SIEMENS

SIMATIC

Getting Started SIMATIC BATCH

Manual

10/2006
A5E00918236-01

Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring to property damage only have no safety alert symbol. The notices shown below are graded according to the degree of danger.

Danger
indicates that death or severe personal injury **will** result if proper precautions are not taken.

Warning
indicates that death or severe personal injury **may** result if proper precautions are not taken.

Caution
with a safety alert symbol indicates that minor personal injury can result if proper precautions are not taken.

Caution
without a safety alert symbol indicates that property damage can result if proper precautions are not taken.

Notice
indicates that an unintended result or situation can occur if the corresponding notice is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel.** Within the context of the safety notices in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

Warning
This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.
Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

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Disclaimer of Liability

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

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Preface

Purpose of the Manual

BATCH Getting Started gives you an overview of the software package SIMATIC BATCH together with the SIMATIC PCS 7 process control system and lets you learn the functions of the batch process control.

Getting Started is intended for new users of SIMATIC BATCH.

Require 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 PCS 7.

SIMATIC BATCH requires the base software of PCS 7. You should already be familiar with working with the configuration as described in the manual "Process Control System SIMATIC PCS 7 V7.0, Getting Started – Part 1".

Scope of the Documentation

This documentation applies to the software package SIMATIC BATCH V7.0 in combination with the process control system, SIMATIC PCS 7 V7.0.

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.

You can find your local Siemens representative at:

http://www.siemens.com/automation/partner

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

http://www.siemens.de/simatic-tech-doku-portal

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

http://mall.automation.siemens.com/

Training Center

We over a variety of course to help you become familiar with the PCS 7 process control system. Please contact your regional training center or the central training center in Nuremberg, Germany.

Phone: +49 (911) 895-3200.

Internet: http://www.sitrain.com/

Technical Support

You can reach the Technical Support for all A&D products

- Via the Web formula for the Support Request
  http://www.siemens.com/automation/support-request
- Phone: + 49 180 5050 222
- Fax: + 49 180 5050 223

Additional information about our Technical Support can be found on the Internet pages http://www.siemens.com/automation/service

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In addition to our documentation, we offer our Know-how online on the internet at:

http://www.siemens.com/automation/service&support

where you will find the following:

- The newsletter, which constantly provides you with up-to-date information on your products.
- The right documents via our Search function in Service & Support.
- A forum, where users and experts from all over the world exchange their experiences.
- Your local representative for Automation & Drives.
- Information on field service, repairs, spare parts and more under "Services".

Contents

1 Part 1: Introduction Batch Processes

1.1 Technical Process Categories

	Manufactoring 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

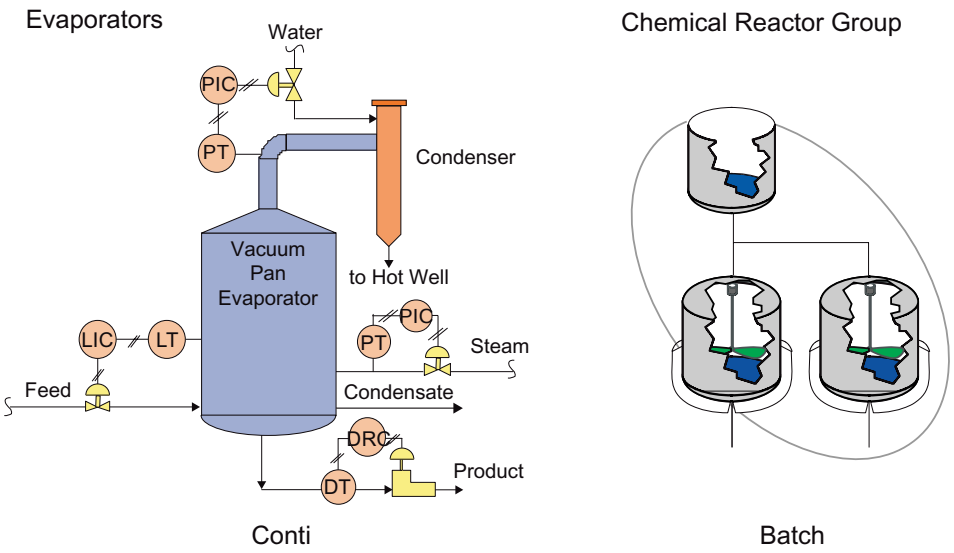
Distinction between Process Engineering and Production Engineering

- The products of industrial processes are normally produced liquid or solid materials
  - physical / chemical / biological processes
  - safety, complete control of (dangerous) processes
  - undetermined (cannot be predicted)
  - at times cannot be interrupted
- Production processes are used to produce specific amounts of goods, for example screws, computers....
  - mechanical activities
  - throughput, speed
  - determined (predictable)
  - can be interrupted

Division within Industrial Processes

- Continuous process
  - Started up once and then operated continuously over a longer period of time
  - Synonym: Continuous flow process
  - Examples: Ammonia synthesis, ethylene production
- Discontinuous process (batch process)
  - Produces the product in individual batches
  - Synonym: Batch process
  - Examples: Production of plastics, paints, fertilizers

1.2 Characteristics of Continuous and Batch Processes



	Conti		Batch
✔	Continuous product flow	✔	Limited product quantities
✔	Large product volumes	✔	Small product volumes
✔	Setpoint-driven	✔	Recipe-driven
✔	Changes rarely made to the plant	✔	Changes often made in the process
✔	Single-product plants	✔	Different products in the same plant
✔	Equilibrium states	✔	Often only semi-automated -> manual interventions
✔	Manual intervention rare	✔	Production know-how is contained in the processes (recipes)
✔	The automation includes the production know-how		

The main difference between batch and continuous processes is in production.

In a batch process, specific quantities of product are produced so that they can be uniquely identified.

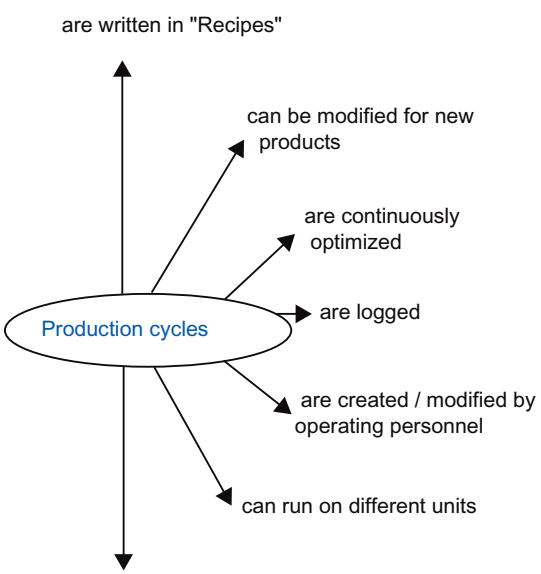
Recipes contain not only the setpoints of the relevant process variables and product quantities but also describe the method or procedure used to make the product.

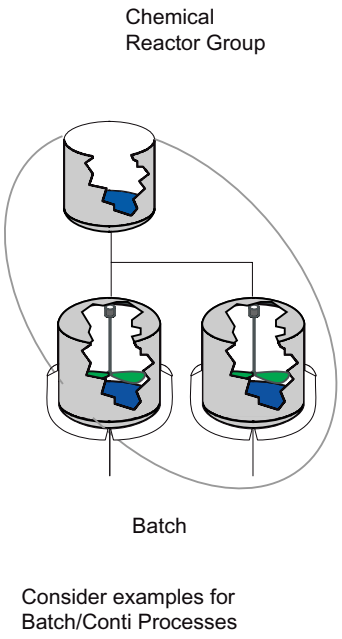
In a continuous process, the sections of plant are specialized for their particular task.

In a batch process, the same section of plant can be used more than once by different batches (shared resources).

Quite often, you will find a mixture of these two processes in which continuous and batch processes are linked together or in which smaller sections of a batch process are handled by an intermediate stage operating continuously.

1.3 Practice: Where is this Used?





The production sequences are described in recipes that reflect the manufacturing process. In contrast to typical continuous applications or production engineering applications, the production sequence is not expressed in the automation solution but is described in a "Recipe".

The production sequences can be adjusted to new products. It is by no means the case that automated production always produces the same thing; various end products can be produced whose manufacturing processes are specified in different recipes. These are constantly optimized both in terms of parameter settings and the production sequences themselves.

In production, it is often vital that the sequences can be documented to allow them to be reconstructed. This is important for quality assurance and to identify defects.

For many end customers it is decisive that they can adapt the production sequences themselves to different products allowing them to introduce new products or to modify existing workflow sequences.

This should be possible for the operating personnel without needing to call in system specialists. It should not be necessary to make changes to the programmable controller itself but rather in the recipes describing the manufacturing process.

During actual production as described in a recipe, the following question often arises: "Where will production take place?". Generally there is more than one production facility capable of performing the same production sequence (for example several production lines). It should therefore be possible to assign the production sequences to different production facilities. This ability must also be included in the system functionality and must not require modifications to the automation program.

1.4 Branches for SIMATIC BATCH


Biotechnology


Food and Luxury Stuffs


Pharmaceuticals


Washing and Cleaning Agents


Paint / Dye

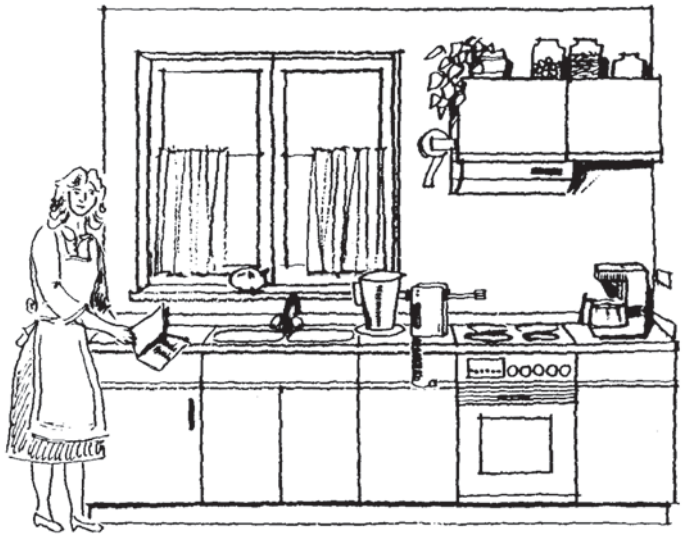

Plastic / Adhesive


Fertilizer / Pesticides


Chemical and Mineral Fiber

Typical branches that use batch processes are listed above. One example is the production of beer in the foodstuffs and luxuries industries.

1.5 Origins of Batch Production: The Kitchen



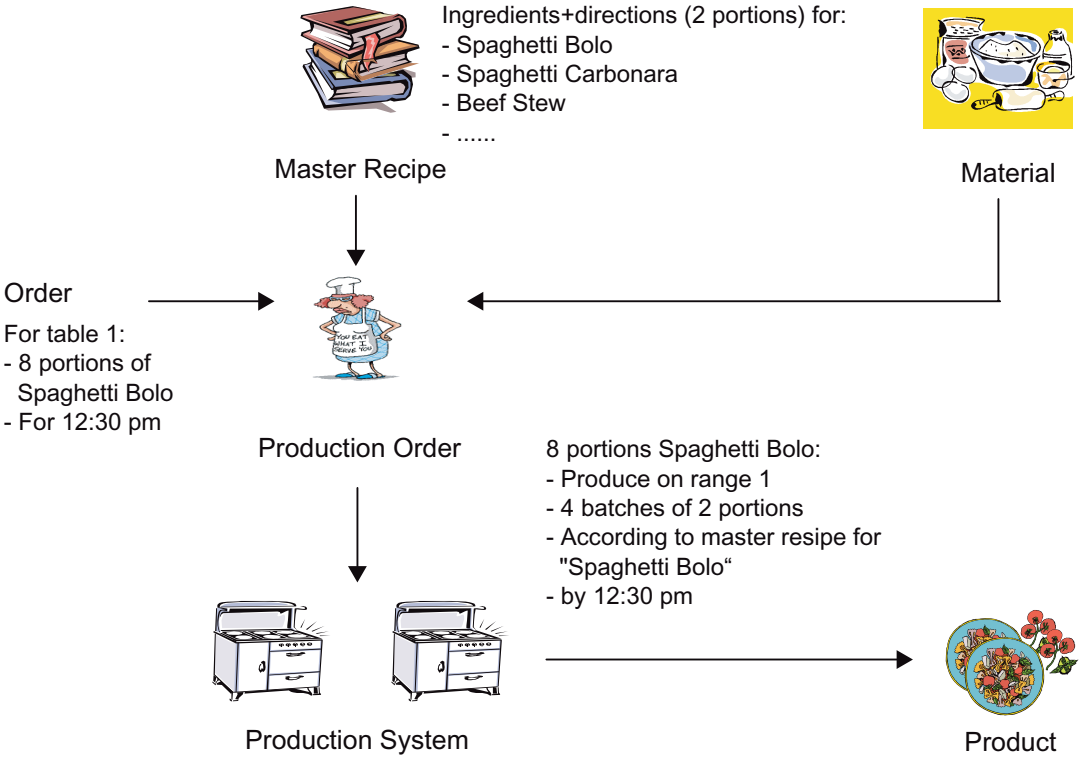
The best example from daily life is the "Kitchen" production plant.

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 also be important to document the production sequences (for example, for quality assurance for the health authorities and for guests who want to know how the product they are consuming was actually produced).

1.6 The Cook - Working Environment and Working Procedures



The working environment of a cook is as follows. The cook has recipes available containing both the instructions as well as the required ingredients and quantities. These recipes are known as master recipes.

To produce the product, materials are required that will be used during production.

Before production can be started, an order is necessary. This contains at least the information about what should be created in which quantity and by when.

To deal with the order, the cook works according to the relevant recipe. The cook must also decide where (for example on which stove) the dish will be cooked. Normally, several orders are being processed at the same time so that some production process cells are in use and not currently available.

The result is the finished product.

1.7 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 considers it to be 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. It is therefore important that everyone speaks the same "language". Definition and unification of the terminology was the aim of NAMUR and ISA SP88.

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

In our kitchen, we will therefore be able to derive a control recipe from the "Spaghetti" recipe for Fred's kitchen that will decide the production sequences and that will produce a batch of spaghetti after it has been processed.

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.

1.8 The Kitchen: 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 champignons 1 kg noodles pinch of salt 1 onions 4 tomatoes : :	Input materials

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

A recipe header with general information on the product (name, reference quantity, ingredients, quantities).

In addition, a recipe must also include instructions or procedural rules for production.

This is known as a recipe procedure.

This does not yet contain any information about the equipment that will be used for production.

1.9 The Kitchen: Master Recipes – Procedure (procedural rules)

Instructions		Procedural Rules
1. Make Bolognese		Unit recipe 1
	Chop onions and tomatoes, place in pan, weigh the ground meat and add	ROP 1: Preparation
		ROP 2: Heating
	Heat pan with level 6	
		ROP 3: Simmer
	Simmer for 1 hour with lid on pan	
2. Cook pasta		Unit recipe 2
	...	
3. Spice	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, 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; in other words 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).

1.10 The Kitchen: What is Required of the Automation

are written in "Recipes"	Recipes for spaghetti, etc.
can be modified for new products	The chef must create new dishes
are continuously optimized	Refinements, recipe modifications
Production processes are logged	Dish production should be recorded and be able to be traced
are created / modified by authorized personnel	Recipes are made by the chef, not by the appliance supplier
can run on different units	Recipes can be used in different kitchens
manage various products (in the same process cell)	Spaghetti, schnitzel, baked potatoes, etc.

The "Kitchen" example is an analogy for the characteristics of batch processes. When automating such processes, the above requirements must therefore be met.

1.11 The Kitchen: Automation Concept

are written in "Recipes"	Possible with AWL, SCL, SFCs, WinCC, though sometimes highly complex
can be modified for new products	AWL, SCL, SFCs can be modified
are continuously optimized	AWL, SCL, SFCs can be modified
Production processes are logged	AWL, SCL, SFCs can be modified
are created / modified by operating personnel	No longer possible
can run in different process cells or units	No longer possible
manage various products (in the same process cell)	Possible with AWL, SCL, SFCs, WinCC, though sometimes highly complex

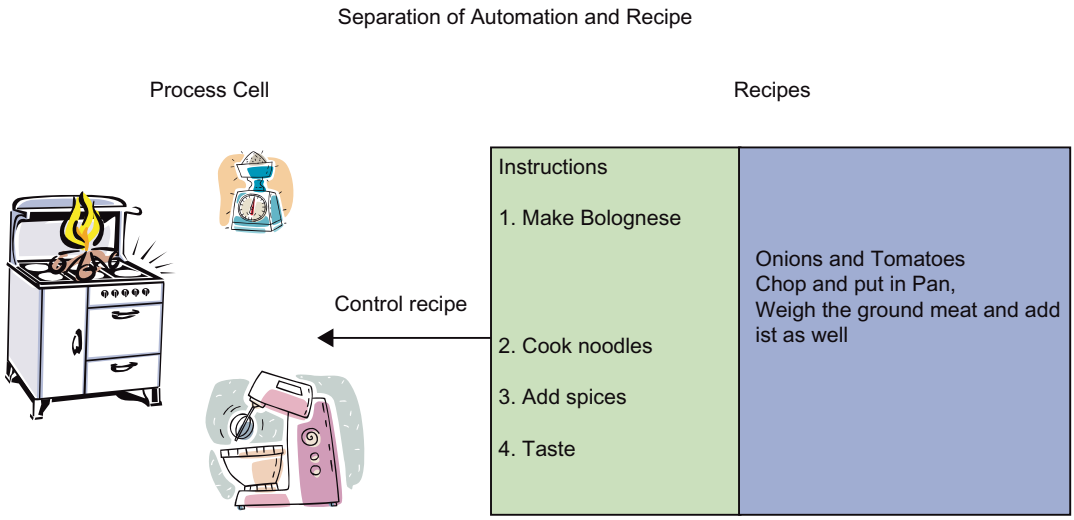
What do these requirements mean when formulating an automation concept? We can think of PCS 7

as a 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 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 determine which units are to be used.

1.12 Automation Concept- New Approach



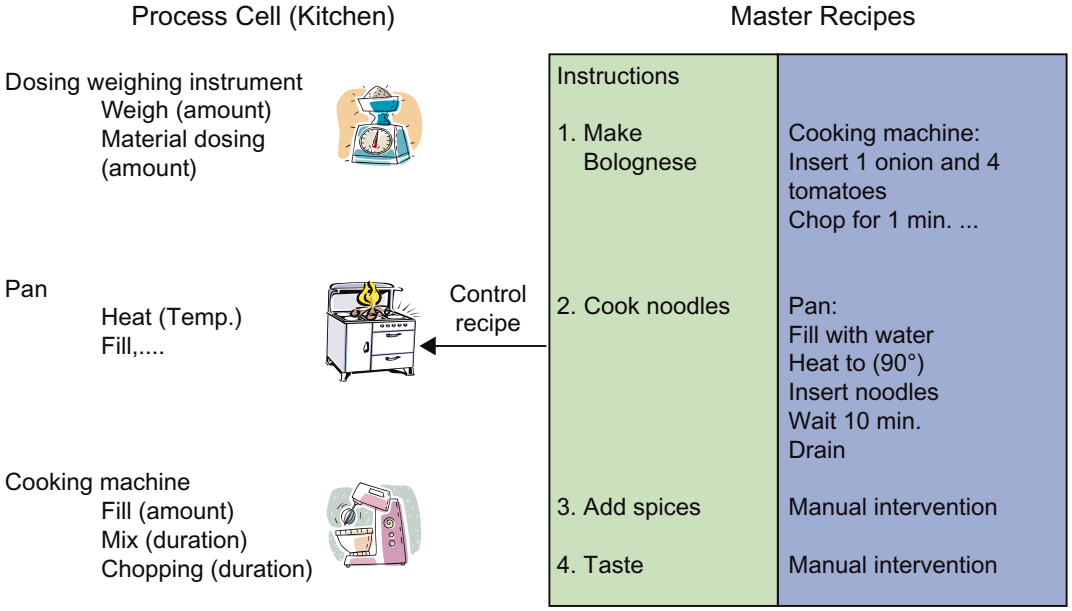
A new approach is required to reduce the complexity, and this is achieved by separating the automation level from the recipe level.

We assume that the physical structure of the process cell remains the same and that only the sequences change. We can therefore implement the process cell-specific parts in the program or controller and map the sequences in a "recipe system" that can be manipulated during operation. This is where the master recipes are created and maintained.

Control recipes are derived from the master recipes and these access the programmable controller.

1.13 Separation of the Automation Level and Recipe Level

Separation of Automation and Recipe



In the process cell, we can create a structure consisting of units (scales, pan, mixer,..). These, in turn, have equipment phases such as weighing, dosing etc.

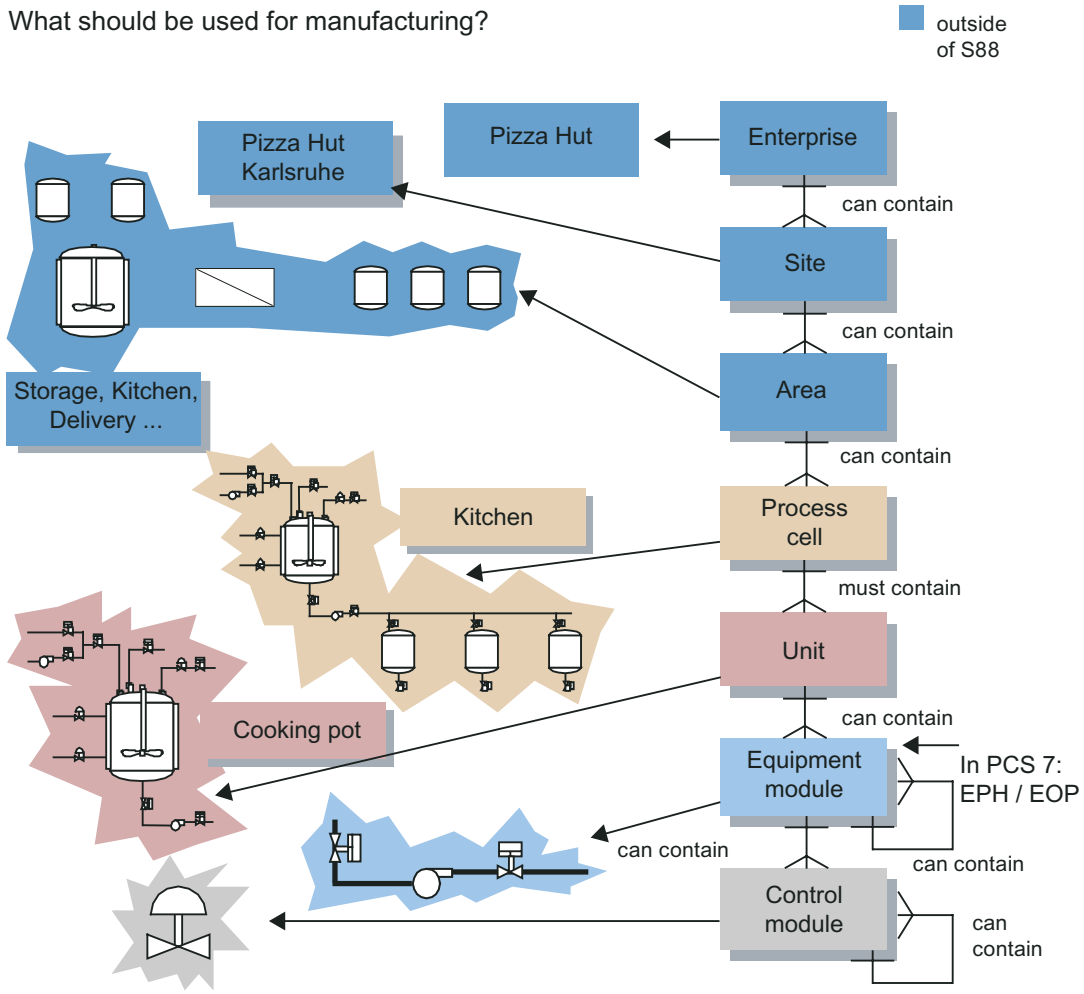
The phases can have parameters such as the quantity parameter of the dosing equipment phase.

This is all mapped in the programmable controller. Here, the term process cell model is used. This represents the "tool box" for the author of 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 provides the equipment phases filling, mixing, chopping. The first step is to put an onion into the machine. The 4 tomatoes are added and then minced for 1 minute, etc.

1.14 ISA S88.01 - Physical Model



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.

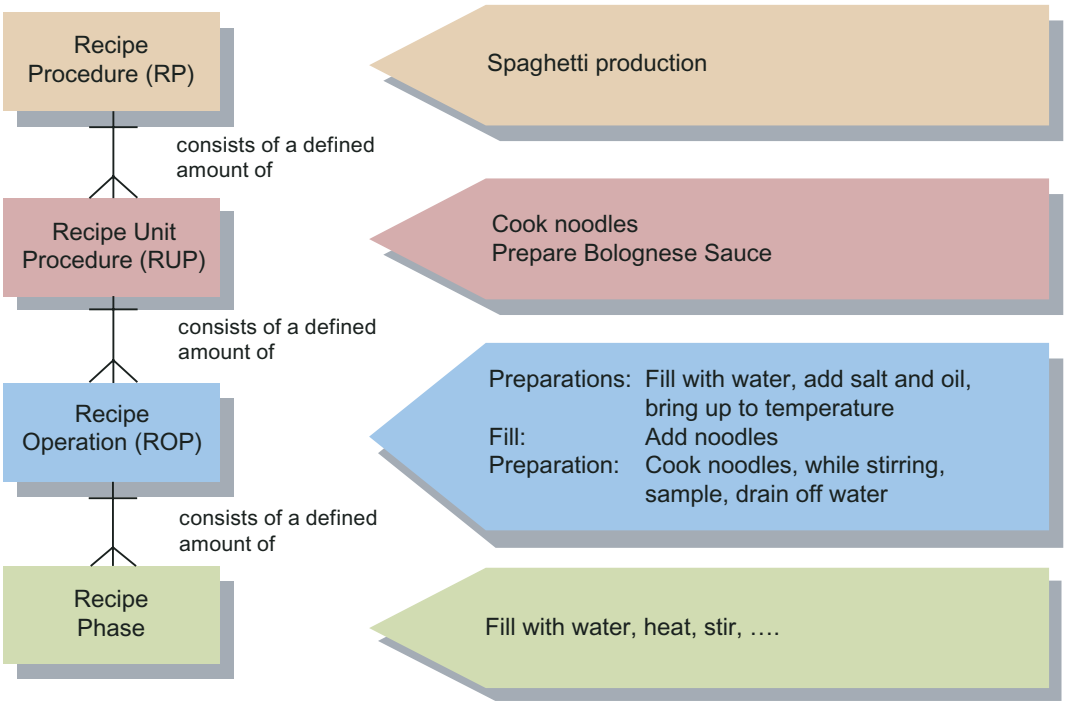
The term "equipment module" here means the "equipment phase" (dosing, weighing, etc.).

In the PCS 7 environment, the term "EPH (equipment phase)" is used. All three terms mean the same.

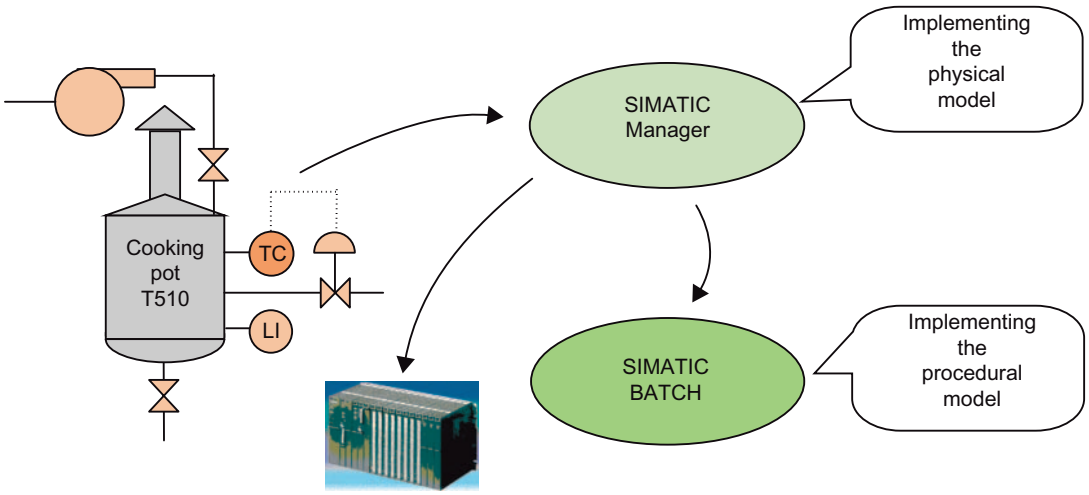
1.15 Procedural Control Model

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

How should it be produced?



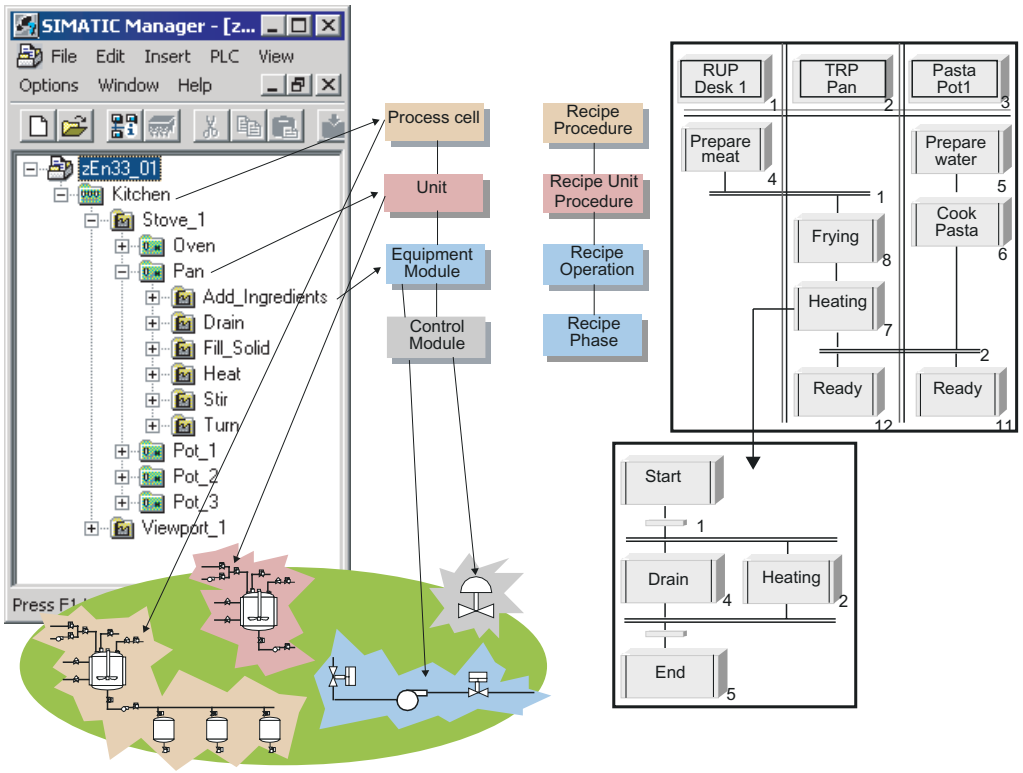
1.16 Implementation – Physical and Procedural Model



The two models are mapped in the architecture of PCS 7 as shown in the picture. The physical model is implemented in the PCS 7 ES. The program structures produced run on the AS.

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

1.17 S88.01 Model – PCS 7



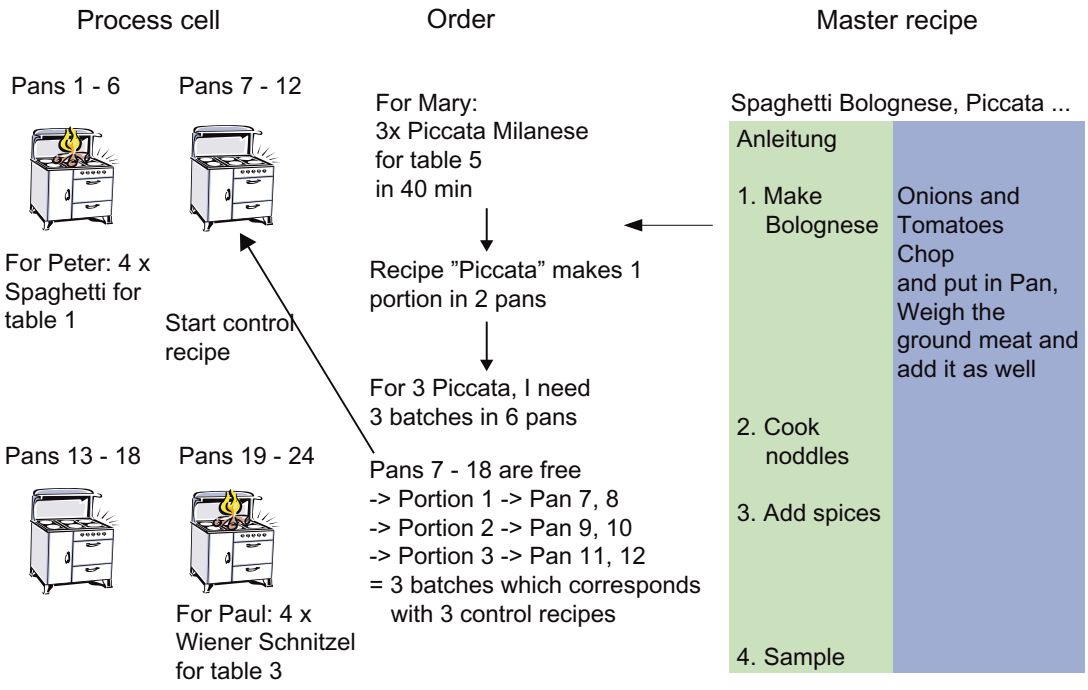
ISA S88.01 describes various models that can be fully covered with PCS 7 and SIMATIC BATCH.

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 on it.

- 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 on an equipment module to perform an industrial process task or function.
- 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 the AS system.

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



Mary puts in an order for three portions of Piccata Milanese. The order is for table 5 and should be ready in 40 minutes.

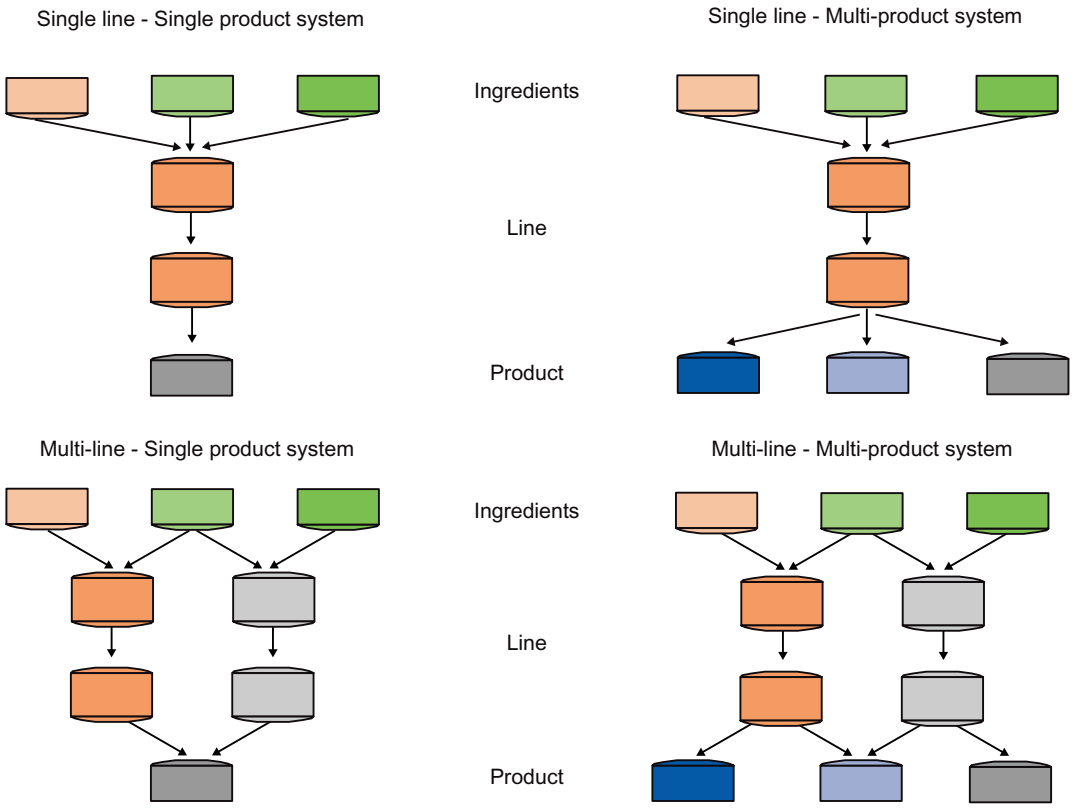
The master recipe "Piccata" is available for production. It describes the process for one portion.

Two pans are required. To create three portions at the same time, six pans are therefore needed. This means that three control recipes must be created (each occupying two pans). Each control recipe produces one batch of Piccata.

If six pans are free, the chef can start the three control recipes at the same time (as shown in the picture).

If only two pans are free, the three batches can only be produced in sequence, one after the other.

1.19 Classification of Batch Process Cells

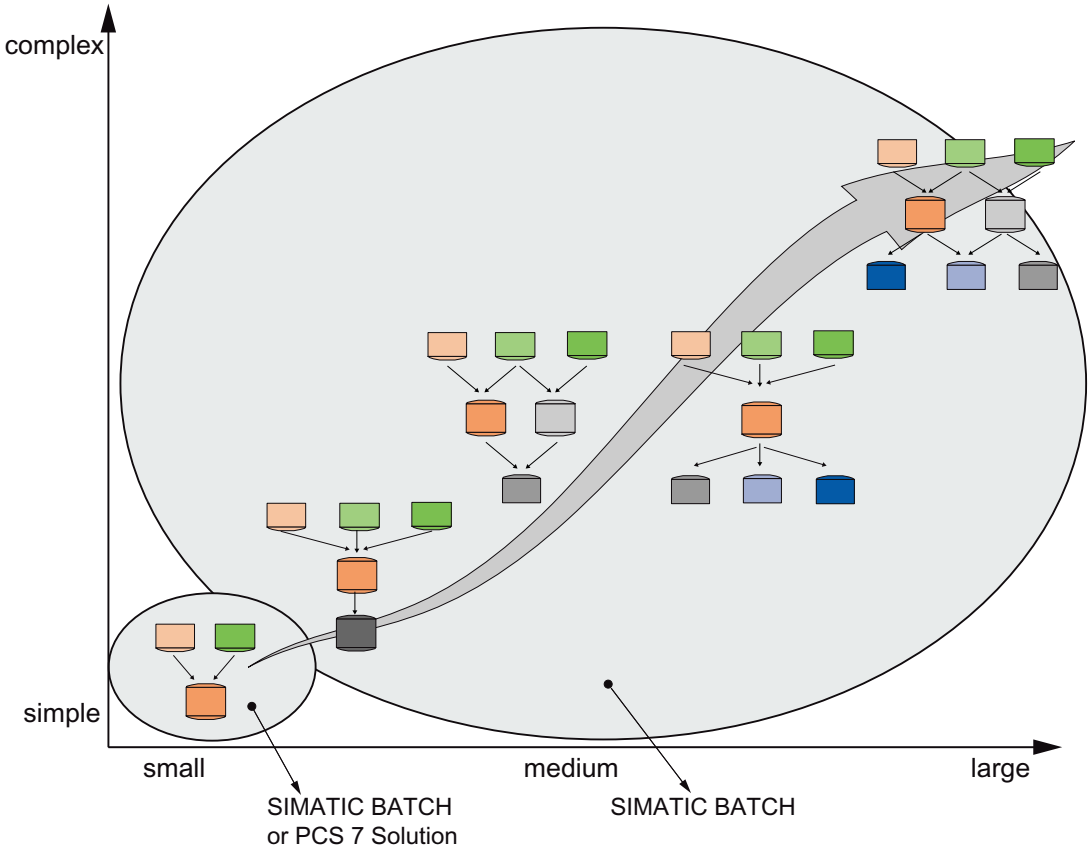


The first criterion in the categorization is the number of products being produced in the process cell:

- Single-product process cells
- Multi-product process cells

The second criterion is the number of production lines allowing simultaneous product flow.

- Single-line structure
- Multi-line structure
- Network structure (all paths fully flexible)



With its scalability, SIMATIC BATCH is suitable both for smaller plants as well as for large complexes that are now possible with V6. With V6, you can now use up to 11 OS servers.

The complexity increases with the number of products and the number of lines. With SIMATIC BATCH, you can automate multi-line, multi-product plants.

For small plants, in which few products or lines are needed, your basic considerations are the licensing costs and the amount of engineering involved to create a solution with SIMATIC BATCH.

1.20 SIMATIC BATCH: Customer Benefits

- The production sequences are described in master recipes that can be created/modified by the operating personnel at any time.
- 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 efficiency
- Production sequences are documented in a batch log (paper or electronic). The production sequences can be reproduced using recipes.
- Easy quality management
- With compulsory validation / FDA is especially interesting.
  Version control, access control, audit trails (21CFR Part11) are supported.
- Low validation-/compliance costs, traceable recipe changes
- Utilization of a standard Siemens product
- Reduced operation and life-cycle costs

2 Part 2: Quick Start

2.1 Basics for Projecting

2.1.1 Quick Start Configuration Overview

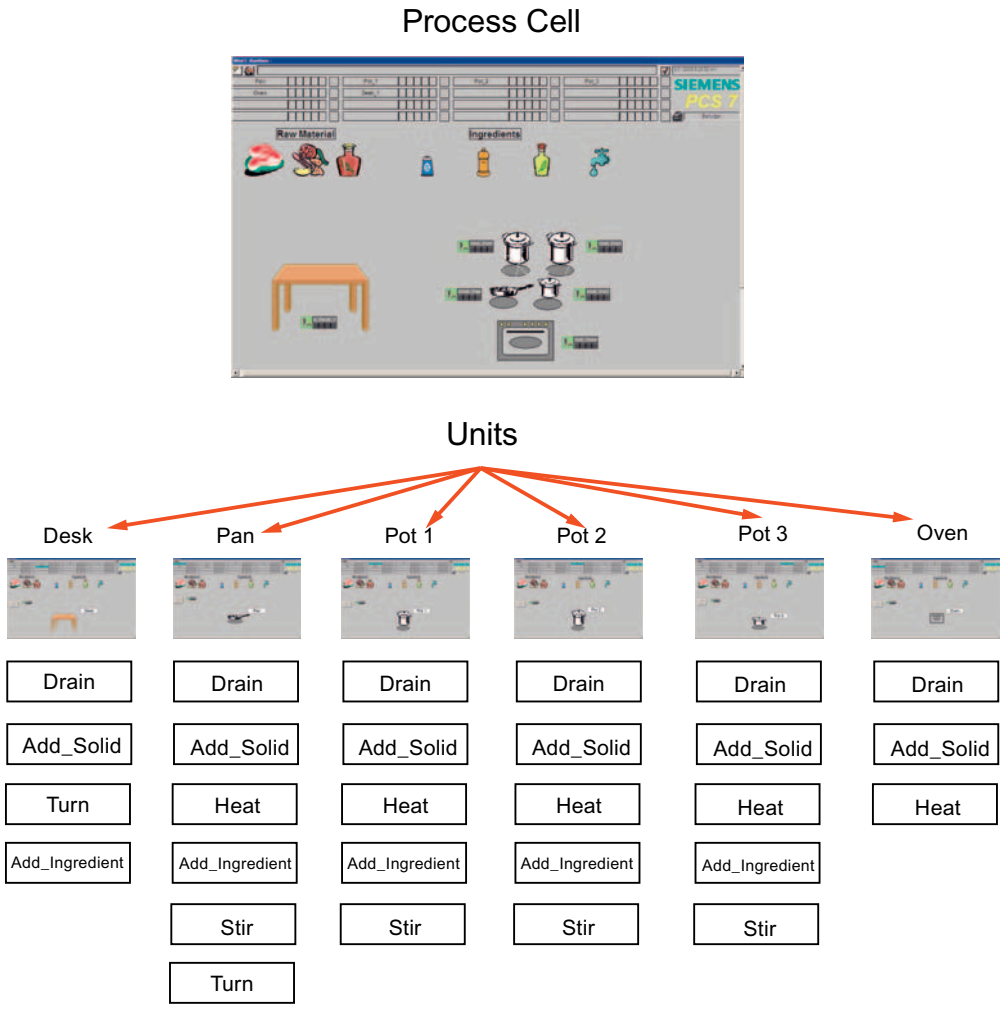
Working in the SIMATIC Manager

1. Retrieving the Project
2. Configuring the BATCH Server and BATCH Client
3. Opening the Plant View
4. Creating the Batch Process Cell
5. Type Definition of the Plant Hierarchy According to ISA S88.01
6. Assigning the "EPH" Batch Category
7. Generating the Type Description in the Batch Types
8. Compiling and Downloading the AS, OS and Batch Process Cell Data
9. Downloading the Batch Process Cell Data
10. Downloading the AS in PLCSim
11. Starting the OS
12. Starting the BATCH Start Coordinator

Working in the BATCH Control Center (BatchCC) and Recipe Editor (RE)

1. Loading the Supplied Recipes and Materials
2. Updating the Loaded Batch Process Cell Data
3. The Recipe for Piccata Milanese Pasta
4. Creating an Output Material
5. Creating a Master Recipe in the BatchCC
6. Creating the Recipe Structure in the Recipe Editor
7. Releasing the Master Recipe for Production
8. Creating an Order (Batch)
9. Releasing and Starting a Batch (Control Recipe)

2.1.2 Description of the Model



2.1.3 PH View in the SIMATIC Manager

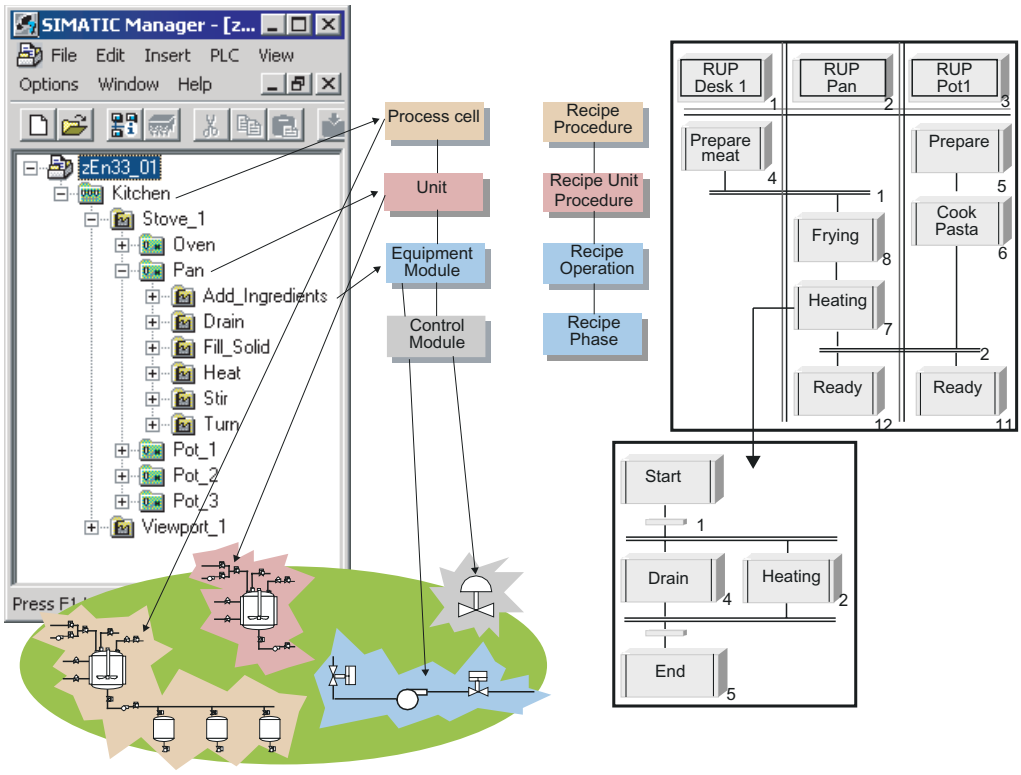
The process cell model in SIMATIC BATCH is used to represent the procedural model of the recipe.

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 function 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.



2.1.4 Software Requirements

Basic Installation of PCS 7 V7.0

- + BATCH server
- + BATCH client
- + Batch Engineering
- + PLCSim
- One network adapter

Note:

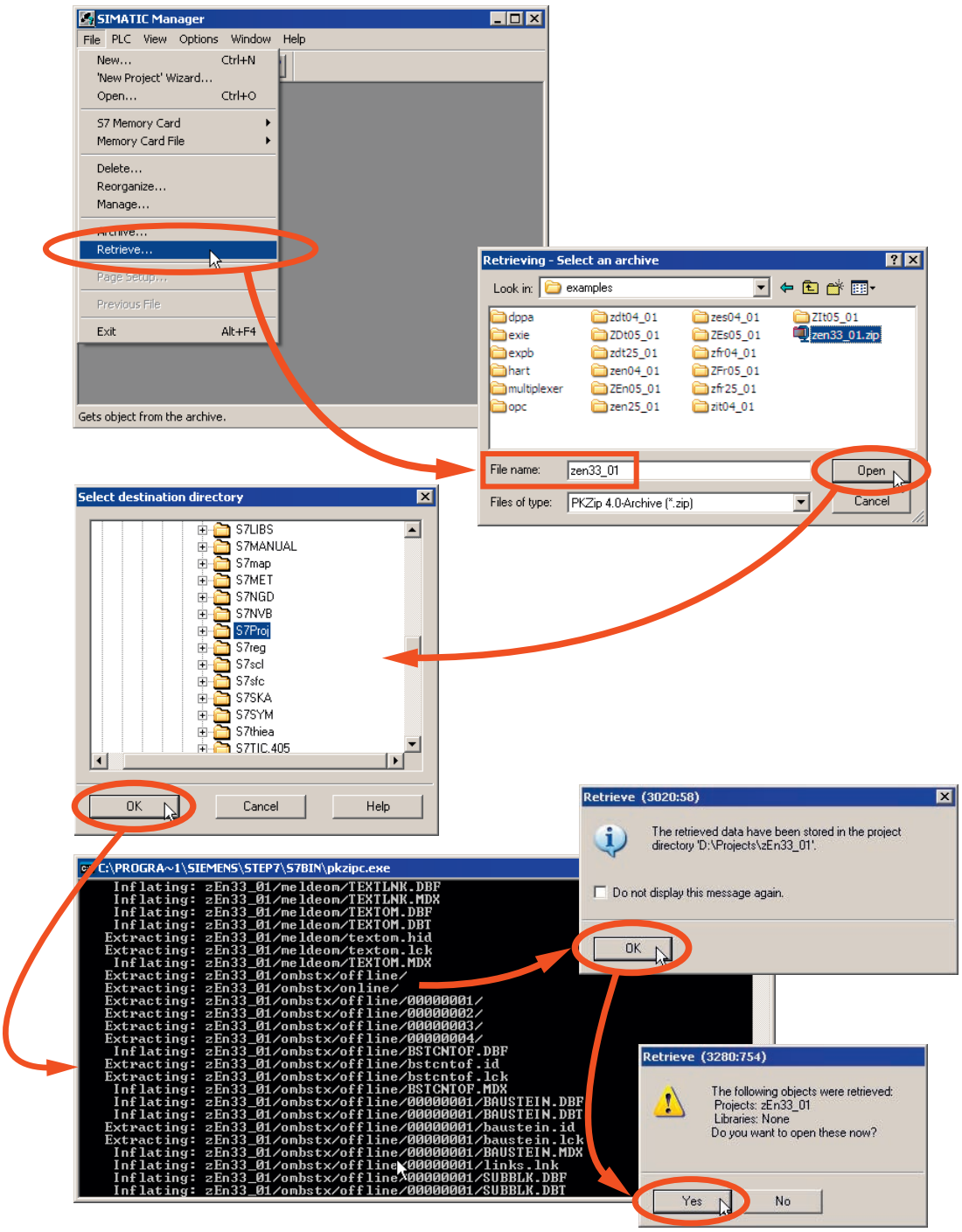
If SIMATIC Logon is installed, role management must be configured and you have to log on every time SIMATIC Batch is started.

The use of SIMATIC Logon is not described in this document.

2.2 Projecting

2.2.1 Chapter 1 Retrieving the Project

1. Retrieve the project (the archive project is called zen33_01.zip located under ..\Siemens\STEP7\examples) and store the project, for example, under ..\Siemens\STEP7\S7Proj.

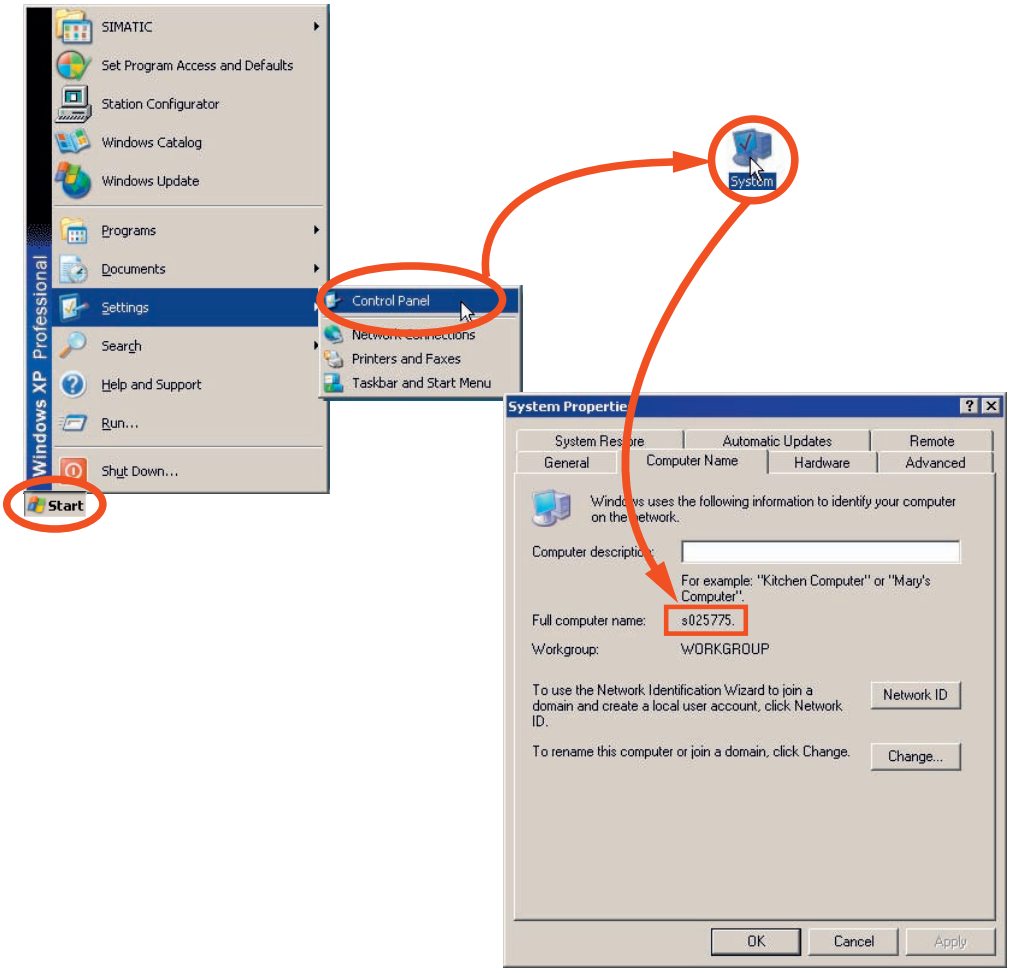


2. Select the PC station in the Component view and open the object properties. Enter the actual name of your computer under "Computer name".

Note:

Only use capital letters, even if your computer name contains small letters!

You can determine the name of your computer as follows:



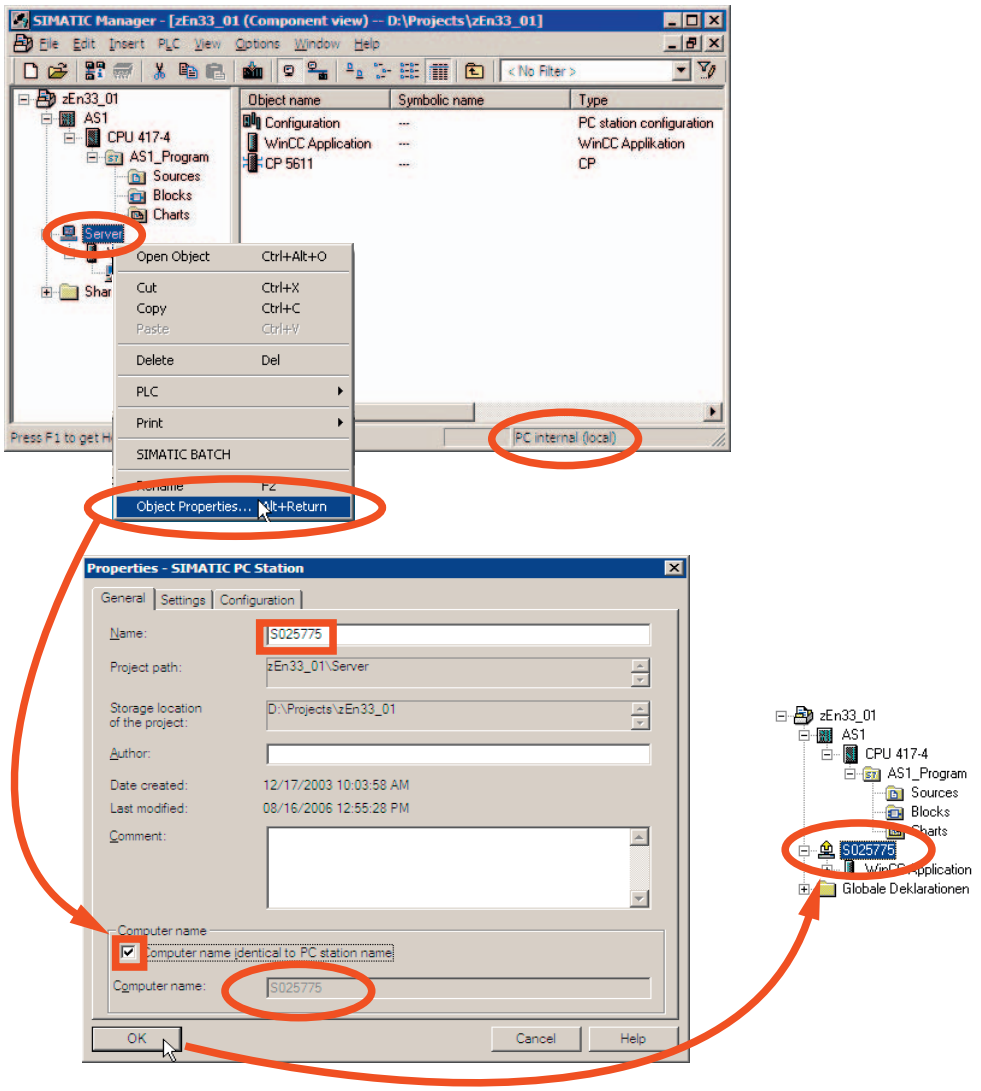
The batch process cell data generated on the ES will be loaded later on this computer.

Note:

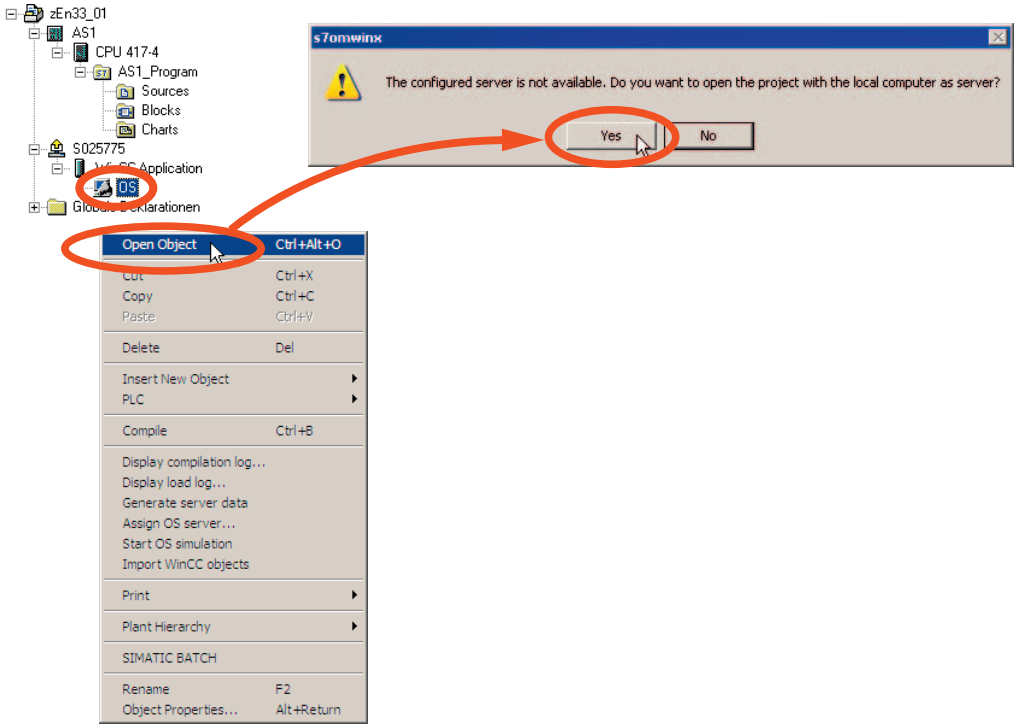
Ensure that the interface in the lower field is set to "PC internal (local)" in the SIMATIC Manager!

If it is not, set the interface to "PC internal (local)" with the menu command Options > Set PG/PC Interface….

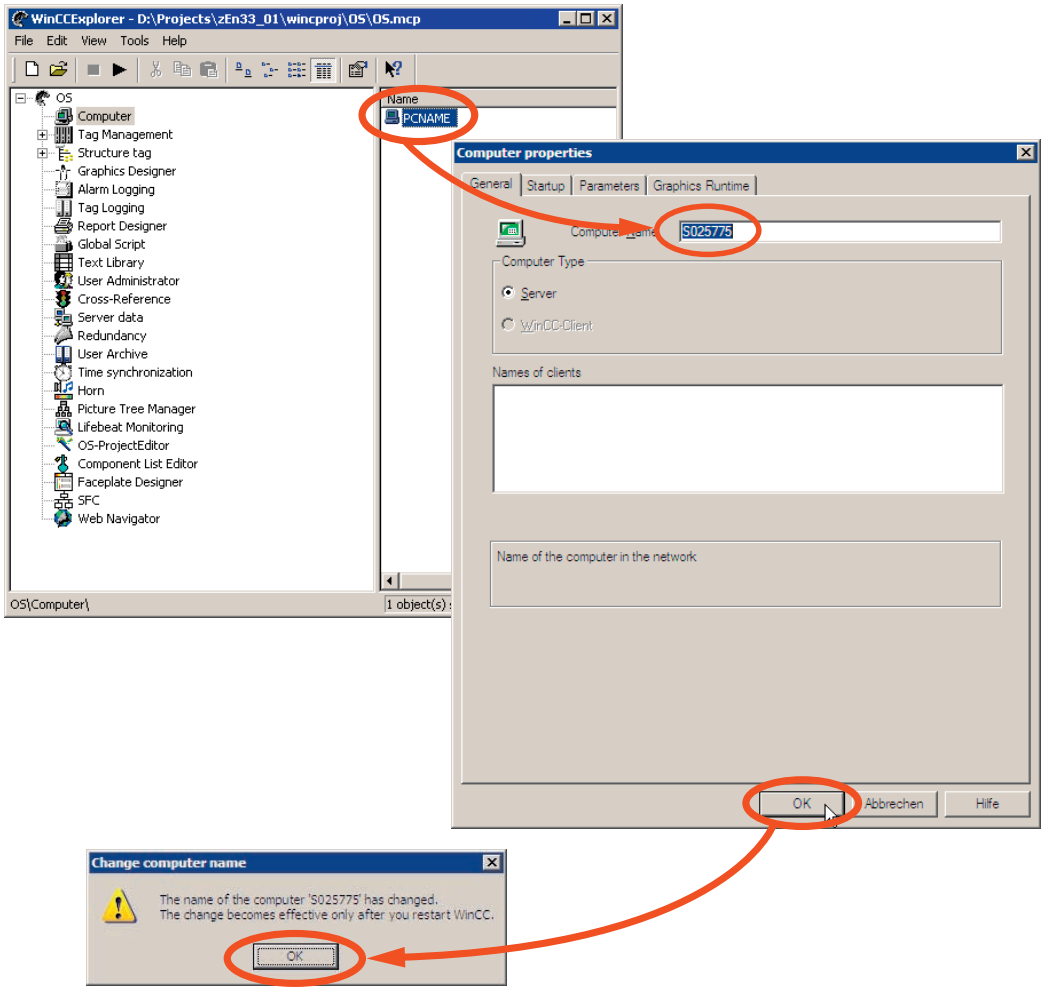
After confirming with "OK", the icon for the PC station changes and is shown with a yellow arrow in the Component view.



3. Open the WinCC Explorer on the OS.



4. Change the computer name in the WinCC Explorer to the name of your computer.

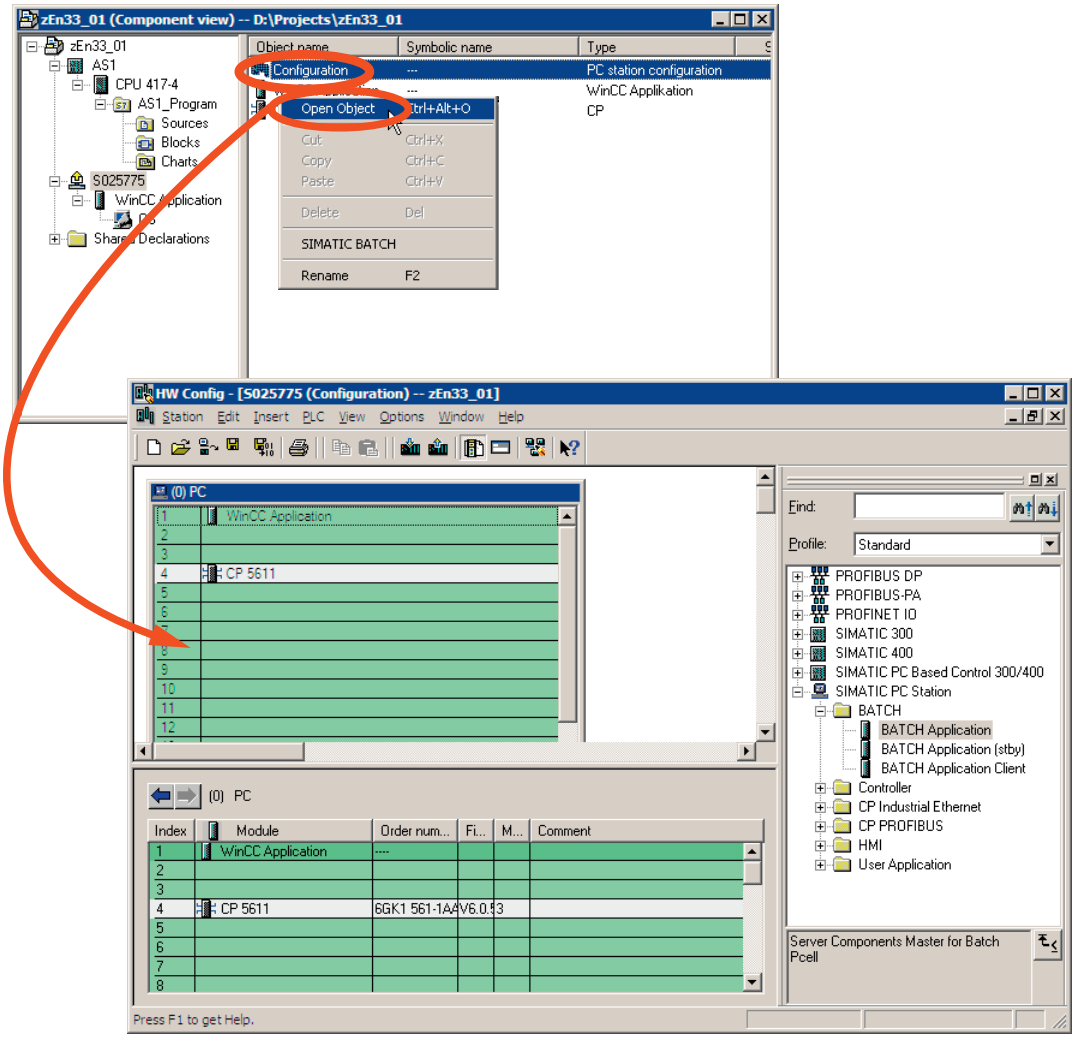


5. Close the WinCC Explorer.

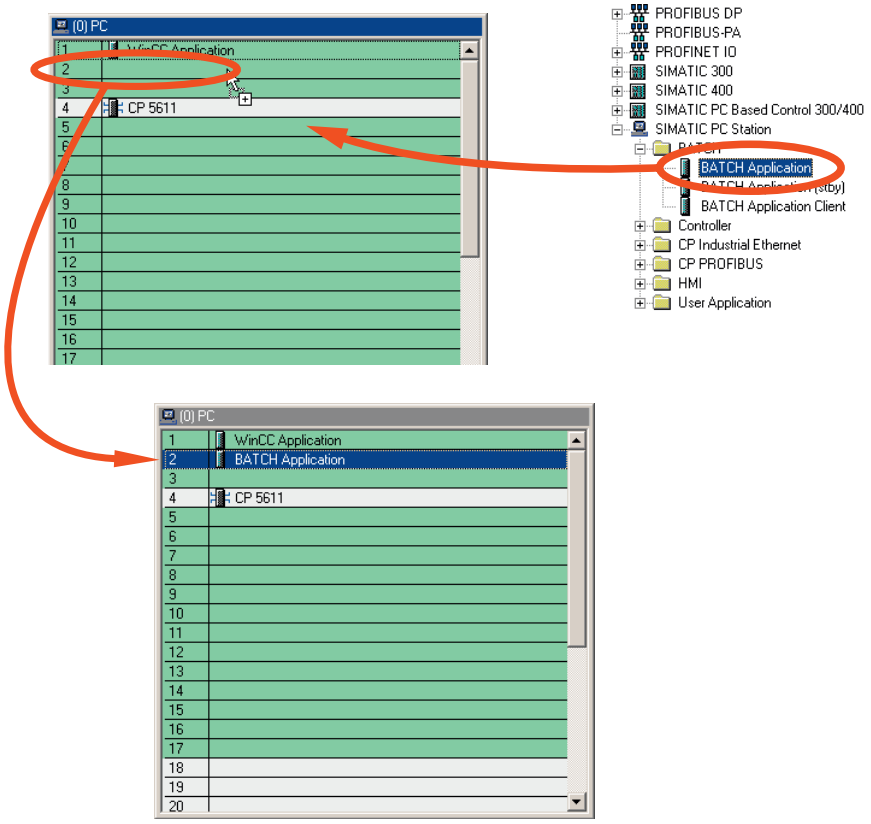
2.2.2 Chapter 2 Configuring the BATCH Server and BATCH Client

- A SIMATIC PC station must be configured with a "BATCH application" in HW Config for every computer on which a BATCH server application runs.
- If you want to work locally on the ES computer with BATCH server/clients (single project engineering), only **one** PC station with a server and client application needs to be set up. In this case, the runtime computer name remains empty (or the local computer name is entered).
- BATCH clients can also run on PC stations on which no OS client is installed.

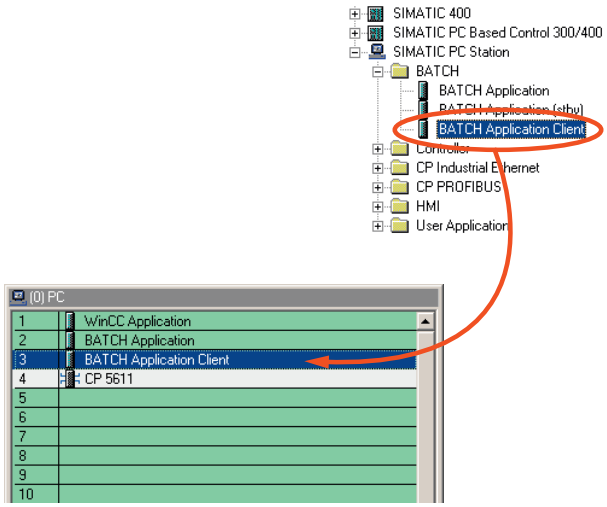
1. Select the PC station in the Component view and open its configuration.



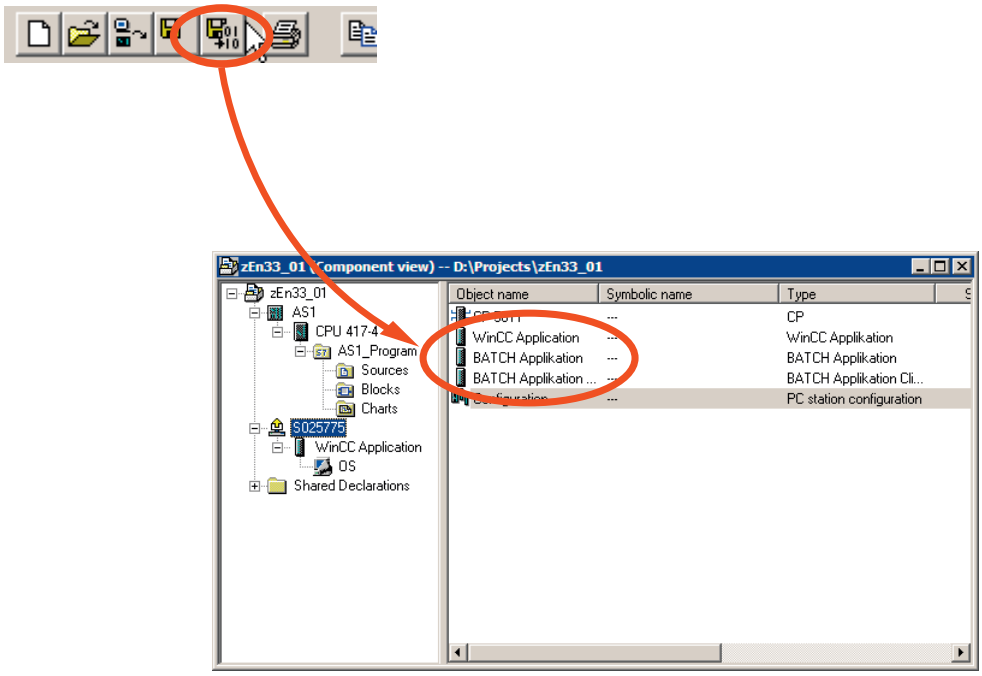
2. Select the "BATCH Application" and drag it to or insert it at position 2.



3. Select the "BATCH Application Client" and drag it to or insert it at position 3.



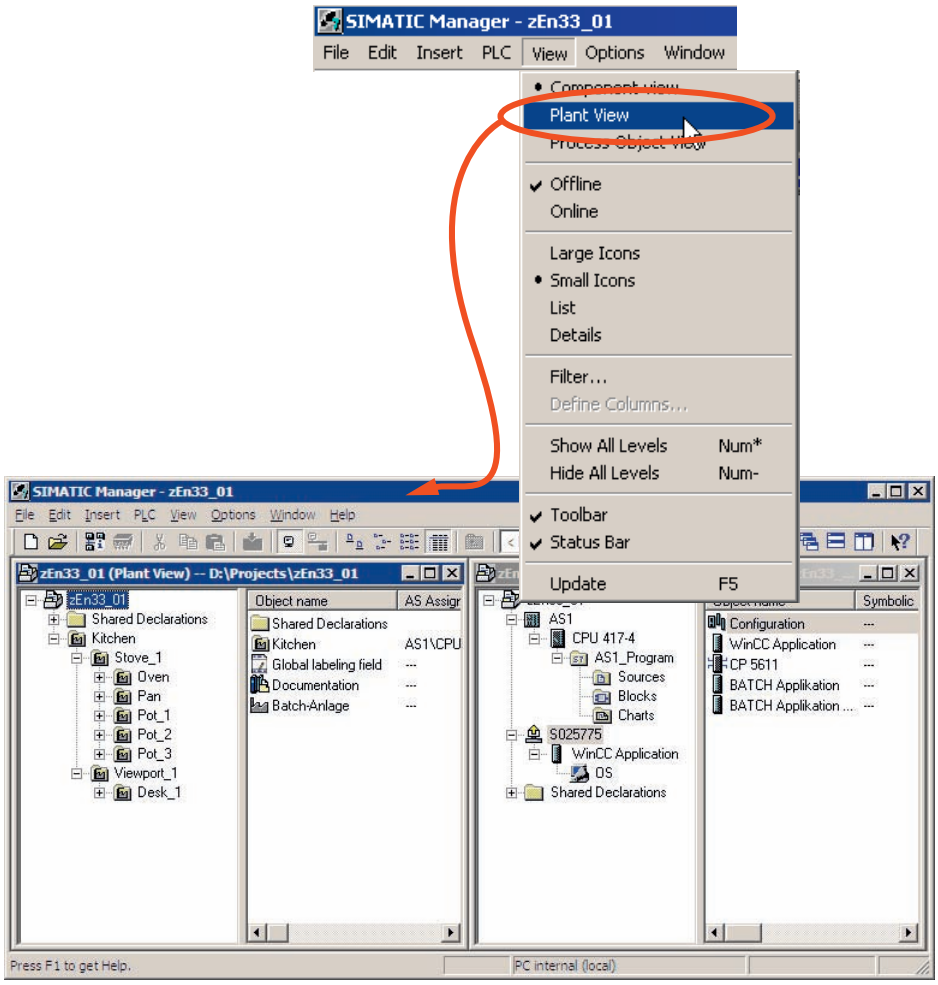
4. Save and compile the hardware configuration of your PC station with the newly added BATCH applications.



5. Close HW Config.

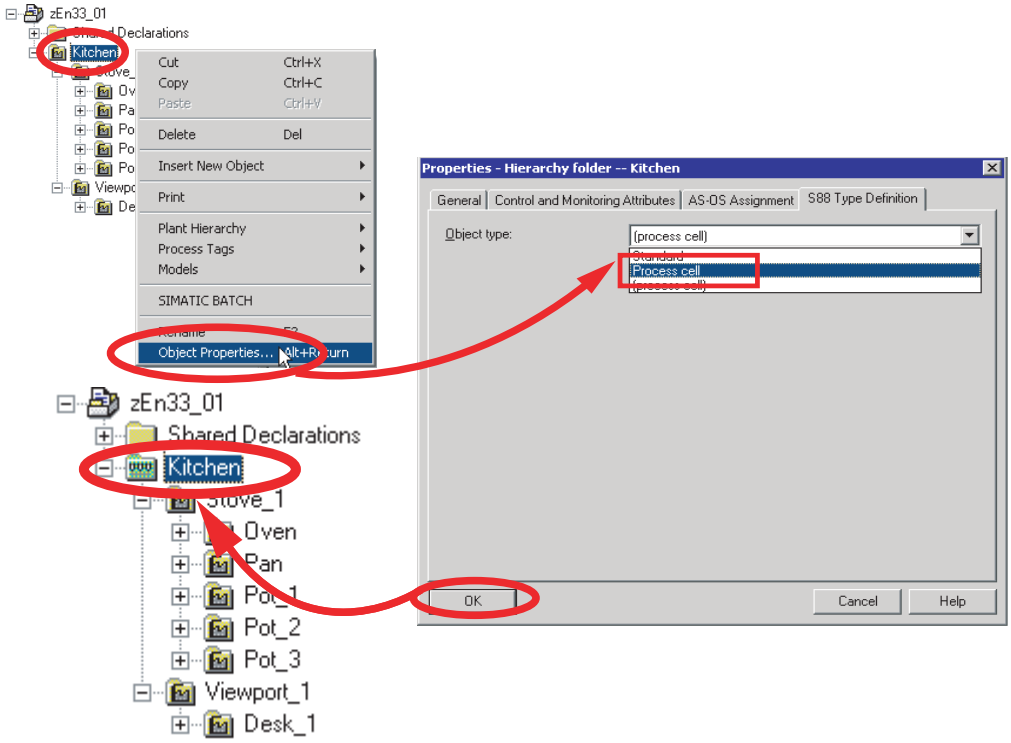
2.2.3 Chapter 3 Opening the Plant View

1. Open the Plant view of the project in the SIMATIC Manager and place the views side-by-side.



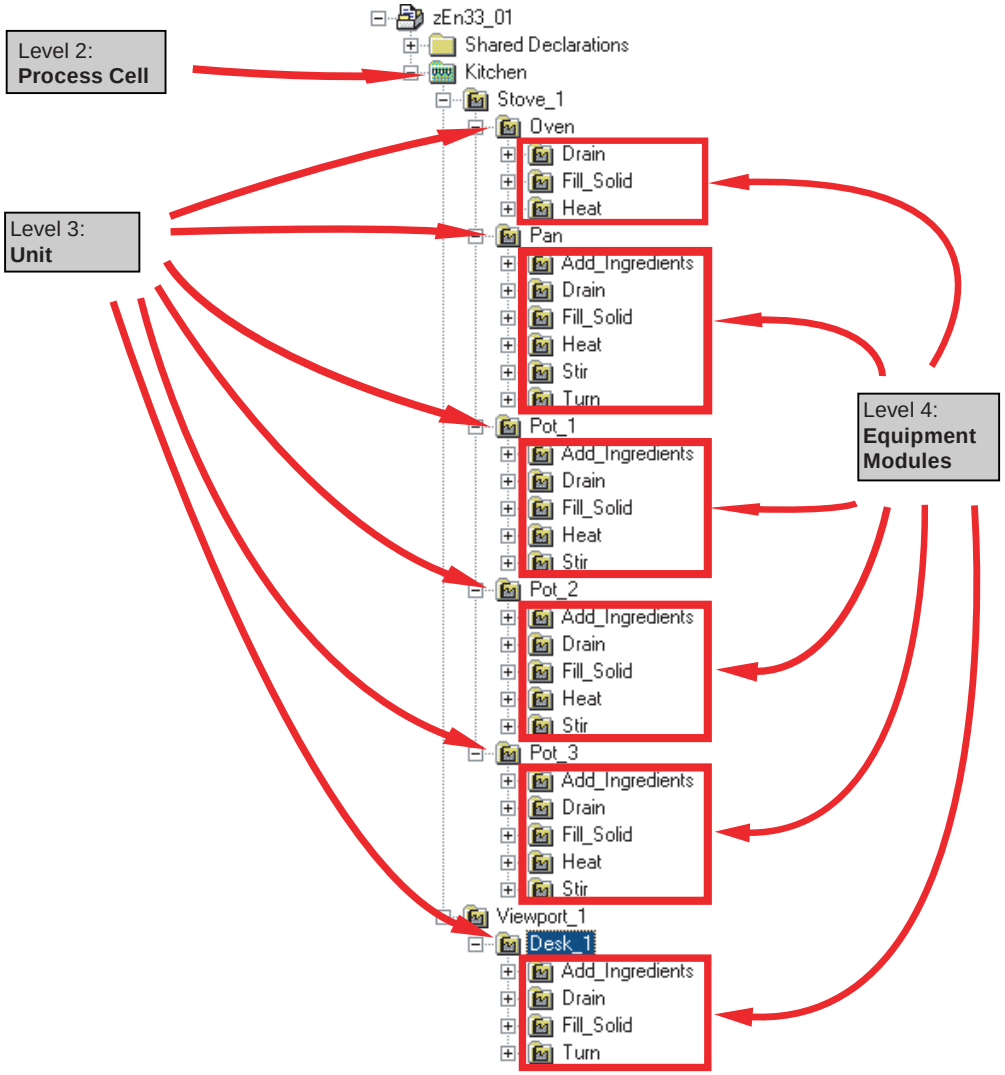
2.2.4 Chapter 4 Creating the Batch Process Cell

1. 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.

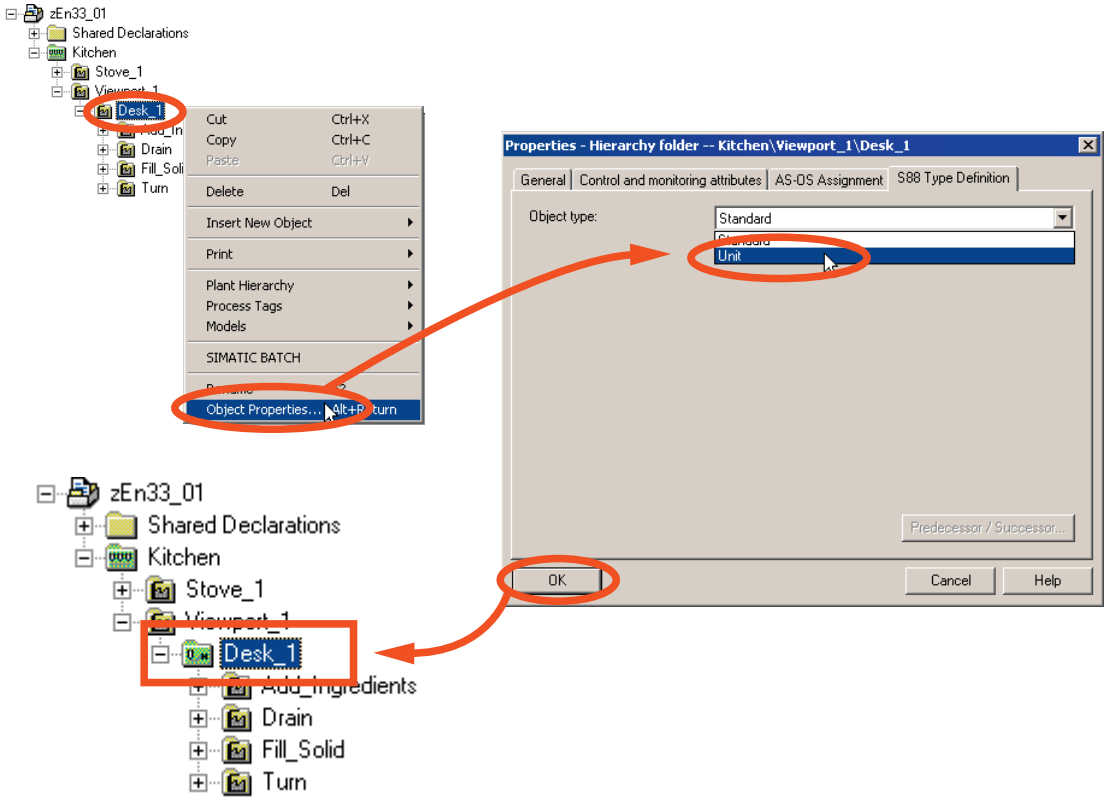


2.2.5 Chapter 5 Type Definition of the Plant Hierarchy According to ISA S88.01

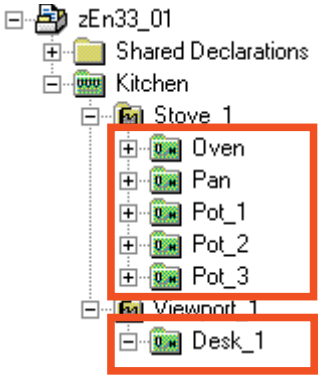
1. Assign the S88 type definition "Unit" and "Equipment module" to the existing hierarchy folders as described in the following four steps.



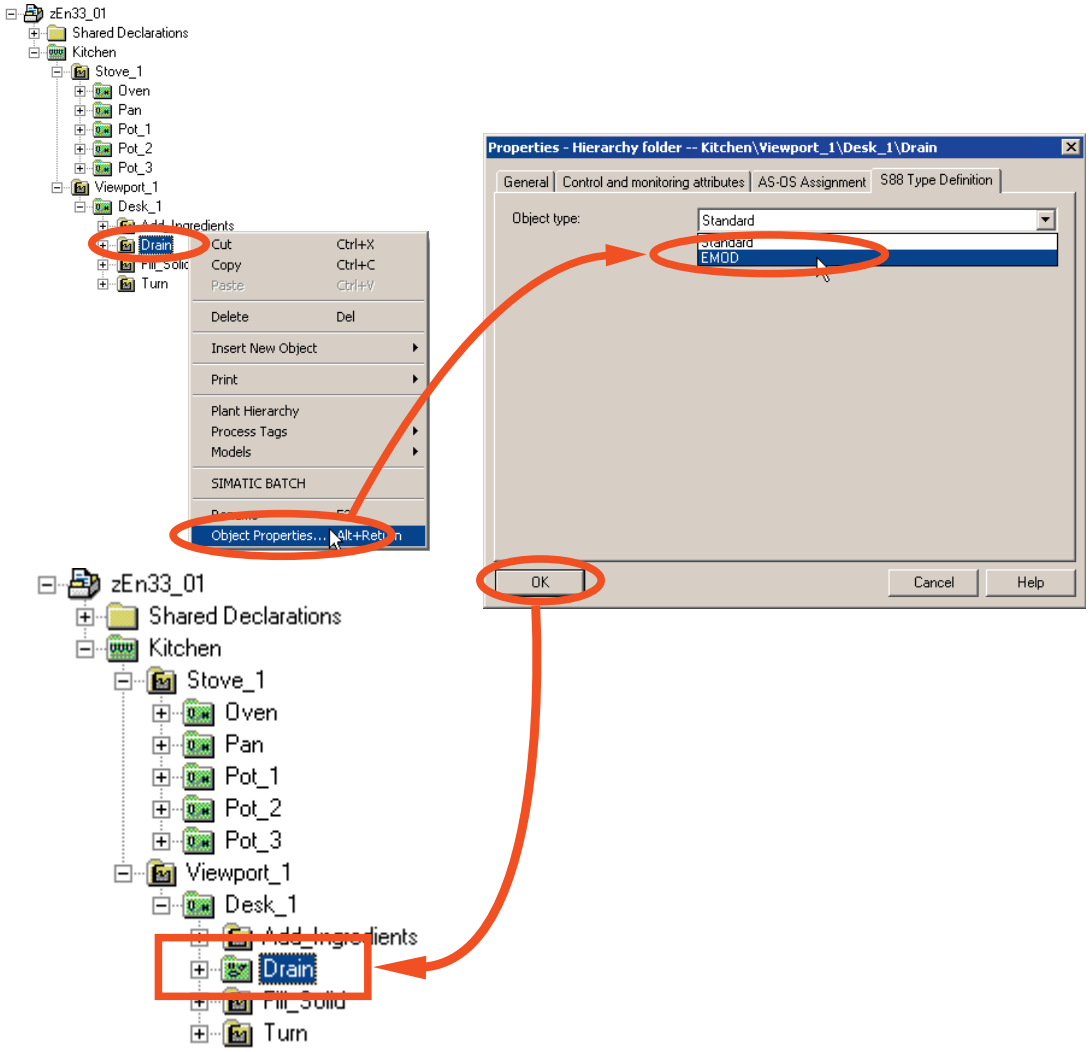
2. Assign the "Desk_1" hierarchy folder the object type "Unit" in the S88 type definition. The "Desk_1" folder is then displayed green identifying it as a unit according to the ISA S88.01 standard.



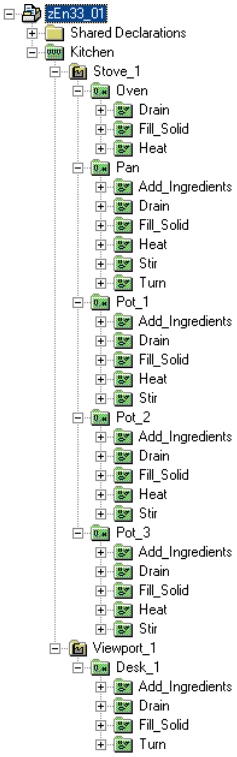
3. Assign the "Unit" object type to the hierarchy folders "Oven", "Pan", "Pot_1", "Pot_2" and "Pot_3", as described in step 1 of S88 type definition.



4. Assign the object type "Equipment module" to the "Drain" hierarchy folder below Kitchen/Stove_1/Oven in S88 type definition. The "Drain" folder is then displayed green and identified as an equipment module according to the ISA S88.01 standard. At the level of the equipment modules, you will find the instances of the SFC types and/or the Batch interface blocks (IEPH, IEPO, IEPAR_xxx).



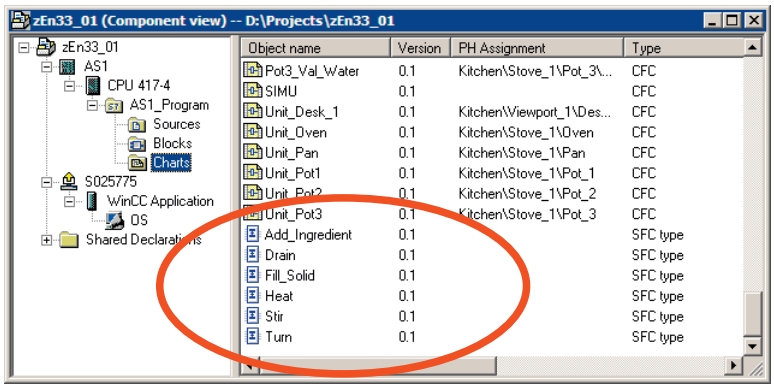
5. Assign the object type "Equipment module" to the hierarchy folders shown at the beginning of this chapter as equipment modules in the SS type definition as described in step 4.



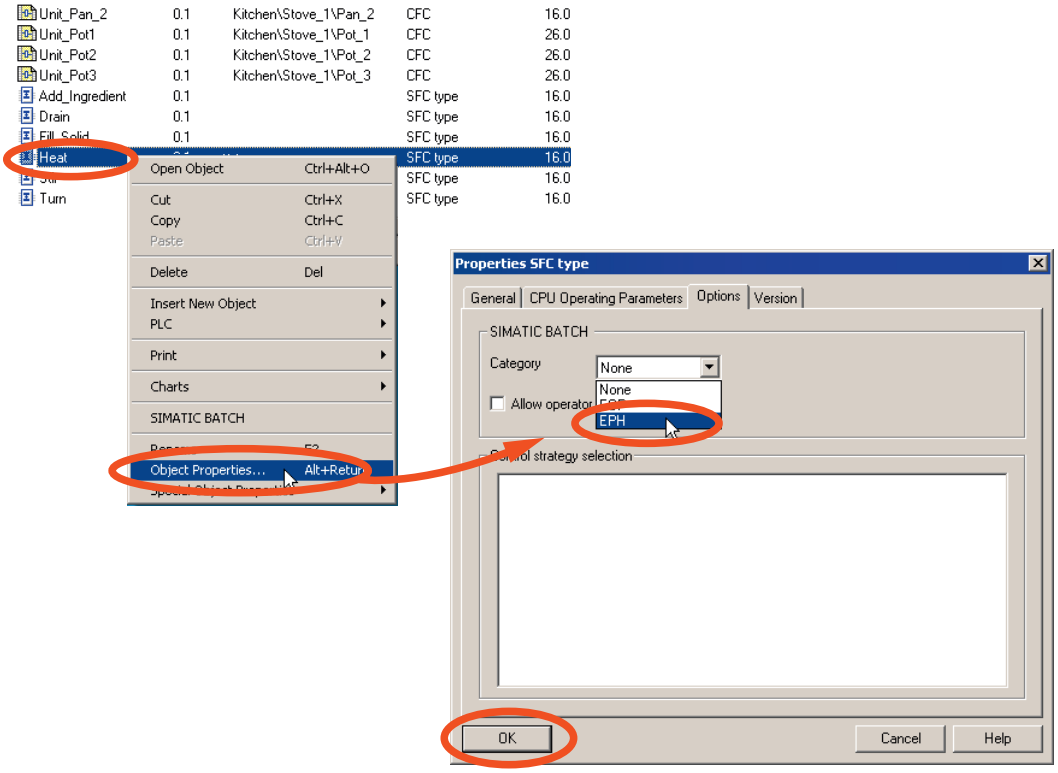
2.2.6 Chapter 6 Assigning the "EPH" Batch Category

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

You will 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.



1. Open the object properties of the SFC type "Heat" and assign it the "EPH" batch category.



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

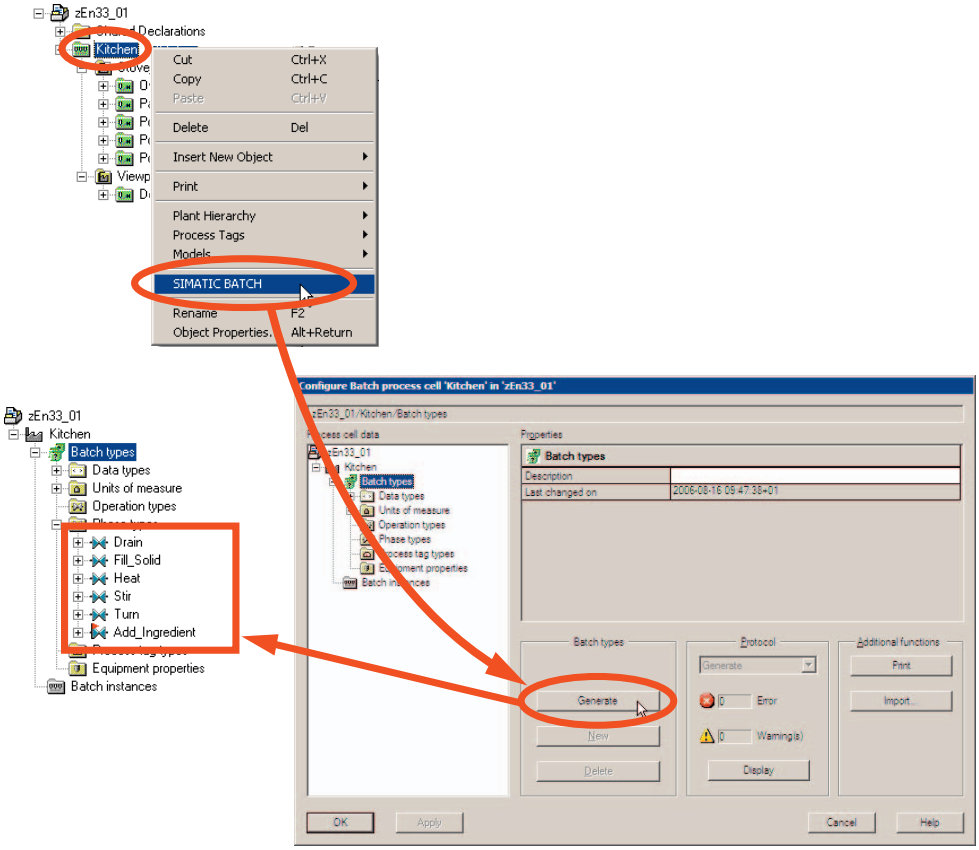
2.2.7 Chapter 7 Generating the Type Description in the Batch Types

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 Description of a Process Cell

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 your own data types and modify their properties.
Units of measure	You can create new units of measure and change 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 their block instances existing. 1st Operation types: Type information of the equipment operations (EOP) 2nd Phase types: Type information of the equipment phases (EPH) 3rd 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	In the "Equipment properties" folder, create a new equipment property, such as the size of the unit (capacity of a silo), or material characteristic of the silo shell. The unit is assigned the equipment properties during the configuration on the ES, and these are queried as conditions when the recipe is created.

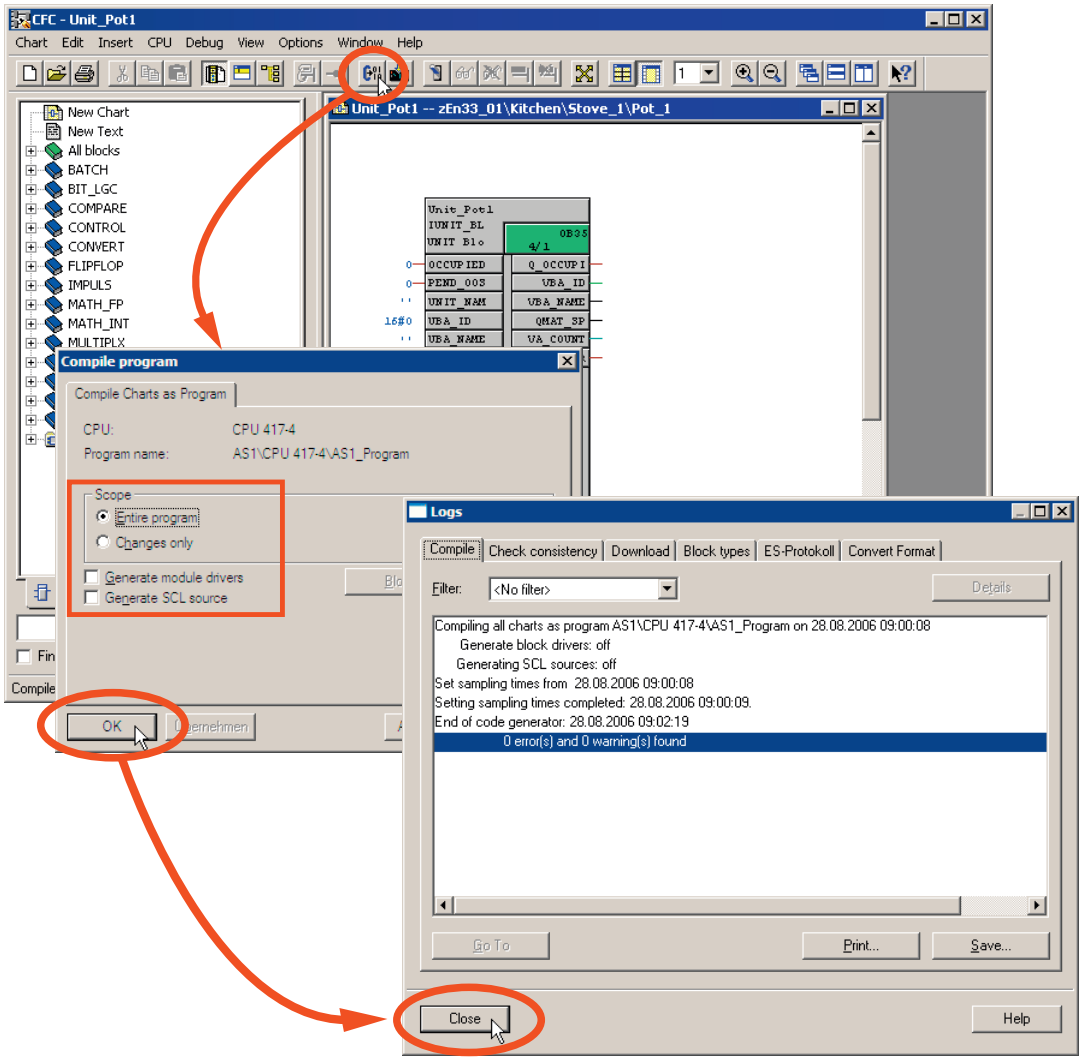
1. Open SIMATIC BATCH and select "Batch types". Then generate the batch types and exit the window with "OK".



2.2.8 Chapter 8 Compiling and Downloading the AS, OS and Batch Process Cell Data

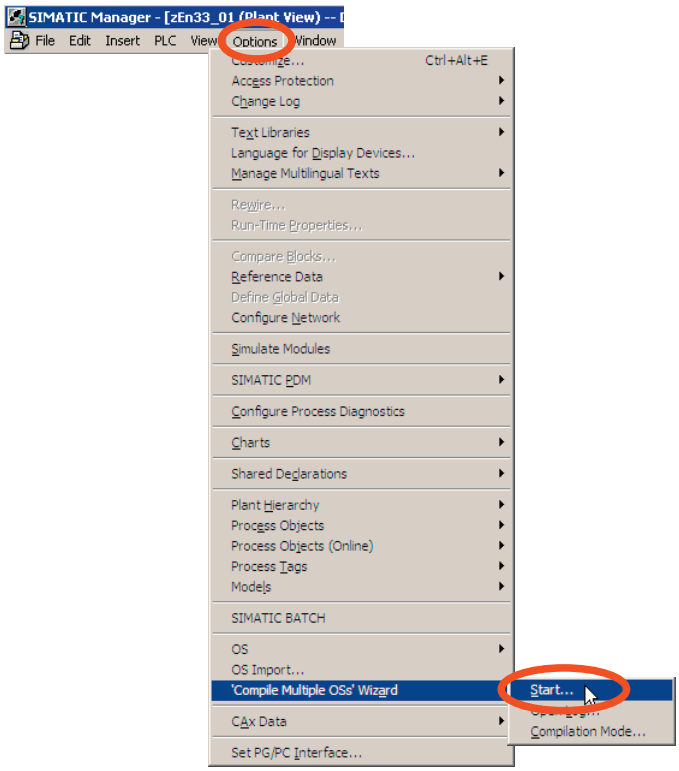
1. Open any CFC chart and compile the entire program for the AS.

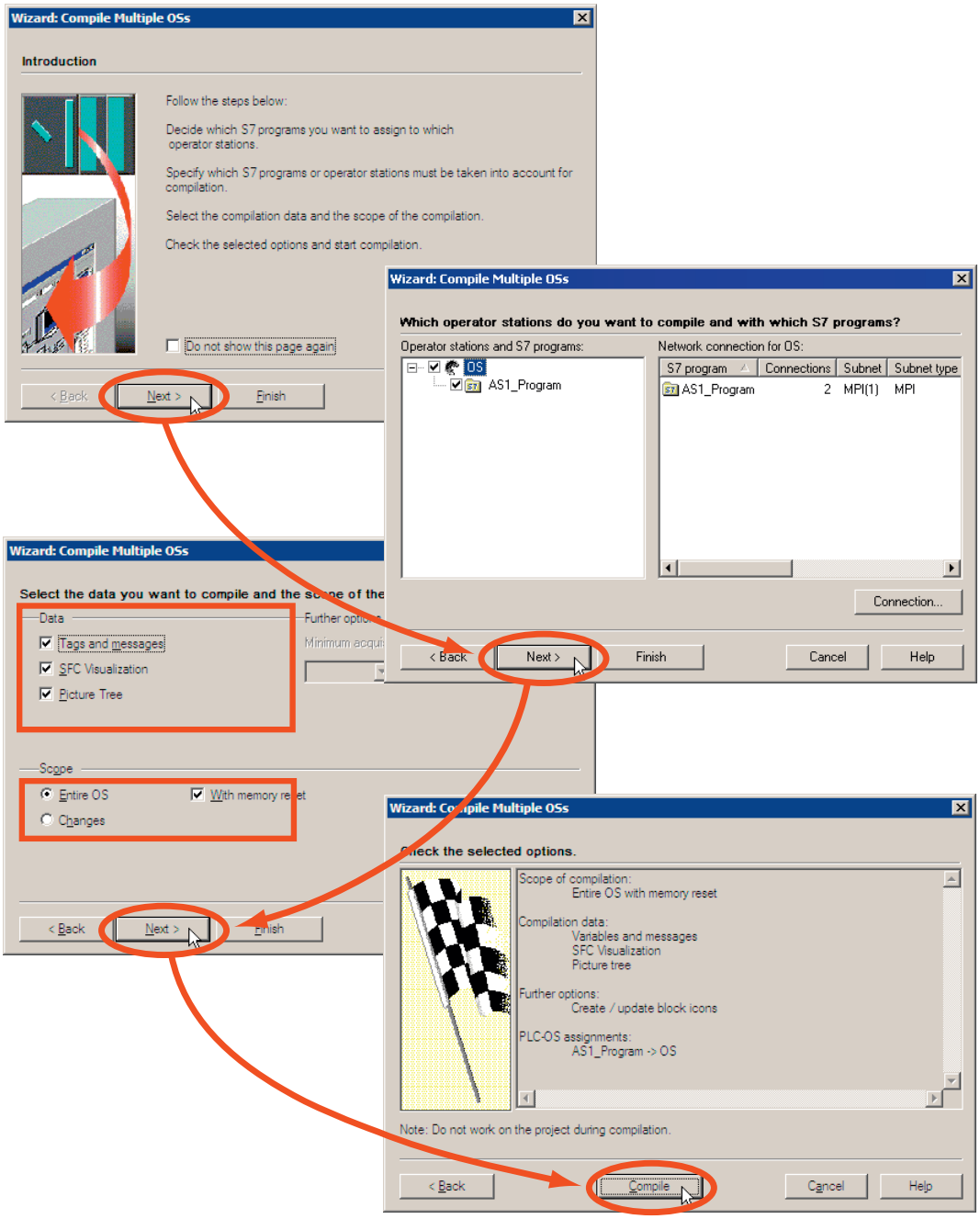
Note:
To avoid warning during the compiling, increase the number of inserted blocks per runtime group or OB to 100 in the CFC Editor under **Options > Settings > Compile/Download**.



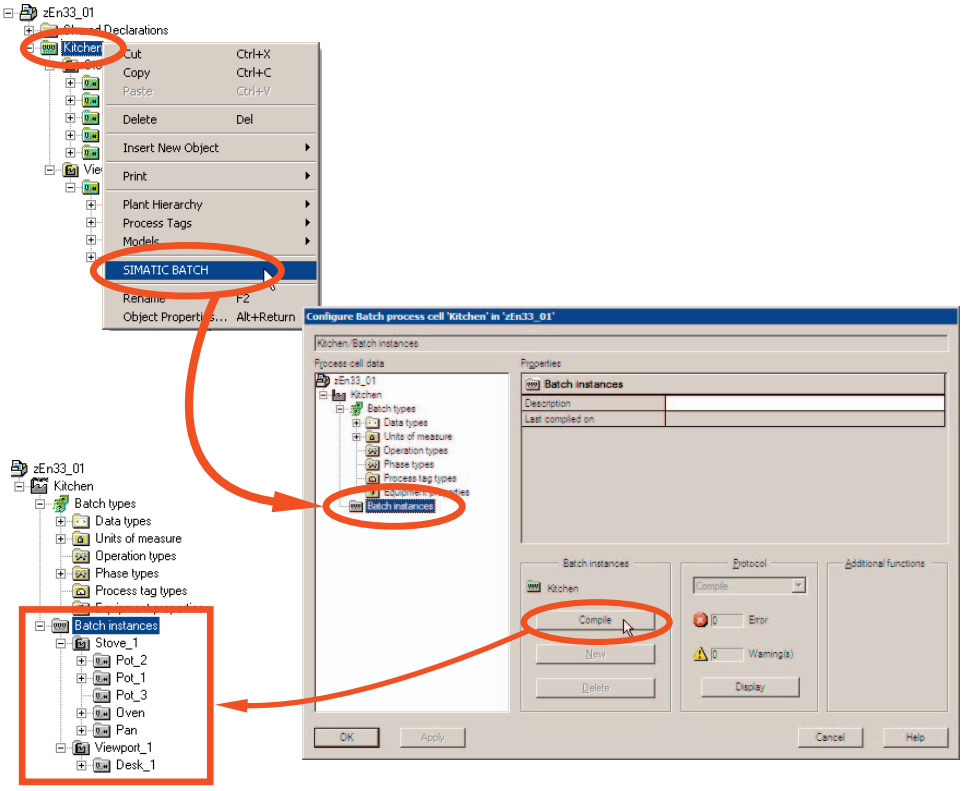
2. Close the CFC Editor.

3. Compile the entire OS with memory reset.

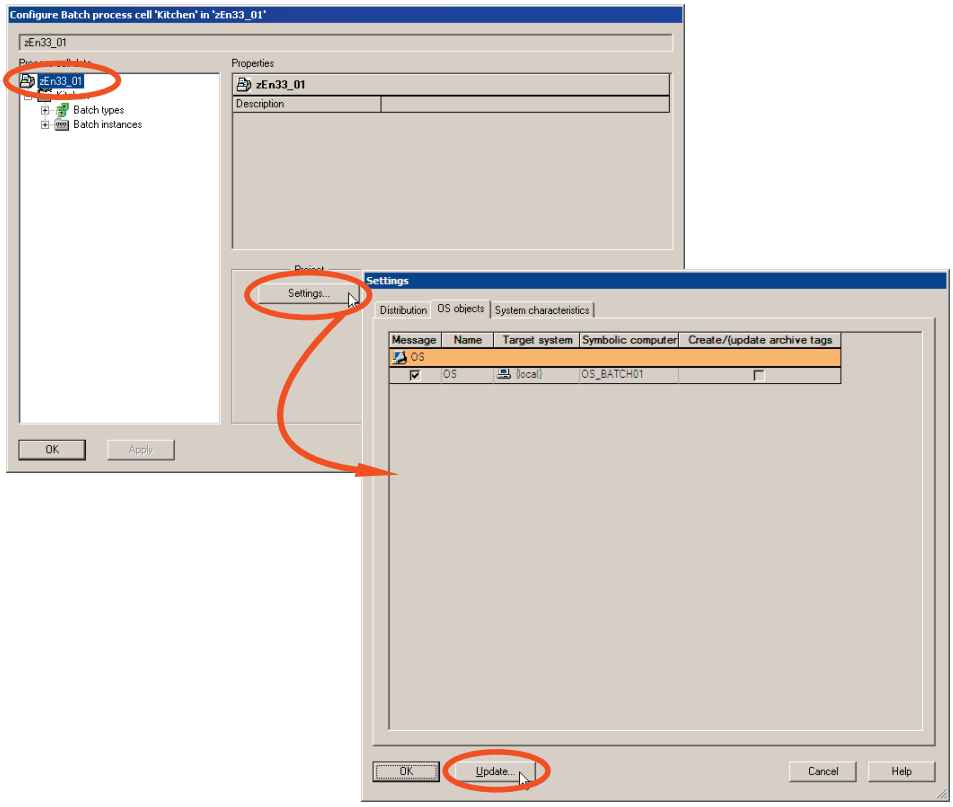



Wizard: Compile Multiple OSs
Introduction
Follow the steps below:
Decide which S7 programs you want to assign to which operator stations.
Specify which S7 programs or operator stations must be taken into account for compilation.
Select the compilation data and the scope of the compilation.
Check the selected options and start compilation.
Do not show this page again
< Back
Next >
Finish
Wizard: Compile Multiple OSs
Which operator stations do you want to compile and with which S7 programs?
Operator stations and S7 programs:
OS
AS1_Program
Network connection for OS:
S7 program
Connections
Subnet
Subnet type
AS1_Program
2
MPI(1)
MPI
Connection...
< Back
Next >
Finish
Cancel
Help
Wizard: Compile Multiple OSs
Select the data you want to compile and the scope of the
Data
Tags and messages
SFC Visualization
Picture Tree
Scope
Entire OS
With memory reset
Changes
< Back
Next >
Finish
Wizard: Compile Multiple OSs
Check the selected options.
Scope of compilation:
Entire OS with memory reset
Compilation data:
Variables and messages
SFC Visualization
Picture tree
Further options:
Create / update block icons
PLC-OS assignments:
AS1_Program -> OS
Note: Do not work on the project during compilation.
< Back
Compile
Cancel
Help

4. Compile the Batch process cell data. Select your project (Kitchen) in the Plant view and select **SIMATIC BATCH > Batch Instances > Compile**.

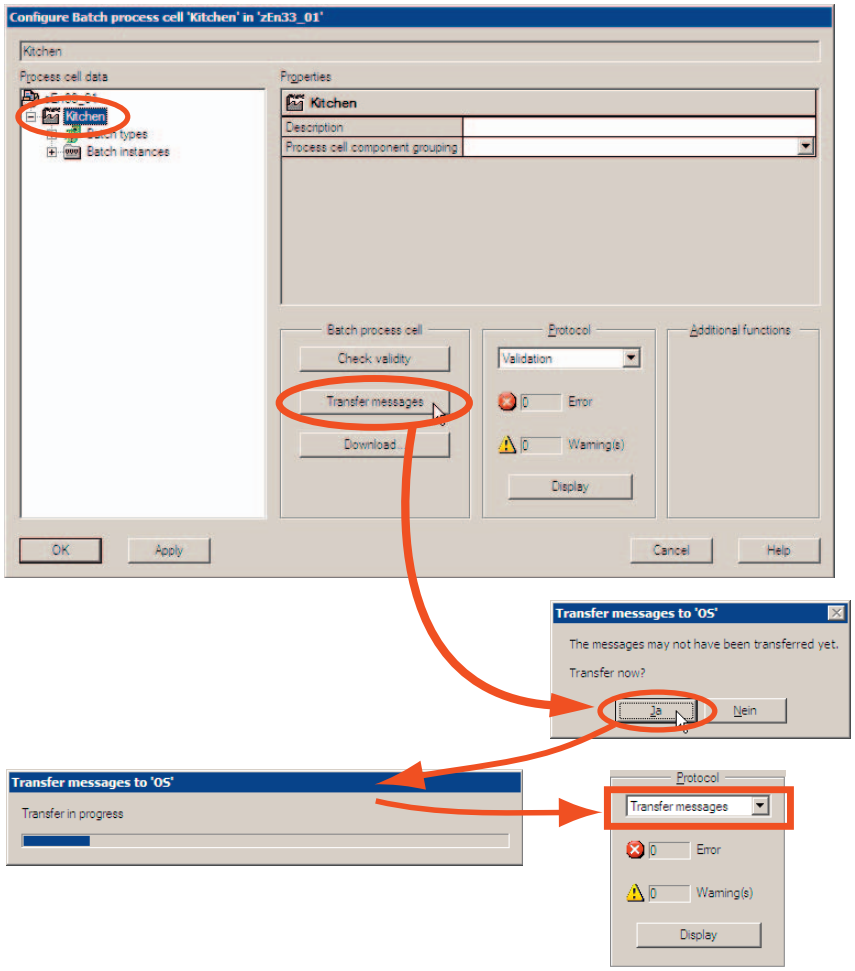


5. Update the status of the entire process cell with the menu command **Settings > OS Objects > Update** and then exit the window with "OK".

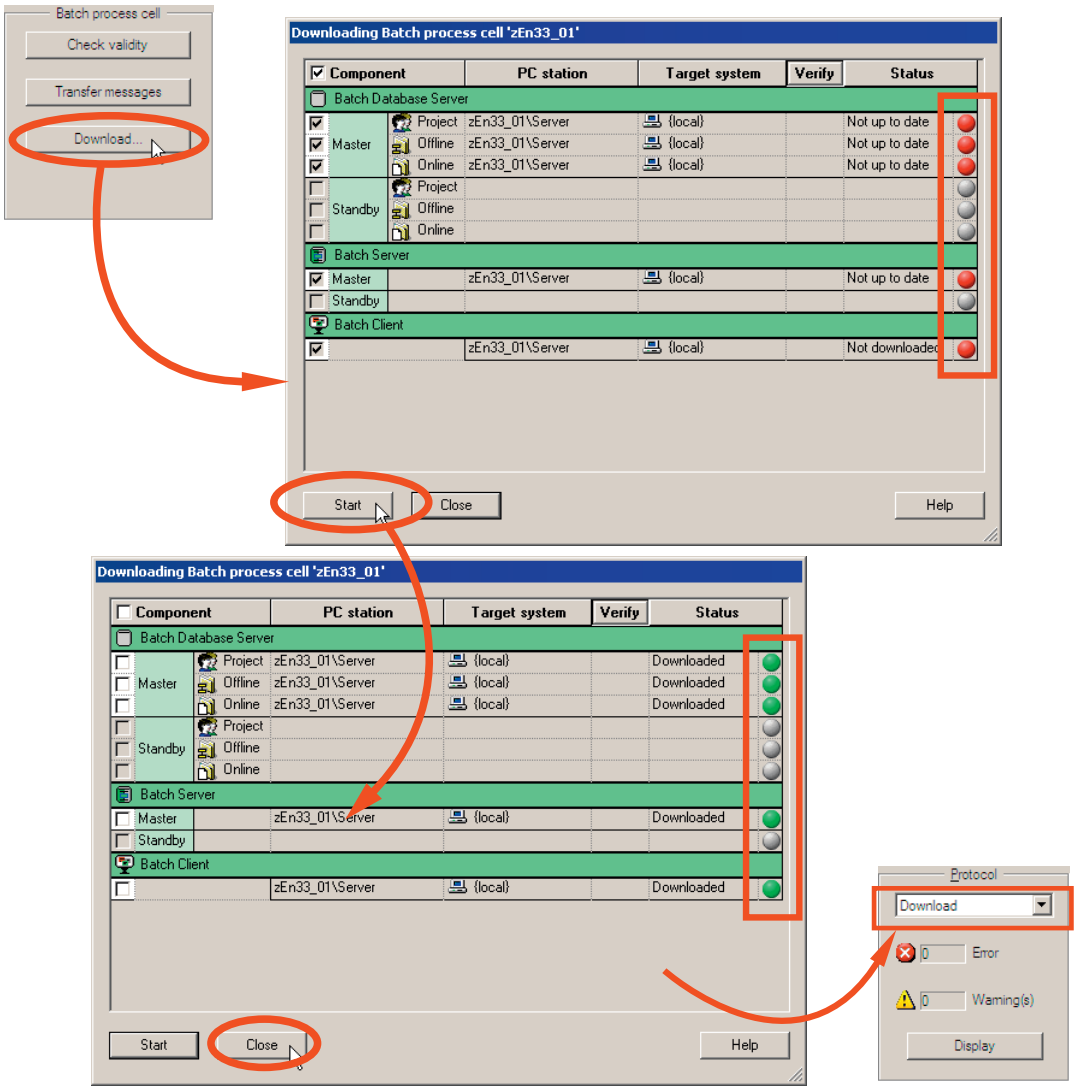


2.2.9 Chapter 9 Downloading the Batch Process Cell Data

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.



2. Download the generated Batch process cell data to the BATCH server and BATCH client. In your case, the BATCH server and BATCH client are on the same computer.

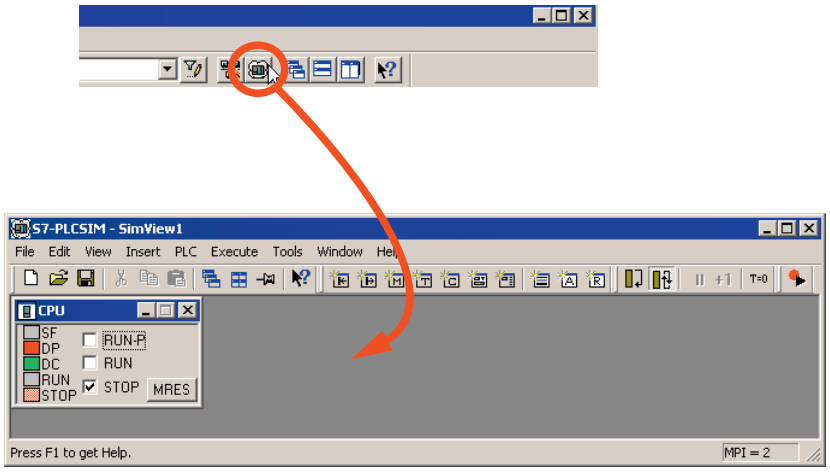


3. Exit the "Configure Batch process cell" dialog with "OK".

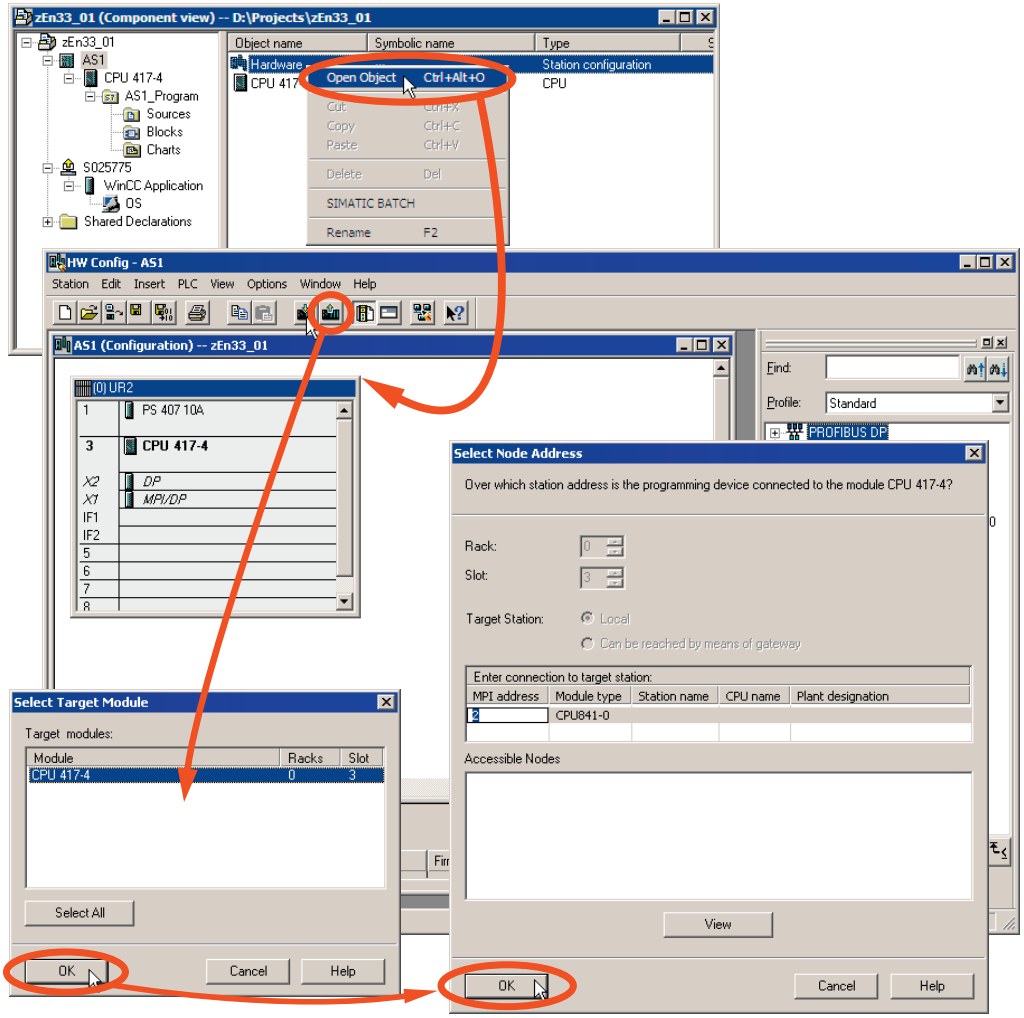
2.2.10 Chapter 10 Downloading the AS to PLCSim

Download the AS data compiled in the SIMATIC Manager to the "PLCSim" simulation program.

1. Open PLCSim in the SIMATIC Manager.

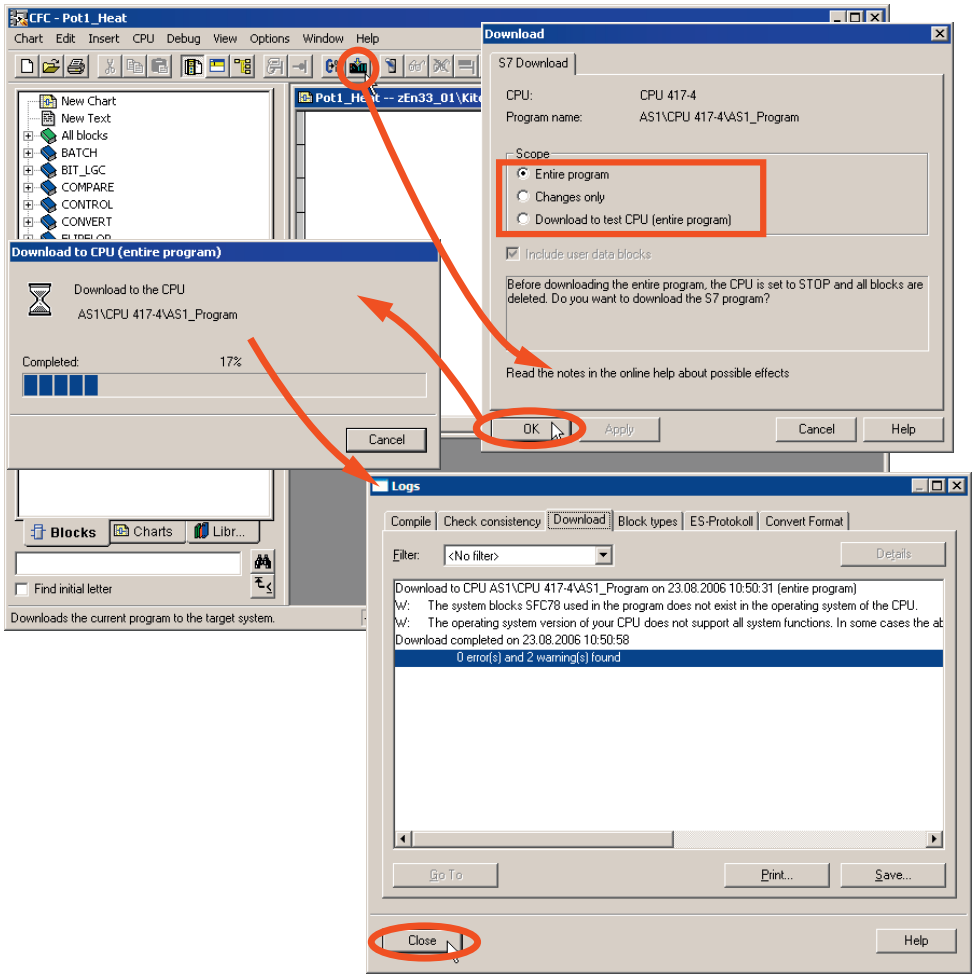


2. Download the hardware configuration to PLCSIM.

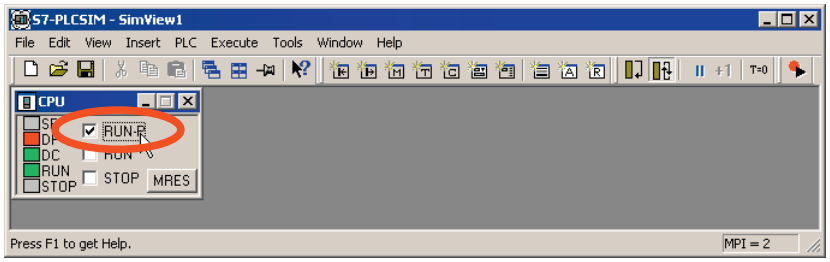


3. Close HW Config.

4. Open a CFC chart from the project and download the charts to PLCSim.

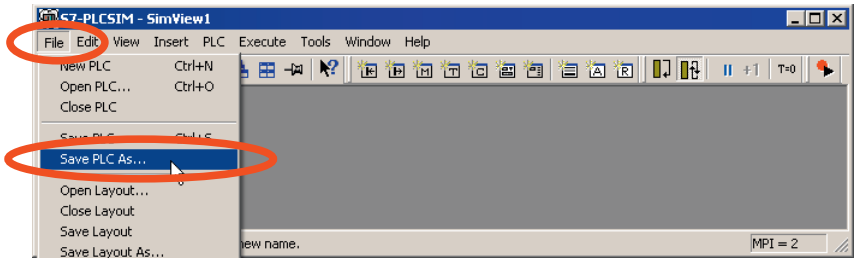


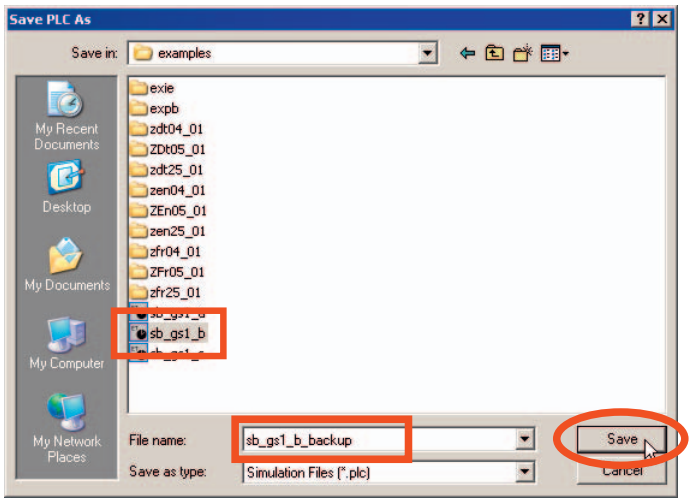
5. Close the CFC Editor.
6. Start PLCSim with "RUN-P".



7. Save the simulation you have downloaded so that it is not lost when you close PLCSim.

If you close PLCSim without saving, you must repeat steps 1 to 5 the next time you work with PLCSim. Saved PLCSim data can be put directly into Run by opening the saved file.



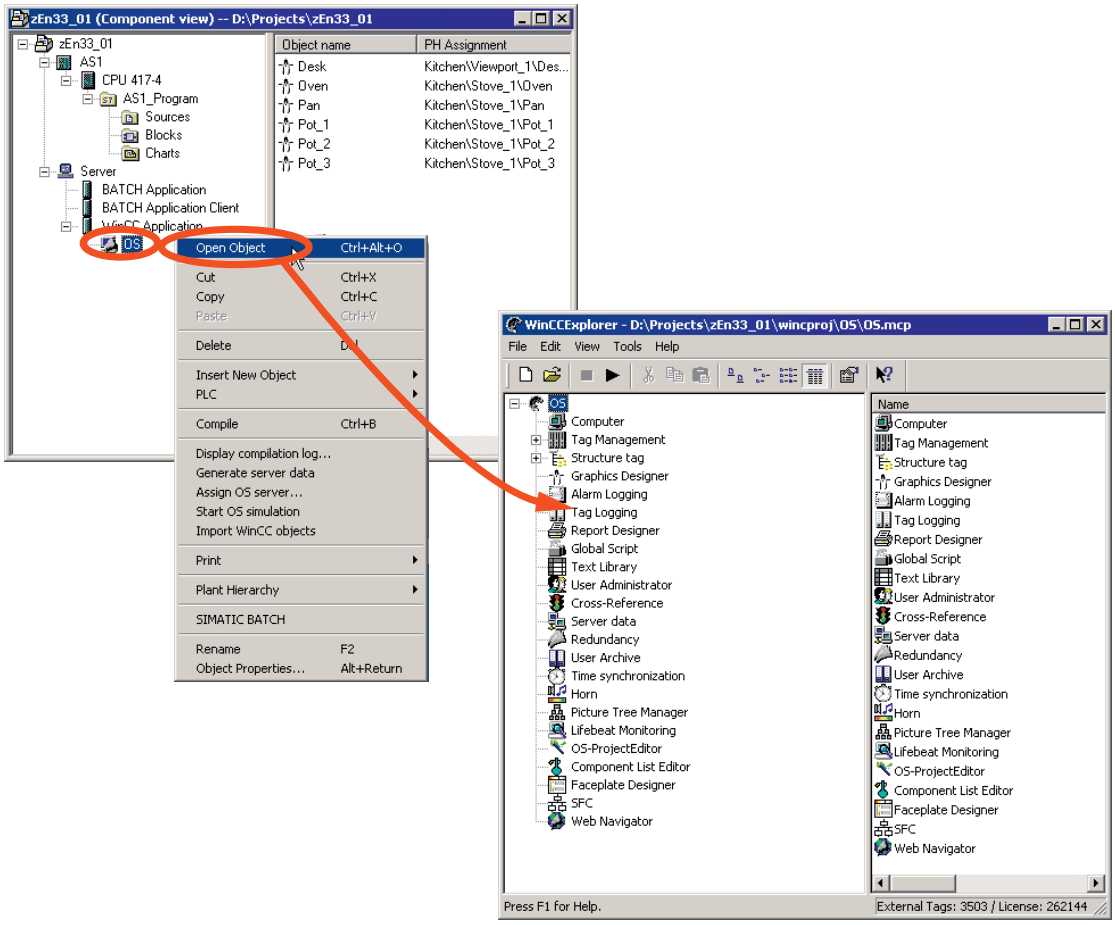


2.2.11 Chapter 11 Starting the OS

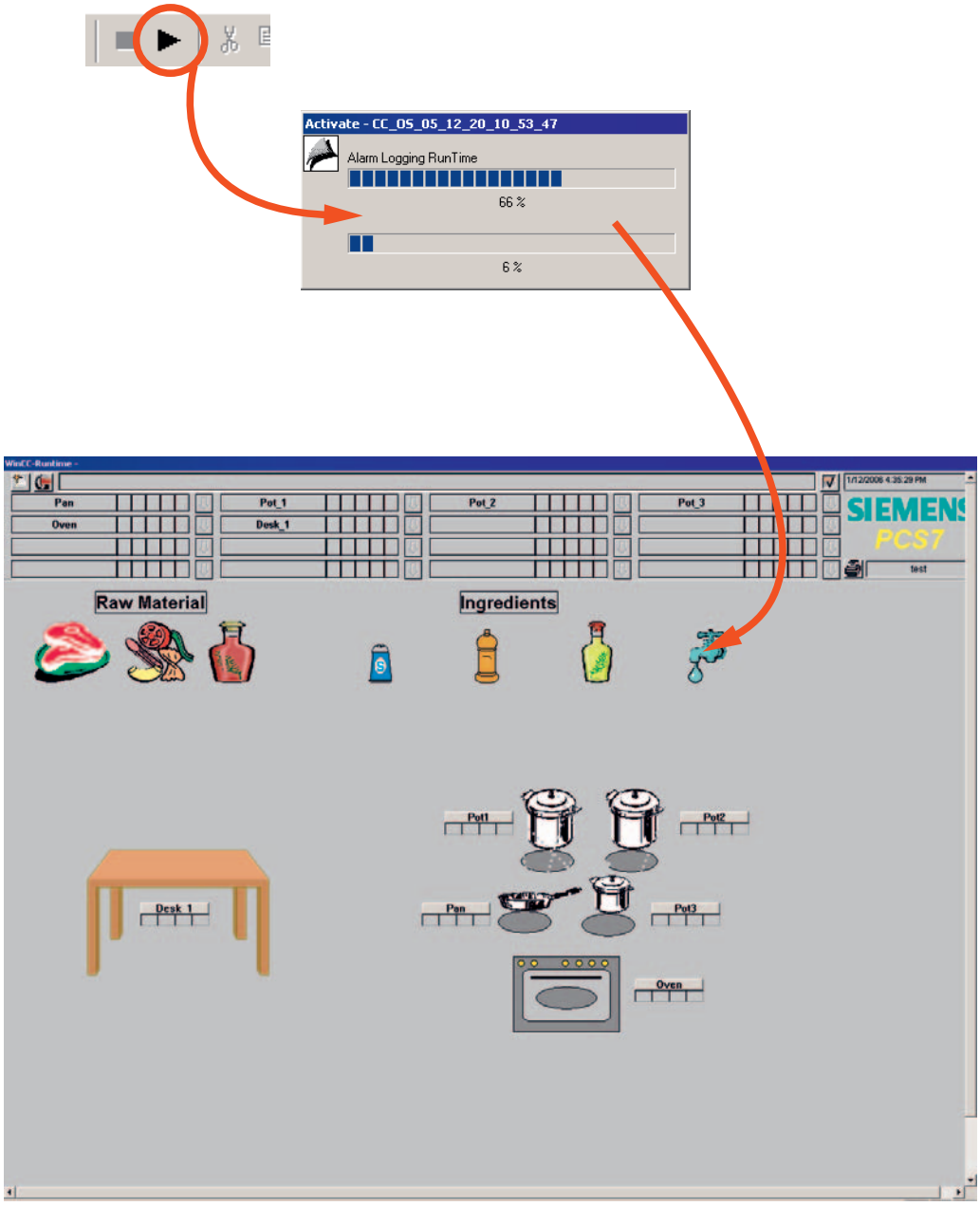
1. Open the WinCC Explorer of the OS. Create a user with full rights in the User Administrator.

Note:

Open the OS project editor and click "OK". This configures the WinCC runtime interface and the alarm system.



2. Put the OS in runtime; the first startup can take several minutes. Log on with the logon information of user you have just created.

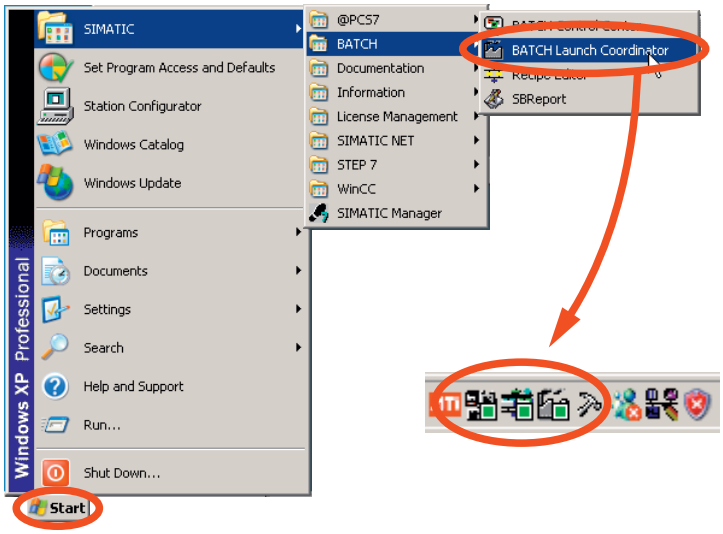


2.2.12 Chapter 12 Starting the BATCH Start Coordinator

The BATCH Start Coordinator starts automatically when you log in. It does not have its own graphic user interface that is visible at the lower right in the taskbar as an icon.

If the BATCH Start Coordinator has been closed, you can start it from the Windows Start menu with **Start > Simatic > BATCH > BATCH Launch Coordinator**.

Starting the BATCH Start Coordinator also starts the Batch Control Server (BCS) and the Batch Data Management (CDV) and these change to the "Ready" status.

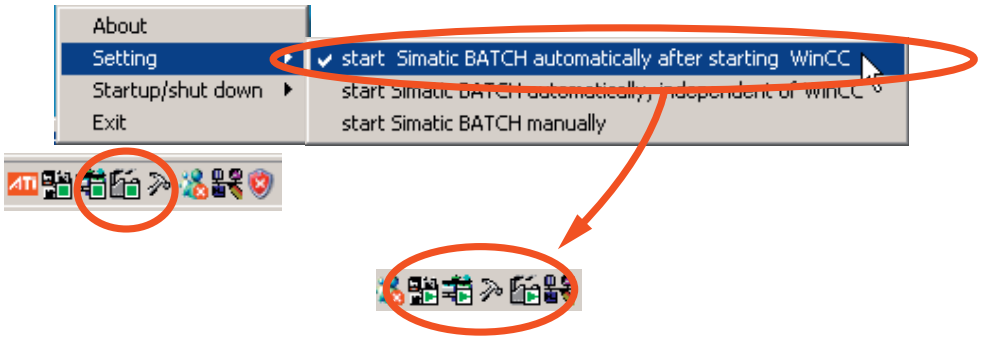


Using the taskbar icon, you can configure the startup characteristics of SIMATIC BATCH.

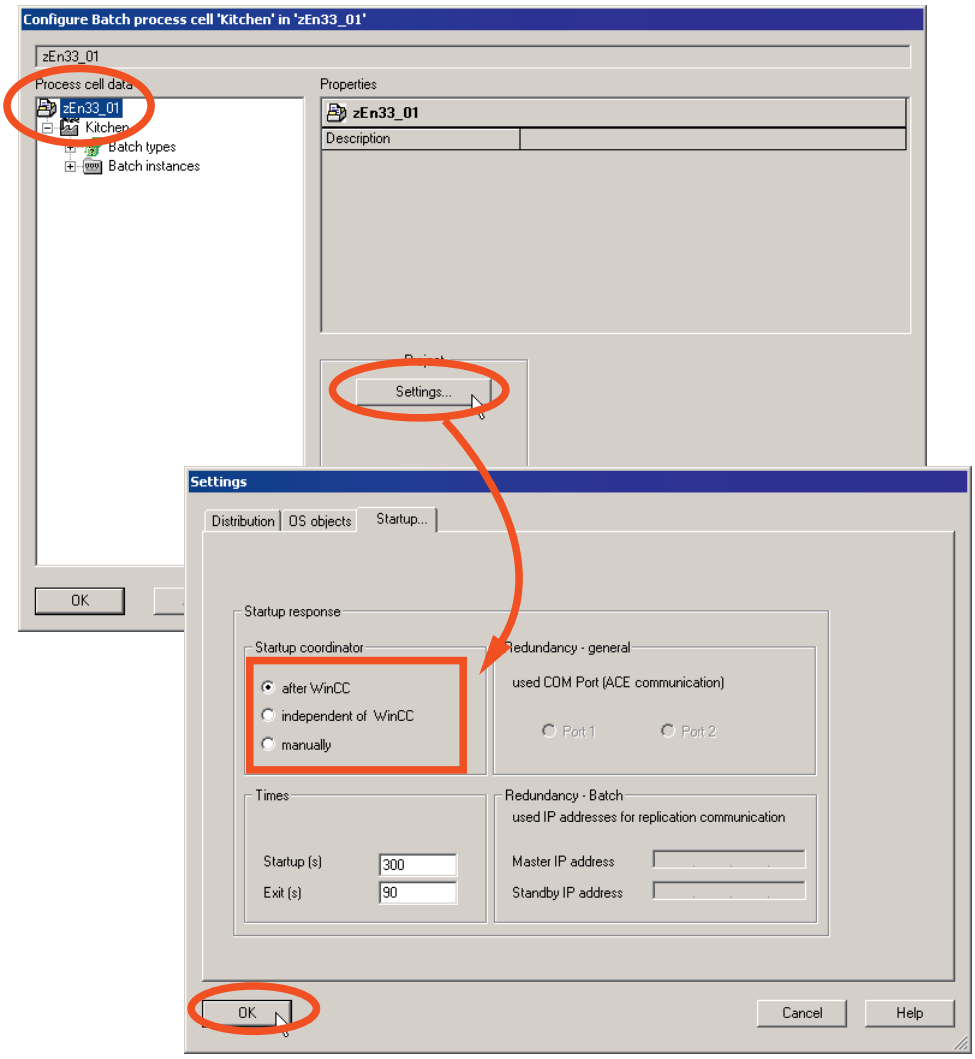
There are three different startup options for the Batch Start Coordinator (right-click on the Start Coordinator):

- "Start SIMATIC BATCH automatically after starting WinCC"
- "Start SIMATIC BATCH automatically, independent of WinCC"
- "Start SIMATIC BATCH manually"

1. Select the "start SIMATIC BATCH automatically after starting WinCC" option. The BATCH applications (BCS and CDV) start up automatically after WinCC starts and they change to the "Running" status. You can only change the settings for a limited time after the start. If the buttons are disabled, close the BATCH Start Coordinator and open it again.



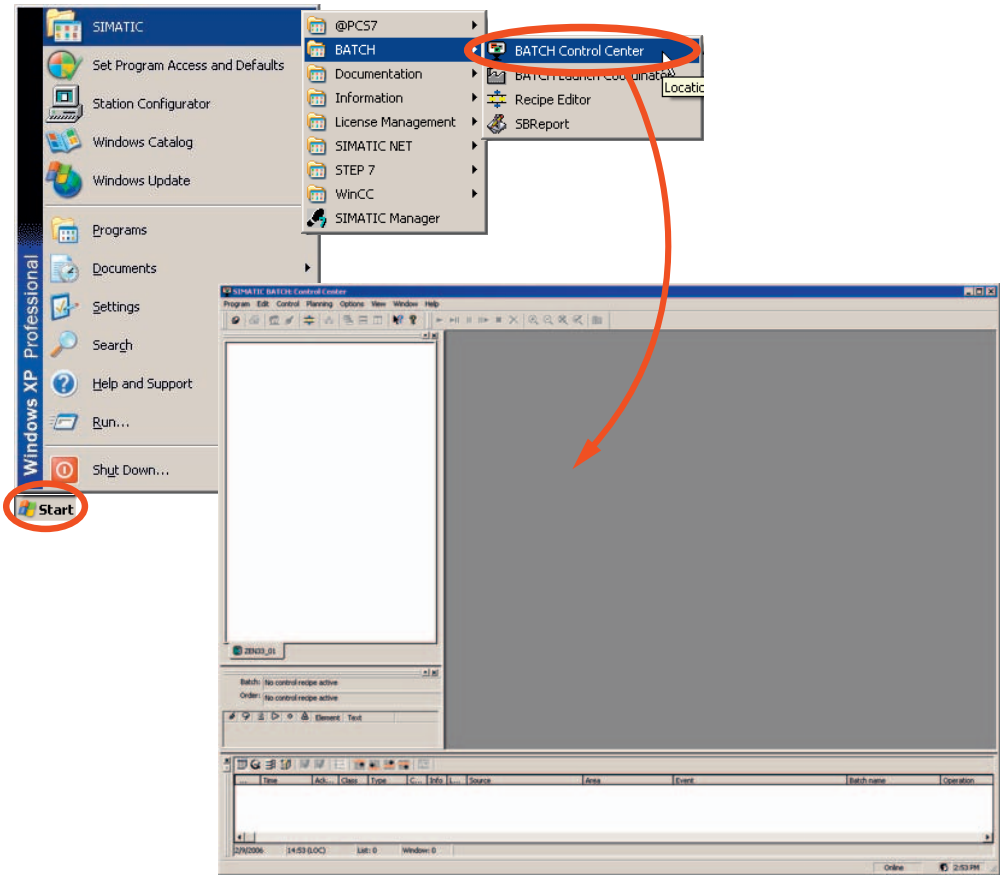
You set the default startup characteristics as follows:



2.2.13 Chapter 13 Loading the Supplied Recipes and Materials

Load the supplied recipe database for this project.

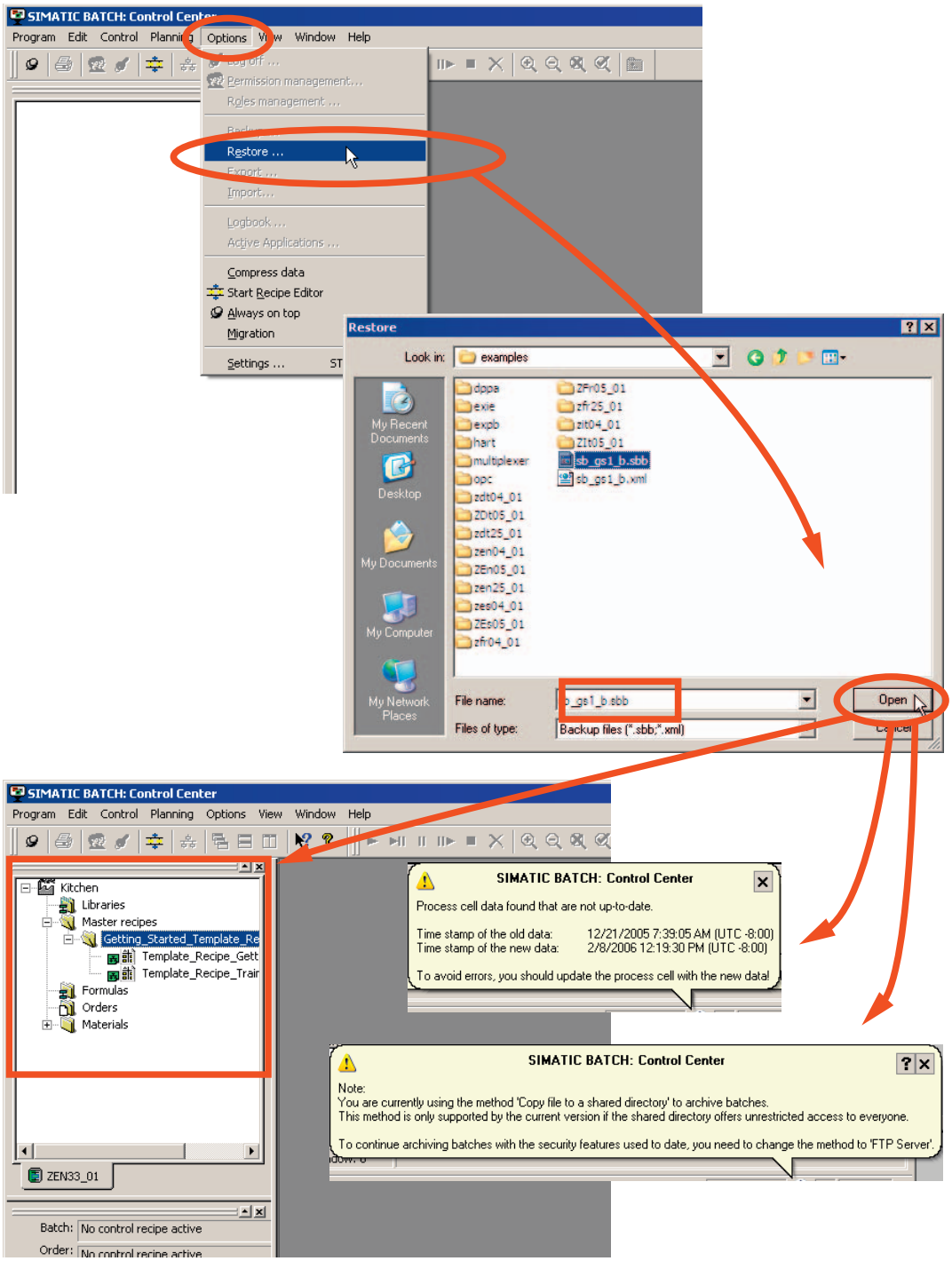
1. Open the Batch Control Center (BatchCC).



The Batch Control Center is the central component for

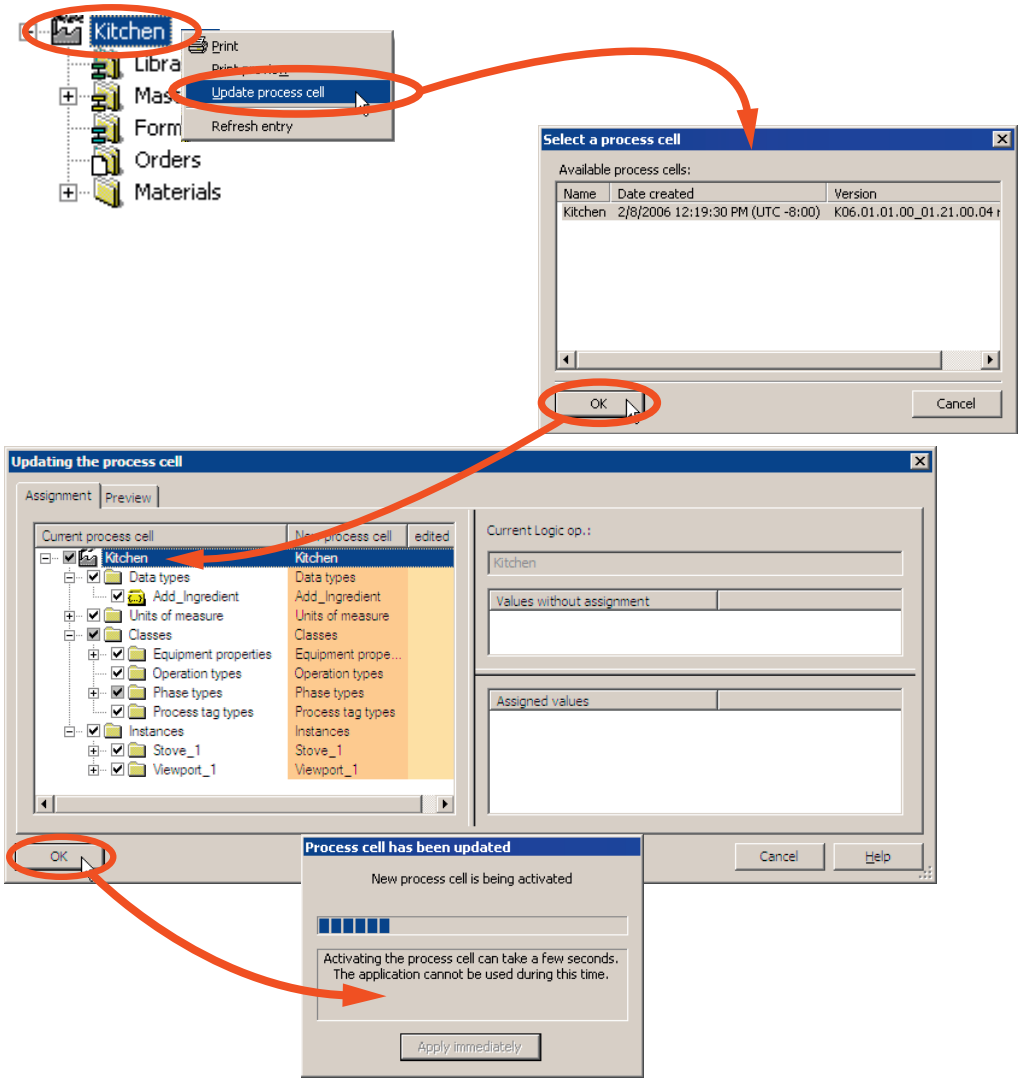
- Batch scheduling
- Batch control
- Management of all batch-relevant data
- (libraries, master recipes, formulas, materials, permission management)

2. In Batch Control Center, perform a restore using the supplied SBB file.
   You can find the SBB file under ..\Siemens\STEP7\examples\sb_gs1_b.sbb.



2.2.14 Chapter 14 Updating the Loaded Batch Process Cell Data

1. Update the Batch process cell data you loaded in the Batch Control Center.



2.2.15 Chapter 15 The Recipe for Piccata Milanese Pasta

Meal	**Piccata Milanese**	
Quantity	2.9 Kg (reference quantity)	
Ingredients	100 ml	oil
	1.9 Kg	noodles
	50 g	salt
	1 liter	tomato sauce

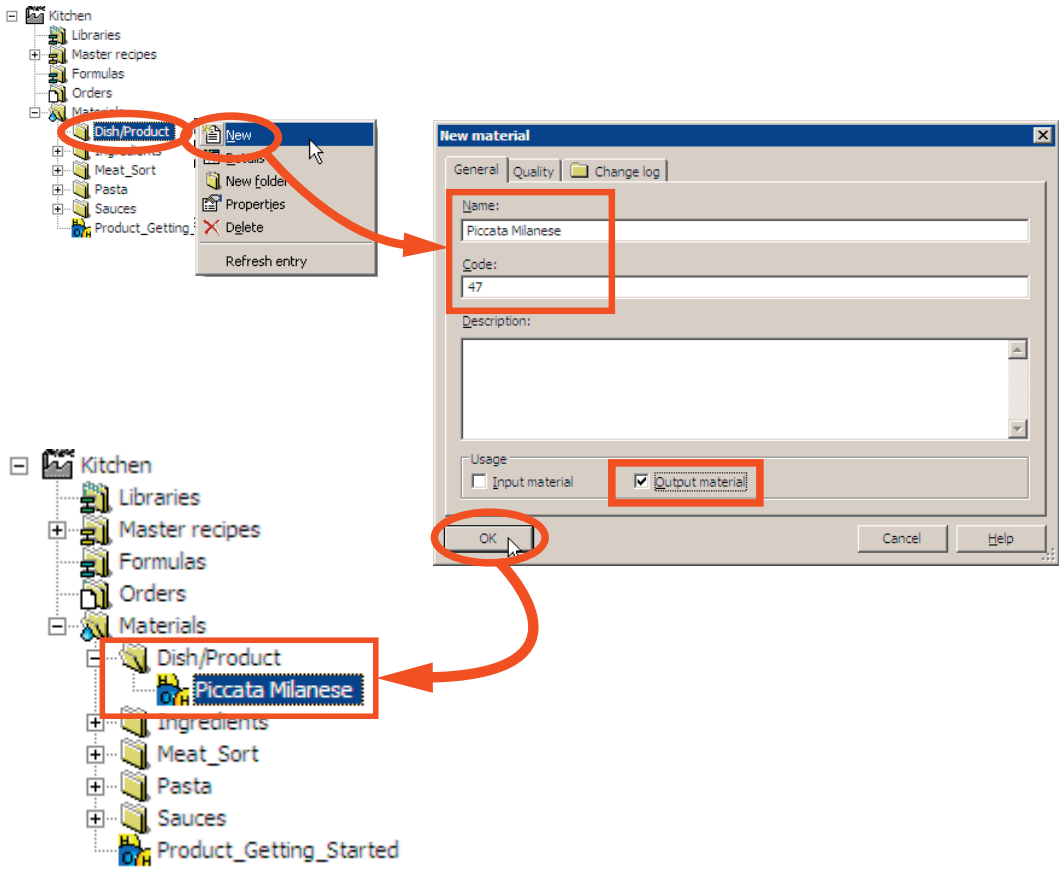
Instructions	**Editing Options and Results**
1st Prepare water	Fill a pot with 3 liters of water, add 100 ml of oil and a pinch of salt, heat to 100° C
2nd Cook pasta	Put 1.9 kg of pasta in the boiling water and cook for 6 minutes
3rd Prepare sauce (while cooking pasta)	Pour 1 liter of tomato sauce in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

2.2.16 Chapter 16 Creating an Output Material

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

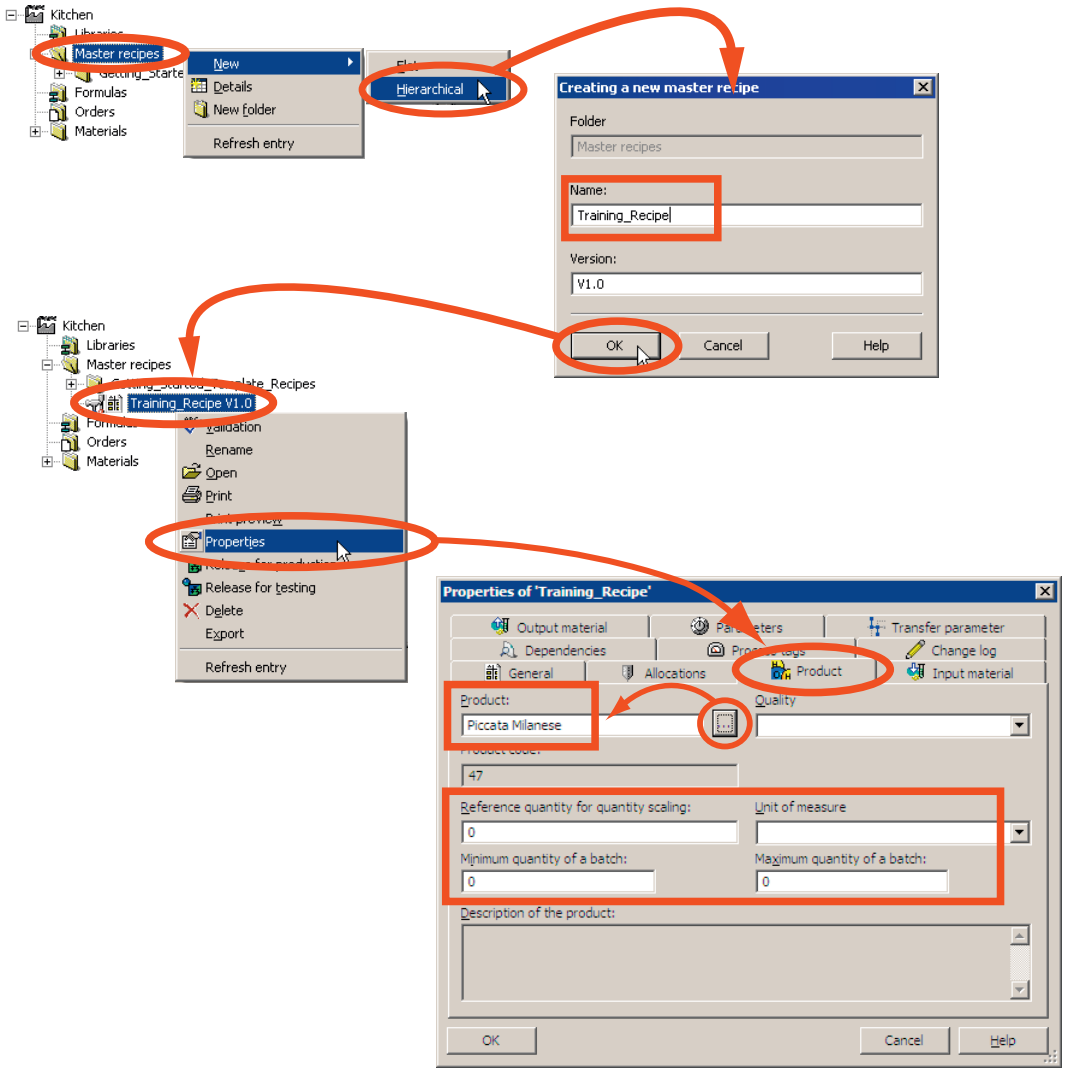
You define the materials in the list boxes displayed in the subsequent dialogs for recipe creation and batch planning. Materials and qualities must also be assigned a unique code (for example an internal company code). This code can, for example, be used to specify setpoint output and process value input 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.

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

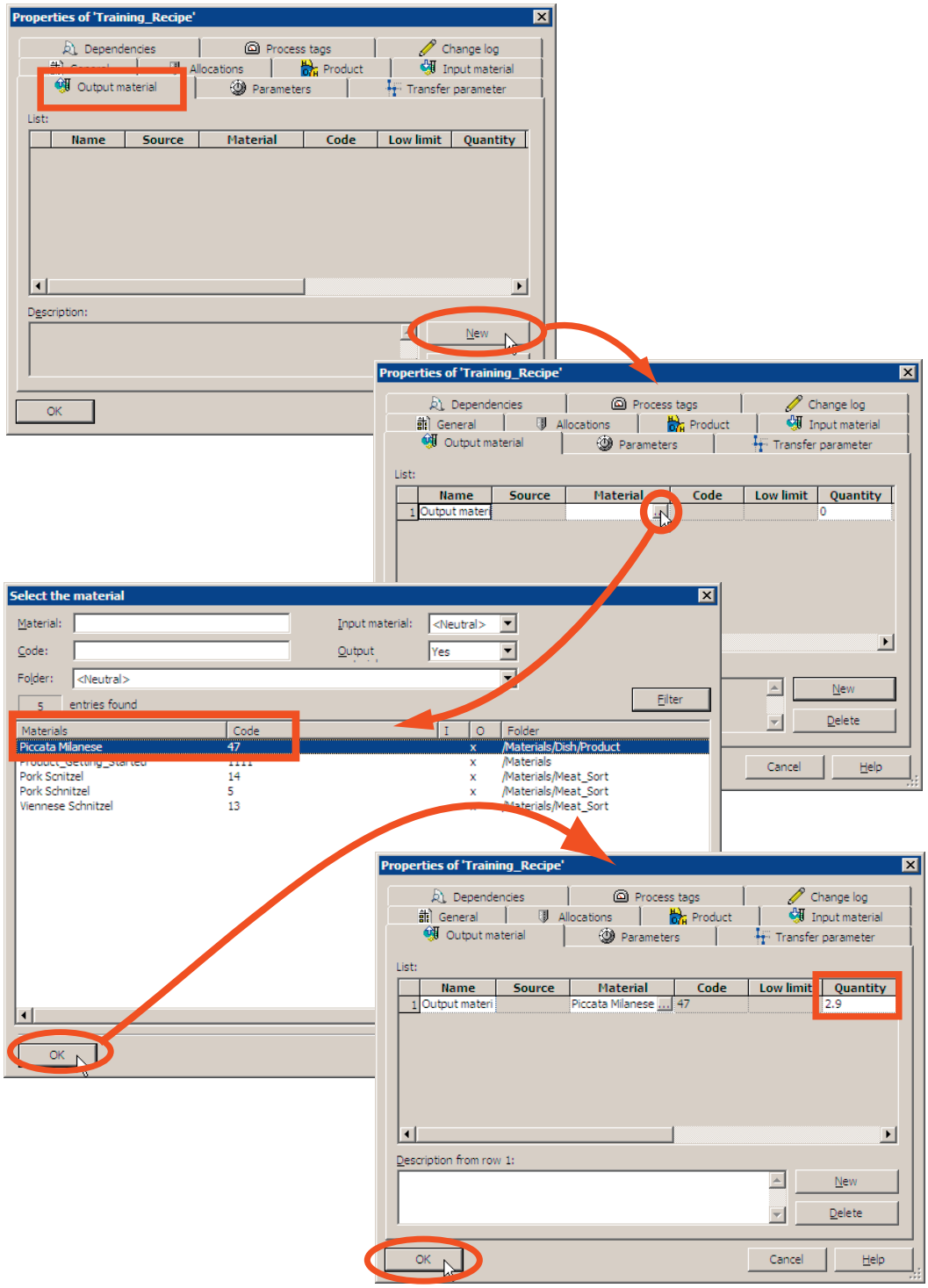


2.2.17 Chapter 17 Creating a Master Recipe in the BatchCC

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).



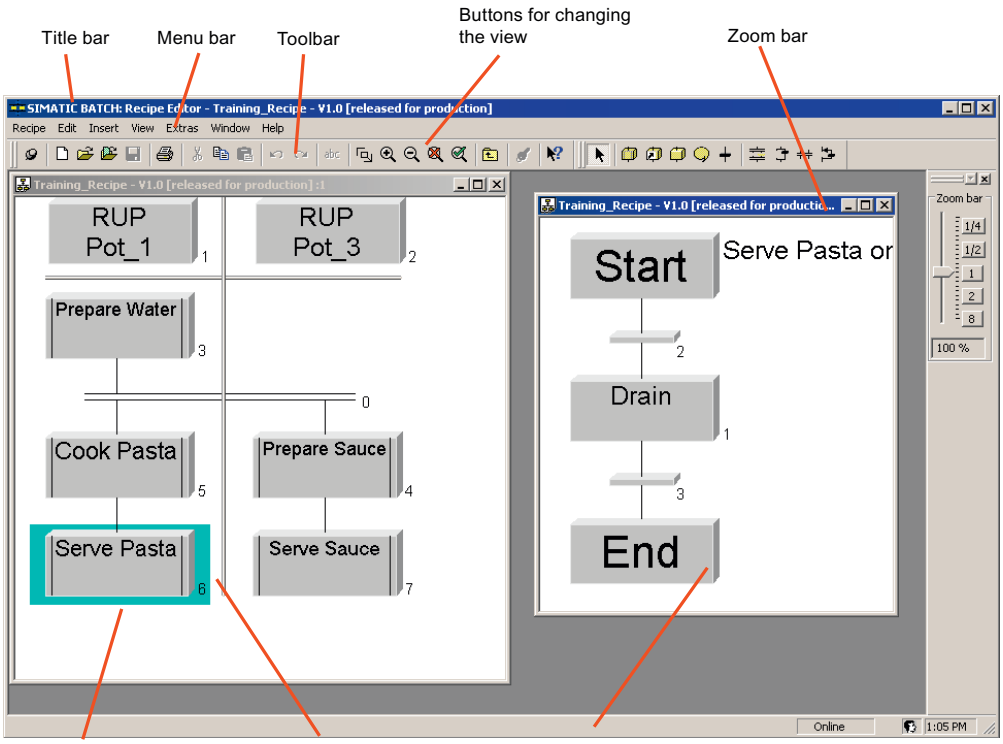
2. Define the main product (here Piccata Milanese) as output material



2.2.18 Chapter 18 Creating the Recipe Structure in 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 Representation of the Hierarchy in the BATCH Recipe Editor

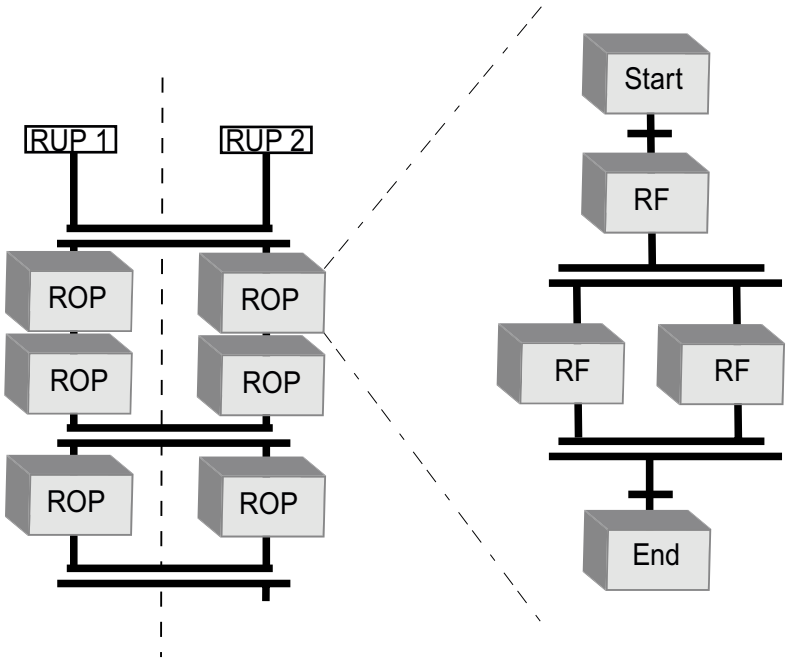
The schematic below shows the basic representation of the hierarchical structure when editing with the BATCH Recipe Editor. The structure of a hierarchical recipe is edited at two levels (editing level 1 and 2).

Editing Level 1

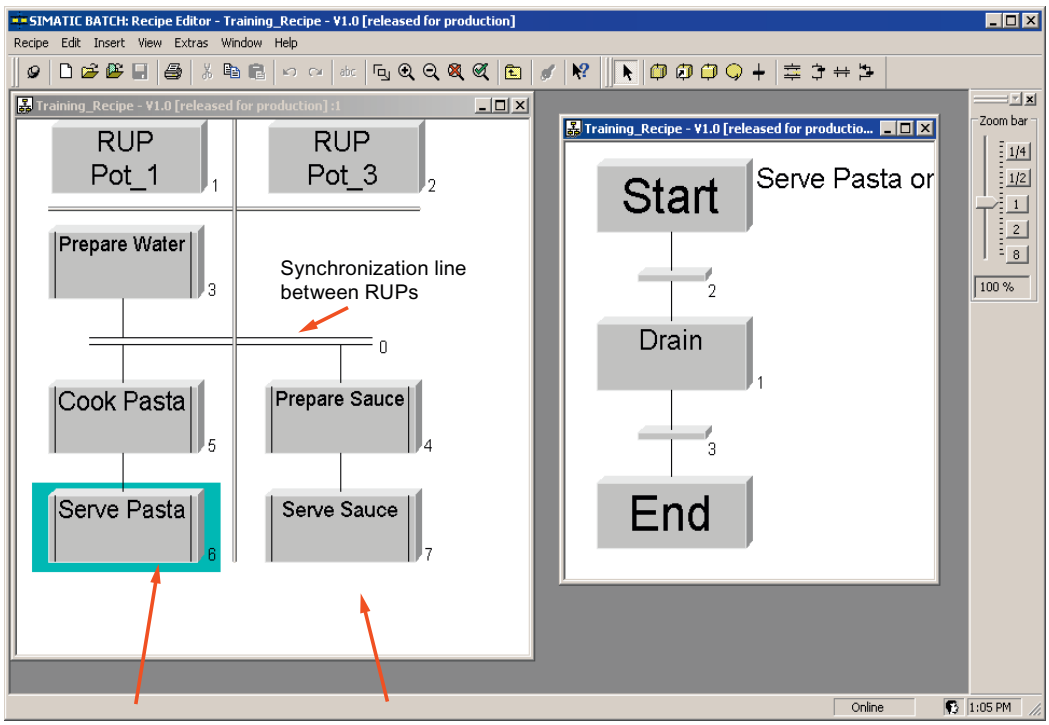
Editing level 1 is intended for the Plant view in which the processes of several cells can be synchronized. A recipe unit procedure (RUP) is made up of recipe operations (ROPs). To structure the process, you can use double lines to synchronize. This allows you to synchronize the timing of ROPs in different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

Editing Level 2

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 2) with recipe operations (ROPs)

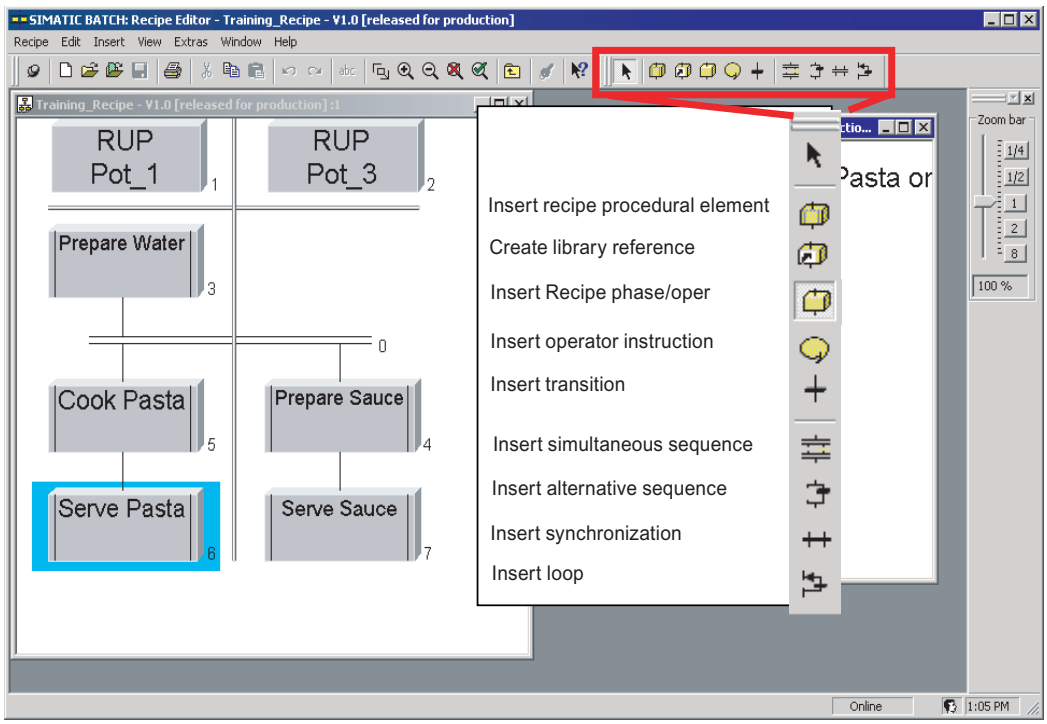
A RUP is always shown within a column, i.e. the ROPs are arranged vertically.

Editing level 1

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

Editing level 2

Tools for Creating the Recipe Structure

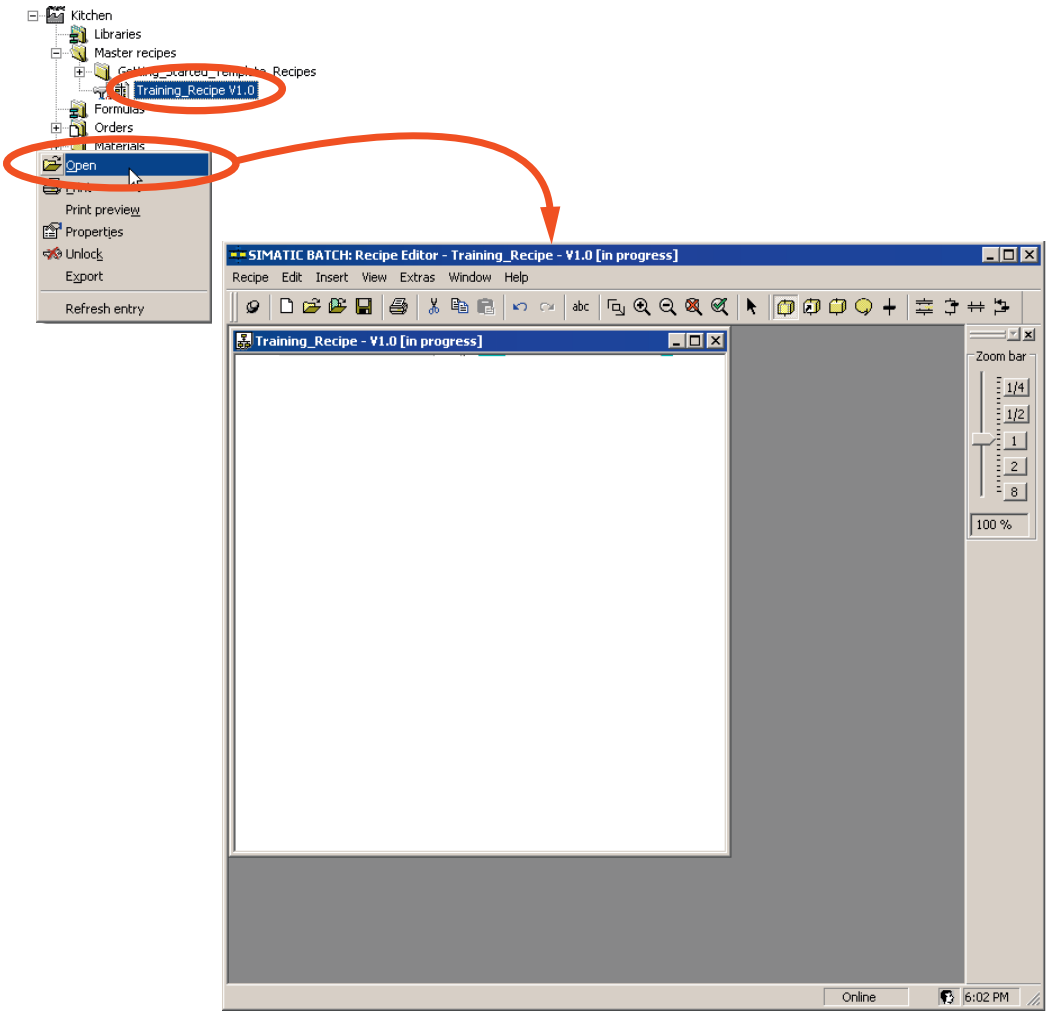


The recipe editor has tools for the simple creation of recipe structures such as:

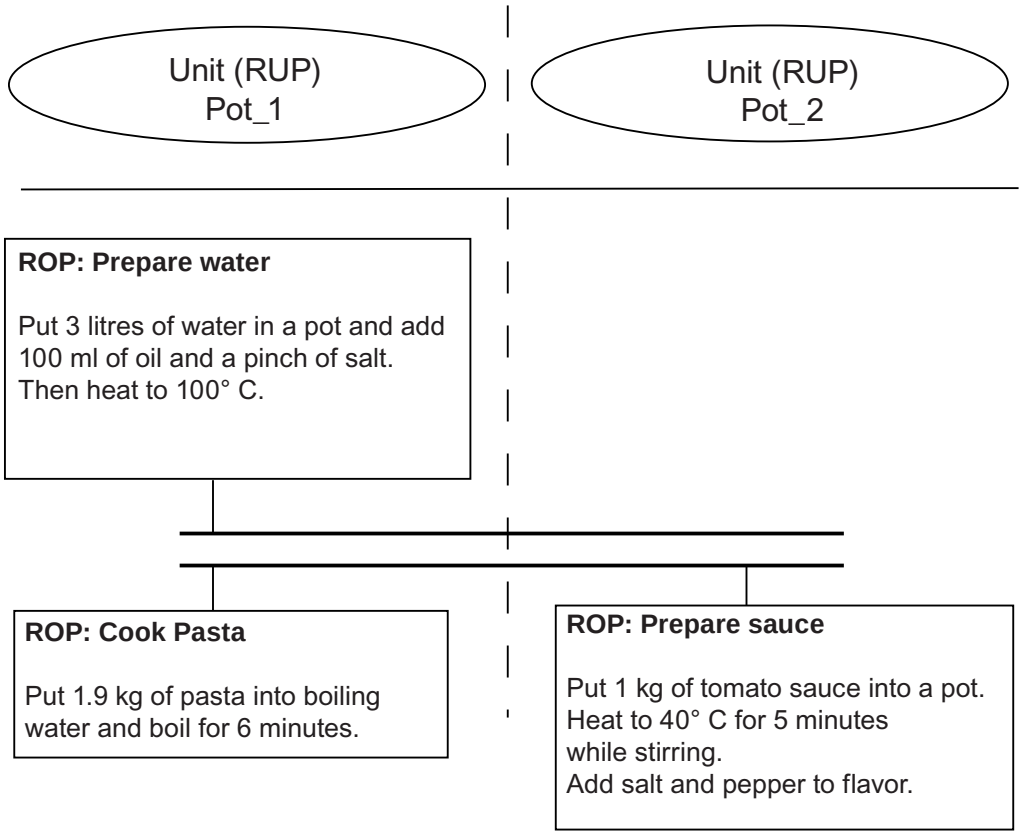
1. Inserting S88 procedure elements such as recipe unit procedures (**RUP**), recipe operations (**ROP**) and recipe phases (**RPH**)
2. Instead of a recipe operation, a referenced library operation (Lib-ROP) can also be inserted
3. Inserting **operator instructions** or **operator dialogs**
4. Inserting **transitions**
5. Inserting **simultaneous branches**
6. Inserting **alternative branches**
7. Inserting **synchronization lines**
8. Inserting **loops**

Creating the Recipe Structure in the Recipe Editor According to the Description in the Recipe

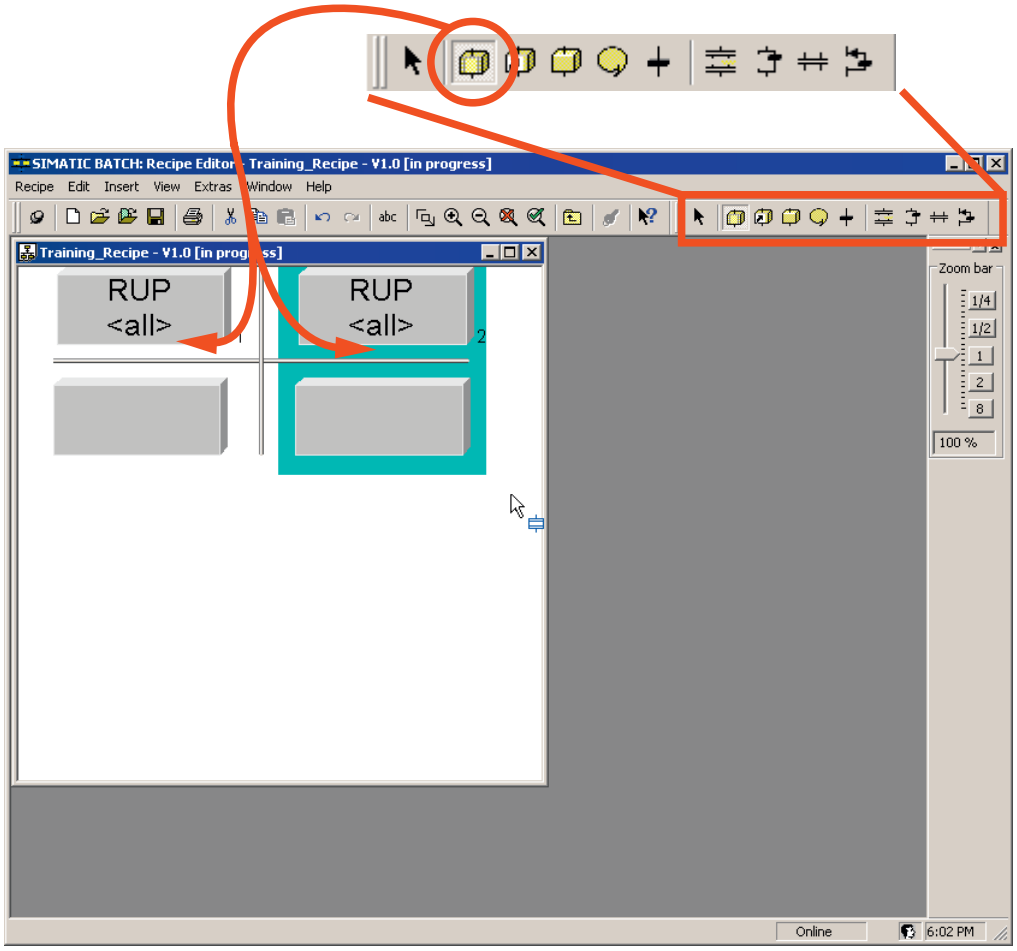
1. Open the Recipe Editor with your master recipe "Training_Recipe".



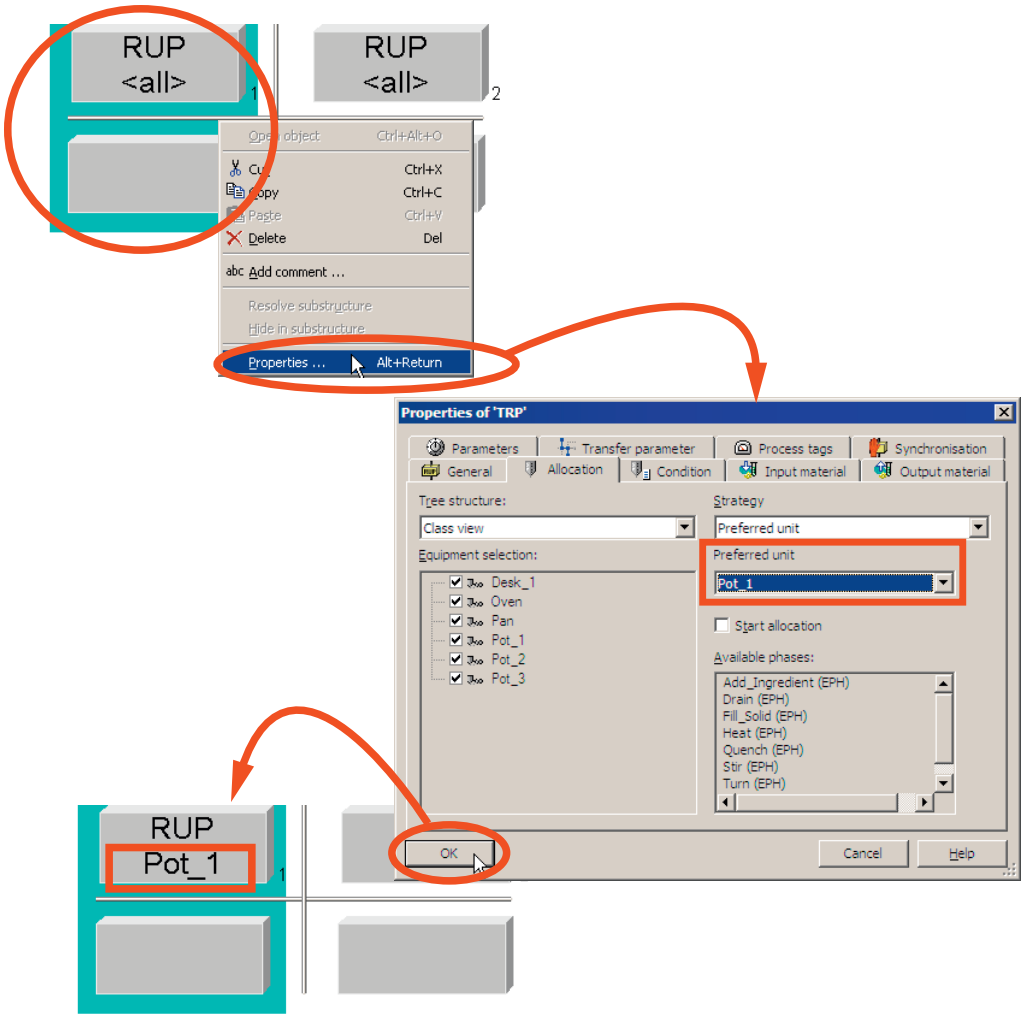
2. Using the tools and the recipe description, create the dish "Piccata Milanese". Use the diagram and the steps described in the following as help.



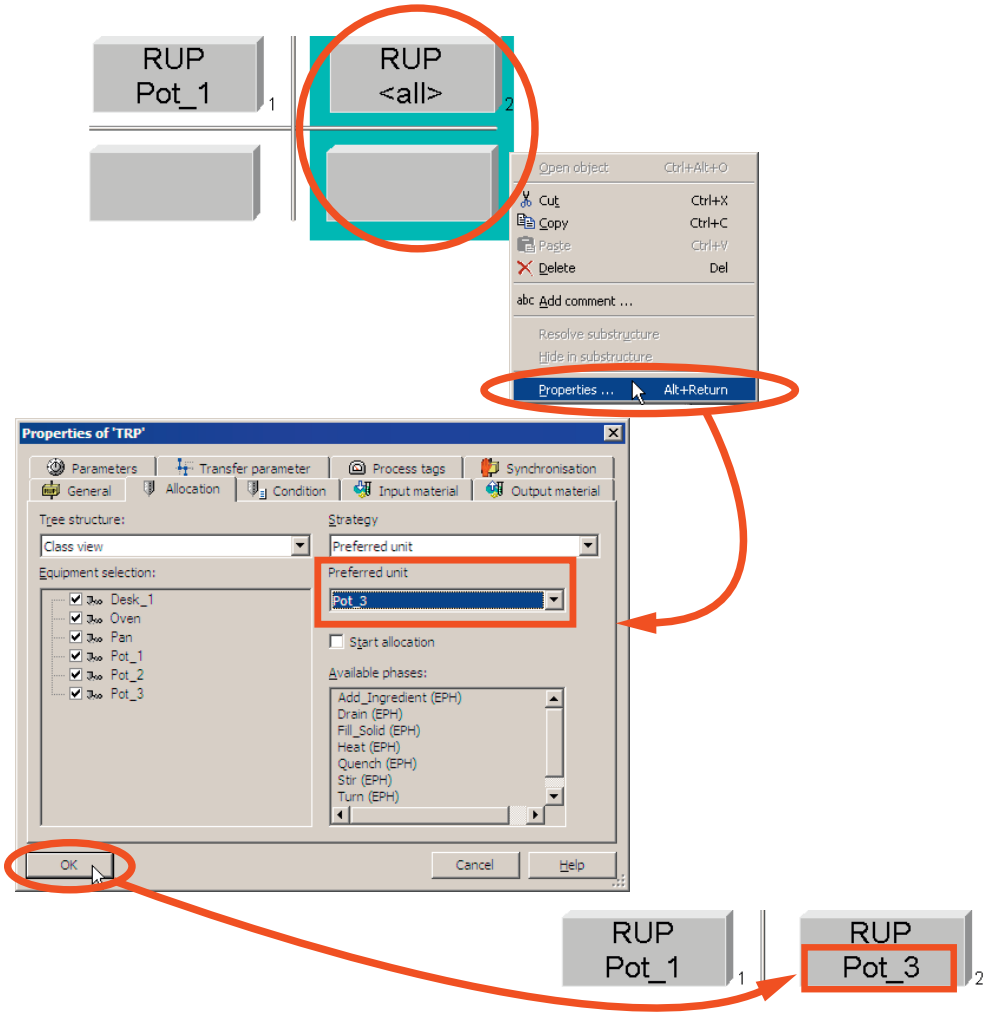
3. Create two RUPs (recipe unit procedures).



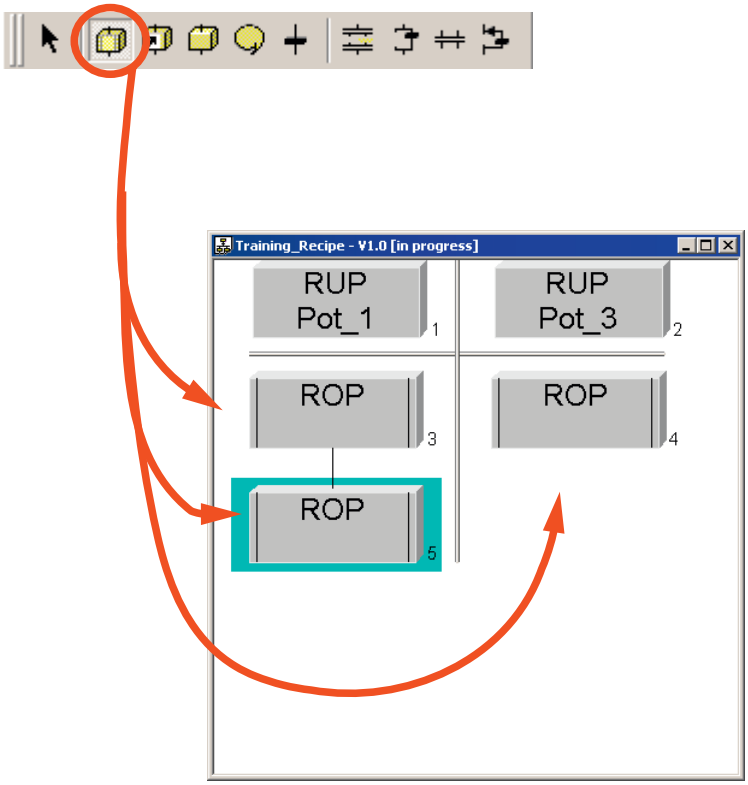
4. Assign the "Pot_1" unit and the "Preferred unit" strategy to the left RUP.



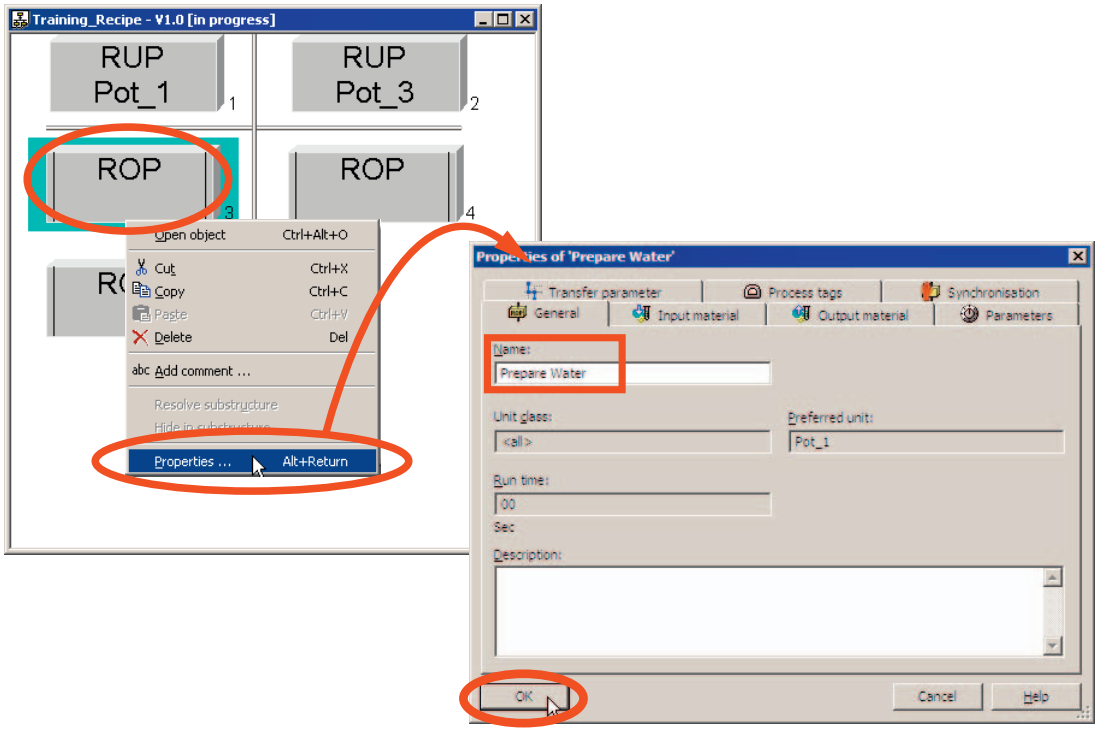
5. Assign the "Pot_3" unit and the "Preferred unit" strategy to the right RUP.

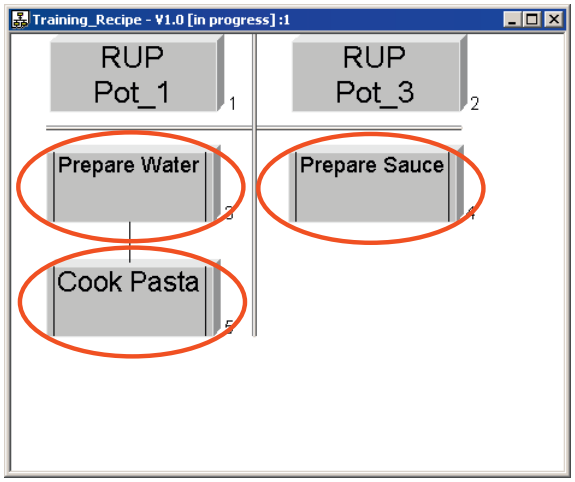


6. Insert the relevant ROPs (recipe operations).

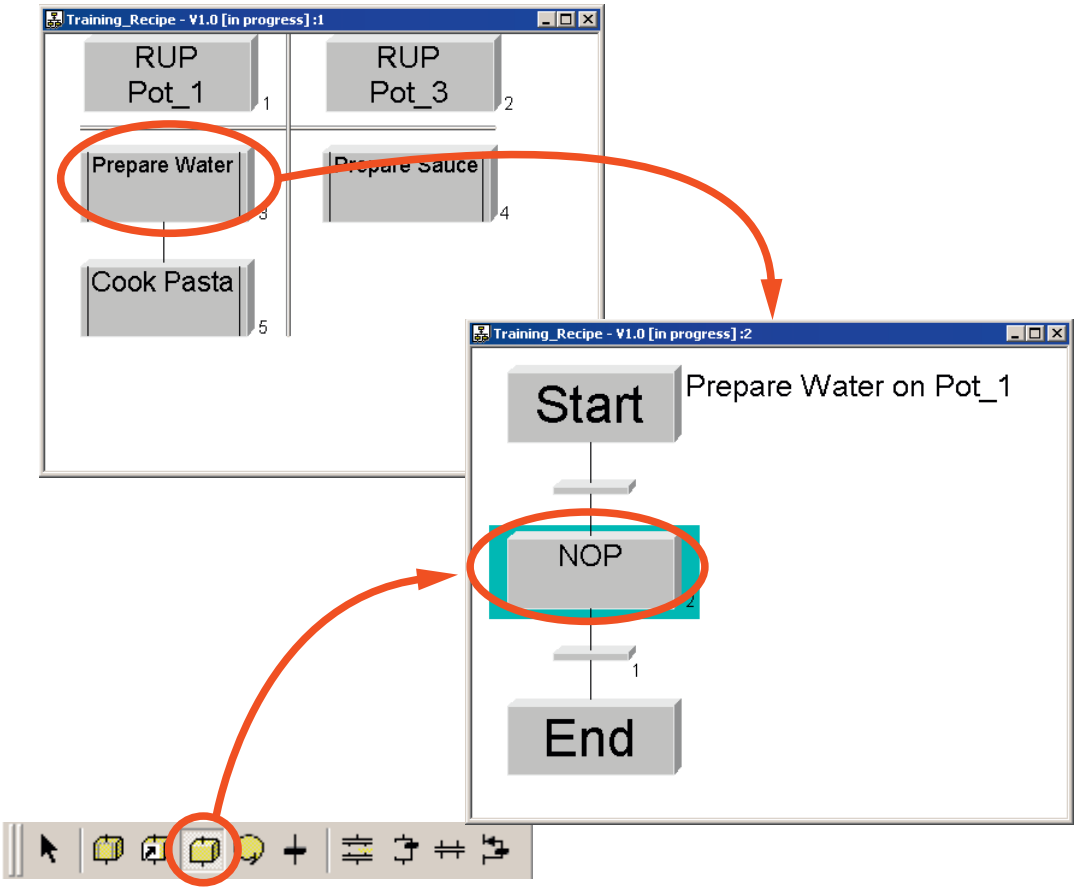


7. Assign the texts "Prepare Water", "Cook Pasta" and "Prepare Sauce" to the ROPs (recipe operations).

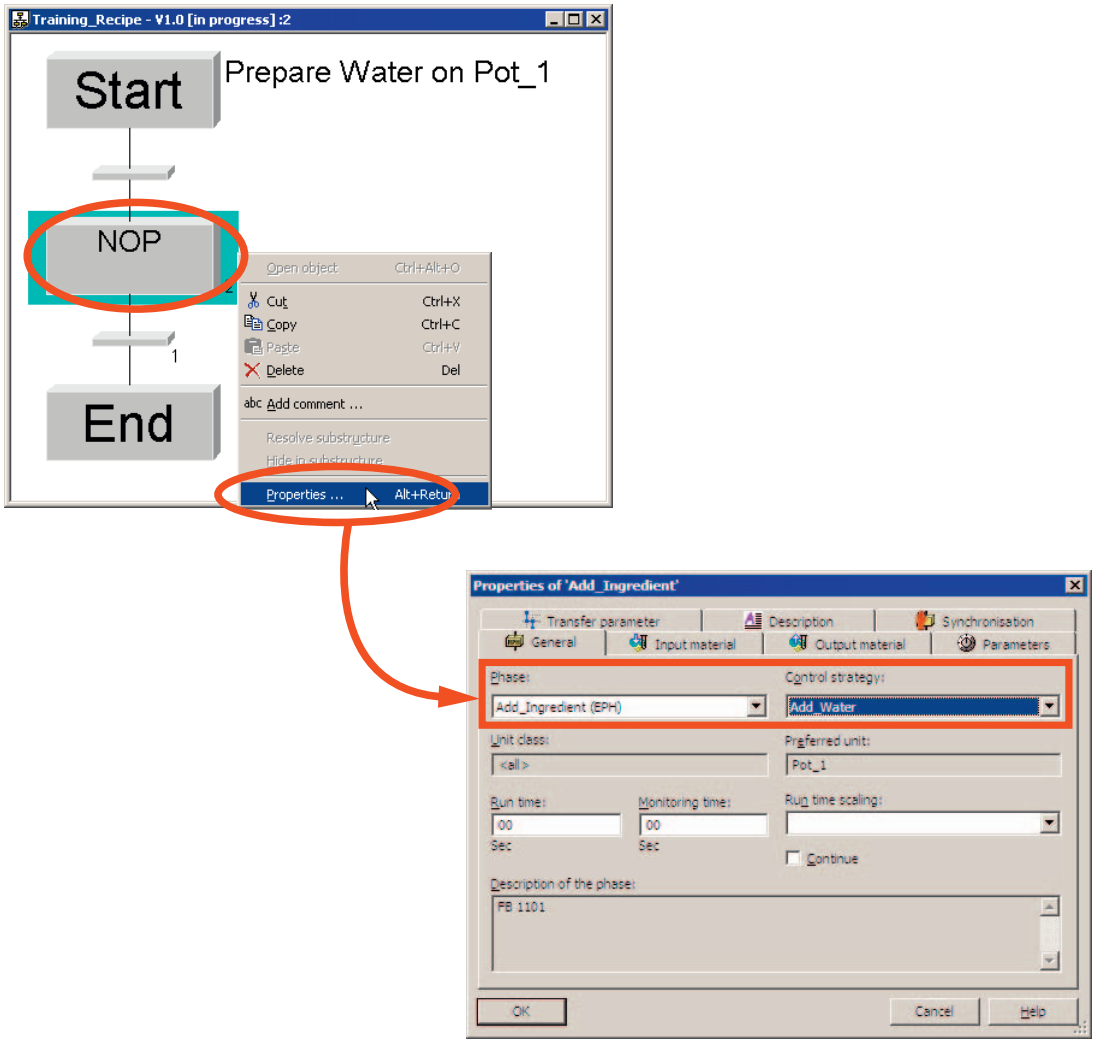




8. Double-click on the "Prepare Water" ROP to insert a recipe phase.

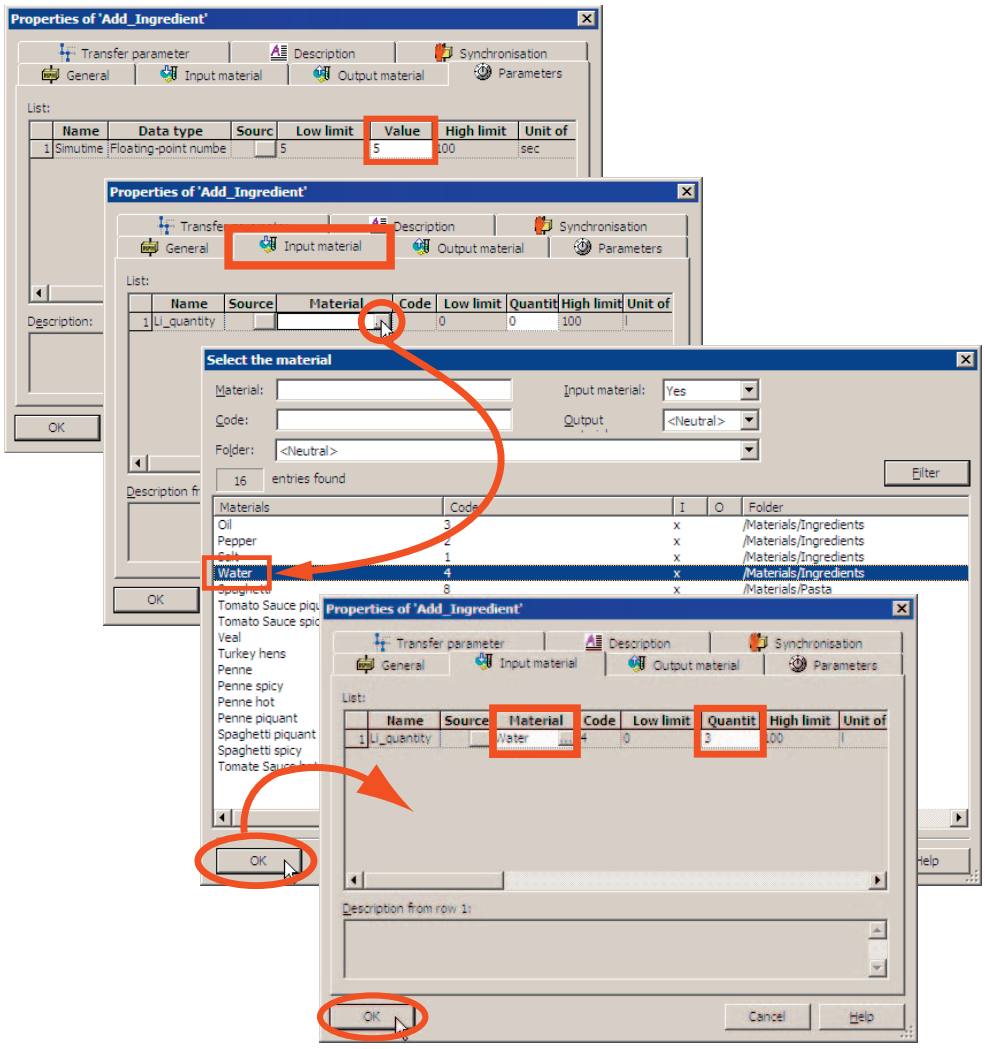


9. Assign the "Add_Ingredient" phase and the "Add_Water" control strategy to recipe phase.

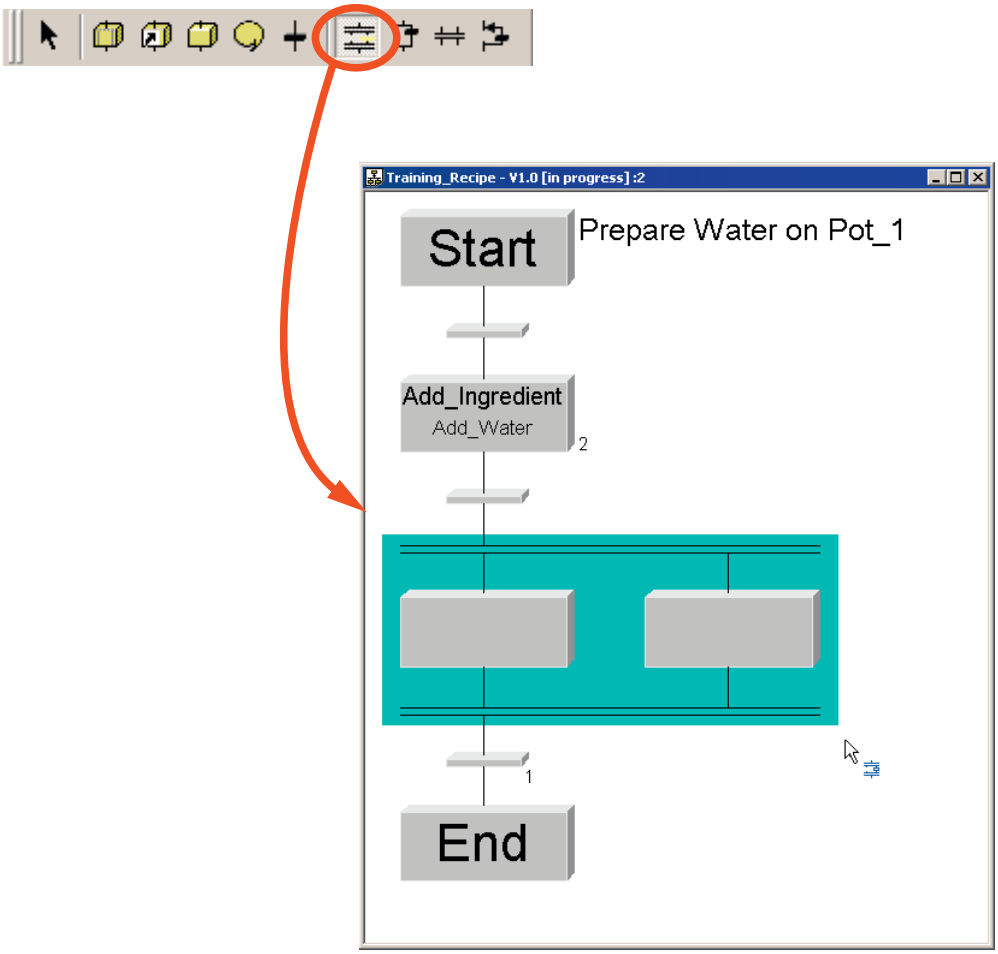


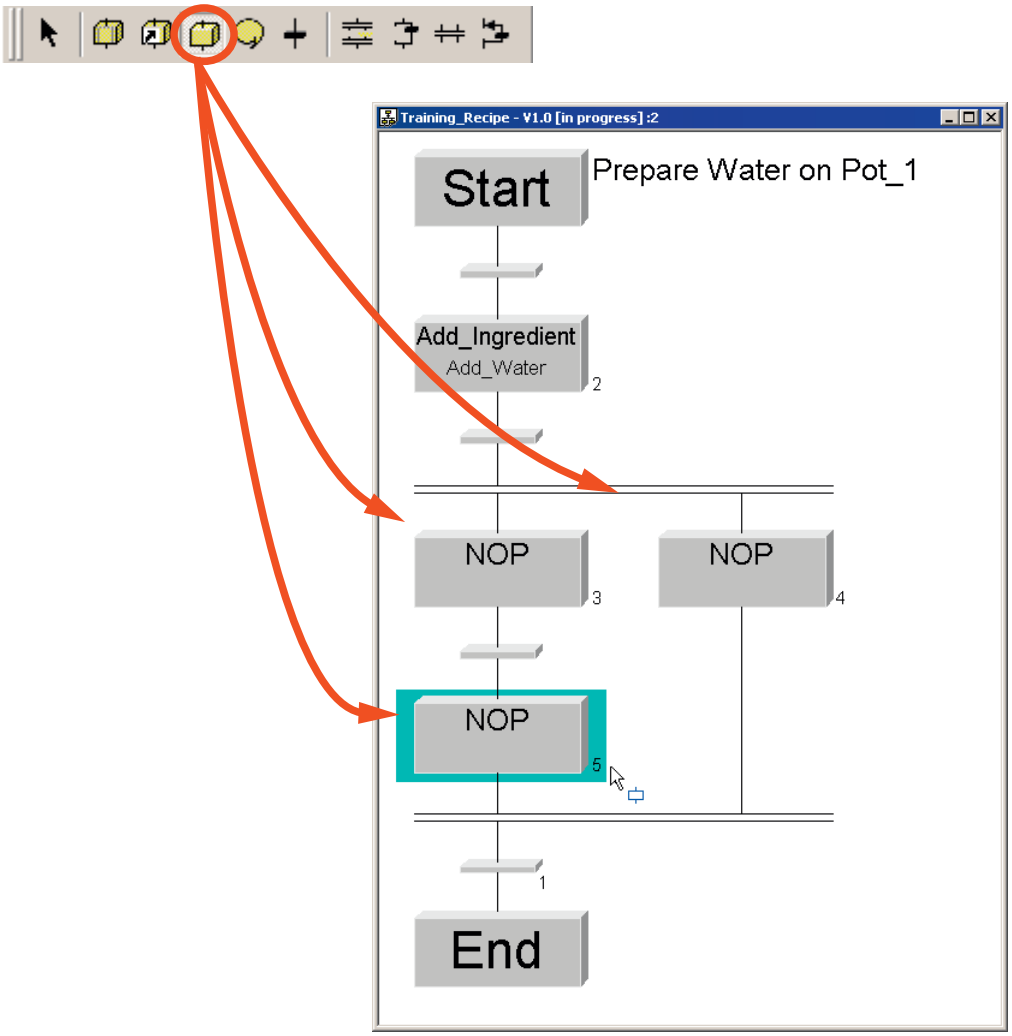
10. Define the input materials and parameters of the "Add_Ingredient" phase. The input material "Li_quantity" must be assigned the material (Water) and the amount to be filled, here 3 l.

    Note: Here, and in all the phases, the "Simutime" parameter is used for simulation. In a real plant, the runtime may change due external events.



11. Insert a simultaneous branch and 3 NOPs.

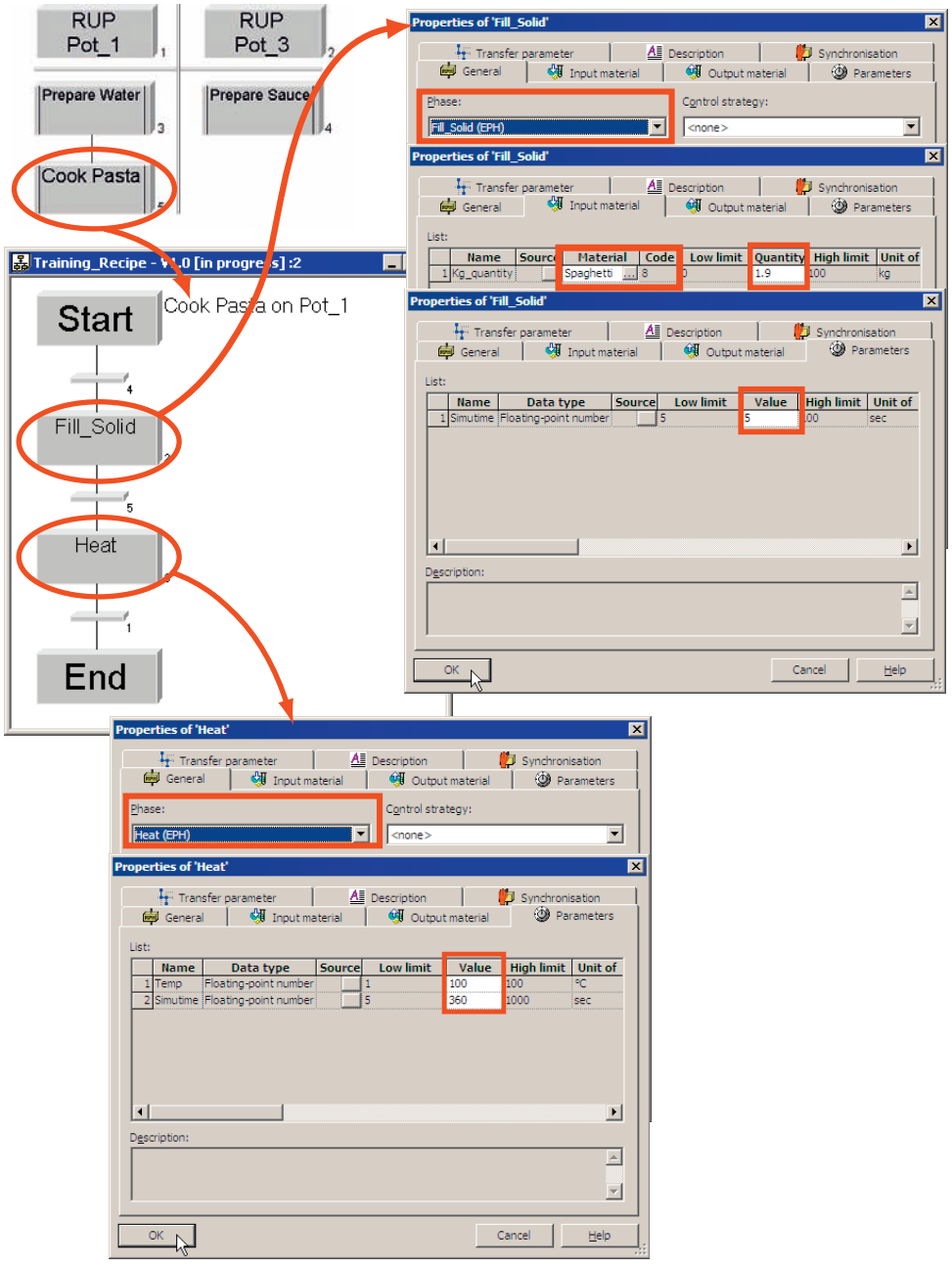




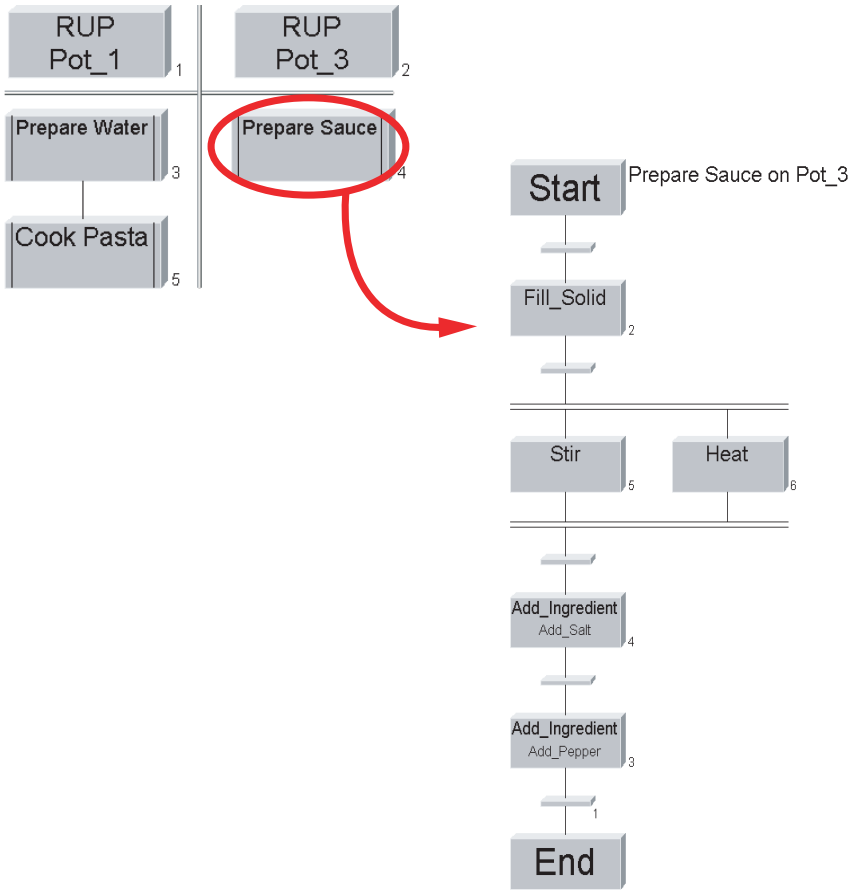
12. Add the "Add_Ingredient" recipe phase with the "Add_Oil" control strategy and assign the "Oil" material to the "Li_quantity" input material and a quantity of "0.1 l". For the simulation time, specify a value of "5" sec.
13. Add the "Heat" recipe phase and assign the value "100° C" to the "Temp" parameter. Set the runtime to the value "300 sec".

14. Within the simultaneous branch, and a further "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. For the simulation time, specify a value of "5" sec.

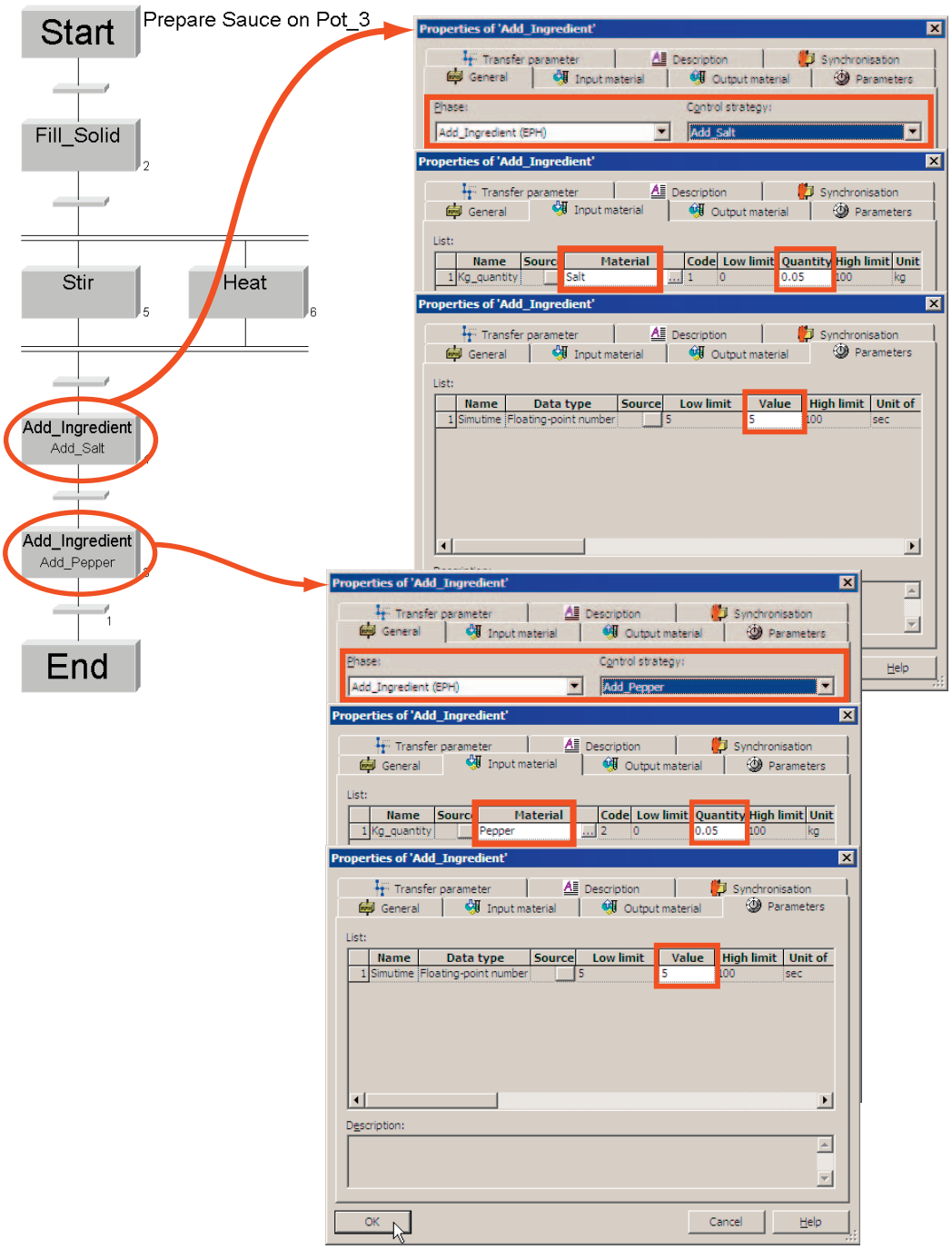
15. Complete the "Prepare Pasta" ROP according to the recipe description for "Piccata Milanese".



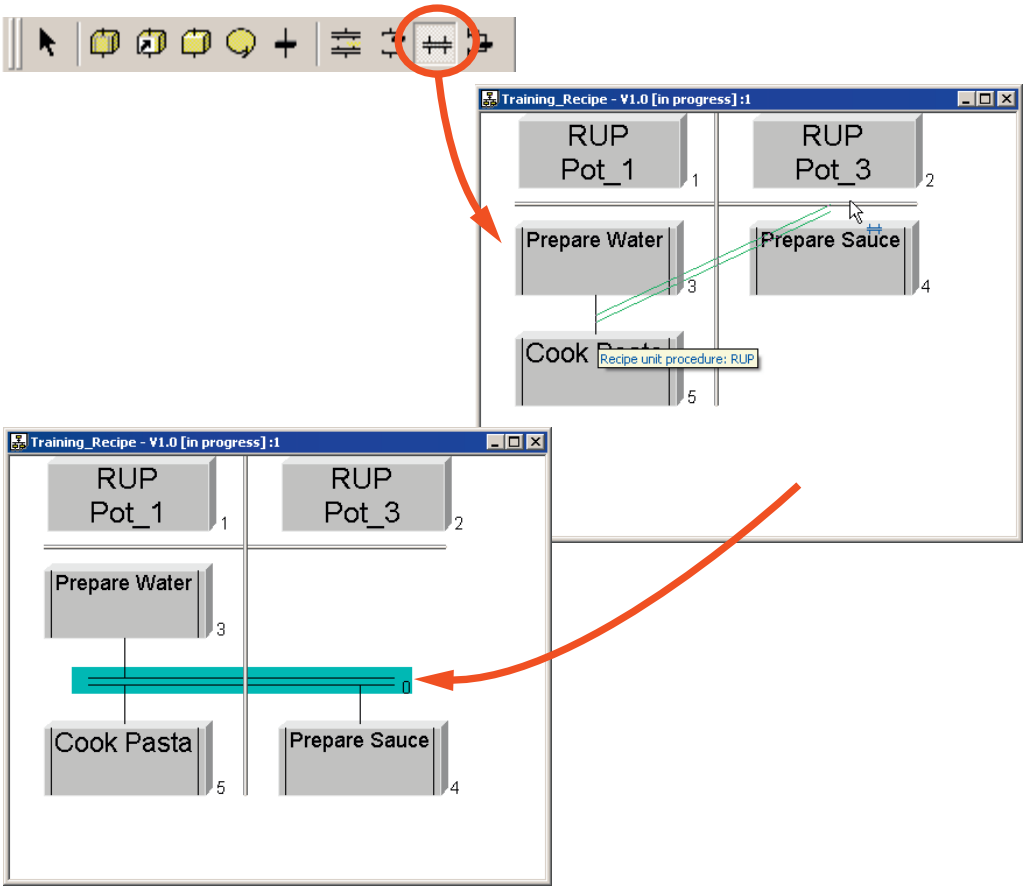
16. Complete the "Prepare Sauce" ROP according to the recipe description for "Piccata Milanese".



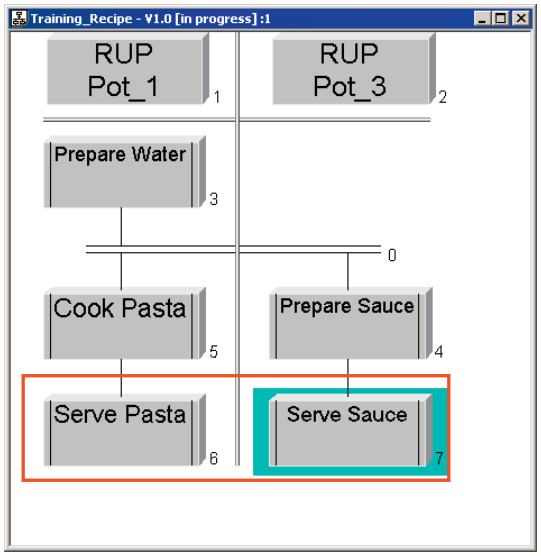

Start
Prepare Sauce on Pot_3
Fill_Solid
Stir
Heat
Add_Ingredient
Add_Salt
Add_Ingredient
Add_Pepper
End
Properties of 'Fill_Solid'
Transfer parameter
Description
Synchronisation
General
Input material
Output material
Parameters
Phase:
Fill_Solid (EPH)
Control strategy:
<none>
List:
Name
Material
Quantity
Low limit
High limit
Unit
Kg_quantity
Tomato Sauce spicy
Data type
Source
Value
Floating-point number
Simutime
Description:
OK
Cancel
Help
Properties of 'Stir'
Stir (EPH)
rev
Direction
Boolean
False
1/min
sec
Properties of 'Heat'
Heat (EPH)
Temp
°C

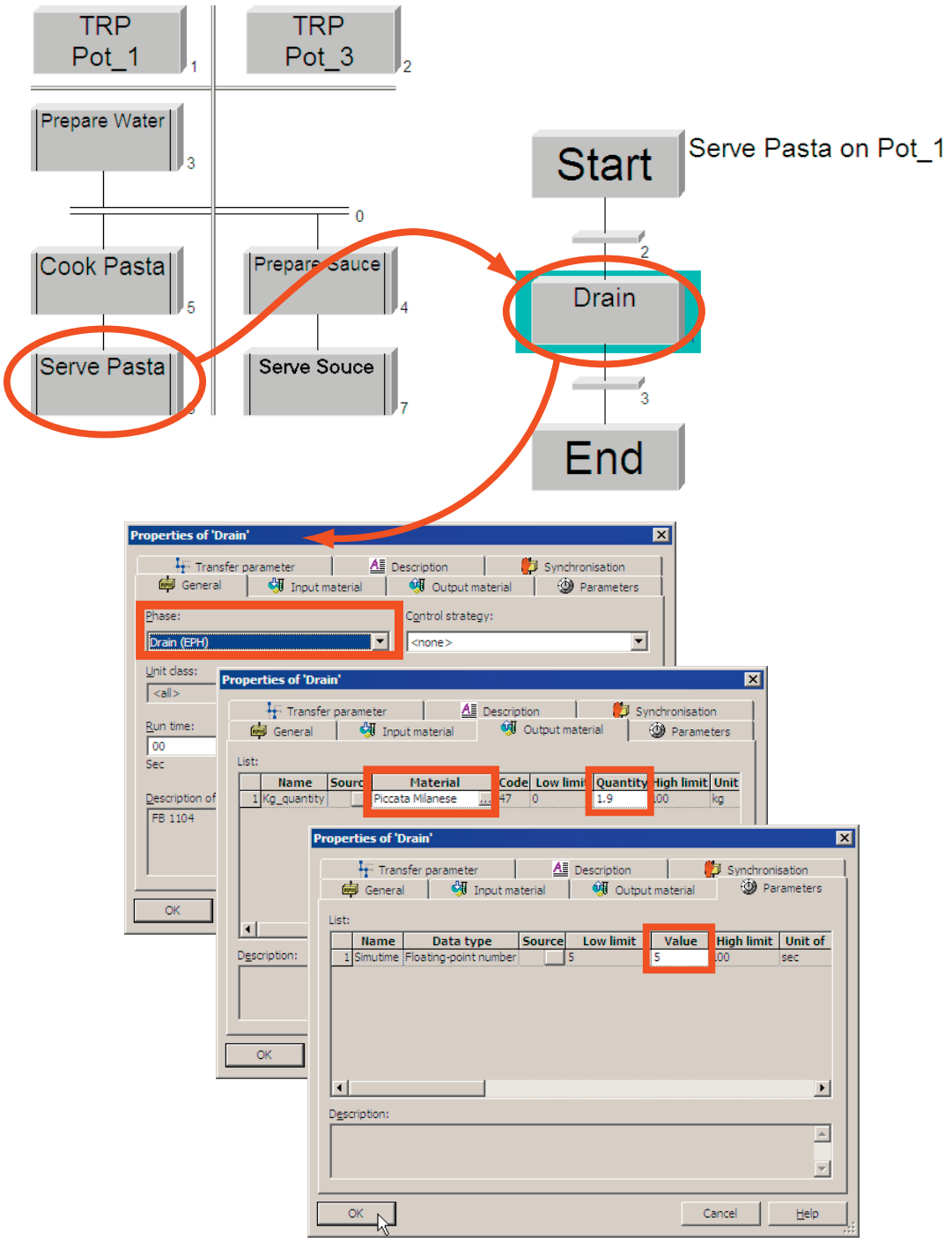

Start
Prepare Sauce on Pot_3
Fill_Solid
2
Stir
5
Heat
6
Add_Ingredient
Add_Salt
Add_Ingredient
Add_Pepper
End
Properties of 'Add_Ingredient'
Transfer parameter
Description
Synchronisation
General
Input material
Output material
Parameters
Phase:
Control strategy:
Add_Ingredient (EPH)
Add_Salt
List:
Name
Material
Code
Low limit
Quantity
High limit
Unit
Kg_quantity
Salt
0.05
100
kg
Data type
Source
Value
Unit of
Simutime
Floating-point number
sec
Add_Pepper
Pepper
Description:
OK
Cancel
Help

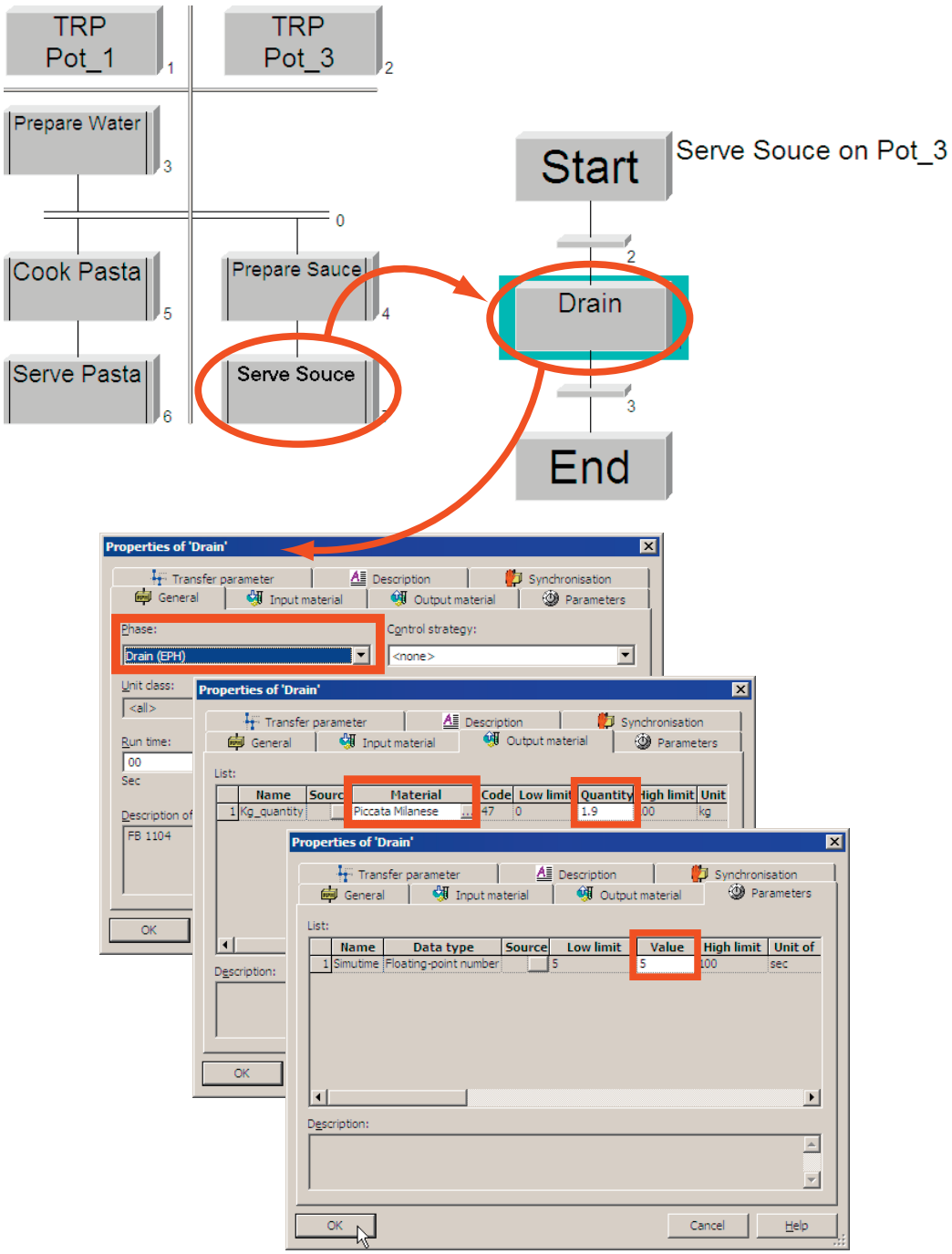
17. Insert a synchronization line by pressing the left mouse button and drawing a line between the left and right columns.



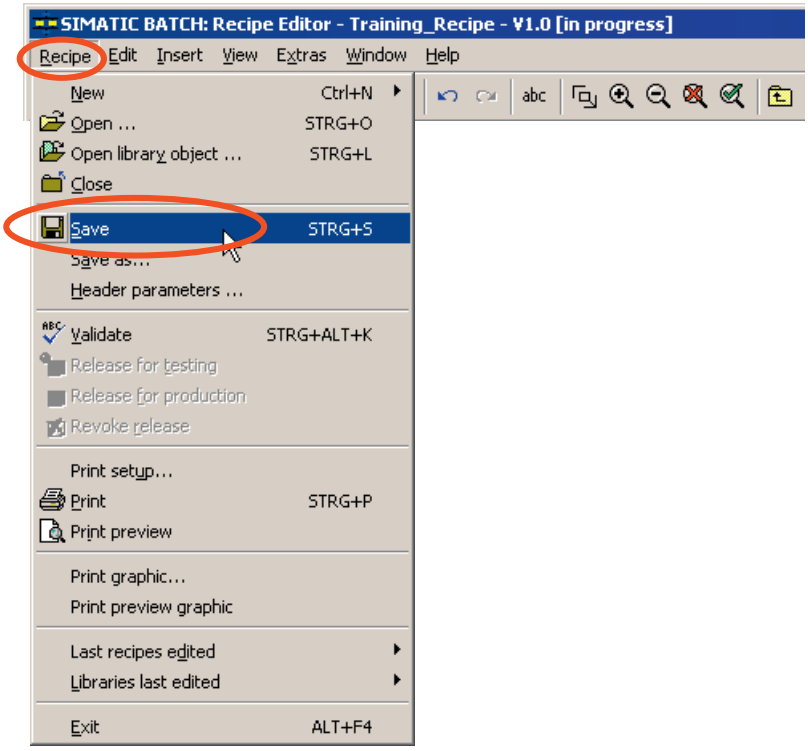
18. Add the "Serve Pasta" and "Serve Sauce" ROPs (recipe operations) and complete them according to the recipe description for "Piccata Milanese".



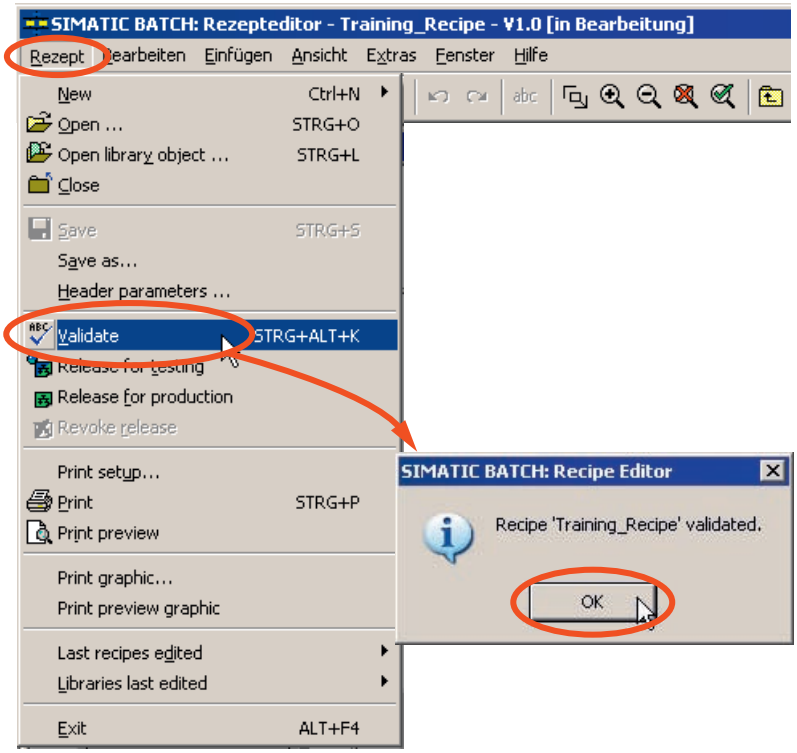

TRP Pot_1
1
TRP Pot_3
2
Prepare Water
3
0
Cook Pasta
5
Prepare Sauce
4
Serve Pasta
Serve Souce
7
Start
Serve Pasta on Pot_1
2
Drain
3
End
Properties of 'Drain'
Transfer parameter
Description
Synchronisation
General
Input material
Output material
Parameters
Phase:
Drain (EPH)
Control strategy:
<none>
Unit class:
<all>
Run time:
00
Sec
Description of
FB 1104
OK
Properties of 'Drain'
Transfer parameter
Description
Synchronisation
General
Input material
Output material
Parameters
List:
Name
Material
Code
Low limit
Quantity
High limit
Unit
1
Kg_quantity
Piccata Milanese
47
0
1.9
100
kg
Properties of 'Drain'
Transfer parameter
Description
Synchronisation
General
Input material
Output material
Parameters
List:
Name
Data type
Source
Low limit
Value
High limit
Unit of
1
Simutime
Floating-point number
5
5
100
sec
Description:
OK
Cancel
Help


TRP Pot_1
1
TRP Pot_3
2
Prepare Water
3
0
Cook Pasta
5
Prepare Sauce
4
Serve Pasta
6
Serve Souce
Start
Serve Souce on Pot_3
2
Drain
3
End
Properties of 'Drain'
Transfer parameter
Description
Synchronisation
General
Input material
Output material
Parameters
Phase:
Drain (EPH)
Control strategy:
<none>
Unit class:
<all>
Run time:
00
Sec
Description of
FB 1104
OK
Properties of 'Drain'
List:
Name
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
100
sec
Description:
OK
Cancel
Help

19. Save the master recipe you have created.



20. Validate the recipe.

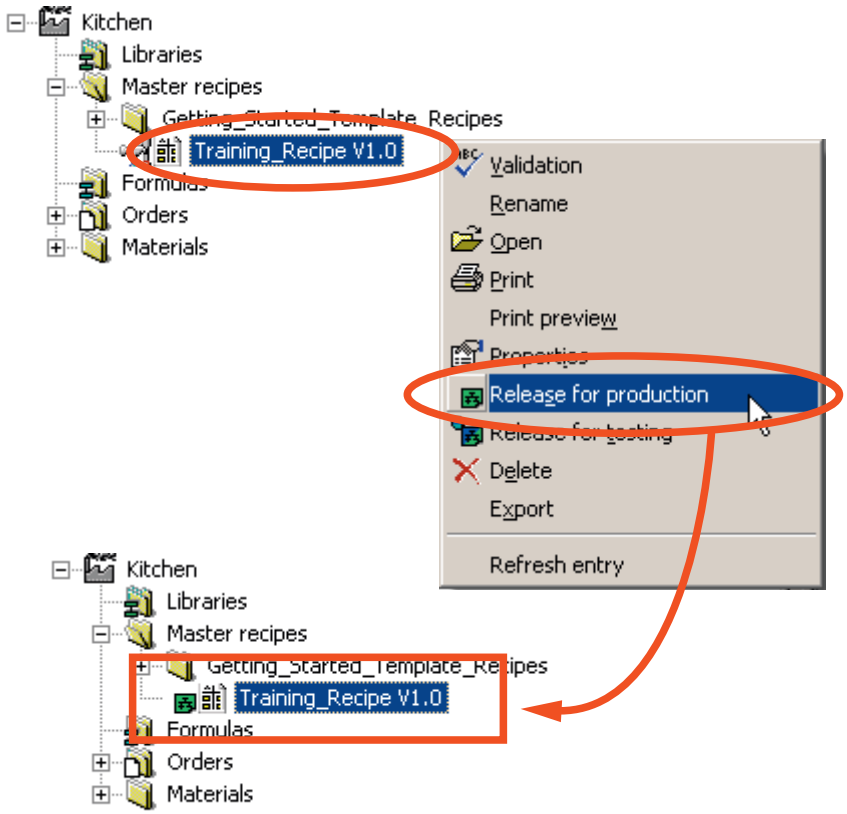


21. Close the Recipe Editor.

2.2.19 Chapter 19 Releasing the Master Recipe for Production

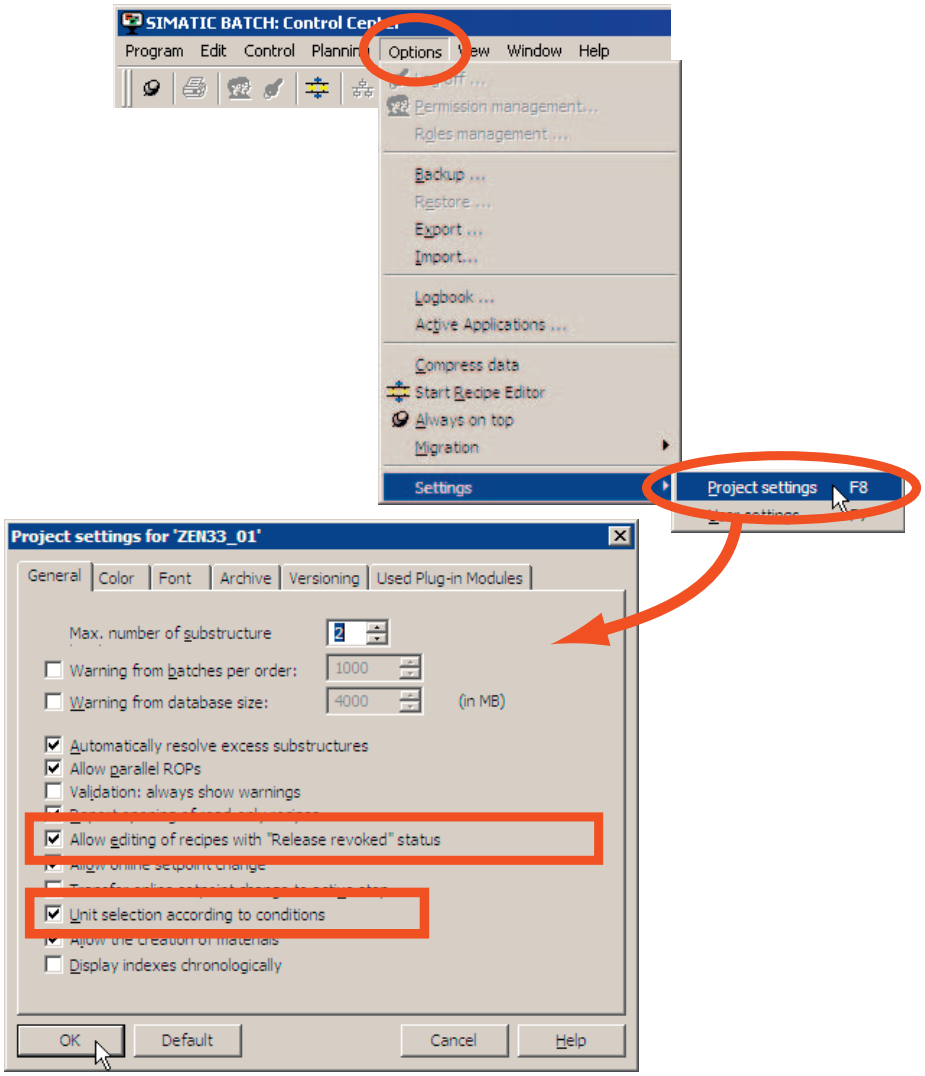
Before you can use your master recipe "Training_Recipe V1.0" to create a batch, the recipe must be released for production or testing.

1. Release your recipe for production.



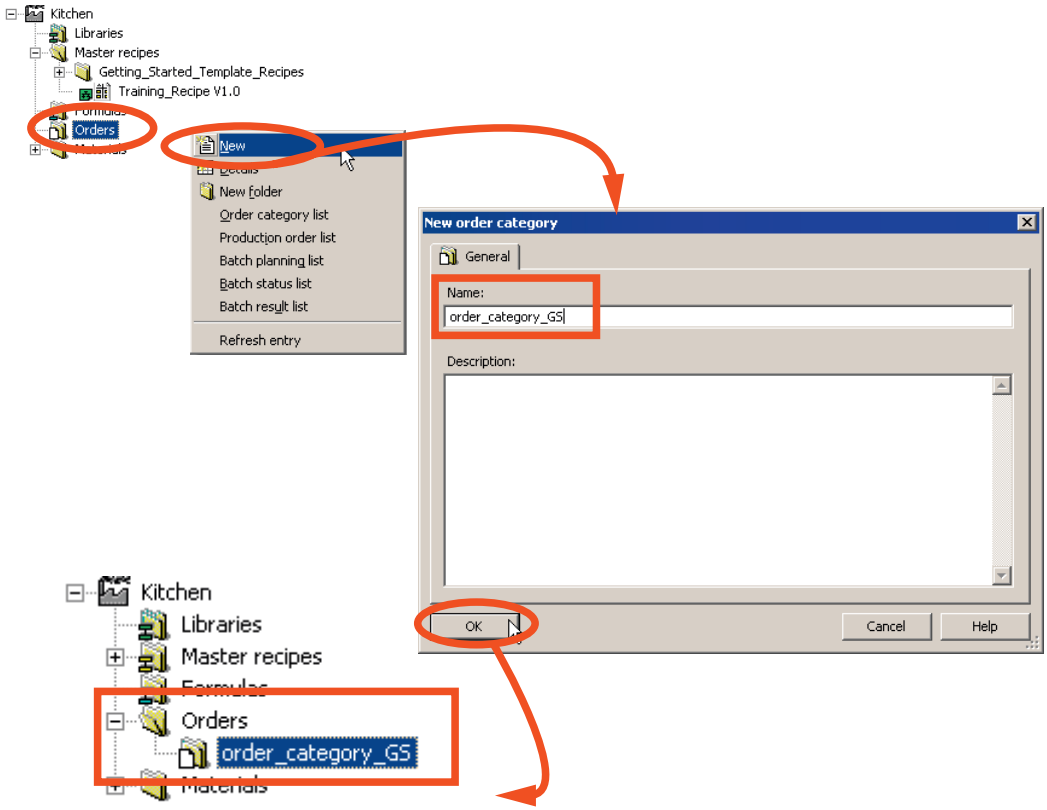
Note:

To be able to edit recipes that have already been released, the release has to be revoked. To do this, open the properties dialog in the BATCH Control Center with the menu command **Options > Settings > Project Settings**, activate the check box "Allow editing of recipes with 'Release revoked' status" and ensure that the "Unit selection according to conditions" check box is activated.

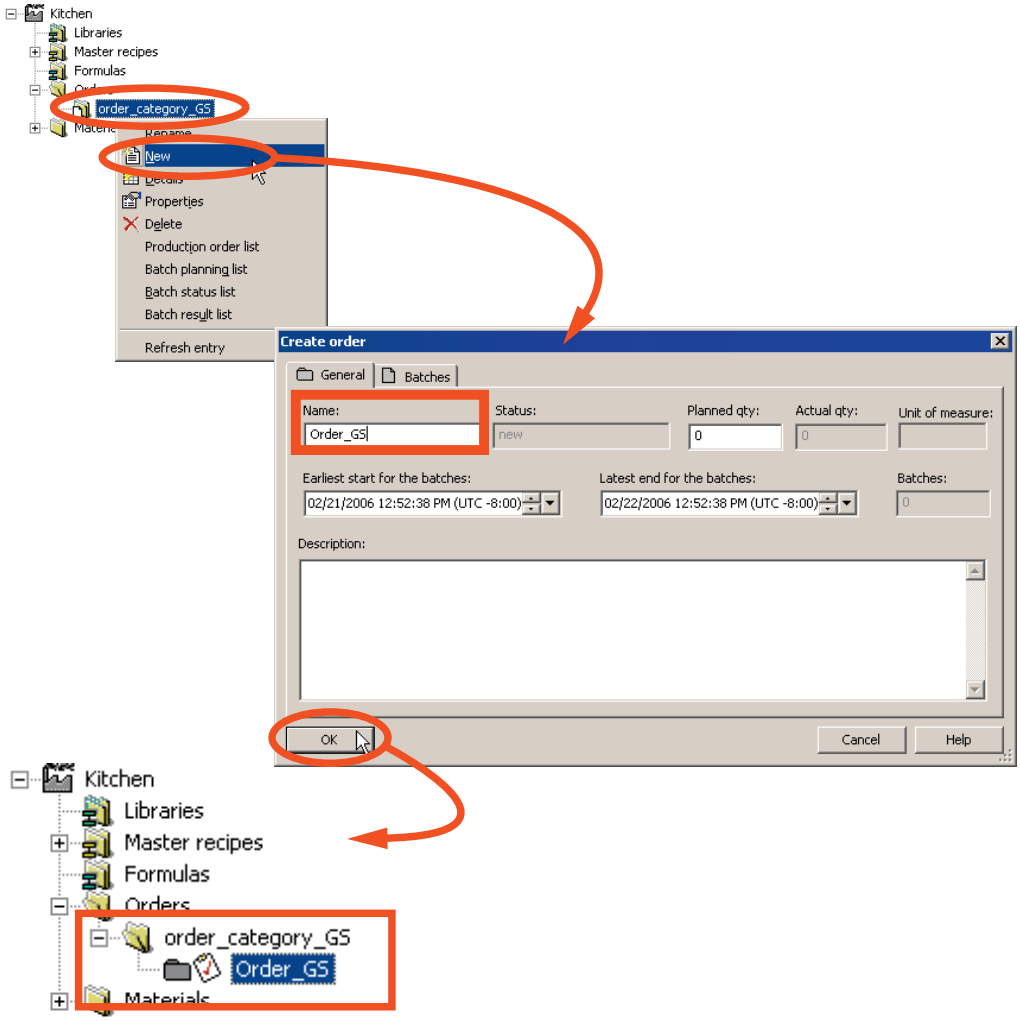

SIMATIC BATCH: Control Cen
Program Edit Control Planning Options View Window Help
Permission management...
Roles management...
Backup ...
Restore ...
Export ...
Import...
Logbook ...
Active Applications ...
Compress data
Start Recipe Editor
Always on top
Migration
Settings
Project settings F8
Project settings for 'ZEN33_01'
General Color Font Archive Versioning Used Plug-in Modules
Max. number of substructure 2
Warning from batches per order: 1000
Warning from database size: 4000 (in MB)
Automatically resolve excess substructures
Allow parallel ROPs
Validation: always show warnings
Allow editing of recipes with "Release revoked" status
Unit selection according to conditions
Display indexes chronologically
OK Default Cancel Help

2.2.20 Chapter 20 Creating an Order (Batch)

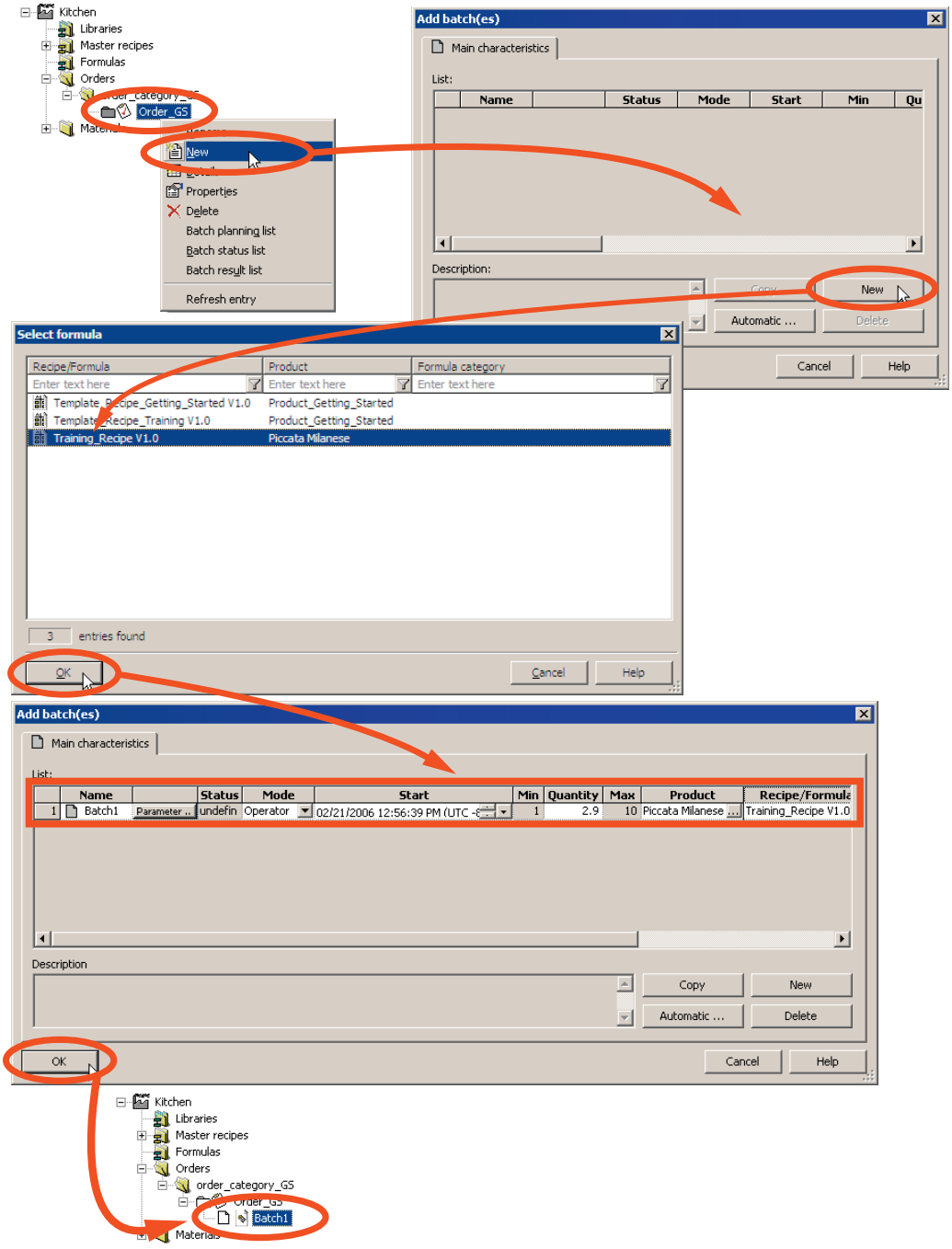
1. Create an order category with the name "order_category_GS".



2. Create an order with the name "Order_GS" under "order_category_GS".

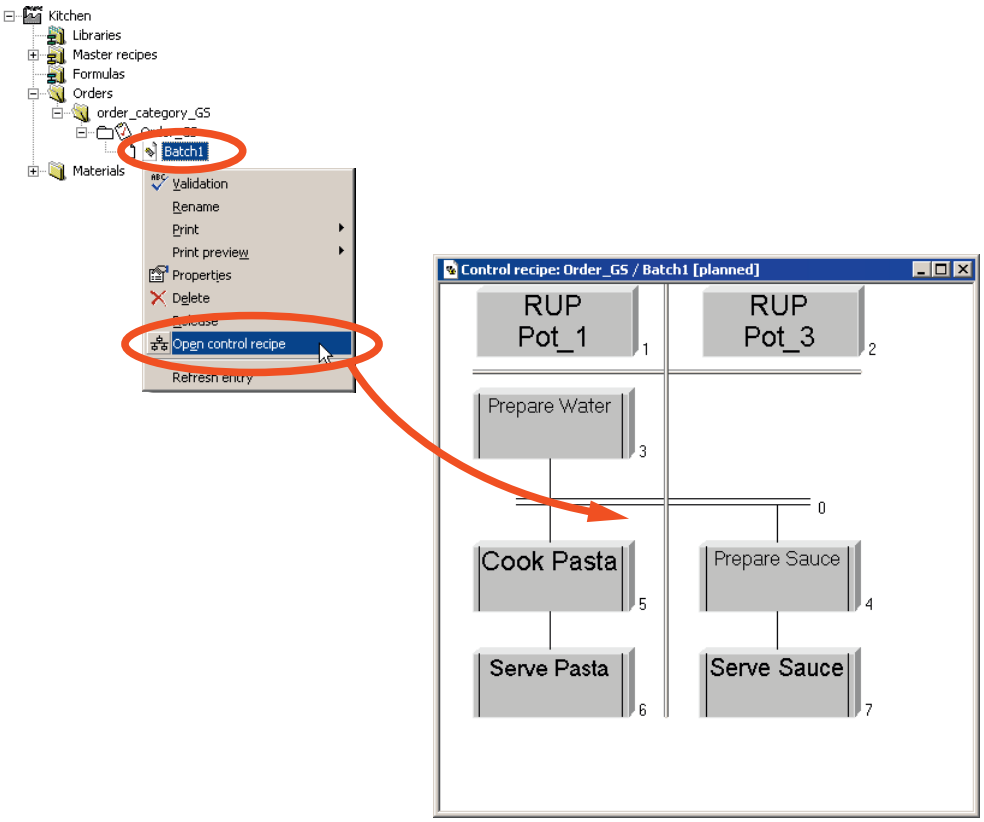


3. Create a batch (e.g. Batch1) for "Order_GS" with the master recipe "Training_Recipe V1.0".

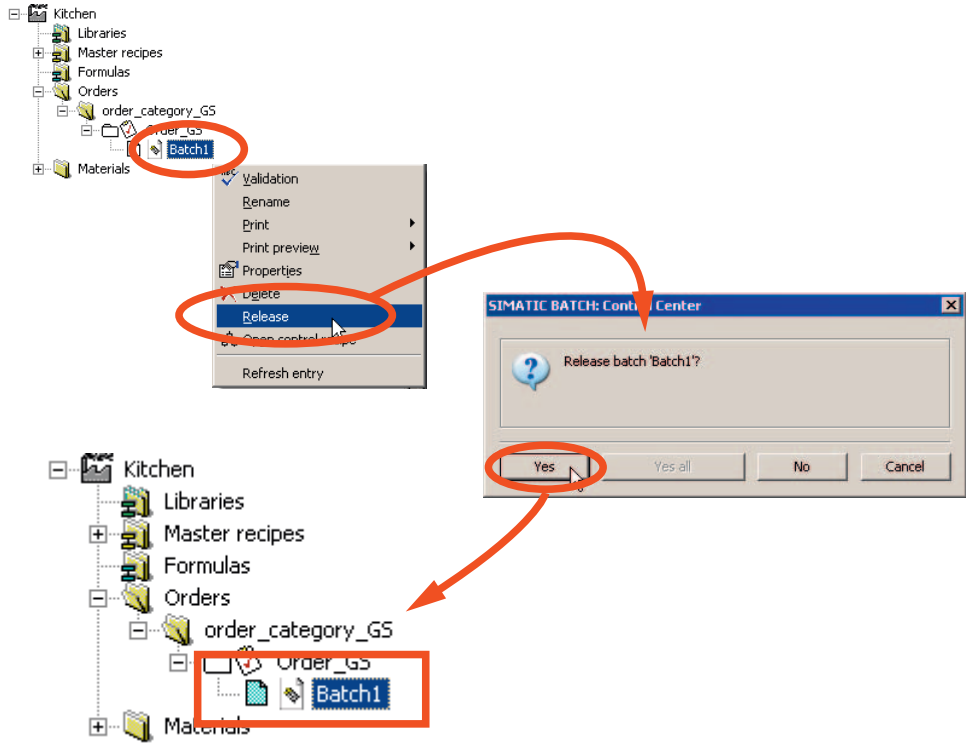


2.2.21 Chapter 21 Releasing and Starting a Batch (Control Recipe)

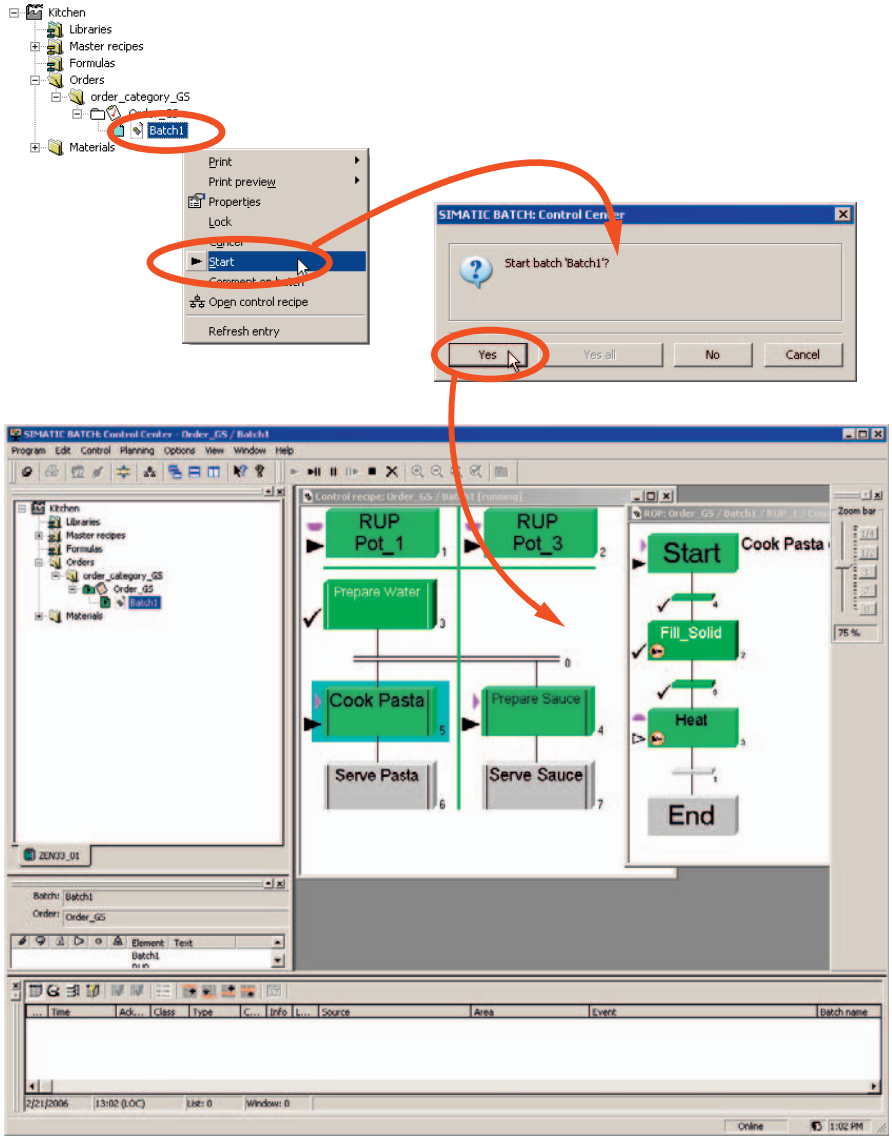
1. Open the batch (control recipe) "Batch1".



2. Release the "Batch1" control recipe. The icon of the control recipe becomes light blue.



3. Start the released control recipe. 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 close WinCC Runtime.

3 Part 3: Creating an Equipment Phase with SFC and BATCH Interface Blocks

3.1 Overview

Working in the SIMATIC Manager

1. Task Definition and Implementation Concept
2. Expanding the Plant Hierarchy
3. Configuring the Control Module Level (Valve V1)
4. Configuring BATCH Interface Blocks for the Control Commands and Process Value Transfer
5. Creating an SFC
6. Connecting the Batch Control Commands with the SFC
7. Compiling and Downloading the AS and OS
8. Generating Batch Types
9. Compiling, Transferring the OS and Downloading Batch
10. Expanding a Recipe

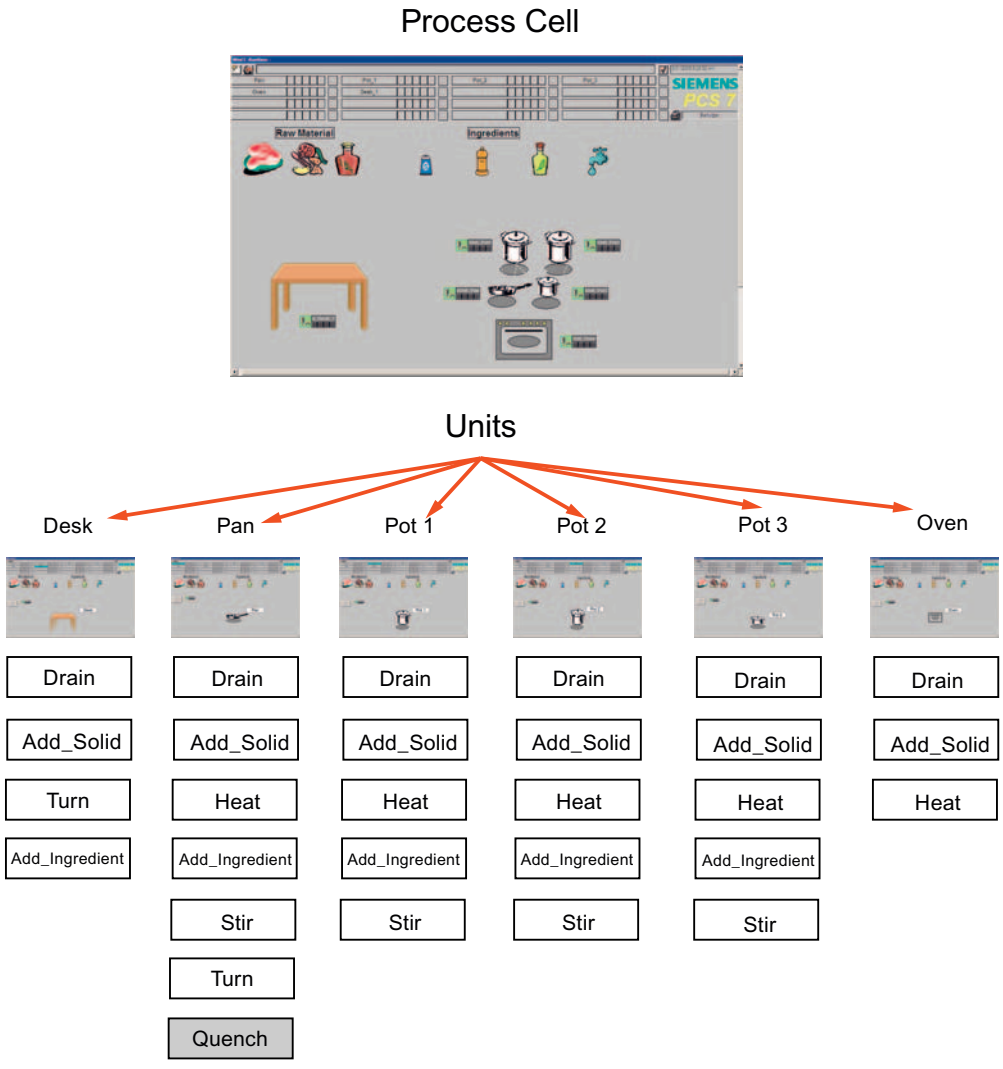
3.2 Projecting

3.2.1 Chapter 1 Task Definition and Implementation Concept

An additional equipment phase is required for the pan: It must be extended by adding the "Quench" 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.

To implement the equipment phase, you select blocks from the Batch library.



Process values

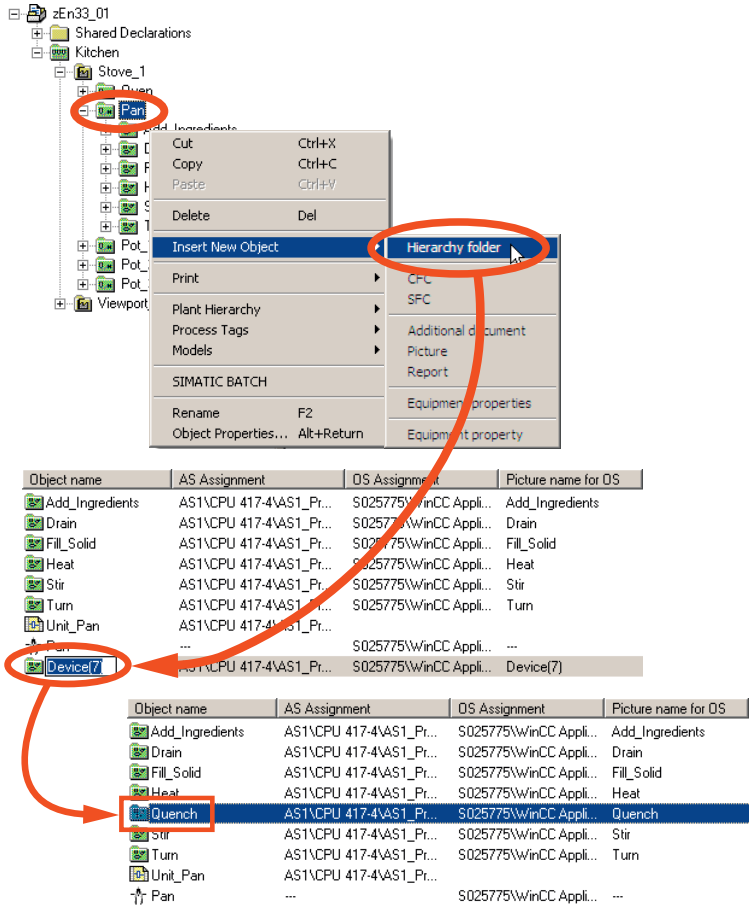
Process value name	Block	Data type	Comment
Quantity	IEPAR_PI	string REAL	
Duration	IEPAR_REAL	REAL	

Block contacts

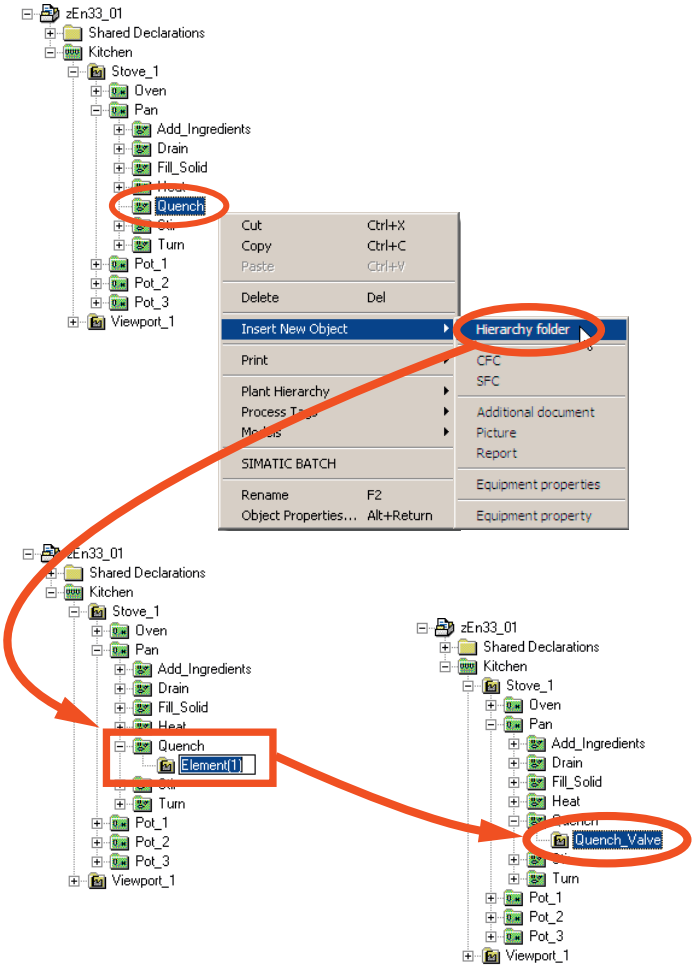
Block name	Block	Comment
V1	IEPAR_PI	

3.2.2 Chapter 2 Expanding the Plant Hierarchy

1. Open your **edited** SIMATIC BATCH Getting Started "Quick Start".
2. Expand the "Pan" unit by adding a hierarchy folder with the name "Quench". The newly added hierarchy folder is automatically declared as an equipment module and therefore also as batch-relevant (folder is green).

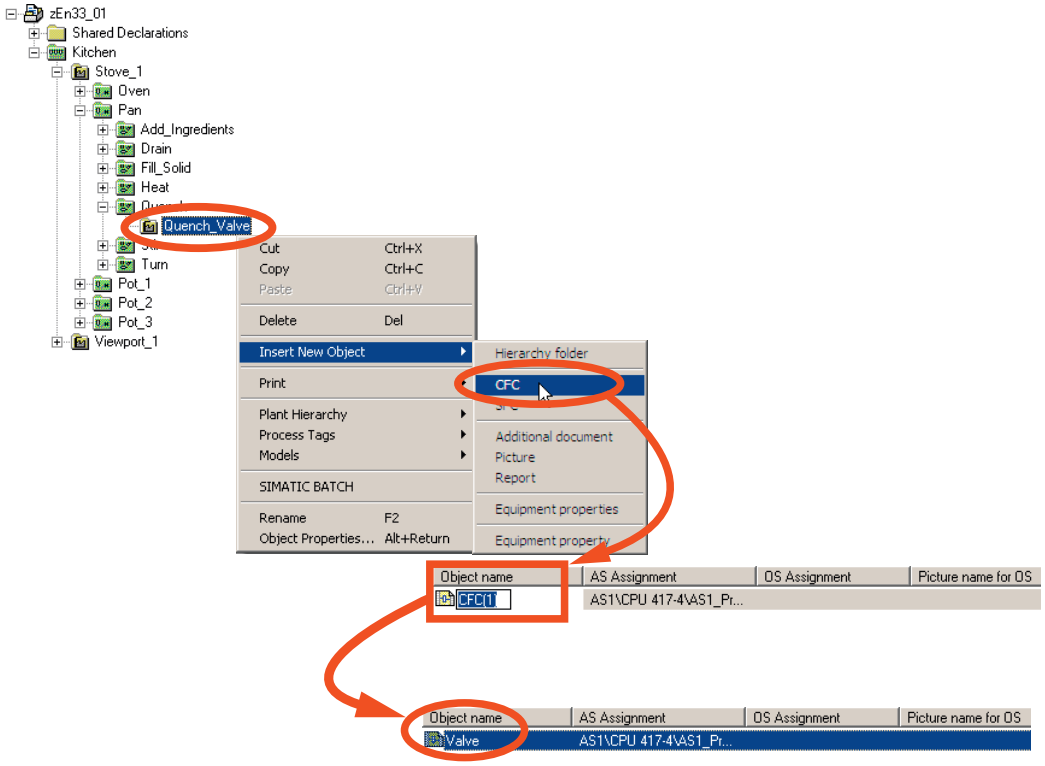


3. Expand the "Quench" hierarchy folder by adding a hierarchy folder with the name "Quench_Valve". This level also contains the control modules (here, the corresponding valve).



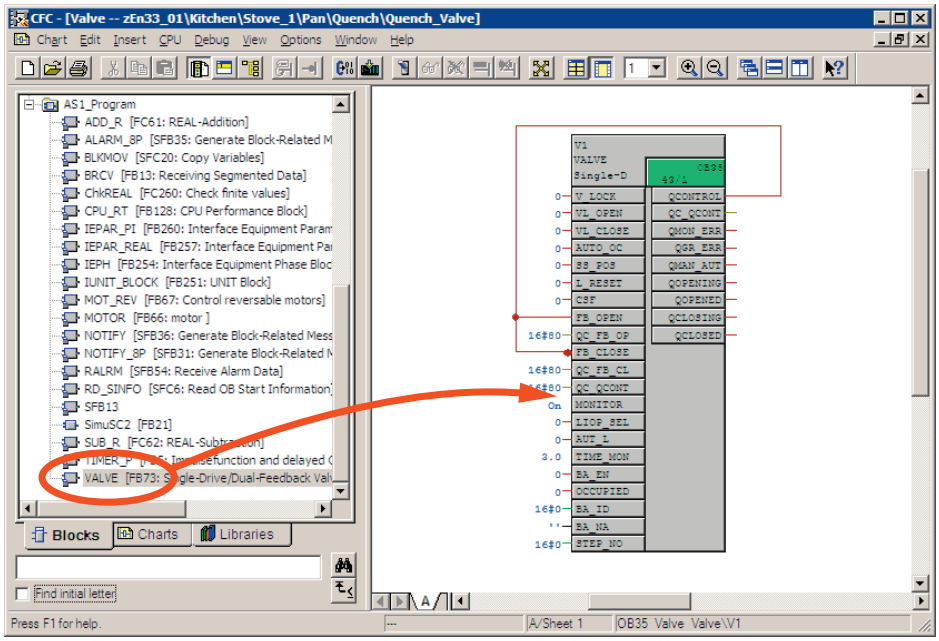
3.2.3 Chapter 3 Configuring the Control Module Level (Valve V1)

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



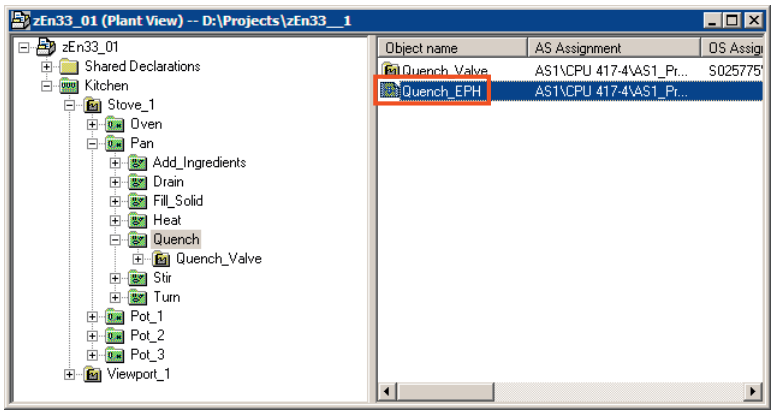
2. Open the "Valve" CFC chart and insert a valve block. Give the valve block the block name "V1".
3. Make the inputs and outputs "QCONTROL", "BA_EN", "BA_ID", "OCCUPIED", "BA_NA", and "STEP_NO" visible.

4. Interconnect the "QCONTROL" output with the "FB_OPEN" and "FB_CLOSE" inputs and invert "FB_CLOSE".

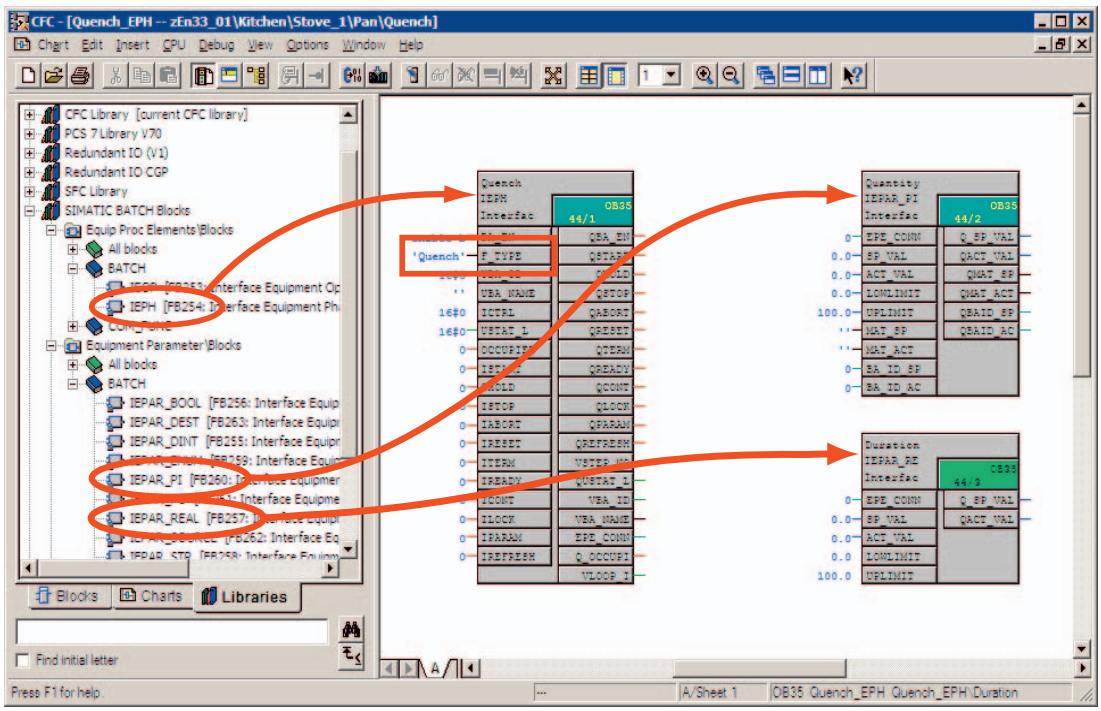


3.2.4 Chapter 4 Configuring BATCH Interface Blocks for the Control Commands and Process Value Transfer

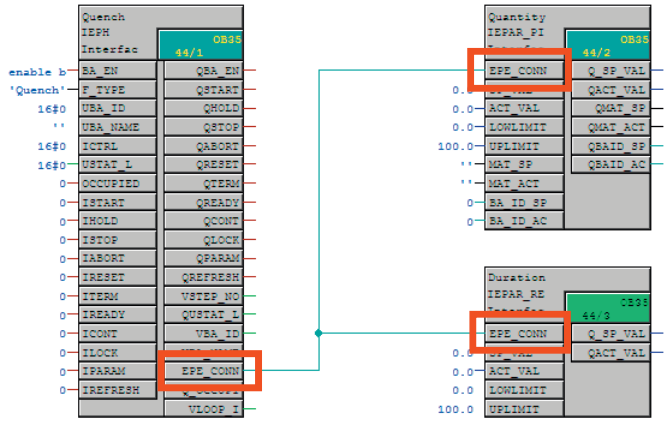
1. Create a CFC chart with the name "Quench_EPH" in the "Quench" hierarchy folder.



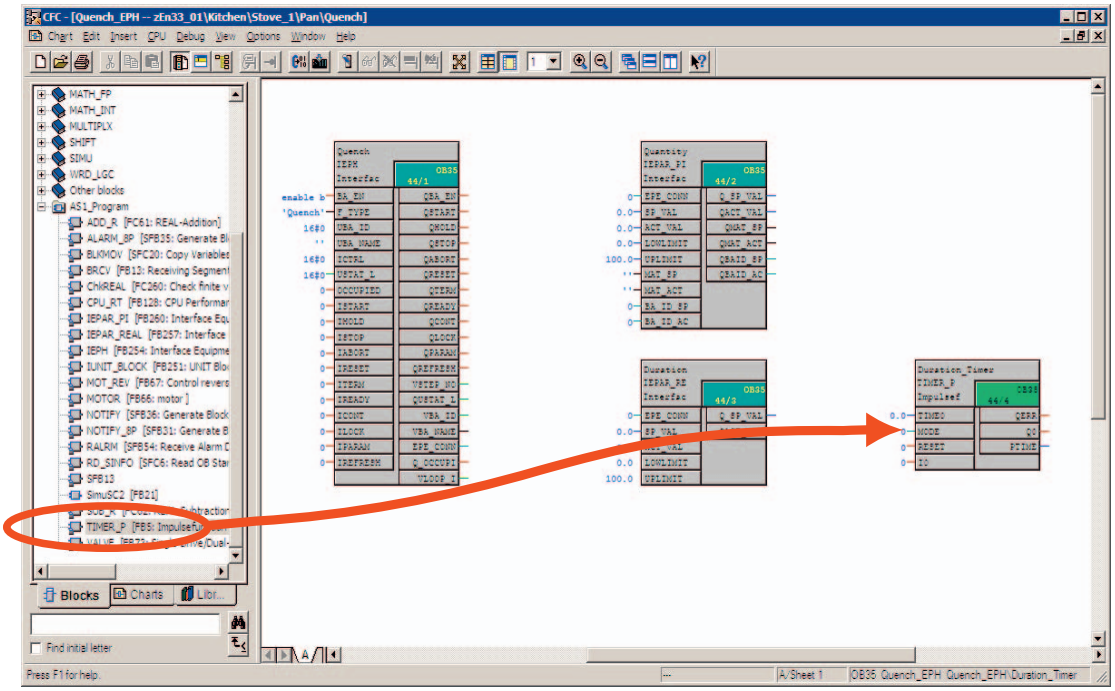
2. Open the "Quench_EPH" CFC chart and add the "IEPH", "IEPAR_PI" and "IEPAR_REAL" blocks from the "SIMATIC BATCH Blocks" library. Rename the IEPH block to "Quench". Enter "Quench" too at the "F_TYPE" input as the input value. Assign the name "Quantity" to the IEPAR_PI block and the name "Duration" to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



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

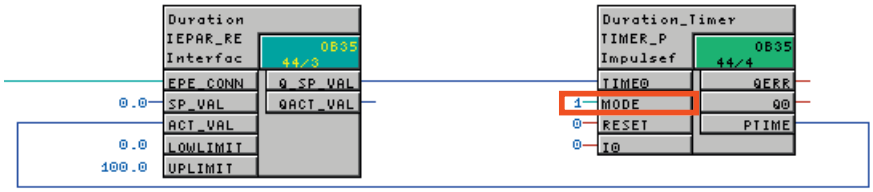


4. Add a TIMER_P block for the simulation of the "Duration" process value.



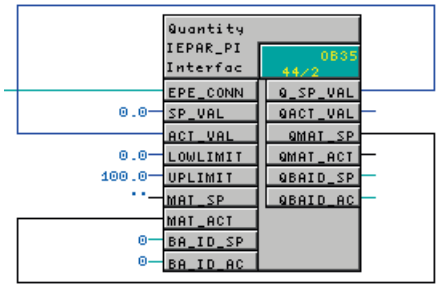
5. Assign the TIMER_P block the name "Duration_Timer" and set the input MODE to 1.
   Interconnect the IEPAR_REAL block "Duration" with the TIMER_P block as follows.

Duration / Q_SP_VAL	with	Duration_Timer / TIMER0
Duration_Timer / PTIME	with	Duration / ACT_VAL



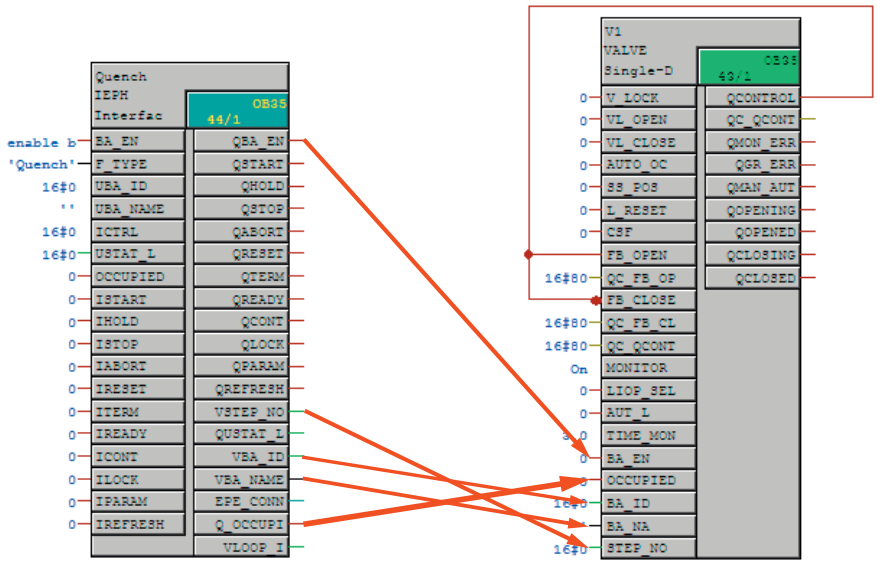
6. Interconnect the IEPAR_PI block "Quantity" to the simulation as follows.

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



7. To have the BATCH name, Batch ID, Batch step number, Batch enable, occupied available at the valve block "V1", the valve block must be interconnected to the Batch control block IEPH "Quench".
   Make interconnections as shown below.

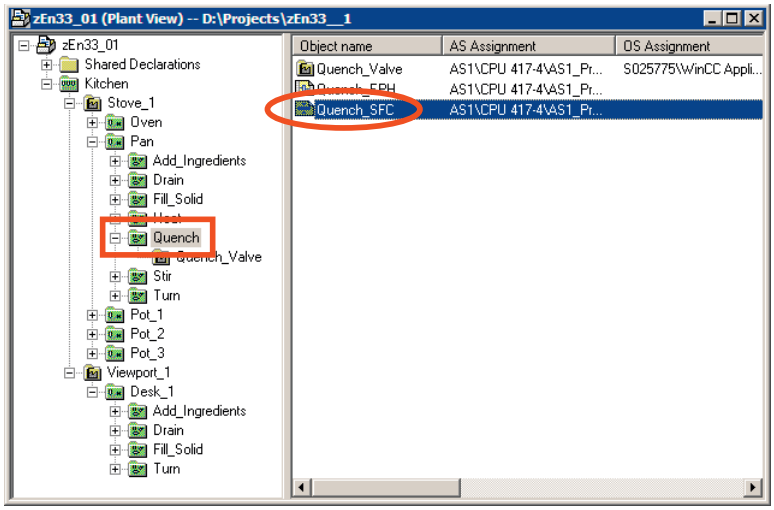
Quench / QBA_EN	to	V1 / BA_EN
Quench / VSTEP_NO	to	V1 / STEP_NO
Quench / VBA_ID	to	V1 / BA_ID
Quench / VBA_NAME	to	V1 / BA_NA
Quench / Q_OCCUPI	to	V1 / OCCUPIED



8. Close the CFC Editor.

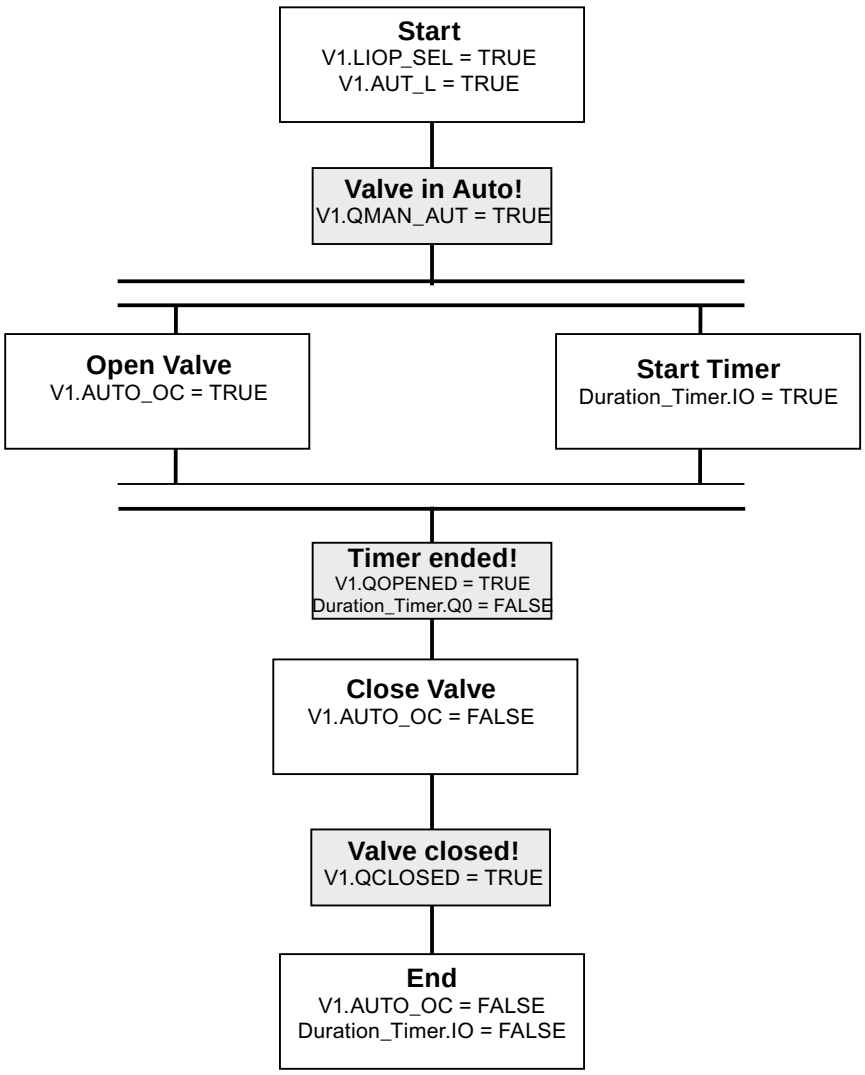
3.2.5 Chapter 5 Creating a SFC

1. Create a SFC chart with the name "Quench_SFC" in the "Quench" hierarchy folder.

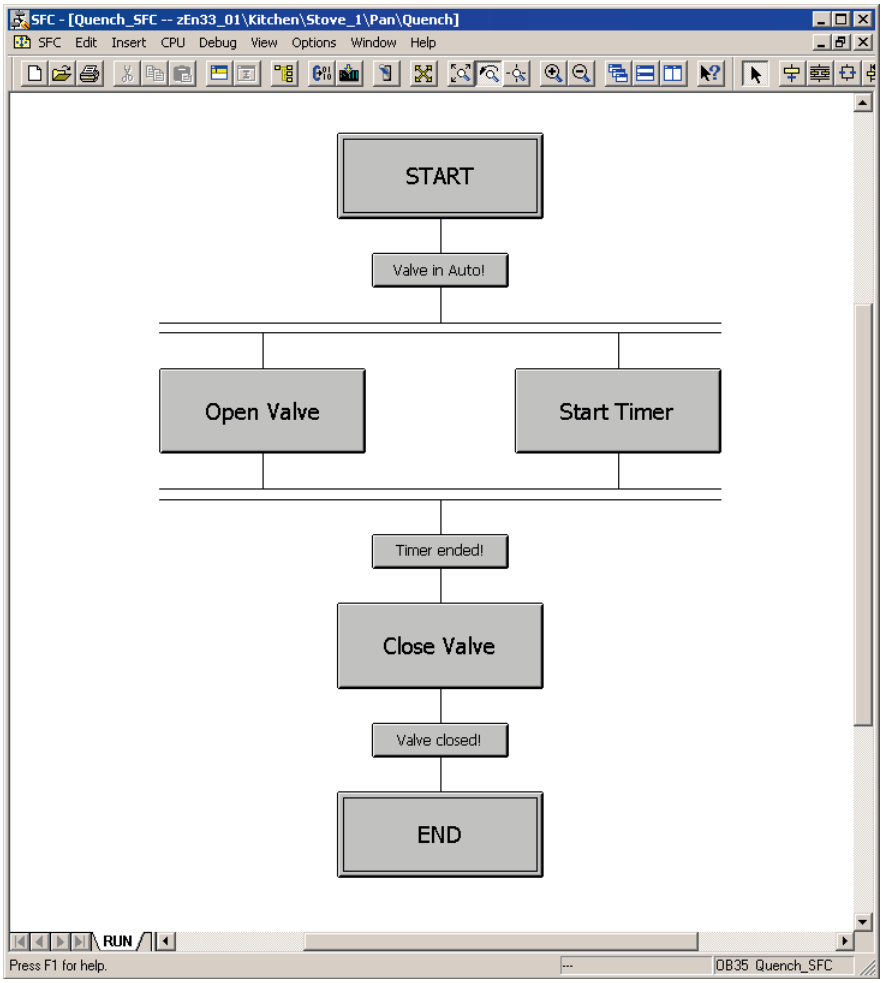


2. Open the SFC chart and configure the RUN sequencer. Base you configuration on the following outline. You can find the Duration_Timer block in the Quench_EPH chart and the V1 block in the Valve chart.

Outline for the "RUN" Sequencer (RUN=1)

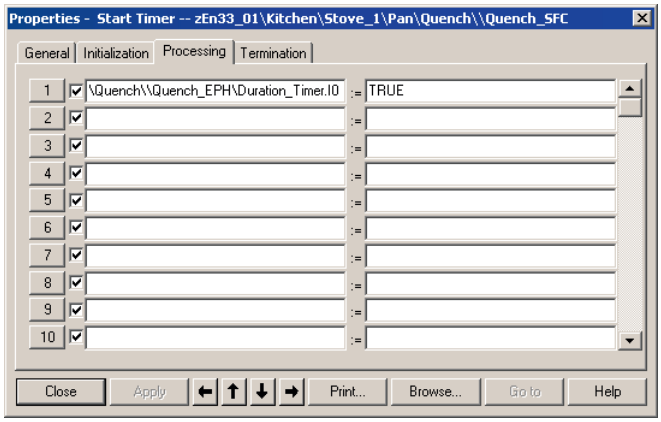


The completed sequencer appears as follows.

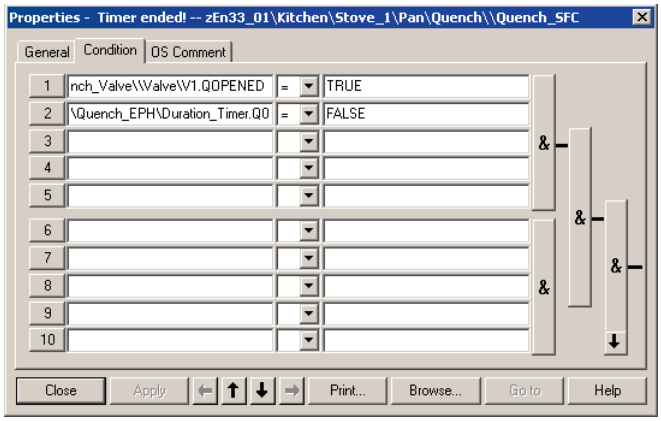


Example for a step and a transition.

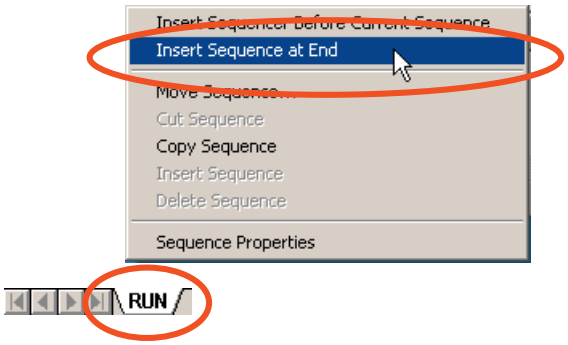
Step: Start Timer



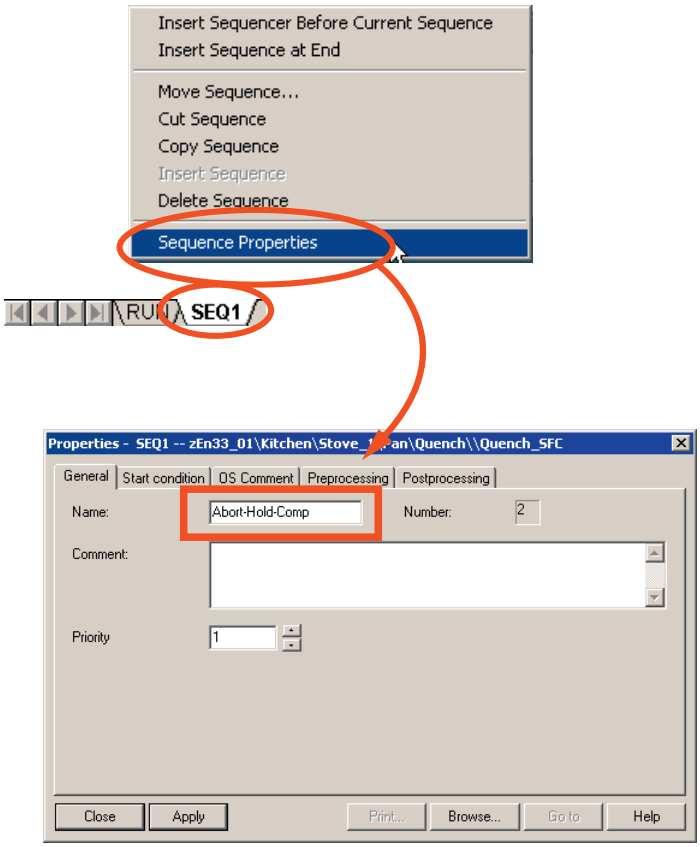
Transition: Timer ended!



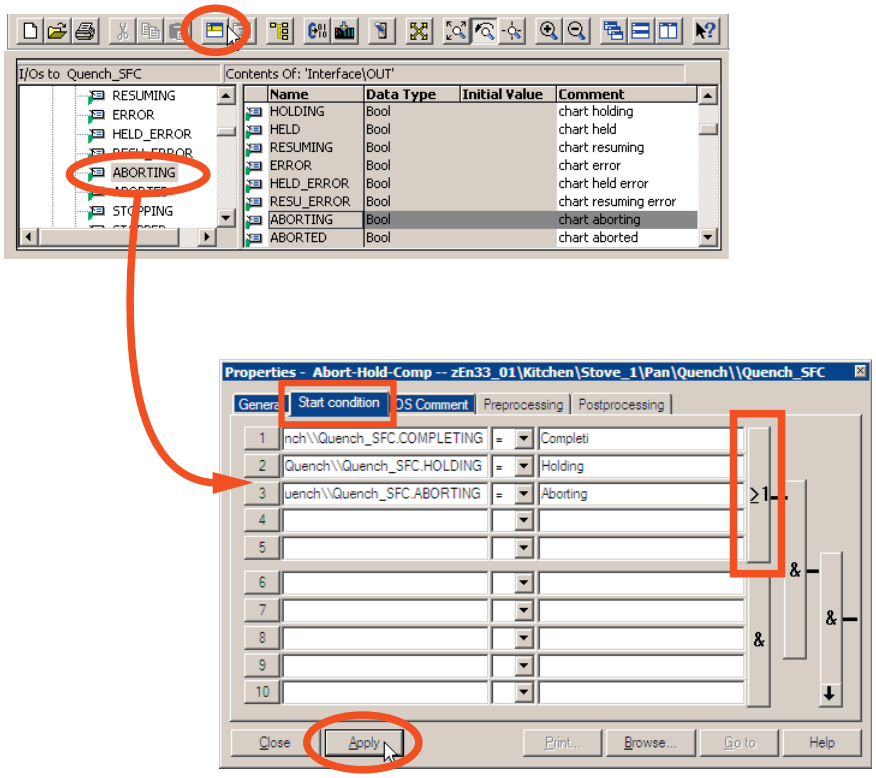
3. Insert a new sequencer in "Quench_SFC".



4. Open the properties window of SEQ1 (double-click on the SEQ1 tab).
   In the "General" tab, enter the name "Abort-Hold-Comp". Then apply the settings.

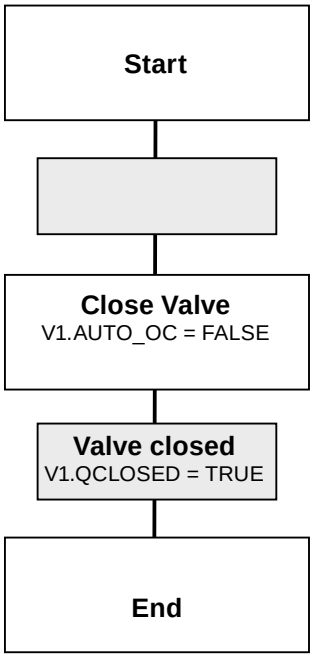


5. Configure the start conditions of the sequencer.
   Make the "Inputs/Outputs" view visible.
   Insert the parameters "HOLDING" ,"ABORTING" and "COMPLETING" as start conditions in the "Start condition" tab by dragging them with the mouse (these parameters are located in OUT).
   Apply the settings and close the "Properties" window.

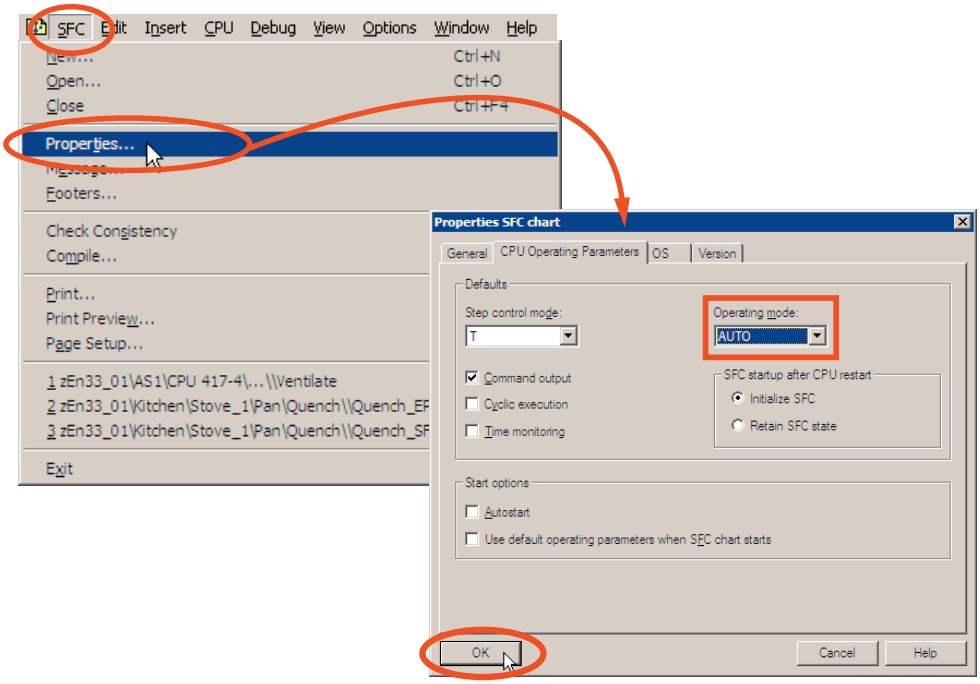


6. Configure the Abort-Hold-Complete sequencer as described below.

Outline for the "Hold/Abort/Complete" Sequencer (Holding=1 or Aborting=1 or Completing=1)



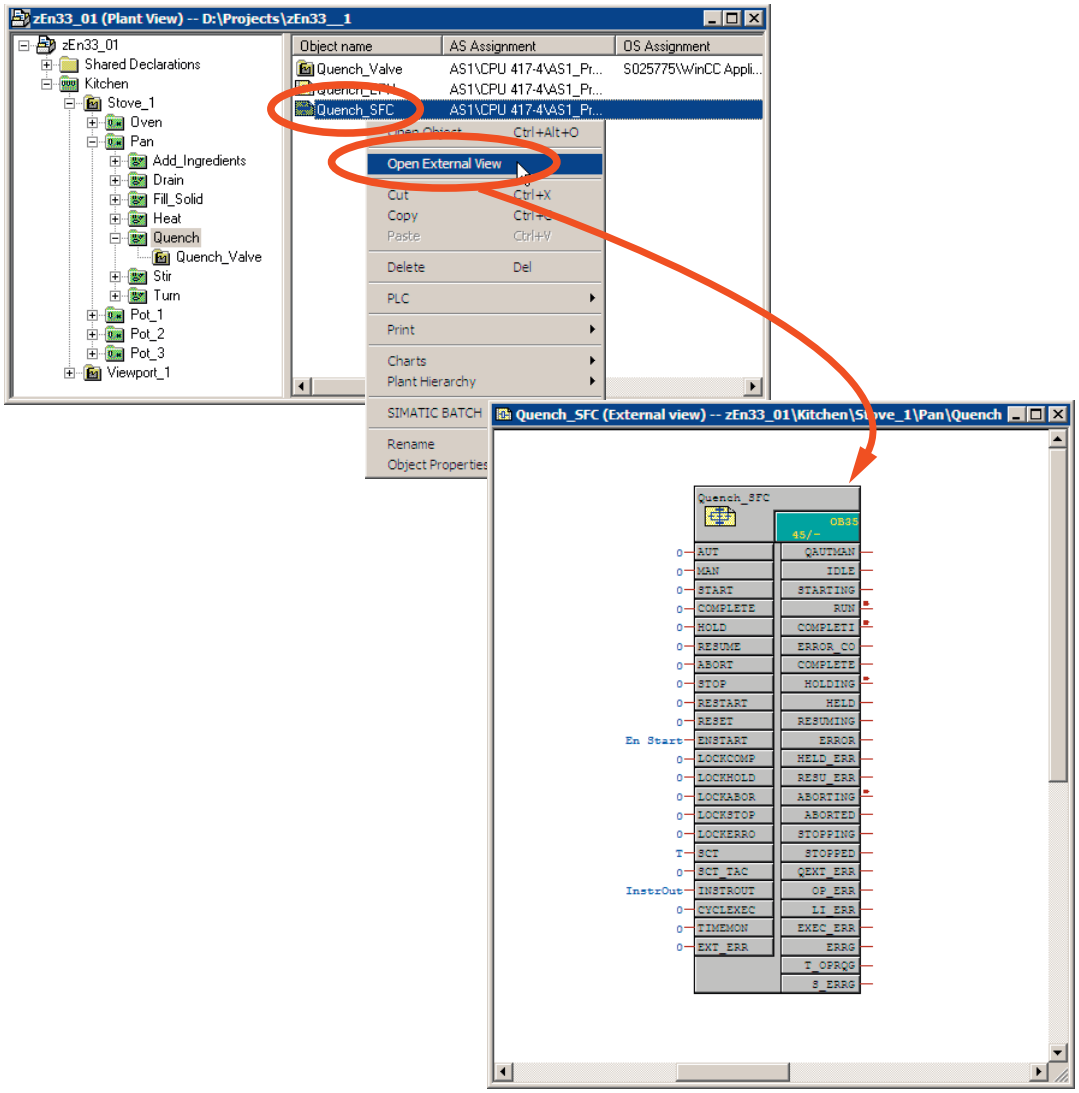
7. Select the "AUTO" mode in the "Quench_SFC" SFC chart.



8. Close the SFC Editor.

3.2.6 Chapter 6 Connecting the Batch Control Commands with the SFC

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

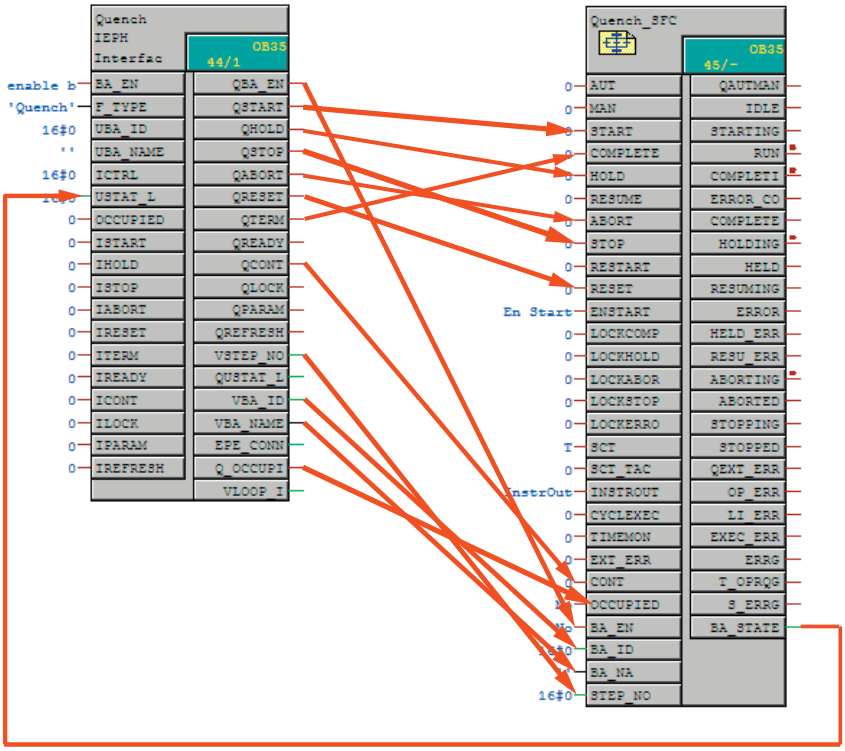


2. Open the "Quench_EPH" CFC chart with the "Quench" interface block.

3. Interconnect the "Quench" interface block with the external view of the "Quench_SFC" SFC chart as follows.

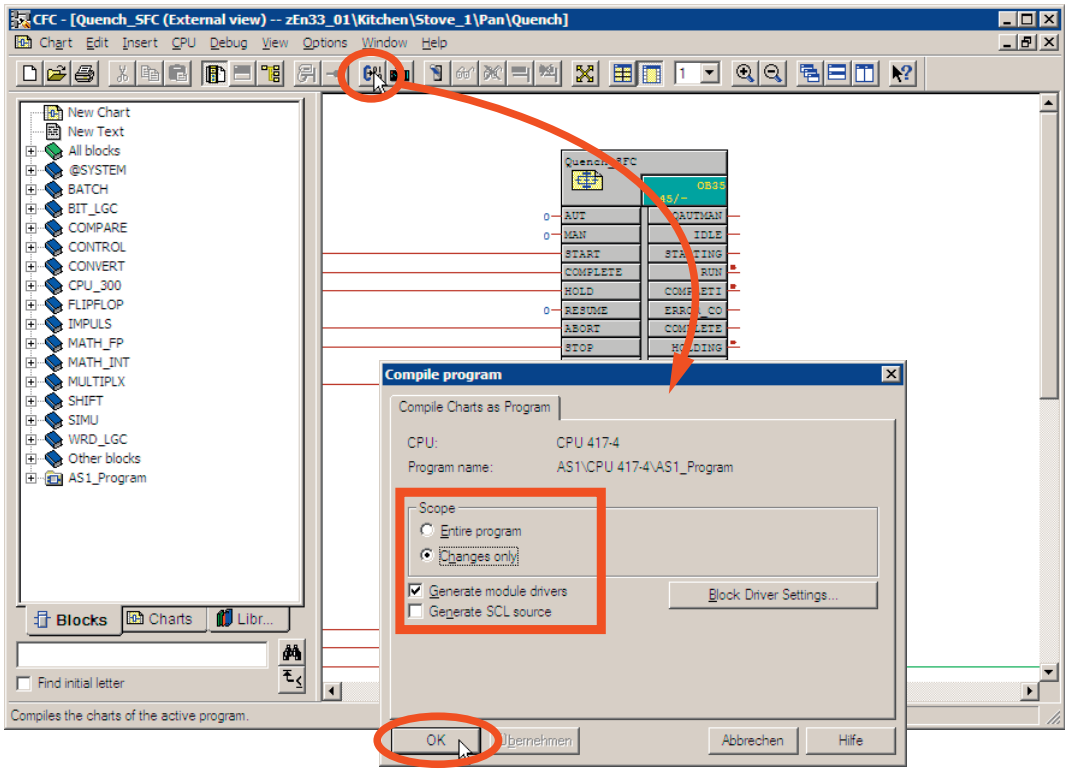
Note:
Set all parameters in the following list to visible at first.

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



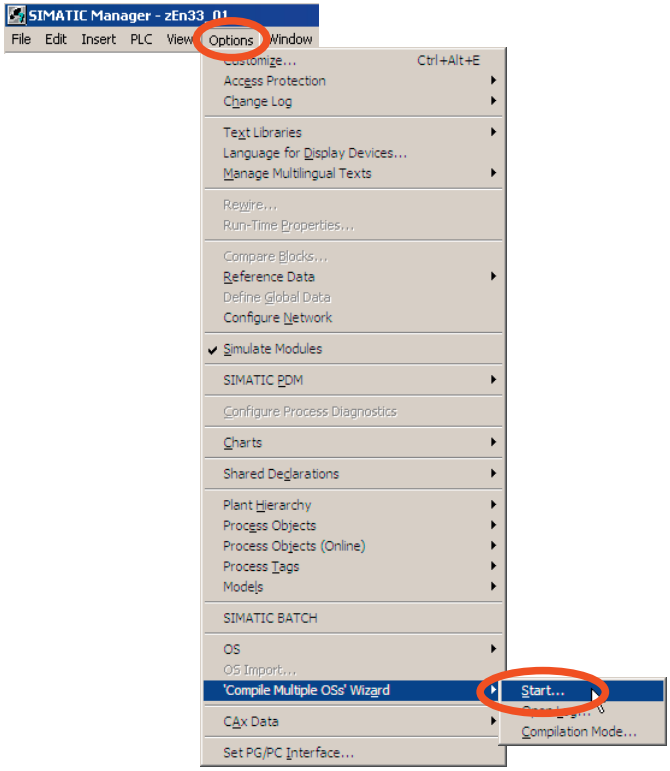
3.2.7 Chapter 7 Compiling and Downloading the AS and OS

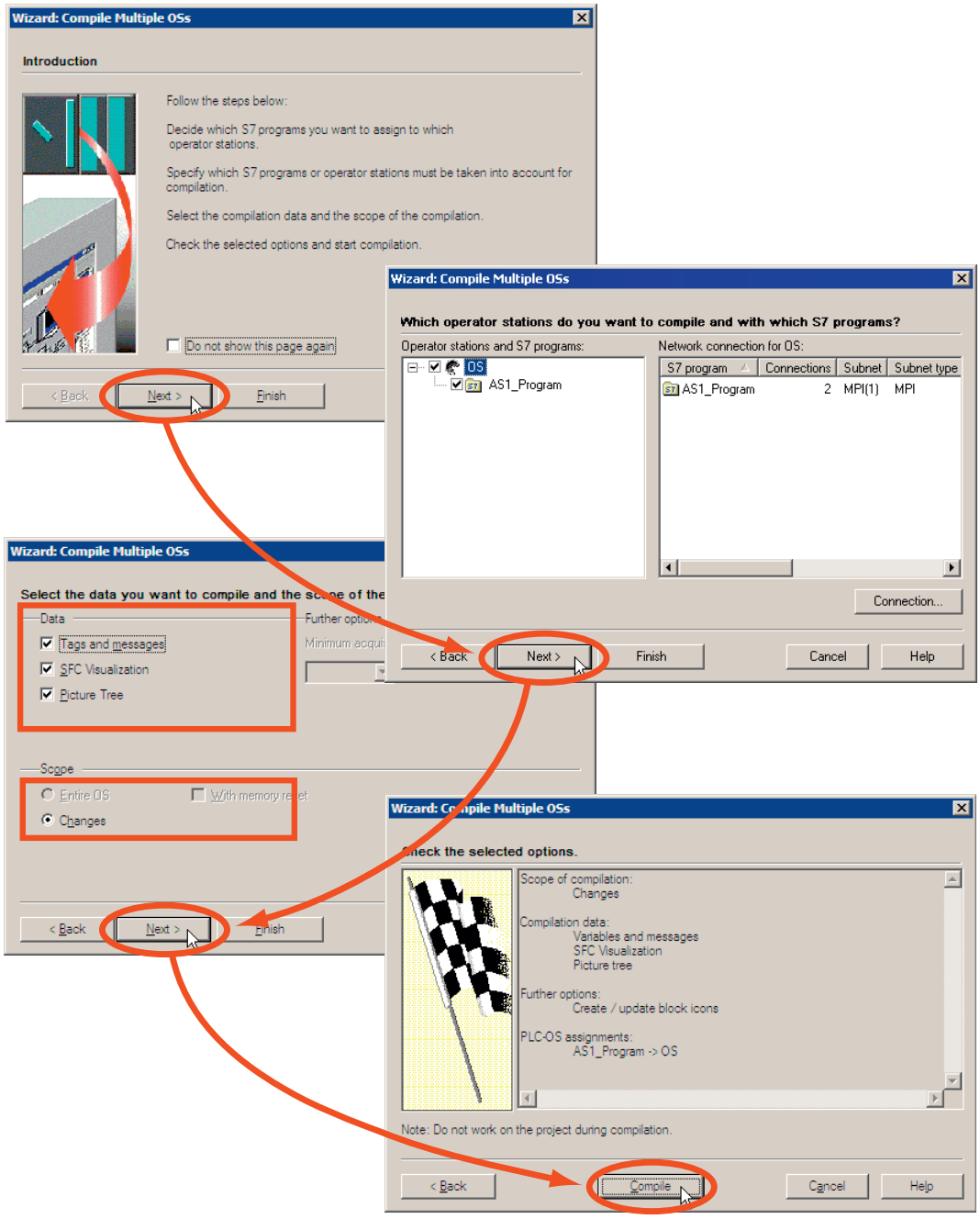
1. Run a changes-only compilation of the AS and then download the newly compiled data to PLCSim with a changes-only download.



When the download is completed, check that the AS in the RUN_P state.

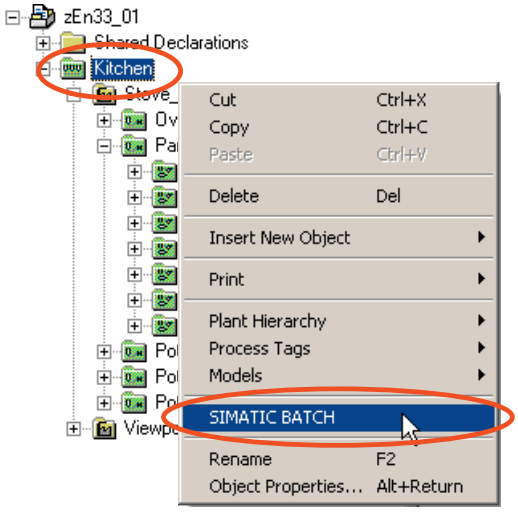
2. Run a changes-only compilation of the OS.



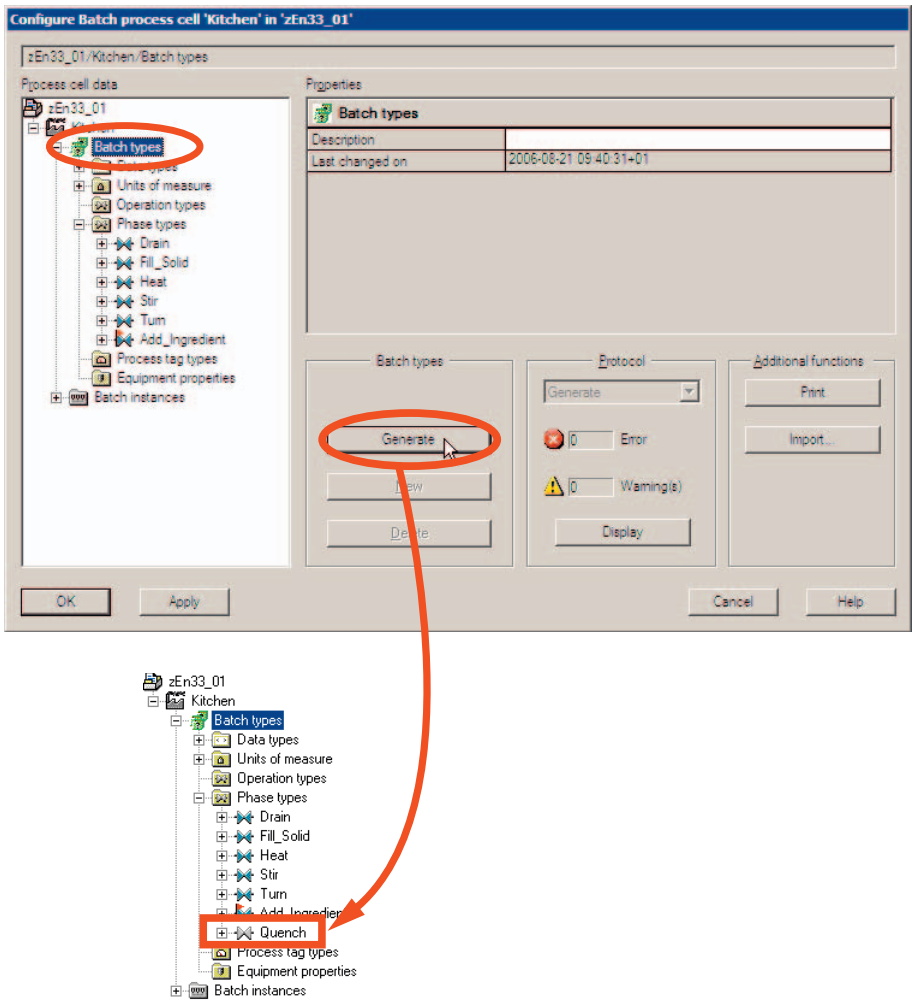

Wizard: Compile Multiple OSs
Introduction
Follow the steps below:
Decide which S7 programs you want to assign to which operator stations.
Specify which S7 programs or operator stations must be taken into account for compilation.
Select the compilation data and the scope of the compilation.
Check the selected options and start compilation.
Do not show this page again
< Back
Next >
Finish
Wizard: Compile Multiple OSs
Which operator stations do you want to compile and with which S7 programs?
Operator stations and S7 programs:
OS
AS1_Program
Network connection for OS:
S7 program
Connections
Subnet
Subnet type
AS1_Program
2
MPI(1)
MPI
Connection...
< Back
Next >
Finish
Cancel
Help
Wizard: Compile Multiple OSs
Select the data you want to compile and the scope of the
Data
Tags and messages
SFC Visualization
Picture Tree
Scope
Entire OS
With memory reset
Changes
< Back
Next >
Finish
Wizard: Compile Multiple OSs
Check the selected options.
Scope of compilation:
Changes
Compilation data:
Variables and messages
SFC Visualization
Picture tree
Further options:
Create / update block icons
PLC-OS assignments:
AS1_Program -> OS
Note: Do not work on the project during compilation.
< Back
Compile
Cancel
Help

3.2.8 Chapter 8 Generating Batch Types

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

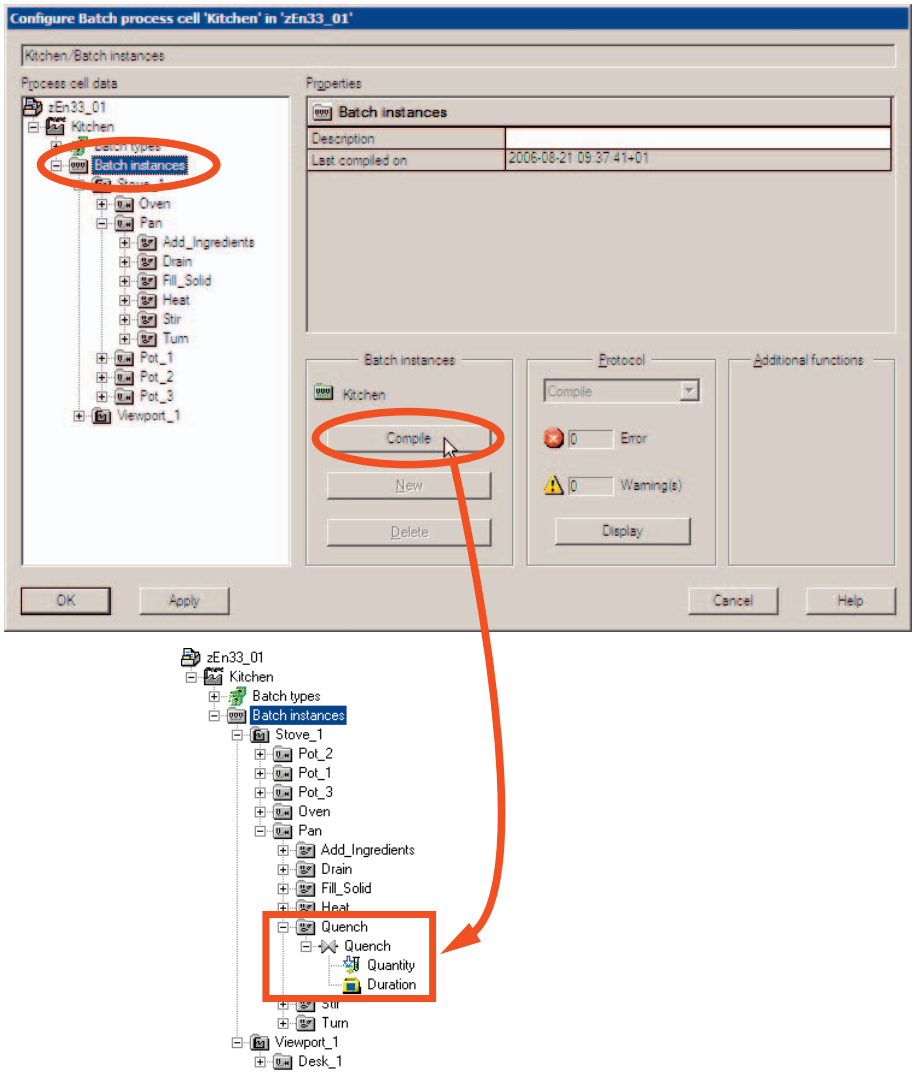


2. Generate the batch types.
   Your batch data newly configured in the "Quench_EPH" CFC chart is now loaded.

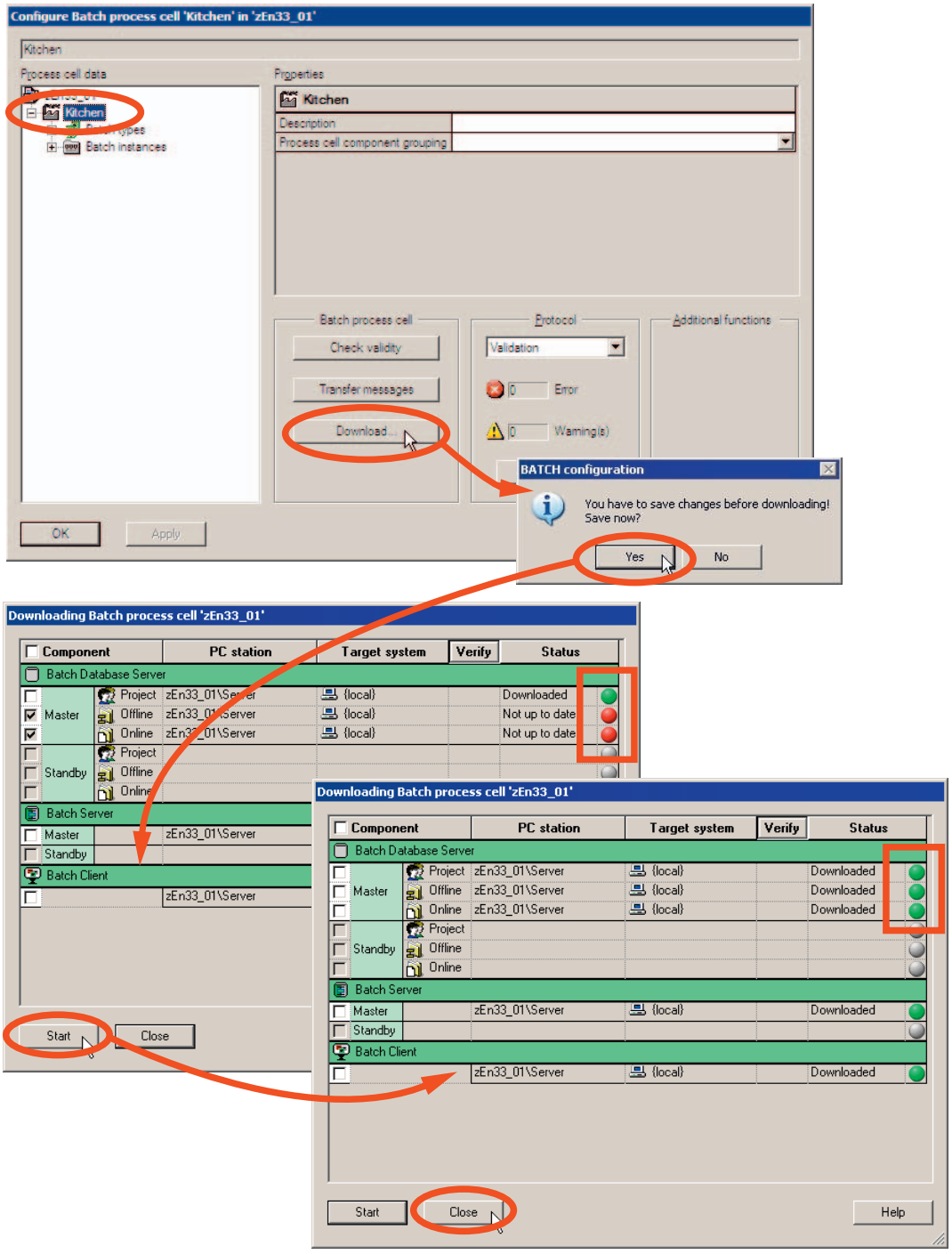


3.2.9 Chapter 9 Compiling and Downloading Batch Process Cell Data

1. Compile the Batch process cell data.
   To do this, select "Batch instances" and select the "Compile" button.

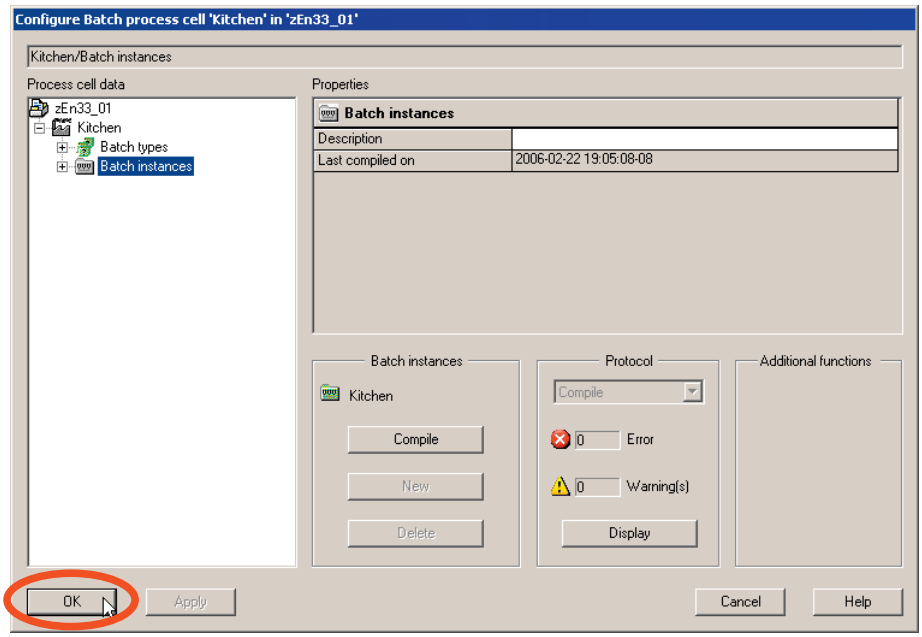


2. Download the Batch process cell data.
   Select the Batch process cell (in this case, Kitchen) and perform a "Download".
   Save the changes (confirm the dialog box with Yes).
   Download the generated Batch process cell data to the BATCH server and BATCH client.
   In this case, the BATCH server and BATCH client are on the same computer.



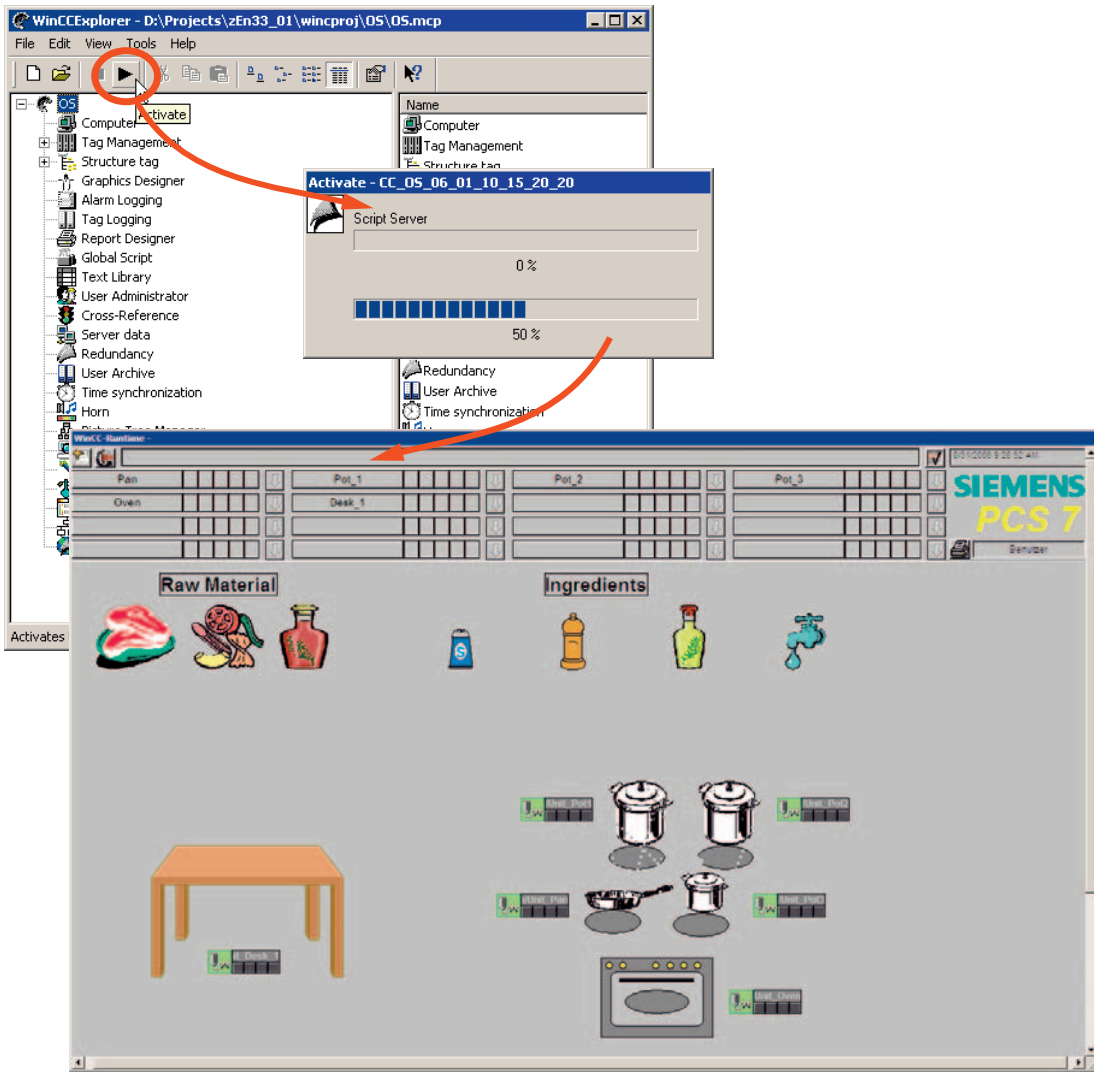
3. Close the dialog.

4. Close the "Configure Batch process cell" dialog.



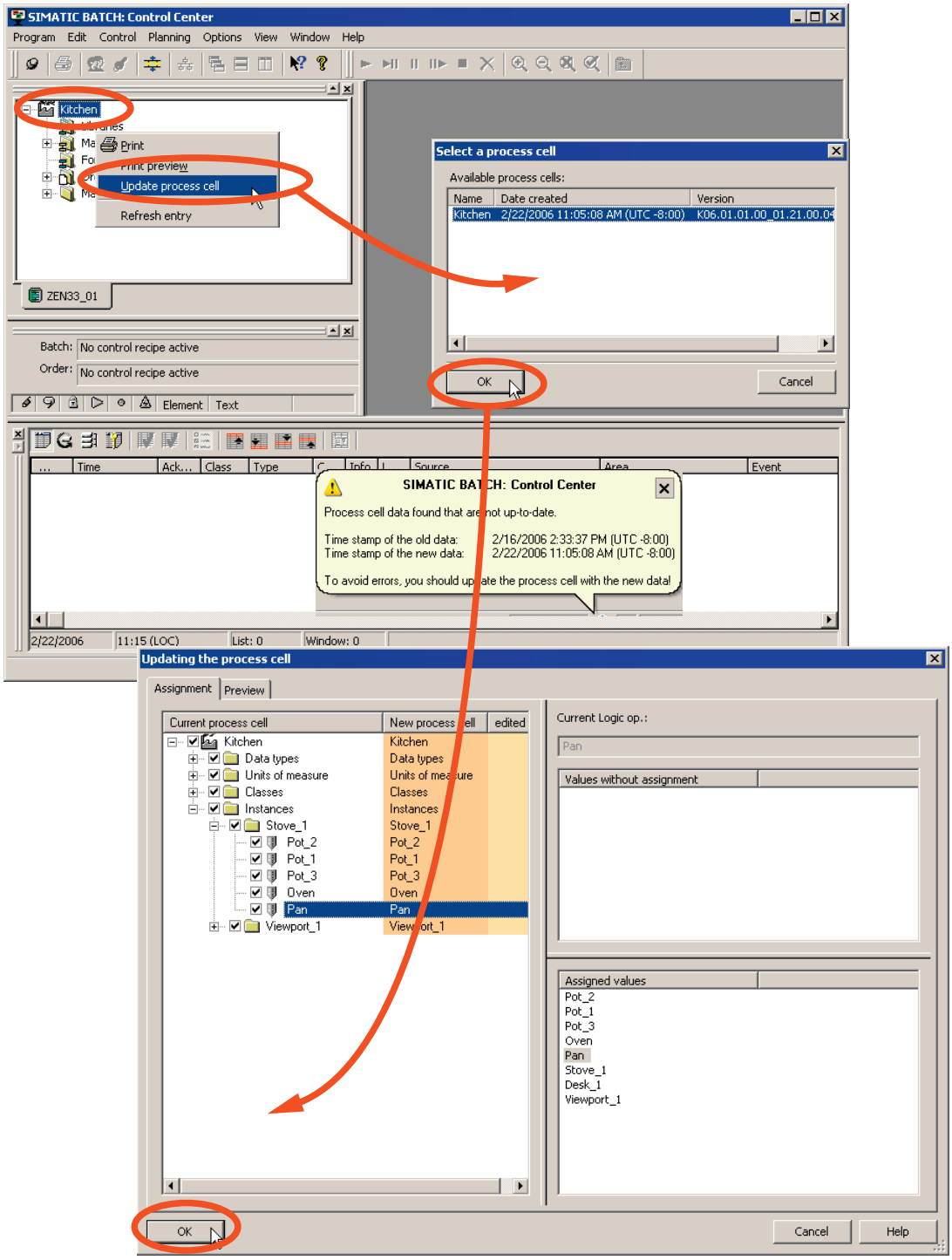
3.2.10 Chapter 10 Expanding a Recipe

1. Start Runtime on the OS.



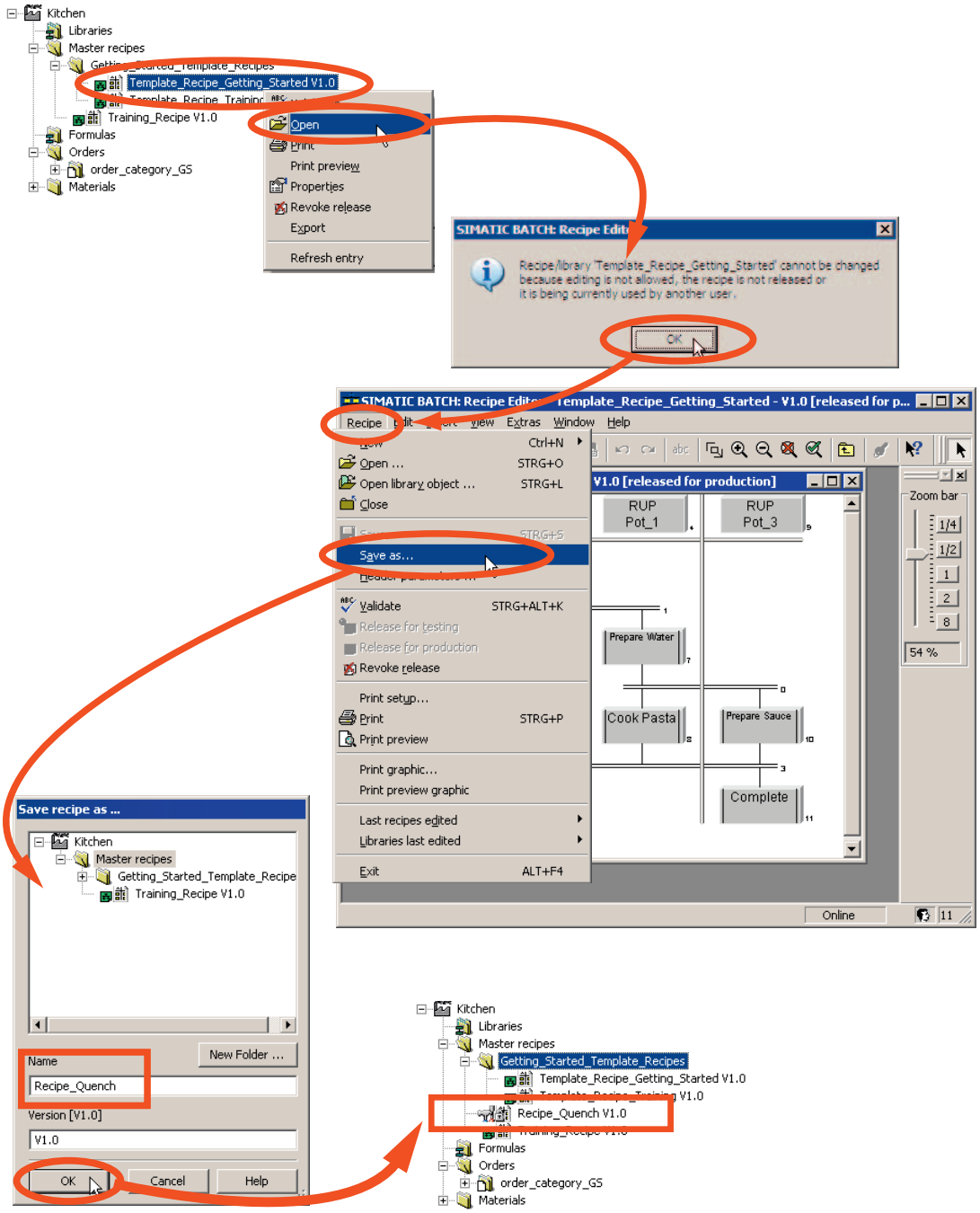
2. The Start Coordinator starts automatically as soon as your WinCC project is in runtime. Wait until it has started all applications completely (BCS and CDV).

3. Start the Batch Control Center and update the newly downloaded Batch process cell data.

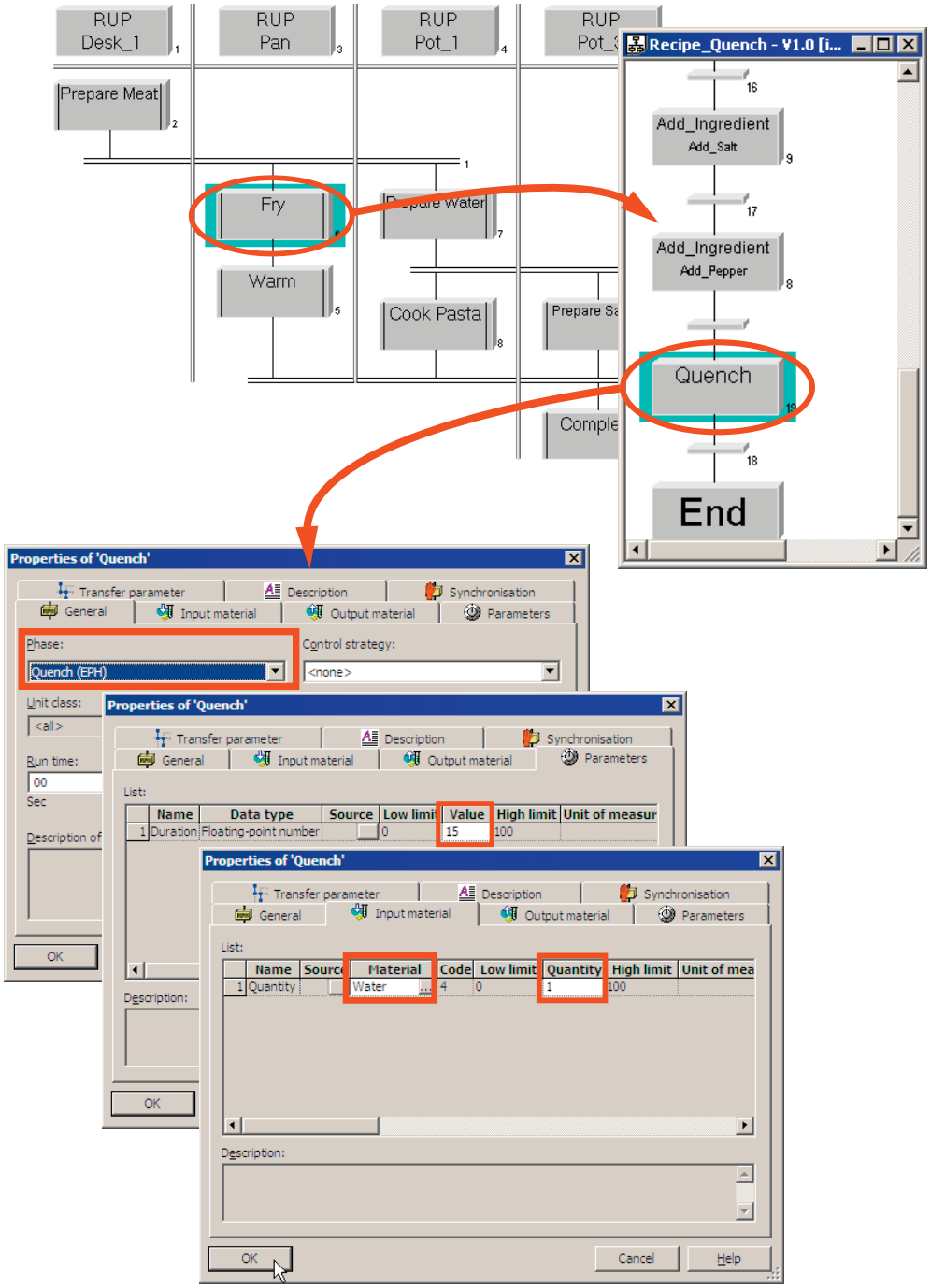


After the update, your newly configured "Quench" phase for the "Pan" unit is available for recipe creation.

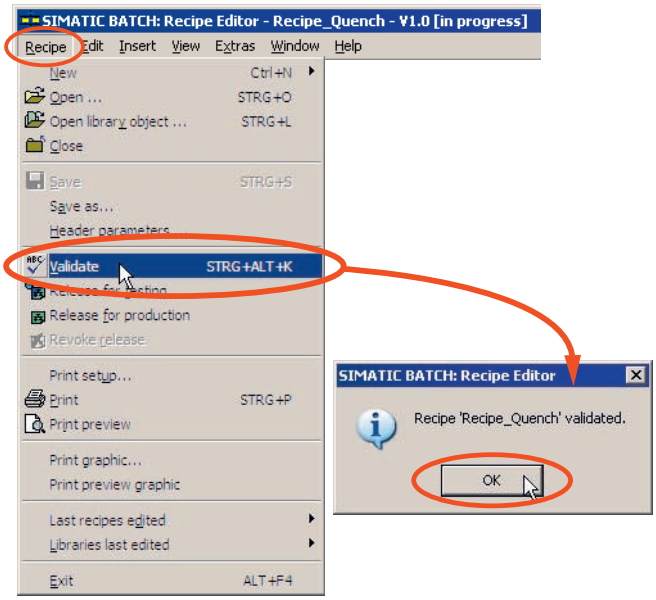
4. Open the "Template_Recipe_Getting_Started" master recipe and save it with the name "Recipe_Quench".



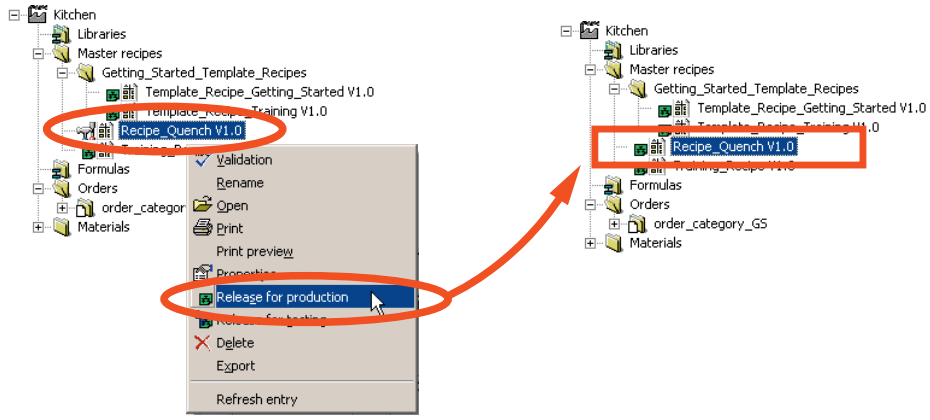
5. In the "Recipe_Quench" recipe you have just created, insert the newly configured "Quench" phase.

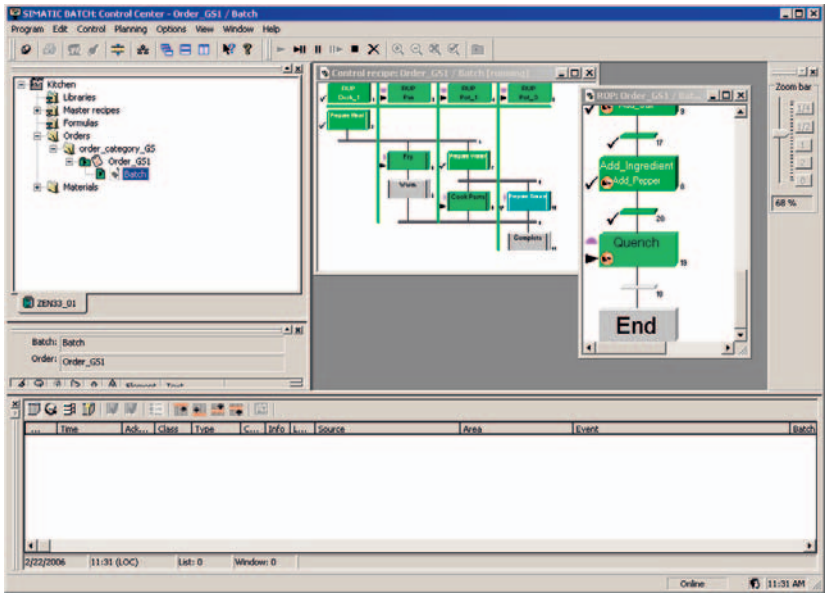


6. Save the recipe and validate it. Then close the Recipe Editor.



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





8. Close the SIMATIC BATCH Control Center and close WinCC Runtime.

4 Part 4: Creating an Equipment Phase with a SFC-Type

4.1 Overview

Working in the SIMATIC Manager

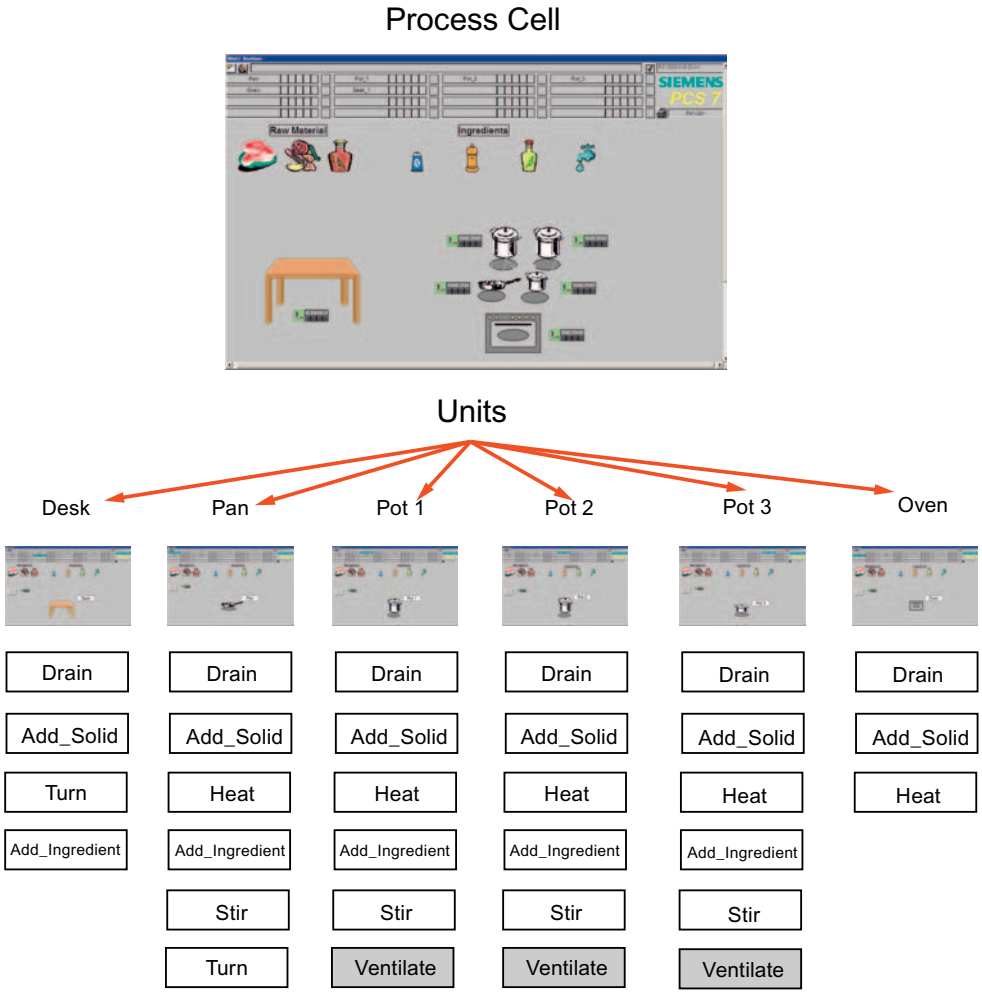
1. Task Definition and Implementation Concept for "Ventilate"
2. Creating SFC Type "Ventilate"
3. Creating Sequencers
4. Expanding the Plant Hierarchy
5. Creating Instances of the SFC Type "Ventilate" for Pot_1
6. Compiling and Downloading AS, OS, and Batch
7. Expanding a Recipe

4.2 Projecting

4.2.1 Chapter 1 Task Definition and Implementation Concept for "Ventilate"

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 phase is necessary for Pots 1-3, select the SFC type to implement it.



Implementation Concept for SFC Type "Ventilate"

Control strategies

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

Setpoints

Setpoint name	Data type	Comment
Duration	REAL	Unit of measure seconds

Process values

Process value name	Data type	Comment
None		

Times

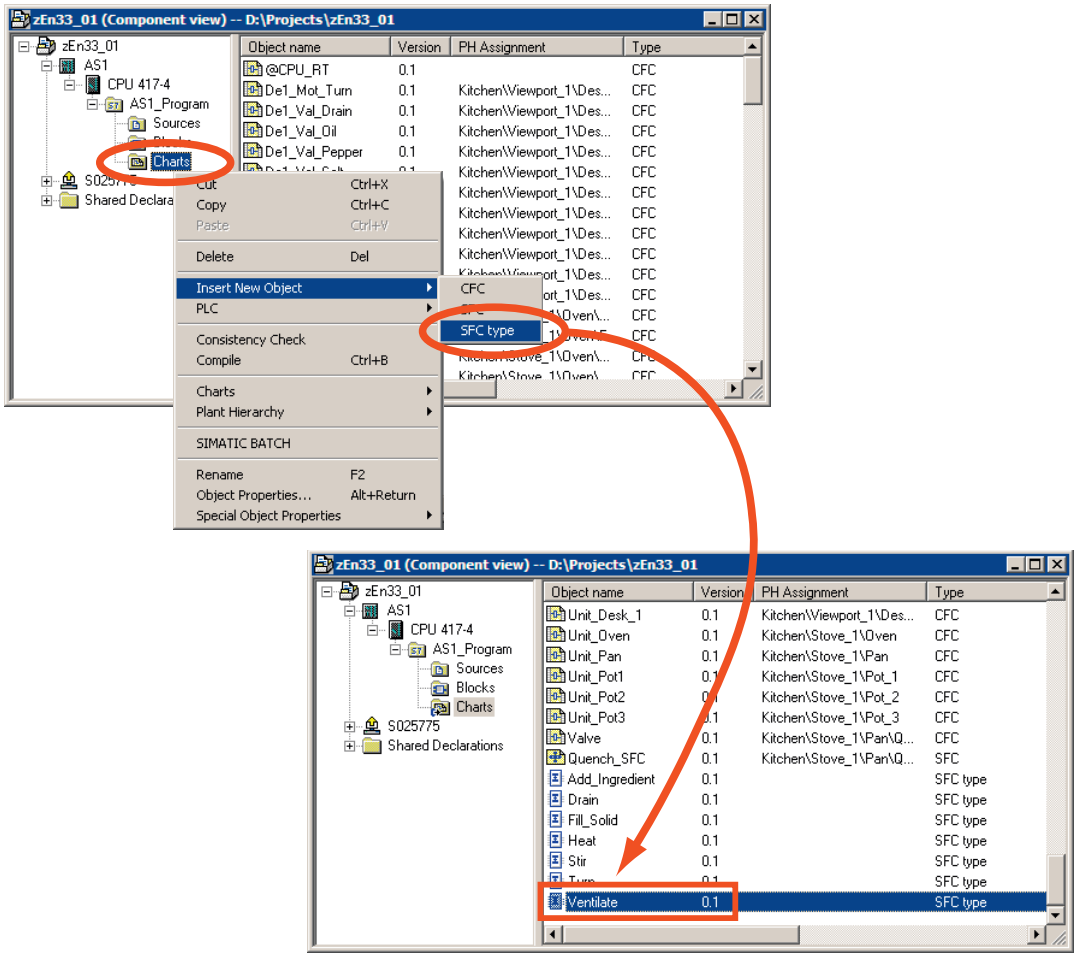
Name	Data type	Comment
T_Duration	Time	Timer for setpoint "Duration", Mode=1

Block contacts

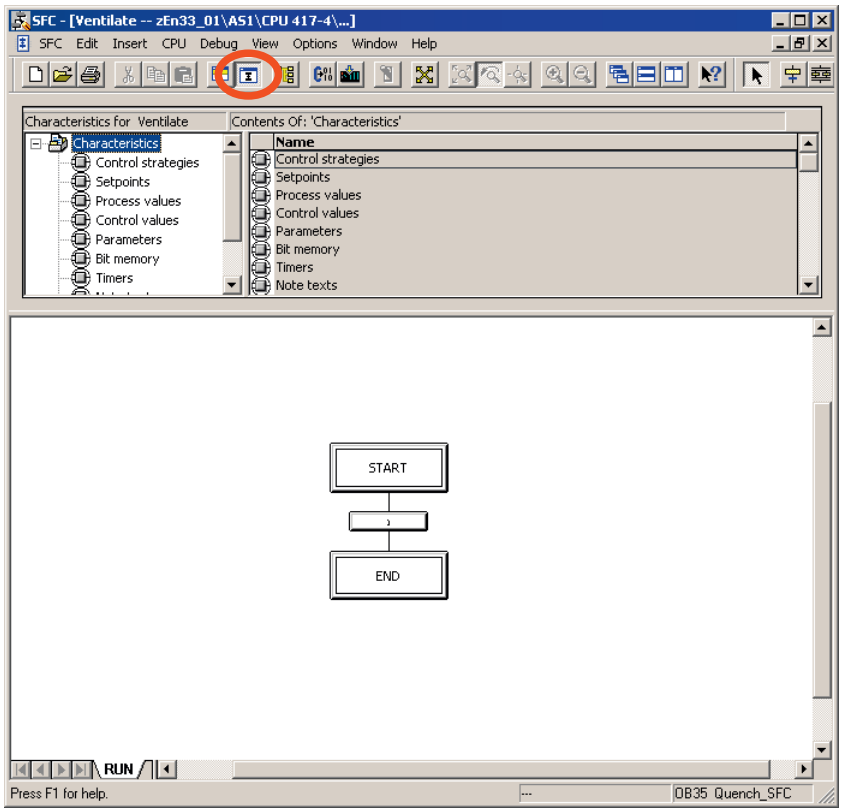
Block name	Data type	Comment
V1	VALVE	Ventilation valve

4.2.2 Chapter 2 Creating SFC Type "Ventilate"

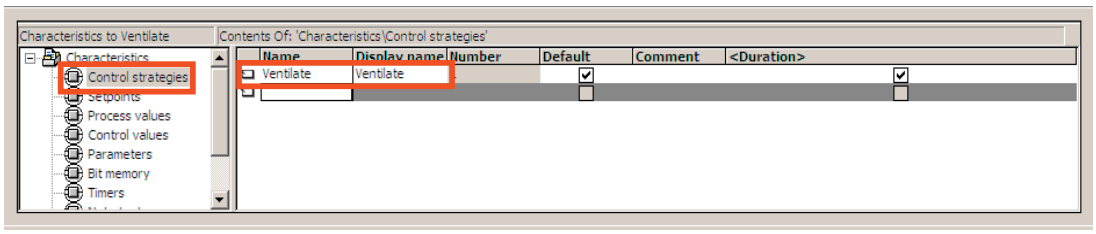
1. Open the Component view and insert the new SFC type "Ventilate".



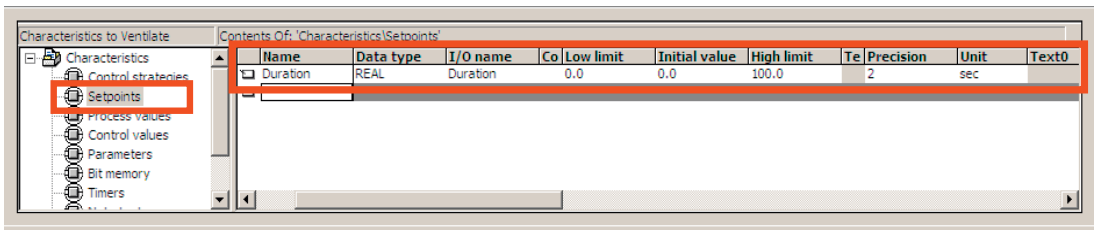
2. Open the characteristics dialog of the "Ventilate" SFC type shown below by double-clicking on it.
   Select the "Characteristics" menu.



3. Select the "Control strategy" characteristic and enter the name "Ventilate" in the right box.



4. 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.

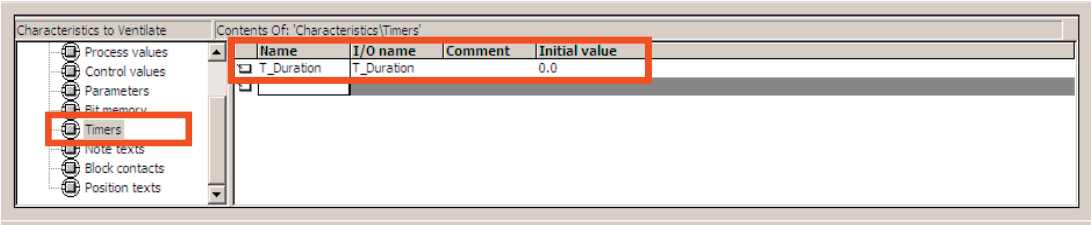


5. Now define the timer. To do this, select the "Timers" characteristic. Enter the name "T_Duration" in the right box. The timers that are used in this way within SFC types, have characteristics similar to the standard "Timer_P" block from the PCS 7 library.

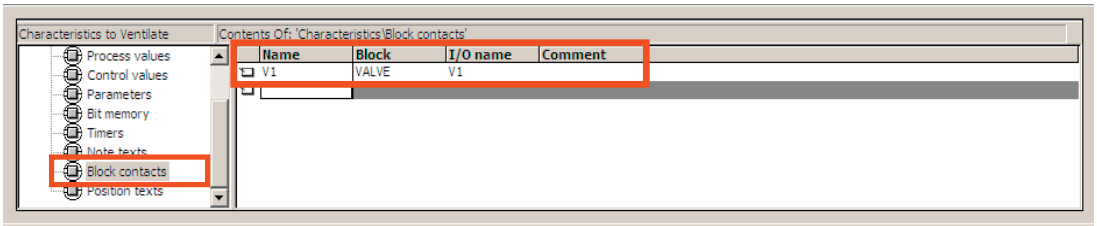
Note:

A pop-up window appears informing you that the TIMER_P block or object "FB5" already exists.

Confirm you entry with "YES".



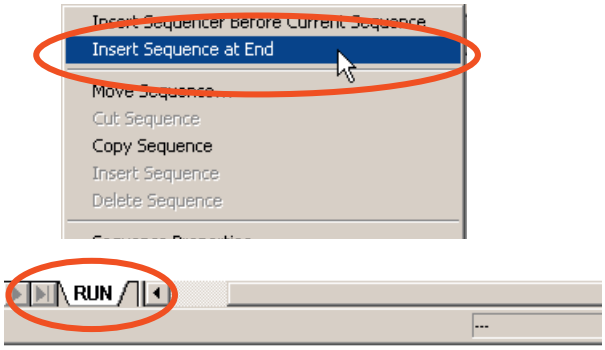
6. In the final step, you will create the valve. Select the "Block contacts" characteristic and enter the name "V1" in the right box. Select the corresponding block types, in this case "VALVE", in the "Block" column.



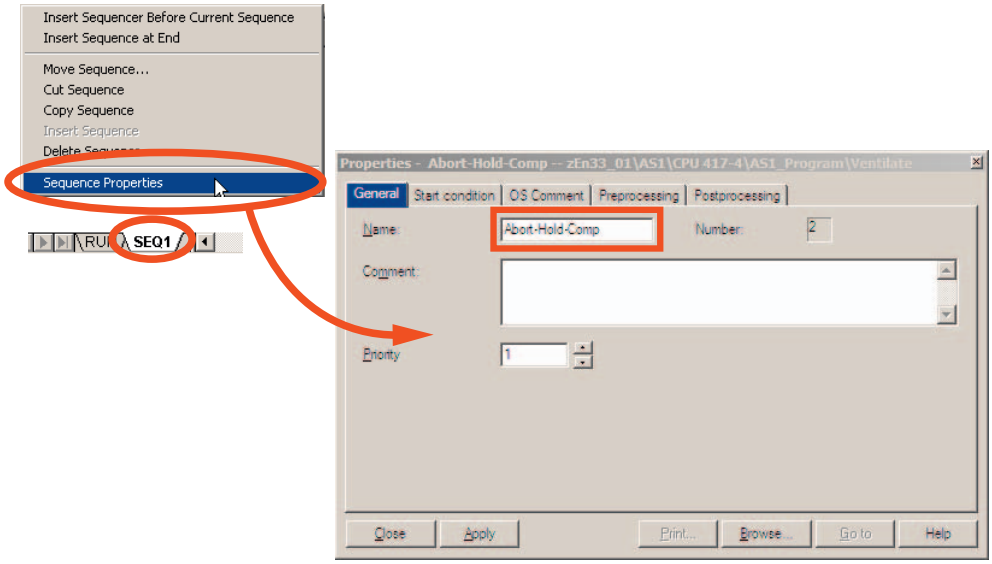
You have now specified all the characteristics required for the "Ventilate" example. The sequencers must now be created and configured.

4.2.3 Chapter 3 Creating Sequencers

The Run sequence path that is processed in the "Run" status has already been created. The sequencer that is processed in the "Holding" "Aborting" "Completing" statuses does not yet exist. Since the content is the same in all three sequencers in this case, you only need to create one sequencer and name it "Abort-Hold-Comp".

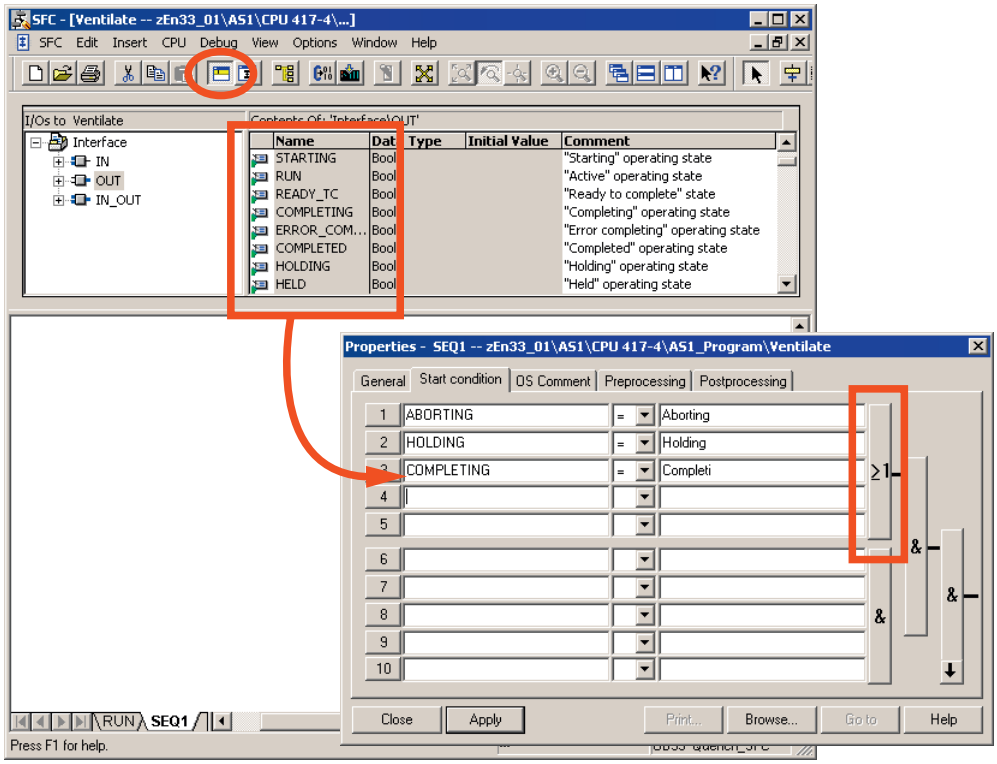


1. To insert a new sequencer, open the "RUN" tab on the right. Select "Insert Sequence at End".
2. A new tab is created called "SEQ1". Set the properties of SEQ1. In the general properties, enter the name Abort-Hold-Comp.

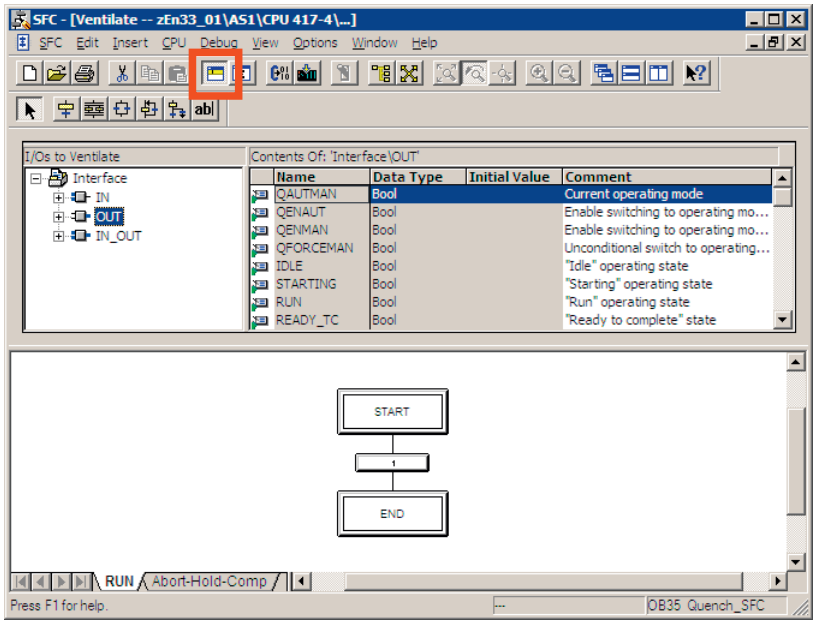


3. We now configure the start conditions of the sequencer in the properties. The start condition is:
   - Aborting=True or Holding=True or Completing=True.
   - Change to the "Inputs/Outputs" view. The I/Os Aborting, Holding and Completing are located in "OUT".
   - Drag the I/Os from the upper section to the dialog for configuring the start condition.

Apply the changes and then close the properties window.



4. The next step is to configure the "RUN" sequencer.
   Remain in the "Inputs/Outputs" view.

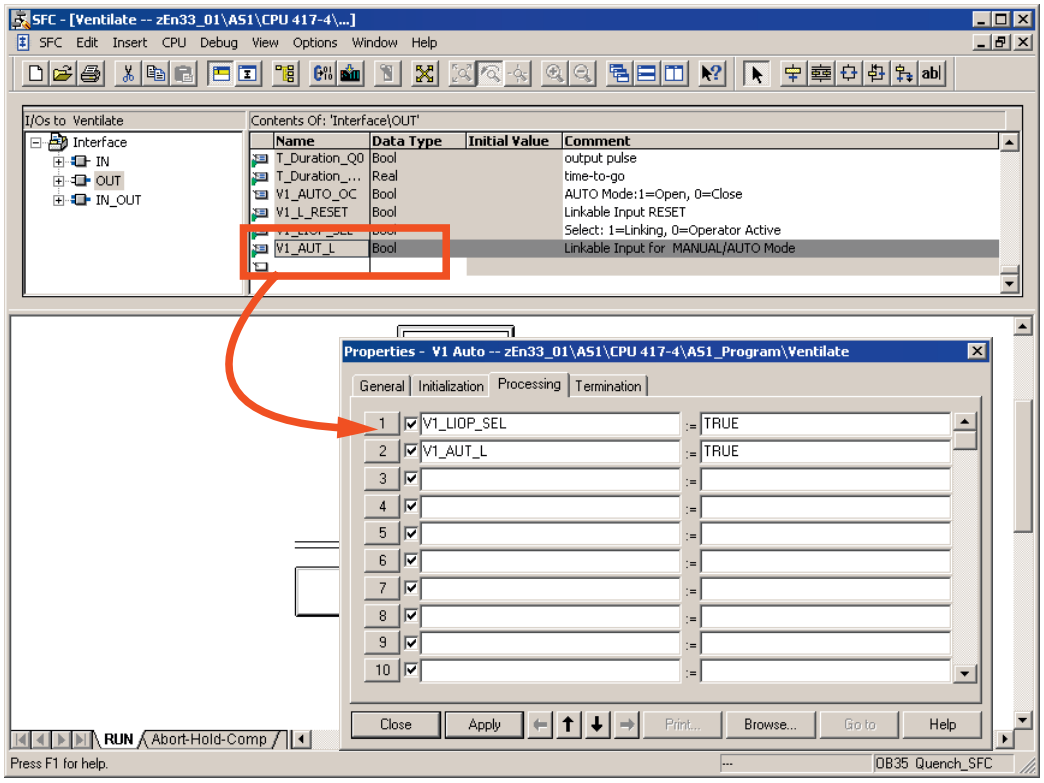


In the left section of the window, you will see the I/Os of the "Ventilate" SFC type grouped according to inputs, outputs and in_outs. In the right section, you see the list of corresponding I/Os.

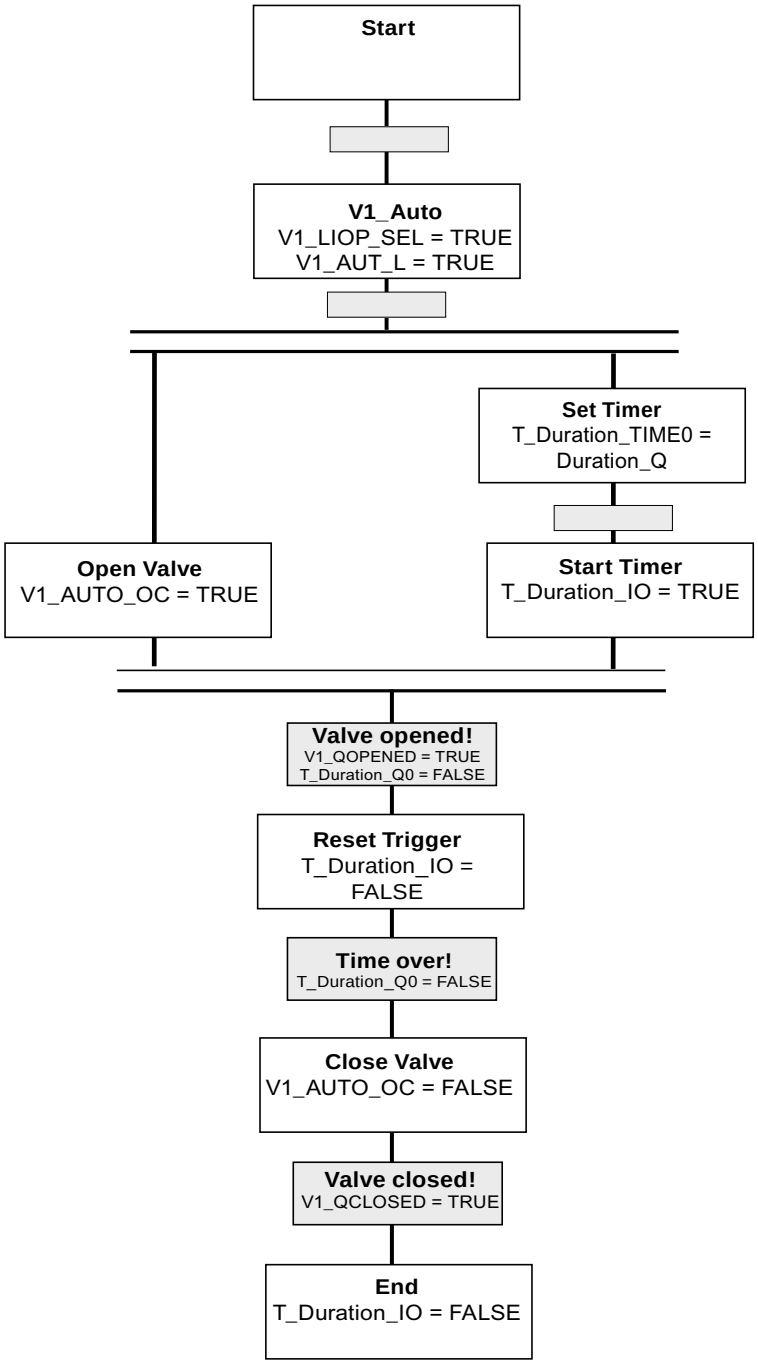
The control outputs for the V1 valve or the T-Duration timer are located under "OUT".

The feedback messages of the V1 valve are created under "IN".

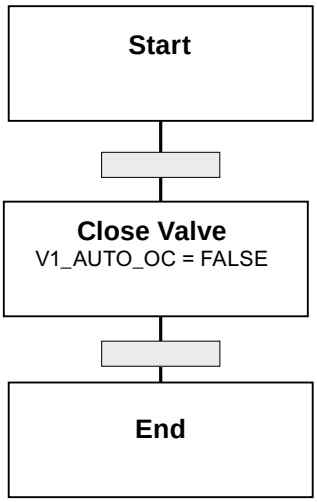
5. Drag the I/Os from the upper part to the dialog for configuring the steps/transitions. The Run and the Abort-Hold-Complete sequencers are structured as shown in Chapter 1. Uses the outlines on the following pages to correctly configure all steps and transitions.



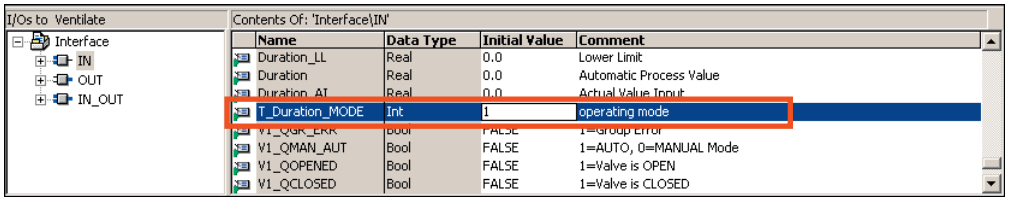
Outline for the "Run" Sequencer (Run=1) for the "Ventilate" Control Strategy (QCS=1)



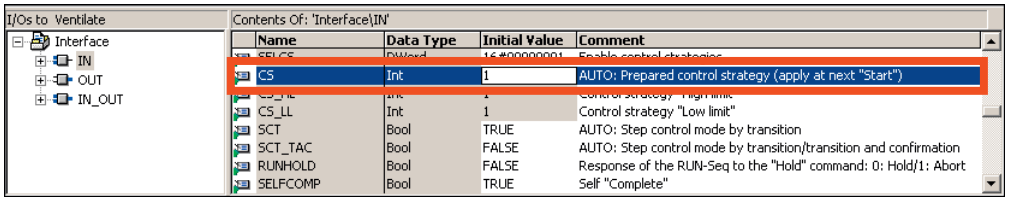
Outline for the "Hold/Abort/Complete" Sequencer (Holding=1 or Aborting=1 or Completing=1)



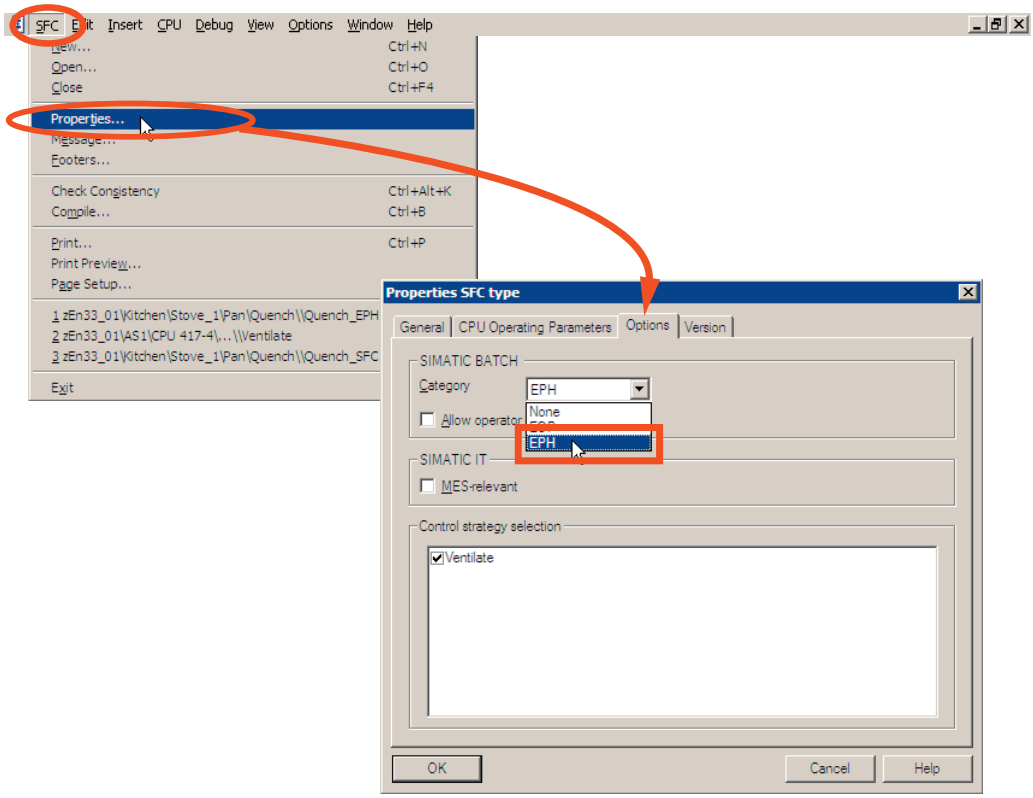
1. Set the start value for the timer mode used to "1" (extended pulse).

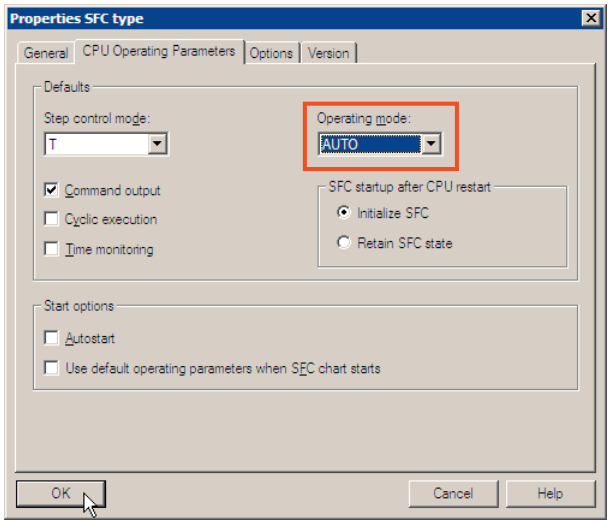


2. Set the start value for the CS parameter (control strategy) to the value 1.



3. Select the SIMATIC BATCH category "EPH".

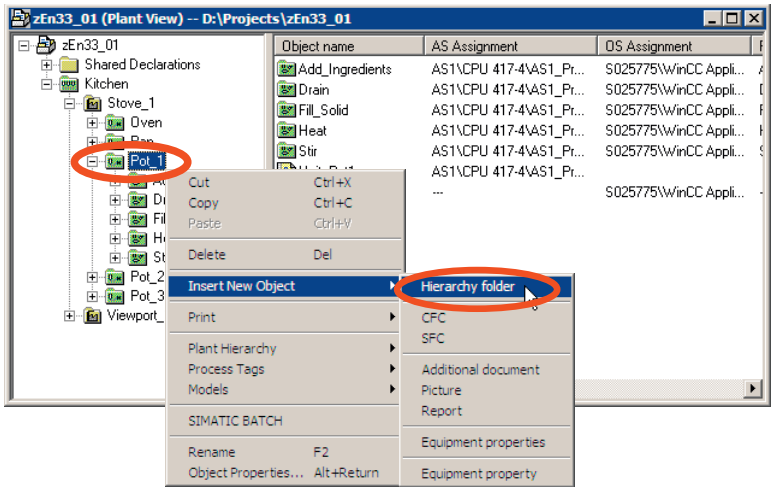




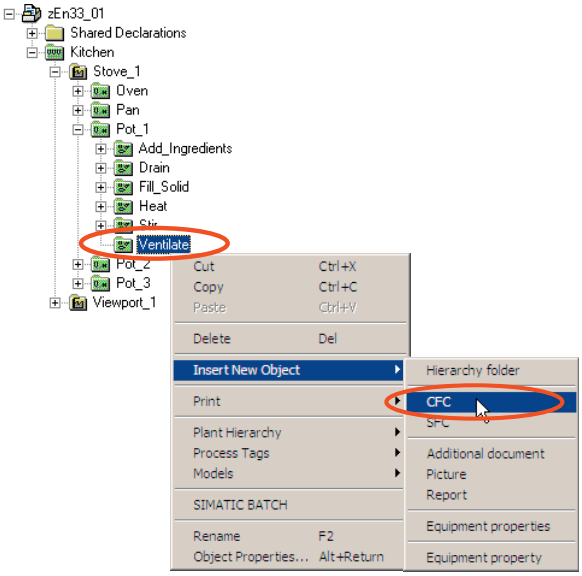
4. Set the AS operating parameter to "Auto" as the default mode.
   This completes all the steps for configuring the "Ventilate" type.
5. Exit the SFC Editor.

4.2.4 Chapter 4 Expanding the Plant Hierarchy

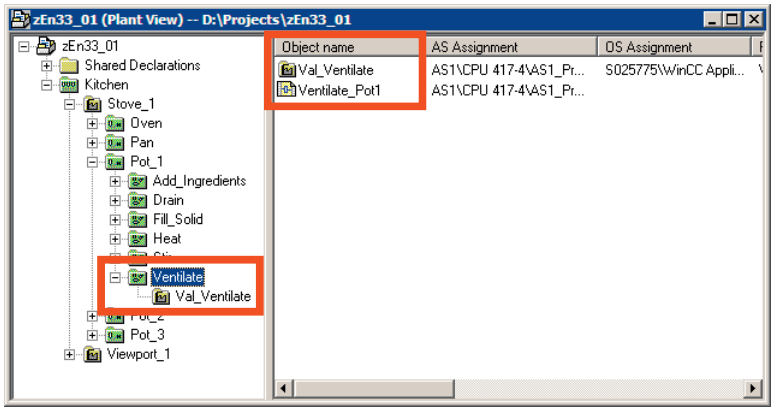
1. Open the Plant view of the project in the SIMATIC Manager. A new "Ventilate" equipment phase needs to be inserted for Pot_1. Create a new hierarchy folder.
   Name the folder "Ventilate".



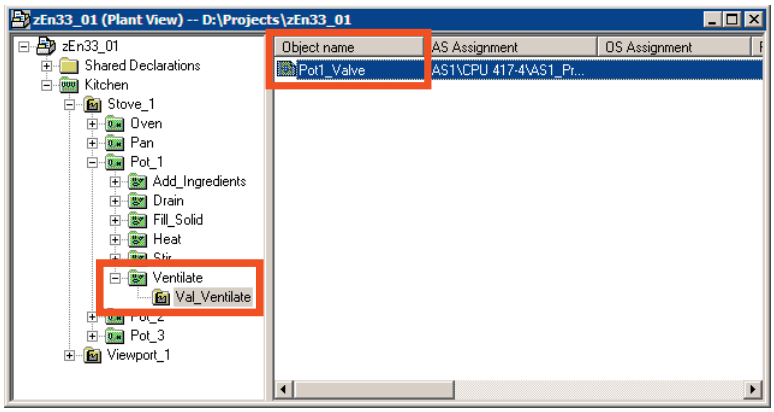
2. Create a CFC chart in the "Ventilate" hierarchy folder. This "Ventilate_Pot1" chart is required for the instance of the SFC type. Now create a "Val_Ventilate" folder in the "Ventilate" folder.



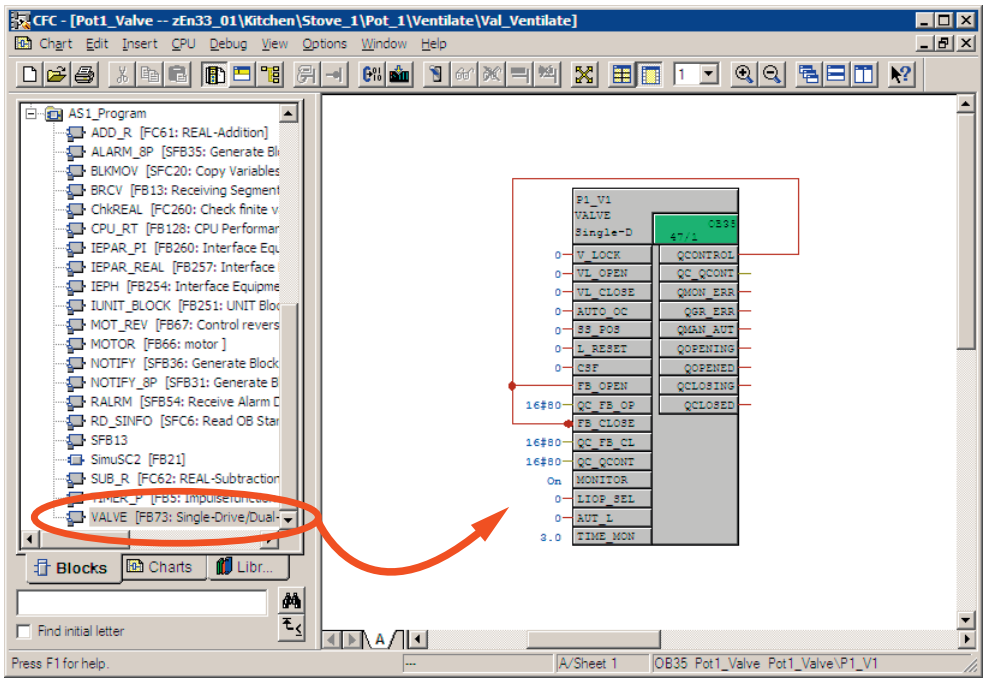
You then have the following screen:



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

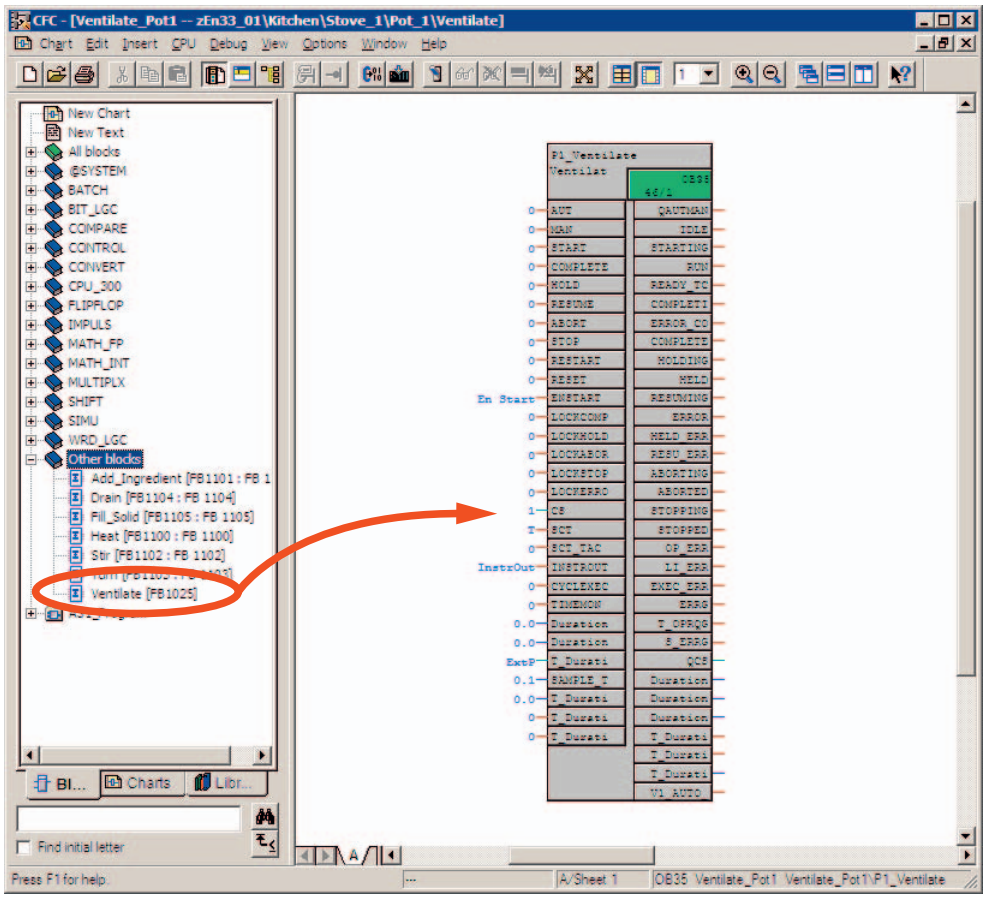


4. Open the CFC chart "Pot1_Valve". Insert a VALVE block with the name P1_V1. To simulate the feedback messages, interconnect the QCONTROL output with the FB_OPEN input and invert the FB_CLOSE input (QCONTROL must first be made visible). You then have the following screen:

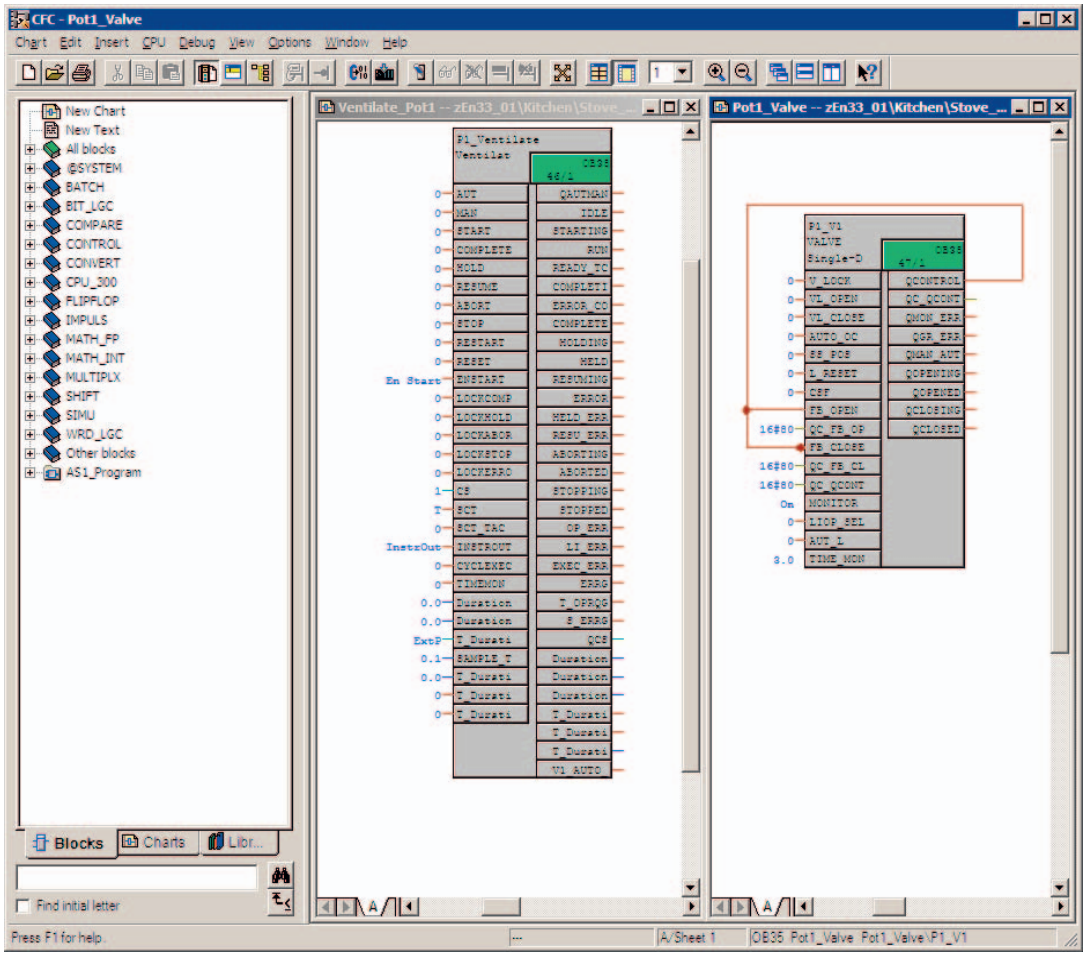


4.2.5 Chapter 5 Creating Instances of the SFC Type "Ventilate" for Pot_1

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



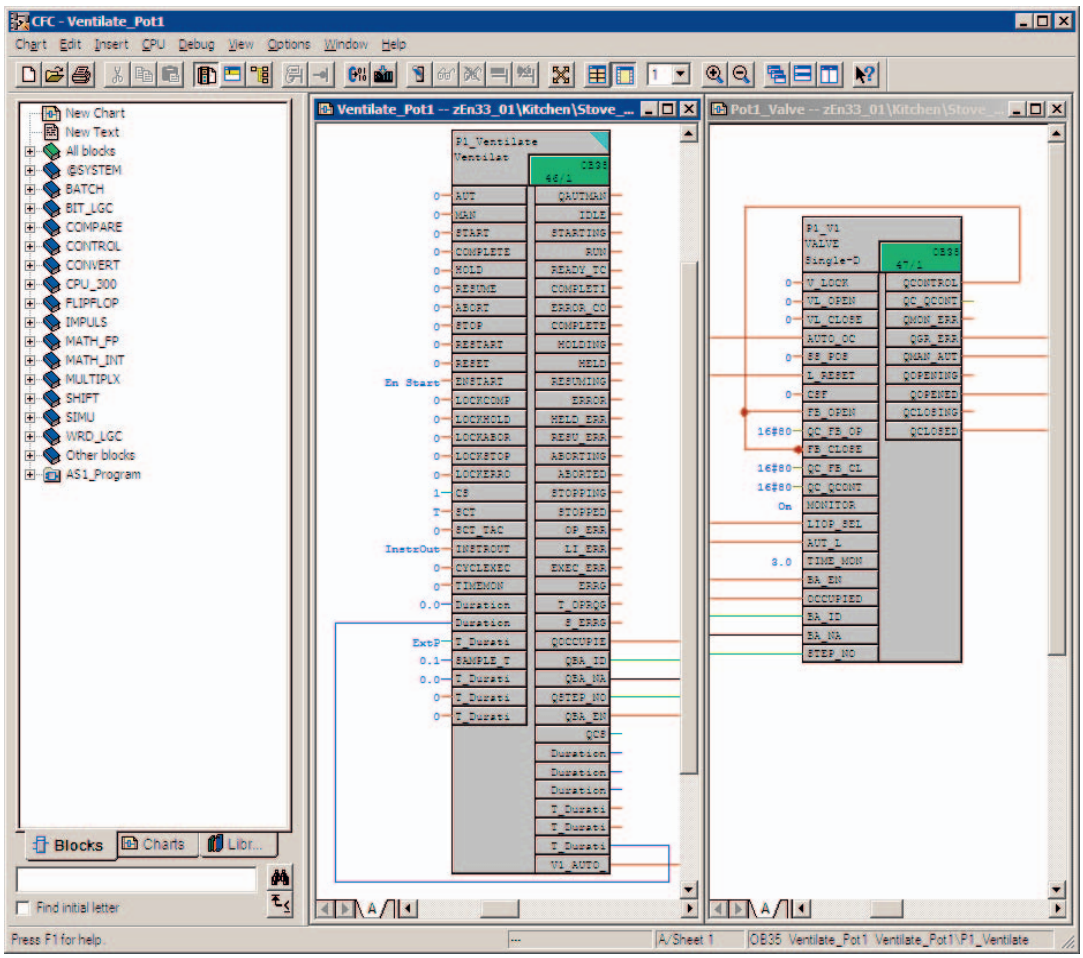
2. Now open the CFC chart "Pot1_Valve" as well and arrange the two windows side-by-side as shown below.



3. The valve P1_V1 must now be interconnected to P1_Ventilate.

   - Select the V1_AUTO_OC output of P1_Ventilate. Select the corresponding valve input AUTO_OC of the P1_V1 valve. All the relevant interconnections to the valve are now created automatically (eight in total).
   - So that all the batch-relevant information that SIMATIC BATCH writes to the block instance of "Ventilate" also arrives at the corresponding valve, the batch-relevant outputs must also 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 valves P1_V1 (BA_EN, BA_ID, BA_NA, STEP_NO,OCCUPIED).
   - Interconnect the "T_Duration_PTIME" output to 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 screen.



Note about creating instances of the "Ventilate" SFC type at Pot_2 and 3: The "Ventilate" equipment phase is inserted at Pots 2 and 3. The procedure is the same as that for Pot 1. Start again at Chapter 4. Create a new "Ventilate" hierarchy folder under the Pot_X hierarchy folder. Continue with Chapter 5. Then the same equipment phase is inserted at Pots 2 and 3. The "Ventilate" type is only defined once, however.

4.2.6 Chapter 6 Compiling and Downloading AS, OS and Batch

Run a changes-only compilation of the AS and then download the newly compiled data to PLCSim with a "changes-only" download.

Note:
You can only do this after the runtime OS has ended.

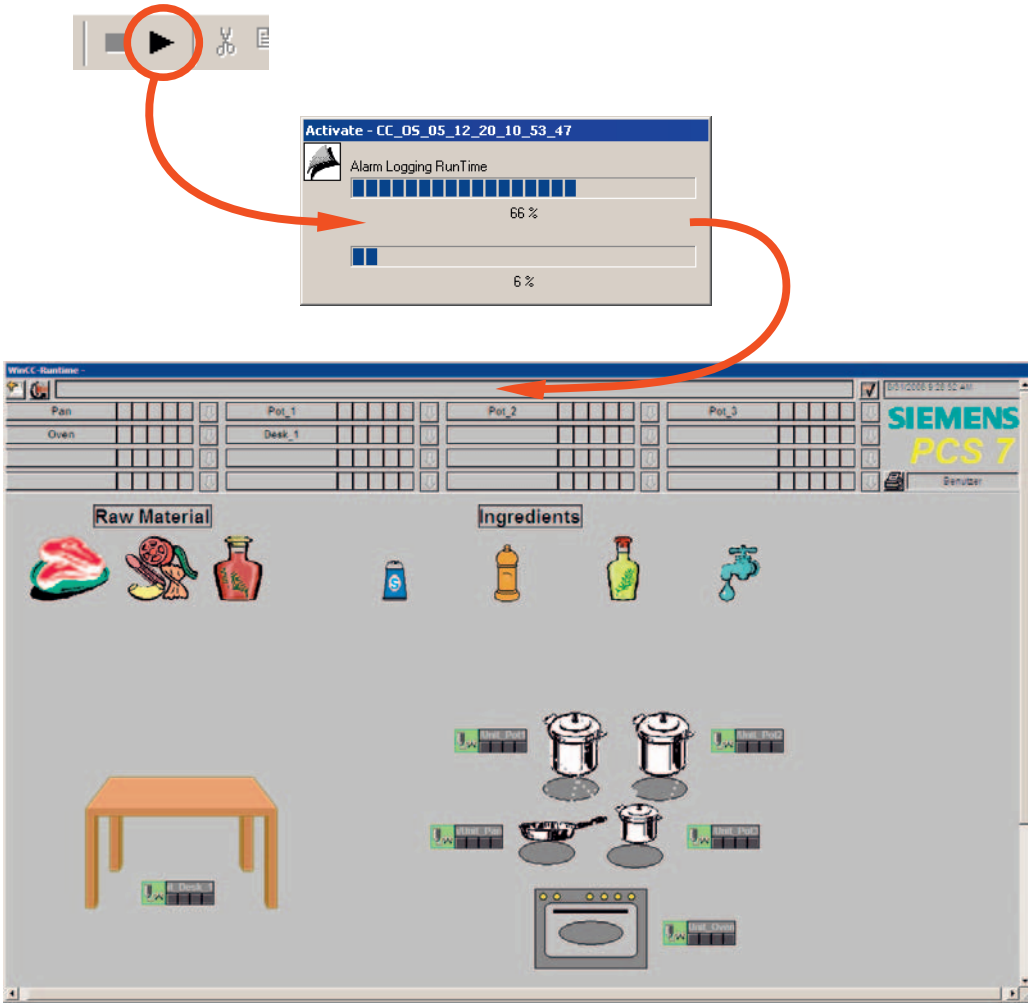
Then run a changes-only compilation of the OS.

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

Select "Batch types". Generate the batch types, compile the batch instances and download the process cell.

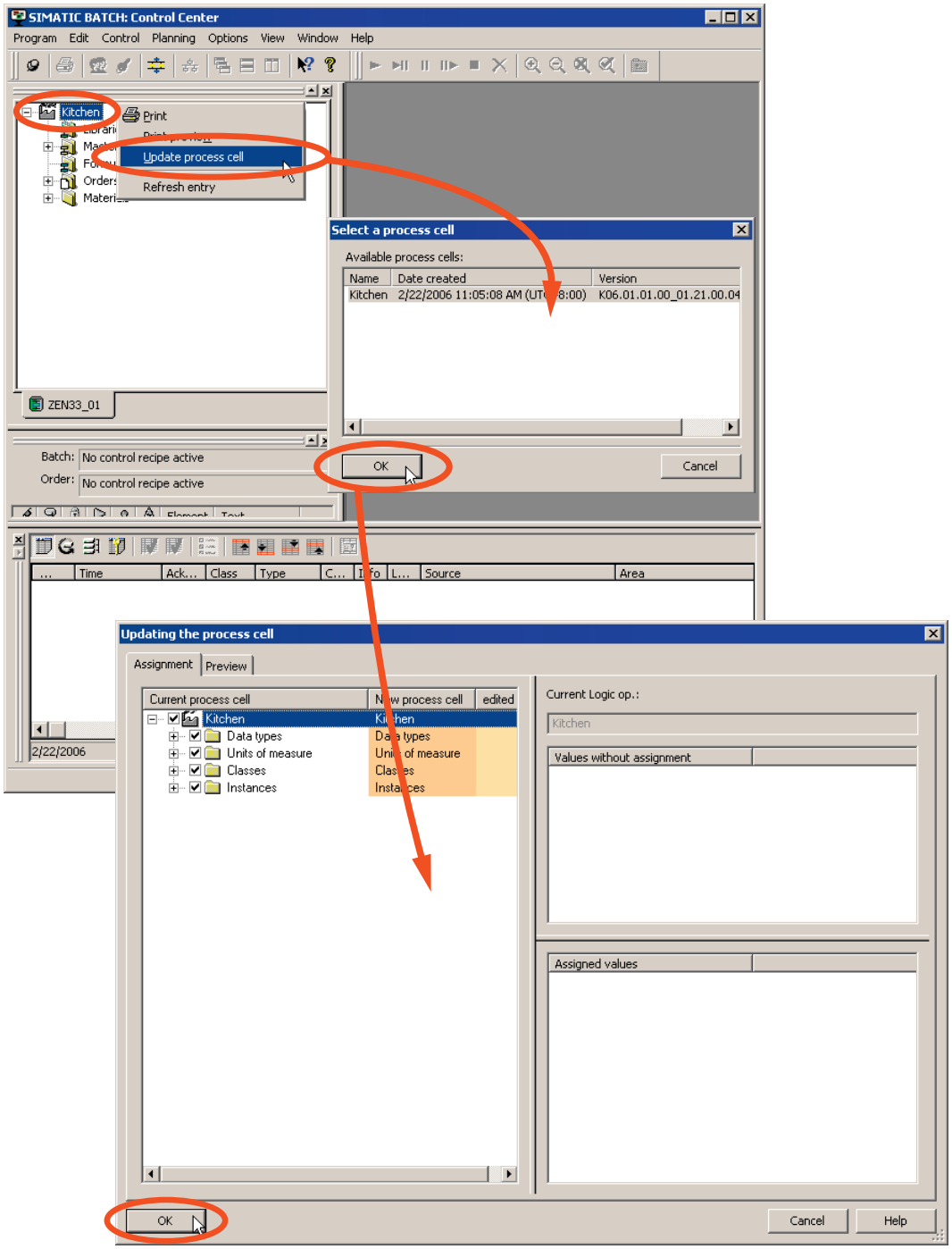
4.2.7 Chapter 7 Expanding a Recipe

1. Start Runtime.



2. The Start Coordinator starts automatically as soon as your WinCC project is in runtime. Wait until it has started all applications completely (BCS and CDV).

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

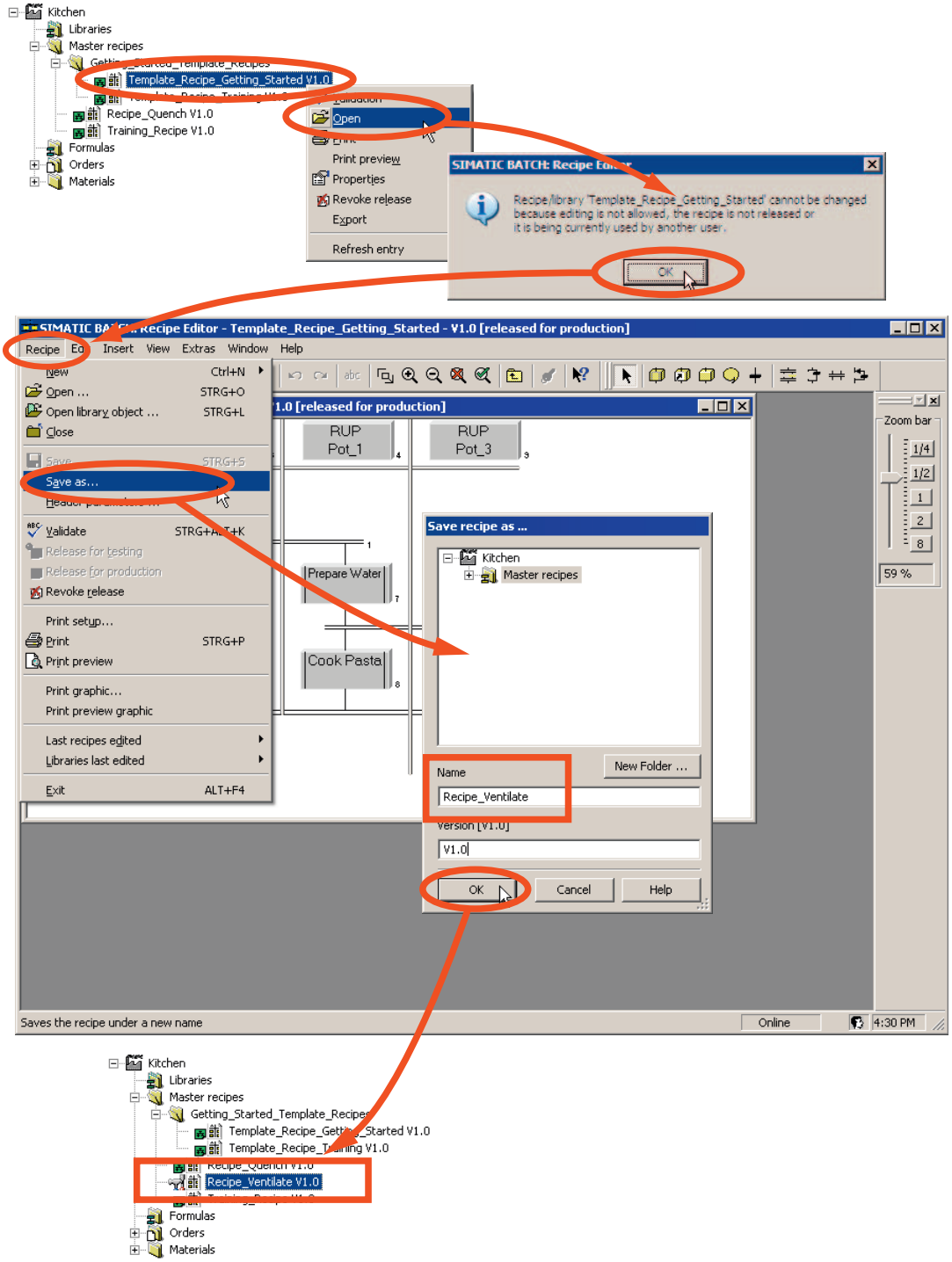


4. After updating, your newly configured "Ventilate" phase is available in the "Pot1" unit.

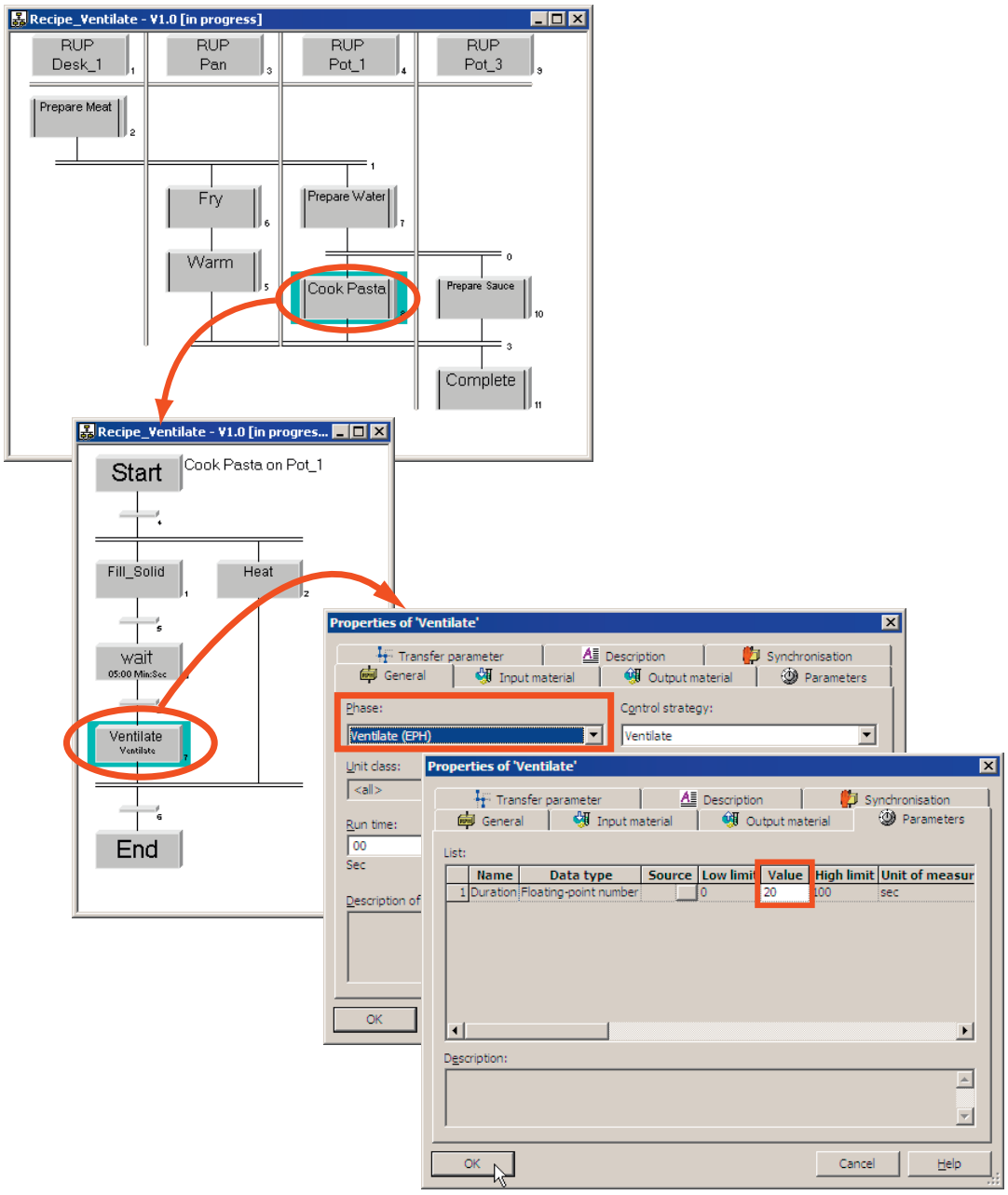
5. Open the "Template_Recipe_Getting_Started" master recipe and save it with the name "Recipe_Quench".

Note:

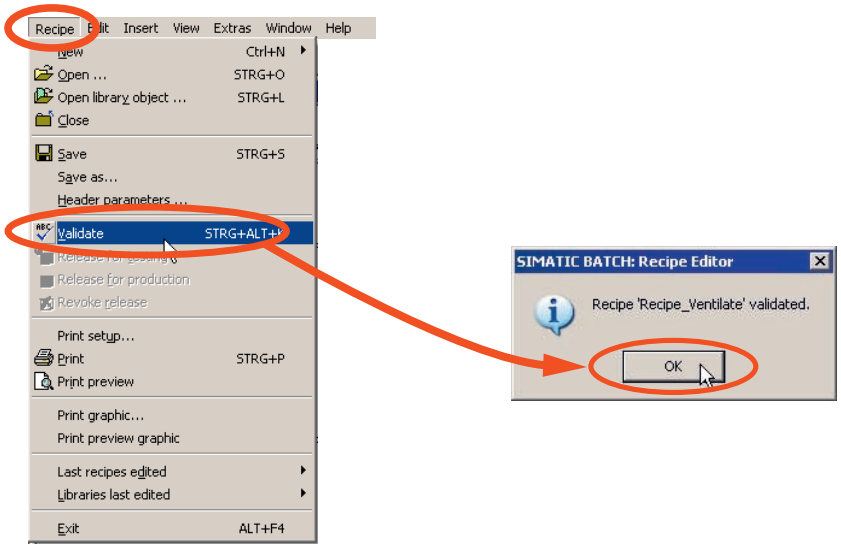
If you cannot modify the recipe, select the option "Allow editing of recipes in the "Release revoked" status in Options - Settings in the Batch Control Center.



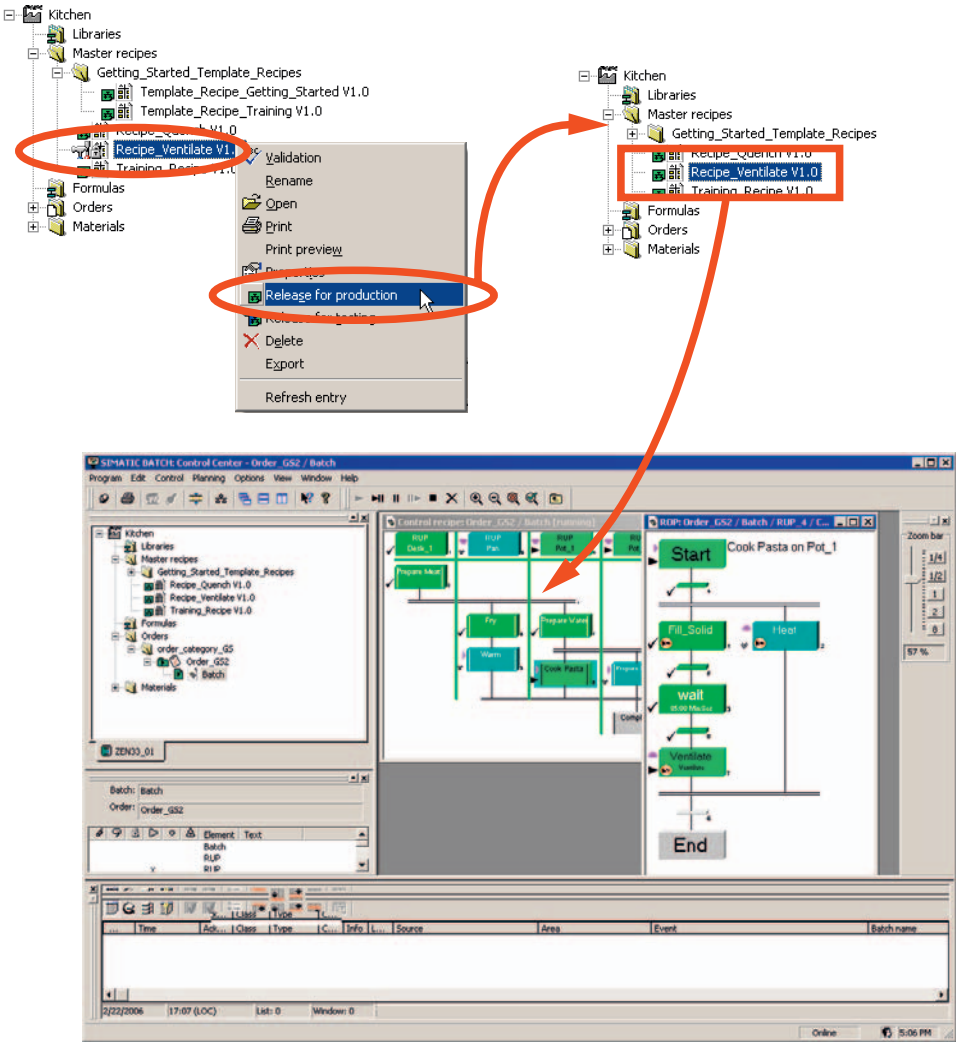
6. Open the "Recipe_Ventilate" recipe you have just created and insert the newly configured "Ventilate" phase in the recipe.



7. Save the recipe and validate it. Then close the Recipe Editor.



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



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