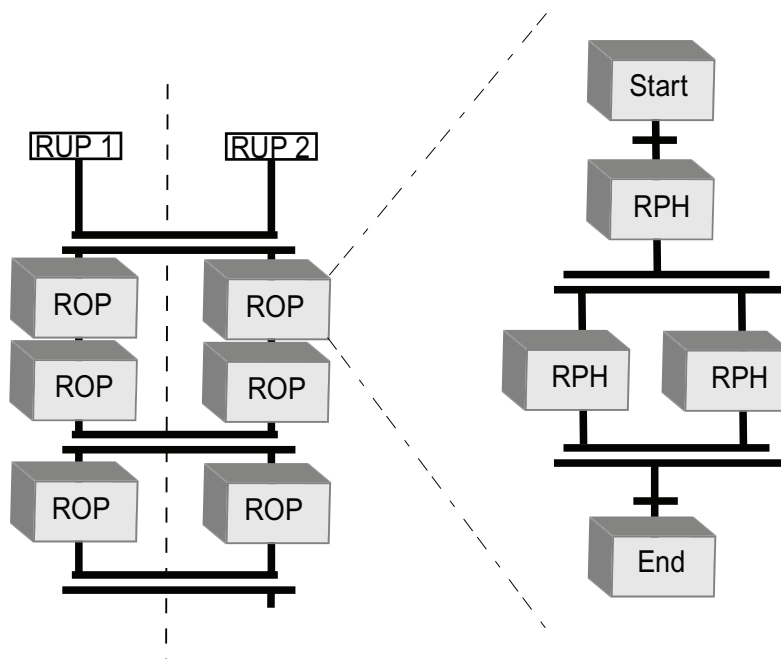
The diagram below shows the basic integration of the hierarchical structure for editing in the BATCH Recipe Editor. The structure of a hierarchical recipe is edited at two levels, that is, editing levels 1 and 2.

Editing level 1 (RUPs and recipe operations)

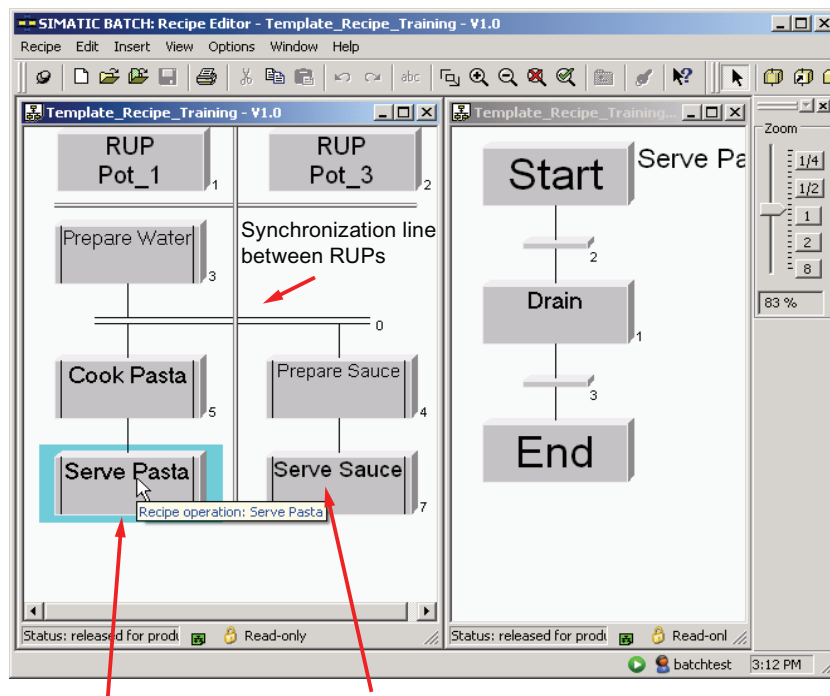
Editing level 1 is intended for the Plant view in which the processes of several cells can be synchronized. A recipe unit procedure (RUP) is made up of recipe operations (ROPs). To structure the process, you can use double lines to synchronize. This allows you to synchronize the timing of ROPs in several recipe unit procedures.

Editing level 2 (recipe phases)

Editing level 2 is used to create ROP sequences. An ROP sequence begins with a Start step. The Start step is followed by a transition that defines the start conditions. Every ROP sequence ends with an End step. A transition that defines the end condition precedes every end step.



Implementation in the BATCH Recipe Editor



1. Recipe unit procedure (RUP 1) with recipe operations (ROPs)

2. Recipe unit procedure (RUP 1) with recipe operations (ROPs)

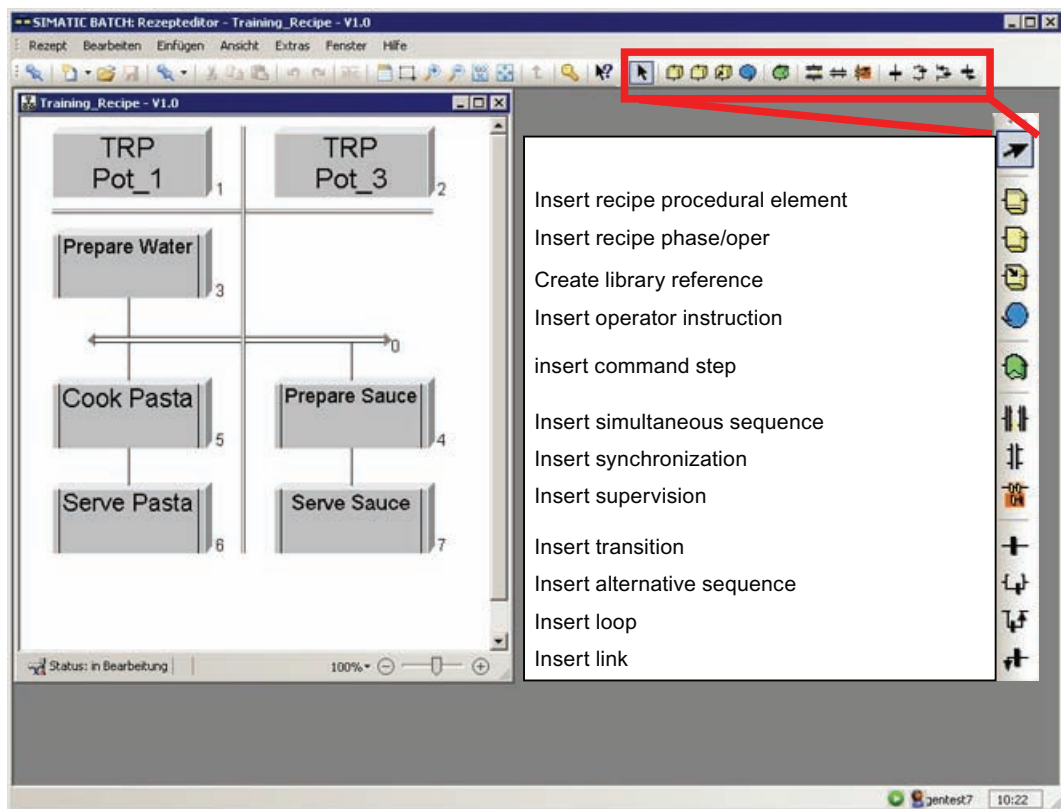
ROP sequence with the SFC structure elements, steps, transitions, branches etc.

A RUP is always shown within a column, i.e. the ROPs are arranged vertically

Editing level 1

Editing level 2

Tools for Creating the Recipe Structure



The recipe editor has tools for the simple creation of recipe structures such as:

- Inserting S88 procedure elements such as recipe unit procedures (RUP), recipe operations (ROP) and recipe phases (RPH)
- Instead of a recipe operation, a referenced library operation (Lib-ROP) can also be inserted
- Inserting operator instructions or operator dialogs
- Inserting a command step
- Inserting monitoring
- Inserting transitions

- Inserting simultaneous branches
- Inserting alternative branches
- Inserting synchronization lines
- Inserting loops
- Inserting a jump

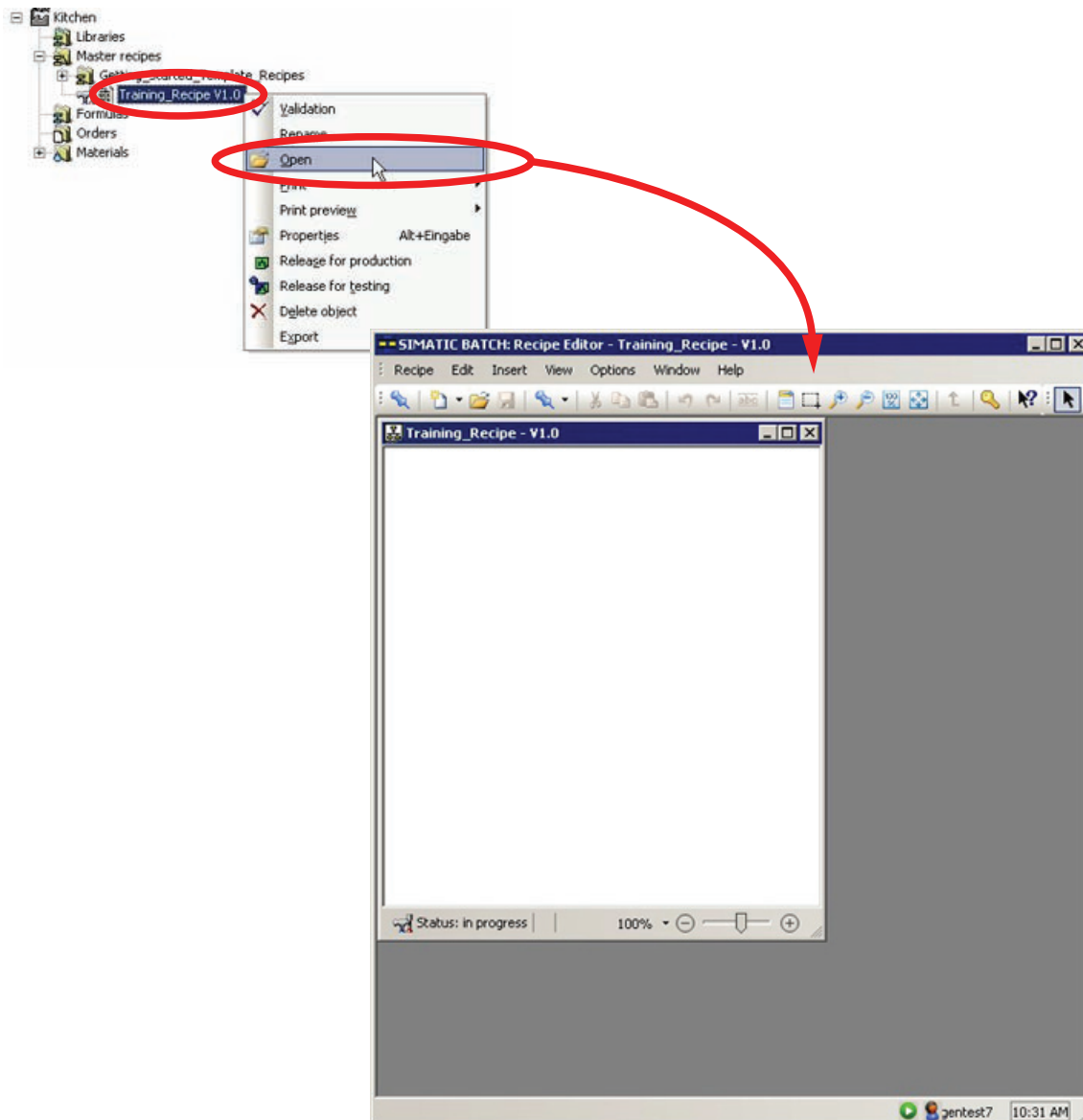
3.2.19.2 Working on editing level 1

Introduction

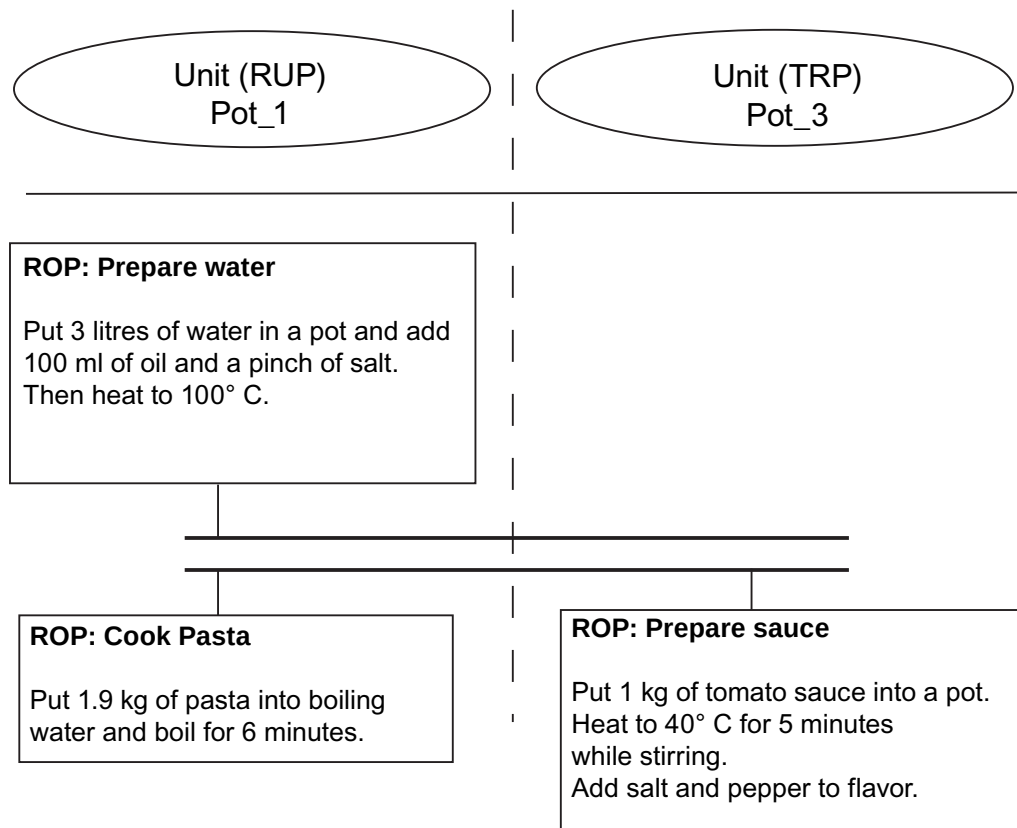
Set up the recipe structure in the Recipe Editor in accordance with the description in the recipe.

Procedure at editing level 1

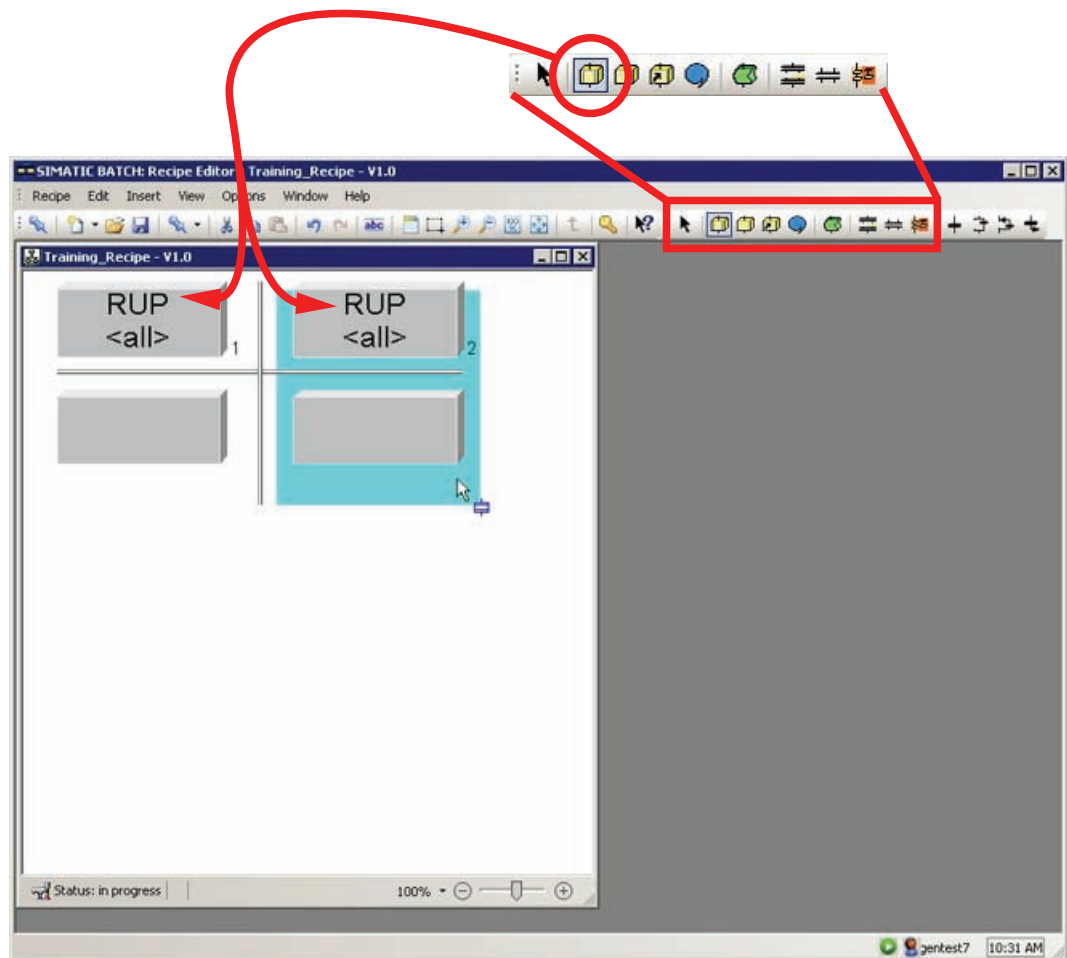
1. Open the recipe editor with your "Training_Recipe" master recipe from the BATCH Control Center.



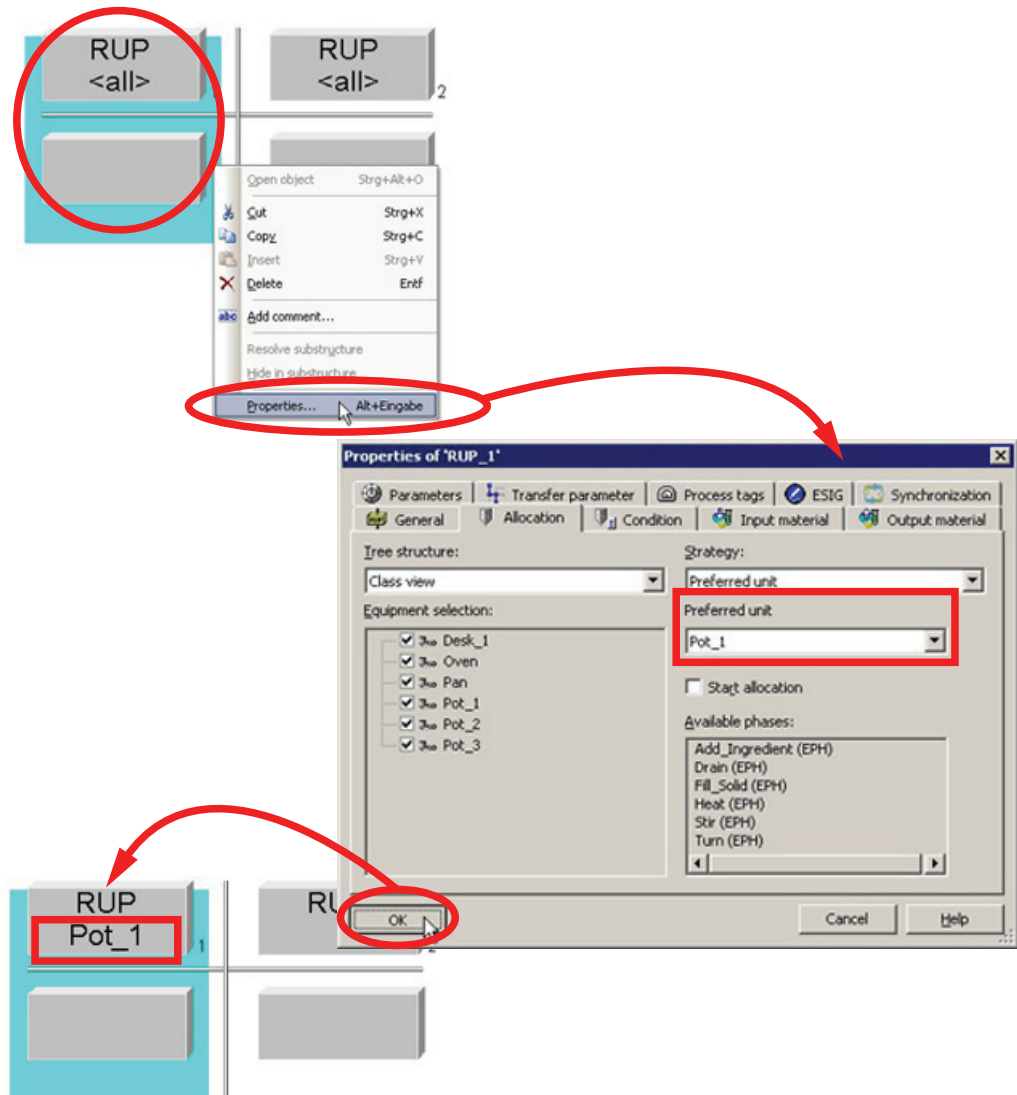
2. Create the "Piccata Milanese" dish using the corresponding tools and recipe description. Refer to the diagram on this page for help.



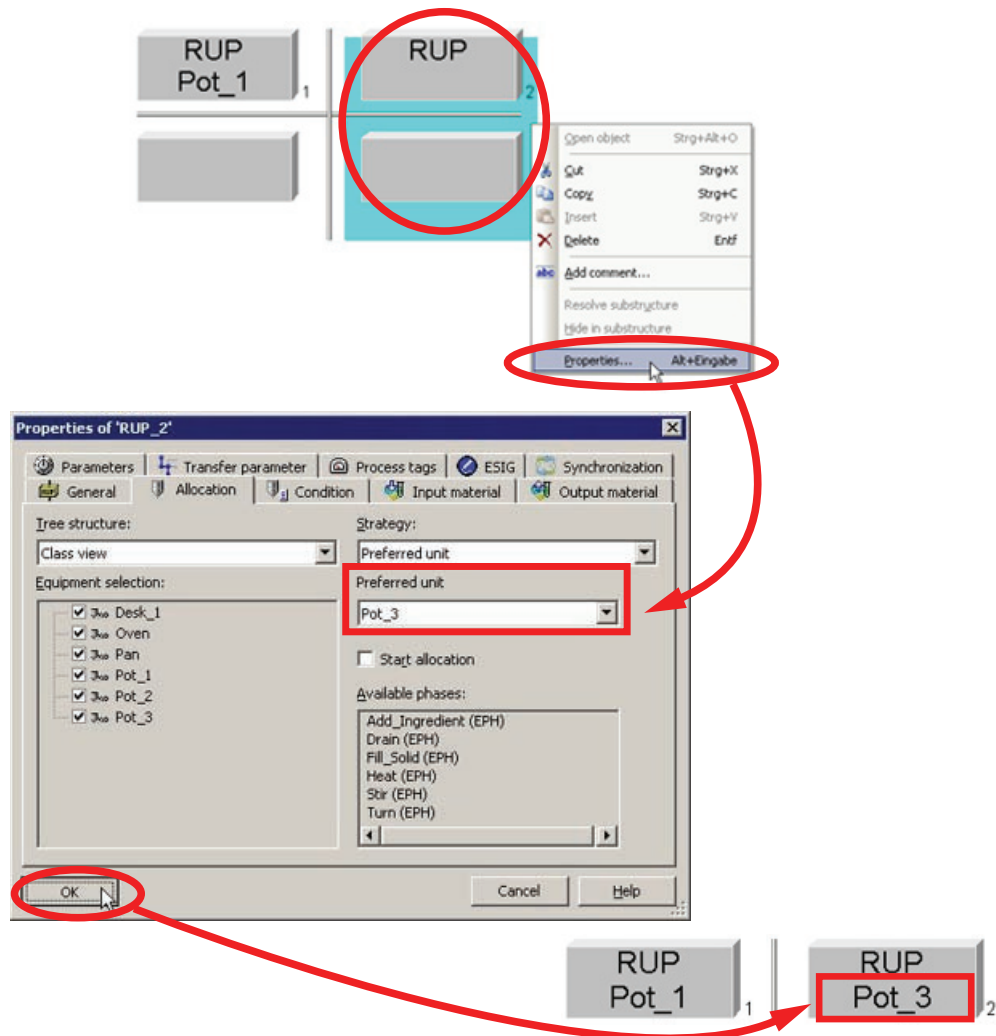
3. Create two RUPs (recipe unit procedures).



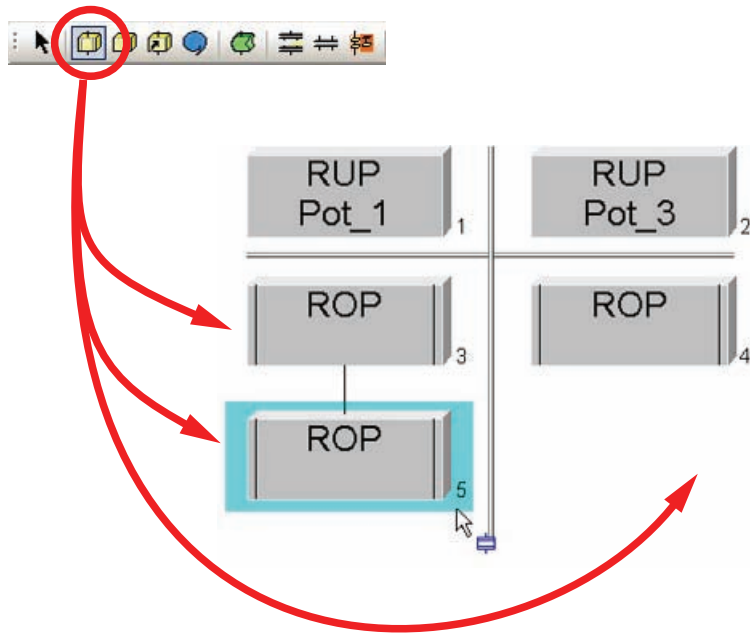
4. Assign the "Pot_1" unit and the "Preferred unit" strategy to the left RUP. Toggle the toolbar to "Select" mode.



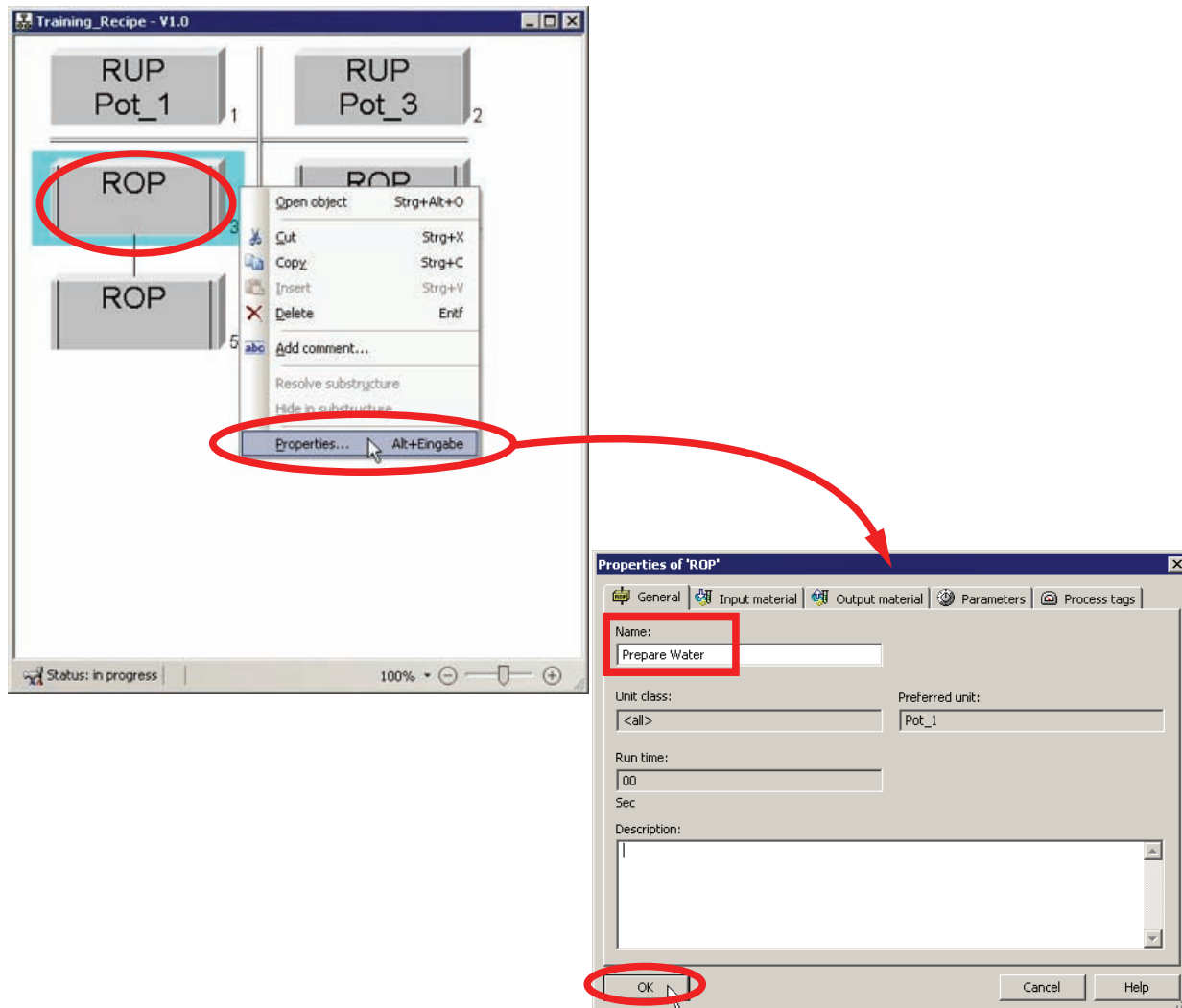
5. Assign the "Pot_3" unit and the "Preferred unit" strategy to the right RUP.

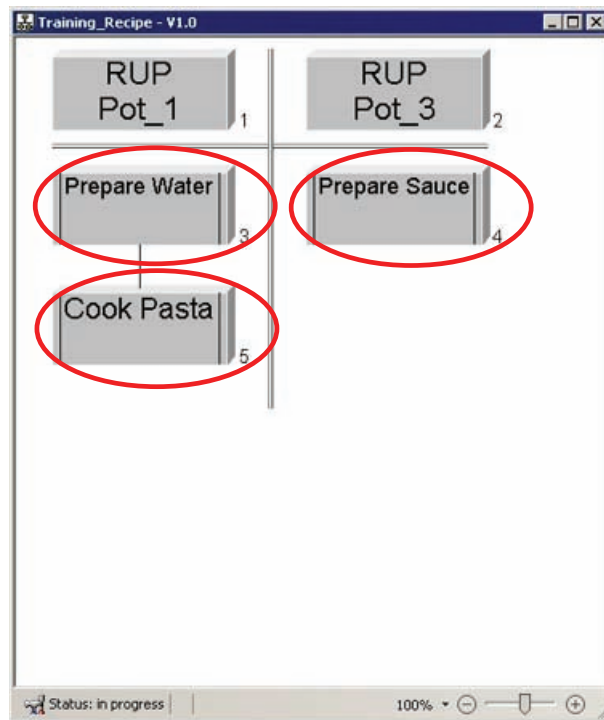


6. Insert the relevant ROPs (recipe operations).



7. Assign the texts "Prepare Water", "Cook Pasta" and "Prepare Sauce" to the ROPs (recipe operations).

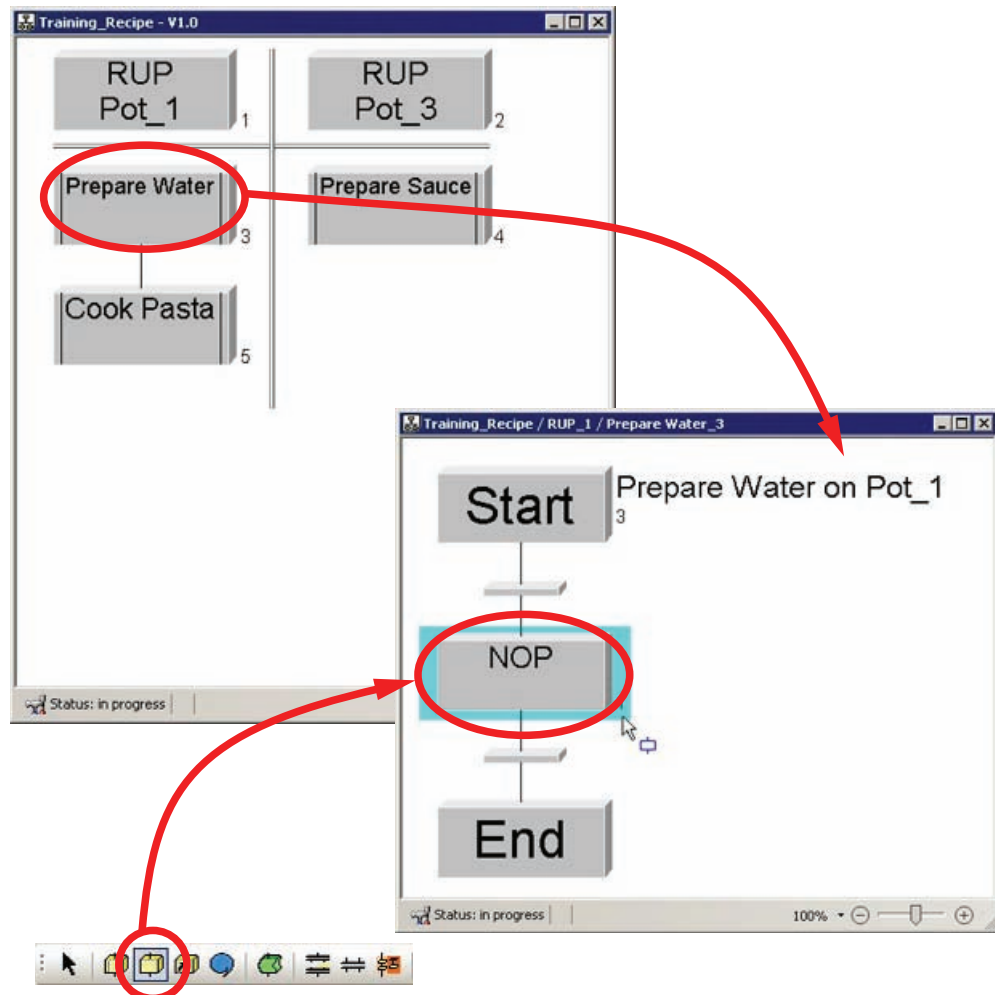




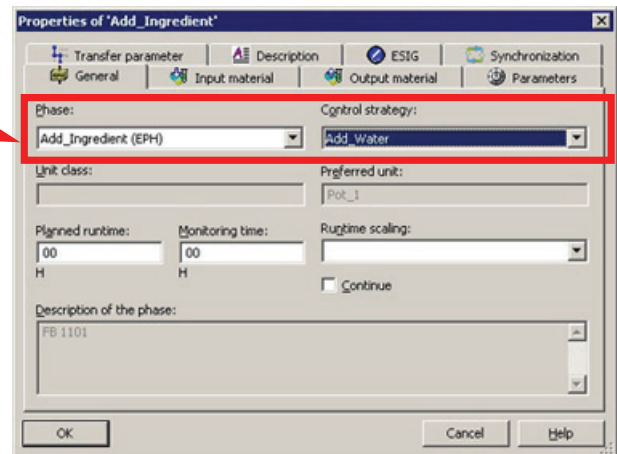
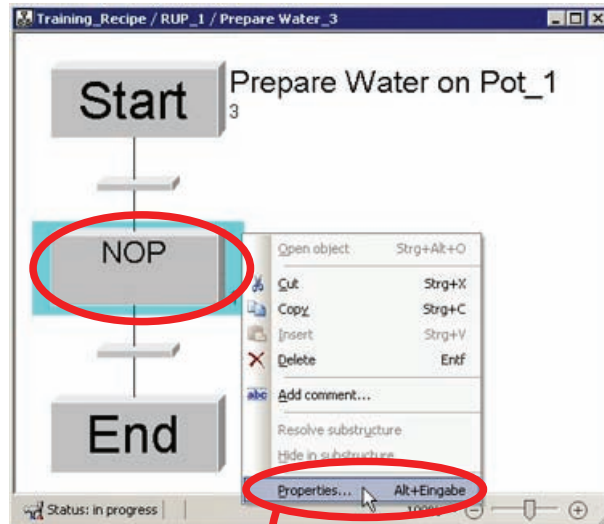
3.2.19.3 Working on editing level 2

Procedure at editing level 2

1. Double-click on the "Prepare Water" ROP to insert a recipe phase (NOP).



2. Assign the "Add_Ingredient" equipment phase with the "Add_Water" control strategy to the empty recipe phase (NOP). The recipe phase takes the name of the equipment phase in this case.

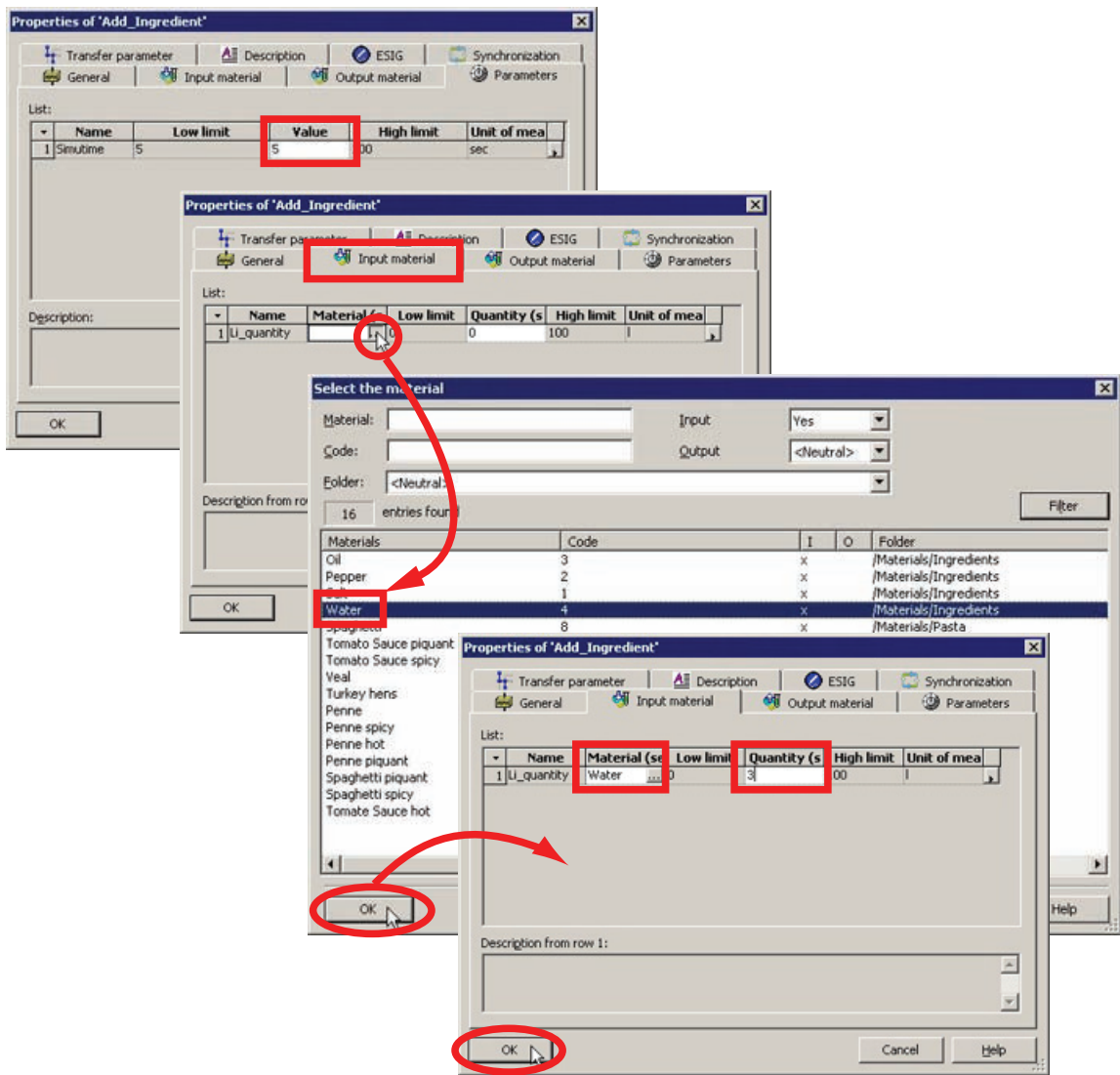


- Define the input materials used and declare the parameters of recipe function "Add_Ingredient". Assign the input material (= water) and filling quantity (= three liters) to the input material "Li_quantity".

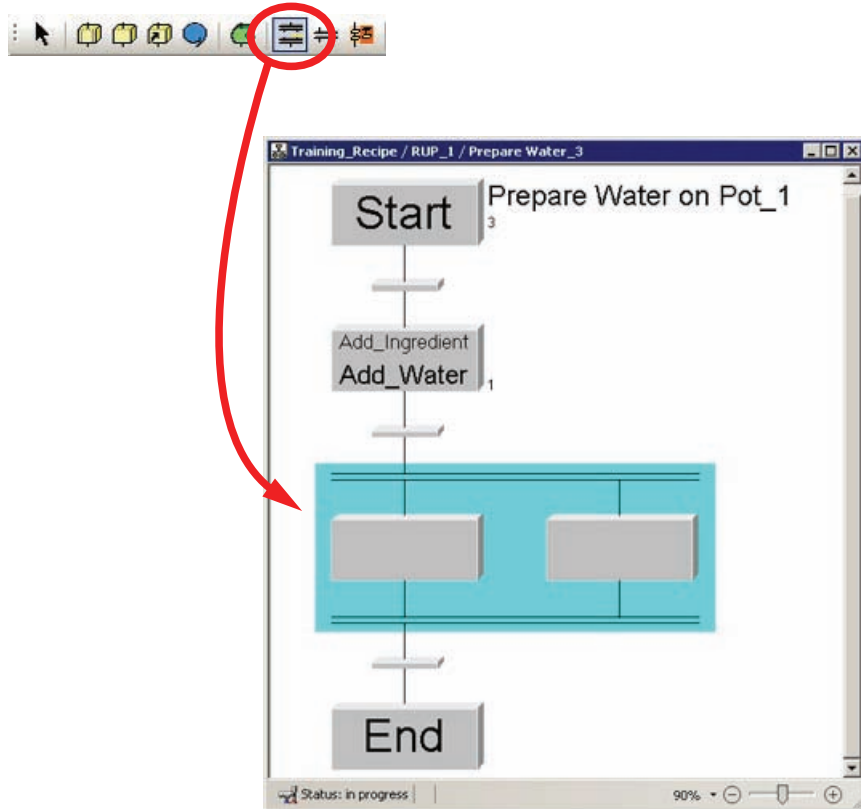
Note

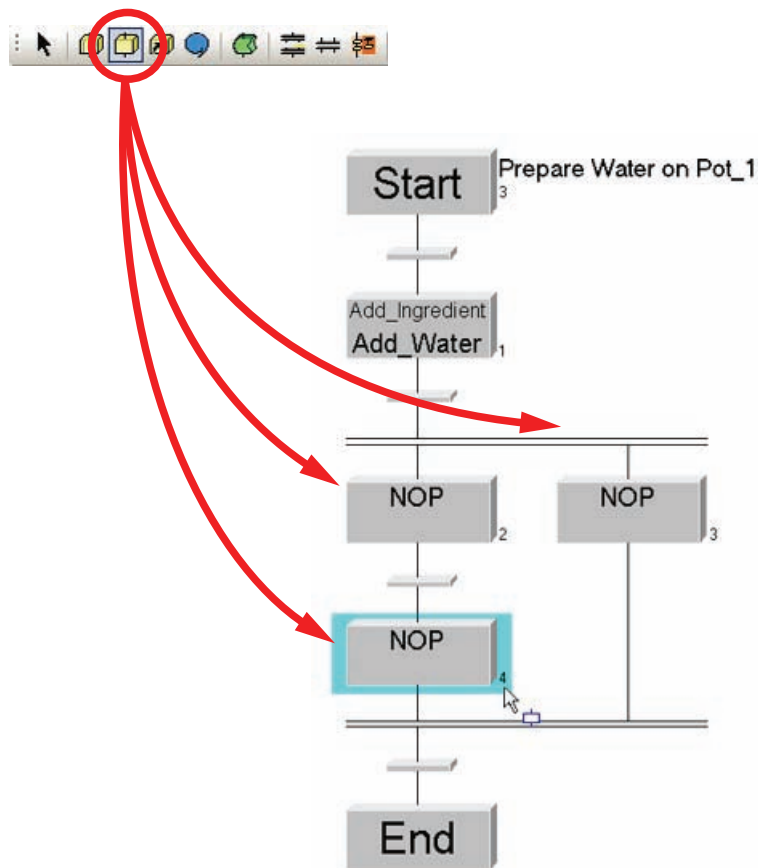
Runtime characteristics

Here, and in all the recipe phases, the "Simutime" parameter is used for simulation. The parameter has no influence on the runtime characteristics of equipment phases and recipe phases in a batch.



4. Insert a parallel branch and three NOPs.





5. Assign an "Add_Ingredient" equipment phase with the "Add_Oil" control strategy to a recipe phase and pass the "Oil" material to the "Li_Quantity" input material with a quantity of "0.1 l". Specify a value of "5 sec" as the run time.
6. Assign the "Heat" equipment phase to a recipe phase and assign the value "100° C" to the "Temp" parameter. Set the run time to the value "300 sec".

7. Within the simultaneous branch, add an additional "Add_Ingredient" recipe phase with the "Add_Salt" control strategy below the "Add_Ingredient" recipe phase and assign the material "Salt" and the quantity "0.01 kg" to the "Li_quantity" input material. Specify a value of "5 sec" as the run time.

The diagram shows a recipe configuration in SIMATIC BATCH V8.0. The sequence of phases is as follows:

- Start** (Prepare Water on Pot_1)
- Add_Ingredient Add_Water**
- Simultaneous Branch 1:**
 - Add_Ingredient Add_Oil** (Control strategy: Add_Oil)
 - Heat** (Control strategy: <none>)
- Simultaneous Branch 2:**
 - Add_Ingredient Add_Salt** (Control strategy: Add_Salt)
- End**

The following tables represent the data entered in the property dialog boxes for the highlighted phases:

Properties of 'Heat'

Name	Low limit	Value	High limit	Unit of mea
1 Temp	1	100	100	°C
2 Simulime	5	300	1000	sec

Properties of 'Add_Ingredient' (Add_Oil)

Name	Material (se	Low limit	Quantity (s	High limit	Unit of mea
1 Li_quantity	Oil	0	0.1	100	l

Properties of 'Add_Ingredient' (Add_Salt)

Name	Material (se	Low limit	Quantity (s	High limit	Unit of mea
1 Kg_quantity	Salt	0	0.01	100	kg

Properties of 'Add_Ingredient' (Simultaneous Branch 2)

Name	Low limit	Value	High limit	Unit of mea
1 Simulime	5	5	100	sec

8. Complete the "Cook Pasta" ROP according to the recipe description for "Piccata Milanese".

The screenshot shows the configuration of the "Cook Pasta" ROP (Recipe Operating Procedure) in SIMATIC BATCH V8.0. The main window displays a sequence of steps: Start, Fill_Solid, Heat, and End. Red circles highlight the "Fill_Solid" and "Heat" steps, with arrows pointing to their respective property dialog boxes.

Properties of 'Fill_Solid'

Phase: **Fill_Solid (EPH)**

Control strategy: <none>

Unit class: Preferred unit:

Name	Material (se)	Low limit	Quantity (s)	High limit	Unit of mea
1	Kg_quantity	Spaghetti	0	1.9	kg

Properties of 'Heat'

Phase: **Heat (EPH)**

Control strategy: <none>

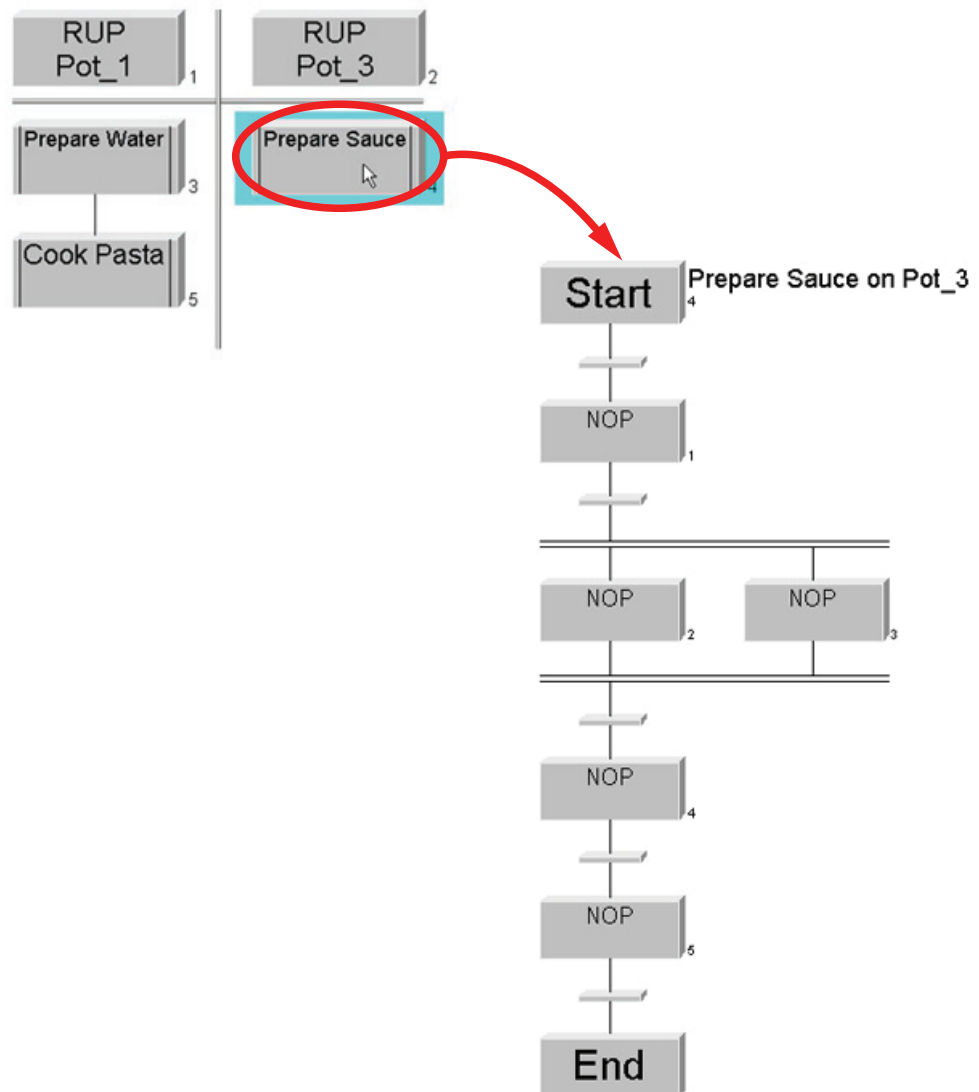
Unit class: Preferred unit:

Planned runtime: 00 H

Description of the phase: FB 1100

Name	Low limit	Value	High limit	Unit of mea
Temp	1	100	100	°C
		360	1000	sec

9. Complete the "Prepare Sauce" ROP according to the recipe description for "Piccata Milanese".



The diagram shows a process flow starting with 'Start' (4), followed by 'Fill_Solid' (1), then a parallel split to 'Stir' (6) and 'Heat' (6). Both lead to 'NOP' (4 and 5 respectively), which then merge and end at 'End' (10). Red circles highlight 'Fill_Solid', 'Stir', and 'Heat' in the flowchart, with arrows pointing to their respective configuration windows.

Properties of 'Fill_Solid'

Phase: **Fill_Solid (EPH)** Control strategy: <none>

Properties of 'Fill_Solid'

Name	Material (set)	Low limit	Quantity (s)	High limit	Unit of m
1 Kg_quantity	Tomato Sauce spicy ...		1		kg

Properties of 'Fill_Solid'

Name	Low limit	Value	High limit	Unit of mea
1 Simultime	5	5	100	sec

Properties of 'Stir'

Phase: **Stir (EPH)** Control strategy: <none>

Properties of 'Stir'

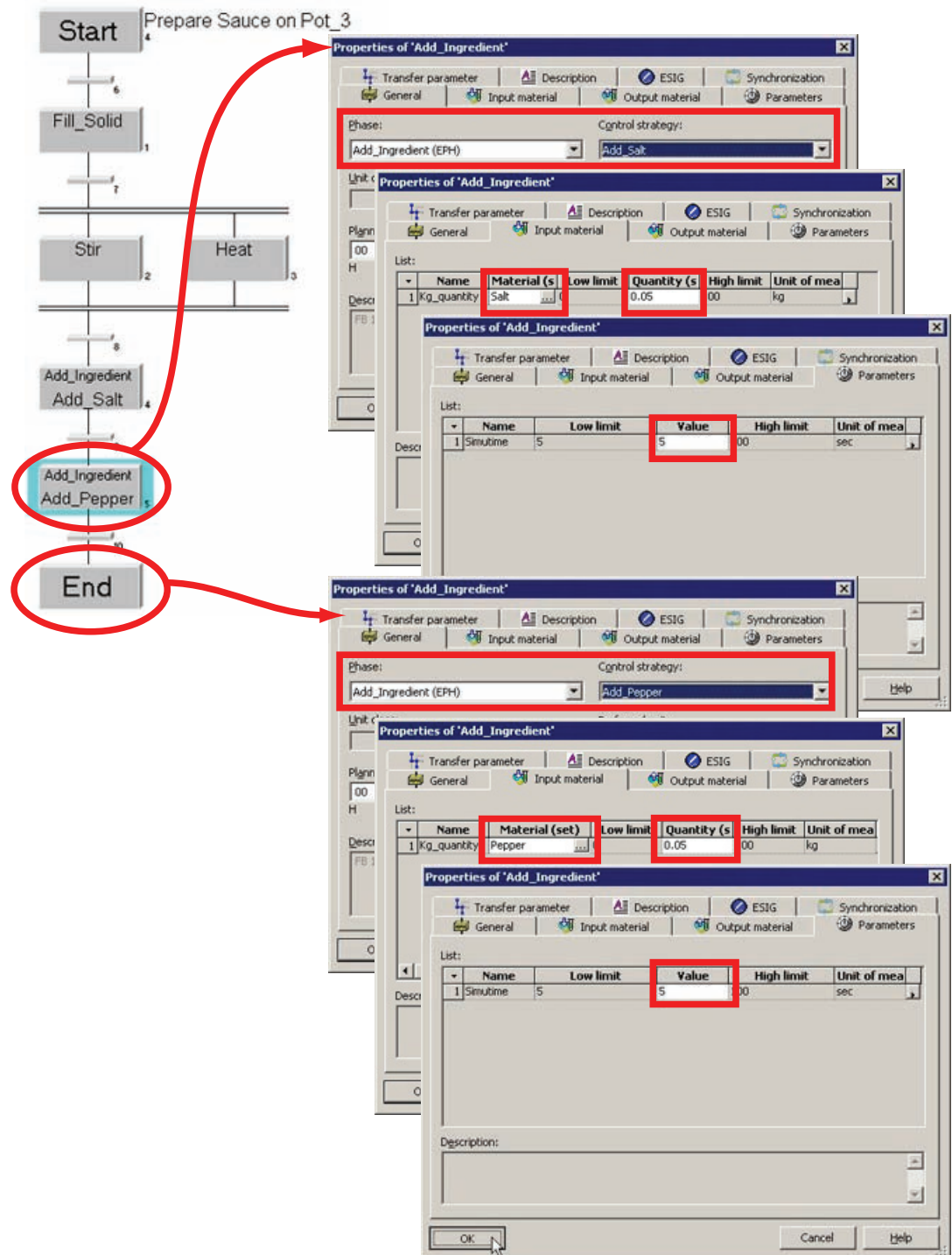
Name	Low limit	Value	High limit	Unit of mea
1 rev	5	5	000	1/min
2 Direction		False		
3 Simultime	5	5	00	sec

Properties of 'Heat'

Phase: **Heat (EPH)** Control strategy: <none>

Properties of 'Heat_3'

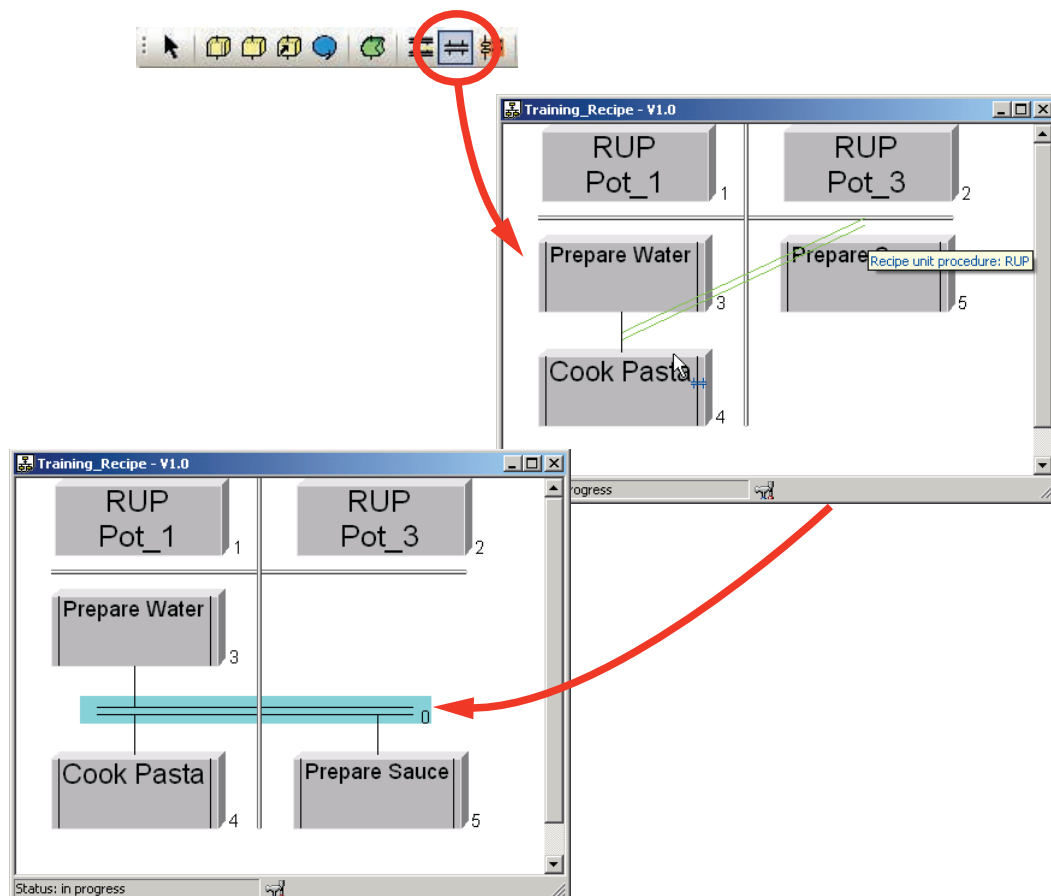
Name	Low limit	Value	High limit	Unit of mea
1 Temp	1	40	00	°C
2 Simultime	5	300	000	sec



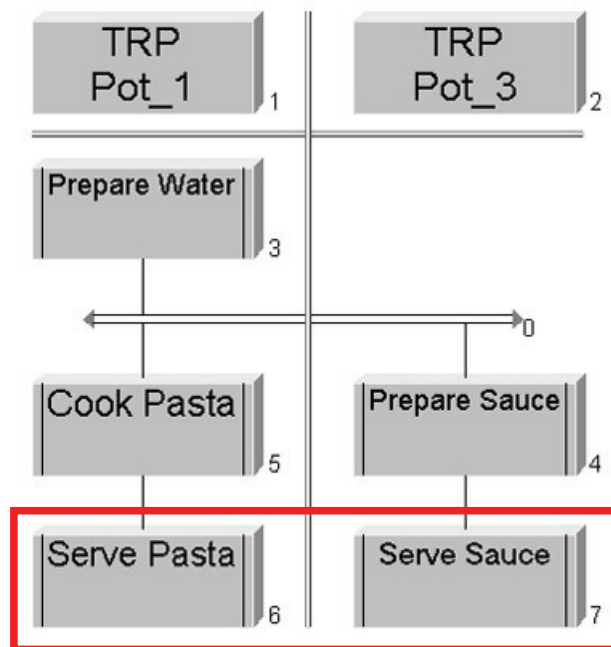
3.2.20 Completing the training recipe

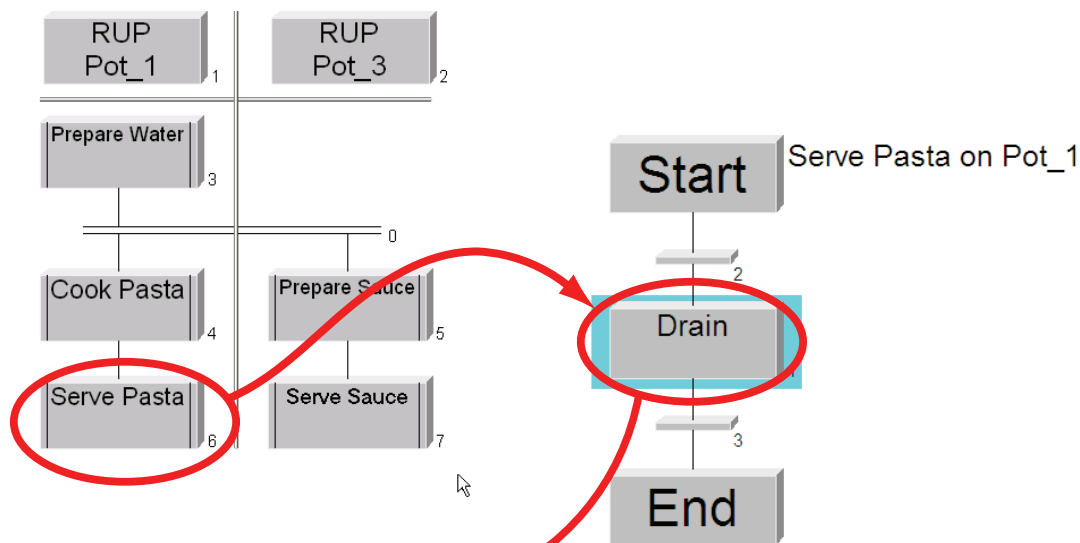
Completing recipes

1. Insert a synchronization line before two recipe operations in the recipe within the Plant view. To do this, press the mouse button and draw a line between the left and right columns.



2. Insert two recipe operations (ROPs), name them "Serve Pasta" and "Serve Sauce", and complete these in accordance with the recipe description for "Piccata Milanese".





Properties of 'Drain'

Phase: **Drain (EPH)** Control strategy: <none>

Unit class: <all>

Run time: 00 Sec

Description of: FB 1104

OK

Properties of 'Drain'

List:

Name	Source	Material	Code	Low limit	Quantity	High limit	Unit
1 Kg_quantity		Piccata Milanese	47	0	1.9	00	kg

Description:

OK

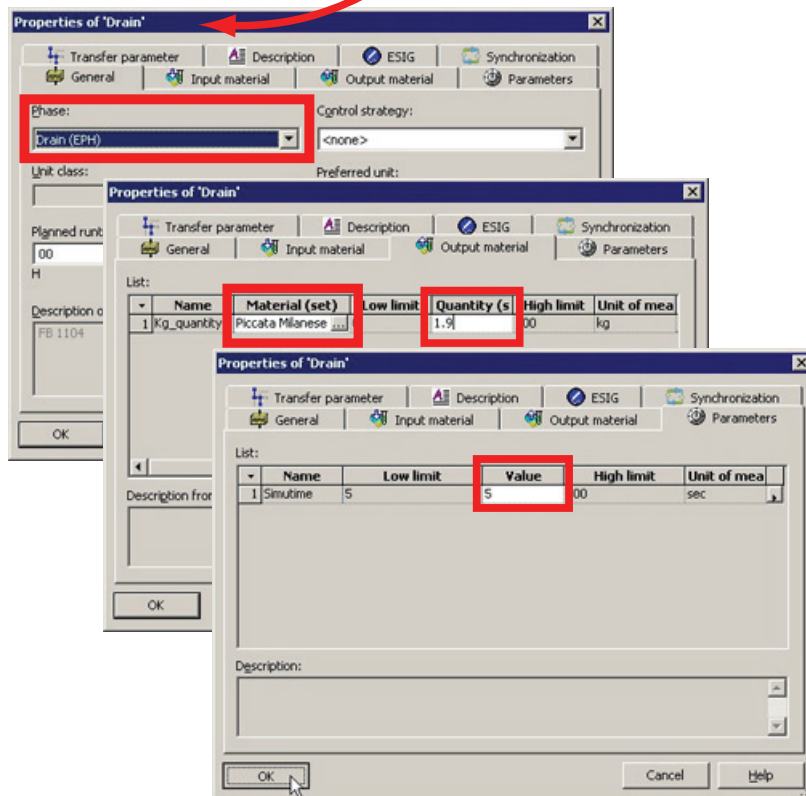
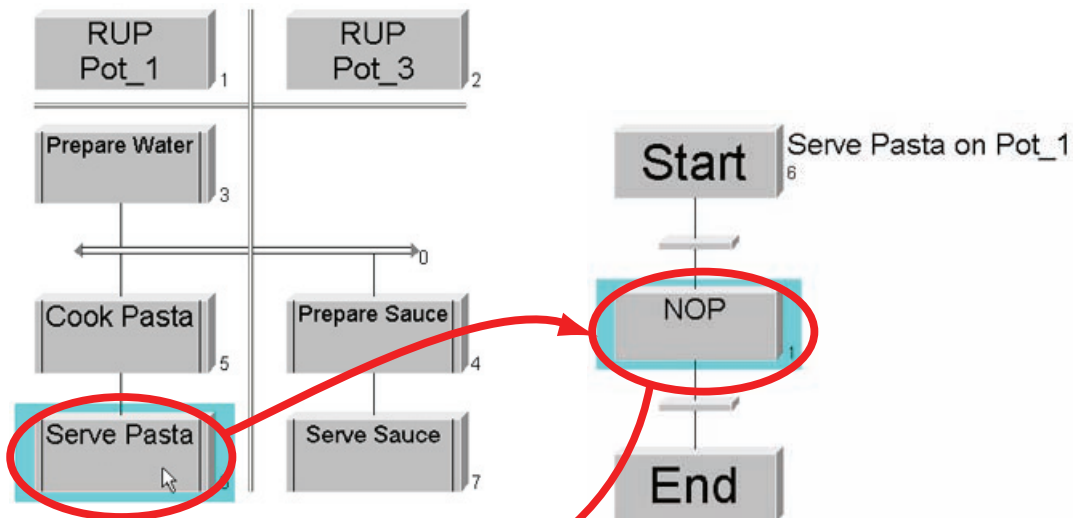
Properties of 'Drain'

List:

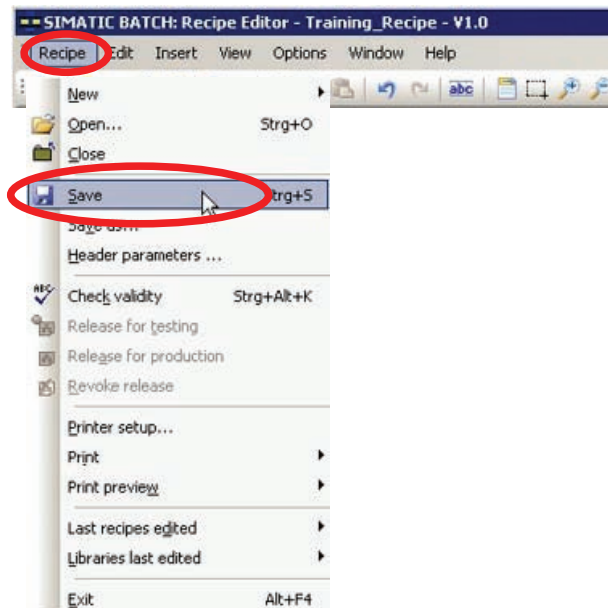
Name	Data type	Source	Low limit	Value	High limit	Unit of
1 Simutime	Floating-point number		5	5	00	sec

Description:

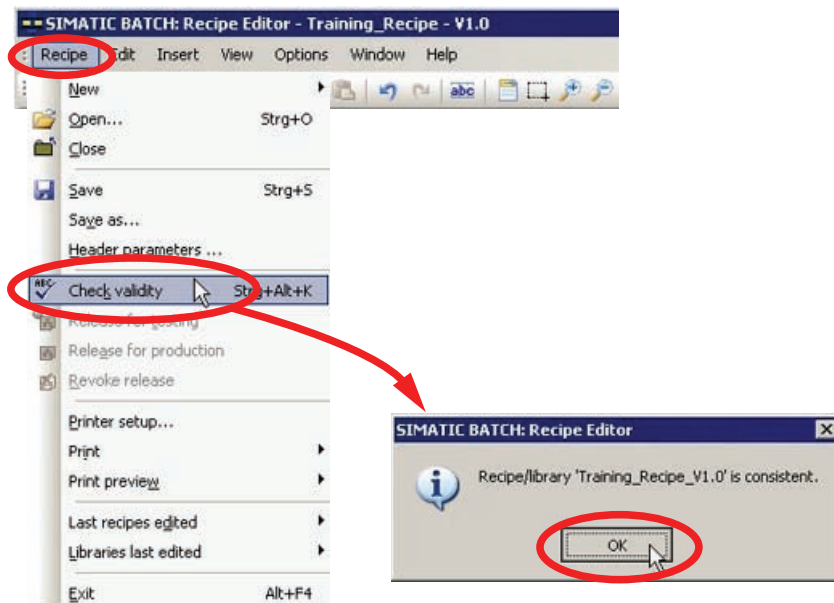
OK Cancel Help



3. Save the master recipe you have created.



4. Validate the recipe.



5. Close the Recipe Editor.

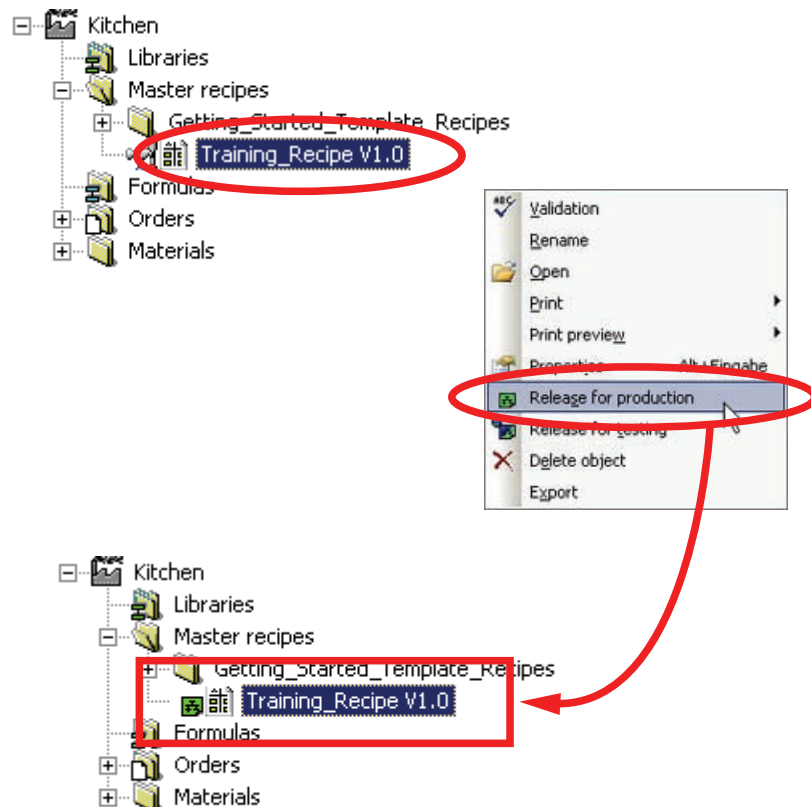
3.2.21 Releasing the master recipe to production

Introduction

Before you can use your master recipe "Training_Recipe V1.0" to create a batch, the recipe must be released for production or testing.

Procedure

1. Release your recipe for production.

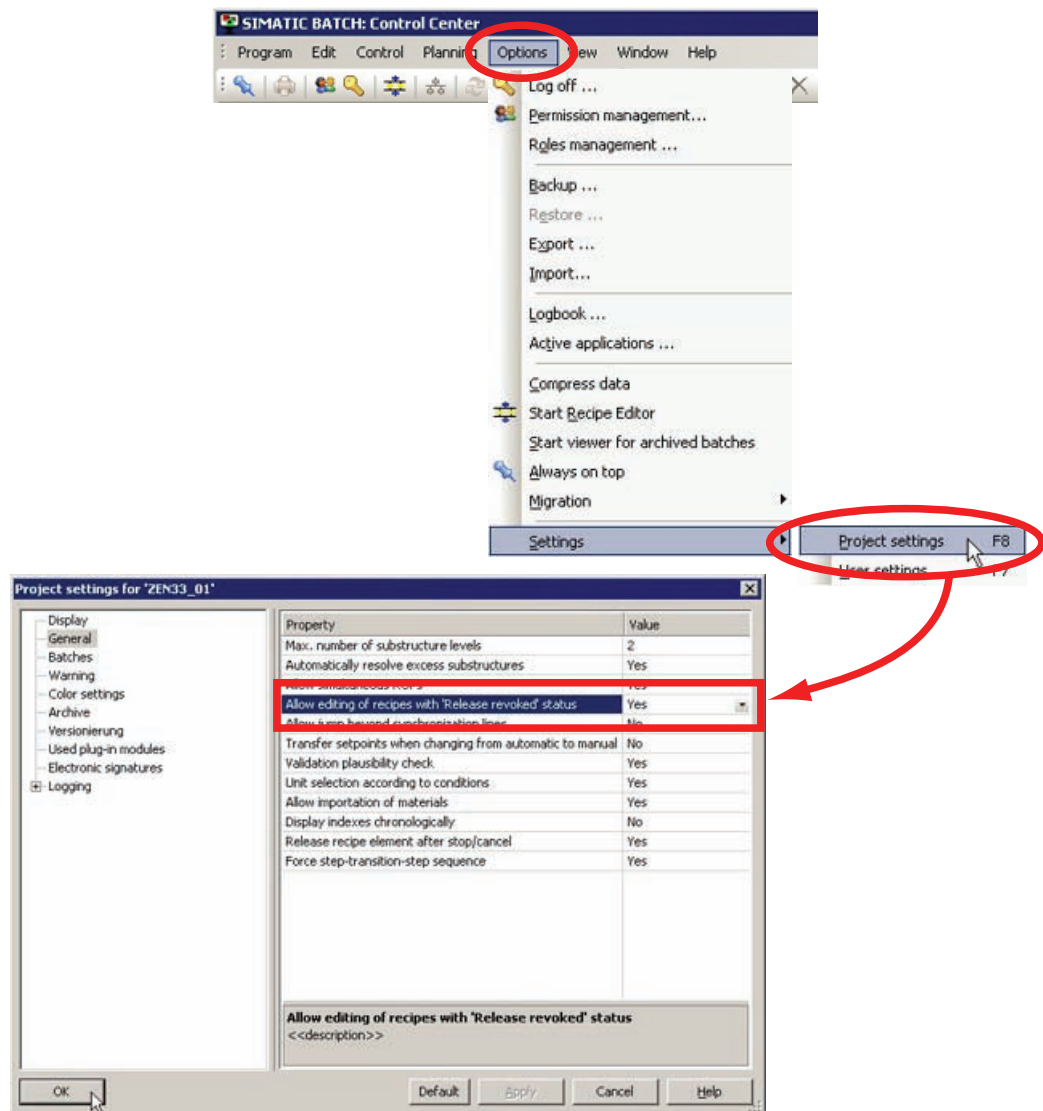


Note

Editing released recipes

In order to be able to edit released recipes you must cancel their release. To do this, ensure that the value of the "Allow editing of recipes with "Release revoked" status" property is set to "Yes" in the dialog **Options > Settings > Project Settings > "General" folder** in the BATCH Control Center. The value for "Unit selection according to conditions" must also be set to "Yes".

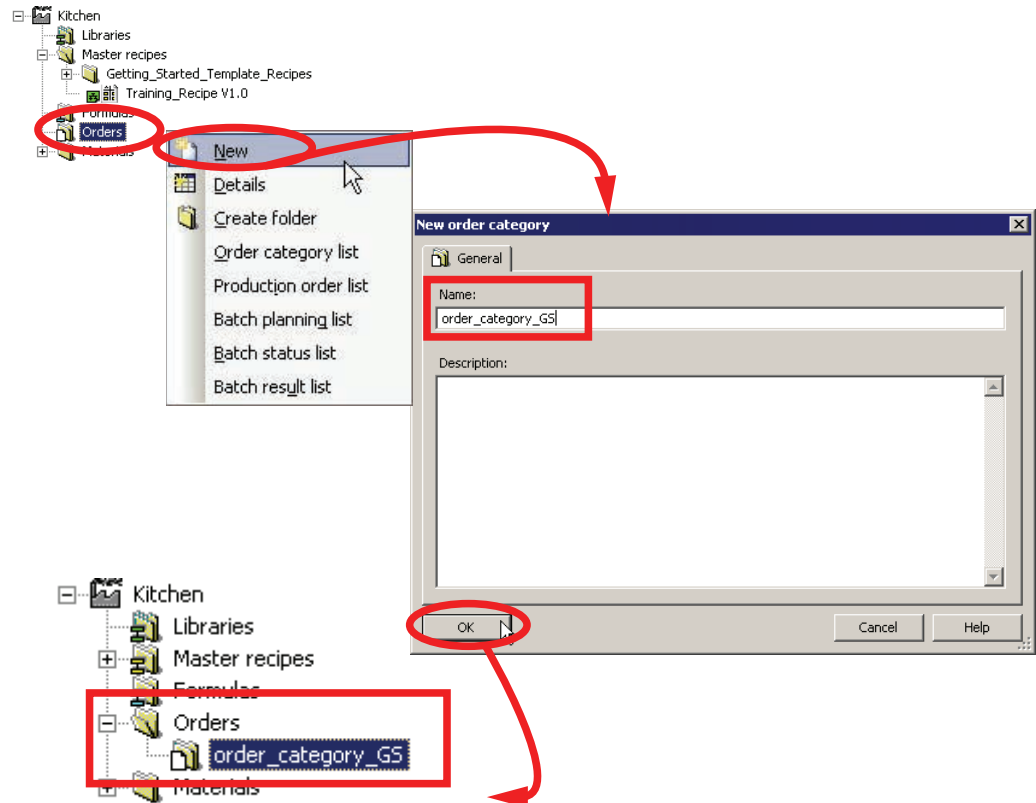
2. Check your project settings.



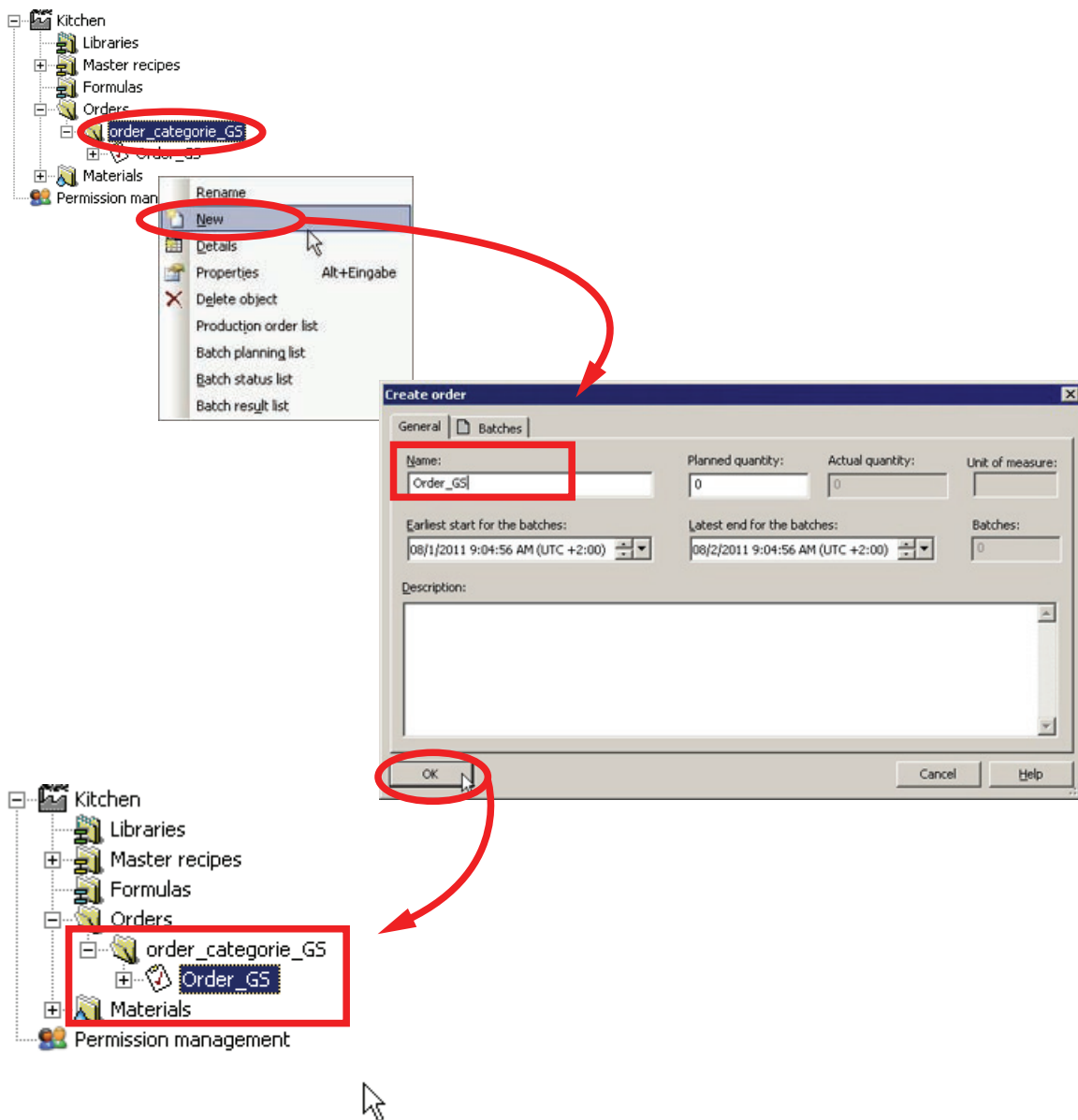
3.2.22 Creating an order (Batch)

Creating an Order (Batch)

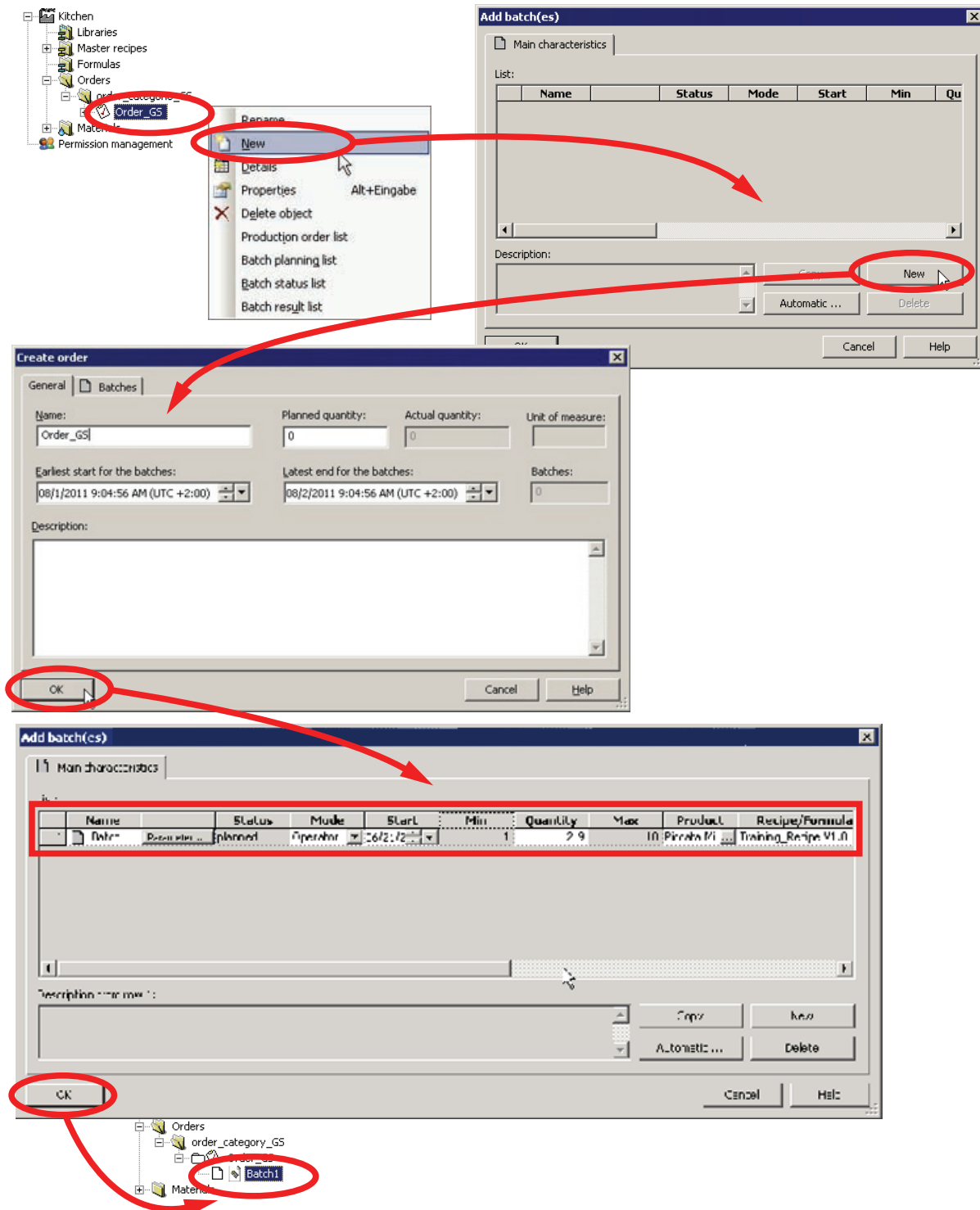
1. Create an order category with the name "order_category_GS".



2. Create an order named "Order_GS" in the "order_category_GS" folder.



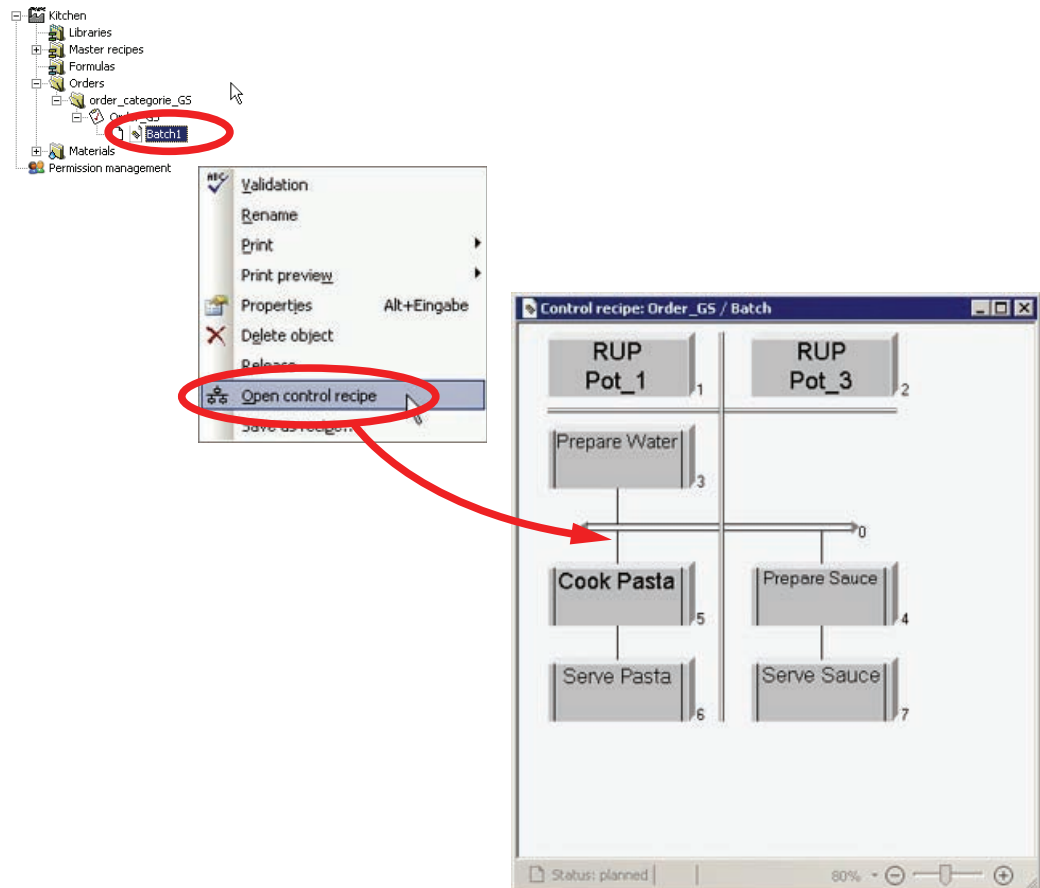
3. Create a batch, for example, Batch1, with master recipe "Training_Recipe V1.0" for "Order_GS".



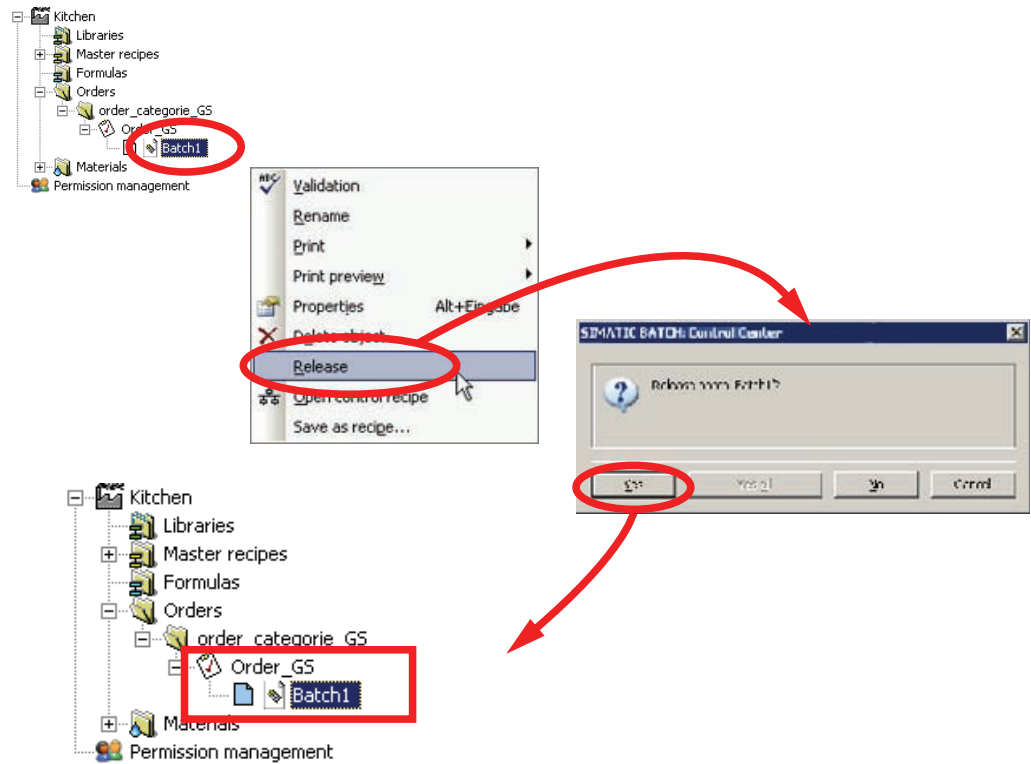
3.2.23 Releasing and starting a Batch (control recipe)

Procedure

1. Open the batch (control recipe) "Batch1".

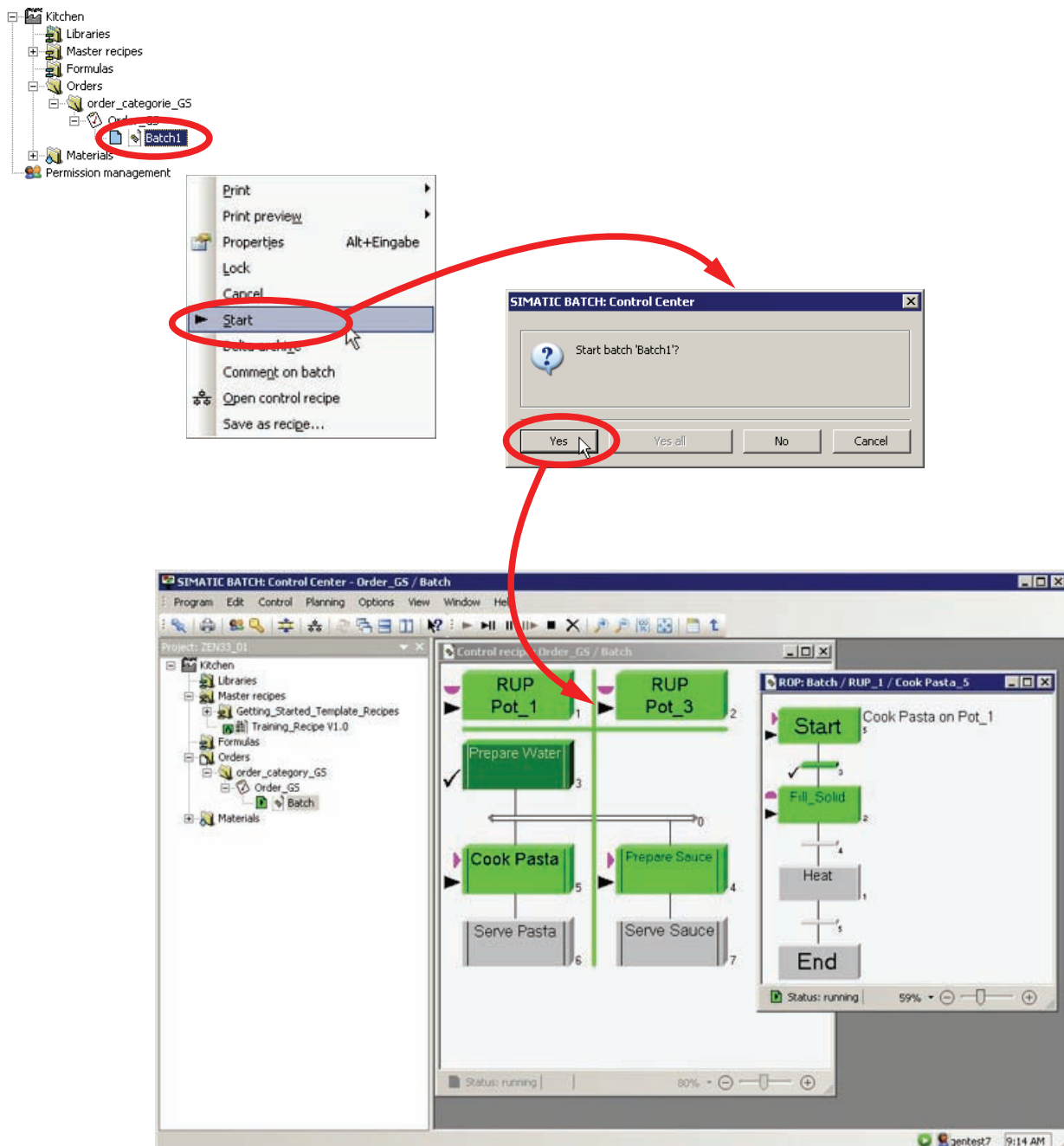


2. Release the "Batch1" control recipe. The color of the control recipe icon changes to light-blue.



3.2 Configuration

3. Start the released control recipe. Please note that WinCC Runtime has to be started for this purpose. The icon changes to green and the units are occupied and started according to the recipe structure.



4. Close the SIMATIC BATCH Control Center and exit WinCC Runtime.

Creating an Equipment Phase Using SFC and BATCH Interface Blocks

4

4.1 Task definition and implementation concept

Task Definition and Implementation Concept

An additional equipment phase is required for the "Pan" unit. This unit must be extended by adding the "Quench" equipment phase. A selectable quantity of a material, for example, red wine, will be added via a quench valve.

To simplify matters, the process of reaching the set quantity will be simulated by a selectable time. If the batch is held or aborted, the valve will close.

Select blocks from the SIMATIC BATCH block library to implement the equipment phase.

4.1 Task definition and implementation concept

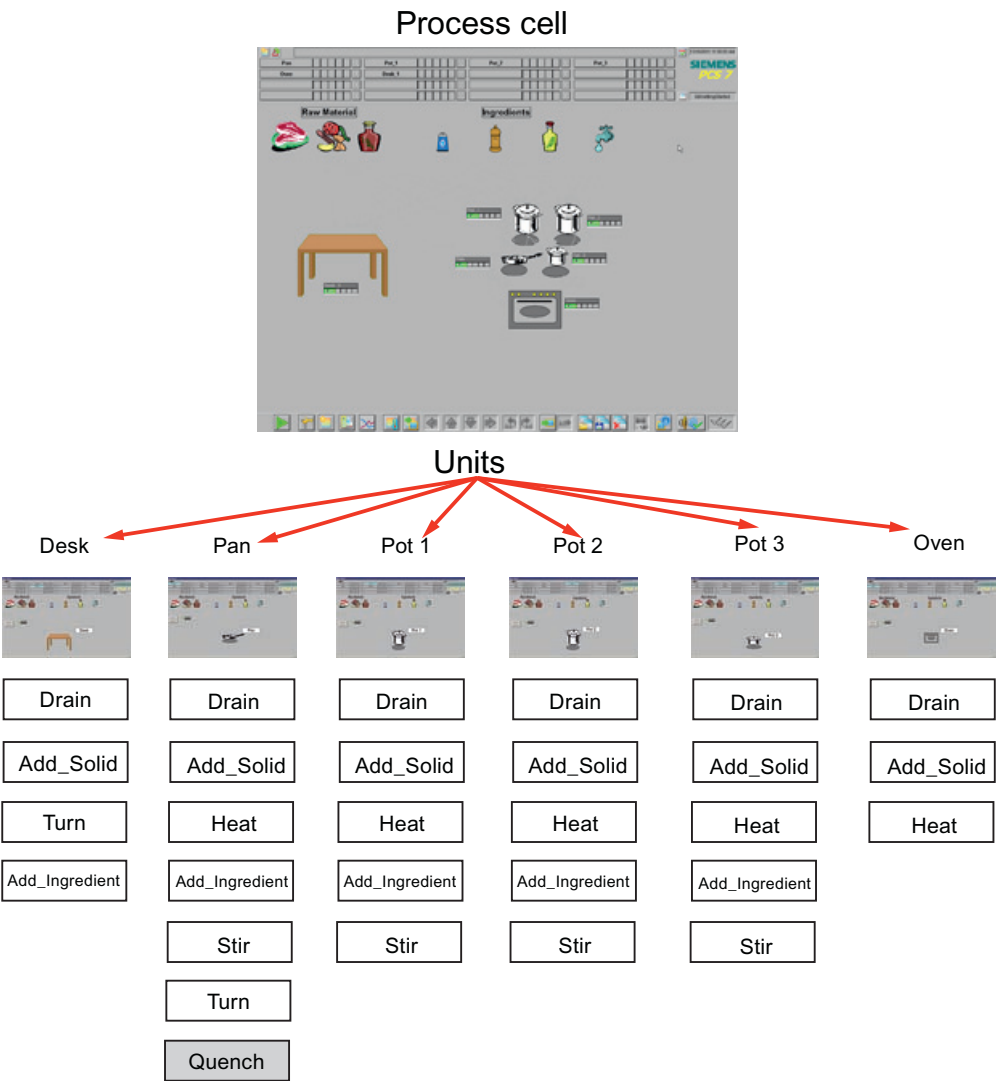


Table 4- 1 Process values

Process value name	Block	Data type	Comment
Quantity	IEPAR_PI	STRING REAL	
Duration	IEPAR_REAL	REAL	

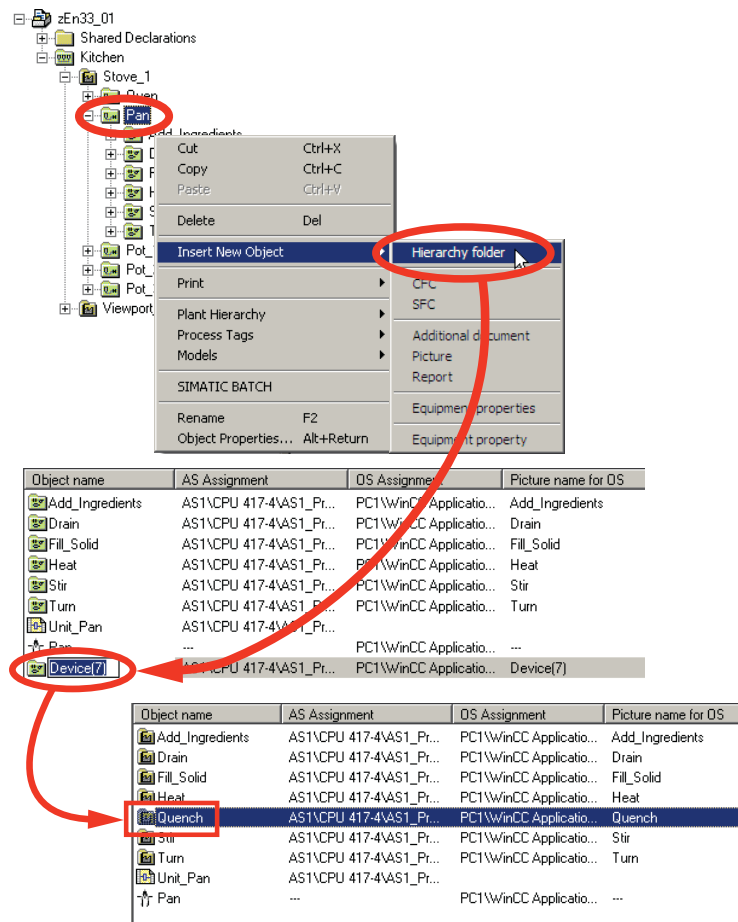
Table 4- 2 Block contacts

Block name	Block	Comment
V1	IEPAR_PI	

4.2 Expanding the plant hierarchy

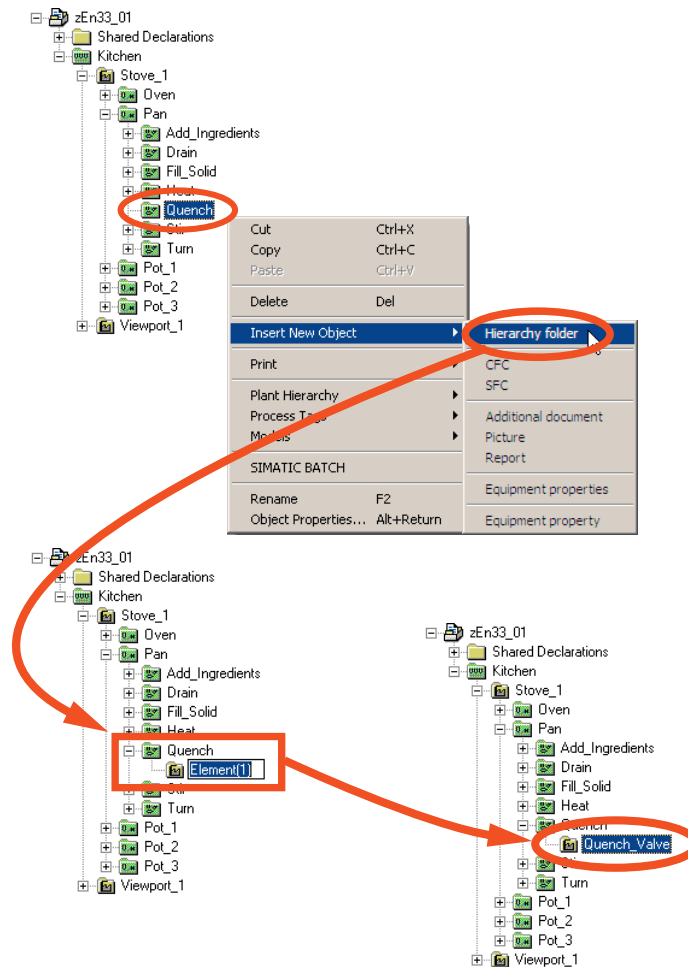
Procedure

1. Open your edited BATCH Getting Started project "zEn33_01" in SIMATIC Manager.
2. Expand the "Pan" unit by adding a hierarchy folder with the name "Quench". The newly added hierarchy folder is automatically displayed as an equipment module and therefore also as usable for SIMATIC BATCH. The folder is shown in green.



4.2 Expanding the plant hierarchy

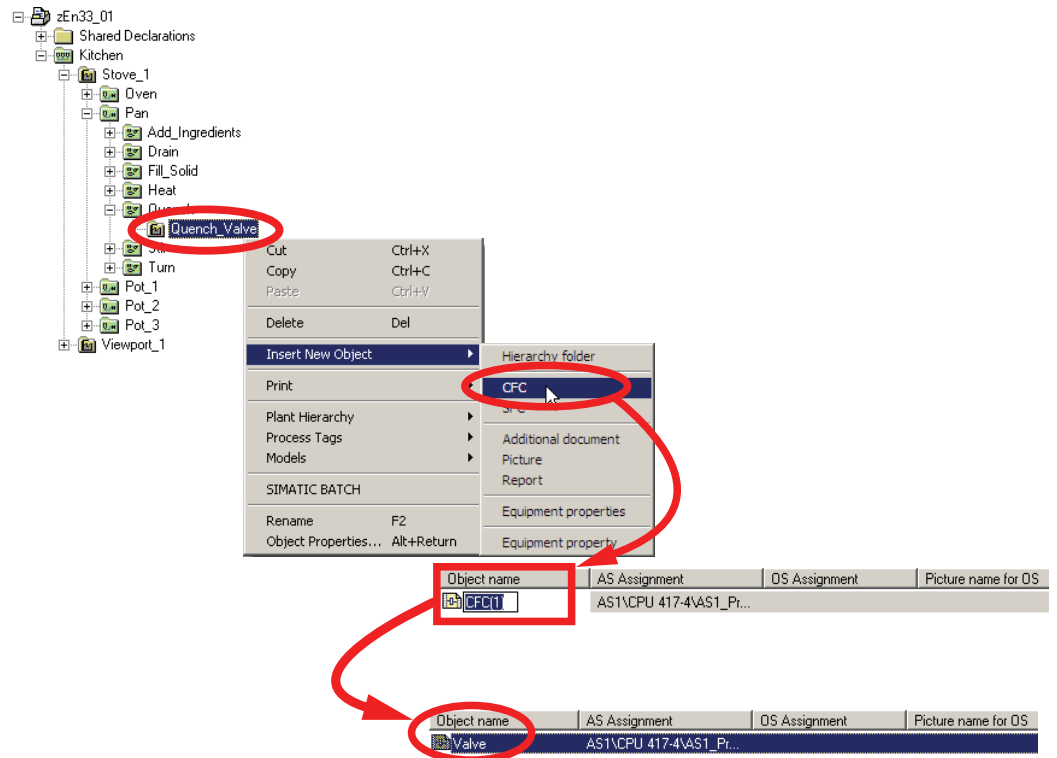
3. Add a hierarchy subfolder named "Quench_Valve" to the "Quench" hierarchy folder. The control modules - the associated valve, in this case - should be located at this level.



4.3 Configuring the control module level (valve V1)

Procedure

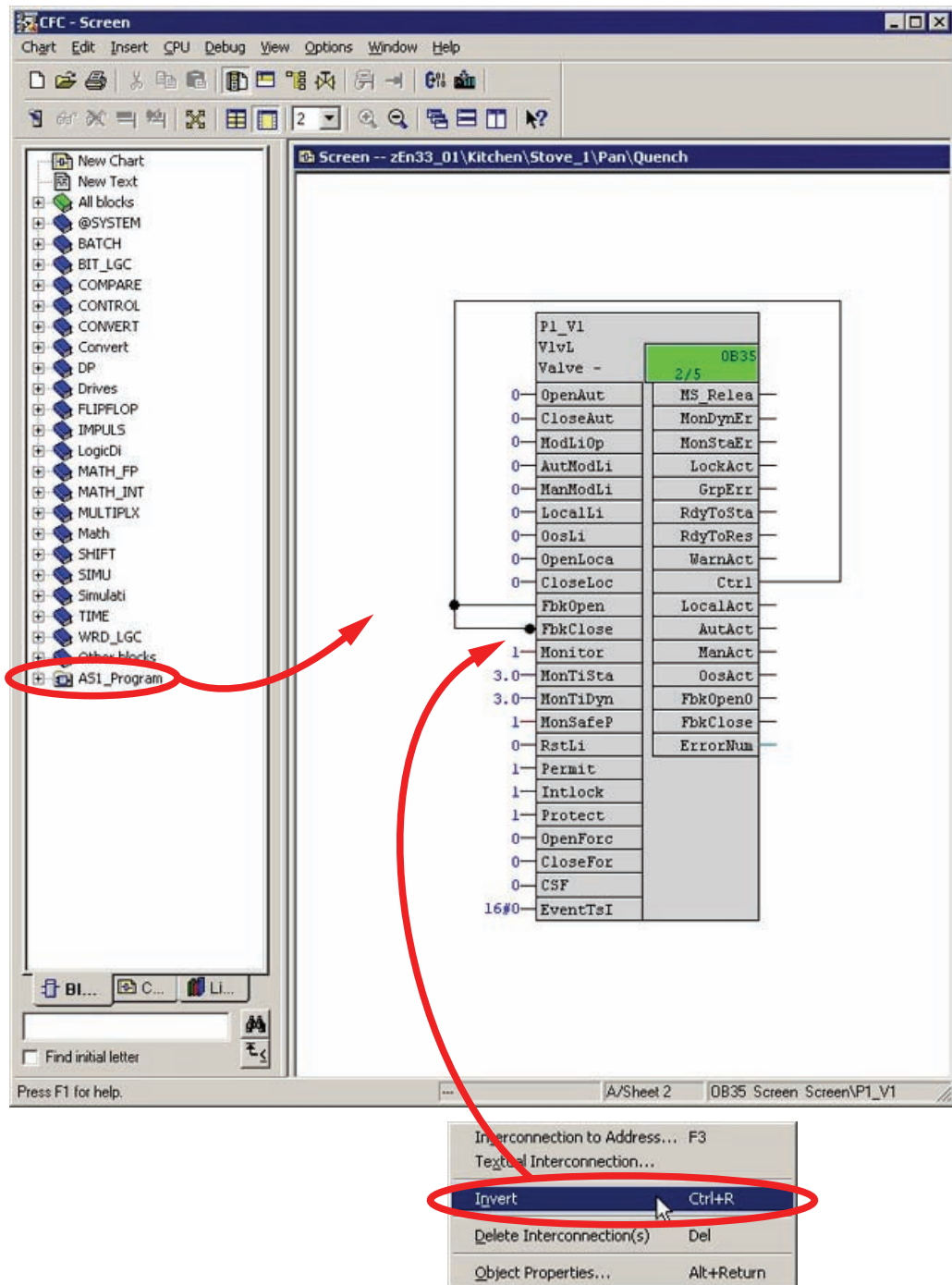
1. Create a CFC chart named "Valve" in the "Quench_Valve" hierarchy folder.



2. Open the CFC chart "Valve" and insert a valve block. Assign the name "V1" to the valve block.

4.3 Configuring the control module level (valve V1)

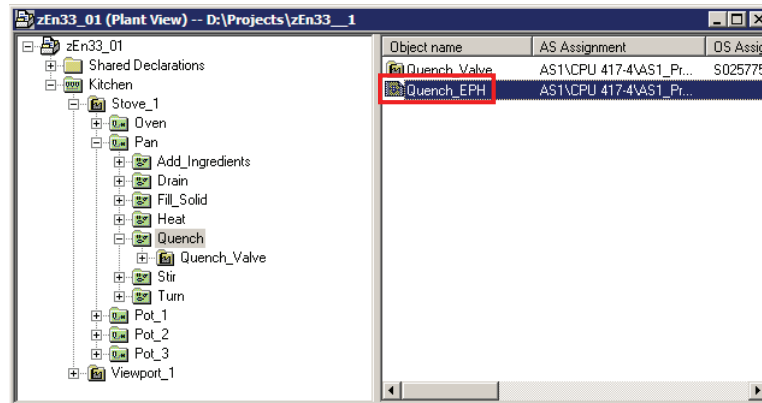
3. Enable visibility of the "CTRL", "BA_EN", "BA_ID", "OCCUPIED", "BA_NA" and "STEP_NO" inputs and outputs. To do this, clear the "Invisible" check box for the relevant block contact in the "Properties of Block" dialog, "I/Os" tab.
4. Interconnect output "CTRL" with inputs "FBK_OPEN" and "FBK_CLOSE" and invert "FBK_CLOSE".



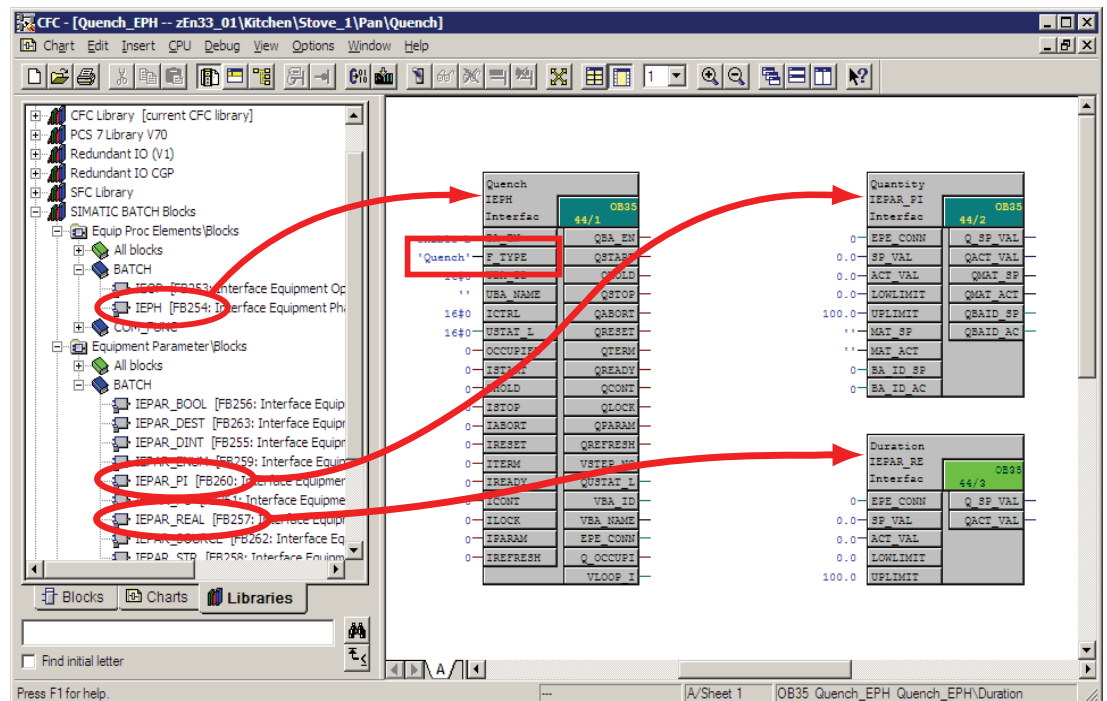
4.4 Configuring BATCH interface blocks

Procedure

1. Create a CFC chart named "Quench_EPH" in the "Quench" hierarchy folder. Make sure that this hierarchy folder already contains the "Quench_Valve" hierarchy folder.

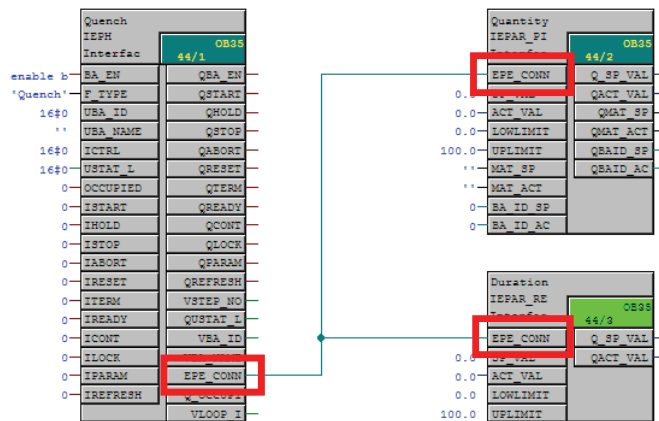


2. Open the "Quench_EPH" CFC chart and add the "IEPH", "IEPAR_PI" and "IEPAR_REAL" blocks from the "SIMATIC BATCH Blocks" library. Rename the IEPH block to "Quench". Enter "Quench" too at the "F_TYPE" input as the input value. Assign the name "Quantity" to the IEPAR_PI block and the name "Duration" to the IEPAR_REAL block.

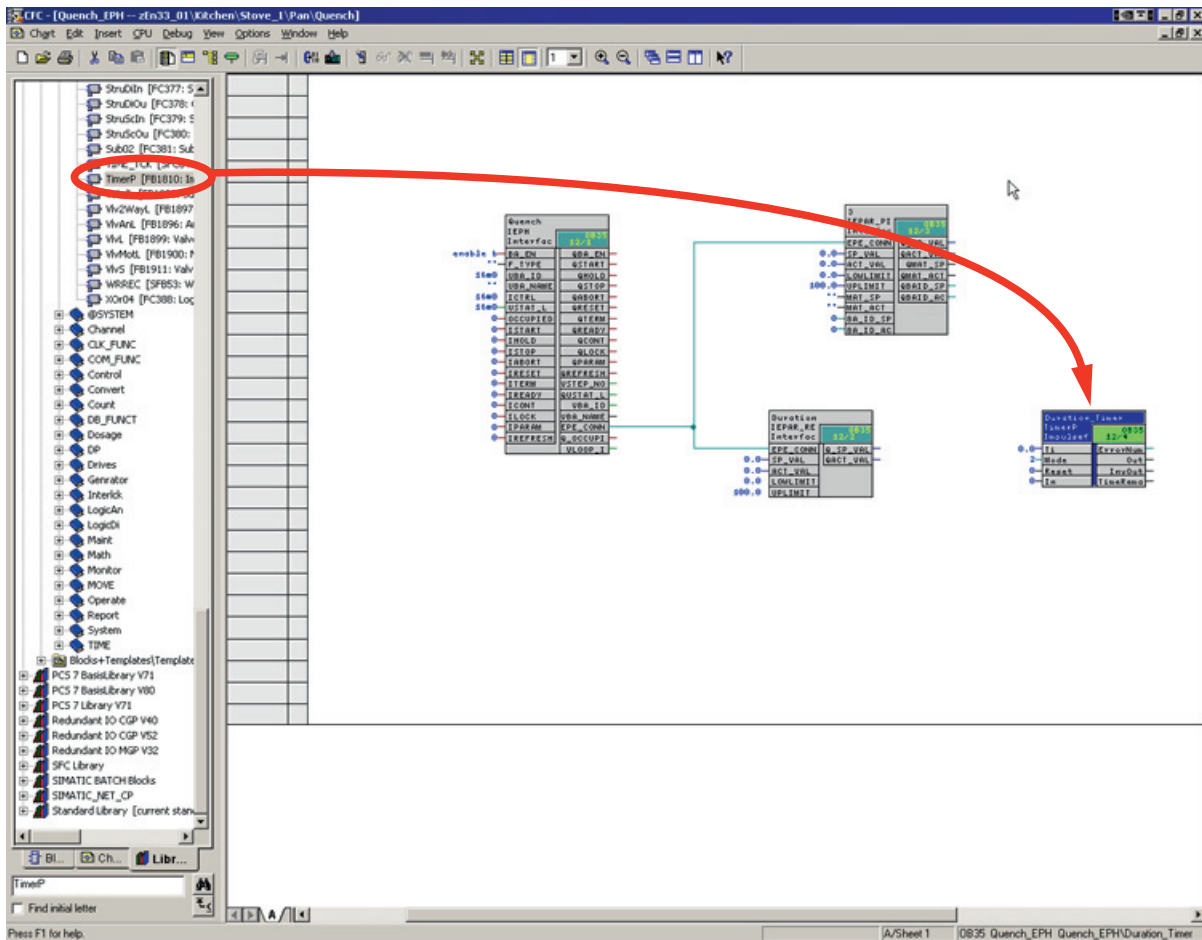


4.4 Configuring BATCH interface blocks

- Interconnect the "EPE_CONN" output of the IEPH block (Quench) with the "EPE_CONN" inputs of the EPAR blocks (Quantity, Duration).

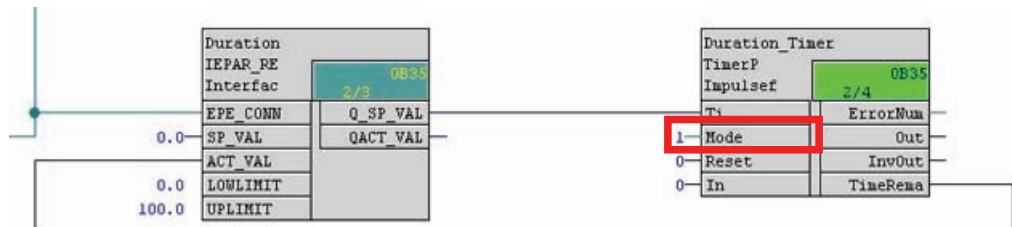


4. Add a TimerP block for the simulation of the "Duration" process value.



5. Assign the name "Duration_Timer" to the TimerP block and set the MODE input to 1. Interconnect the IEPAR_REAL block "Duration" with the TimerP block as follows.

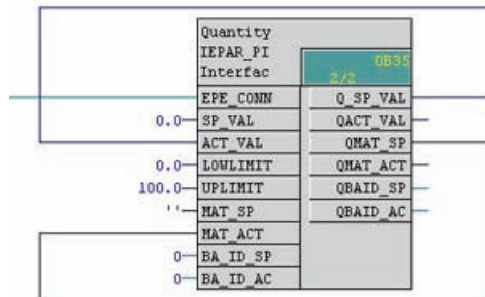
Duration / Q_SP_VAL	with	Duration_Timer / Ti
Duration_Timer / TimeRema	with	Duration / ACT_VAL



4.4 Configuring BATCH interface blocks

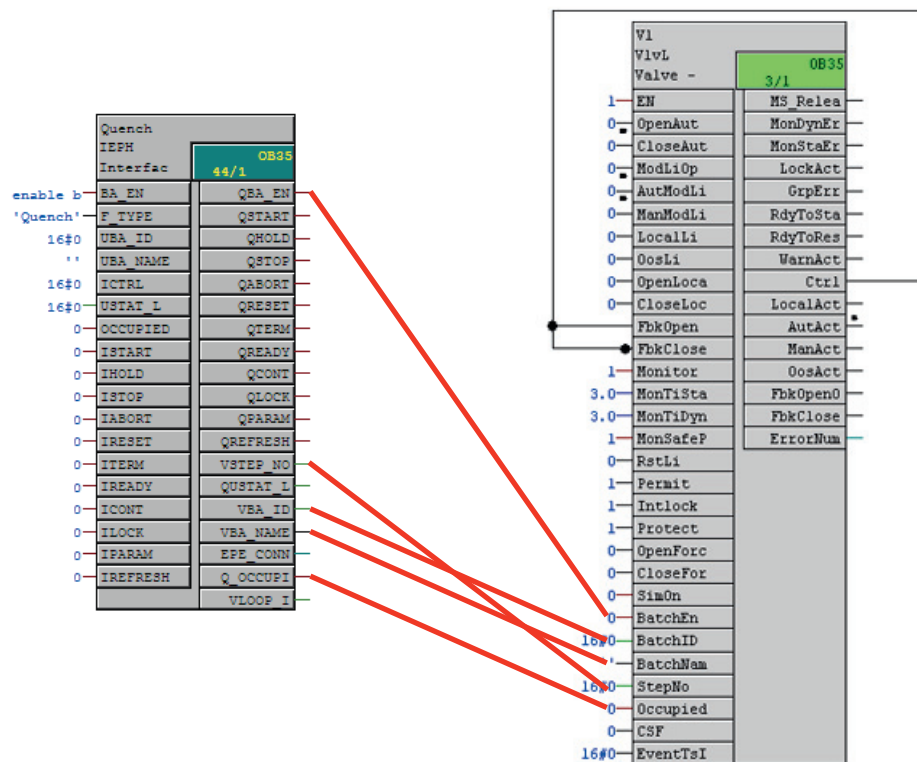
6. Interconnect the IEPAR_PI block "Quantity" with the simulation as follows:

Quantity / Q_SP_VAL	with	Quantity / ACT_VAL
Quantity / QMAT_SP	with	Quantity / MAT_ACT



7. In order to make the BATCH name, Batch ID, Batch step number, Batch enable, occupied data available to the "V1" valve block, the valve block must be interconnected with the Batch control block IEPH "Quench". Open the two blocks in the CFC editor, arrange the opened windows next to one another, make the interconnections shown in the table.

Quench / QBA_EN	with	V1 / BA_EN
Quench / VSTEP_NO	with	V1 / STEP_NO
Quench / VBA_ID	with	V1 / BA_ID
Quench / VBA_NAME	with	V1 / BA_NA
Quench / Q_OCCUPI	with	V1 / OCCUPIED



8. Close the CFC Editor.

4.5 Creating an SFC

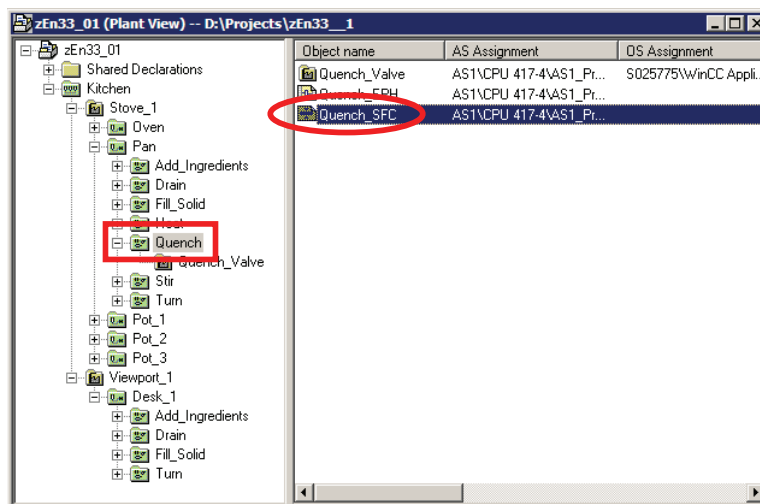
Introduction

The configuration of the SFC explained here is only an example. Information about the configuration of SFCs is provided in the "PCS 7 Getting Started, Part 1 or 2" or in "Help on SFC" documentation.

4.5 Creating an SFC

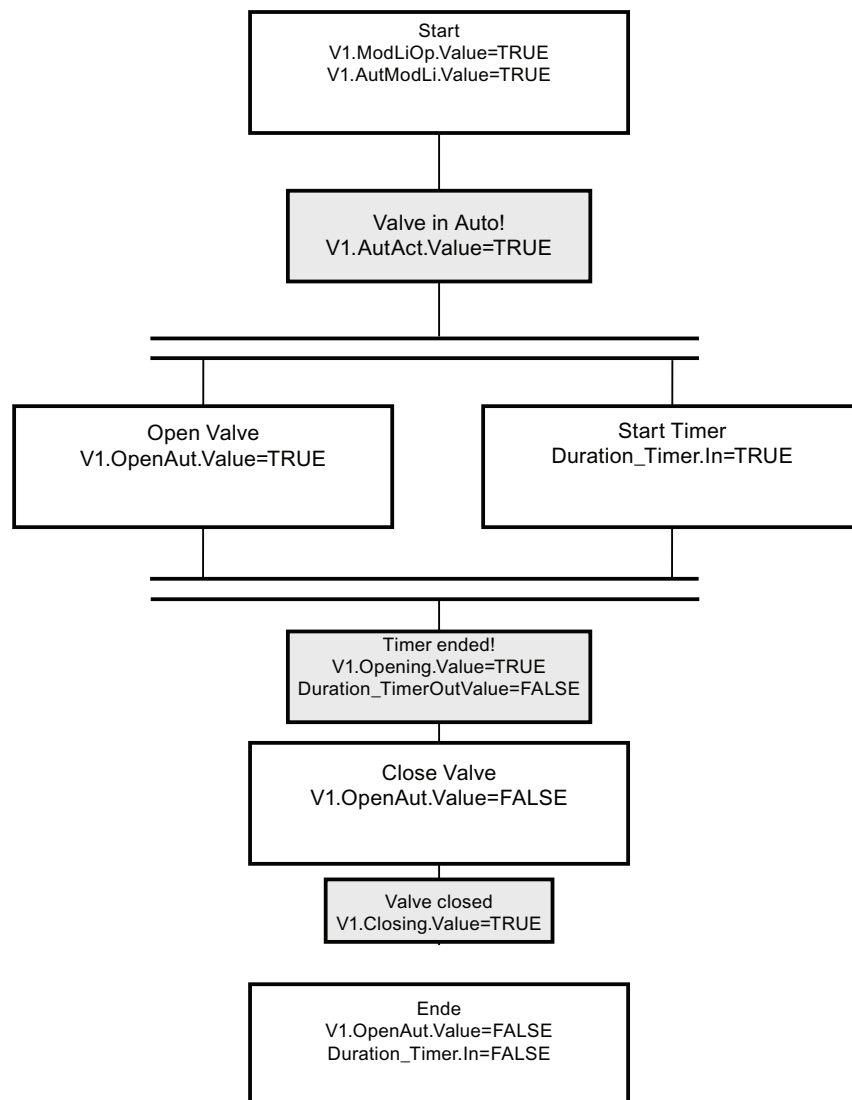
Procedure

1. Create an SFC with the name "Quench_SFC" in the "Quench" hierarchy folder. Make sure that this hierarchy folder already contains the "Quench_Valve" hierarchy folder and a "Quench_EPH" CFC chart.



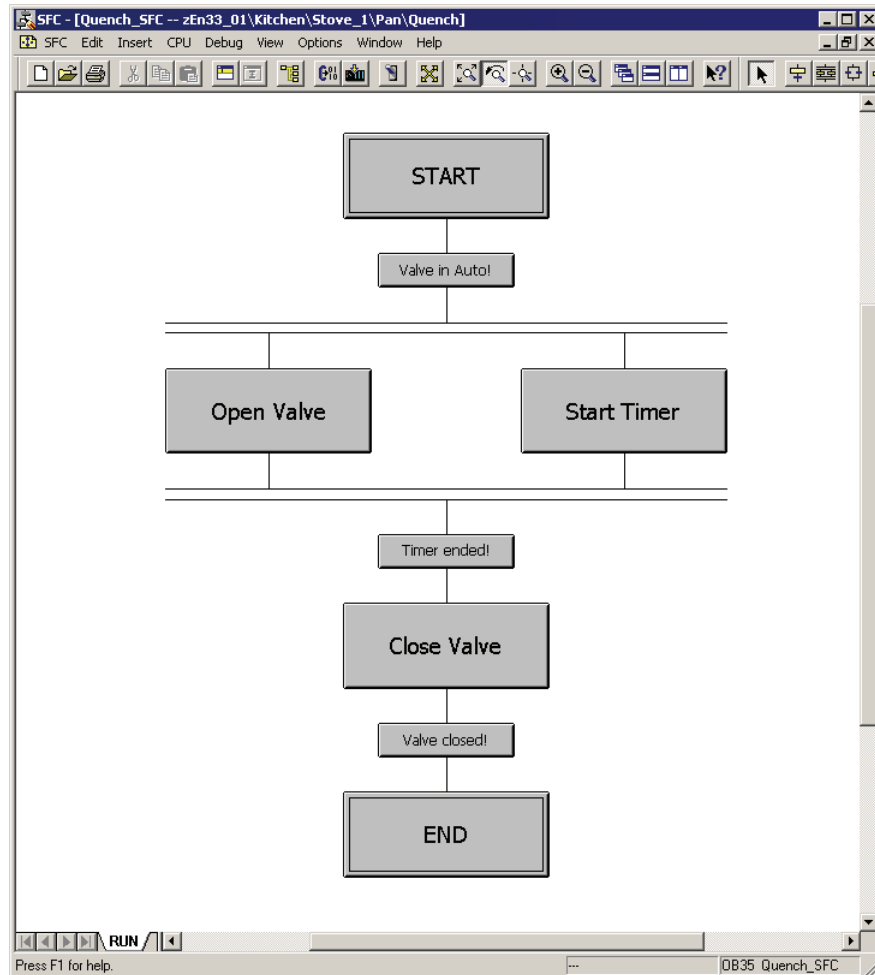
2. Open the SFC and configure the "RUN" sequencer. Base your configuration on the outline. The "Duration_Timer" block is available in the "Quench_EPH" chart, and the V1 block is available in the "Valve" chart.
3. You open the Properties dialog by double-clicking on the initial step of the Run sequence. Then, click on the "Processing" tab and on "Search". For information on how to proceed, see the following example images.

Diagram of the "RUN" sequence (RUN=1)



Result

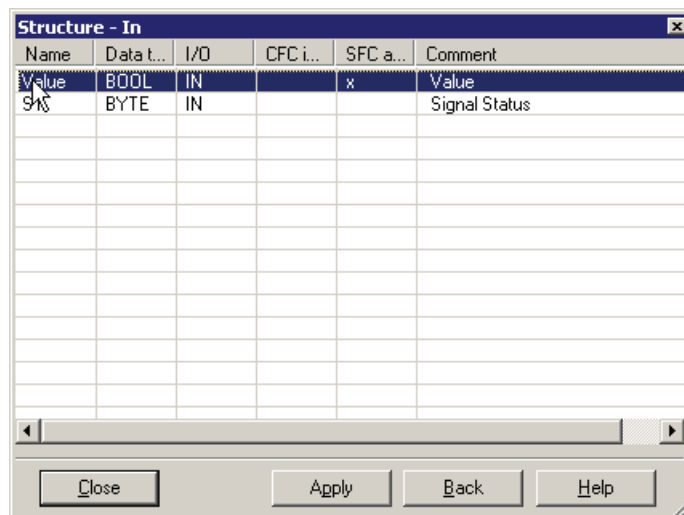
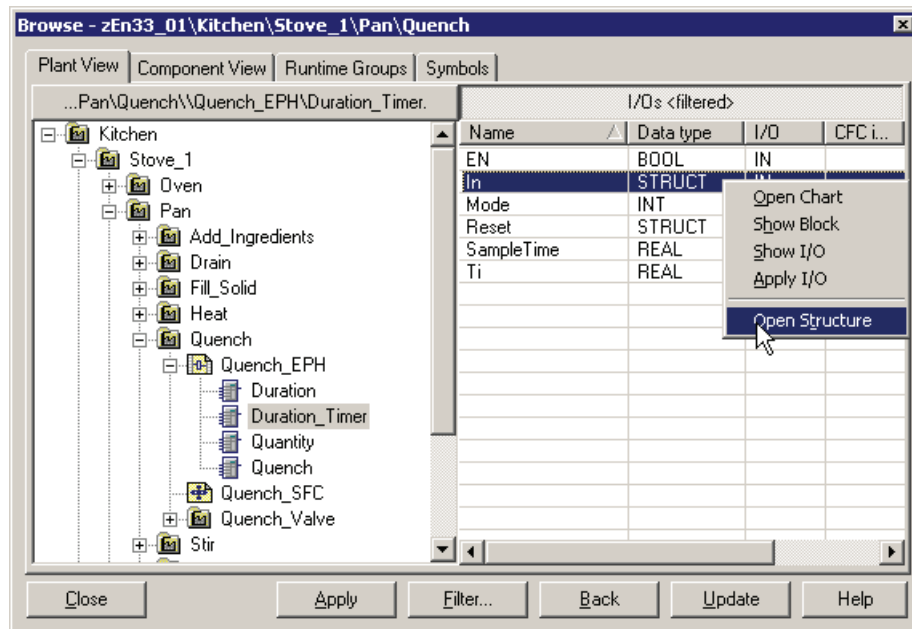
Layout of the configured sequencer:

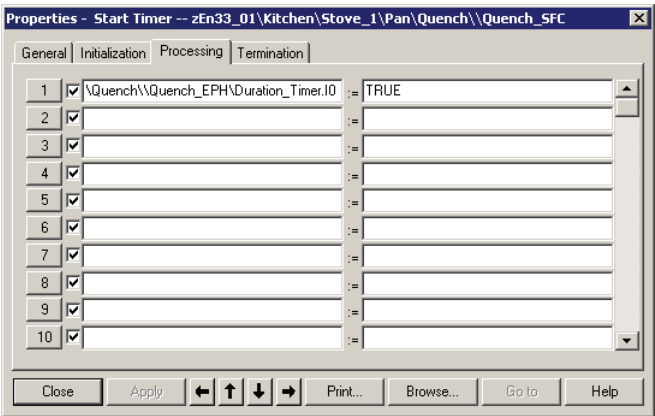


Example of a step and of a transition

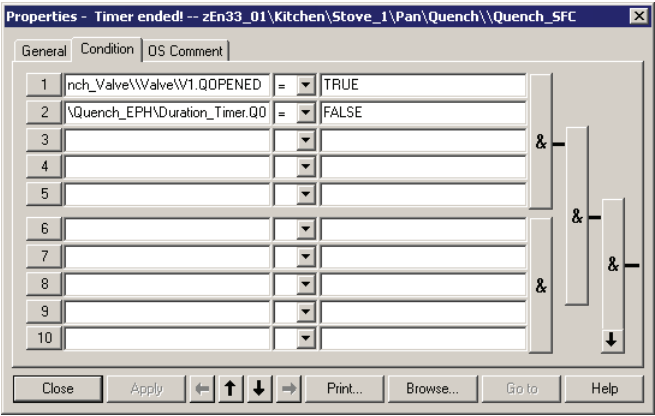
You should preferably use the "Editing" tab to handle the steps.

Step: Start Timer

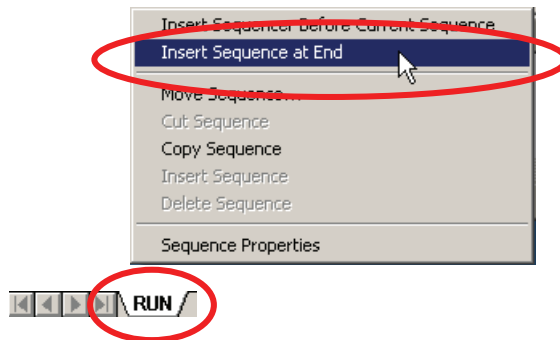




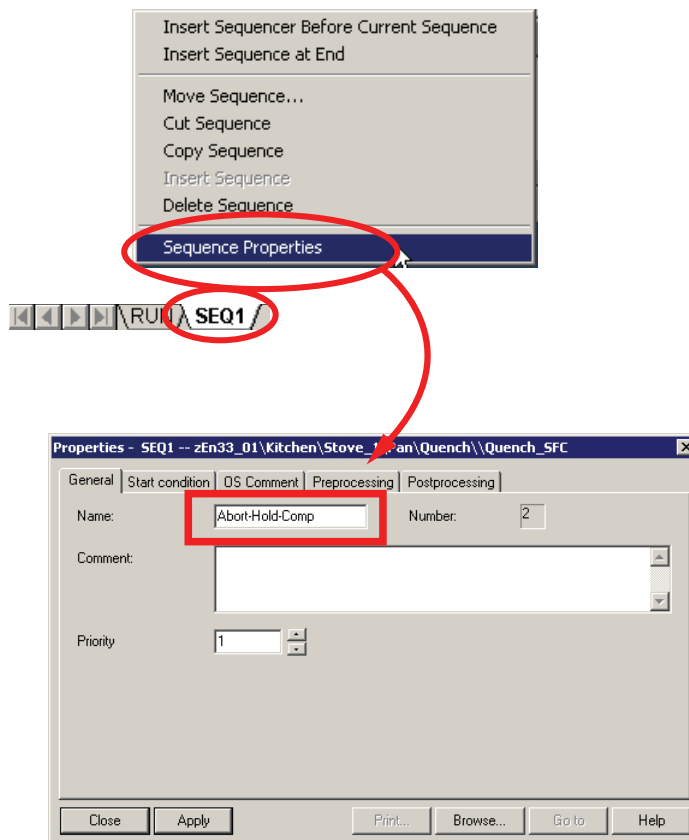
Transition: Timer ended



1. Insert a new sequencer in "Quench_SFC".

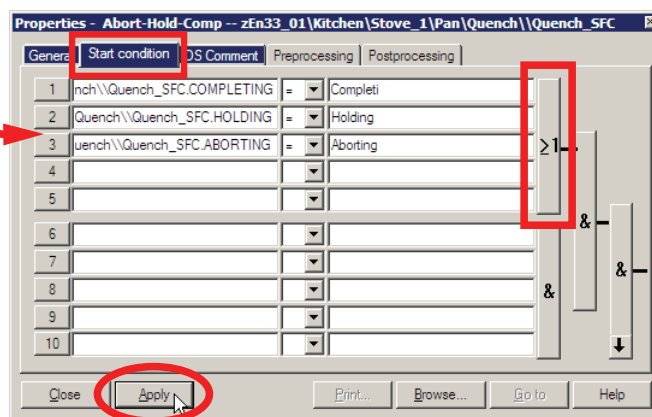
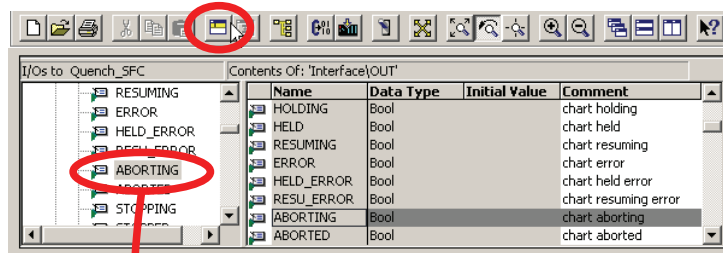


2. Opens the properties dialog box of SEQ1 (by double-clicking the SEQ1 tab, or with right click). Enter the name "Abort-Hold-Comp" in the "General" tab. Then apply the settings.



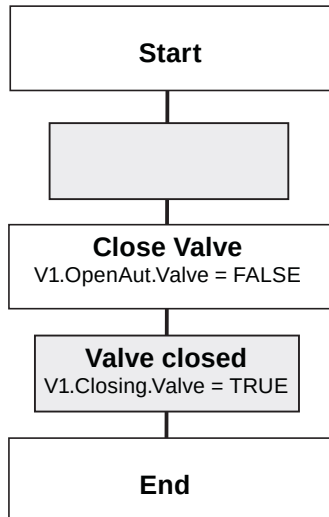
4.5 Creating an SFC

3. Configure the start conditions for the sequence in the "Sequence properties...".
 - Activate the "I/Os" view.
 - Drag-and-drop the "HOLDING", "ABORTING" and "COMPLETING" parameters (available in the menu: View > I/Os in the OUT folder) as start condition to the "Start condition" tab.
 - Create a logical OR operation. Apply the settings and close the "Properties" dialog box.

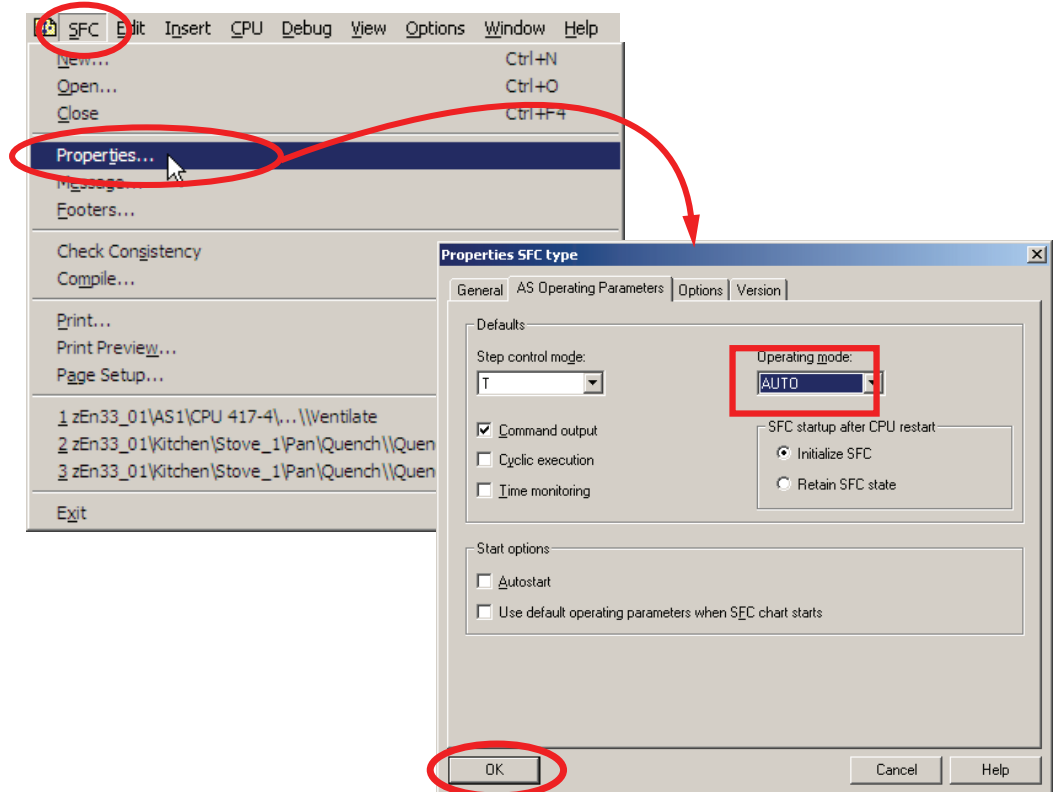


4. Configure the Abort-Hold-Complete sequencer shown below.

Diagram of the "Hold/Abort/Complete" sequence (Holding=1, or Aborting=1, or Completing=1)



1. Select the "AUTO" mode in the "Quench_SFC" SFC chart.

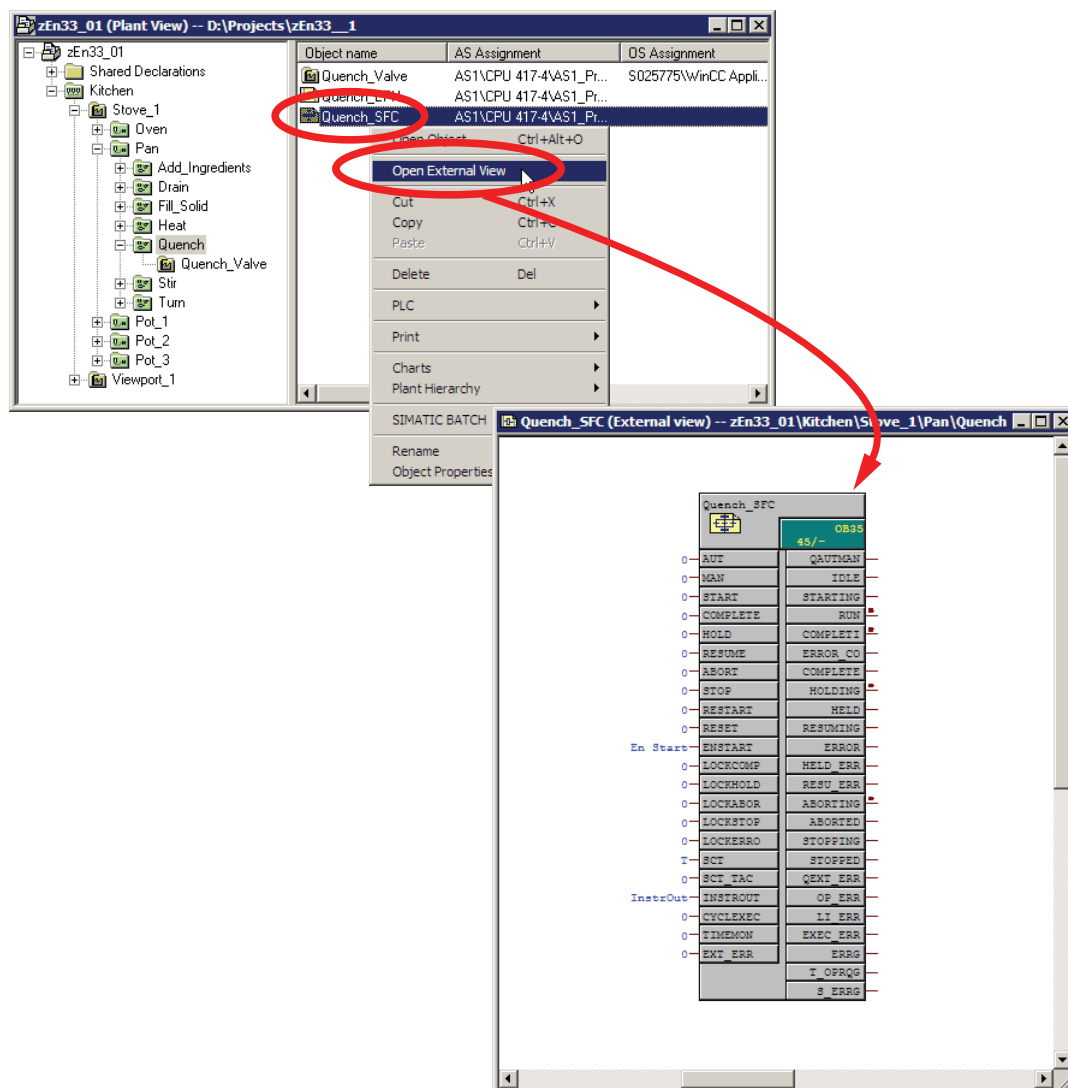


2. Close the SFC Editor.

4.6 Connecting the Batch control commands with the SFC

Procedure

1. Open the external view of the "Quench_SFC" SFC chart.

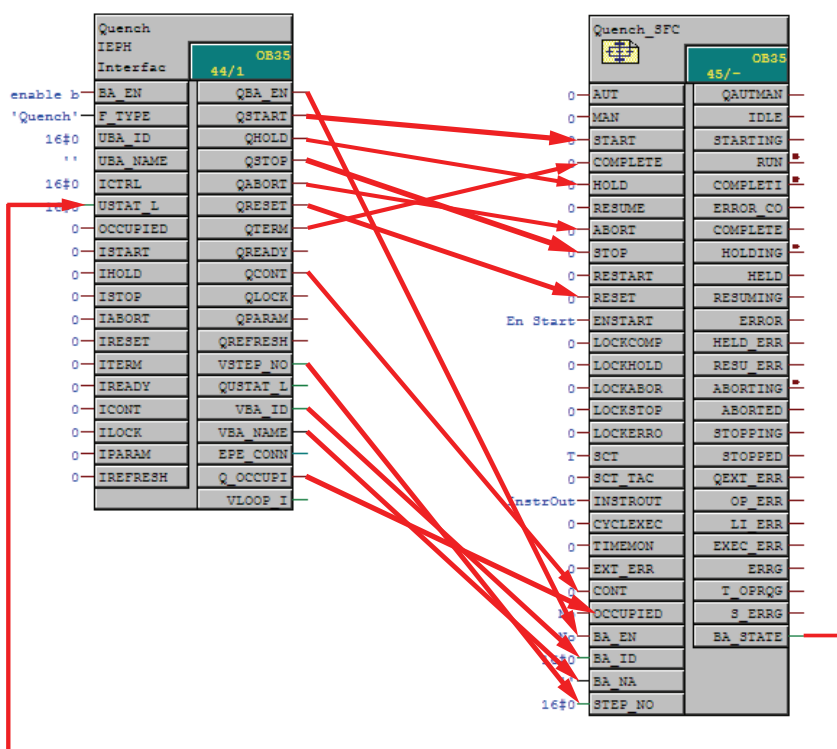


2. Open the CFC chart "Quench_EPH" with the "Quench" interface block.
3. Interconnect the "Quench" interface block with the external view of SFC chart "Quench_SFC" as shown below.

Note

Start by activating the visibility of all parameters of the list below.

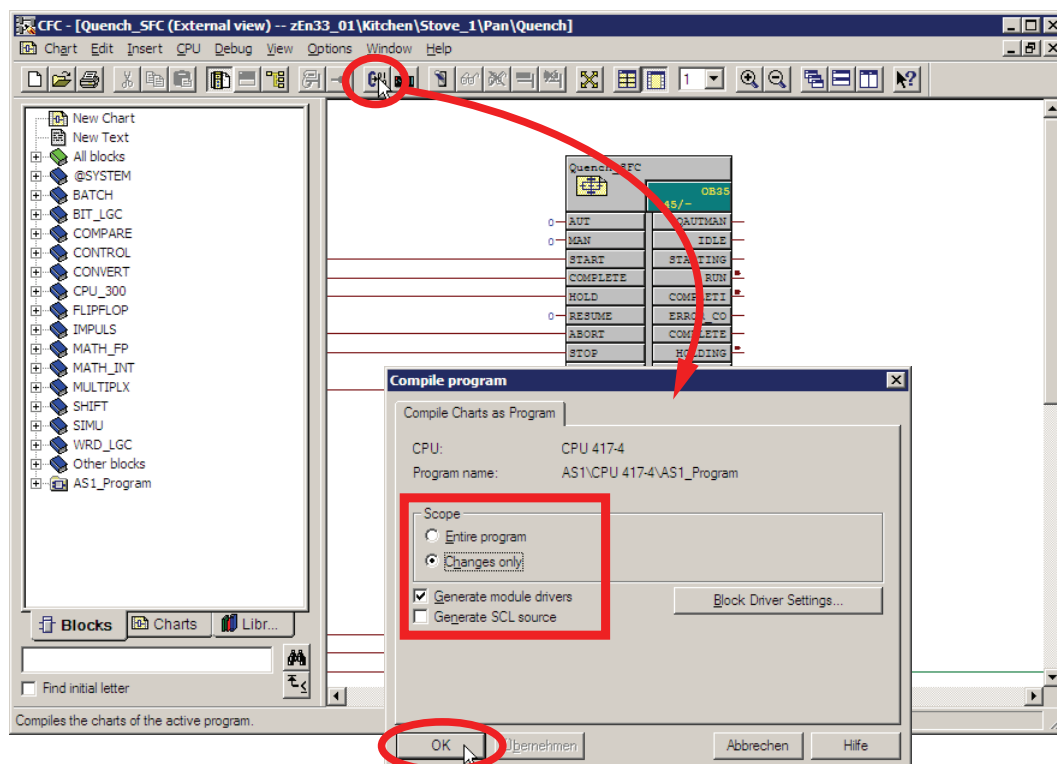
Quench / QSTART	with	Quench_SFC / START
Quench / QHOLD	with	Quench_SFC / HOLD
Quench / QSTOP	with	Quench_SFC / STOP
Quench / QABORT	with	Quench_SFC / ABORT
Quench / QRESET	with	Quench_SFC / RESET
Quench / QTERM	with	Quench_SFC / COMPLETE
Quench / QCONT	with	Quench_SFC / CONT
Quench / QBA_EN	with	Quench_SFC / BA_EN
Quench / VSTEP_NO	with	Quench_SFC / STEP_NO
Quench / VBA_ID	with	Quench_SFC / BA_ID
Quench / VBA_NAME	with	Quench_SFC / BA_NA
Quench / Q_OCCUPI	with	Quench_SFC / OCCUPIED
Quench / USTAT_L	with	Quench_SFC / BA_STATE



4.7 Compiling and downloading the AS and OS

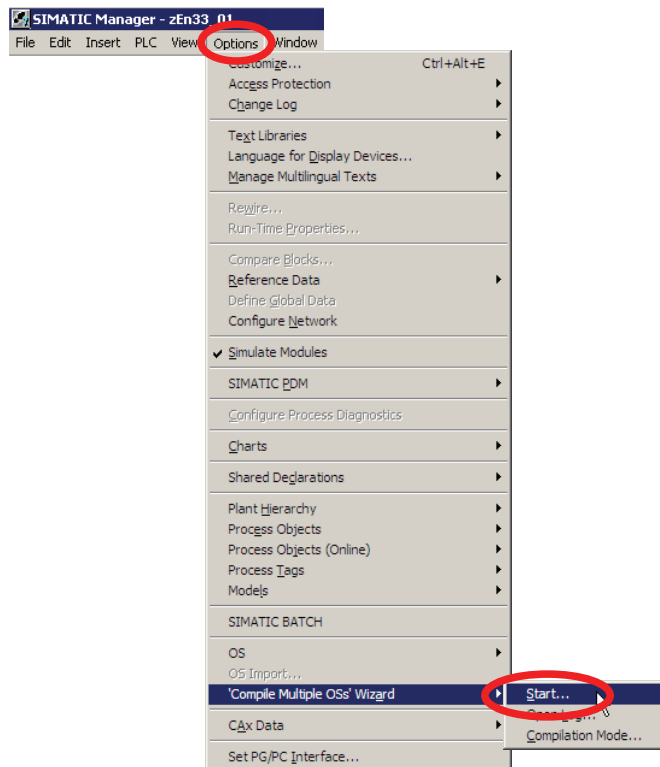
Procedure

1. Compile the modified AS data and then download this data with a "delta download".
The Runtime OS must be closed for this operation.

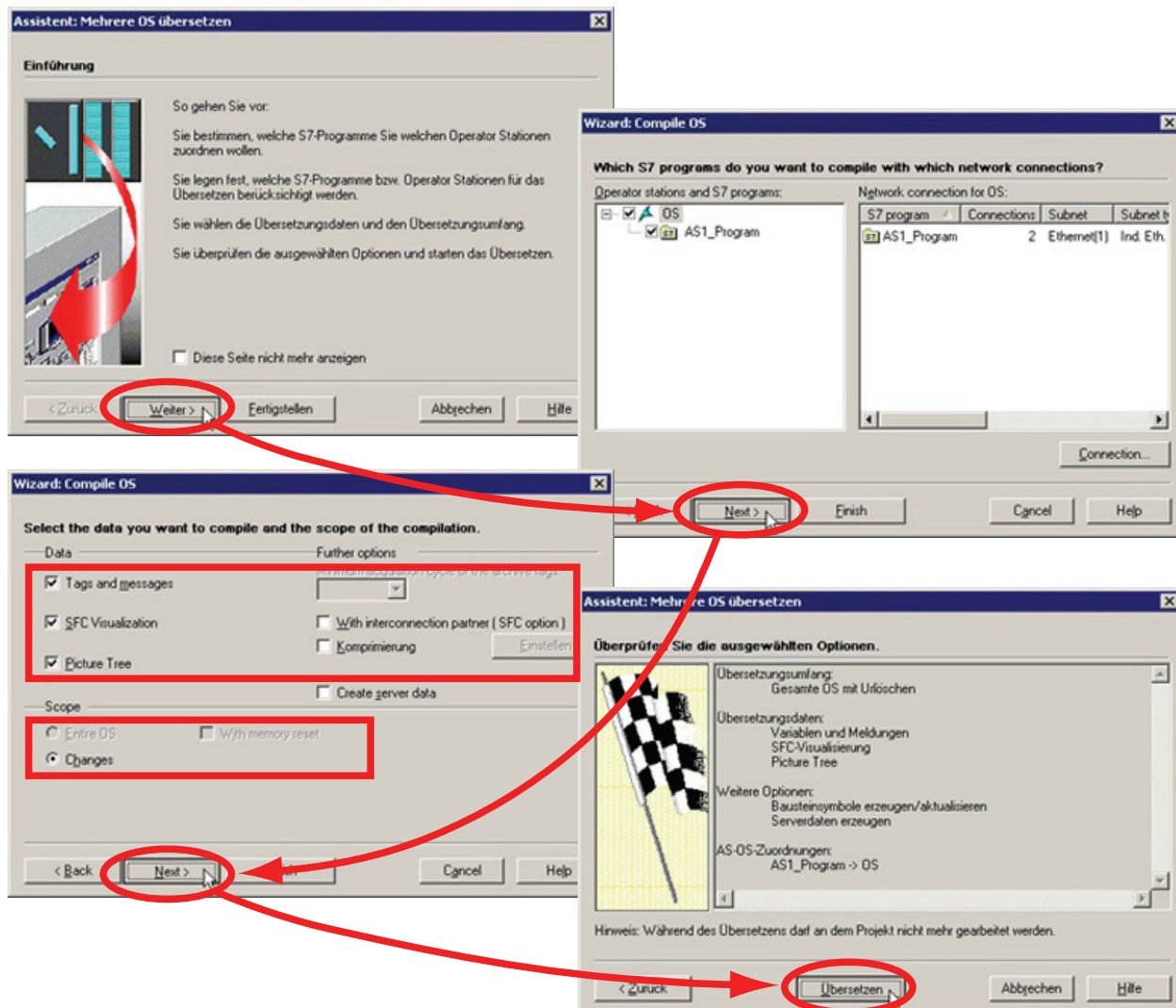


2. Verify that the AS is in RUN_P state after you completed the download.

3. Compile the changes made to OS data.



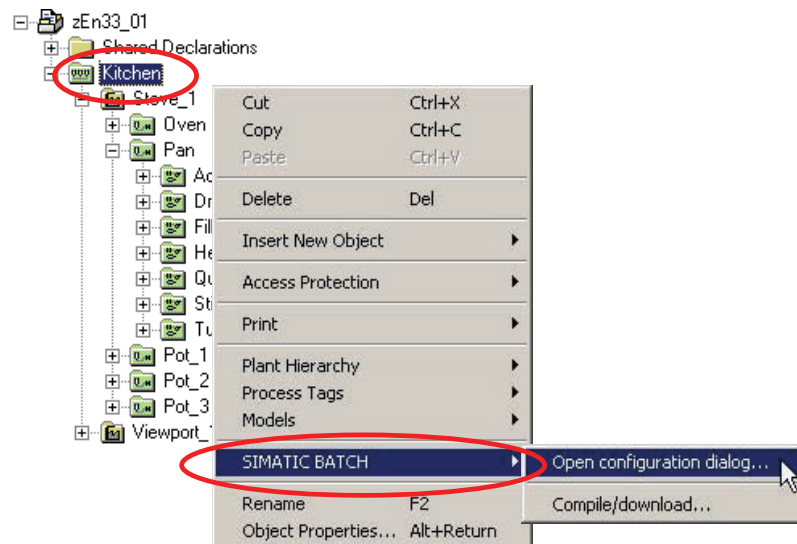
4.7 Compiling and downloading the AS and OS



4.8 Generating Batch Types

Procedure

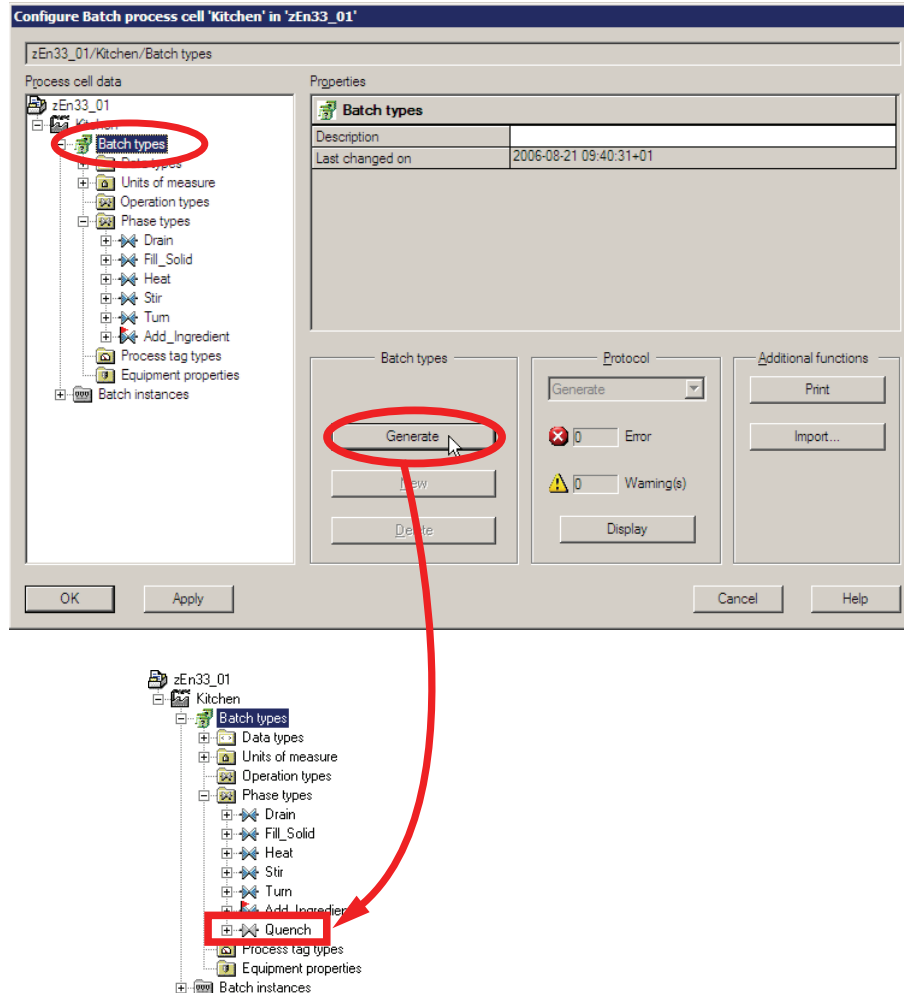
1. Open the "Configure Batch process cell" dialog in the Plant view in your project. Select "Batch types".



4.9 Compiling and Downloading Batch Process Cell Data

2. Generate the Batch types.

You new data you configured in the CFC chart "Quench_EPH" are now loaded.



4.9 Compiling and Downloading Batch Process Cell Data

Procedure

1. Compile the Batch process cell data.
To do this, select "Batch instances" and select the "Compile" button.
2. Download the Batch process cell data.
Select the Batch process cell (here the Kitchen) and initiate a "Download" operation.
Save your changes (confirm the dialog with Yes).
Download the Batch process cell data you generated on the ES to the BATCH Server.
3. Close the dialog box.
4. Close the "Configure Batch process cell" dialog box.

Illustrations to the above described procedure items

For illustrations to the above described steps, see the section **Configuring test project "Kitchen" > Configuring > "Compiling the AS, OS and Batch Process Cell Data"**.

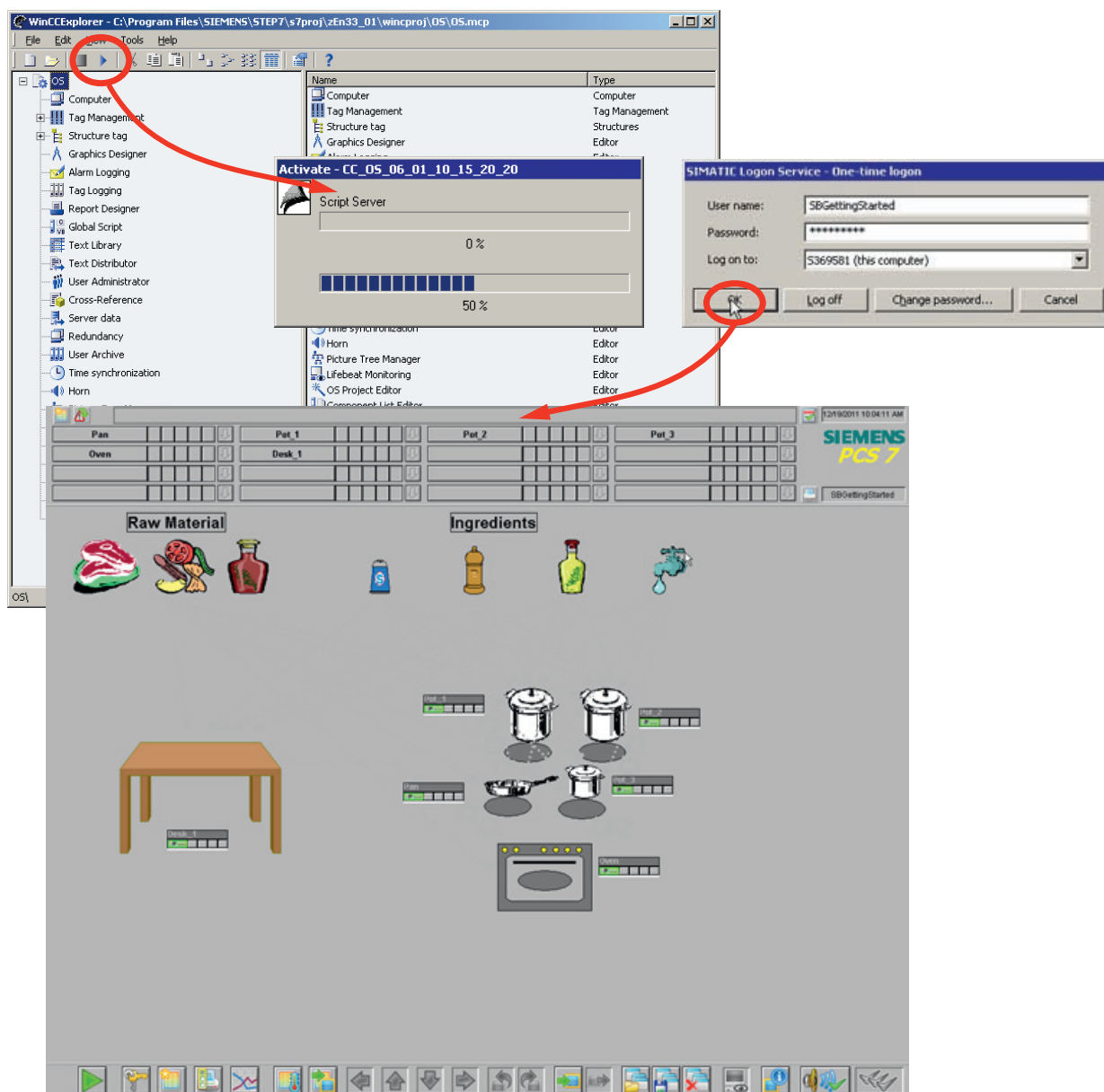
See also

Compiling and downloading the AS, OS and Batch process cell data (Page 48)

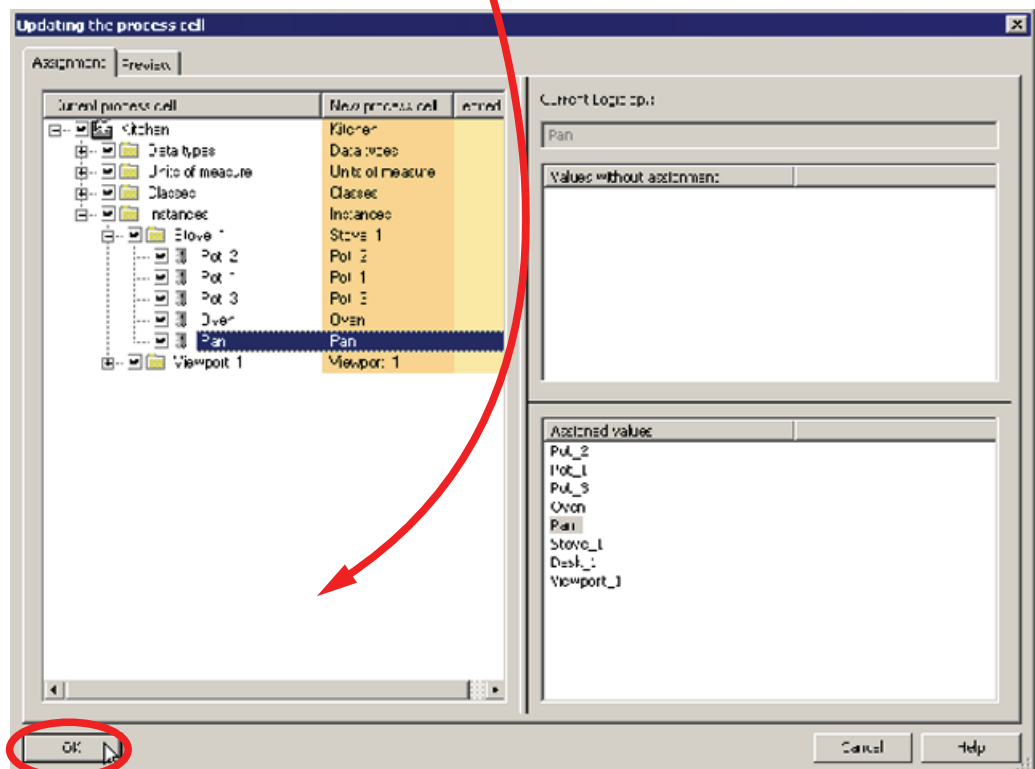
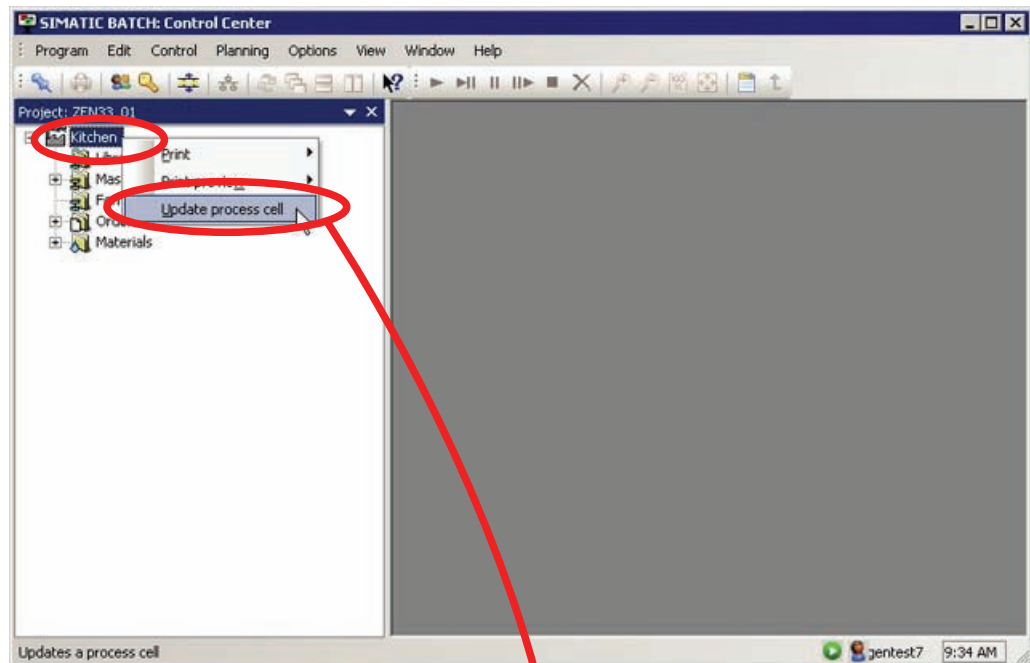
4.10 Expanding recipes

Procedure

1. Start Runtime on the OS.

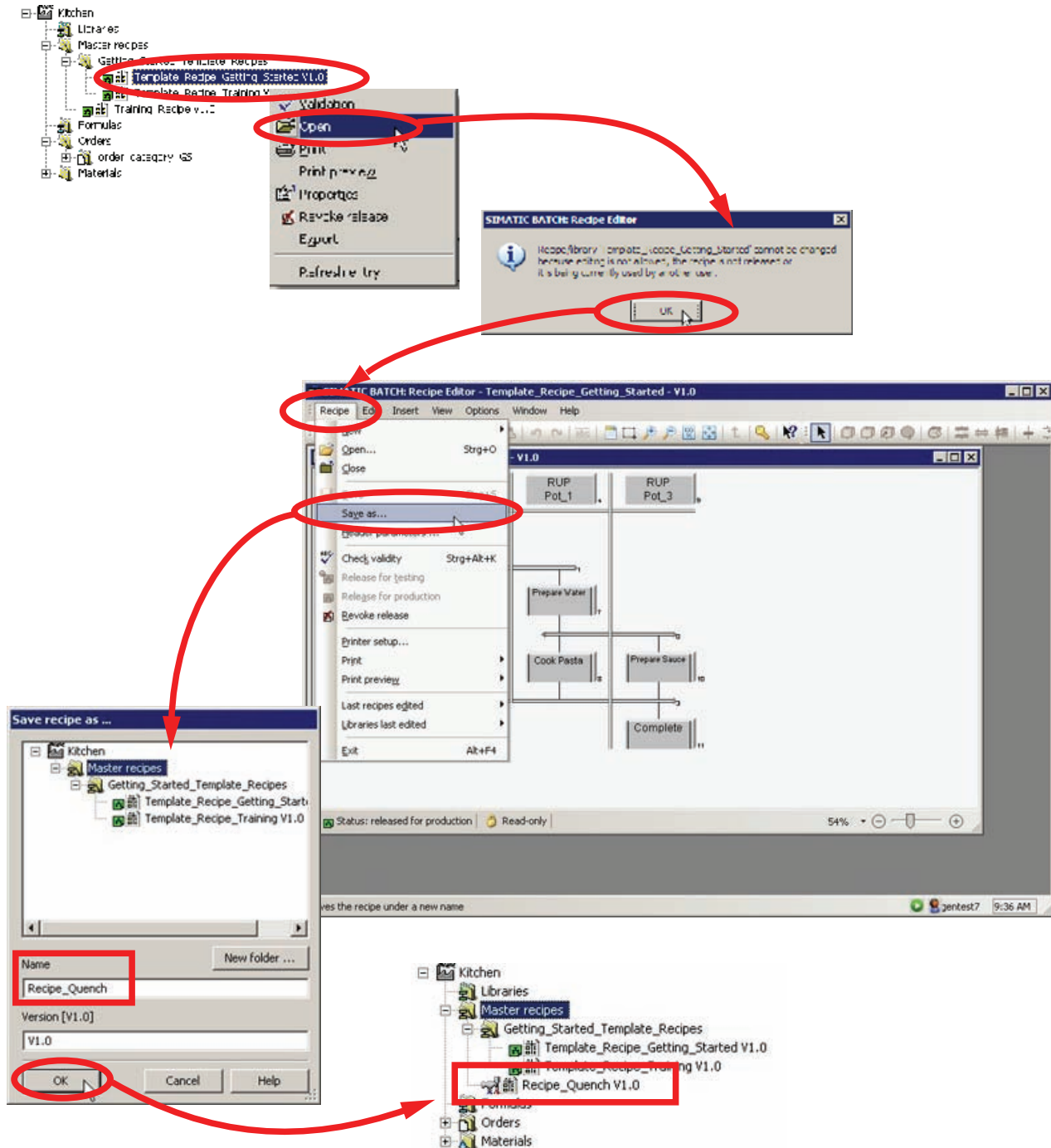


2. Start the Batch Control Center and update the new Batch process cell data you downloaded.

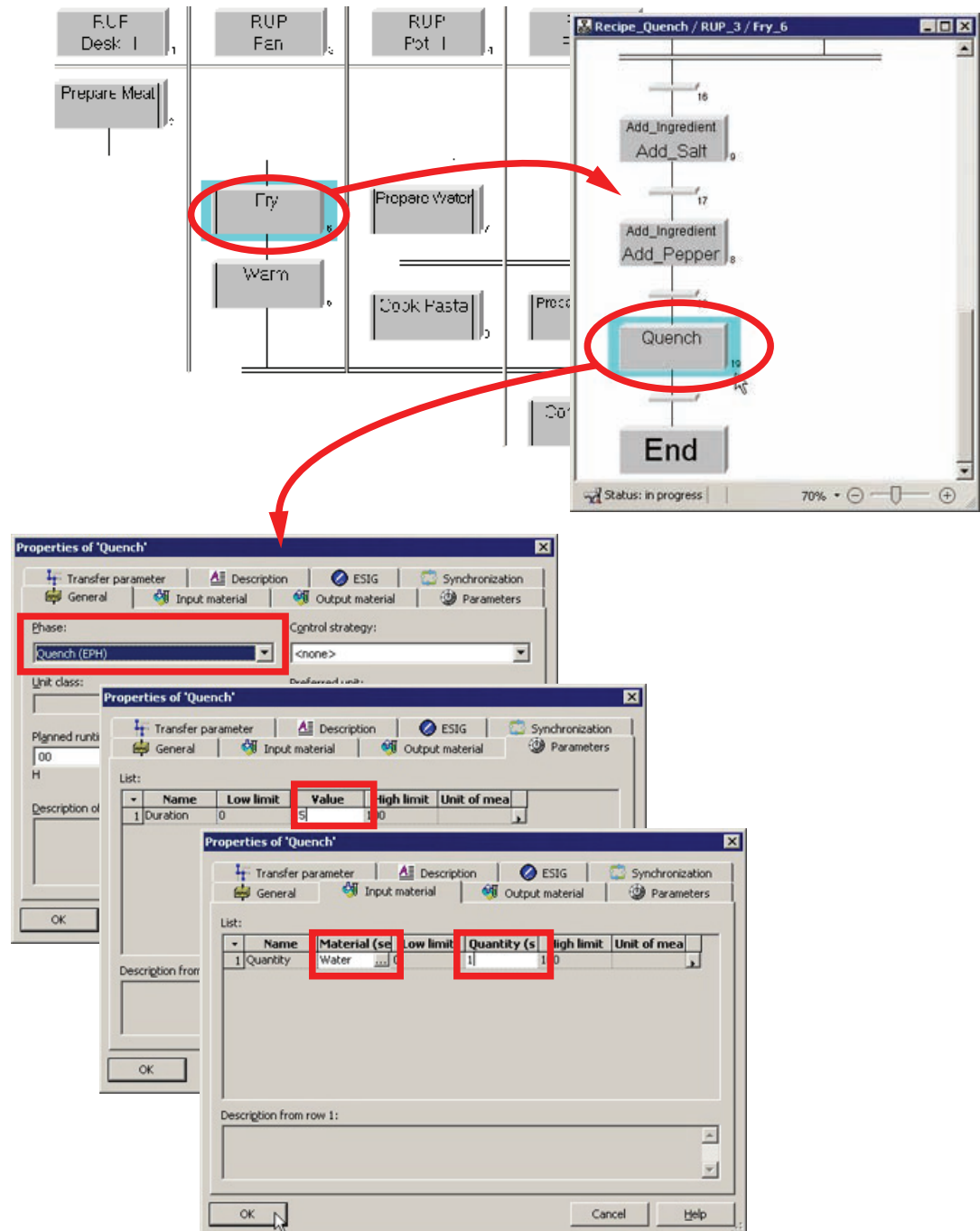


4.10 Expanding recipes

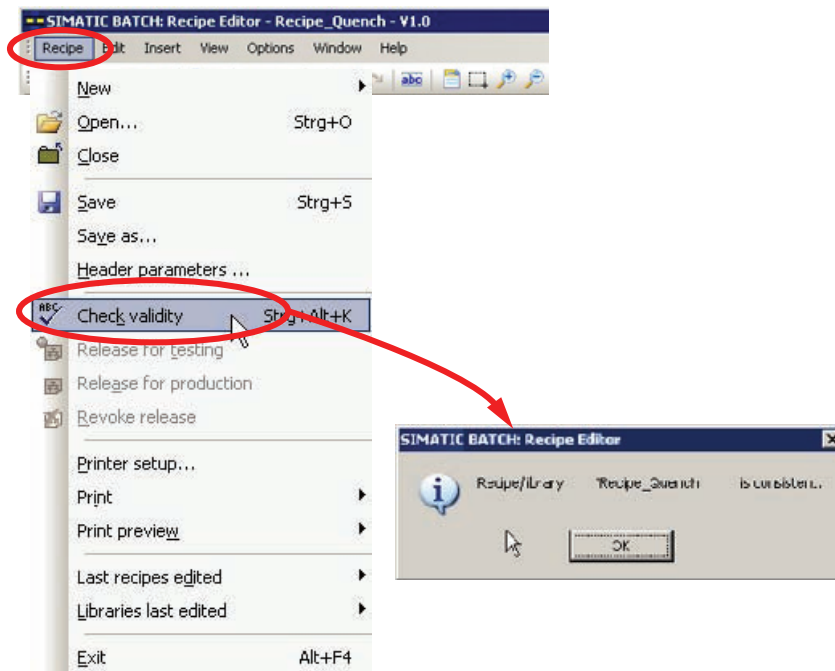
- Open the "Template_Recipe_Getting_Started" master recipe and save it with the name "Recipe_Quench".



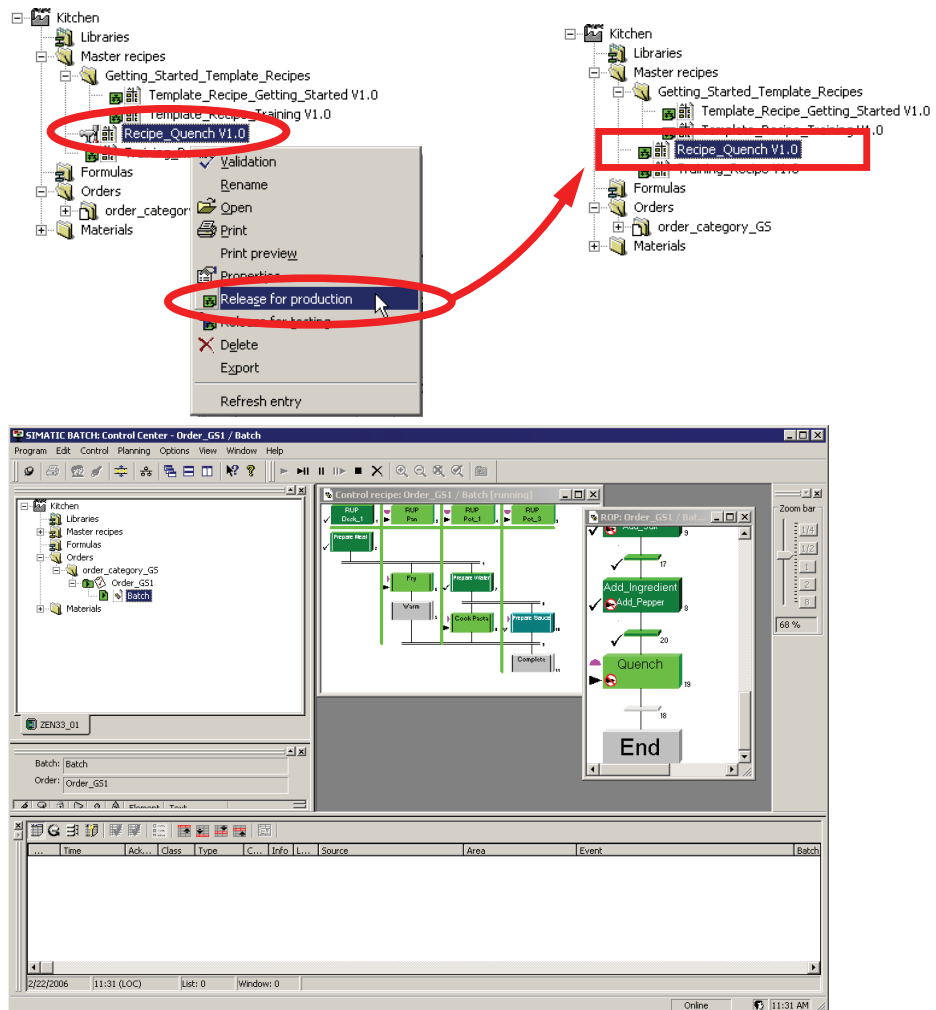
4. In the "Recipe_Quench" recipe you have just created, insert the newly configured "Quench" phase.



5. Save and validate the recipe. Then close the Recipe Editor.



- Release the recipe for production. Then create a new batch with the "Recipe_Quench" recipe, release and start it.



- Close the SIMATIC BATCH Control Center and exit WinCC Runtime.

Creating an Equipment Phase Using an SFC Type

5.1 Task definition and implementation concept for "Ventilate"

Procedure

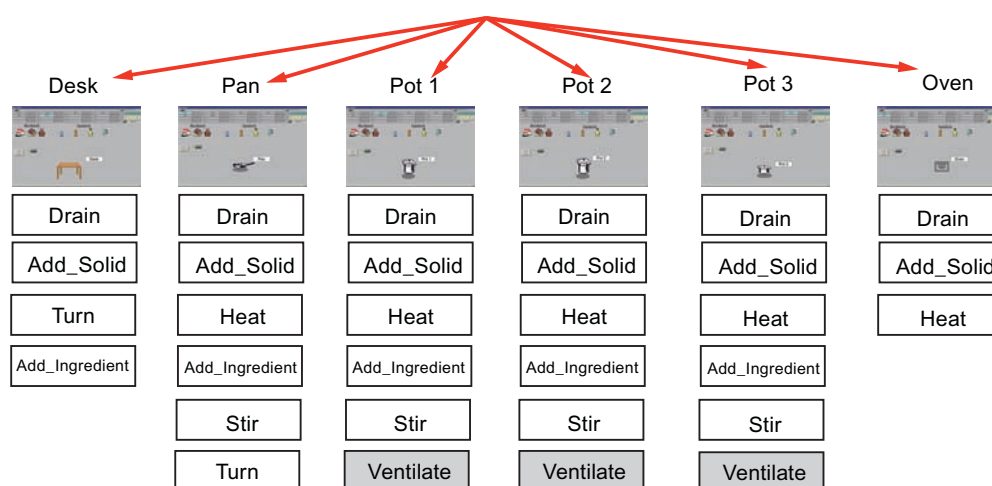
An additional equipment phase is required for the pots. It needs to be extended by adding the "Ventilate" phase. A ventilation valve must be opened for a selectable time. If the batch is held or aborted, the valve will close.

Since the same equipment phase is required for Pots 1-3, select the SFC type to implement it.

Process Cell



Units



Implementation Concept for SFC Type "Ventilate"

Table 5- 1 Control strategies

Control strategy name	Comment
Ventilate	First control strategy, QCS=1

Table 5- 2 Setpoints

Setpoint name	Data type	Comment
Duration	REAL	Unit of measure seconds

Table 5- 3 Process values

Process value name	Data type	Comment
None		

Table 5- 4 Times

Name	Data type	Comment
T_Duration	Time	Timer for setpoint "Duration", Mode=1

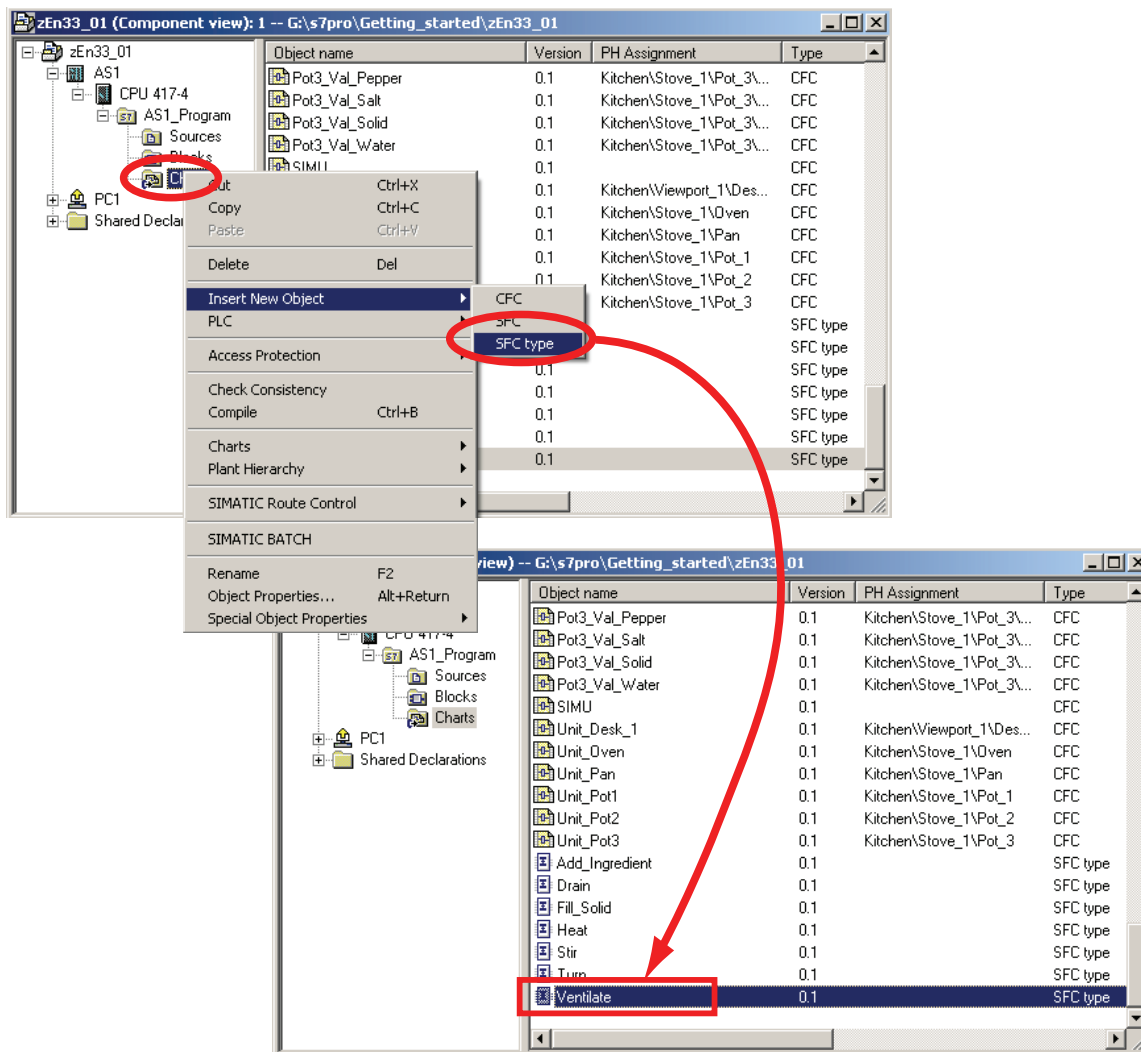
Table 5- 5 Block contacts

Block name	Data type	Comment
V1	VALVE	Ventilation valve

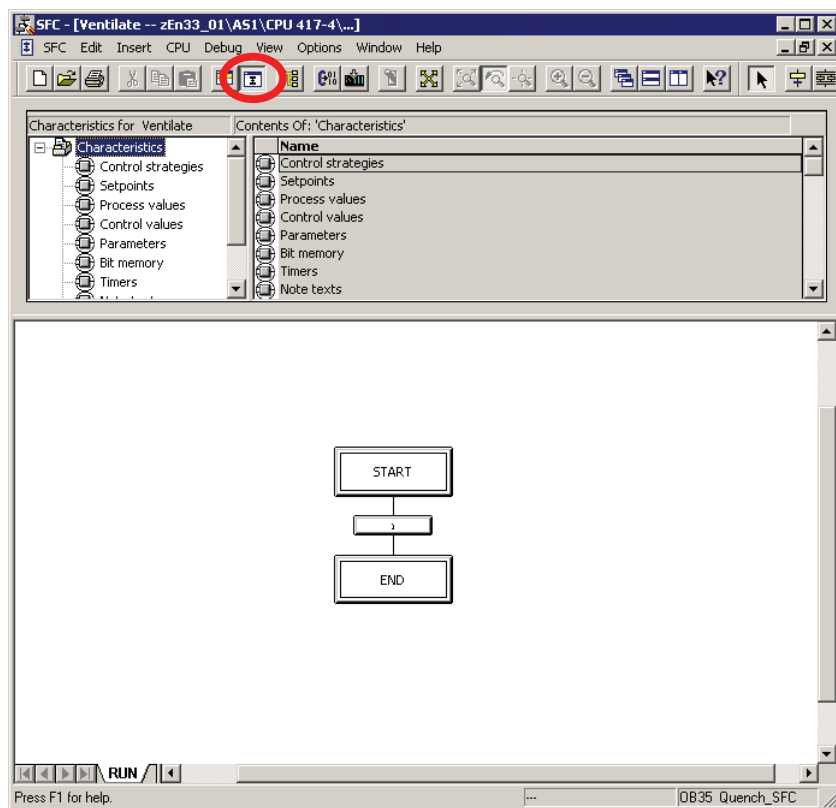
5.2 Creating an SFC type "Ventilate"

Procedure

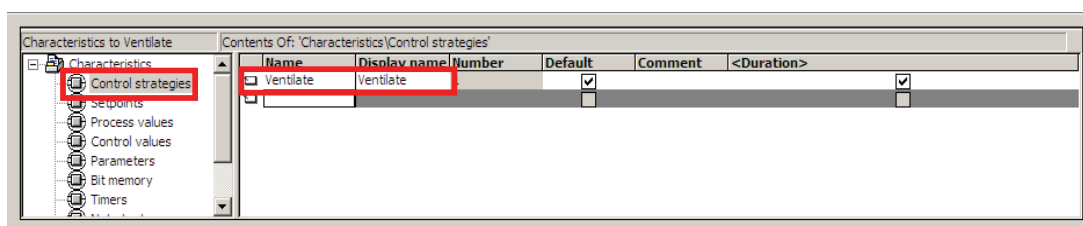
1. Open the Component view and insert the new SFC type "Ventilate".



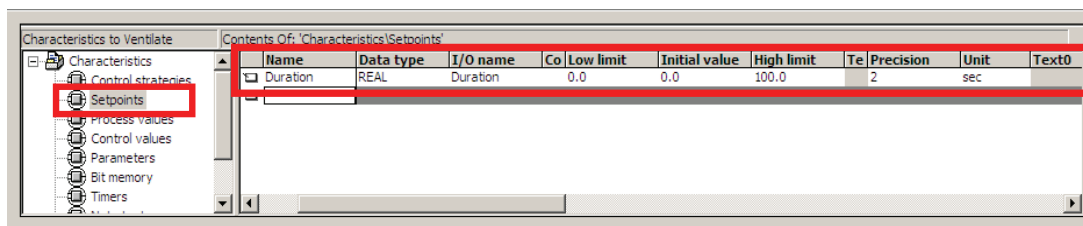
- Open the characteristics dialog of the "Ventilate" SFC type shown below by double-clicking on it.
Select the "Characteristics" menu.



- Select the "Control strategy" characteristic and enter the name "Ventilate" in the right box. Check mark the "Default" entry. This control strategy initiates the start of the SFC instance.



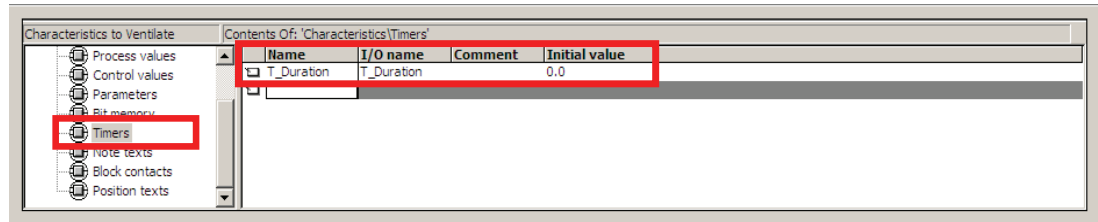
- Now select the "Setpoints" characteristic and enter the setpoint name "Duration" in the right box. Select "REAL" as the data type for Duration. Enter "sec" as the unit of measure for Duration.



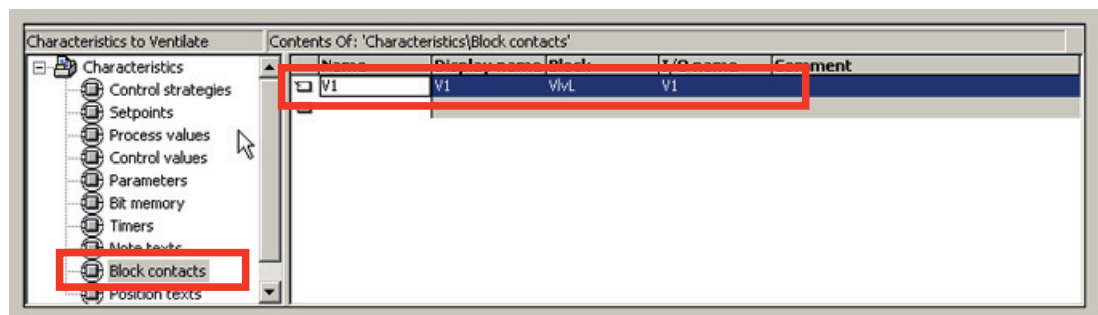
5. Now define the timer. To do this, select the "Timers" characteristic. Enter the name "T_Duration" in the right box. The timers that are used in this way within SFC types, have characteristics similar to the standard "Timer_P" block from the PCS 7 library.

Note

A pop-up window informs you that the TIMER_P block or the "FB5" object already exists. Confirm the prompt with "Yes".



6. In the final step, you will create the valve. Select the "Block contacts" characteristic and enter the name "V1" in the right box. In the "Block" column, select the corresponding block types, in this case "VlvL".

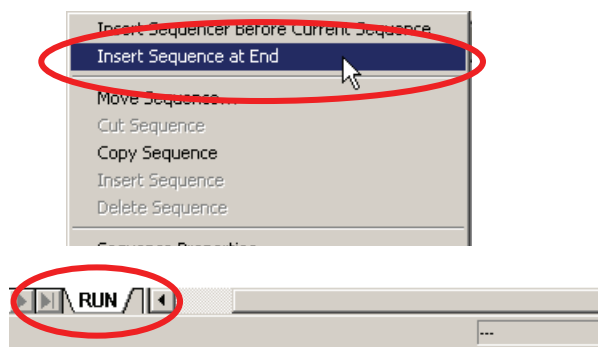


You have now specified all the characteristics required for the "Ventilate" example. The sequencers must now be created and configured.

5.3 Creating Sequencers

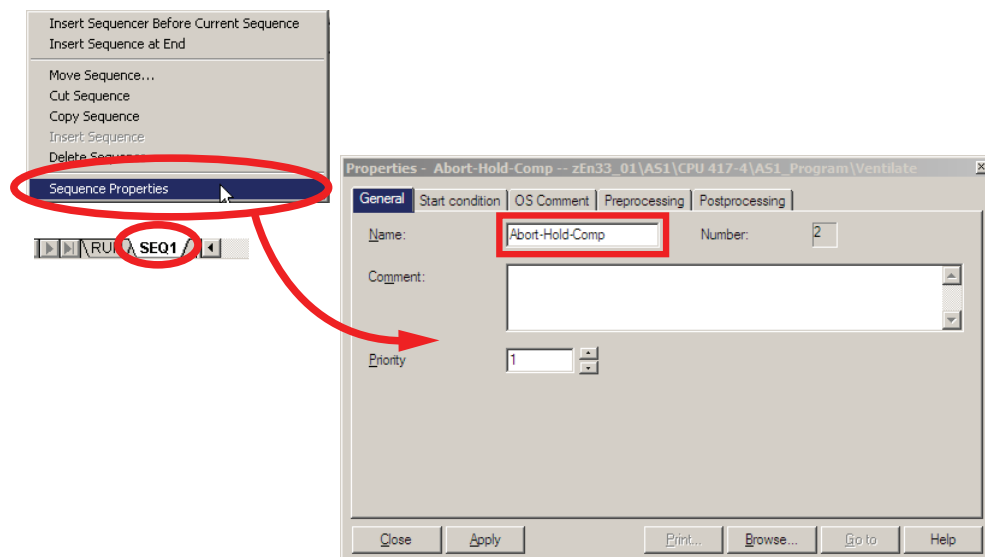
Introduction

The Run sequencer that is processed in the "Run" status has already been created. The sequencer which is processed in the "Holding", "Aborting" and "Completing" states is still missing. You only need to create one sequencer and name it "Abort-Hold-Comp" as the content is the same in all three sequencers.

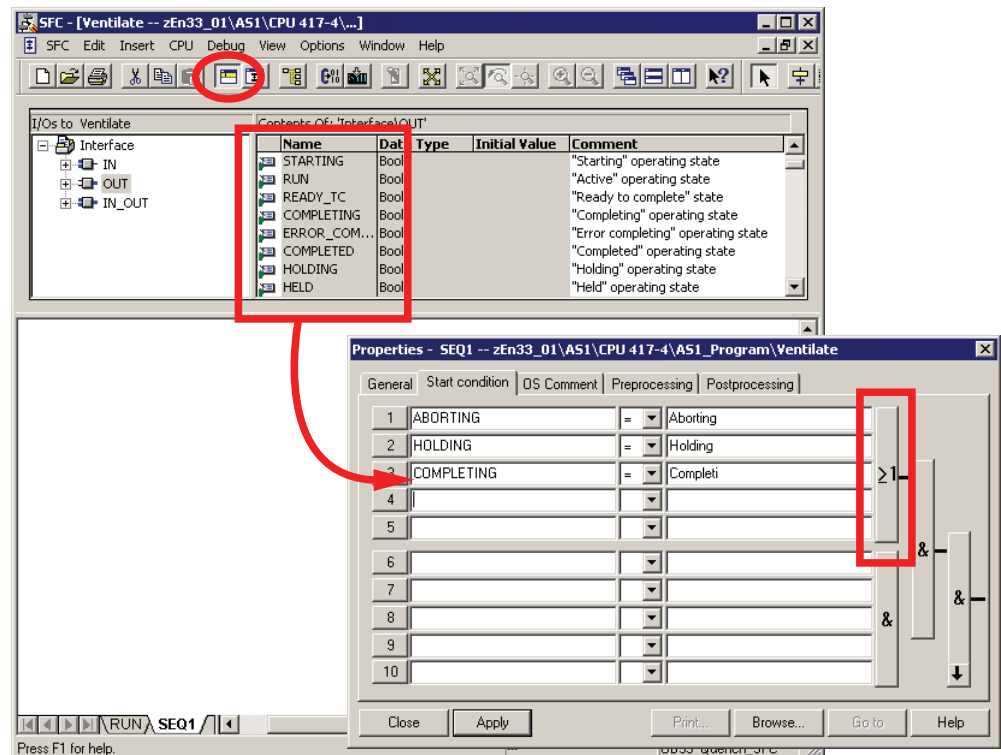


Procedure

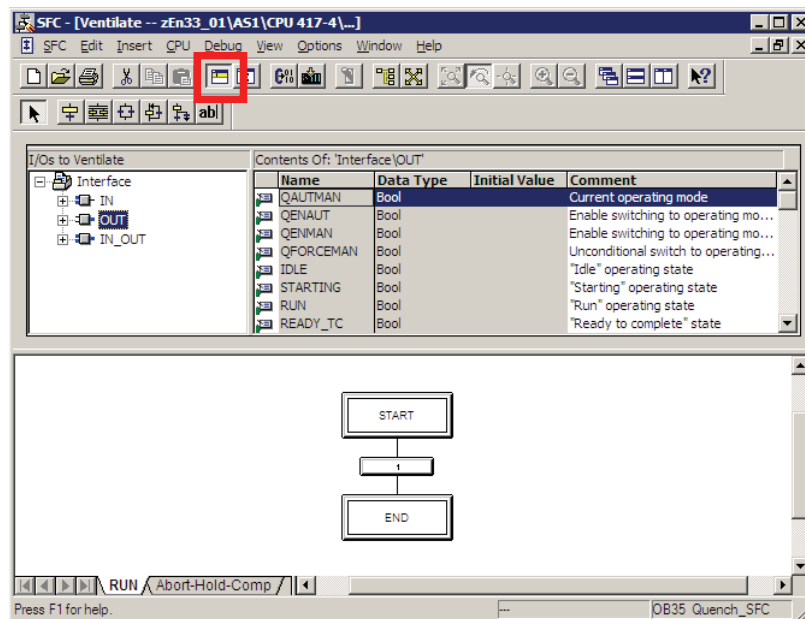
1. Right-click in the "RUN" tab to insert a new sequence. Select "Insert new sequence at the end".
2. A new tab opens, namely the "SEQ1" tab. Set up the SEQ1 properties. Enter the name "Abort-Hold-Comp" in the general properties.



3. You continue by configuring the start conditions of the sequence in the properties. Start condition in this case:
 - Aborting=True, or Holding=True, or Completing=True.
 - Change to the "I/Os" view. The Aborting, Holding and Completing I/O are available in "OUT".
 - Drag-and-drop the I/O from the upper section to the dialog box for configuring the start condition.
 - Apply the settings and close the properties dialog box.



4. The "RUN" sequencer is configured in the next steps. Stay in the "I/Os" view.



The left pane of the window shows the I/O of the SFC type "Ventilate", organized by input, output and in/out objects. The right section of the list shows the associated I/O.

The control outputs for valve V1 or for timer T_Duration are available in "OUT" or in "IN_OUT".

The feedback signals of valve V1 are created in "IN".

Drag-and-drop the I/O from the upper section to the dialog box for configuring the steps / transitions. The Run sequence and the Abort-Hold-Complete sequence are configured as shown in chapter 1. Use the diagrams on the next pages to support you in properly configuring all steps and transitions.

I/Os to Ventilate

Name	Data Type	Initial Value	Comment
Value	Bool		Value
ST	Byte		Signal Status

Properties - V1 Auto

Condition	Value	Initial Value
1	☒ V1_ModLiOp.Value	:= TRUE
2	☒ V1_AutModLi.Value	:= TRUE
3	☒	:=
4	☒	:=
5	☒	:=
6	☒	:=
7	☒	:=
8	☒	:=
9	☒	:=
10	☒	:=

Press F1 for help. DB35 Pot3_Valve

Diagram of the "RUN" sequence (RUN=1) for control strategy "Ventilate" (QCS=1)

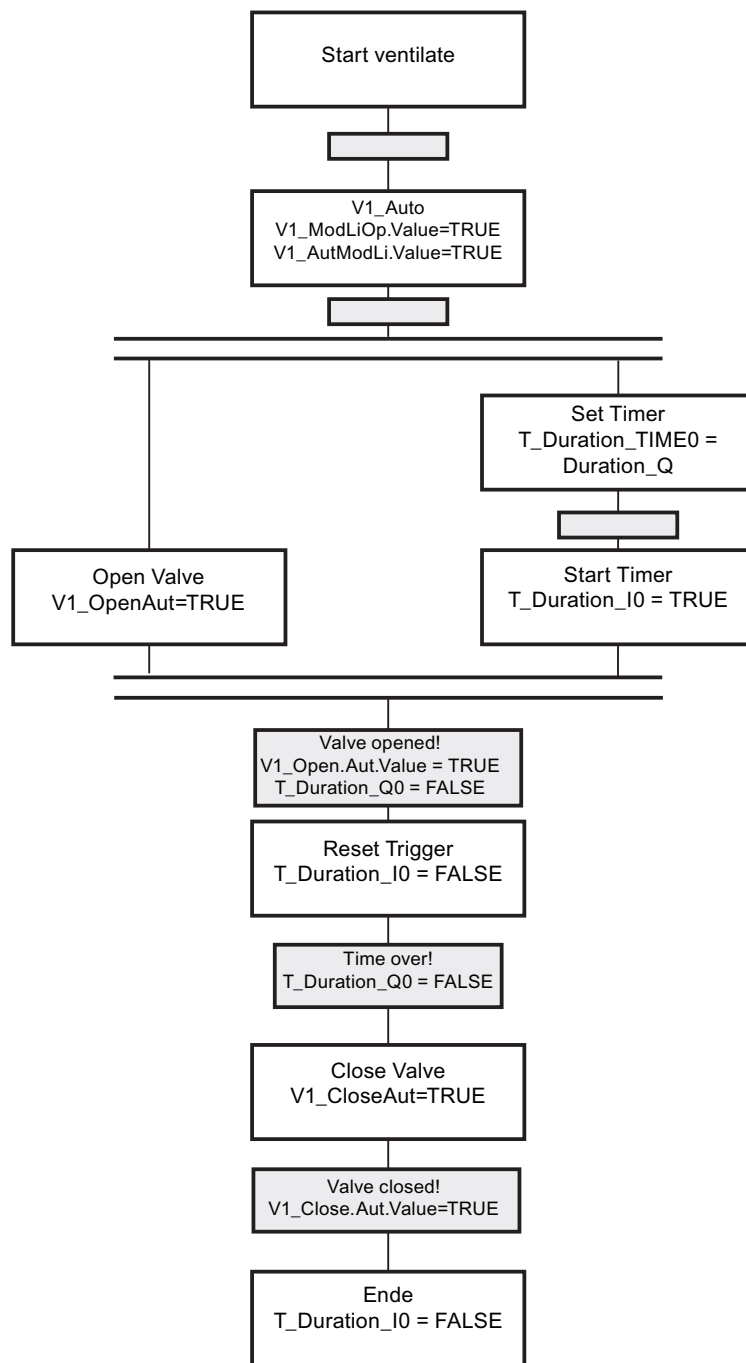
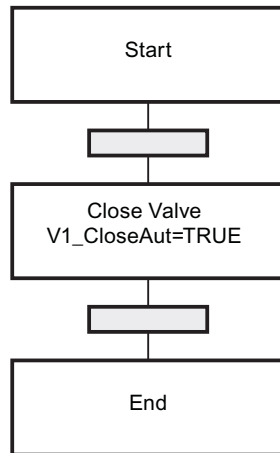
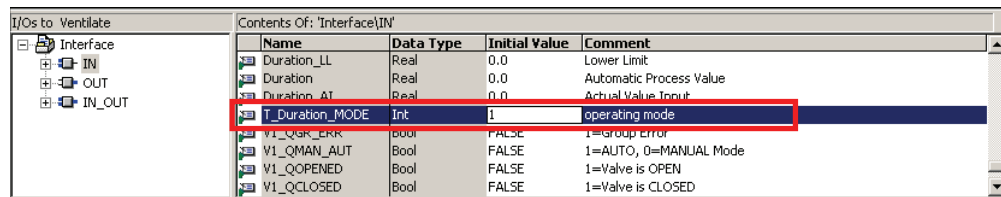


Diagram of the "Hold/Abort/Complete" sequence (Holding=1, or Aborting=1, or Completing=1)

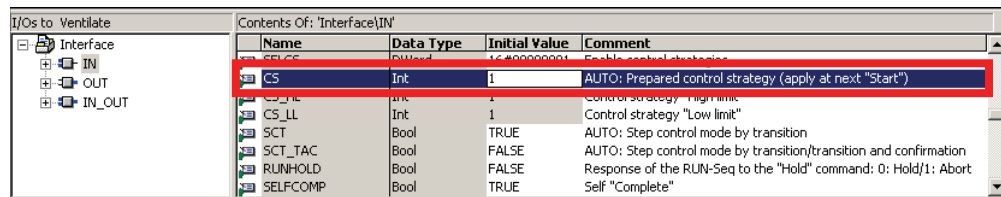


1. Set the start value "1" (extended pulse) for the timer mode.



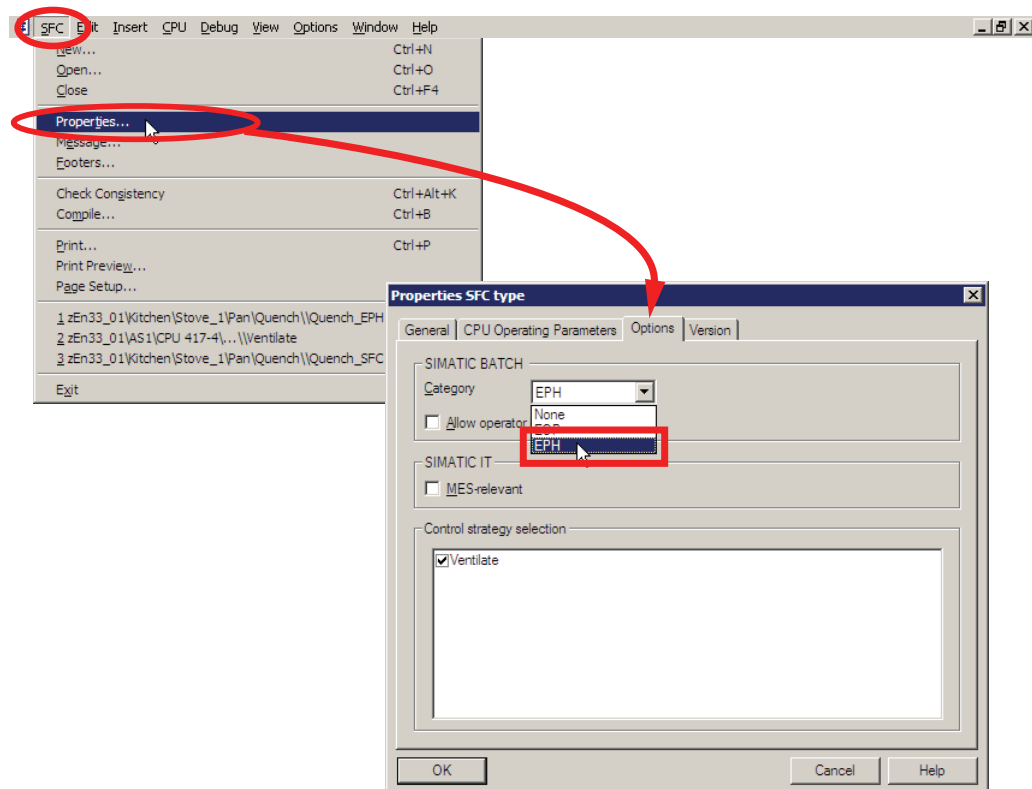
Name	Data Type	Initial Value	Comment
Duration_LL	Real	0.0	Lower Limit
Duration	Real	0.0	Automatic Process Value
Duration_AT	Real	0.0	Actual Value Input
T_Duration_MODE	Int	1	operating mode
V1_QGR_ERR	Bool	FALSE	1=Group Error
V1_QMAN_AUT	Bool	FALSE	1=AUTO, 0=MANUAL Mode
V1_QOPENED	Bool	FALSE	1=Valve is OPEN
V1_QCLOSED	Bool	FALSE	1=Valve is CLOSED

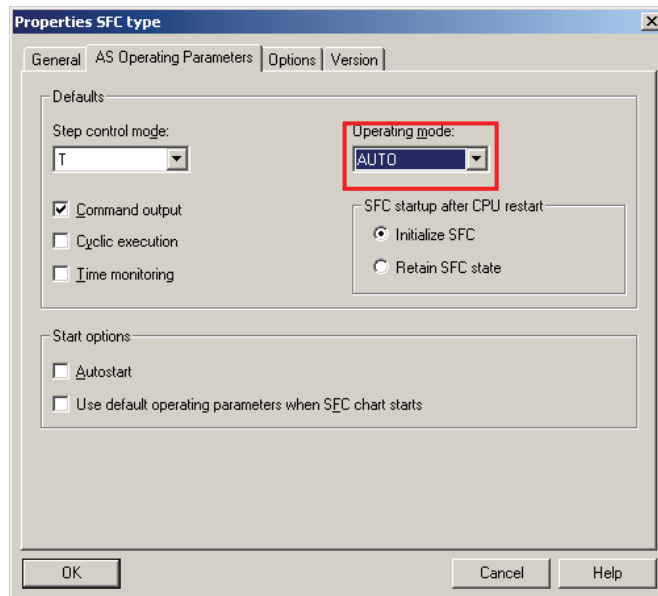
2. Set the start value "1" at parameter CS (control strategy).



Name	Data Type	Initial Value	Comment
CS	Int	1	AUTO: Prepared control strategy (apply at next "Start")
CS_LL	Int	1	Control strategy "Low limit"
SCT	Bool	TRUE	AUTO: Step control mode by transition
SCT_TAC	Bool	FALSE	AUTO: Step control mode by transition/transition and confirmation
RUNHOLD	Bool	FALSE	Response of the RUN-Seq to the "Hold" command: 0: Hold/1: Abort
SELFCOMP	Bool	TRUE	Self "Complete"

3. Select the SIMATIC BATCH category "EPH".



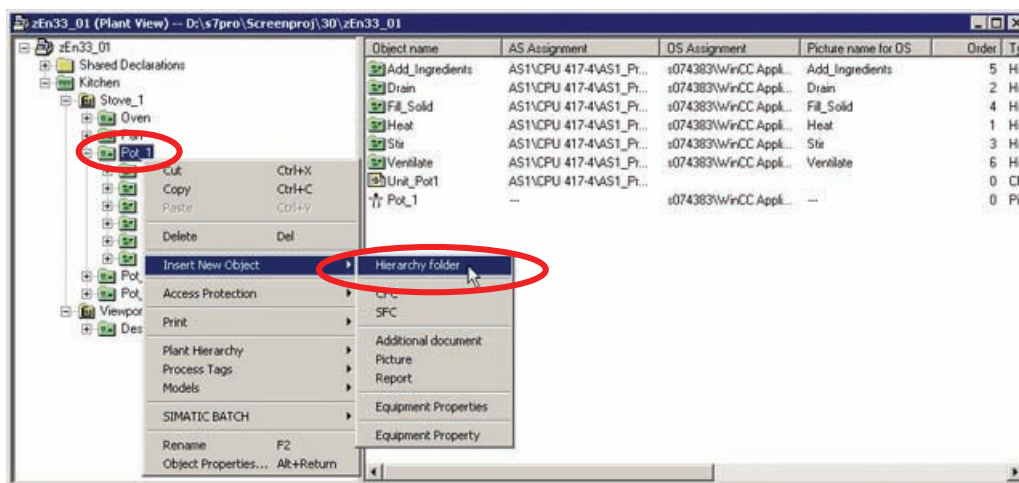


4. Set "Auto" mode as default at the AS operating parameters.
You have successfully completed all tasks for configuring the "Ventilate" type.
5. Close the SFC Editor.

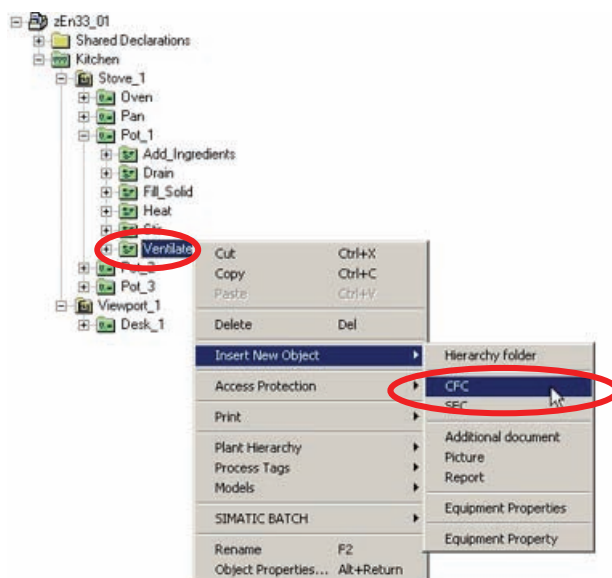
5.4 Expanding the plant hierarchy

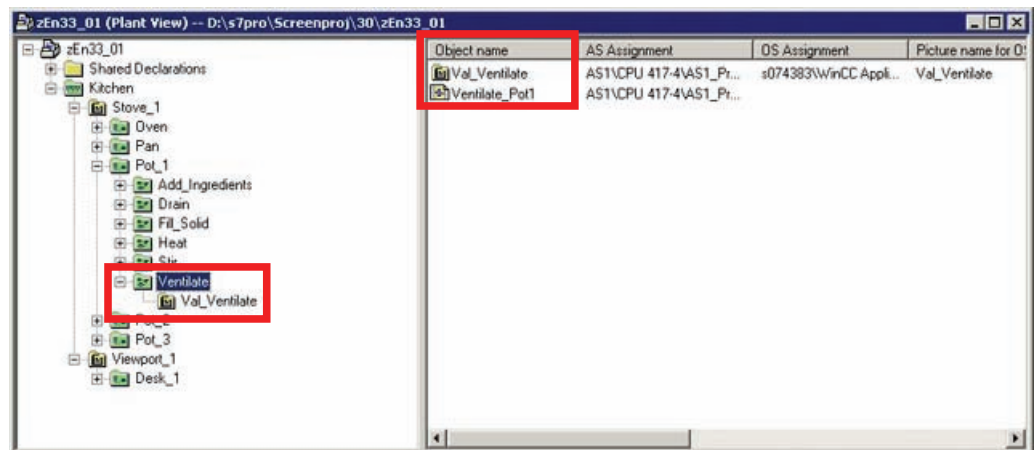
Procedure

1. Open the Plant view of the project in the SIMATIC Manager. A new "Ventilate" equipment phase needs to be inserted for Pot_1. Create a new hierarchy folder. Name this folder "Ventilate".

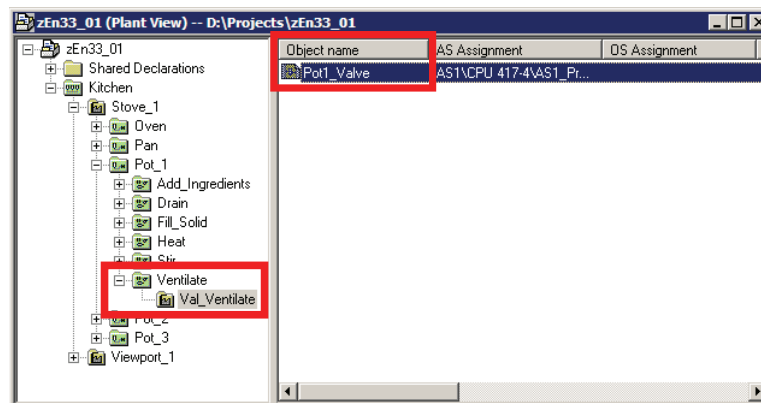


2. Create a CFC chart in the "Ventilate" hierarchy folder. This "Ventilate_Pot1" chart is required for the instance of the SFC type. Now create a "Val_Ventilate" folder in the "Ventilate" folder.

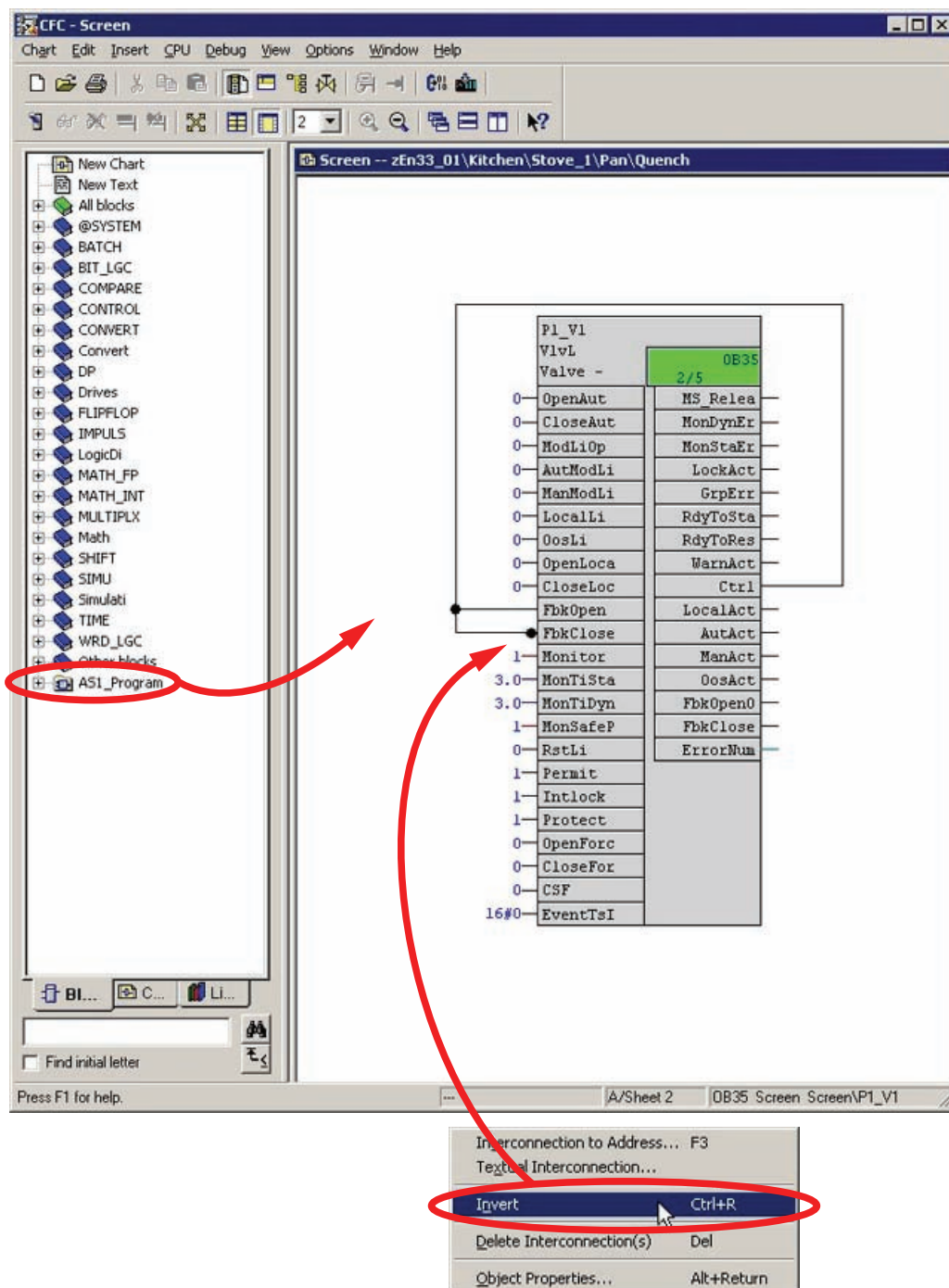




3. Create the "Pot1_Valve" CFC chart in the "Val_Ventilate" subfolder. In this chart, you configure the valve required to ventilate Pot_1.



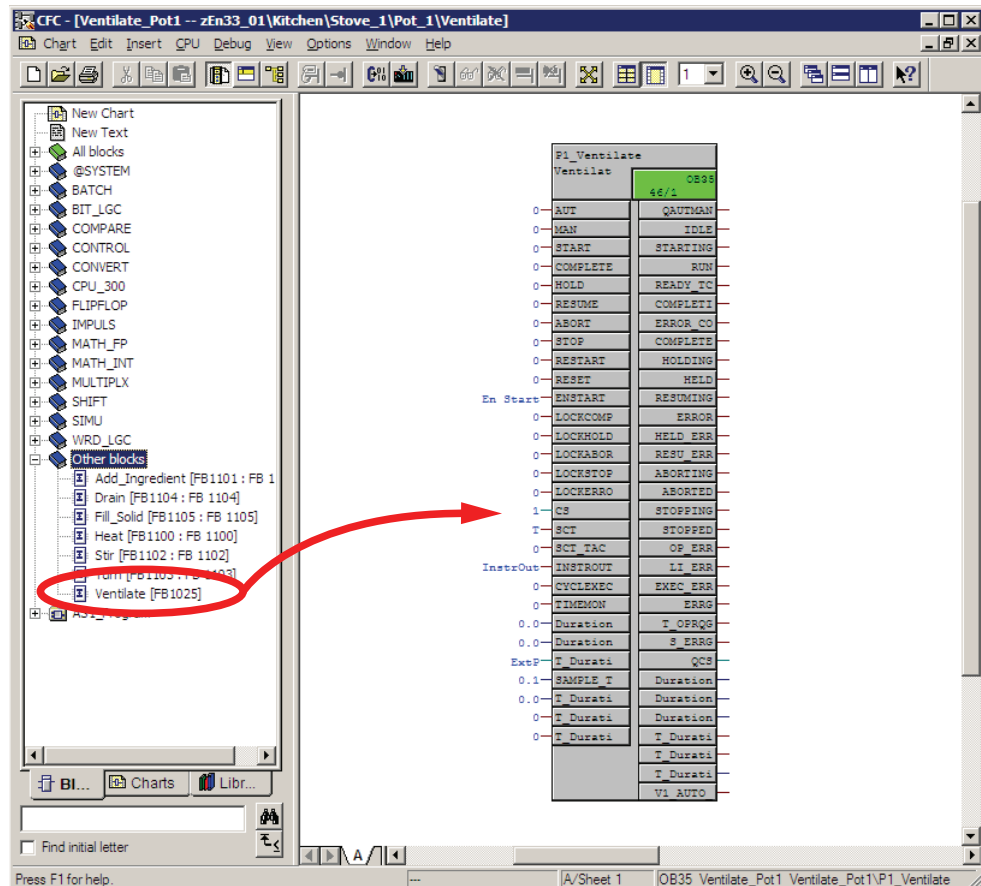
4. Open the "Pot1_Valve" chart. Place a VlvL block with the name P1_V1. To simulate the feedback messages, interconnect the CTRL output with the FB_OPEN input and interconnect it inverted with the FB_CLOSE input (CTRL must first be made visible). You then have the following screen:



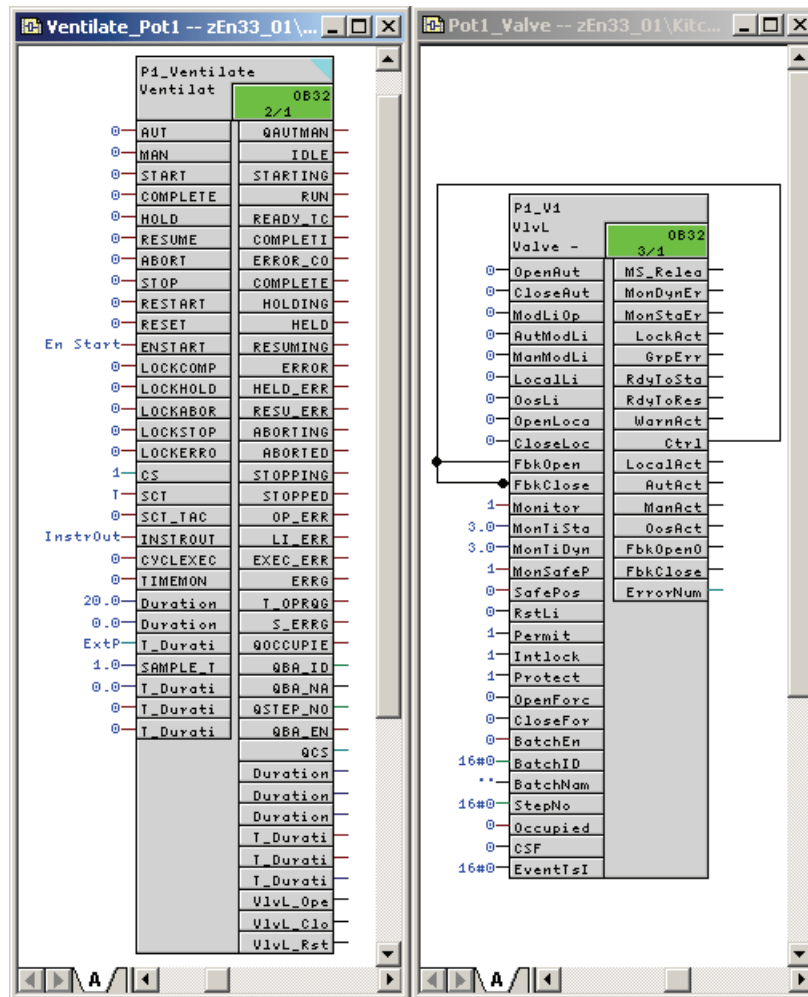
5.5 Instantiating the SFC Type "Ventilate" at Pot_1

Procedure

1. Open the chart "Ventilate_Pot1". You will find the previously created type under "Catalog/Blocks/Other blocks". Place a block with the name "P1_Ventilate", type "Ventilate" in the chart.
You then have the following screen:

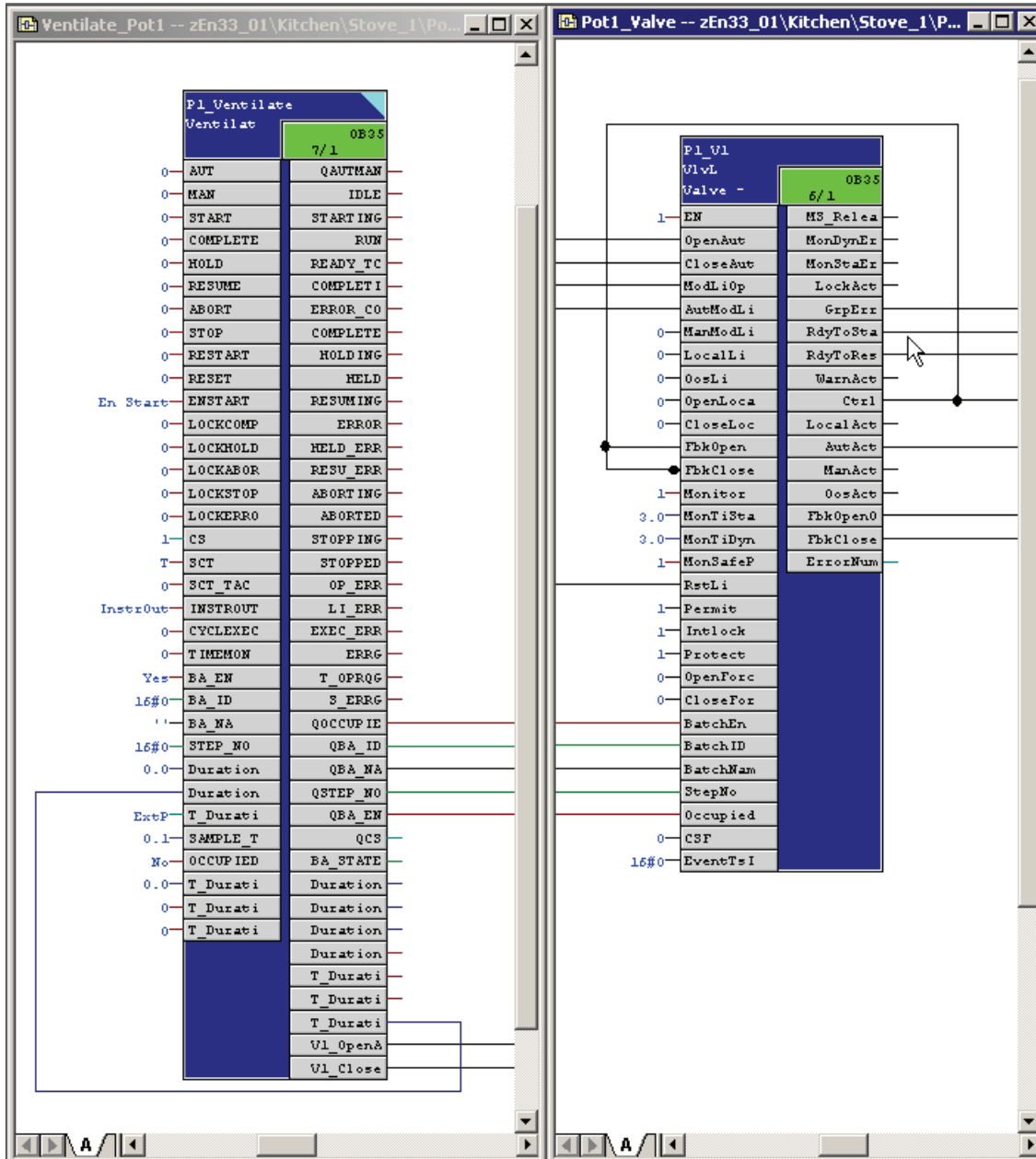


- Now open the "Pot1_Valve" chart as well and arrange the two windows side-by-side as shown below.



- The valve P1_V1 must now be interconnected to P1_Ventilate.
 - To do this, select the outputs V1_OpenAut and V1_CloseAut from P1_Ventilate and interconnect them with the associated valve inputs OpenAut and CloseAut of the P1_V1 valve. All the relevant interconnections to the valve are now created automatically (eight in total).
 - In order for all the batch-relevant information that SIMATIC BATCH writes to the block instance of "Ventilate" to actually arrive at the corresponding valve, the (five) batch-relevant outputs must be interconnected with the valve. First, the following parameters must be set to visible:
 - On the valve P1_V1: BA_EN, BA_ID, BA_NA, STEP_NO, OCCUPIED
 - On the "Ventilate" P1_Ventilate phase: QBA_EN, QBA_ID, QBA_NA, QSTEP_NO, QOCCUPIED
 - Interconnect the five outputs of P1_Ventilate (QBA_EN, QBA_ID, QBA_NA, QSTEP_NO, QOCCUPIED) to the inputs of the P1_V1 valve (BA_EN, BA_ID, BA_NA, STEP_NO, OCCUPIED).

- Interconnect the "T_Duration_PTIME" output with the "Duration_AI" input. This is important for display in the OS faceplate and for reading the process values by SIMATIC BATCH. The process value input on "P1_Ventilate" is called "Duration_AI" (Actual Value Input).
- Check the interconnection based on the following picture.



Note

Creating instances of the "Ventilate" SFC type at Pot_2 and 3:

The "Ventilate" equipment phase is also inserted at Pots 2 and 3. The procedure is the same as that for Pot 1. Start again with Chapter 4. Create a new "Ventilate" hierarchy folder under the Pot_X hierarchy folder. Continue at chapter 5. Insert the same equipment phase at Pots 2 and 3. Note that the "Ventilate" type is configured only once.

5.6 Compiling and downloading AS, OS, and Batch

Procedure

1. Compile the changes made to AS data in the CFC Editor and then download these data to PLCSIM using a "delta download".

Note

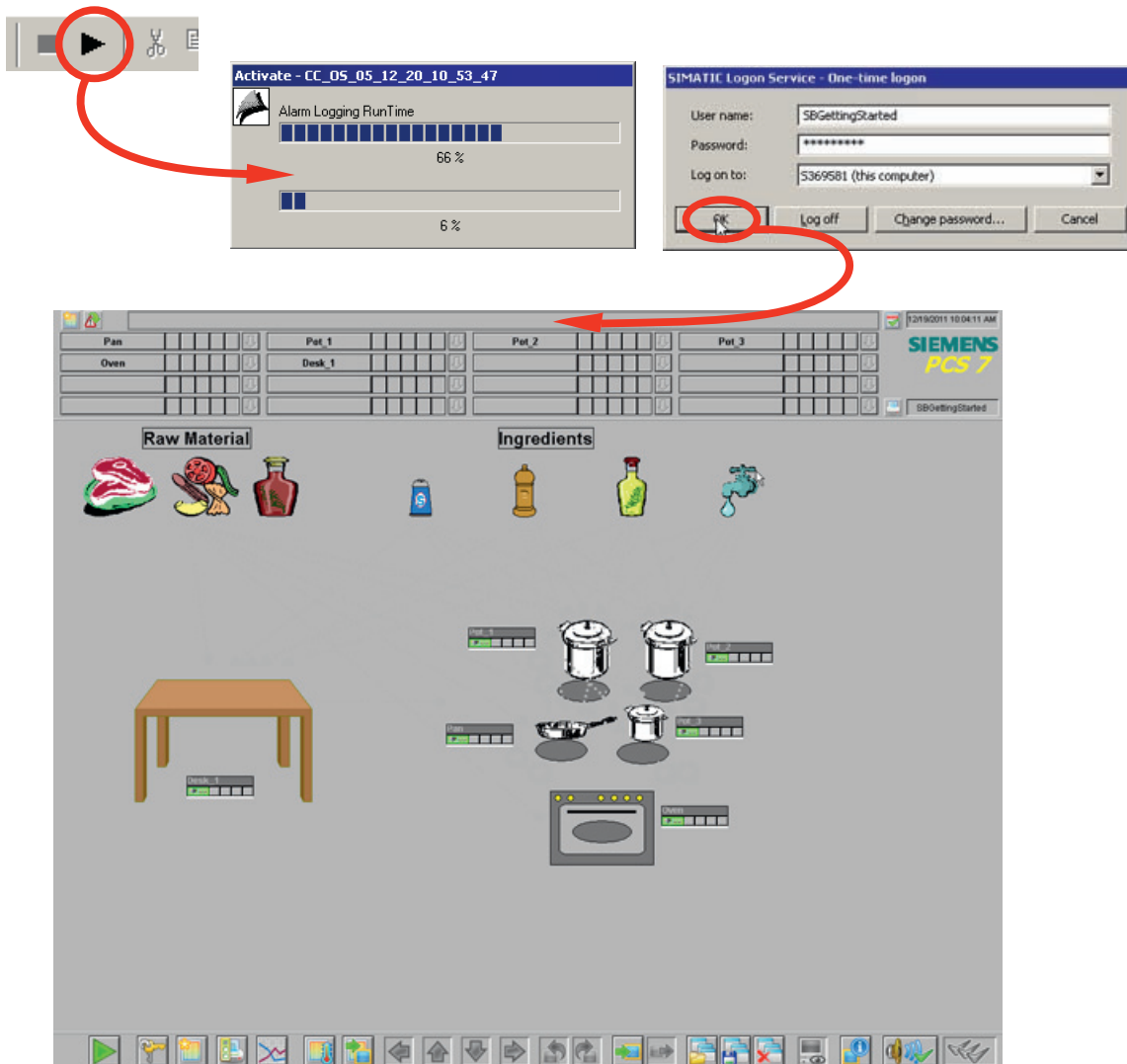
The Runtime OS must be deactivated.

2. Then run a changes-only compilation of the OS.
3. Open the "Configure Batch process cell" dialog in the Plant view in your project.
4. Select "Batch types". Generate the Batch types, compile the Batch instances and download the process cell.

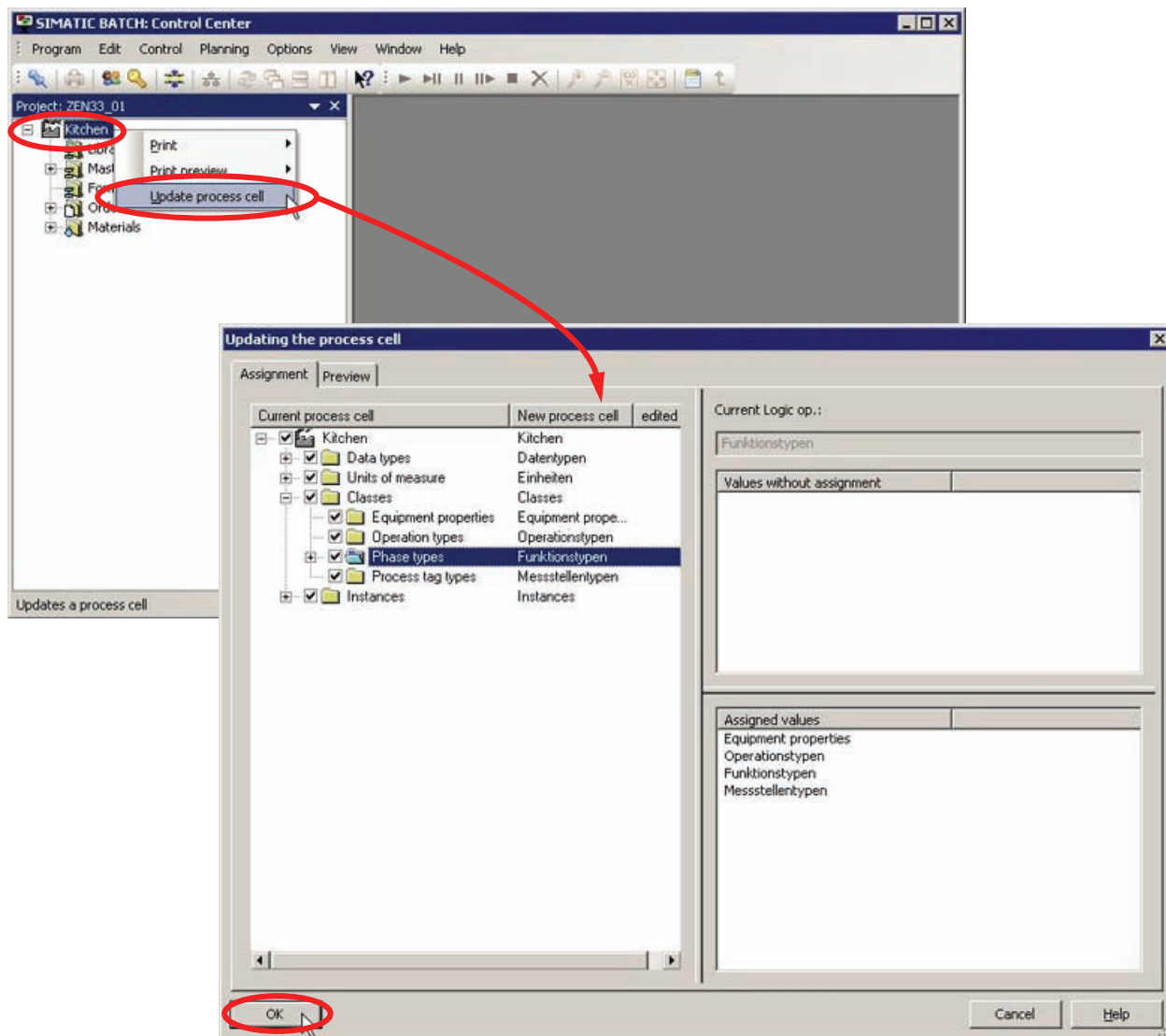
5.7 Expanding a Recipe

Procedure

1. Start Runtime.



2. Start the Batch Control Center and update the Batch process cell data.

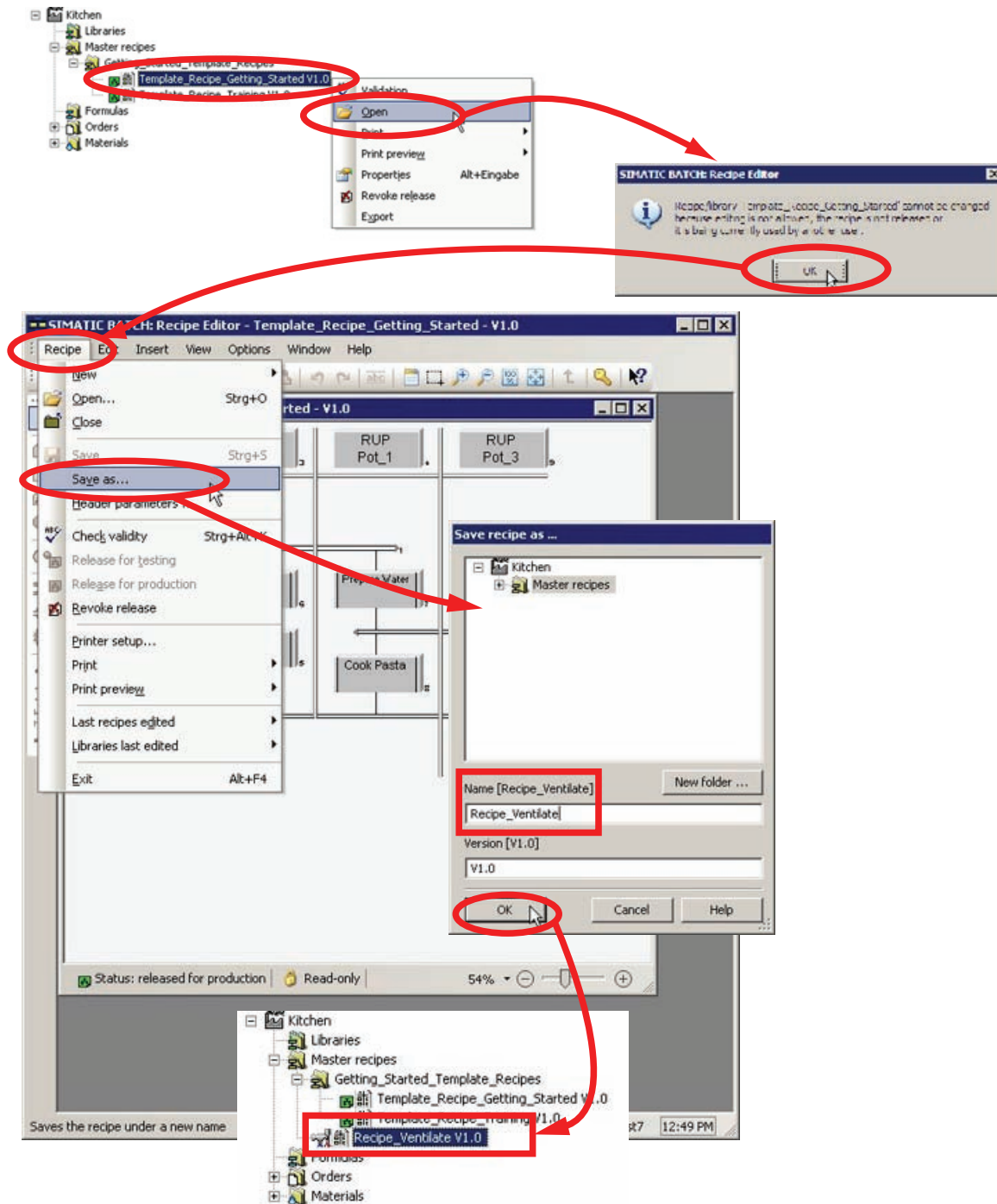


3. The new "Ventilate" equipment phase you configured is available in the "Pot1" unit as recipe function after you completed the update of Batch process cell data.

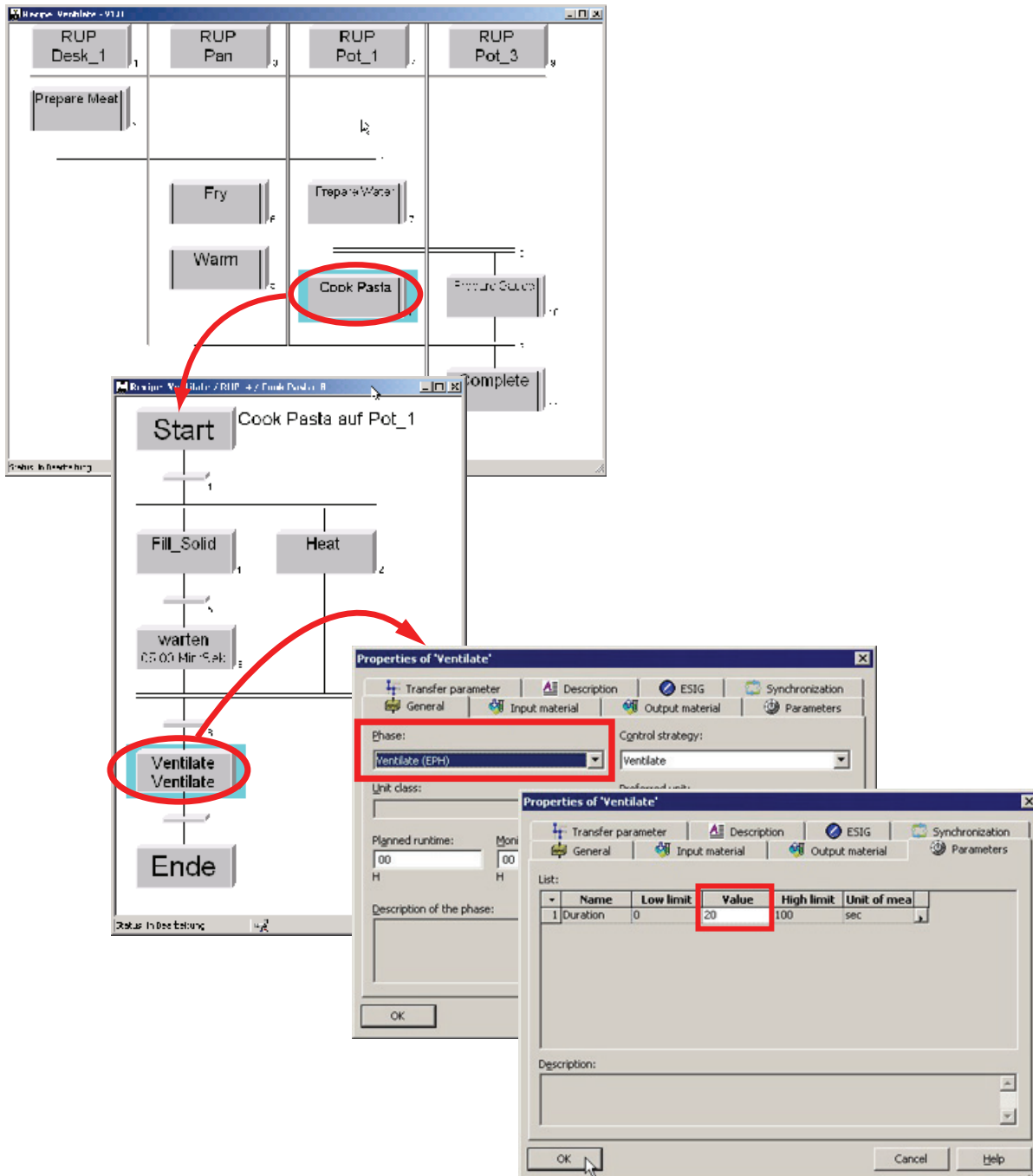
4. Open the "Template_Recipe_Getting_Started" master recipe and save it with the name "Recipe_Ventilate".

Note

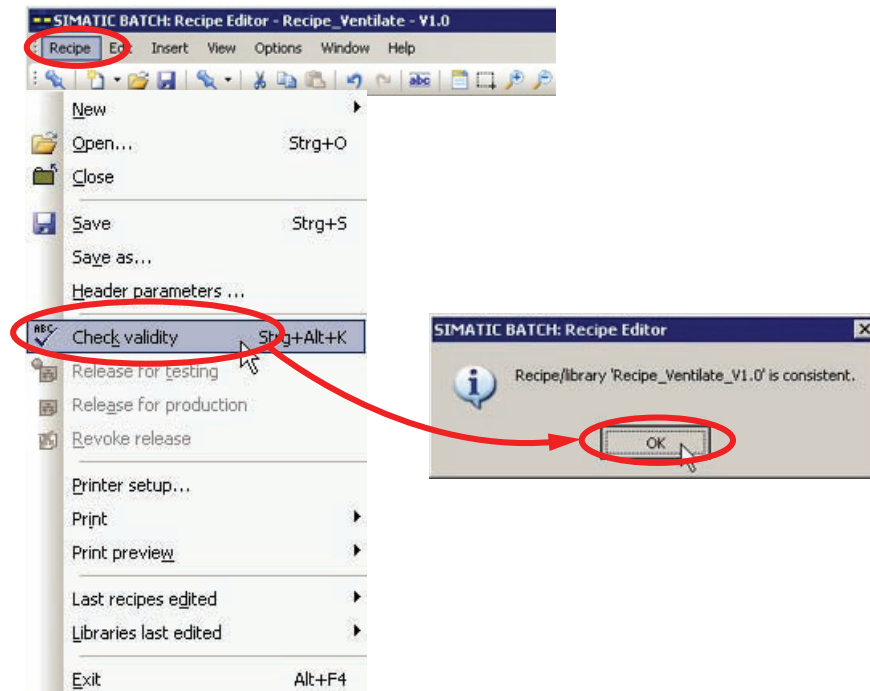
If you cannot edit the recipe, activate the "Allow editing of recipes in "release revoked" state" in the Options - Settings dialog of Batch Control Center.



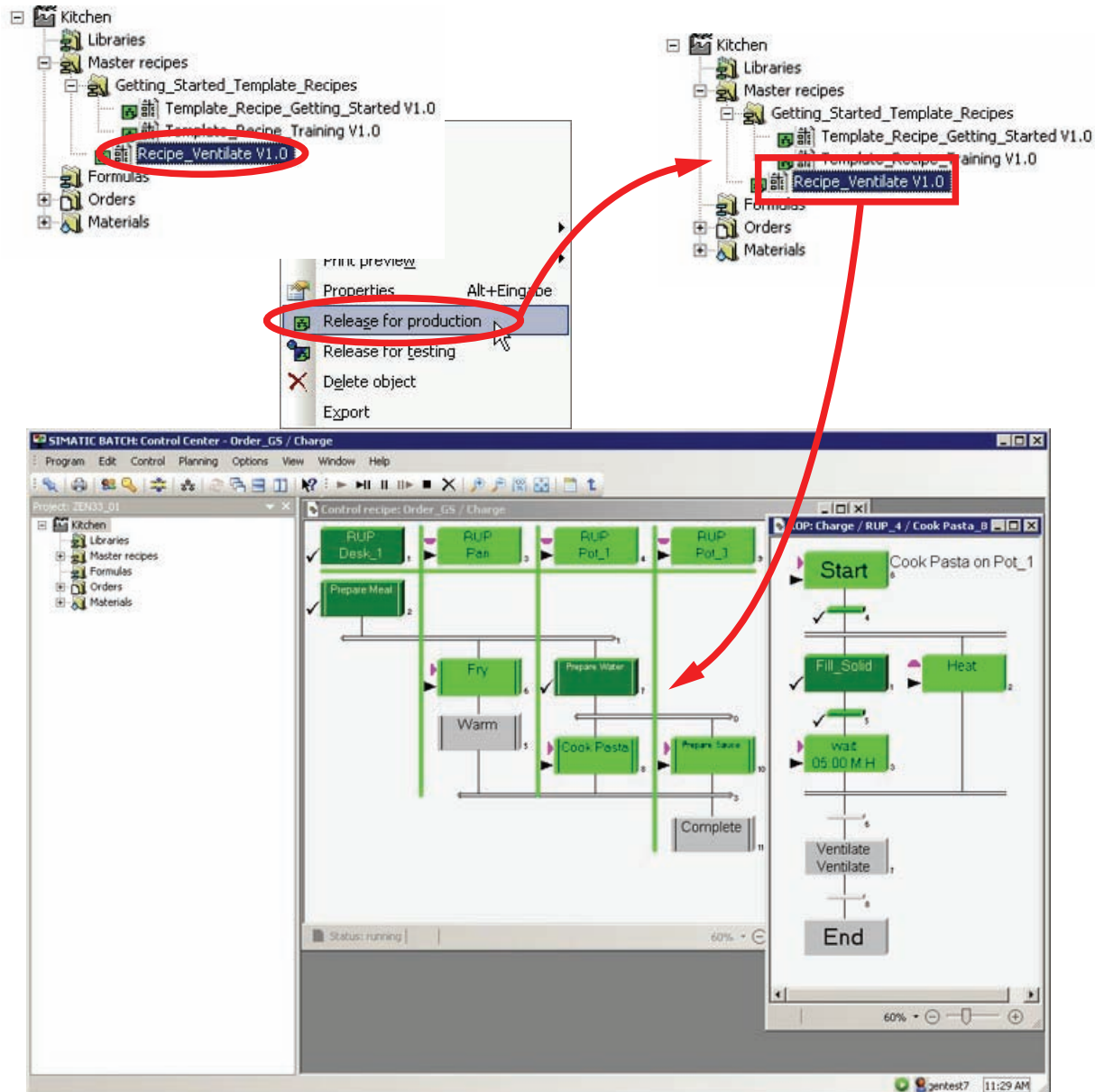
- Open the recipe "Recipe_Ventilate" you just created and install the new recipe function (NOP) "Ventilate" in the recipe.



6. Save and validate the recipe. Close the Recipe Editor.



- Release the recipe for production. Create, release and then run a new batch with the "Recipe_Ventilate" recipe.



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