SIEMENS

SIMATIC

**Process Control System PCS 7
SIMATIC BATCH**

Manual

Edition 04/2004
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This manual contains notices intended to ensure personal safety, as well as to protect the products and connected equipment against damage. These notices are highlighted by the symbols shown below and graded according to severity by the following texts:

Danger
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Preface

Purpose of the Manual

This manual describes how batch processes can be automated using the BATCH program package from SIMATIC PCS 7.

Required Basic Knowledge

To understand this manual, you require general experience in the field of automation engineering and process control.

You must also be familiar with working with PCs or similar devices (for example programming devices) and the Windows 2000 operating system.

Before you install PCS 7 components you should always read the *readme.wri* file of the current version of PCS 7.

Where is this Manual valid?

This manual is valid for the BATCH software V6.0 SP4 and the PCS 7 Process Control System V6.0 SP3.

The electronic manual is largely identical to the content of the online help. Due to technical reasons involving the production of electronic manuals, there may be slight differences between the manual and online help systems. In such cases, the information in the online helps is more recent and takes precedence over the information in the manual.

Further Support

If you have any technical questions, please get in touch with your Siemens representative or agent responsible.

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

Training Centers

Siemens offers a number of training courses to familiarize you with the SIMATIC S7 automation system. Please contact your regional training center or our central training center in D 90327 Nuremberg, Germany for details:

Telephone: +49 (911) 895-3200.

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The languages of the SIMATIC Hotlines and the authorization hotline are generally German and English.		

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1 Product Introduction and Installation

1.1 SIMATIC BATCH

1.1.1 What is SIMATIC BATCH?

What is SIMATIC BATCH?

SIMATIC BATCH is a SIMATIC PCS 7 program package with which discontinuous processes, known as batch processes, can be configured, planned, controlled and logged.

Simple batch processes with configurable sequential control systems are automated with the CFC and SFC tools included in the PCS 7 Engineering System. SIMATIC BATCH is used for high requirements with recipe control strategy. With SIMATIC BATCH, recipe structures are designed, modified, and started graphically on an operator station or on a separate PC.

All process and operator data can be collected for a specific batch while it is being made and can then be processed and printed out in a batch log.

Possible Applications of SIMATIC BATCH

SIMATIC BATCH is suitable for batch processes of any complexity. It provides simple support for batch applications ranging from small to extremely large.

The main features of SIMATIC BATCH are as follows:

- Simple, graphic recipe creation

- Control and monitoring of recipe execution in the same graphic representation as used in recipe creation

- Control strategy with data from multiple programmable logic controllers

- Integrated permission management with detailed access permissions

- End-to-end logging of all events (including manual intervention) for comprehensive production documentation

- Simple and clear batch planning, when required with interfacing to higher level PPS systems

- Modular expandability

- Application of NAMUR and ISA SP88 standards

1.1.2 Functions of SIMATIC BATCH

SIMATIC BATCH supports you throughout all the stages involved in the automation of batch processes. The functions provided by SIMATIC BATCH can be divided into four basic areas:

- Recipe system:
  Creation and management of any number of master recipes and library operations

- Batch planning:
  Planning and replanning of batches and production orders

- Batch control:
  Execution, visualization, and control of batches released for production and the corresponding control recipes as well as visualization of the current unit allocation

- Batch data management:
  Acquisition, storage and logging of batch data

1.1.3 Migration from Older Projects

Migration

Projects created with BATCH *flexible* **V4.02** can be converted to SIMATIC BATCH **V6.0**. A migration tool is provided to help you migrate your existing SIMATIC BATCH applications to the new version.

Note:

BATCH *flexible* V4.02 projects can be migrated so that they can continue to be used in SIMATIC BATCH V6.0 with all the functionality of the V4.02 version.

BATCH *flexible* V4.02 and V6.0 use different interface blocks in the programmable controller for controlling the batch process. Migration can be performed in such a way that after migrating to V6.0,

- you will **not** have to interconnect the interface blocks again

- · modify the content of the programmable controller

Migrated Data

The migration tools enable you to move the following data from BATCH *flexible* V4.02 to V6.0:

- Process cell data (including units of measure, user data types, and materials)

- Unit recipes (now known as master recipes in V6.0:)

The following data are **not** moved from the BATCH *flexible* V4.02 database to V6.0 during a migration:

- Production order data

- Batch data (including control recipes)

- Users/user permissions

Further Information

You will find information on migrating from V4.02 to V6.0 in the section "Migration V4.02 -> V6.0". This section describes the following in detail:

- Migration requirements

- Overview of the basic migration procedure

- Migration step-by-step

1.1.4   Components of SIMATIC BATCH

SIMATIC BATCH consists of the following components:

- Batch Control Center (BatchCC)

- BATCH Recipe Editor

- BATCH Report

- BATCH Control Server

- BATCH Interface Blocks

1.1.4.1   Batch Control Center (BatchCC)

Definition

The Batch Control Center (BatchCC) is the central component in SIMATIC BATCH for batch planning and batch control. BatchCC manages all the data relevant to SIMATIC BATCH. This means that all batch data is logged in BatchCC.

The Batch Control Center is started on the run-time computers according to the settings made in the Batch Launch Coordinator.
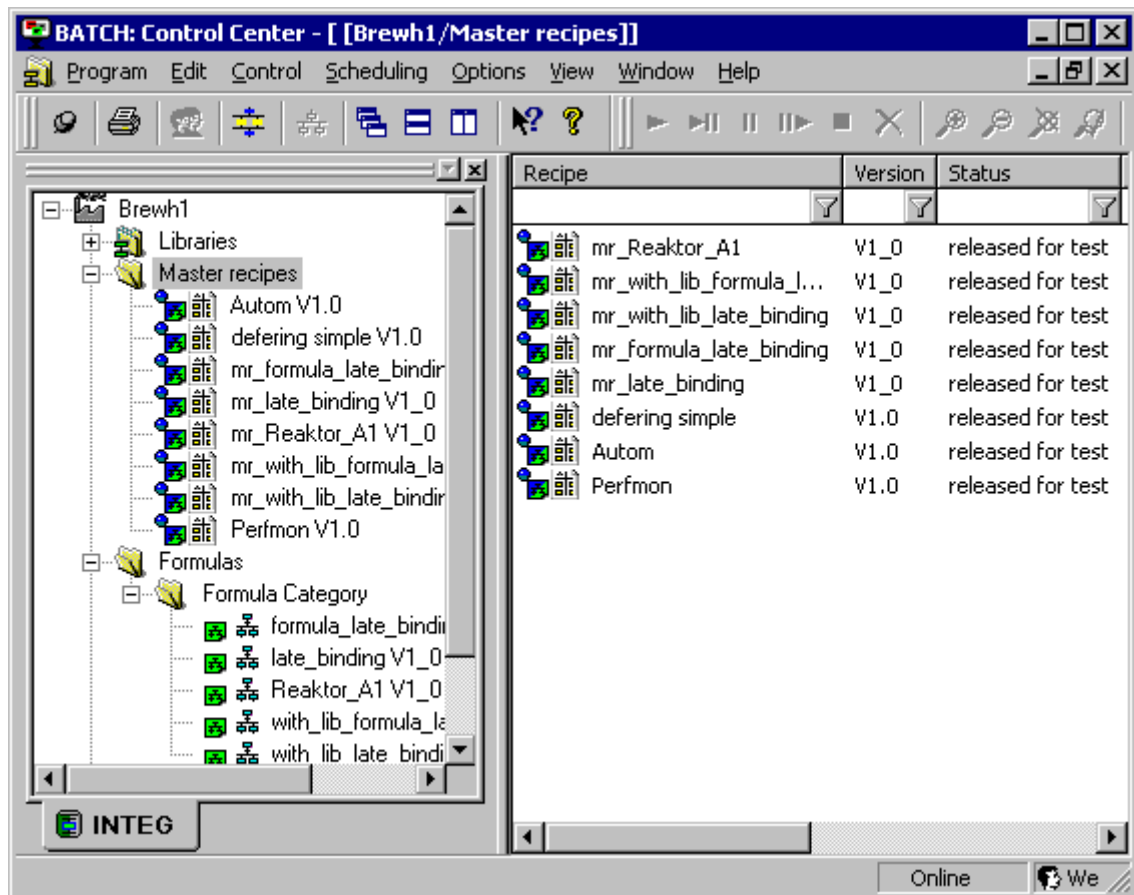
Functions

With the Batch Control Center (BatchCC), you can do the following:

- Read in the process cell data from the basic control.

- Specify the user permissions for all functions of BATCH.

- Define the names and codes of the materials used.

- Manage master recipes and start the BATCH Recipe Editor to configure the recipe structure.

- Manage libraries with recipe elements (library operations).

- Edit and manage the formula categories and corresponding formulas.

- Plan production orders using master recipes and batches.

- Start and control batch executions.

- Monitor and troubleshoot batch executions.

- Log recipes and batch data

1.1.4.2   BATCH Recipe Editor

Definition

The BATCH Recipe Editor is part of SIMATIC BATCH and provides you with a graphic user interface for creating and modifying master recipes and library operations. Recipe creation is based on the BATCH objects from the Batch process cell configuration in the engineering system of SIMATIC PCS 7, for example, units and equipment phases.
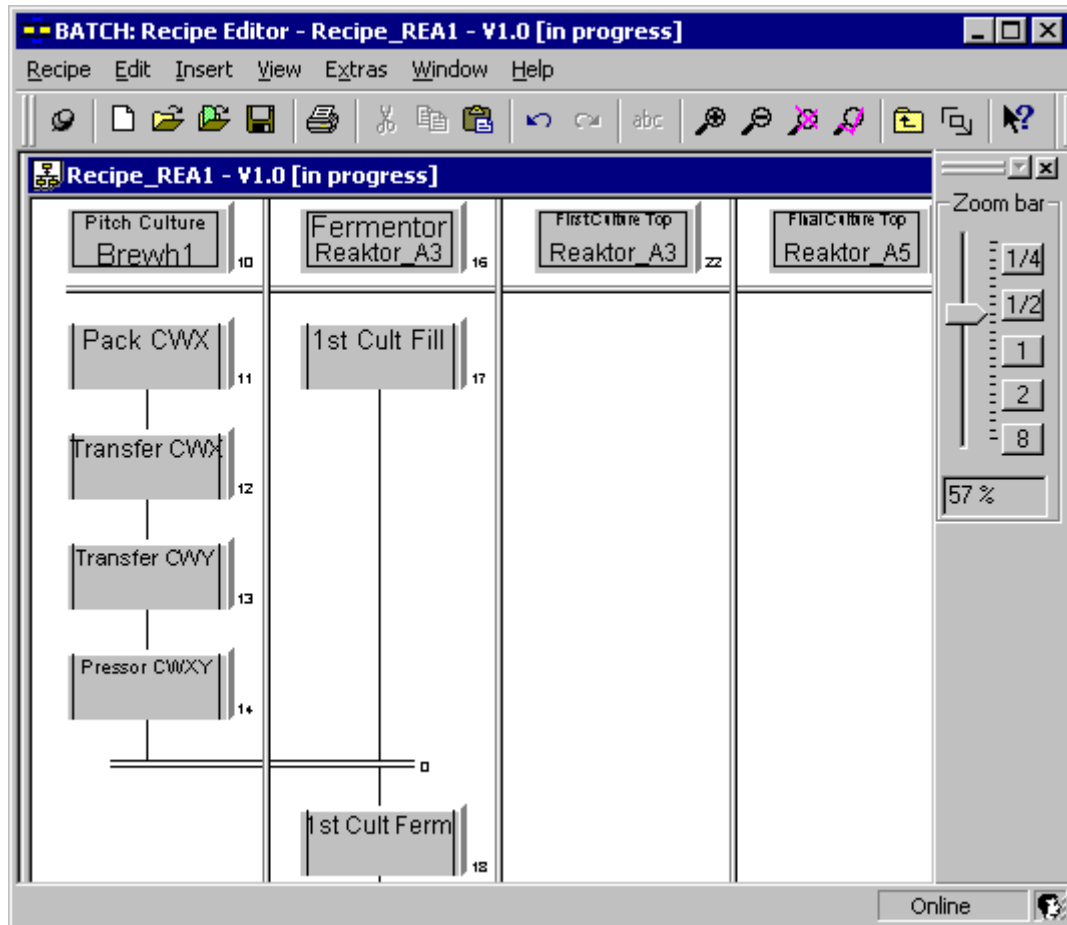
Functions

With the BATCH Recipe Editor, you can do the following:

- Create new master recipes and library operations.

- Modify existing master recipes and library operations (structural or parameter modifications).

- Log the master recipes and library operations.

- Release master recipes and library operations for testing or for production.

- Validate recipes.

When working in the editor, the familiar functions known from MS Windows programs such as paste, cut, copy, undo and redo can be used on single or grouped objects.

1.1.4.3   BATCH Report

Definition

BATCH Report allows documentation of recipes and batch data in the form of logs.

- The "off-the-shelf" recipe report contains all the data required for production. This includes the recipe header data, the input material and output material list and the procedural rules.

- The batch report contains all the information required for the reproducibility of the batch process, the quality assurance and the fulfillment of legal requirements. These include the identification data, control recipe data, effective production data, chronological sequence of the steps, error and disturbance messages as well as operator intervention.

BATCH Report is fully integrated in the user interface of BatchCC. The recipe reports and batch reports are created in BatchCC and can be displayed and printed out in BatchCC at any time.

To be able to view recipe reports and batch reports on other computers, for example, at a later time, the Viewer of BATCH Report is available as a separate setup.

Functions

Within an open report (recipe or batch report) you can browse through the individual elements using a hierarchical table of contents:

- Recipe/batch
- Recipe unit procedure
- Recipe operation
- Recipe phase
- Transition

1.1.4.4   BATCH Control Server

Definition

The BATCH Control server is a component of SIMATIC BATCH. The BATCH Control server handles communication with the process and controls and monitors execution of the current batches.

The BATCH Control Server does not have its own user interface. The BATCH Control Server is started on the run-time computer.

Functions

Once a batch has been released and started, the BATCH Control server takes over monitoring of its execution. The batch data (online data) of SIMATIC BATCH are stored temporarily in the online data management of SIMATIC BATCH.

To acquire batch data (messages), there is a connection to the message server and to the process data acquisition of the PCS 7 OS (WinCC).

1.1.4.5   BATCH Interface Blocks

Introduction

SIMATIC BATCH V6.0 can use the new functionality of the SFC types in the engineering system to define operation and phase types. As an alternative, SIMATIC BATCH V6.0 continues to provide special interface blocks as the communications interface to the processing programs on the programmable controller. These so-called BATCH interface blocks are supplied with a block library with SIMATIC BATCH (see also section "Using BATCH Interface Blocks").

Definition

The BATCH interface blocks form the communications interface between SIMATIC BATCH and the processing programs of the process cell control system in the programmable controller. The BATCH interface blocks are implemented as CFC blocks and are inserted in the CFC charts according to their function and stored in the corresponding hierarchy folders in the plant view in the SIMATIC Manager.

Functions

Using the BATCH interface blocks along with SIMATIC BATCH makes the following functions possible:

- Controlling the Procedure:
  The IEPH/IEOP blocks are for this purpose. These provide the commands (for example start or hold) of the control recipe steps from the batch control to the processing blocks (for example: SFC_CTL or user blocks). The processing blocks report their current statuses back to the batch control.

- Assigning and releasing a unit via a running control recipe:
  The IUNIT_BLOCK blocks are for this purpose.

- Summing up actual values for the creation of transition conditions and for logging measured values in the batch log:
  The TAG_COLL blocks are for this purpose.

- Transferring setpoint and actual values:
  The IEPAR blocks are for this purpose. The batch control writes the recipe parameters (setpoints) for the processing blocks into these blocks via the IEPH/IEOP blocks. The processing blocks write the result data (actual values) into the IEPAR blocks so that they can be stored as batch data by the batch control once again using the IEPH/IEOP blocks.

1.2 Configuration Options with SIMATIC BATCH

1.2.1 Client/Server Architecture of SIMATIC BATCH

Client/Server Architecture

SIMATIC BATCH is usually distributed on several BATCH clients and a BATCH server all working with the same process cell project. The BATCH Server provides the services for the BATCH clients that form the interface to the operator (the HMI) in other words function as operator control terminals.

Interaction with PCS 7 OS

SIMATIC BATCH is linked to the PCS 7 OS at run time.

- Communication with the programmable controller (for example writing recipe parameters or reading process values) is handled by the data manager of the PCS 7 OS. In other words, SIMATIC BATCH does not have its own interface to the programmable controller.

- The BATCH Server and the OS server of the PCS 7 operator stations generally run on separate computers. In the batch process cell configuration, the PCS 7 operator stations that are relevant for the batches are made known to the BATCH Server.

- BATCH Clients can run on a PC as well as together with OS Clients on a computer.

Sample Configuration
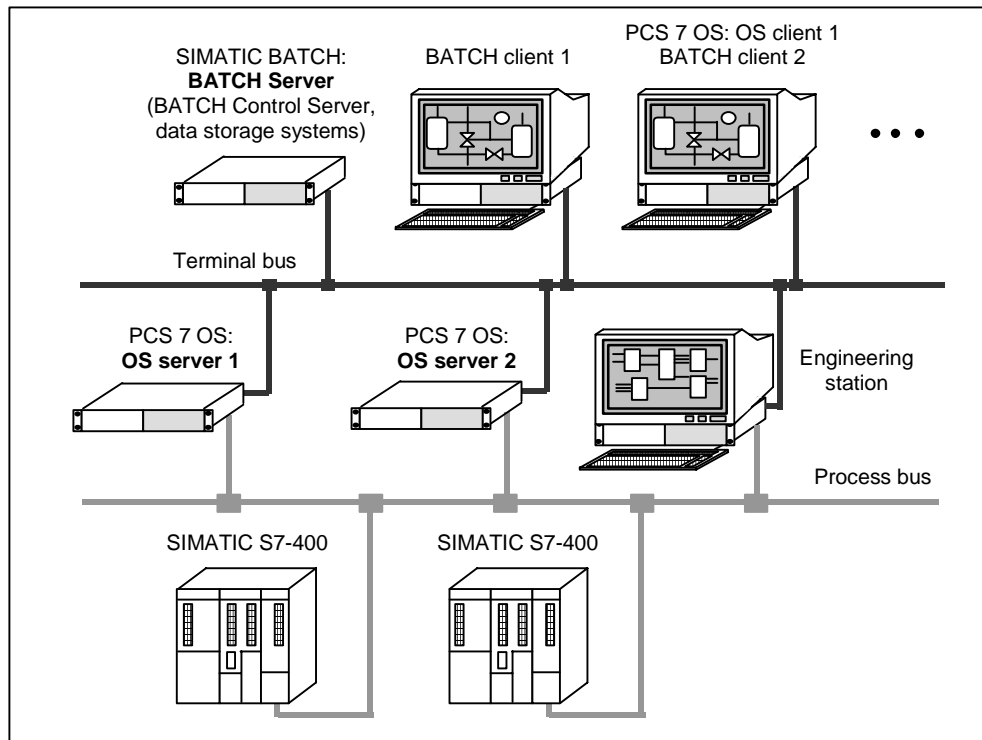
Large PCS 7 projects with distributed PCS 7 operator stations

SIMATIC BATCH supports the model of distributed operator stations in large PCS 7 projects. This means that with suitable configuration in the engineering system, SIMATIC BATCH can access all operator stations and therefore all programmable controllers in the PCS 7 project.

Solution with One PCS 7 OS (No Distributed PCS 7 Operator Stations)

The configuration described so far, applies to the concept of distributed PCS 7 OSes. If one **PCS 7 OS** is used in a small configuration, this PCS 7 OS and the BATCH Server will be on the same computer. This computer then also has an interface to the SIMATIC S7-400.

Configuring in the Engineering System

BATCH Servers and BATCH clients are configured just like the OS servers and OS of the PCS 7 operator stations in the SIMATIC Manager of the Engineering Station and downloaded from there.

Maximum Number of BATCH Clients

A maximum of 32 BATCH clients can be connected to one BATCH server.

1.2.2   Distribution of the BATCH Applications

SIMATIC BATCH provides a wide range of options for distributing BATCH applications on various computers:

Variant	Label	Possible Configurations
1	Standalone level 1	BATCH Control Server, all data storage, BATCH Client Application on one computer - together with a PCS 7 OS server and OS client.
2	Standalone level 2	BATCH Control Server, all data storage, BATCH Client Application on one computer - separated from a PCS 7 OS server and OS client.
3	Distributed system level 1	BATCH Control Server and all data storage on one computer, BATCH Client Application on the corresponding separated computer – separated from PCS 7 OS server and OS client

Data Storage Systems

SIMATIC BATCH operates with the following three databases:

- Project DB: Data storage for user permissions

- Offline DB: Data storage for recipes, formulas, materials

- Online DB: Data storage for batches

BATCH Server

The BATCH Control Server and the Batch data management are always located on the BATCH Server.

BATCH Clients

The following BATCH client applications can be distributed on the BATCH clients as options:

- Batch Control Center (BatchCC)

- BATCH Recipe Editor

- API Interface

Further references

You will find a detailed description of the possible distribution and installation of batch applications in the manual *Process Control System PCS 7; PC Configuration and Authorization*.

1.2.3 Interface to MES/ERP

With the *API interface* optional package for SIMATIC BATCH, you can interface online and offline functions of SIMATIC BATCH directly to an OEM system or any MES/ERP application. The API interface provides both a C interface (CSV data format) as well as a COM interface (XML data format).

Please check the readme and the online help on the optional software *API interface* for information on its usage and configuration options.

1.3　Installation

1.3.1　The SIMATIC BATCH Product

Introduction

SIMATIC BATCH is available as a basic package with a series of optional packages for step-by-step expansion and optimization.

Basic Package

The basic package supports you throughout all the stages involved in the automation of batch processes. The basic package provides you with the following components:

```
┌──────────────────────────────────────────────────────────────────┐
│                          Basic Package                             │
│  ┌──────────────────────────┐   ┌──────────────────────────────┐  │
│  │ BATCH client applications│   │  BATCH server applications   │  │
│  │                          │   │                              │  │
│  │  ┌────────────────────┐  │   │  ┌────────────────────────┐  │  │
│  │  │ BATCH Control Center│ │   │  │ BATCH Control Server   │  │  │
│  │  │    (BatchCC)       │  │   │  │ batch data management  │  │  │
│  │  │   BATCH Report     │  │   │  └────────────────────────┘  │  │
│  │  └────────────────────┘  │   └──────────────────────────────┘  │
│  │                          │   ┌──────────────────────────────┐  │
│  │  ┌────────────────────┐  │   │   BATCH interface blocks     │  │
│  │  │ BATCH Recipe Editor│  │   │                              │  │
│  │  │   (flat recipes)   │  │   │  ┌────────────────────────┐  │  │
│  │  └────────────────────┘  │   │  │ IEPH, IEOP, TAG_COLL,  │  │  │
│  └──────────────────────────┘   │  │ IUNIT_BLOCK, IEPAR...  │  │  │
│                                 │  └────────────────────────┘  │  │
│                                 └──────────────────────────────┘  │
│  ┌──────────────────────────────────────────────────────────────┐ │
│  │                      BATCH Engineering                        │ │
│  │  ┌────────────────────────────────────────────────────────┐  │ │
│  │  │  •  ES basic functionality up to 150 process objects   │  │ │
│  │  └────────────────────────────────────────────────────────┘  │ │
│  │  ┌────────────────────────────────────────────────────────┐  │ │
│  │  │ The engineering software of the basic package can be   │  │ │
│  │  │ expanded in **three expansion stages** to suit the     │  │ │
│  │  │ plant size:                                            │  │ │
│  │  │  •  ES functionality up to 600 process objects         │  │ │
│  │  │  •  ES functionality up to 1800 process objects        │  │ │
│  │  │  •  ES functionality > 1800 process objects            │  │ │
│  │  └────────────────────────────────────────────────────────┘  │ │
│  └──────────────────────────────────────────────────────────────┘ │
└──────────────────────────────────────────────────────────────────┘
```

Note:

BATCH Engineering: The number of process objects (PO) is the sum of the BATCH interface blocks (IEOP, IEPH, IUNIT_BLOCK).

The number of Process objects are countable in the Engineering System (see Section "Counting Process Objects (PO)").

Optional packages

The following optional packages can also be installed in addition to the basic package:

```
┌──────────────────────────────────────────────────────────────────┐
│                       Optional Packages                          │
│                                                                  │
│   ┌────────────────────────┐        ┌────────────────────────┐   │
│   │    Batch Planning      │        │     Separation of      │   │
│   │                        │        │  Procedure and Formula │   │
│   └────────────────────────┘        └────────────────────────┘   │
│   ┌────────────────────────┐        ┌────────────────────────┐   │
│   │  Hierarchical Recipes  │        │     API Interface      │   │
│   └────────────────────────┘        └────────────────────────┘   │
│   ┌────────────────────────┐                                     │
│   │      ROP Library       │                                     │
│   │  (library operations)  │                                     │
│   └────────────────────────┘                                     │
└──────────────────────────────────────────────────────────────────┘
```
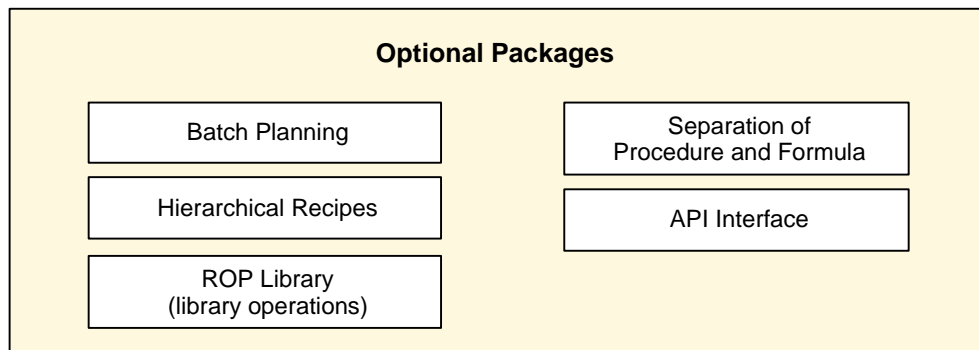
Component	Application
Batch Planning	Allows configuration of batches in BatchCC
Hierarchical Recipes	Allows the creation of hierarchical recipes according to S88.01 with RP, RUP, ROP and RPH
ROP Library (library operations)	Allows the creation and management of library operations
Separation of Procedure/Formula	Allows you to work with formulas and formula categories. n formulas can be created for a procedure.
API Interface	Powerful functions for online and offline operation, for example interfacing to MES

1.3.2 Requirements for Installation

Hardware Requirements

To be able to work with SIMATIC BATCH V6.0, the same hardware requirements must be met as for PCS7 V6.0.

SIMATIC BATCH V6.0 also requires:

- Approximately 260 Mbytes of free space on your hard disk to install files. Additional space is also required for projects and the database.

- A printer for recipe reports. All printers with graphics capability supported by Windows 2000 are suitable.

- The software was tested with the HP-Laser Jet.

Software Requirements

SIMATIC BATCH is a 32-bit application that requires MS Windows 2000 as operating system.

To use SIMATIC BATCH V6.0 components, the following software requirements must be met:

Component	Property
PC Operating System	Microsoft Windows 2000
Internet Explorer	Microsoft Internet Explorer V6.0 (for displaying recipe reports)
TCP/IP configured	See Windows system settings

Readme File

Note:

Make sure that you read the latest information on SIMATIC BATCH in the *PCS 7 BATCH Base - readme.wri* on the software CD.

1.3.3 Required Authorization

Authorization

To use the SIMATIC BATCH software, you require an authorization (right to use the software). This means that the software protected in this way can only be used properly when the authorization required for this software package is detected on the hard disk of the relevant PG/PC. Otherwise an irritating box keeps popping up.

Different authorizations are required for the basic package, the three expansion stages of the basic package and the optional packages.

Installing and Uninstalling the Authorization

To install the authorization, you require the copy-protected authorization diskette supplied with the particular software package. The number of possible authorizations depends on an authorization counter on the authorization diskette. When you install an authorization, the counter is decremented by 1. Once the counter reaches the value 0, there are no more authorizations on the diskette.

The authorizations for SIMATIC BATCH are installed and uninstalled in exactly the same way as for PCS 7 and the PCS 7 optional packages. You will find detailed information on installing and handling an authorization, for example in the basic help of the SIMATIC Manager.

Readme File

> **Note:**
>
> Make sure that you read the latest information on SIMATIC BATCH in the *PCS 7 BATCH Base - readme.wri* on the software CD.

Overview of the Required Authorizations

You will find an overview of the authorizations required for the individual batch applications in the manual *Process Control System PCS 7*; *PC Configuration and Authorization*.

1.3.4   Installing the Components of SIMATIC BATCH

Installation

You can start the installation program of SIMATIC BATCH within the general setup of PCS 7. On-screen prompts guide you step by step through the entire installation. The general setup of PCS 7 is started with the normal procedure under Windows 2000 for installing software.

Note:

Make sure that you read the information on installing SIMATIC BATCH in the *PCS 7 BATCH Base - readme.wri file.* The readme file is on the same CD-ROM as SIMATIC BATCH.

Options for Installing the Components

When you install the components with the installation program of SIMATIC BATCH , you can decide whether you want a single-workplace installation with all components or whether you require a distributed installation on several BATCH client/server computers. If you require a distributed installation, start the installation program on each client/server computer.

When you start to install the basic package, the following applications are offered for installation. You can select the applications you want to install.

- **SBBase (**basic software, **API**; does not need to be selected and is installed automatically**)**

- SBBUILDER (BATCH Engineering)

- SBClient (Batch Control Center (BatchCC), BATCH Recipe Editor, BATCH Report)

- SBServer (BATCH Control Server, Batch data management)

- SBBLOCK (BATCH interface blocks)

- SBWINCCOPTION (faceplates)

- SBFastobjects (for database server)

- Cluster Setup (for redundancy with Microsoft Cluster)

SBBUILDER (BATCH Engineering)

Note:

- BATCH Engineering is only installed when PCS 7 (SIMATIC Manager) is already installed on the ES computer.

- It is possible to install only BATCH Engineering on an ES computer (without client or server functionality). This installation is perfectly adequate for configuring batch objects and their distribution. When required, the BATCH interface blocks must be installed separately.

Uninstalling

Note:

If you uninstall SIMATIC BATCH, you must always do this before uninstalling the plant hierarchy (SIMATIC PH).

Installation in a Redundant System

Note:

Some special features are to be taken note of in a redundant PCS 7 System. For a detailed description of the installation, refer to the section "Redundancy".

BATCH Report

On the one hand, BATCH Report is fully integrated in the user interface of BatchCC. The recipe reports and batch reports are created in BatchCC in XML format and can be displayed and printed out in BatchCC at any time.

On the other hand, the Viewer of BATCH Report is available as a separate Setup SBReport on the Toolset CD. This allows you to view recipe reports and batch reports on other computers, for example, at a later time, without needing a BatchCC installation on the computer. You can copy and run the Setup SBReport on any Win2000 computer.

After installation along with the basic package, start the Viewer as follows:

Start > Simatic > SIMATIC BATCH > BATCH Report

1.3.5 Readme File with the Latest Information

Readme File

Note:

Make sure that you read the latest information on SIMATIC BATCH in the *PCS 7 BATCH Base - readme.wri* on the software CD.

The readme file is opened as follows:

- Double-click on *PCS 7 BATCH Base - readme.wri* on the CD-ROM or

- from the Start menu of **Windows:**
  `Start > Simatic > Note > PCS 7 BATCH Base - Readme.wir`

2 Technological Basics According to ISA S88.01

2.1 Which Standards is SIMATIC BATCH Based On?

Standards

SIMATIC BATCH was developed based on the ANSI/ISA S88.01 (1995) Batch Control, Part 1: Models and Terminology standard.

Use of SFC

In the "Technical Report" ISA-TR88.0.03-1996, the use of SFC (Sequential Function Charts, DIN/IEC 1131) as a graphic language for describing recipe procedures is also recommended. The creation of recipes with the BATCH Recipe Editor follows the structures and functionalities described in this standard.

2.2 Introduction to Technical Terminology

The following definitions are mainly excerpts from the ANSI/ISA S88.01 (1995) standard Batch Control, Part 1.

Batch process

A process that leads to the production of finite quantities of material by subjecting quantities of input materials to an ordered set of processing activities over a finite period of time using one or more pieces of equipment.

The product manufactured in a batch process is known as a batch. Batch processes are discontinuous processes.

Typical Equipment Phases of a Batch Process
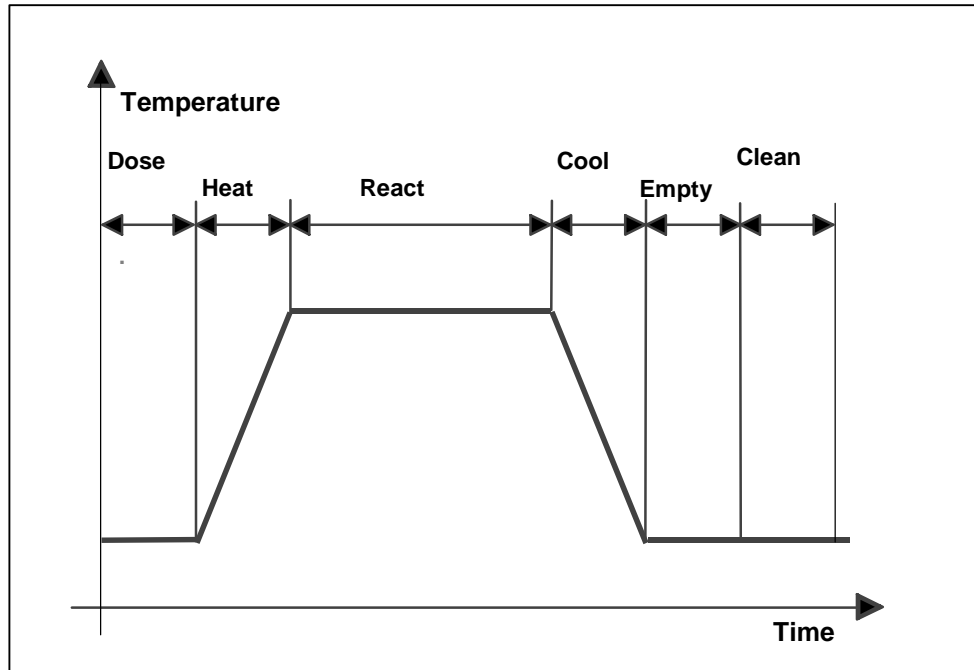
Batch

- Material that is being produced or that has been produced by a single execution of a batch process.

- An entity that represents the production of a material at any point in the process.

Note: Batch means both the material created by and during the process as well as the unit that represents the manufacturing procedure for this material. Batch is used as an abstract contraction of the words "the production of a batch".

Recipe

The necessary set of information that uniquely defines the production requirements for a specific product. A recipe is the set of rules and information required to define how a product is manufactured.

Two types of recipe are used in SIMATIC BATCH.

- Master Recipe

- Control recipe

```
┌─────────────────────┐  contains  ┌─────────────────────────┐
│                     │───────────▷│   Process cell-specific │
│   Master Recipe     │            │       information       │
│                     │            │                         │
└─────────────────────┘            └─────────────────────────┘
          │
       is the
      basis for
          │
┌─────────────────────┐  contains  ┌─────────────────────────┐
│                     │────────────│  Batch ID,quantity, process, │
│   Control Recipe    │            │   system or operator    │
│                     │            │      information        │
└─────────────────────┘            └─────────────────────────┘
```
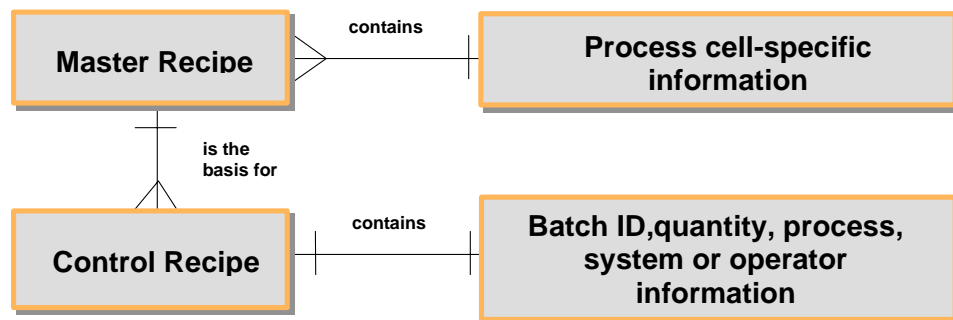
Master Recipe

A type of recipe that accounts for equipment capabilities and may include process cell-specific information. A master recipe is an indispensable recipe level without which control recipes cannot be created or batches produced.

Master recipes can contain material and production parameters as standardized, calculated, or fixed values.

A master recipe can be derived from a general or site recipe from the enterprise level (refer to the standard IEC 61512-1: 1997).

Control Recipe

A type of recipe which, through its execution, defines the manufacture of a single batch of a specific product.

The control recipe is a copy of a particular version of the master recipe that is then modified as necessary with information for planning and execution making it specific to a single batch.

A control recipe can also be modified during the production of a batch. Examples:

- Definition of the equipment actually used in the control recipe at the start of the batch or at the time it becomes known.

- Addition or modification of parameters on the basis of "As Dosed" qualities of raw materials or analyses during production of the batch.

- Modification of the procedure due to an exceptional event.

Control strategy

Different and (in terms of the same run) mutually exclusive equipment phases of the same equipment module = control strategy of this equipment module.

Process

A sequence of chemical, physical, or biological activities for the conversion, transport, or storage of material or energy.

2.3   Basic Structure of a Recipe

Components of a Recipe

Recipes contain the following four categories of recipe information:

Recipe Header

- recipe and product identification
- version number
- author and date created
- releases
- status

Material and Production Data (Formula)

- process inputs: resources for creating product
- process outputs:expected results
- process parameters: global recipe parameters

Unit Requirements

- requirements of the equipment for manufacturing the product

Recipe Procedure

- describes the strategy (the procedure)
- is the description of the recipe execution using the procedure elements (SFC)

2.4　　Material and Production Data (Formula)

Material and production data (formula) for recipe creation is comprised of:

- Process Inputs
- Process outputs
- Process parameters

Process Inputs

Process inputs are the input materials (resources) required to make the product. Each input material has the following characteristics:

- Name of parameter
- Name of the input material
- Lower limit value for the quantity
- Set point for the quantity
- Upper limit value for the quantity
- Unit of measure
- Name of the scaling algorithm

Process Outputs

The process outputs are the output materials (main, interim, by, and waste products) resulting from the manufacture of a product. Each output material has the following properties:

- Name of parameter
- Name of the product
- Name of the output material
- Lower limit value for the quantity
- Set point for the quantity
- Upper limit value for the quantity
- Unit of measure
- Name of the scaling algorithm

Process Parameters

Process parameters are physical parameters such as speed, pressure, temperature.

Process parameters can also be logic parameters and character chains: For example, release number of loop of type integer or material information HCL of type string or bolean values e.g., releases.

2.5 Basic Structure of a Recipe Procedure

Recipe procedure and its elements according to the standard:

Recicpe procedure (RP)	
	Can be an ordered set of
Recipe unit procedure (RUP)	
	Can be an ordered set of
Recipe operation (ROP)	
	Can be an ordered set of
Recipe phase (RPH)	
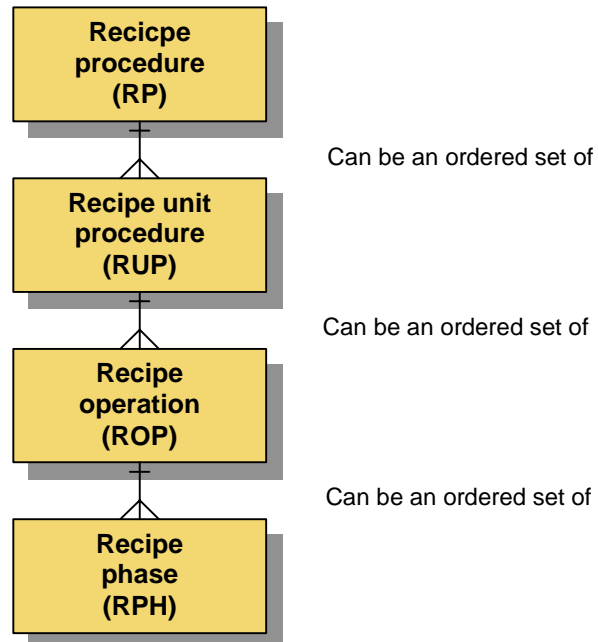
2.6 Relationship between Recipe Procedure, Formula and Master Recipe

How the Master Recipe is Formed

By assigning formulas to a recipe procedure, different master recipes can be created for a process cell or a grouping of equipment belonging to a process cell. The schematic below illustrates this relationship.

Recipe Procedure   **+**   **Formula**   **=**   **Master Recipe**

Formula #1	
Quantity	500 kg
Temperature	70 °C
Flow	100 l/min
Duration	320 sec
Speed	120 rpm

=   **Master recipe #1**

Formula #2	
Quantity	125 kg
Temperature	110 °C
Flow	80 l/min
Duration	200 sec
Speed	150 rpm
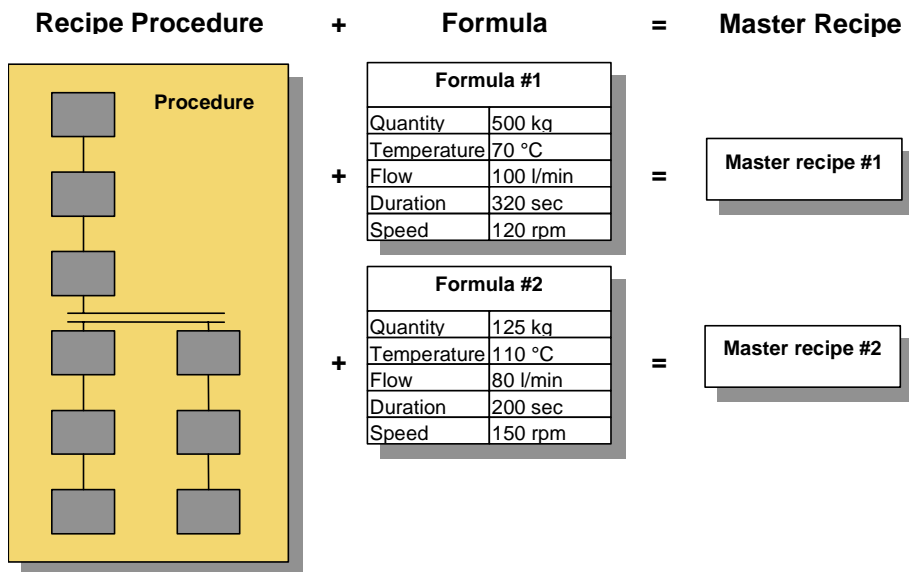
=   **Master recipe #2**

2.7   What is a Formula Category?

Definition

A formula category is a grouping of recipe formulas associated with a single master procedure each having the same attributes. The only differences between the formulas in a formula category are the concrete parameter values.

The formula category is a therefore a "template" / a "type" for different material and production data records.

The formula category contains the parameters that can be manipulated by the operator during batch planning. These parameters are included in the formula category with their data type and unit of measure.

Note:

Formula categories can be defined independently of the recipe.

Purpose

Working with formula categories makes it much easier to maintain master recipes based on the same recipe procedures. Modifications only need to be made at one point (of a recipe procedure) and not in "n" recipe procedures!

ISA S88.01 does not mention the formula category. The formula category does not, however, contradict the formula definition in ISA S88.01, but rather expands it (see also "Models of the ANSI/ISA S88.01 Standard").

2.8　　Internal and External Formulas

To support you better when using formulas and formula categories, BATCH makes a distinction between internal and external formulas.

Internal Formula

If you want to keep your material and production data directly in the master recipe procedure, you can do this in the "internal" formula in the master recipe. The parameters can be set there during the creation of the master recipe procedure and modified during batch planning and/or also while a batch is executing.

External Formula

If you want to manage several material and production data lists separate from the master recipe procedure, you can do this using "external" formulas belonging to a formula category. You simply need to assign a master recipe procedure to the external formula to establish the association with the master recipe procedure. The parameters of external formulas can also be modified during batch planning and/or while a batch is executing.

2.9 Models of the ANSI/ISA S88.01 Standard

2.9.1 Overview of the Models of the ISA S88.01 Standard

Introduction

The following sections describe the models of the ISA S88.01 standard that relate directly to the use of SIMATIC BATCH. You will find information on other topics in the standard itself.

ISA S88.01 Models

The following models of the ANSI/ISA S88.01 standard provide the foundation for batch-oriented control strategies with SIMATIC BATCH.

- Procedural Control Model
- Physical Model
- Process Model

Hierarchical Structure of the Models

The figure below illustrates the hierarchical structure and relationship of the models – from the sequential control on the equipment as far as the processing functionality.

Procedural Control Model		Physical Model		Process Model
Procedural Elements		**Equipment**		**Resulting Process Functionality**
Procedure (s)	combined with a	Process cell	provides process functionality to carry out a	Process
Unit Procedure (s)	combined with a	Unit	provides process functionality to carry out a	Process stage
Operation (s)	combined with a	Unit	provides process functionality to carry out a	Process operation
Phase (s)	combined with a	Unit	provides process functionality to carry out a	Process action
Phase (s)	combined with a	Equipment module	provides process functionality to carry out a	

Implementation of the Models

The hierarchical structure of the models is the basis for the configuration of the batch-oriented control strategies with PCS 7:

- The plant hierarchy of your process cell is structured in the SIMATIC Manager (plant view) based on the S88.01 physical model.

  see section: Structure of the Plant Hierarchy

- You structure the recipes for batch control with the BATCH Recipe Editor based on the S88.01 procedural control model.

  see sections: Structure of the Hierarchial Recipe

2.9.2 Procedural Control Model

Procedural Control Model with Example – How Do We Want to Produce?

Process	is an ordered set of	**Produce PVC**
Unit process	is an ordered set of	**Polymerize vinylchloride monomer** **Recover residual vinylchloride** **Dry PVC**
Operation	is an ordered set of	**Preparation:** **Evacuate reactor and coat reactor walls with build-up suppressants** **Fill:** **Distilled water and solvent** **Reaction:** **Add VCM and catalyst, heat and wait for pressure to drop**
Phase		**Add vinylchloride monomer** **Add catalyst** **Heat**

Function

A phase is the smallest element of procedural control that can accomplish a process-oriented task. The purpose of a phase is to define or cause a process-oriented action.

Characteristics of a phase:

- Can be subdivided into smaller parts in the form of steps and transitions (as described in IEC 848: 1988)

- A step can cause one or more actions

- The execution of a phase can result in the following

    - Commands to basic control

    - Commands to other phases (either in the same or another equipment entity)

    - The collection of data

2.9.3 Physical Model

Physical Model with Example – What Do We Use to Produce?
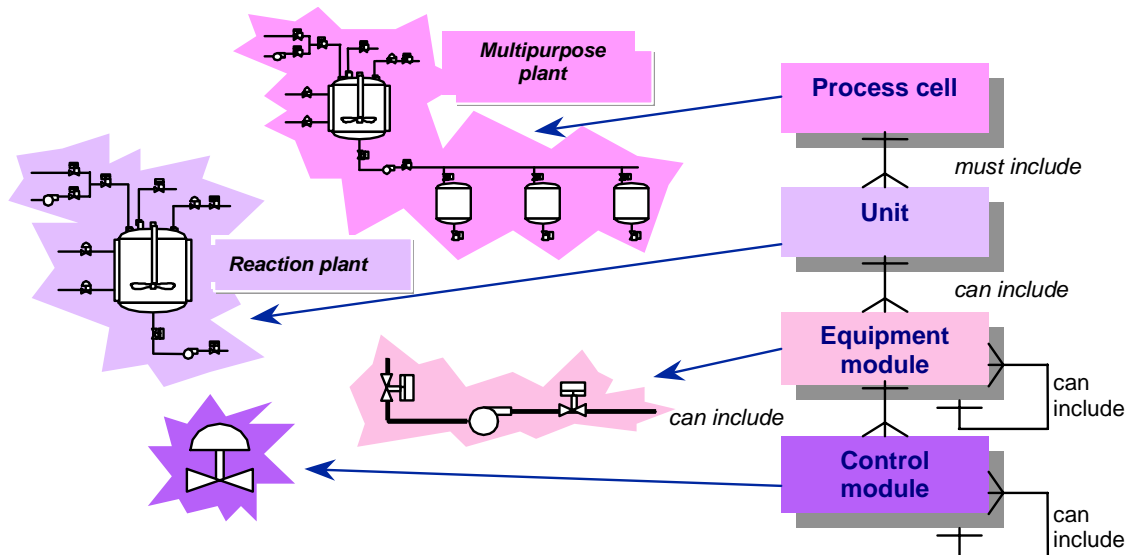
Process cell

A process cell contains all the equipment required to make a batch. Process cells are often divided into trains. A train is made up of all units and other equipment that can be used by a particular batch. Trains can be left unchanged from batch to batch or can be defined differently for each batch.

Unit

A unit is made up of equipment modules and control modules. A unit is an independent grouping of equipment usually centered around a major piece of processing equipment, such as a mixing tank or reactor.

Characteristics of a unit:

• A unit can execute one or more major processing activities, such as react, crystallize, and make a solution.

• Units operate relatively independently of each other.

• A unit often contains a complete batch of material at some point in the processing sequence of the batch.

• A unit cannot process more than one batch at the same time.

Equipment Module

An equipment module can be made up of control modules and subordinate equipment modules. An equipment module is usually centered on a piece of processing equipment, such as a filter.

Characteristics of an equipment module:

- Can be part of a unit or stand-alone grouping of equipment within a process cell

- Can carry out a finite number of specific minor processing activities, such as dosing or weighing

- Can, but does not need to contain the raw materials for a batch

Control Module

A control module is usually a collection of sensors, actuators, other control modules and associated processing equipment that can be operated as a single entity from the point of view of control engineering.

A control module can also be made up of other control modules. As an example, a dosing control module could be defined as the combination of several automatic switching valve control modules.

There is no figure for the individual control modules in the procedural model and the process model (see also figure in section "Overview of the Models of the ISA S88.01 Standard"). Therefore, it cannot be addressed in SIMATIC BATCH either.

2.9.4 Process Model

Process Model with Example – What Do We Want to Produce?

Process	**Production of polyvinylchloride by polymerization of vinylchloride monomers**
is an ordered set of	
Process stage	- Polymerization: **Vinylchloride monomer is polymerized to polyvinylchloride** - Recovery: **Vinylchloride monomer** - Drying: **Polyvinylchloride powder**
is an ordered set of	
Process operation	- Preparation: **Evacuate reactor** - Fill: **Add distilled water and reagents** - Reaction: **Add vinylchloride monomer + catalyst, heat to 120 °C and hold temperature until pressure drops**
is an ordered set of	
Process step	- Add : **Amount of catalyst** - Add : **Amount of vinylchloride monomer** - Heat : **Heat reactor to 120 °C** - Hold temp.: **Hold temperature until pressure drops**

3 Getting Started

3.1 Getting Started

Requirement

The components of the basic package of SIMATIC BATCH are installed on the PG/PCs of the BATCH OS (BATCH Server, BATCH clients) and those of the engineering system.

Basic Procedure

If you are working with SIMATIC BATCH for the first time, you will find the following list of the most important steps a useful overview.

Engineering	1. Configuring a Process Cell in the Engineering System (ES)
	2. Compiling Process Cell Data in Single-Project Engineering
	3. Downloading Process Cell Data to the Target System
	4. Reading Process Cell Data into BATCH
Permissions management	5. Specifying User Permissions
Recipe Creation (Offline)	6. Editing Materials
	7. Creating and Editing Master Recipes
	8. Creating and Editing Library Operations
	9. Validating Recipes
	10. Releasing Recipes for Production
	11. Creating a New Formula Category (with external formula only)
	12. Creating Formulas (with external formula only)
	13. Interconnecting Parameters between the Master Recipe and Formula
Run time	14. Creating Production Orders
	15. Creating and Editing Batches
	16. Releasing Batches
	17. Starting Production of a Batch
	18. Controlling Production of a Batch
	19. Logging Batches
	20. Archiving Batches

Engineering

Configuration of the batch process cell takes place along with the basic engineering of the S7-400 on the Engineering Station (ES) of SIMATIC PCS 7 in the SIMATIC Manager (for example phase and operation types, unit classes, user data types, units of measure etc.).

The batch process cell data are compiled on the Engineering Station and are transferred to the database (project directory) of SIMATIC BATCH using the "Download target system" function.

Using the "Read in process cell" or "Update process cell" function in BatchCC, the process cell data of BatchCC are read in to the BATCH clients.

Permission Management

SIMATIC BATCH uses the central user management of PCS 7.

You define user roles for SIMATIC BATCH (for example operator) and their assignment to the defined Windows user groups using the *SIMATIC Logon* software. Within SIMATIC BATCH (BatchCC), you can restrict the user permissions of a user role even further - for a specific computer and for a specific unit:

Recipe Creation (Offline)

Reading in the Batch process cell data (Batch engineering data) on any BATCH client with BatchCC allows the creation of offline data. You create the materials, formula categories, and formulas with BatchCC. You create libraries and master recipes with the Recipe Editor. Releasing master recipes, library elements and formulas allows their use in the run-time mode.

Runtime

The first run-time function is batch planning. Here, a production order is created first. This is divided into individual batch orders (at least one) that are then released and started. The actual Batch processing programs (equipment phases) run on the programmable controller and are coordinated by the batch control (BATCH Control Server). Communication with the equipment phases is implemented by the WinCC data manager.

The batch data management also makes use of individual WinCC components. From the measured value archive, the values for the required measured value sequences are obtained for the batch report and all batch-relevant messages are filtered out of the message archive.

A further important run-time function is the operator control and monitoring of a batch or the control recipe. This takes place partly in SIMATIC BATCH itself and partly using Batch faceplates in WinCC.

4 Configuration in the ES

4.1 Introduction

Engineering Basic Control

A batch process is automated using the programs on the programmable logic controller (PLC). This so-called "basic control" is created with CFC and/or SFC for the specific PLC. The software charts to be created are managed in the plant hierarchy in the SIMATIC Manager. For SIMATIC BATCH fixed hierarchy levels must be kept to.

Interface to the Processing Programs

The interface between SIMATIC BATCH and the actual processing on the programmable controller is implemented as follows:

- either using the SFC types that can be created with the SFC standard tools as of PCS 7 V6.0 (refer to the section "Using SFC Types")

- or using the BATCH interface blocks (see section "Application of the BATCH Interface Blocks")

In the Engineering System (ES), the equipment phases (for example dosing, agitating, heating) are interconnected and their parameter values set with the PLC structuring tools (CFC).

Note:

Mixed use of both variants (SFC types, BATCH interface blocks) within a project is possible.

Editing the Type Description of the Process Cell

The data required by SIMATIC BATCH for creating recipes and for producing batches must be specified for a process cell. This data is also specified in the engineering system (ES). The type description for a process cell, for example unit classes or function types, can be edited in the SIMATIC Manager independent of the basic control. Before creating the process cell data for SIMATIC BATCH, the type description must be synchronized with the SFC types and the CFC charts (block instances).

Compiling and Downloading Process Cell Data

To be able to download the process cell data distributed on the BATCH server and the BATCH clients according to the configured plant hierarchy, you create and configure SIMATIC PC stations with server and client applications in the SIMATIC Manager. The process cell data can then be derived from the plant hierarchy and downloaded to the BATCH server and the BATCH clients. Prior to downloading, the OS and batch process cell data must always be compiled.

4.2 Difference between Single Project and Multiproject Engineering

The engineering involved in a batch process cell can be done both on one computer (single project) or on several computers (multiproject).

Single Project Engineering

In small batch process cells and when only one configuration engineer is available, engineering is done in a single project; in other words, on one computer.

Multiproject Engineering

In larger batch process cells, simultaneous configuration is necessary on different computers and by different configuration engineers. This is made possible by multiproject engineering. Access to the data on the other computers is possible. The individual projects of the process cell are merged on a central ES computer using the "Multiproject" object.

4.3 Flowchart: Engineering Steps for a Single Project

Introduction

Below you will see a **recommended** sequence of configuration steps. The order of the steps shown in the schematic is not absolutely necessary. We have selected a method on which the following more detailed description is oriented.

Requirement

The basic control has been created; in other words, the PLC hardware is configured, the CFC and SFC charts have been created and compiled. The information below relates only to the supplementary ES configuration for creating recipes and batch control with SIMATIC BATCH.

Example of a Configuration for Single-Project Engineering

Single project
Executable functions:
• S7 configuration
• Configuring BATCH clients
• Configuring BATCH servers
• Configuring SFC types
• Configuring PH

Executable functions in the
"Edit Batch process cell" dialog:
• for the project:
 • Settings: distribution, OS objects
• for the process cell:
 • Transfer to OS
 • Download
• for the Batch types:
 • Edit
 • Generate
 • Synchronize
• for the Batch instances
 • Compile
 • Validation

ES computer

What is involved in the ES configuration for SIMATIC BATCH?

```
┌─────────────────────────────────────────────────────────────────────────┐
│                         SIMATIC Manager                                   │
│   ┌──────────────────────────────┐                                        │
│   │ Configuring BATCH server and │                                        │
│   │       BATCH clients          │◄──────────────────────────────┐        │
│   └──────────────┬───────────────┘                               │        │
│   ┌──────────────▼───────────────┐                               │        │
│   │   SFC: Creating SFC types for│◄───────────────────────┐      │        │
│   │       SIMATIC BATCH          │                         │      │        │
│   └──────────────┬───────────────┘        ┌───────────────────────┐       │
│   ┌──────────────▼───────────────┐        │ CFC: Creating CFC     │       │
│   │  Creating the plant hierarchy│◄───────│ charts with SFC type  │       │
│   └──────────────┬───────────────┘        │ instances orBATCH     │       │
│                  │                         │ interface blocks      │       │
│   ┌──────────────▼───────────────┐        └───────────────────────┘       │
│   │        Compiling OS          │                                        │
│   └──────────────┬───────────────┘                                        │
│   ┌──────────────▼───────────────┐                                        │
│   │ •  Specifying the message OS │                                        │
│   │    and Batch-relevant OS     │                                        │
│   │ •  If nec. Updating of distri│                                        │
│   │    bution and process cell   │                                        │
│   └──────────────┬───────────────┘                                        │
│   ┌──────────────▼───────────────┐                                        │
│   │ Generating and editing Batch │                                        │
│   │           types              │                                        │
│   └──────────────┬───────────────┘                                        │
│   ┌──────────────▼───────────────┐                                        │
│   │      Batch validation        │                                        │
│   └──────────────┬───────────────┘                                        │
│   ┌──────────────▼───────────────┐                                        │
│   │ Compiling Batch process cell │                                        │
│   │           data               │                                        │
│   └──────────────┬───────────────┘                                        │
│              ◇───▼───◇      yes                             Debug          │
│           Validation error? ─────────────────────────────────────┘        │
│              ◇───────◇                                                     │
│                  │ no                                                      │
│   ┌──────────────▼───────────────┐                                        │
│   │       Transfer to the OS     │                                        │
│   └──────────────┬───────────────┘                                        │
│   ┌──────────────▼───────────────┐                                        │
│   │ Download Batch process cell  │                                        │
│   │           data               │                                        │
│   └──────────────┬───────────────┘                                        │
│            ◇─────▼─────◇   no (distributed computer structure)            │
│            BATCH server  ─────────────┐                                    │
│               local?           ┌──────────────────────────┐               │
│            ◇───────────◇        │ Change to remote computer│               │
│                  │ yes          │     (BATCH server)       │               │
│                  │              └──────────────────────────┘               │
│   ┌──────────────▼───────────────┐                                        │
│   │   Start PCS 7 OS (WinCC) and │                                        │
│   │        BATCH server          │                                        │
│   └──────────────┬───────────────┘                                        │
│            ◇─────▼─────◇   no (distributed computer structure)            │
│            BATCH client  ─────────────┐                                    │
│               local?           ┌──────────────────────────┐               │
│            ◇───────────◇        │ Change to remote computer│               │
│                  │ yes          │     (BATCH client)       │               │
│   ┌──────────────▼───────────────┐                                        │
│   │       Start BatchCC and      │                                        │
│   │    read in process cell data │                                        │
│   └──────────────────────────────┘                                        │
└─────────────────────────────────────────────────────────────────────────┘
```

Updating the Process Cell Data

Note:

If you modify the basic control (CFC/SFC charts, hardware configuration, plant hierarchy etc.), the process cell data must be updated again and downloaded to the target system (BATCH Server, BATCH clients) and batch-relevant data must be transferred to the operator stations.

Prior to this, the OS must first be compiled and downloaded again.

4.4 Flowchart: Engineering Steps for a Multiproject

General Documentation on Multiproject Engineering

The manual *Process Control System PCS7; Engineering System* provides an introduction to multiproject engineering with PCS 7.This documentation is on the "Electronic Manuals, PCS 7" CD. This is general documentation that describes the configuration of a multiproject and the interaction between individual S7 projects from a neutral perspective.

You will find further information in the online help in PCS 7 in the topic "What you Should Know about Multiprojects".

The following information relates to the additional engineering steps involved in configuring batch processes with the components of SIMATIC BATCH.

Sample Configuration for a Centrally Managed Multiproject for SIMATIC BATCH

The first step is to create a "Multiproject" object on a central ES computer in the SIMATIC Manager. You set up all the S7 projects along with drive information relating to the ES computers on which the S7 projects will be configured below the multiproject. The individual S7 projects can then be configured at the same time on the ES computers (computer 1, computer 2, computer 3, ...). The data for the BATCH Server is configured on **one** of the ES computers (computer 1).

Note:

It is, of course, **also** possible to configure one of the projects on the central ES computer, for example the computer with the BATCH Server configuration. To keep the picture clear, however, the description that follows is based on the configuration shown in the schematic below.

Multiproject
Executable functions in "Edit Batch process cell" dialog box:
- For the multiproject:
  - Settings: Distribution, OS objects, process cells
- For the process cell:
  - Transfer to the OS
  - Download
- For the Batch types:
  - Edit
  - Generate
  - Propagate
  - Synchronize
- For the Batch instances
  - Merge/compile
  - Validation

Executable functions for a booked in project:
- S7 configuration
- Configuring BATCH clients
- Configuring BATCH server
- Configuring SFC types
- Configuring PH

Executable functions in the "Edit Batch process cell" dialog
- For the Batch types:
  - Update
  - Read-only
- For the Batch instances
  - Compile
  - Validation

Central ES computer

SIMATIC Manager

Multiproject
S7Proj1
S7Proj2
S7Proj3
...

ES computer 2

S7Proj1

ES computer 3

S7Proj2

...

Booked out project **with** editable Batch types

Booked out project **without** editable Batch types

Executable functions
- S7 configuration
- Configuring BATCH clients
- Configuring BATCH server
- Configuring SFC types
- Configuring PH
Executable functions in "Edit Batch process cell" dialog box:
- For the Batch types:
  - Edit
  - Generate
- For the Batch instances
  - Compilation
  - Validation

Executable functions:
- S7 configuration
- Configuring BATCH clients
- Configuring BATCH server
- Configuring SFC types
- Configuring PH
Executable functions in "Edit Batch process cell" dialog box:
- For the Batch types:
  - Read-only
- For the BATCH instances
  - Compilation
  - Validation

What is involved in the ES configuration for SIMATIC BATCH in a multiproject?

Configuration for the multiproject

SIMATIC Manager

Create multiproject with projects (PCS 7 Wizard)

Configuration for the peer projects

PCS 7 configuration (standard)

Configure BATCH server and BATCH clients

SFC: Create SFC types for SIMATIC BATCH

Create plant hierarchy

CFC: Create CFC charts with a SFC type instances or BATCH interface blocks

Compile OS

Batch validation

Compile Batch process cell data

Configuration for the multiproject

- Specify message OS and Batch-relevante OS
- If nec. update distribution and process cell

Generate and edit Batch types

Batch validation

Merge and compile Batch process cell data

Validation error? — yes — Debug

no

Transfer to OS

Download Batch process cell data

Runtime computer: Start PCS 7 OS and BATCH server

Client computer: Start BatchCC and read in entire process cell data

Updating the Process Cell Data

> **Note:**
>
> If you modify the basic control (CFC/SFC charts, hardware configuration, plant hierarchy etc.), the process cell data must be compiled again, batch-relevant data must be transferred to the operator stations, and downloaded to the target system (DB server, BATCH Server, BATCH clients).
>
> Before data is transferred to the operator stations, the OS must be recompiled.

Uniqueness of the Names

> **Note:**
>
> Please note that if you distribute the configuration work on several ES computers, the project names and the names of the project objects contained must be unique on all ES computers. The process cell name must be identical in all projects.

4.5 Using the PCS 7 Wizard

When you create a new single multiproject, you can also use the PCS 7 wizard in the SIMATIC Manager. This allows you to create a single project or multiproject with one project including a PC station for the BATCH Server and a PC station for a BATCH client.

Starting the Wizard

In the SIMATIC Manager, select the menu command **File > "New Project" Wizard** and follow the instructions in the dialogs.

Settings for SIMATIC BATCH

In the 3rd dialog box "Which objects will be used in the project?", the "SIMATIC BATCH" option is available. Select this option and three further options appear on the right-hand side in the same dialog box. Select the project version you require. Once the PCS 7 wizard is completed, the PC stations are visible in the component view.

4.6 Configuring BATCH Servers and Clients

4.6.1 Basics of Configuration

Principle

The BATCH Server and the BATCH clients of a process cell project generally run on different computers. To download the process cell data of a project and distribute it to these computers, a **SIMATIC PC station** is created for the BATCH server (BATCH control server, DB server) and each BATCH client in the component view of the SIMATIC Manager.

> ⚠️ **Warning**
>
> Configuring applications (WinCC, SIMATIC BATCH, ...) on separate "SIMATIC PC station" objects and then merging them to create one PC station by assigning the same computer name to the "SIMATIC PC station" objects is not permitted!

Structure of the Batch Project in the SIMATIC Manager (Component View)
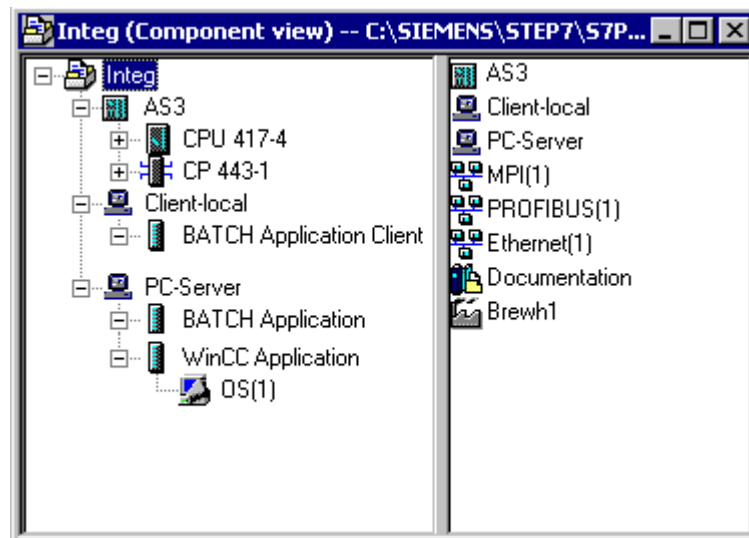
Functions Available for BATCH Configuration

Object	Meaning	Available Functions
BATCH Application Client	BATCH Client Application	• Configuring the BATCH Clients
BATCH Application	BATCH Control Server or data storage system	• Configuring the BATCH Server
Batch types	Only in a redundant system: BATCH Control Server or data storage system standby	• Configuration of the Redundant BATCH Server
WinCC Application OS	WinCC application on PCS 7 OS	• Compiling the OS

BATCH Application Client

A "BATCH application client" stands for the BATCH Recipe Editor, the Batch Control Center (BatchCC), for batch operator control and monitoring, and batch data management.

BATCH Application

"BATCH application" is the representative for

• "DB server project": Data storage for user permissions

• DB server offline: Data storage for recipes, formulas, materials

• DB server online: Data storage for batches

• BATCH Control Server (BCS)

BATCH application [stby]

"BATCH application [stby]" stands for the redundant applications:

• "DB server project": Data storage for user permissions

• DB server offline: Data storage for recipes, formulas, materials

• DB server online: Data storage for batches

• BATCH Control Server (BCS)

4.6.2   Configuring the BATCH Server

Rules

- A SIMATIC PC station must be created and configured with a "BATCH application" in HW Config for the computer on which the BATCH server runs.

- If you want to work locally on the ES computer with BATCH Server/clients (single project engineering), only **one** PC station with server and client application needs to be set up and in which the run-time computer name remains empty (or the local computer name is entered).

/!\   **Warning**

Configuring applications (WinCC, SIMATIC BATCH, ...) on separate "SIMATIC PC station" objects and then merging them to create one PC station by assigning the same computer name to the "SIMATIC PC station" objects is not permitted!

Follow the steps outlined below in the SIMATIC Manager:

1. Select the project in the component view.

2. Select the menu command Insert > Station > SIMATIC PC Station.

    Result: A new SIMATIC PC station is inserted in the current project.

3. Set the computer name of the PC station:

    - Select the SIMATIC PC station.

    - Select the menu command **Edit > Object Properties**.

    - Enter the computer name in the last field.

4. Configure this SIMATIC PC station in HW Config.

    - Select the SIMATIC PC station.

    - Select the menu command **Edit > Open Object**.

      Result: HW Config opens.

    - Insert a batch application from the hardware catalog:

      Path in the hardware catalog: **Standard > SIMATIC PC Station > HMI > BATCH Application**.

      If you are using a redundant BATCH Server, select "BATCH application (stby)" instead.
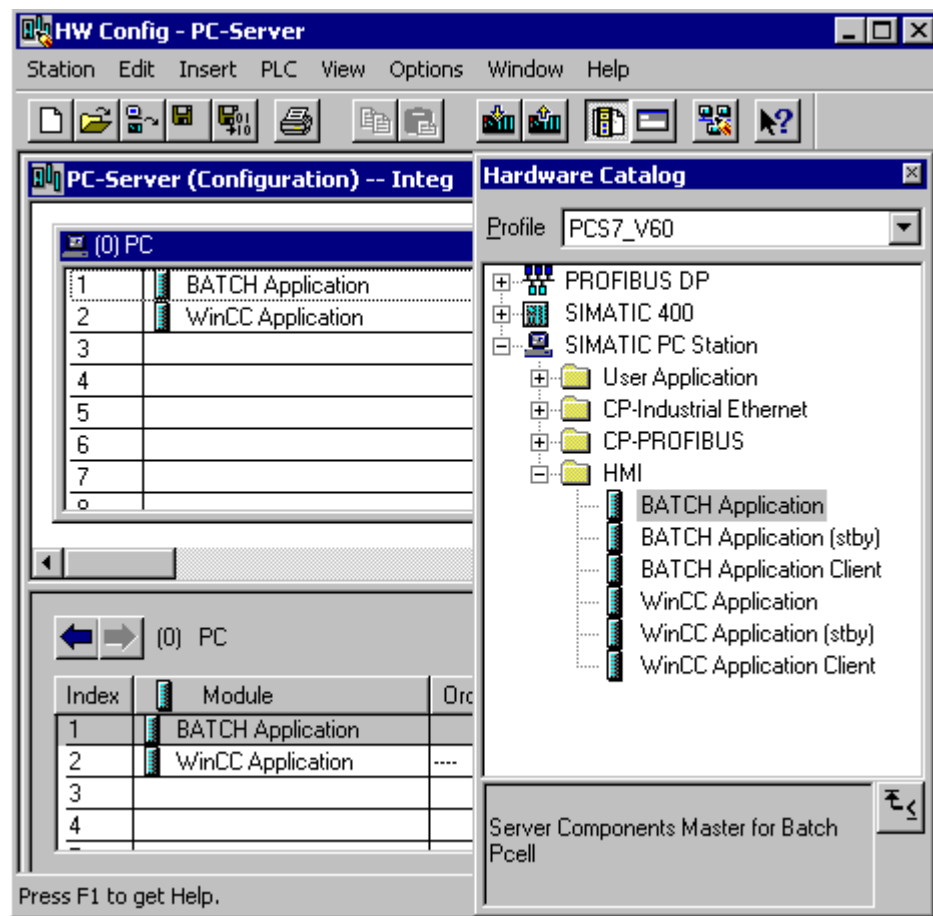
5. Select the menu command Station > Save and Compile.

Result: In the component view, the object [BATCH Application] is displayed below the configured SIMATIC PC station.

4.6.3   Configuring the BATCH Clients

Rules

- A SIMATIC PC station must be created and configured with a "BATCH application client" in HW Config for every computer on which a BATCH client application runs.

- BATCH clients can also run on PC stations on which no OS client (multiclient) is installed.

Follow the steps outlined below in the SIMATIC Manager:

1. Select the project in the component view.

2. Select the menu command Insert > Station > SIMATIC PC Station.

   Result: A new SIMATIC PC station is inserted in the current project.

3. Set the computer name of the PC station.

   - Select the SIMATIC PC station.

   - Select the menu command **Edit > Object Properties**.

   - Enter the computer name in the last field.

4. Follow the same procedure and install a further SIMATIC PC station for each BATCH client in the project.

5. Configure these SIMATIC PC stations in HW Config.

   - Select the SIMATIC PC station.

   - Select the menu command **Edit > Open Object**.

   Result: HW Config opens.

   - Insert a batch client application from the hardware catalog: On a BATCH client, you insert an additional WinCC application if the BATCH client is operated along with an OS client on one computer.

     Path in the hardware catalog: **Standard > SIMATIC PC Station > HMI > BATCH Application (client)**.
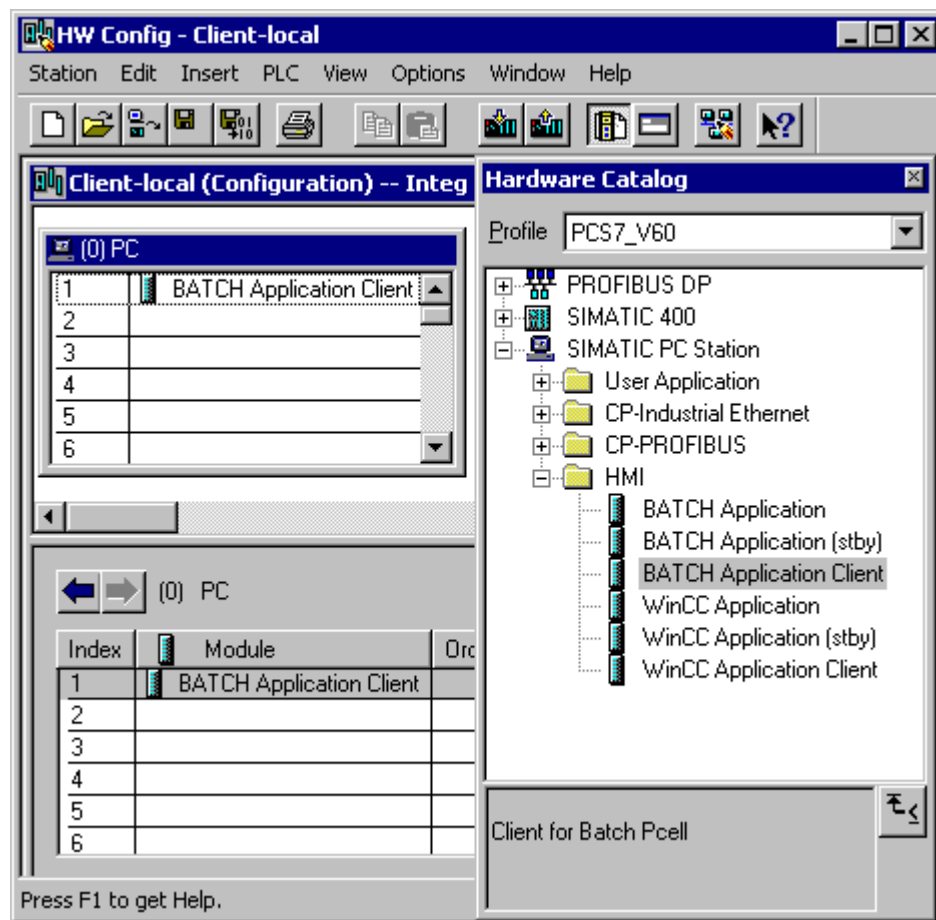
6. Select the menu command Station > Save and Compile.

Result: In the component view, the object [BATCH Application Client icon] BATCH Application Client is displayed below the configured SIMATIC PC station.

4.6.4 Installing on BATCH Servers and BATCH Clients

You will find an overview of the Batch applications that can be installed on BATCH servers and BATCH clients and the required authorizations in the manual *Process Control System PCS 7; PC Configuration and Authorization*.

4.7 Basics of the Plant Hierarchy

4.7.1 Structure of the Plant Hierarchy

Introduction

With the plant hierarchy, the Engineering System provides you with the means of recreating the technological structure of the process cell in the PCS 7 system. The objects such as CFC/SFC charts, OS reports, or OS operator pictures are added in the plant hierarchy.

Structure of the Plant Hierarchy

The highest level is fixed by the system when you create a new project. The next hierarchy levels can either be neutral folders or folders with configuration data for SIMATIC BATCH. This is decided in the object properties of the relevant hierarchy folder in the "S88 Type Definition" tab under the object type properties.

In multiproject engineering, the top level is the "Multiproject" object, below that you will find the individual projects and the process cell below these projects.

For the configuration data for SIMATIC BATCH, the three hierarchy folders shown in the schematic below are necessary (these are generally known as batch hierarchy folders):

project_1 (Plant View) -- C:\SIEMENS\STEP7\...
 	
 project_1
    PCell
      Unit
        equipment modul
 	
 PCell
 Global labeling field
 Documentation
	Three hierarchy folders for SIMATIC BATCH:
	 • Process cell folder
	 • Unit folder
	 • Equipment module folder

Technological Significance of the Batch Hierarchy Folders

The three batch hierarchy folders have the following defined technological significance according to the ANSI/ISA S88.01 (1995) standard:

Batch hierarchy folder	Level	Meaning
Process Cell	Level 2	Within a project, only one process cell can currently be created. A recipe can therefore only access phases of this process cell. Examples of the process cell level might be polymerization plant, dyehouse, colored pigment plant, or multipurpose plant.
Unit	Level 3	Several units can be defined in one process cell. These units can be used within a recipe. Examples of units might be neutralization, extraction, distillation, or preparation.
Equipment module	Level 4	Several equipment modules such as a dosing or bottling machine can be defined in a unit. Equipment phases such as heating, cooling, ventilating, emptying can be created for the equipment modules.

Included in the Naming Scheme (Yes/No)

The name of the project exists once and is not included in the naming scheme for tags in WinCC. All other folders can be included in the naming scheme during configuration.

Note:

As default, inclusion in the naming scheme is deactivated. This means that no hierarchy folder is included in the name.

Storage of the Blocks

The charts with the corresponding SFC type instances or BATCH interface blocks can be stored in the appropriate batch hierarchy folders according to their technological significance. Only TAG_COLL can be stored in the process cell folder. The IUNIT_BLOCKs along with EOPs, EPHs and TAG_COLLs can be stored in folders of the "Unit" object type. EPHs and TAG_COLLs can be stored in folders of the "Equipment Module" object type.

The charts with the function blocks (valves, controllers etc.) and sequential controls (SFC) required for the automation task can also be stored in these BATCH hierarchy folders. You can also extend the structure specified by SIMATIC BATCH for the general function blocks using neutral hierarchy folders so that you produce the ideal plant structure for your requirements.
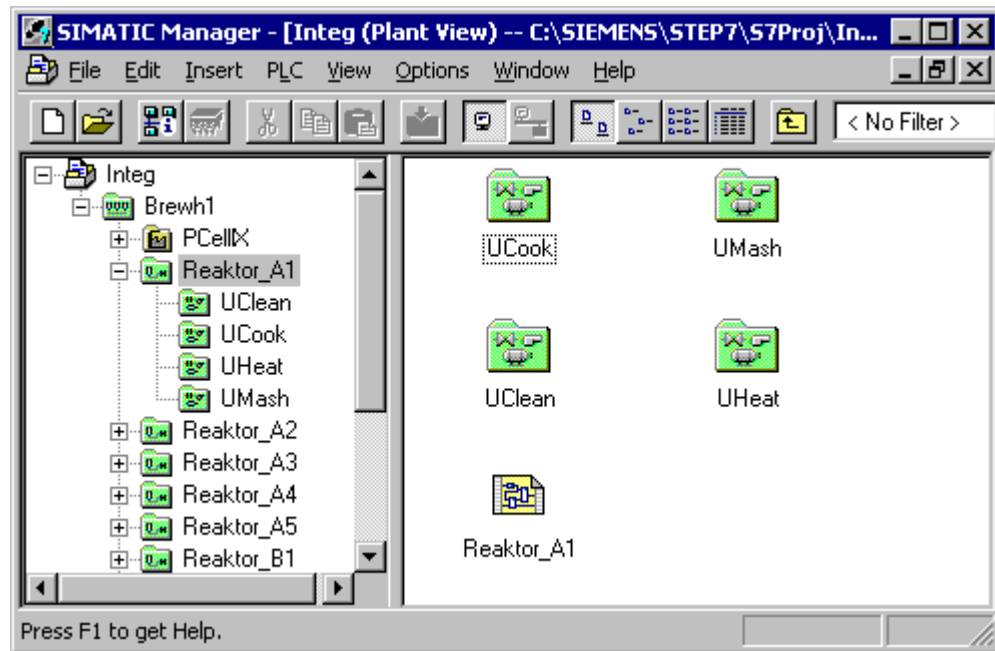
Example:

4.7.2 Extending the Plant Hierarchy by Adding Neutral Folders

Neutral Folders

As already mentioned, the three-stage hierarchy for SIMATIC BATCH can be extended by adding neutral folders to improve the structuring of the project, for example to divide units into groups. The neutral folders can be created at any level. The total number of possible levels (batch hierarchy levels, levels with neutral folders) is limited to 5.

Neutral folders can, for example, be inserted above the "Unit" level. This level can then be used, for example, as the area level. A further level could, for example, be inserted below the "Equipment Module" level. This level can then serve as a control module level.

Example
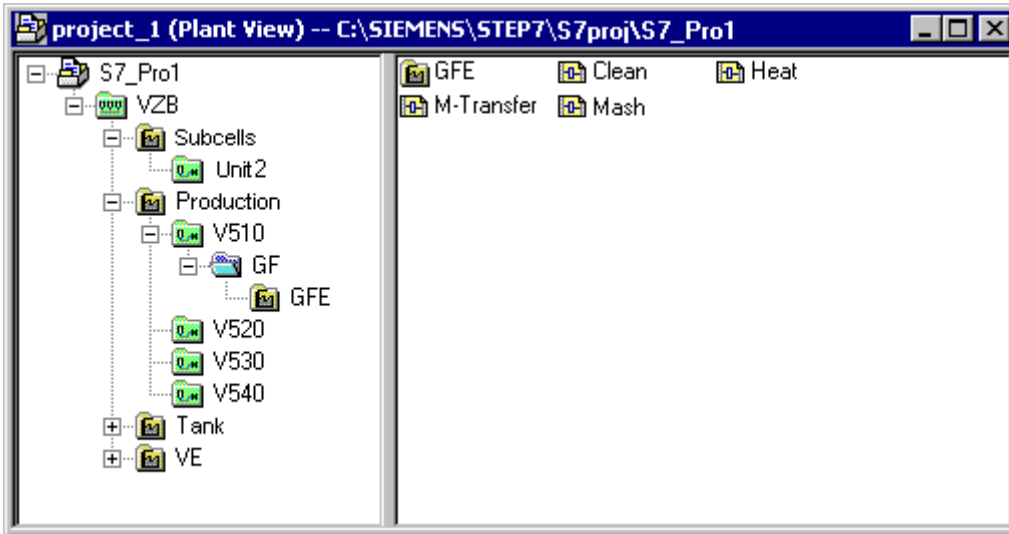
Levels in the Example:

- Process cell: Crop protection plant
- Area: Subcells, production, tanks
- Unit   In the production area: V510, V520, V530, V540
- Equipment Module   In unit V510: aerate, dose, pump,...
- Control Module   P020, P021, P022, T390, Y400, Y405

Batch allocations of the levels in the example:

- Process cell: Data types/measured value types/phase types, unit classes, units of measure
- Area: None (not relevant for batches)

  Areas are displayed during recipe creation as a filter criterion for unit allocation.
- Unit   Units and possibly equipment phases
- Equipment Module   Equipment phases
- Control Module   None (not relevant for batches)

4.7.3 Relationship between Plant Hierarchy, Blocks, and Recipes

Introduction

For recipe creation and processing, the process cell and unit levels must exist at least once. Whether or not you require the equipment module level depends on how you define the equipment procedural elements.

Relationship Between Hierarchy Folders, Block Instances and Recipe Elements for a Hierarchical Recipe:
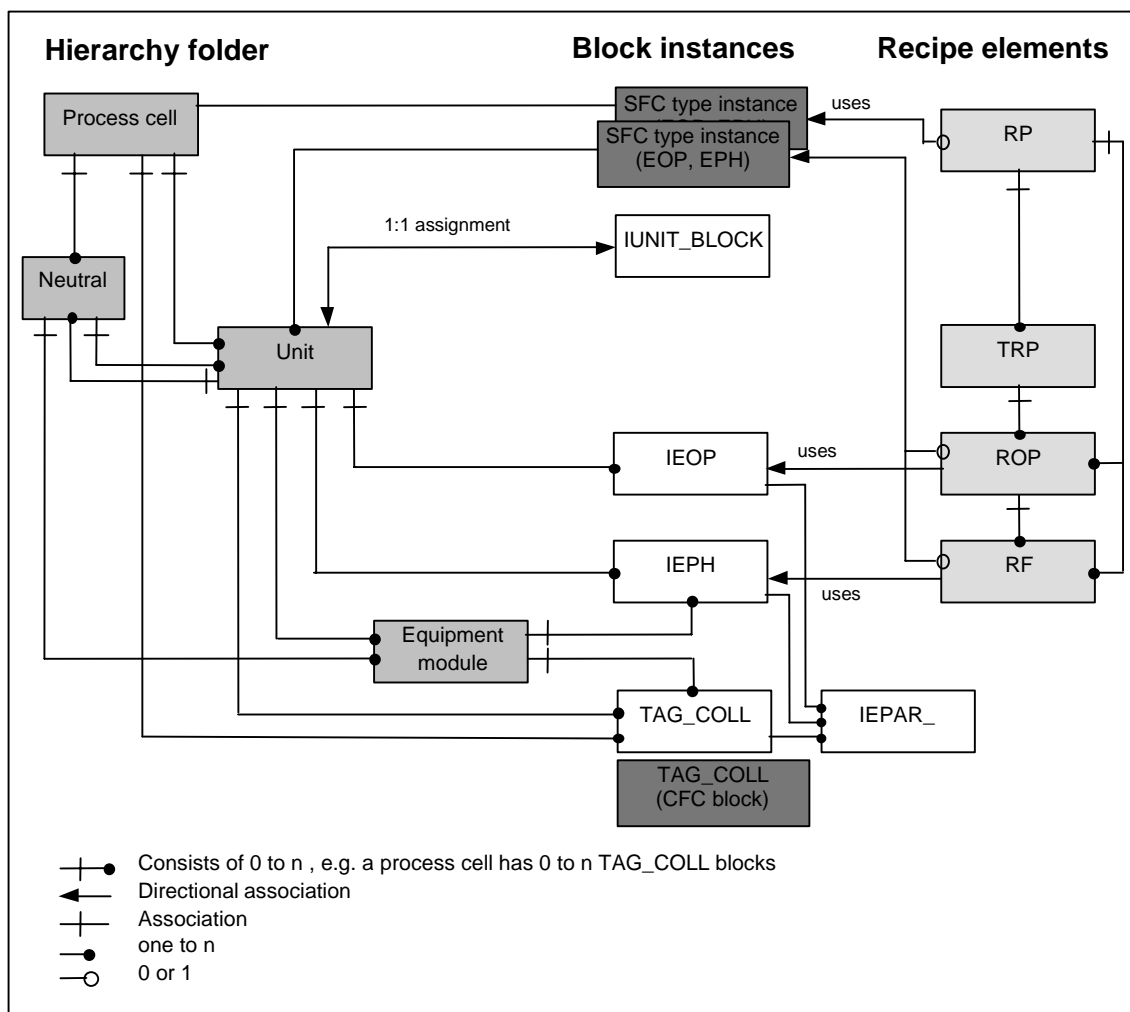
Legend:

Batch hierarchy folder of a process cell

Process cell

Unit

Equipment module

Neutral folder

Block instances

IEOP   -> Interface Equipment Operation

IEPH   -> Interface Equipment Phase

IUNIT_BLOCK   -> Interface Unit Status and Allocation

TAG_COLL   -> Collection of Process Values

Recipe Elements

RP   -> Recipe Procedure

RUP   -> Recipe Unit Procedure

ROP   -> Recipe Operation

RPH   -> Recipe Phase

4.7.4   Interface to the Technischen Function (CFC Charts)

4.7.4.1   Introduction

Interface to the Equipment Phase

In SIMATIC BATCH, each terminal step (recipe phase) of a control recipe communicates during run time with a programmable controller equipment phase that implements the required phase of the recipe phase. Both setpoints and process values as well as the current status of the equipment phase or control commands of the recipe phase are exchanged.

As of version V6.0, SIMATIC BATCH can use the new functionality of the SFC types in the Engineering System (see section "Use of the SFC Types"). As an alternative and to ensure compatibility, SIMATIC BATCH continues to provide the BATCH interface blocks as a communications interface to the processing programs on the programmable controller (refer to the section "Using the BATCH Interface Block")

BATCH interface blocks - up to SIMATIC BATCH V6.0

In the versions of SIMATIC BATCH lower than V6.0, communication between SIMATIC BATCH and the equipment phases on the programmable controller is implemented using interface blocks (IEPH, IEOP and IEPAR_xxx). These blocks are implemented as CFC blocks and are installed during the SIMATIC BATCH setup. They are interconnected with the appropriate inputs and outputs of the control block and technological blocks of the equipment phase in CFC charts.

SFC types – Use as of SIMATIC BATCH V6.0

As of SIMATIC BATCH V6.0, there is a merging of interface block and equipment phase using the standard tools of SFC. An SFC type (= BATCH type block) with parameters is created for each equipment phase type in the SFC chart. Each BATCH type block is displayed in the "Other Blocks" block library or in the family assigned to the SFC type (for example batch) of CFC and can be inserted simply into the SFC chart.

Storage in the Plant Hierarchy

The BATCH interface blocks and BATCH type blocks are stored in the CFC charts according to their function in the corresponding hierarchy folders in the plant view in the SIMATIC Manager.

4.7.4.2 Use of the BATCH Interface Blocks

Functions

Using the BATCH interface blocks along with SIMATIC BATCH makes the following functions possible:

- Controlling the Procedure:
  The IEPH/IEOP blocks are for this purpose. These provide the commands (for example start or put on hold) of the recipe steps from the batch control to the processing blocks (for example : SFC CTL or user blocks). The processing blocks report their current statuses back to the batch control.

- Assigning and releasing a unit via a running control recipe:
  The IUNIT_BLOCK blocks are for this purpose.

- Collection of process values to be used in transition conditions of third-party units and for archiving and logging.
  The TAG_COLL blocks are for this purpose.

- Transferring setpoint and actual values:
  The IEPAR blocks are for this purpose. The batch control writes the recipe parameters (setpoints) for the processing blocks into these blocks via the IEPH/IEOP blocks. The processing blocks write the result data (actual values) into the IEPAR blocks so that they can be stored as batch data by the batch control once again using the IEPH/IEOP blocks.
  The IEPAR blocks linked to the IEPH/IEOP blocks are also used to form transition conditions for the local unit.

Overview of the BATCH Interface Blocks

Block	Application
IEPH	Control of simple processes
IEOP	Control of complex processes
IUNIT_BLOCK	Management of unit allocation
TAG_COLL	Collecting of process values for archiving, logging, and forming transitions
IEPAR_DINT	Parameter block for the data type **double integer**
IEPAR_BOOL	Parameter block for the data type **Boolean** (binary)
IEPAR_REAL	Parameter block for the data type **real** (floating point)
IEPAR_STR	Parameter block for the data type **string** (text)
IEPAR_PI	Parameter block for the data type **process input**
IEPAR_PO	Parameter block for the data type **process output**
IEPAR_ENUM	Parameter block for the data type **enumeration type** (user-defined enumeration type)

Online Help on the BATCH Interface Blocks

You will find a detailed description of the function, operation, and input/output parameters for each individual BATCH interface block in the context-sensitive online help for the block in CFC.

With a BATCH interface block selected in the CFC chart, simply press the F1 key to open the context-sensitive help.

4.7.4.3   Using SFC types

Functions

Using the SFC types (SFC standard) along with SIMATIC BATCH makes the following functions possible:

Controlling the Procedure:
Here, you use the SFC type instances in the CFC charts (of the type EPH/EOP). These provide the commands (for example start or put on hold) of the recipe steps from the batch control to the internal processing. The status of the internal processing and the process values are reported back to batch control so that they can be stored by batch control as batch data.

Supplementary Use of the BATCH Interface Block IUNIT_BLOCK

The following function continues to use a BATCH interface block even after converting to SFC types:

Assigning and releasing a unit via a running control recipe:
The IUNIT_BLOCK interface blocks are used for this purpose.

Supplementary Use of the TAG_COLL Function Block

Even when using the SFC types, a standard FB is used for the following function:

Collection of process values to be used in transition conditions and for archiving and logging: Here, the TAG_COLL blocks are used.

4.8   Creating the Plant Hierarchy

4.8.1   Using the BATCH Hierarchy Folder

4.8.2   "Process Cell" Hierarchy Folder

Introduction

Below the project you create the SIMATIC BATCH hierarchy folder of the object type "Process Cell". You set the object type in the properties of the hierarchy folder in the "S88 Type Definition" tab.

Definition of a Process Cell

A process cell is a logical grouping of facilities/devices (containers, actuators, sensors, etc.) for creating one or more batches. The process cell determines the spectrum of logical control options for a set of process equipment within a plant.

Rules for the "Process Cell" Hierarchy Folder

- Within a project, only one "Process Cell" hierarchy folder can be created. Examples of this might be a polymerization plant, dyehouse, multipurpose plant.

- When creating a master recipe in SIMATIC BATCH, the data of this process cell are made available. This means that all the units and equipment phases required in a master recipe must be created below the process cell folder.

Multiproject

Each project of a multiproject contains the same "Process Cell" object. Below this, you can configure different units in the individual projects.

4.8.2.1 "Unit" Hierarchy Folder

Introduction

Below the process cell, you create the hierarchy folder with the object type "Unit".

- If the unit folder is created directly below the process cell folder, the "Unit" object type is assigned automatically by the system when you create it.

- If the unit folder is not created directly below the process cell folder but is inserted below a neutral folder, the inserted folder is automatically assumed to be a neutral folder. You can then set the "Unit" object type afterwards in the properties of the hierarchy folder in the "S88 Type Definition" tab.

"Unit" Hierarchy Folder

Several units can be defined in one process cell. Several units can be used within a master recipe. Examples at this level could be the division of a process cell into neutralization, extraction, distillation, or preparation.

Assigning the Unit Class

In the object properties of the "Unit" hierarchy folder, you assign the corresponding unit class (for example "Reactor") to each unit. You also enter concrete values for the unit parameters (for example "Coating = Glazed", "Volume = 500 l").

The unit parameters are used in SIMATIC BATCH when a batch is created in conjunction with the equipment requirements for restricting the possible candidates in unit selection. An example of the properties of a unit class might be the inner coating of the reactor, for example rubber coated, enameled, glazed etc.

You can open this dialog from the Object Properties dialog of the "Process cell" hierarchy folder > "S88 Type Definition" tab > "Unit class" dialog box.

Managing Unit Allocation with the IUNIT_BLOCK

To map the unit on the programmable controller, there is exactly one instance of the BATCH interface block UNIT_BLOCK in one of the charts of the "Unit" hierarchy folder. The batch control enters the batch ID and the batch name in the IUNIT_BLOCK block so that the allocation of units can be managed.

With suitable user configuration on the PLC, IUNIT_BLOCK can be used to prevent the use of a unit by batch control (input BA_EN, BATCH enable).

4.8.2.2 "Equipment Module" Hierarchy Folder

Introduction

Below the unit, you create the hierarchy folder of the "equipment module" object type.

- If the equipment folder is created directly below the unit folder, the "Equipment Module" object type is assigned automatically by the system when it is created.

- If the equipment folder is not created directly below the unit folder but is inserted below a neutral folder, the inserted folder is automatically assumed to be a neutral folder. You can then set the "Equipment Module" object type afterwards in the properties of the hierarchy folder in the "S88 Type Definition" tab.

"Equipment Module" Hierarchy Folder

Several equipment modules such as a dosing or bottling machine can be defined in a unit. Equipment phases such as heating, cooling, ventilating, emptying can be created for the equipment modules.

4.8.3   Editing the Plant Hierarchy

4.8.3.1   How to Create the Plant Hierarchy

Information on Creating and Setting the Plant Hierarchy

For detailed information on creating, modifying, and setting the properties of the plant hierarchy, refer to the manual *Process Control System PCS 7; Engineering System*.

Below, only the **additional and special** settings for the batch configuration are described.

Special Settings for Batch Configuration

The following additional settings must be made or checked for batch configuration:

- Specifying the Basic Settings for the Plant Hierarchy
- Assigning the Object Type "Process Cell", "Unit" or "Equipment Phase" to Hierarchy Folders
- Assigning a Unit Class to a Unit
- Executable Functions in a Single Project
- Executable Functions in a Multiproject
- Inserting CFC Charts with EPHs/EOPs

4.8.3.2   Specifying the Basic Settings for the Plant Hierarchy

Necessary Settings

The following basic settings are necessary for the plant hierarchy of the current project:

- Number of hierarchy levels
- Whether or not the hierarchy names of an entire level will be included in the tag names (in WinCC) (HID = higher-level designation).

Follow the steps outlined below in the SIMATIC Manager:

Once you have created the first hierarchy folder, you can make the basic settings.

1. Select any hierarchy folder in the plant view.
2. Select the menu command Options > Plant Hierarchy > Customize.
3. Make the following settings in the "Customize Plant Hierarchy" dialog box:
   - Enter the maximum number of possible hierarchy levels that can occur in the project. For the BATCH hierarchy, only three hierarchy levels are relevant. If you decide to use neutral folders, up to 5 hierarchy levels are possible.
   - Using the "Include in designation" check box, you can decide whether the hierarchy folder name of any particular level will be included in the higher level designation (HID).

     You can decide whether the name of an individual hierarchy folder will be included in the HID in the operator control and monitoring attributes of each individual hierarchy folder (menu command **Edit > Object Properties > Control and Monitoring Attributes"**).
4. Confirm with OK.

4.8.3.3 Assigning the "Process Cell", "Unit" or "Equipment Phase" Object Type

To identify the BATCH hierarchy, each hierarchy folder is explicitly assigned the object type "Process Cell", "Unit", or "Equipment Phase". Depending on the object type, other BATCH attributes can then be set.

After creating a new hierarchy folder, one of the object types "process cell", "unit", "equipment phase" or "neutral" is automatically assigned depending on the position. You can change the object type assigned to a hierarchy folder as follows:

Follow the steps outlined below in the SIMATIC Manager:

1. Select the hierarchy folder in the plant view.

2. Select the menu command **Edit > Object Properties**.

3. Change to the "S88 Type Definition" tab.

4. Set the required type (process cell, unit, or equipment module) of the hierarchy folder for the "Object Type". If you select the "<neutral>" object type, the BATCH hierarchy will be deactivated again for this folder.

5. Confirm with OK.

Result: The graphic display of the hierarchy folder matches the selected object type.

Neutral Folders

The "<neutral>" object type deactivates the BATCH hierarchy for the "process cell" object. The lower-level BATCH hierarchy folders retain their object type but are no longer relevant for the SIMATIC BATCH configuration. In "Object type", the nested hierarchy folders no longer relevant for SIMATIC BATCH are displayed in round brackets, for example: (Unit).

4.8.3.4 Assigning Unit Classes to a Unit

Introduction

In the object properties of the "Unit" hierarchy folder, you assign the corresponding unit class (for example "Reactor") to each unit. You also enter concrete values for the unit parameters (for example "Coating = Glazed", "Volume = 500 l").

In the BATCH recipe editor, the options for selecting unit candidates and the corresponding equipment phases (of the type EOP/EPH) can then be restricted to a unit class. The great advantage of this is that when you convert the master recipe to the control recipe, the actual unit allocation is always successful since the master recipe contains only the permitted unit candidates.

Follow the steps outlined below in the SIMATIC Manager:

1. Select a "unit" hierarchy folder in the plant view.

2. Select the menu command **Edit > Object Properties**.

3. Change to the "S88 Type Definition" tab.

4. Select an existing class for "unit class".

   Note: You create new unit classes and the corresponding parameters for the entire process cell when specifying the type description with the menu command **Options > SIMATIC BATCH: Batch Types -> Unit Classes**.

5. Assign the parameters values under "Unit class" in the table and confirm with OK.

4.8.3.5 Rules for Inserting CFC Charts

Rules for Storing CFC Charts in the Plant Hierarchy

The process cell model is created in the SIMATIC Manager based on the CFC charts and the configured plant hierarchy. When inserting CFC charts in the plant hierarchy, note the following:

- The charts with the corresponding SFC type instances or BATCH interface blocks can be stored in the appropriate batch hierarchy folders according to their technological significance. Only TAG_COLL can be stored in the process cell folder. The IUNIT_BLOCKs along with EOPs, EPHs and TAG_COLLs can be stored in folders of the "Unit" object type. EPHs and TAG_COLLs can be stored in folders of the "Equipment Module" object type.

- The CFC charts with the function blocks (valves, controllers etc.) and sequential controls (SFC) required for the automation task can also be stored in these BATCH hierarchy folders.

- You can also extend the hierarchy specified by SIMATIC BATCH for the general function blocks using neutral hierarchy folders so that you produce the ideal plant structure for your requirements.

Example:
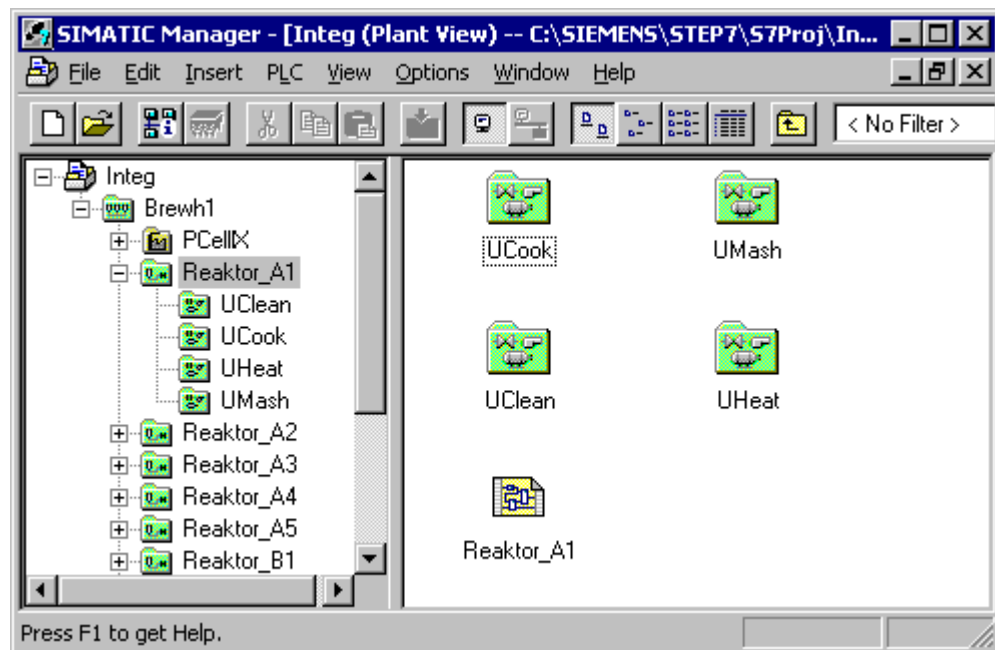
4.9 Inserting BATCH Interface Blocks in CFC Charts

4.9.1 Introduction

You drag the BATCH interface blocks from the library **PCS 7 Library > SIMATIC BATCH Blocks** to the CFC chart.

Engineering in CFC Charts

The BATCH interface blocks are inserted in the CFC charts for the following engineering tasks:

- Defining units
  A CFC chart is created for each unit and contains an instance of the IUNIT_BLOCK with assigned parameter values.

- Linking process blocks with SIMATIC BATCH
  A uniform interface is created for each equipment phase or operation. This is achieved with an IEPH or IEOP block. This is inserted in the SFC chart along with the corresponding IEPAR_xxx parameter blocks and the processing block (using the SFC external view or user block). The control outputs QSTART, QHOLD, QABORT, QTERM, QRESET of the IEPH/IEOP block are interconnected with the corresponding inputs of the processing block (using the SFC external view or user block).

- Collecting process values together to form transition conditions and defining measured variables
  For IEPARs that will be used in transition conditions in the BATCH Recipe Editor and are not available as IEPAR in the IEPH, the process values can be collected. Process tags can also be included as parameters to be used in the batch measured value acquisition. Alternatively, the measured value acquisition can also be specified in the type parameters of the Batch types (phase and operation types).

4.9.2   Rules for the IEPH and IEOP Interface Blocks

Rules for Interconnection in CFC Charts

- The IEPH, IEOP interface blocks for controlling the process must be inserted in sequences before the processing block in the CFC chart.

- The IEPH block is used for a recipe step of the type RPH (recipe phase). The IEOP block is used for a recipe step of the type ROP (recipe operation).

- To pass control commands from SIMATIC BATCH to the SFC, the following and connections between IEPH, IEOP and SFC external view must be configured:

IEPH/IEOP		SFC external view	
QBA_EN	(OUT)	BA_EN	(IN)
VSTEP_NO	(OUT)	STEP_NO	(IN)
VBA_ID	(OUT)	BA_ID	(IN)
VBA_NAME	(OUT)	BA_NA	(IN)
Q_OCCUPI	(OUT)	OCCUPIED	(IN)
QSTART	(OUT)	START	(IN)
QHOLD	(OUT)	HOLD	(IN)
QSTOP	(OUT)	STOP	(IN)
QABORT	(OUT)	ABORT	(IN)
QRESET	(OUT)	RESET	(IN)
QTERM	(OUT)	COMPLETE	(IN)
QCONT	(OUT)	CONT	(IN)

- For continuous operation of the equipment procedural element (CONTINUOUS mode), the following conditions must be satisfied for the SFC:

  - ENASTART = 1

  - SELFCOMP = 0

- The equipment procedural element must return the actual status to SIMATIC BATCH. This requires the following interconnection:

SFC external view		IEPH/IEOP	
BA_STATE	(OUT)	USTAT_L	(IN)

- The underlying parameter blocks (IEPAR_xxx) must be connected at the EPE_CONN output of the IEPH/IEOP blocks. The following parameter types are possible:

  IEPAR_REAL   Floating point

  IEPAR_DINT   Integer

  IEPAR_BOOL   Binary value

  IEPAR_PI   Input material

  IEPAR_PO   Output materials

  IEPAR_STR   String

  IEPAR_ENUM   Enumeration

  With the IEPAR_ENUM enumeration time, the data type name is specified at the "ENUM" block I/O. In the Batch types, the values are assigned to this data type (for example 1 = ON / 2 = OFF etc.).

- Exactly one IEPAR block for the required data type is necessary for each parameter (setpoint/process value) of an IEOP/IEPH.

- The phase/operation type name must be specified in each IEPH/IEOP block.

- In all IEPAR blocks (apart from the Bool and Enum type) the lower and upper limit value and the default setpoint must be specified. The default value must be within the limits.

Example
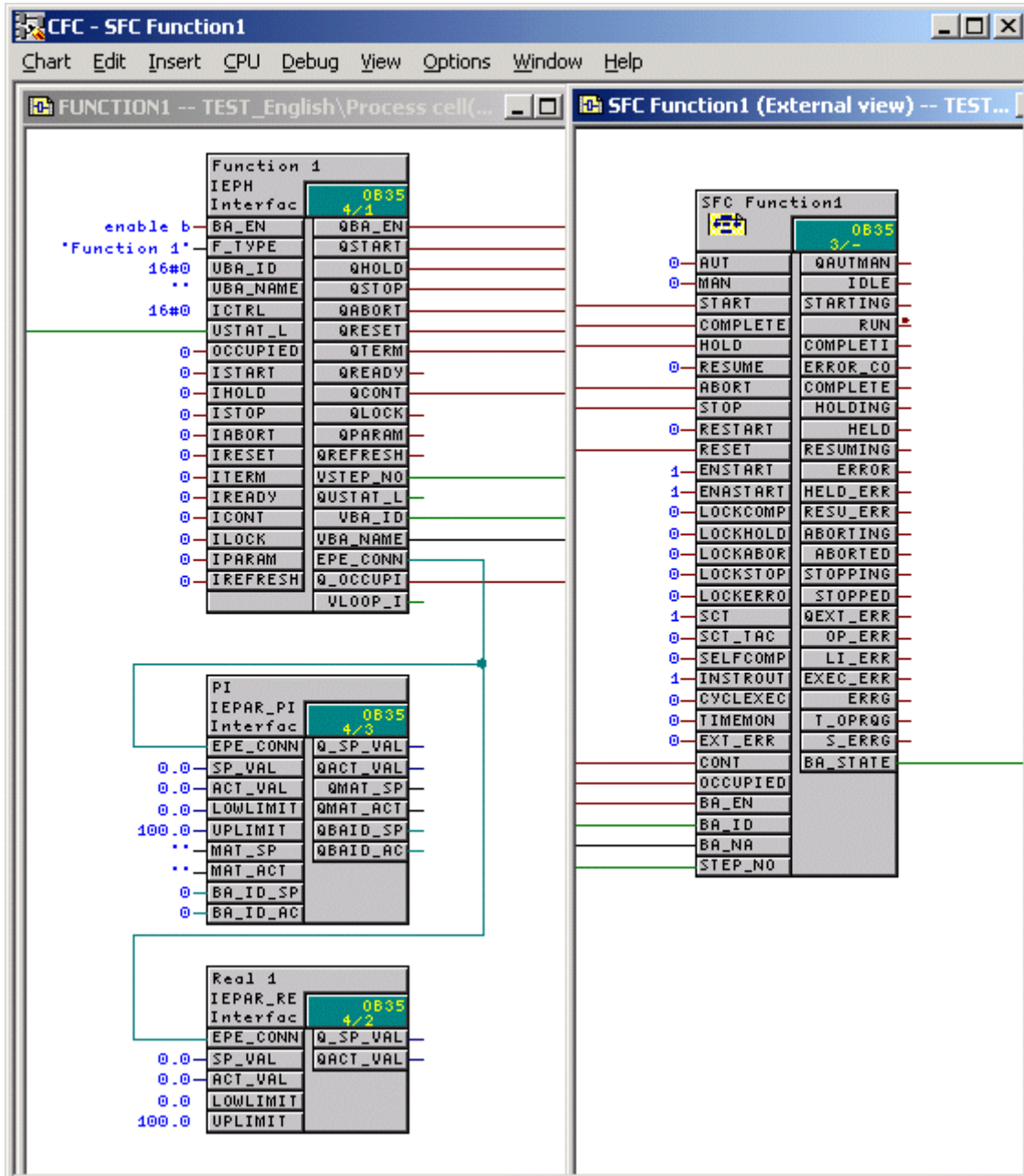
Rules for Supplying the Equipment Procedural Elements with Batch Data

Equipment procedural elements controlled by SIMATIC BATCH must be supplied with the batch data. The faceplates on the PCS 7 OS then indicate whether this equipment procedural element is being used by SIMATIC BATCH and which batch is running. The batch name and the batch ID are included in the messages to the PCS 7 OS.

To allow this, the five following interconnections must be configured:

IEPH/IEOP	**Automation Function** for example SFC (external view), MEAS_MON, MOTOR...
QBA_EN	BA_EN
QOCCUPI	OCCUPIED
VBA_ID	BA_ID
VBA_NAME	BA_NA
VSTEP_NO	STEP_NO

Example

Example of the interconnection between IEPH, a MOTOR block and a MEAS_MON block:
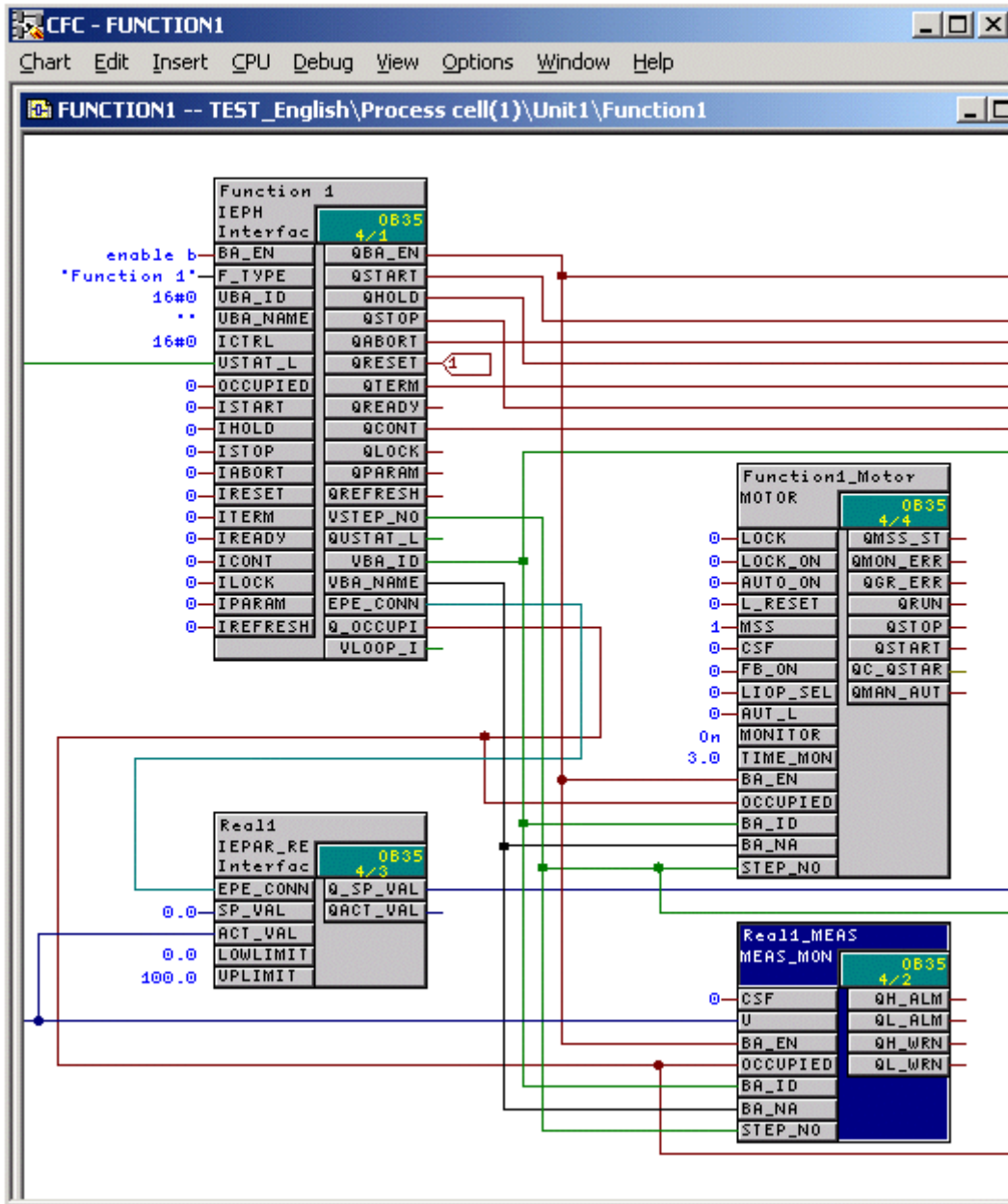
Rules for Control Strategies with IEPH, IEOP

In the CFC chart, an IEPAR_ENUM must be assigned to the BATCH interface block IEPH, IEOP to allow transfer of the control strategy number. The user data type, in this case the control strategy parameter name, must be specified at the "ENUM" block I/O.

How configuration continues is described in the section "Specifying Control Strategies for a Type".

4.9.3   Rules for the IUNIT_BLOCK Interface Block

Rules for Interconnection in CFC Charts

- To map the unit on the PLC, there must be exactly one instance of the UNIT_BLOCK in one of the charts of the "Unit" hierarchy folder.

- The block name must be entered otherwise no other settings or interconnections are absolutely necessary with the IUNIT_BLOCK.

- At the "UNIT_NAME" input of the IUNIT_Block, a unit name can be specified that differs from the unit name in the plant hierarchy. This unit name is then used in the remaining SIMATIC BATCH configuration.

Example

4.9.4 Rules for the TAG_COLL Interface Block

Rules for Interconnection in CFC Charts

- If process values of IEPAR blocks are queried in transitions and these are not available as IEPAR_xxx in the IEPH or IEOP, a TAG_COLL must be inserted in the CFC chart. This is, for example, the case when values of other units are queried.

- The parameter blocks (IEPAR_xxx) must be connected to the EPE_CONN output of the TAG_COLL block.

- A process tag type name must be specified for each TAG_COLL.

Example
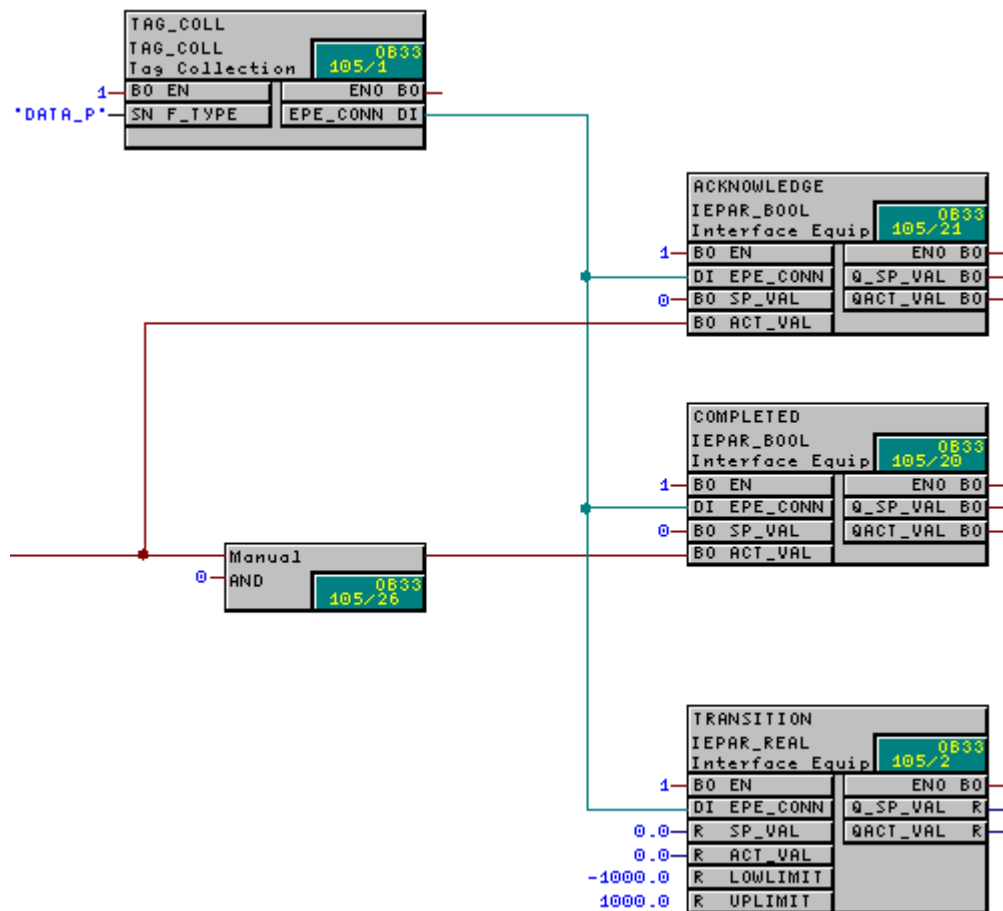
4.10 Creating and Inserting SFC Types in CFC Charts

4.10.1 How to Work with SFC Types

Note:

You create SFC types and their instances in the CFC charts for SIMATIC BATCH using SFC/CFC standard tools. SIMATIC BATCH does **not** need to be installed!

Configuring an SFC Instance

Below, you will find a **recommended order** for creating an SFC type (equipment phase) and an instance in the CFC chart.

SIMATIC Manager

```
┌─────────────────────────────────────────┐
│ SFC:                                     │
│  •  Create the SFC type                  │
│  •  Create parameters for the SFC type   │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│ CFC:                                     │
│  •  Insert SFC type in CFC chart         │
│  •  interconnect instance of the SFC type│
└─────────────────────────────────────────┘
```
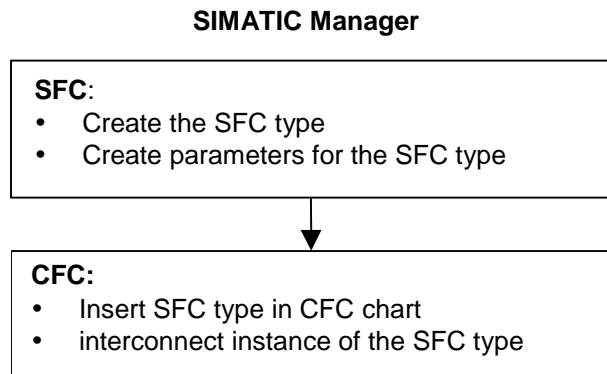
Underlying Principle

In the SFC, you create the following SFC types for SIMATIC BATCH:

*   EOP (equipment operation)

*   EPH (equipment phase)

The type (EOP or EPH) and the type name are specified for the SFC type. This creates the interface to SIMATIC BATCH.

The following can be created as characteristics of the SFC type:

*   The control strategies of the equipment operation/phase

*   The setpoints (parameters) of the equipment operation/phase

The process values of the equipment operation/phase are derived from the setpoints.

SFC types created in this way (= BATCH type blocks) are stored in the chart folder.

In CFC, these BATCH type blocks are available in the **other blocks** library or the family assigned to the SFC type (for example batch) and can be dragged to the CFC chart and interconnected.

4.10.2   Creating a new SFC Type

Follow the steps outlined below in the SIMATIC Manager (component view)

1. Select the "S7 Program" object in the component view.

2. Select the menu command Insert > Insert New Object > SFC Type.

3. Mark the new object "SFC Type": ⊞ SFC-Typ(1).

4. Select the menu command **Edit > Object Properties**.

5. The "Properties SFC Type" dialog box opens.

   - Under Name, change the phase/operation tied name (Batch type).

   - You can also enter the required number for the FB number and the name of the block library for the family.

   - Change to the "Options" tab.

   - Under Category, set the version "EOP" or "EPH" and whether this operation type/phase type is allowed as an operator instruction.

Note:

The "EOP" or "EPH" setting is necessary to generate the type description. Only these SFC types are read in the BATCH configuration dialog for the process cell (batch types)!

---

6. Select the menu command **Edit > Open Object**.

Result: SFC is opened with the new SFC type:
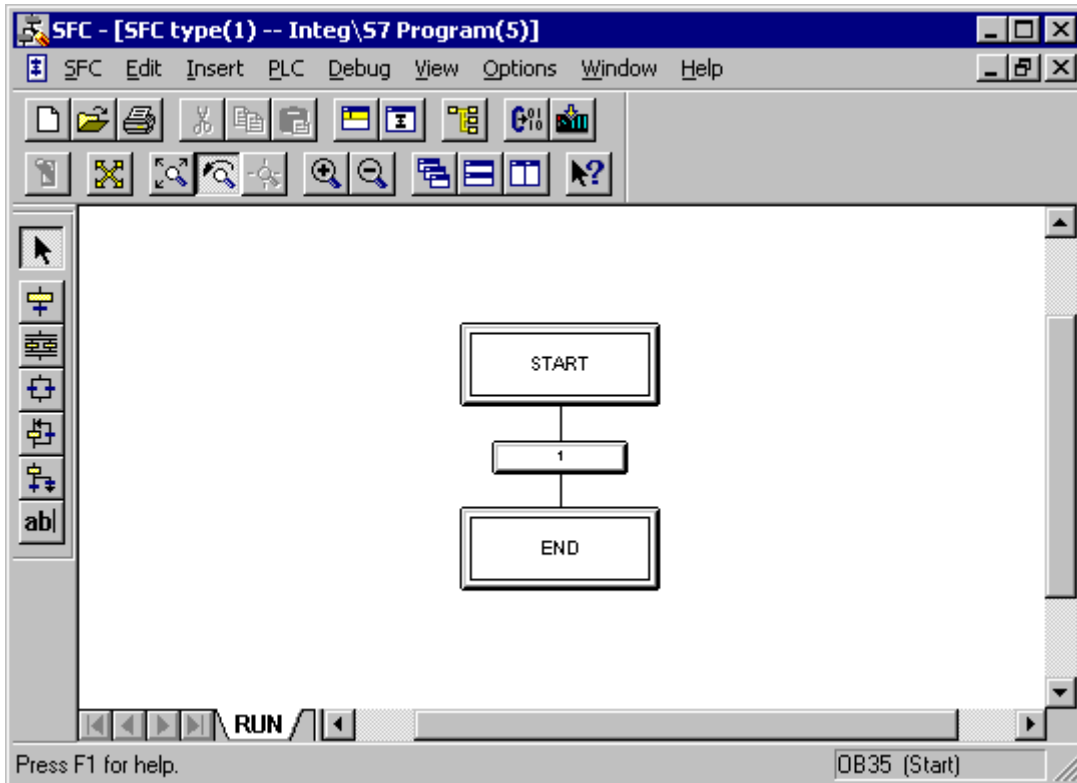
7. Here you can use the standard SFC tools to edit the sequential control of the equipment operation/phase.

8. Change to the characteristics view by selecting the menu command **Edit > Characteristics** or click 🔲

9. Enter your setpoints and control strategies here.

Note:

With the INT and DINT data types, an enumeration data type can be assigned. This is stored as the system attribute "S7_enum" on the interface I/Os.

The enumeration is then available for operator control and monitoring of SFC instances in SIMATIC BATCH.

Further references

For more detailed information on programming a sequential control and defining the SFC characteristics, refer to the online help of SFC (<F1> or menu command **Help > Contents**).

4.10.3 Specifying the Parameters

Features

You create setpoints (parameters) and control strategies that are relevant for SIMATIC BATCH in the characteristics view in SFC:
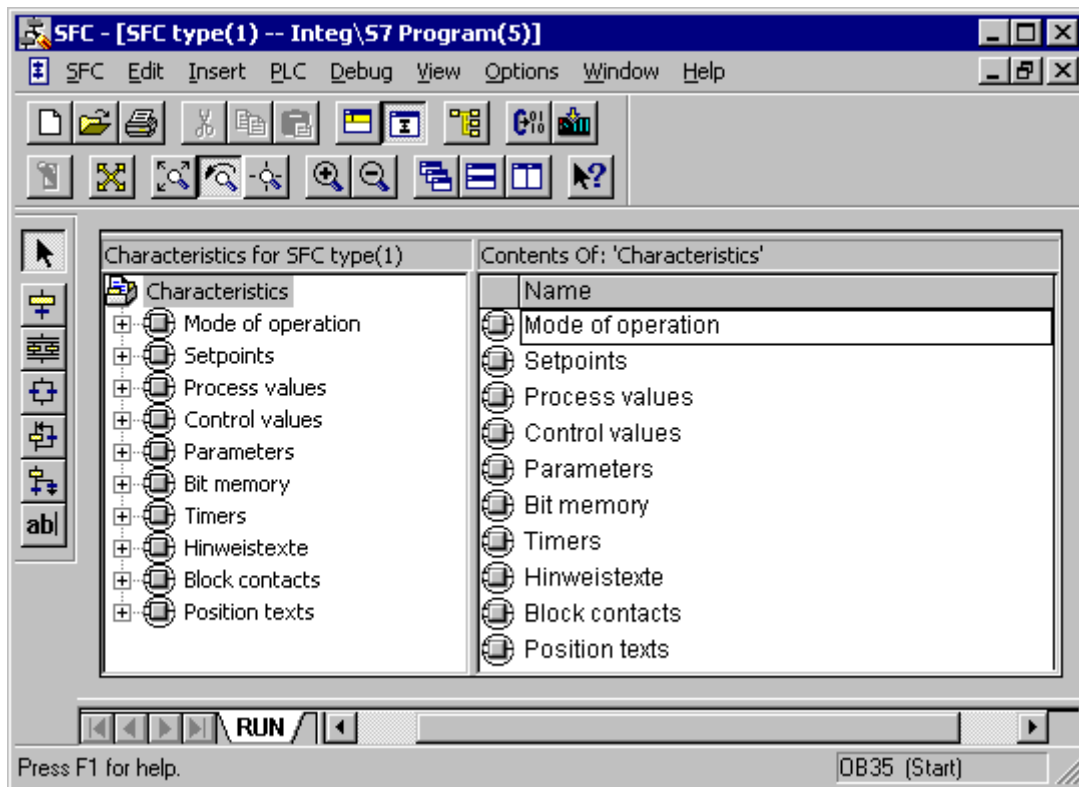
Overview of the Relevant Parameters

The following parameters must be set for SIMATIC BATCH:

Parameter	Where to edit	Meaning
Setpoint	Under "setpoints" characteristic	Parameters for the equipment operation/phase; it is possible to assign previously defined control strategies.
Input material/ Output materials	Under the "Setpoint" characteristics: Data type PI/PO	Input material/output material for the equipment operation/phase; it is possible to assign previously defined control strategies.
Control strategy	Under the "Control strategies" characteristic	Control strategy name

Follow the steps outlined below in SFC:

1. Mark the new object "SFC Type": SFC-Typ(1).

2. Select the menu command **Edit > Open Object**.

3. SFC opens with the new SFC type.

4. Change to the characteristics view of SFC Select the menu command **Edit > Characteristics** or press .

5. The characteristics view of the SFC type opens.

6. Here, you edit all the setpoints and control strategies relevant for SIMATIC BATCH by clicking on the characteristic in the left column, for example on "Setpoints".

On the right-hand side, you can now set the parameter with all the attributes relevant for SIMATIC BATCH.

To assign setpoints for a control strategy:

1. Select the setpoint in the characteristics view.

2. Select the menu command **Edit > Object Properties**.

3. The properties dialog (control strategy assignment) _z for the setpoint opens.

4. Using the button, assign the required (already created) control strategies in which the setpoint parameter is located.

5. Confirm with the "Close" button.

4.10.4   Inserting an Instance of the SFC Type in the CFC Chart

Introduction

After creating the SFC type and storing it, the SFC type can now be dragged from the **other blocks** library or the family assigned to the SFC type (for example batch) and placed in the CFC chart. At the same time, the type FB is copied to the project or if it already exists, it is updated. A DB is created and therefore an instance of the SFC type. Remember the following rules:

Rules

- The SFC types in a chart container are displayed in CFC in the catalogs under **other blocks** or in the family assigned to the SFC type (for example batch).

- If you create an instance of the SFC type, the SFC type (including the FB) is copied to the project (chart container).

- After placing the SFC instance in a CFC chart, it can be interconnected.

- The SFC instance is not displayed in the chart container (only the CFC chart).

- The SFC instance is displayed in the CFC chart like a block with an interface.

- If you select an instance of the type, you can open and edit it within the CFC chart using the "Open" context-sensitive menu.

- The interconnection is possible with the control module level (CMs), the interlock logic, and batch control.

- In the SFC, in addition to the name of the operation/phase type parameter, an I/O name must be specified in the characteristics view for setpoints. One setpoint results in several block I/Os:

I/O name		Meaning
<name>	(IN)	Setpoint from SIMATIC BATCH or PCS 7 OS
<name>_Q	(OUT)	Setpoint (valid value for SFC)
<name>_AI	(IN)	Process value return input for process value
<name>_ AO	(OUT)	Process value for SIMATIC BATCH and PCS 7 OS
<name>_M	(IN)	Material code setpoint from SIMATIC BATCH*
<name>_MQ	(OUT)	Material code (valid MatCode for SFC)*
<name>_MAI	(IN)	Material code process value return input*
<name>_MAO	(OUT)	Material code process value for PCS 7 OS*
<name>_B	(IN)	Reserved for batch ID, not currently used
<name>_BQ	(OUT)	Reserved for batch ID, not currently used
<name>_BAI	(IN)	Reserved for batch ID, not currently used
<name>_BAO	(OUT)	Reserved for batch ID, not currently used

*   Only for PI or PO data types

- The following block I/Os exist for the control strategy:

I/O name		Meaning
CS	(IN)	Control strategy from SIMATIC BATCH or PCS 7 OS
QCS	(OUT)	Control strategy (valid control strategy for SFC)

Example
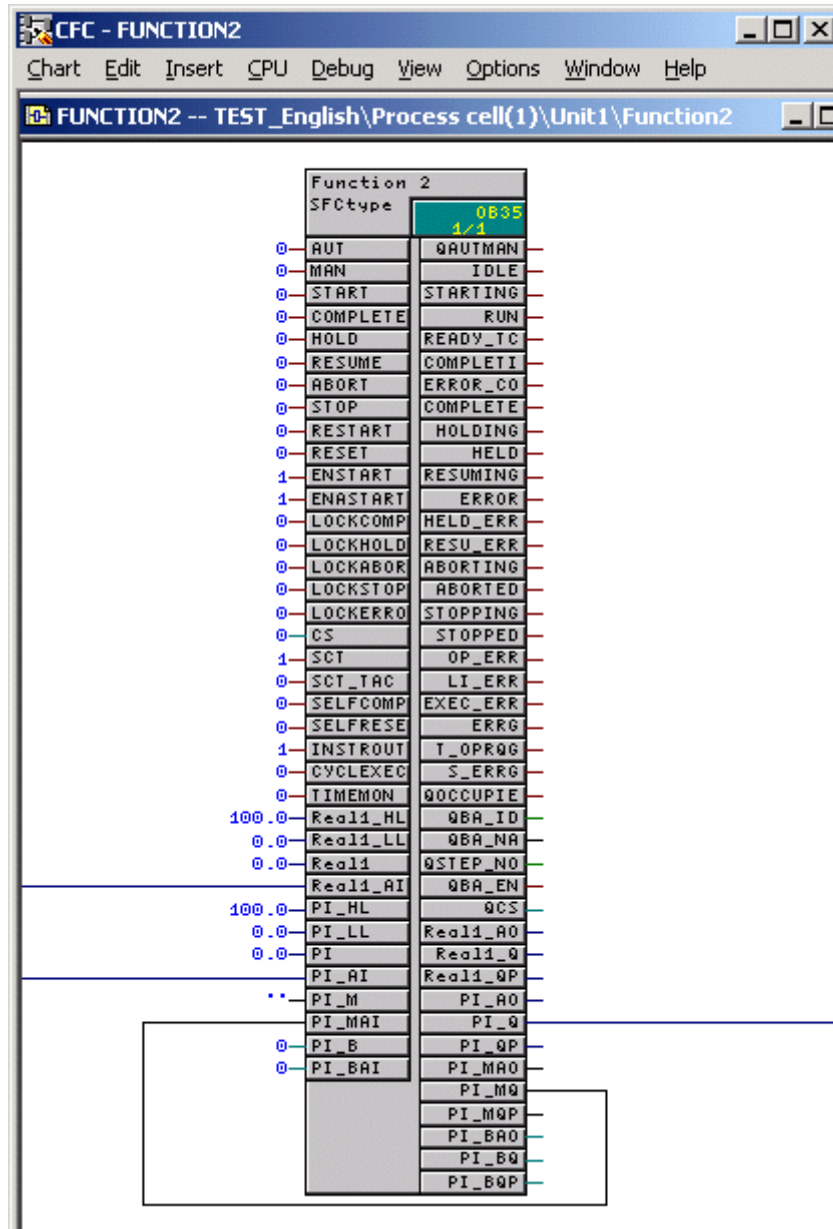
Rules for Supplying the Equipment Procedural Elements with Batch Data

Equipment procedural elements controlled by SIMATIC BATCH must be supplied with the batch data. The faceplates on the PCS 7 OS then indicate whether this equipment procedural element is being used by SIMATIC BATCH and which batch is running. The batch name and the batch ID are included in the messages to the PCS 7 OS.

To allow this, the five following interconnections must be configured:

SFC type	equipment procedural element_ for example MEAS_MON, MOTOR...
QBA_EN	BA_EN
QOCCUPIED	OCCUPIED
QBA_ID	BA_ID
QBA_NA	BA_NA
QSTEP_NO	STEP_NO

4.10.5   Counting Process Objects (PO)

If you want to know how many process objects (SFC types, IEOP, IEPH, and IUNIT_BLOCK instances) already exist, for example to order the correct license/authorization for SIMATIC BATCH, you can use the compilation function to find this out (refer also to the section "The SIMATIC BATCH Product").

Follow the steps outlined below in the SIMATIC Manager:

1. Open the BATCH configuration dialog with the with the menu command **Options > SIMATIC BATCH**.

2. Click the "Compile" button or "Validate".

3. Under "Log", select the "Compile" or "Validate" option and click the "Display" button.

Result: A window opens displaying the log data. The number of process objects is displayed under the "Process objects" title.

4.11 Creating and Inserting User Process Tag Types in CFC Charts

Introduction

Collecting measured values, for example to form transition conditions, is possible in two ways:

- Using the BATCH interface block TAG_COLL (as in BATCH *flexible* V5.x)

- Using the standard function block TAG_COLL, given the name TAG_COLLECT below to distinguish the two (new in SIMATIC BATCH V6.0)

Individual measured values are created in the interface or standard function block. The process tag types are then generated in the BATCH configuration dialog within the context of the batch types ("Generate" button) from the TAG_COLL/TAG_COLLECT blocks.

Using the TAG_COLL BATCH Interface Block

When using BATCH interface blocks, the TAG_COLL block is used to collect process values to form transition conditions and for archiving and logging measured values: Description -> refer to section Rules for the TAG_COLL Interface Block), The process tag types that are then generated can be further processed and modified in the BATCH configuration dialog.

Using the TAG_COLLECT Function Block

If you configure with SFC types it is advisable to configure a TAG_COLLECT standard function block to collect process values. The process tag types that are then generated are read-only in the BATCH configuration dialog. Modifications to the process tag type can only be made in the function block. These are then adopted in any existing instances. After modification, the Batch types and therefore also the process tag types must be generated again.

Note:

Points to note:

- To allow a TAG_COLLECT FB/FC type to be read into the BATCH configuration dialog (generated) for the process cell, an instance of the TAG_COLLECT must have been created at least once in the CFC chart.

- FB types are unique only within an S7 program or a CPU. For Batch configuration, however, the uniqueness throughout the entire project or the multiproject must be guaranteed.

There are two ways of creating process tag types:

- Method 1: A new FB is created directly.

- Method 2: A new CFC chart is created and then compiled as a block.

Method 1: To create process tag types directly as FB types TAG_COLLECT

1. In the component view of the SIMATIC Manager, create a new function block in an S7 program or a block folder by selecting the menu command **Insert > Insert New Object > Function Block**.

2. Select the function block and select the menu command **Edit > Open Object**.

3. Here, you can edit all the values that will be collected as measured values as input parameters.

Note:

Use only the data types permitted with SIMATIC BATCH:

Bool, Int, Dint, Real and String

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4. If required, assign the parameters the following attributes "S7_measval = true" for archiving or "S7_check = true" for checking and "S7_unit = unit of measure" (unit of measure is the name of the unit of measure).

5. Select the function block and select the menu command **Edit > Object Properties**.

6. Assign a symbolic name to the FB.

7. Go to the "Attributes" tab in the open properties dialog of the function block.

8. Here, set the attribute "S7_tagcollect" (process tags) to "true".

Properties - Function Block

General - Part 1 | General - Part 2 | Calls | Attributes

	Attribute	Value
1	S7_tagcollect	true
2		
3		
4		
5		
6		
7		
8		
9		
10		

Insert Row | Delete Row

OK | Cancel | Help
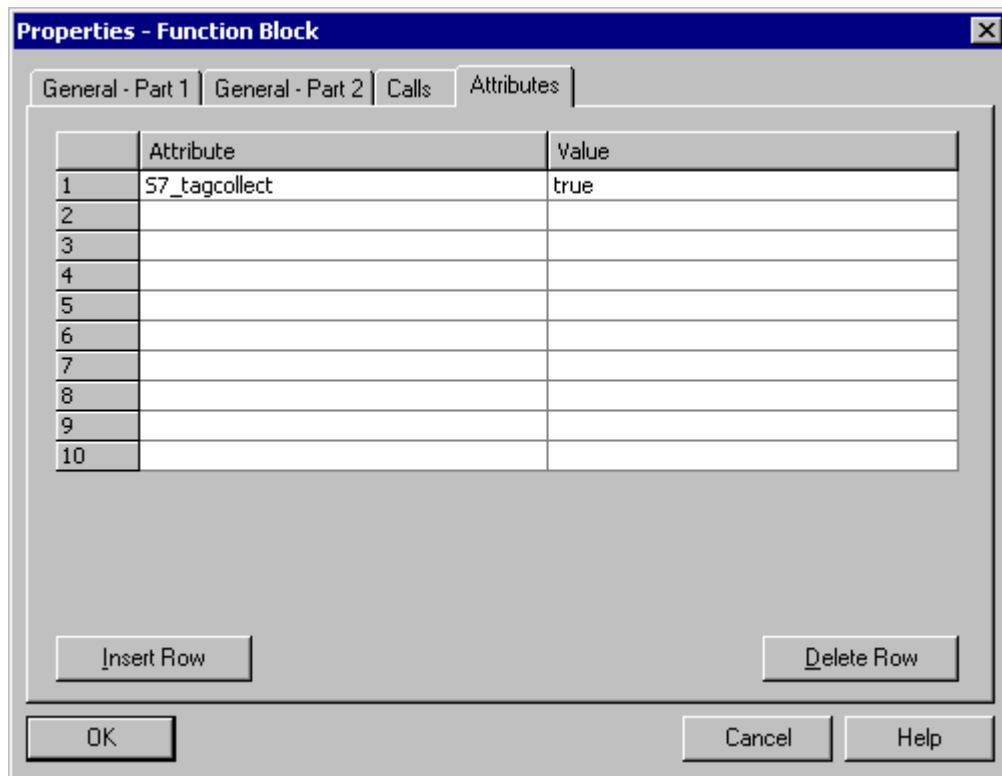
9. Accept the attributes with "OK".

10. Open the CFC chart and insert the function block from the "S7 Program" folder into a CFC chart.

Result: The FB type TAG_COLLECT appears in the "Other Blocks" library or the family assigned to the FB (for example Batch) and can be used immediately for configuring further process tag types.

Note:

The FB type TAG_COLLECT must be stored in the library, for example "Other Blocks" so that the measuring point types created in this way can be generated in the BATCH configuration dialog.

---

11. Open the BATCH configuration dialog with the **Options > SIMATIC BATCH** menu command.

12. Select the "Batch types" object in the left window.

13. Click the "Generate" button in the right-hand area.

14. Result: The new process tags that you have defined along with the set values (input parameters) are read in and displayed (read only).

15. Confirm all settings with OK.

Result: These process tag types are available for use as process cell references in the transitions during recipe creation. If the "S7_measval" attribute was set for the parameters and the interconnection to the WinCC archive was established for the "Process variables" assigned to the process cells, these can be used in the "Process tags" tab for batch logging during recipe creation.

Note:

The outputs of the standard blocks interconnected with the inputs of a TAG_COLLECT function block must all have the attribute "S7_m_c = true" set.

Method 2: To create process tags using a CFC chart

1. In the component view of the SIMATIC Manager, create a new CFC chart below a chart folder by selecting the menu command **Insert > Insert New Object > CFC**.

2. Select the CFC chart and select the menu command **Edit > Open Object**.

3. Open the I/O table with **View > Chart I/Os**.

4. Here, you can edit all the values that will be collected as measured values as input parameters under **IN**.

5. If required, assign the parameters the following attributes "S7_measval = true" for archiving or "S7_check = true" for checking, and "S7_unit = unit of measure" (unit of measure is the name of the unit of measure) (in the "Properties - Variable" dialog box for the parameter: This is selected with the right mouse button and context-sensitive command **Object Properties**):
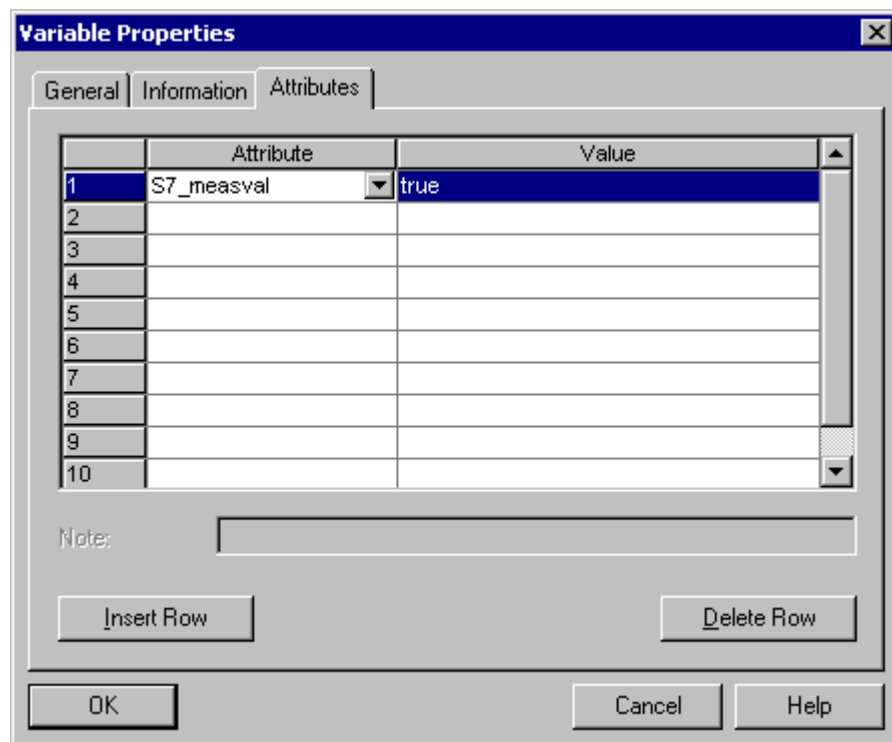
6. Confirm the settings with OK.

7. Select the menu command Chart > Compile > Chart as Block Type.

8. Specify the following in the "General" tab: FB name, symbolic name, and the family (for example BATCH)

9. Change to the "Attribute" tab.

10. Here, set the attribute "S7_tagcollect" (process tags) to "true".

	system attribute	value
1	S7_m_c	false
2	S7_blockview	big
3	S7_tagcollect	true
4		
5		
6		
7		
8		
9		
10		
11		

Reference:

Insert Row   Delete Row

OK   Abbrechen   Hilfe
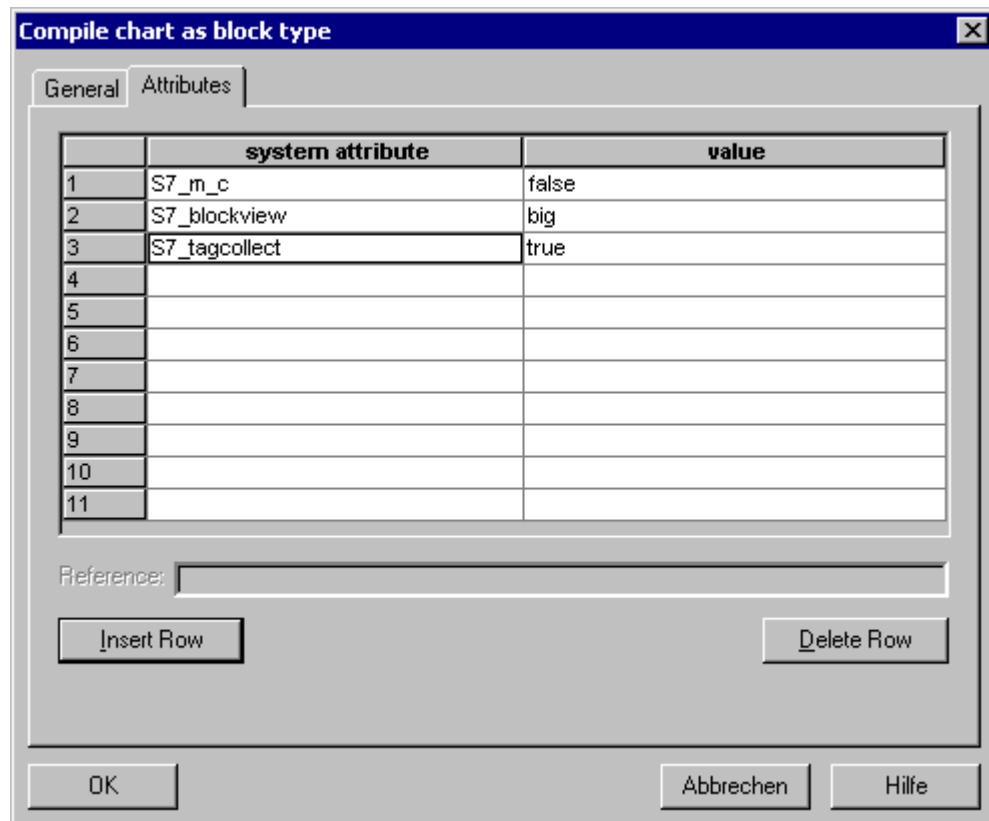
11. Accept the setting with "OK".

Result: The FB/FC type TAG_COLLECT you have created can be used immediately for configuring other process tag types. The procedure from now on is exactly the same as in Method 1 starting at Step 9.

4.12 Specifying the Type Description of the Process Cell

4.12.1 Type Description of the Process Cell

Introduction

As the basis for creating recipes in SIMATIC BATCH, the type description of the process cell must be edited or generated and, where necessary, synchronized with the block instances of the CFC charts. The following types can be defined for creating recipes.

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.
Unit classes	You can create new unit classes 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 the block instances for them existing. • Operation types: Type information for the equipment operations (EOP) • Phase types: Type information for the equipment phases (EPH) • Measured variable types: Type information of the TAG_Coll blocks Operation types and phase types can be assigned control strategy parameters.

Configuring the Type Description

The type description is configured in the SIMATIC Manager in the BATCH configuration dialog. How this is done depends on:

• whether single or multiproject engineering is involved

• whether you are using SFC types or BATCH interface blocks

4.12.2   Type Description in a Single Project

Configuring the Type Description

You configure the type description in the BATCH configuration dialog. You can open this dialog in the component view and in the plant view:

- using the menu command **Options > SIMATIC BATCH**

- by selecting any object and then the context menu command SIMATIC BATCH

BATCH configuration dialog

For the type description, the "Batch types" object must be selected on the left-hand side in the BATCH configuration dialog.By expanding the object (click on "+"), you will see all the possible Batch type objects. The attributes of a type object are displayed on the right-hand side of the dialog under "Properties".
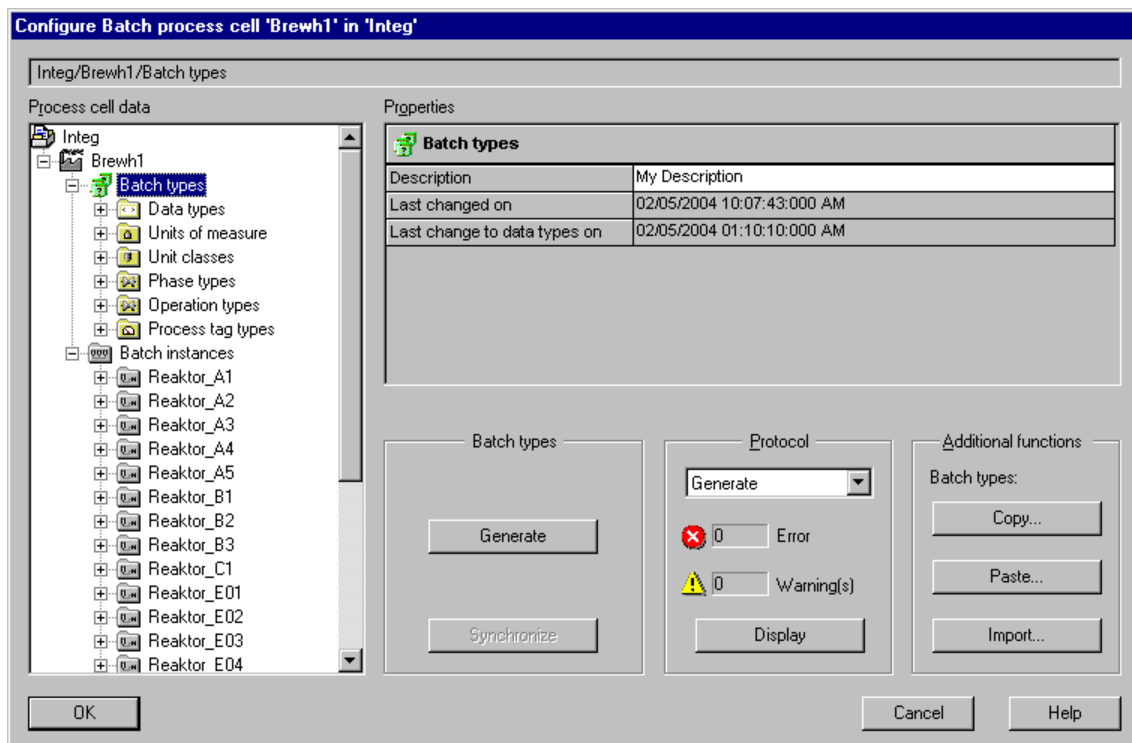
4.12.3   Executable Functions in a Single Project

Functions Available in the BATCH Configuration Dialog

Function	Selected Object	Description
Generate	Batch Types	• SFC types: Operation/phase types are generated from the SFC types with the EOP/EPH IDs. • BATCH interface blocks: Batch types (units of measure, operation/phase types, process tag types) are generated from the instances of the BATCH interface blocks. **Note:** If Batch instances, SFC types or TAGCOLLECT FBs are modified, the "Generate" function must be run prior to compilation. The same applies to modifications in the PH, for example after moving or copying CFC charts.
Synchronize	Batch Types	If, for example, IDs of units of measure, phase, operation, or process tag types, identifiers of type parameters etc. are modified in the BATCH configuration dialog, these changes are propagated to the individual instances in the CFC charts using the "Synchronize" function. If this button is not used explicitly, there is an automatic synchronization (following an operator prompt for confirmation) when you close the BATCH configuration dialog. This function ensures that the entire process cell remains validated following changes to types.
New	Data types User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	Creation of new data types, user data types, units of measure, unit classes, phase, operation, and process tag types under the selected area and creation of the corresponding type parameters.
Delete	Data type User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	Deletion of a selected Batch type or the corresponding type parameter. If type objects are inadvertently deleted, the action can be undone by closing the BATCH configuration dialog with "Cancel". Type objects that are in use cannot be deleted, for example units of measure, phase types etc.
Edit	User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	Editing the attributes of the Batch types and type parameters Exception: SFC types and process tag types You will find a description of editing SFC types and process tag types in the section "Creating a New SFC Type".

Function	Selected Object	Description
Additional functions • **Copy** • **Paste** • **Import**	Batch Types	• Copy: Copying Batch types to a library or another project • Paste Pasting Batch types from a library or from another project • Import Importing Batch types generated with the BATCH Migrator (BFMIG) from the V4.02 database.
Additional functions • **Display**	User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	List of all instances that refer to this type object. Certain attributes can be selected using a filter.
Log	Batch Types	Display of the logs of the executed functions "Generate" and "Synchronize" ("Synchronize" function is in preparation) First select executed function in the combo box and then click the "Display" button.

4.12.4   Type Description in a Multiproject

Configuring the Type Description

In a multiproject, the type description is configured only in the multiproject itself.

The Batch types cannot be modified in any of the projects booked into the multiproject; in other words, no Batch types can be edited or added.

If a project is booked out of the multiproject, you can specify whether or not the Batch types can then be modified in this project. This applies to current Batch types and every project of the multiproject (activate the editing option). This allows you to adapt your own Batch types to those of the multiproject in every project; in other words, to update them.

Note:

All projects in the multiproject have the same rights and priorities.

At any one time, only one project can be booked out of a multiproject so that the Batch types can be edited.

You configure the type description in the BATCH configuration dialog. You can open this dialog in the component view and in the plant view:

• using the menu command **Options > SIMATIC BATCH**

• by selecting the multiproject and then the context menu command SIMATIC BATCH

BATCH configuration dialog

For the type description, the "Batch types" object must be selected on the left-hand side in the BATCH configuration dialog. By expanding the object (click on "+"), you will see all the possible Batch type objects. The attributes of a type object are displayed on the right-hand side of the dialog under "Properties".
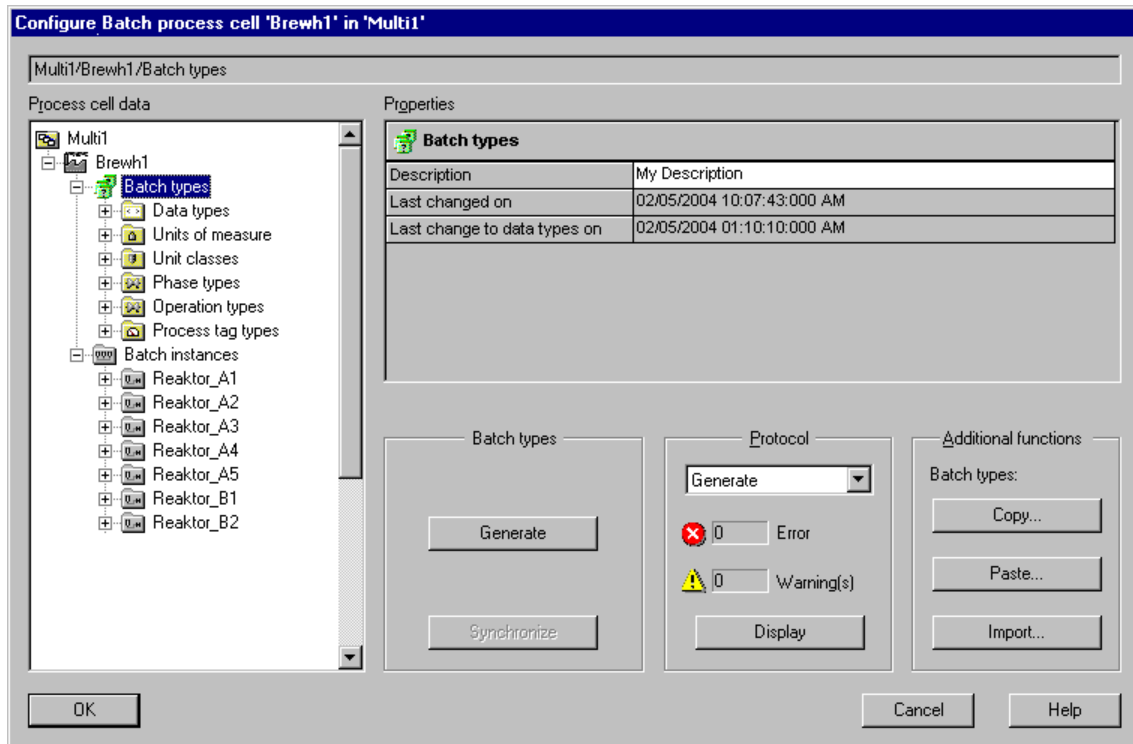
4.12.5 Executable Functions in a Multiproject

Functions Available in the BATCH Configuration Dialog

Function	Selected Object	Description
Generate	Batch Types	• SFC types: Operation/phase types are generated from the SFC types with the EOP/EPH IDs. • BATCH interface blocks: Batch types (units of measure, operation/phase types, process tag types) are generated from the instances of the BATCH interface blocks. • In multiproject engineering, this command generates the batch types from the SFC types or BATCH interface blocks of all projects of the multiproject. **Note:** If Batch instances, SFC types or TAGCOLLECT FBs are modified, the "Generate" function must be run prior to compilation. The same applies to modifications in the PH, for example after moving or copying CFC charts.
Propagate	Batch Types	The complete type description is distributed to the individual projects of the multiproject. After executing this function, you can select the projects to be involved in the propagation of the Batch types in a dialog box. The type descriptions of all selected projects are then consistent.
Synchronize	Batch Types	If, for example, IDs of units of measure, phase, operation, or process tag types, identifiers of type parameters etc. are modified in the BATCH configuration dialog, these changes are propagated to the individual instances in the CFC charts using the "Synchronize" function. If this button is not used explicitly, there is an automatic synchronization (following an operator prompt for confirmation) when you close the BATCH configuration dialog. This function ensures that the entire process cell remains validated following changes to types.
New	Data types User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	Creation of new data types, user data types, units of measure, unit classes, phase, operation, and process tag types under the selected area and creation of the corresponding type parameters.
Delete	Data type User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	Deletion of a selected Batch type or the corresponding type parameter. If type objects are inadvertently deleted, the action can be undone by closing the BATCH configuration dialog with "Cancel". Type objects that are in use cannot be deleted, for example units of measure, phase types etc.

Function	Selected Object	Description
Edit	User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	Editing the attributes of the Batch types and type parameters Exception: SFC types and process tag types You will find a description of editing SFC types and process tag types in the section "Creating a New SFC Type".
Additional functions • **Copy** • **Paste** • **Import**	Batch Types	• Copy: Copying Batch types to a library or another project • Paste Pasting Batch types from a library or from another project • Import Importing Batch types generated with the BATCH Migrator (BFMIG) from the V4.02 database.
Additional functions • **Display**	User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	List of all instances that refer to this type object. Certain attributes can be selected using a filter.
Log	Batch Types	Display of the logs of the executed functions "Generate", "Propagate", and "Synchronize" ("Synchronize" function is in preparation) First select executed function in the combo box and then click the "Display" button.

4.12.6 Executable Functions in a Project of a Multiproject

Functions Available in the BATCH Configuration Dialog

Function	Selected Object	Description
Additional functions • **Display**	User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	List of all instances that refer to this type object. Certain attributes can be selected using a filter.
Log	Batch Types	Display of the logs of the executed functions "Generate" and "Synchronize" ("Synchronize" function is in preparation) First select executed function in the combo box and then click the "Display" button.
Update	Batch Types	Updating of the Batch types in this project (reading in the Batch types of the multiproject)

4.12.7 Executable Functions in a Booked-out Project

Functions in the Booked-out Project with Editable Batch Types

Function	Selected Object	Description
Generate	Batch Types	• SFC types: Operation/phase types are generated from the SFC types with the EOP/EPH IDs. • BATCH interface blocks: Batch types (units of measure, operation/phase types, process tag types) are generated from the instances of the BATCH interface blocks. • This command generates the batch types from the SFC types or BATCH interface blocks of the booked out project. **Note:** If Batch instances, SFC types or TAGCOLLECT FBs are modified, the "Generate" function must be run prior to compilation. The same applies to modifications in the PH, for example after moving or copying CFC charts.
New	Data types User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	Creation of new data types, user data types, units of measure, unit classes, phase, operation, and process tag types under the selected area and creation of the corresponding type parameters.
Delete	Data type User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	Deletion of a selected Batch type or the corresponding type parameter. If type objects are inadvertently deleted, the action can be undone by closing the BATCH configuration dialog with "Cancel". Type objects that are in use cannot be deleted, for example units of measure, phase types etc.
Edit	User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	Editing the attributes of the Batch types and type parameters Exception: SFC types and process tag types You will find a description of editing SFC types and process tag types in the section "Creating a New SFC Type".
Additional functions • **Copy** • **Paste** • **Import**	Batch Types	• Copy: Copying Batch types to a library or another project • Paste Pasting Batch types from a library or from another project • Import Importing Batch types generated with the BATCH Migrator (BFMIG) from the V4.02 database.

Function	Selected Object	Description
Additional functions • **Display**	User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	List of all instances that refer to this type object. Certain attributes can be selected using a filter.
Log	Batch Types	Display of the logs of the executed functions "Generate" First select executed function in the combo box and then click the "Display" button.

Functions in the Booked-out Project with Read-only Batch Types

Function	Selected Object	Description
Additional functions • **Copy**	Batch Types	Copying Batch types to a library or another project
Additional functions • **Display**	User data type (if present) Units of measure Unit classes Phase types Operation types Process tag types	List of all instances that refer to this type object. Certain attributes can be selected using a filter.

4.12.8   Specifying the Control Strategies for a Type

Introduction

Different and (in terms of the same run) mutually exclusive equipment phases/operations of the same equipment module are known as control strategies of this equipment module.

Recipe phases/operations can be implemented with various control strategies (set of setpoints) that can be used in the manual mode or in the automatic mode (recipe mode). To be able to use the control strategies in the automatic mode, the recipe phases/operations must also be capable of the control strategies. The control strategies and their corresponding setpoint parameters are configured in the engineering system in the batch or SFC types.In the Recipe Editor, the control strategies defined in this way are available as a set of setpoints with a control strategy name. During parameter assignment in the recipe, only the parameters belonging to the control strategy are available.

Basic Procedure

- Using an SFC type: When you configure the SFC type, you can also specify the control strategy type to be valid for this equipment phase/operation using the characteristics function. In addition to this, the amount of parameters can also be put together based on the setpoints for each control strategy.

- Using BATCH interface blocks: New control strategies are specified using new user data types ("Control Strategy" was selected in Properties) and assigning them as the data type for the control strategy parameter of operation types/phase types in the "Edit Batch process cell" dialog box.

The control strategies and control strategy parameters are included in the process cell data when you compile and are therefore available later in the BATCH Recipe Editor.

Follow the steps outlined below in SFC (SFC types)

1. Mark the new object "SFC Type": ▣ SFC-Typ(1).

2. Select the menu command **Edit > Open Object**.

   SFC opens the SFC type.

3. Change to the characteristics view of SFC Select the menu command **Edit > Characteristics** or press ▣.

The characteristics view of the SFC type opens.
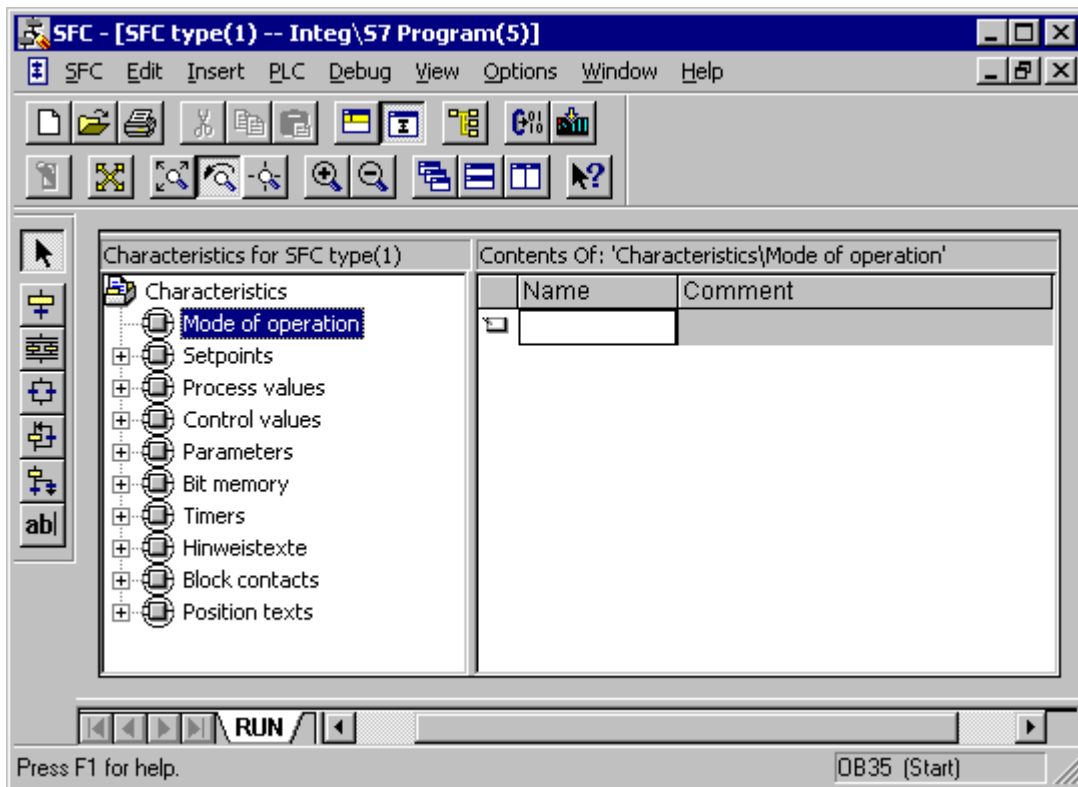
4. Here, you edit all the control strategies relevant for SIMATIC BATCH by clicking on the "Control strategy" characteristic in the left column.

5. Select a setpoint in the characteristics view to which one or more control strategies will be assigned.

6. Select the menu command **Edit > Object Properties**.

7. The properties dialog of the setpoint opens.

8. Using the [⟶] button, assign the required (already created) control strategies in which the setpoint is located.

9. Confirm with the "Close" button.

Result: After reading in the type description in the BATCH configuration dialog with the "Generate" button, the control strategies you have edited in this way (read-only) are indicated by a red flag:

Follow the steps outlined below in the SIMATIC Manager (BATCH interface blocks)

1. Open the BATCH configuration dialog with the with the menu command **Options > SIMATIC BATCH**.

2. Define the control strategies using a new user data type, for example FW_heat (values: hot, normal, cold) Select the "Data types" object under "Batch types" and then click the "New" button.

3. Result: A new control strategy is created.

4. For operation/phase type, create a new parameter (for example fw_param). Select the required "Phase type" under "Phase types" in the left-hand window and then click the "New" button.

5. Result: A new type parameter is created.

6. Assign the correct control strategy (for example FW_Heat) on the right-hand side in the "Assigned data type" list box.

7. Activate the "Control strategy parameters" check box. Click the "Edit" button to the right of the "Control strategy parameters" check box. Assign the setpoints (parameter data record) to every control strategy in the open properties dialog for the control strategies "Control Strategies of FW_heat".

8. Close the Properties dialog with OK.

Result: The new control strategy appears in the BATCH configuration dialog with the following icon: fw_param

---

Note:

Only one control strategy parameter (in the example: fw_param) can be created per operation/phase type.

4.12.9   Propagating a Type Description to other Projects (Multiproject)

To allow batch configuration in the individual projects of the multiproject and to compile unit data with the latest type description, the type description generated centrally in the multiproject can be distributed (propagated) to the individual projects of the multiproject.

Follow the steps outlined below in the SIMATIC Manager:

1. Select the "Batch types" object in the BATCH configuration dialog.

2. Click the "Propagate" button.

3. Result: The "Propagate types for entire process cell" dialog box opens.

4. Activate all the projects to be propagated.

5. Click the "Start" button.

Result: The complete type description is distributed to the projects of the multiproject. After running this function, the Batch types are consistent in all selected projects.

4.12.10   Managing Type Descriptions in a Library or Project

Introduction

The type descriptions for SIMATIC BATCH can also be stored and managed in a standard library. You can save editing time by storing type descriptions you want to use again in a library.

Principle

The type description of a process cell can also be created and configured as an object Batch types   in a library:

Using the "Copy" additional function in the BATCH configuration dialog within the context of Batch types, existing Batch types can be copied to a library or a project. You can also create a new "Batch types" object in a library.

Using the "Paste" additional function in the BATCH configuration dialog within the context of Batch types, existing Batch types can be pasted from a library or a project.

To insert an edited type description:

1. Open the project with the existing Batch types.
2. Select the menu command **Options > SIMATIC BATCH**.
3. Select the "Batch types" object in the left window.
4. Click the "Copy" button.
5. Result: A dialog box opens in which you can select the required targets (library or project).
6. Make your selection and confirm with OK.

To create a new type description:

1. Open the library or create a new library.
2. Select the menu command Insert > Insert New Object > Batch Types.

Result: A new object Batch types   is created.

4.13   Use of Archive Data from WinCC Archives

4.13.1   Configuring Use of Archive Data from WinCC Archives

Introduction

The batch data also includes the values of important process variables over time. SIMATIC BATCH does not record these measured value sequences itself but fetches the values from the WinCC Measured Value Archives. To allow this, the instance parameters must be assigned to the WinCC archive tags.

Requirement

You have selected the "Archive measured variable" option for the parameters of the operation, phase, all process tag types that you intend to use as the measured value sequence:

- When using BATCH interface blocks: Specified in the BATCH configuration dialog with the "Batch types" object.

- When using SFC types: The "Archive" column of the characteristics for the setpoint is activated for the SFC type.

Basic Procedure

In the BATCH configuration dialog, the additional function "Instances -> Display" can be activated for the selected type parameter. All the instant parameters having a reference to this type parameter are displayed. In the next dialog, you can open the WinCC tag browser for each instance parameter in which the required WinCC archive tag can be assigned.

Follow the steps outlined below in the SIMATIC Manager:

1. Select the required type parameter in the BATCH configuration dialog.

2. Click the "Display" button in the right-hand area.

3. Result: The "Instances that use the <Name> type parameter" dialog box opens.

4. Click on the row on the right-hand side and then once again on the arrow that appears.

5. Result: The "WinCC archive tag for <Name>" dialog box opens. This displays all the operator stations and the archive tags.

6. Display the individual hierarchies in the WinCC tag browser.

7. Select the required WinCC archived tag.

8. Click the "Apply" button.

4.14   Compiling the OS

Introduction

SIMATIC BATCH communicates with the programmable controller via the defined OS (message OS). As a result, on completion of configuration and following every change to the Batch process cell data, the OS must be compiled. This downloads all the Batch objects as WinCC tags to the appropriate OS. Only after compiling the OS is it possible to generate the correct full runtime name when generating the Batch process cell data. Before downloading the batch process cell data, the WinCC projects must first be downloaded.

Follow the steps outlined below in the SIMATIC Manager:

1. Select the menu command**Options > OS > Compile**.

2. Make the entries in the subsequent dialogs as you would in standard PCS 7. There are no specific SIMATIC BATCH settings necessary.

Note:

When using SIMATIC BATCH an S7 program can be assigned to only **one** batch-relevant OS!

4.15 Compiling and Downloading Process Cell Data

4.15.1 How to Compile and Download the Process Cell Data

Basic Procedure

SIMATIC Manager

```
┌─────────────────────────────────────┐
│             Compile OS               │
│      (see "Compiling the OS")        │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│ •  Specify message OS and Batch-relevant │
│    operator stations                 │
│ •  Transfer messages and Batch-relevant data │
│    to the operator stations          │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│    Compile the Batch process cell data │
│ •  On all ES computers with the individual │
│    projects of the multiproject or   │
│ •  On the central ES computer by merging and │
│    compiling the multiproject        │
│                                      │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│       Download WinCC projects        │
│       (1st target system OS)         │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│    Download Batch process cell data  │
│     (2nd target system BATCH server, │
│  BATCH server Stby and BATCH clients)│
└─────────────────────────────────────┘
```

Compiling Unit Data

To allow SIMATIC BATCH to use the process cell data, this must be created (compiled) explicitly. After completing configuration of all the process cell data and following any change to the process cell data, these must be recompiled **before** downloading.

You compile the process cell data using the "Compile" function. During this process, the process cell data are compiled and validated. Any possible errors are displayed and entered in a test log. If the data is not valid, it will not be compiled.

Specifying the Batch-Relevant Operator Stations, the Message and Transferring OS-Relevant Data to the OS

In many Batch process cells, process automation is not exclusively recipe-controlled. In other words, it is perfectly possible that there is one or more OS servers in the process cell that do not have any batch-relevant data. This means that the batch-relevant operator stations must be specified for SIMATIC BATCH. To achieve an optimum load distribution, you can select a message OS to which SIMATIC BATCH sends its messages.

- **Specifying Batch-Relevant Operator Stations**

You must specify the operator stations of the project that are relevant for SIMATIC BATCH. In other words, you specify the OS in which BATCH blocks (UNIT_BLOCK, EOP/EPH, IEOP/IEPH) are accessed using faceplates.

- **Specifying the Message OS**

You must select a suitable OS to which SIMATIC BATCH sends its messages. The message OS is also the communication OS for the BATCH server.

- **Transferring OS-Relevant Data to the OS**

The message texts of all BATCH messages and all OS-relevant data from SIMATIC BATCH are transferred automatically to the selected operator stations by the "Transfer to OS" function.

Downloading WinCC Projects

WinCC projects continue to be transferred to the operator stations independently of SIMATIC BATCH using the "PLC Download" function. The downloading of process cell data to the BATCH Server and BATCH clients is unaffected. You must, however, make sure that the WinCC projects are downloaded before you start the batch downloads

Downloading Batch Process Cell Data

After compiling the process cell data successfully, it is transferred to the BATCH Server, DB server and the BATCH clients. The process cell data is downloaded automatically using the "PLC Download" function.

Reading in Batch Process Cell Data

To ensure controlled copying of the process cell data to the batch system, this requires an explicit operator command. This can be entered at any BATCH client within BatchCC. There is an internal comparison and synchronization of the new with the old process cell data.
For more information about reading in the process cell data, refer to the section "BatchCC".

4.15.2 Compiling the Batch Process Cell Data in Single-Project Engineering

Introduction

The process cell data is compiled by the "Compile" function in the BATCH configuration dialog. At the same time, the process cell data are checked for plausibility. Any possible errors are displayed and entered in a test log. If the data is not valid, it will not be compiled.

Follow the steps outlined below in the SIMATIC Manager:

1. Open the BATCH configuration dialog with the with the menu command **Options > SIMATIC BATCH**.

2. Select the "Batch instances" folder under process cell data in the left window.

3. Click the "Compile" button in the right-hand area.

    Result: If the validation is successful, the process cell data is compiled. A log is created that you can display as follows:
    In the BATCH configuration dialog: under Log >: "Compile" setting > "Display" button

4. Select the process cell object under process cell data in the left window.

5. Click the "Transfer to OS" button in the right-hand area.

    Result: A dialog opens with all operator stations of the project that were defined as Batch-relevant when the settings were made in the "OS objects" tab. In the "Status" column, you will see the current status displayed. Here, you can see whether or not the OS-relevant data has already been transferred.

6. Click the "Start" button.

    Result: The messages and the OS-relevant data are transferred. A log is created that you can display as follows:
    In the BATCH configuration dialog: under Log >: "Transfer to OS" setting > "Display" button

4.15.3 Compiling the Process Cell Data in Multiproject Engineering

Introduction

The process cell data is compiled by the "Compile" function in the BATCH configuration dialog. At the same time, the process cell data are checked for plausibility. Any possible errors are displayed and entered in a test log. If the data is not valid, it will not be compiled.

Follow the steps outlined below in the SIMATIC Manager:

1. Open the BATCH configuration dialog with the with the menu command **Options > SIMATIC BATCH**.

2. Select the "Batch instances" folder under process cell data in the left window.

3. Click the "Merge" button in the right-hand area.

Result: A dialog opens display all Batch-relevant projects. In this dialog, you can compile the Batch process cell data of all projects and then merge the data.

4. Here, you select the projects whose process cell data will be included.

With the central check boxes "Include" and "Compile" in the table header, all the settings for the individual projects are made automatically depending on the status. If, for example, the status for a project is "Types not up to date", the "Compile" check box is automatically selected as a result of including the project.

Note:
Compilation is also possible in every individual project of the multiproject.

Note:
If projects are booked out, the check boxes are inactive (gray). If process cell data compiled earlier for this project already exists, this data is also adopted.

---

5. Click the "Start" button.

6. Select the process cell object under process cell data in the left window of the BATCH configuration dialog.

7. Click the "Transfer to OS" button in the right-hand area.

Result: A dialog opens with all operator stations of all projects of the multiproject that were defined as Batch-relevant when the settings were made in the "OS objects" tab.

8. Click the "Start" button.

Result: All Batch-relevant data (messages and user data types) is downloaded to the appropriate operator stations.

Results:

- If the validation is successful, the process cell data is compiled. A log is created that you can display as follows:
  In the BATCH configuration dialog: under Log >: "Merge" setting > "Display" button

- The messages and the OS-relevant data are transferred. A log is created that you can display as follows:
  In the BATCH configuration dialog: under Log >: "Transfer to OS" setting > "Display" button

Tip

Do not forget to run the "Compile OS" function **before** compiling and downloading. This avoids the display of errors in the run-time names when you compile the process cell data.

4.15.4   Downloading the Process Cell Data to the Target System

Introduction

You download the process cell data to the BATCH Server, the DB server (data storage systems) and the BATCH clients using the "PLC -> Download" function.

Order of the Downloads

Note:

To ensure data consistency, the following order must be kept to when you download:

- Download the OS server
- Download the BATCH Server and BATCH clients

Follow the steps outlined below in the SIMATIC Manager:

1. Open the BATCH configuration dialog with the with the menu command **Options > SIMATIC BATCH**.

2. Select the process cell object under process cell data in the left window.

3. Click the "Download" button.

Result: In the "Download <process cell>" dialog box, all the PC stations for BATCH Servers (single, redundant), DP server and the BATCH clients are displayed along with their download status.

Downloading Batch process cell 'Integ'

Component			PC station	Target system	Verify	Status	
Database server							
Master	☑	Project	Integ\Server-RechnerLokal	{local}		Not current	🔴
	☑	Offline	Integ\Server-RechnerLokal	{local}		Not current	🔴
	☑	Online	Integ\Server-RechnerLokal	{local}		Not current	🔴
Standby	☐	Project					⚪
	☐	Offline					⚪
	☐	Online					⚪
Server							
Master	☑		Integ\Server-RechnerLokal	{local}		Not current	🔴
Standby	☐						⚪
Client							
	☑		Integ\Server-RechnerLokal	{local}		Not current	🔴

Close	Start				Help

4. Click the "Start" button.

Updating the Process Cell Data

Note:

If you modify the basic control (CFC/SFC charts, hardware configuration, plant hierarchy etc.), the process cell data must be updated again and downloaded to the target system (BATCH Server, BATCH clients).

Prior to this, the OS must first be compiled and downloaded.

4.15.5　Simultaneous Compilation and Download

PCS 7 also provides a complete function "Compile and Download" for all PC stations (including operator stations) that can also be used for a batch process cell.

Follow the steps outlined below in the SIMATIC Manager:

1. In the component view or plant view, select the single project or multiproject and then select **Target System > Compile and Download Objects** in the context menu.

   The "Compile and Download Objects" dialog box opens.

2. Select the "Process Cell" among the objects and then click the "Edit" button in the section "Settings for Compilation/Download".

3. Make the following settings in the tabs:

   - In the multiproject in the "Merge/compile" tab: Here, select all projects to be included when generating the Batch process cell data.

   - In the single project/multiproject in the "Transfer" tab: Here, select the message OS and the Batch-relevant operator stations.

   - In the single project/multiproject in the "Download" tab: Here, select components to be downloaded (BATCH server, BATCH clients, DB server)

4. Confirm with OK.

   In the "Compile" and "Download" columns of the "Compile and Downloads Objects" dialog box, specify the objects to be included in the compilation or download.

5. Start the procedure with the "Start" button.

Note:

In a multiproject, only the process cell below a project of the multiproject needs to be selected and the options "Compile" and "Download" only need to be specified for this project.

4.15.6 Working with Several Process Cell Projects

Several Process Cells of Different S7 Projects

With SIMATIC BATCH, it is also possible to generate BATCH Servers and BATCH clients in several S7 projects. It is, for example possible to run three S7 projects each with three PCS 7 operator stations and the save multiclient (with a BATCH client). The multiclient (with BATCH client) can communicate with the BATCH Server of each S7 project.

The various process cell projects belonging to the S7 projects can be opened simultaneously by the BATCH client. In this case, the batch applications must be opened more than once. The display of several process cell projects within a batch application, for example within a BatchCC is, on the other hand, not possible.

Working with Projects on one BATCH Server

Different process cell projects can be run on one BATCH Server **one after the other**: Several projects can be loaded on the same BATCH Server PC. However, only one process cell project (in other words a BATCH Server) can be active at any one time. This is an advantage, for example when the "Correct" project and a test project need to be run separately without modifying the data of the other process cell project.

By selecting the OS project (PCS 7 OS changes to runtime), a switchover is made on the BATCH Server PC. SIMATIC BATCH recognizes which process cell project belongs to which OS project.

Switching Over the BATCH Client

The assignment of the BATCH client <-> BATCH server is generally made during configuration in the engineering system. After reading in the process cell data, a BATCH client then operates with the process cell project of the corresponding BATCH Server.

If there is information on more than one process cell project on the BATCH server, a selection dialog with all existing process cell projects is displayed on the BATCH client after selecting the menu command **Program > Read in new process cell** . By selecting a process cell project, you establish the connection to the BATCH Server (and therefore also to the required process cell project).

One BATCH Server Per Project

Note:

In the scenarios described above, the rule that there must be only one BATCH server per S7 project /multiproject still applies.

5 Batch Control Center (BatchCC)

5.1 Starting and Working

5.1.1 Starting BatchCC

After you have installed SIMATIC BATCH, you will find the following components in the Start menu of Windows 2000 under **Simatic > SIMATIC BATCH**:

- BATCH Control Center (simply called BatchCC from now on)
- Recipe Editor (known as the BATCH Recipe Editor from now on)

To start BatchCC:

1. Go to the Start menu of Windows 2000 and select the menu command **Start > Simatic > SIMATIC BATCH > BATCH Control Center**.

   Result: If several local projects are found when you start BatchCC or if the link to the project cannot be established, a selection dialog appears.

2. Select the project you require.

   Result: Once you have made a selection, BatchCC is started with the project selected. If you select a project that does not have a link, the application is closed.

Language

In both BatchCC and in the BATCH Recipe Editor, you can change languages using the menu command **Options > Settings> "Languages" tab** .

5.1.2   Getting Help

Online Help

There are various ways of getting online help:

Call	Type of Help
Help menu	Introductory information, description of the user interface, concrete instructions
"Help" button or F1 key in a dialog box	Context-sensitive help in every dialog box
Selecting a menu command and pressing the F1 key	Context-sensitive help for every menu command

Screen Tips

To display a brief text explaining the buttons in the toolbar, position the cursor on a button until the screen tip is displayed.

Changing the Font Size

With the menu command **Options > Font** in the help topic window, you can set the font size to "small", "normal" or "large.

No help when starting from WinCC

> **Note:**
> If the Batch Control Center or the BATCH Recipe Editor is started from **WinCC**, Help will not be available.

5.1.3 User Interface and Operation

5.1.3.1 Layout of the Main Window

The screen shot below shows the basic layout of the BatchCC user interface. On the left-hand side of the main window you will see the process cell as a tree structure. The mid section displays the batch objects in list form. On the right-hand side, you can create shortcuts.

You can change the view with the **View** menu in BatchCC.
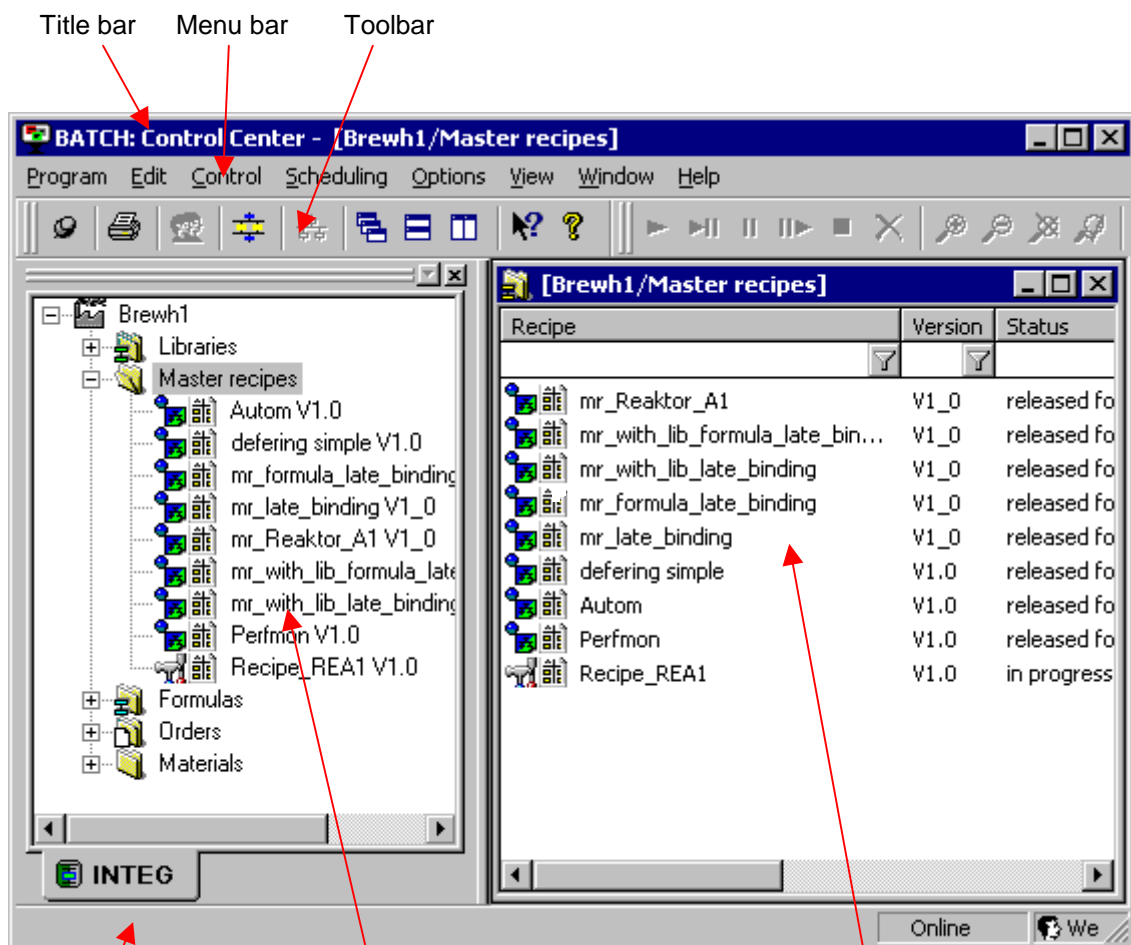
Title bar   Menu bar   Toolbar

Status bar
with context-
sensitive
information

Editing window with Batch objects:
- Libraries with library operations
- Master recipes
- Formula categories with formulas
- Production orders
- Input and output materials
- Permission management

Overview lists depending
on the context for
- Library operations
- Master recipes
- Formulas
- Production orders
- Materials

Title Bar

The title bar of the main window contains the system buttons with which you can:

- exit BatchCC
- minimize the main window to its icon,
- restore the window to its normal size again, and
- display the main window in full-screen size.

Menu Bar

The menu bar is located at the top edge of the main window. Its functions relate to the currently active window. You can only select menu commands that are feasible in the current status of the object. As an example, you can only select the menu command **Edit > Delete** when at least one object is selected. Menu items that cannot be selected are displayed in gray.

Toolbar

The toolbar is located below the menu bar. It contains a series of buttons that trigger the more commonly required functions of the menu bar. You can see which function is triggered by a button in the toolbar by positioning the mouse pointer on the button (without clicking). A box appears with the name of the button. In the status bar, you can see more detailed information about the function. Clicking the button triggers the function. Buttons that cannot be selected are displayed in gray.

Status Bar

At the lower edge of the user interface, you will see the status bar that displays important information and states. The information displayed changes depending on the particular operation and object status.

In the **left** part of the status bar, you will see context-sensitive information, for example explanations of menu commands, operator prompts or error messages.

In the **right** part of the status bar, you can see the current user and the current time. The connection status to the BATCH Control Server is also displayed here:

- Online (there is a connection to the BATCH Control Server)
- Offline (there is no connection to the BATCH Control Server).

In some situations, a progress bar is also displayed for processes that require longer.

5.1.3.2   Creating and Manipulating Objects

Selecting Functions

All important functions relating to an object are available in the context-sensitive menu.

As an alternative, the same functions are also available in the **Edit** menu. Functions that cannot be executed in the current status of an object are deactivated (displayed in gray) in the **Edit** menu.

General Functions

Some basic functions are common to all objects. These common functions are listed below. The descriptions of other functions assume that you know how to use these functions.

The normal sequence of activities involving objects is as follows:

• Creating the object

• Selecting the object

• Performing actions with the object (for example, open, delete).
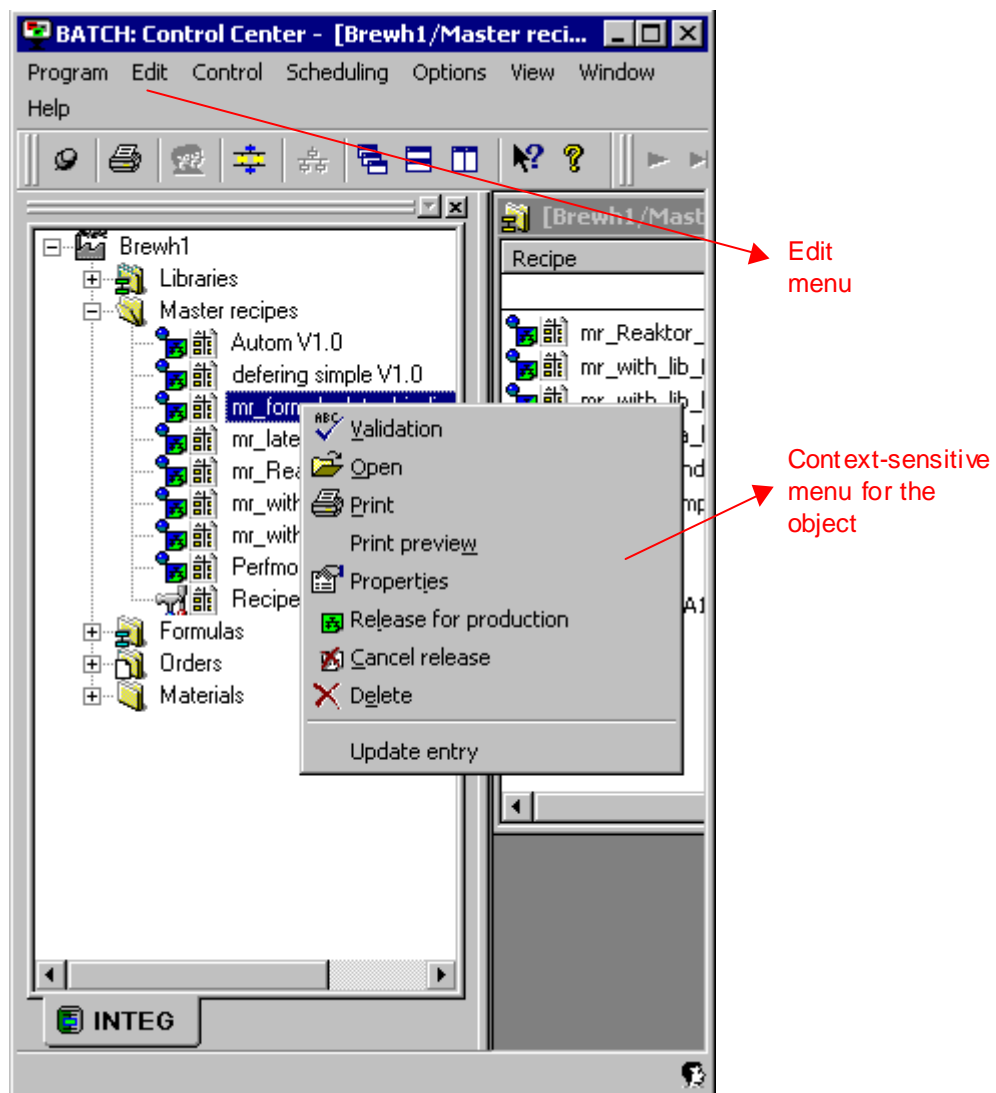
Creating Objects

To create a new object, select the destination of the object in the editing window of the BATCH object window (for example the "Formulas" folder if you want to create a new formula category). To start the function, you then select the menu command **Edit > New**.

Opening Objects

There are several ways of opening an object:

• Double or single click on the object icon

• Select the object and then the menu command **Edit > Open**. This functions only with objects that are not folders, for example master recipes.

After opening an object, you can create or modify its content.

Properties of Objects

Object properties are data belonging to the object that decide its behavior, for example the properties of a master recipe.

The menu command **Edit > Properties** opens a dialog box in which you can see and set the properties of the selected object.

Renaming Objects

The names of batch objects are specified when the objects are created. This name can be changed by selecting the **Rename** command.

The **Rename** command is not always available. For example with materials, qualities, or neutral folders, it is only possible to rename in the corresponding "Properties" dialog box.

Deleting Objects

You can delete both folders and objects. It is only possible to delete most folders when they contain no elements. Exception: Orders - If an order only contains batches that can be deleted, the command is available for the order and you will be informed that n batches will also be deleted.

Deleting is permanent and cannot be undone. If you are not sure whether or not you still need an object, it is advisable to archive the entire project before deleting.

5.1.3.3   System Settings

You can change the system settings for the BatchCC and the BATCH Recipe Editor in tabs. The system settings contain general selections and rules about the layout, dimensions, zoom, colors and fonts of the recipe elements. You can also specify the display of messages during the batch process, the display of measured values in the batch report, and the option for online modification of setpoints.

To display the system settings dialog:

• Select the menu command **Options > Settings**.

This opens the dialog box shown below in which you can make individual settings. Use the context-sensitive help if you want more information about the possible settings ("Help" button).
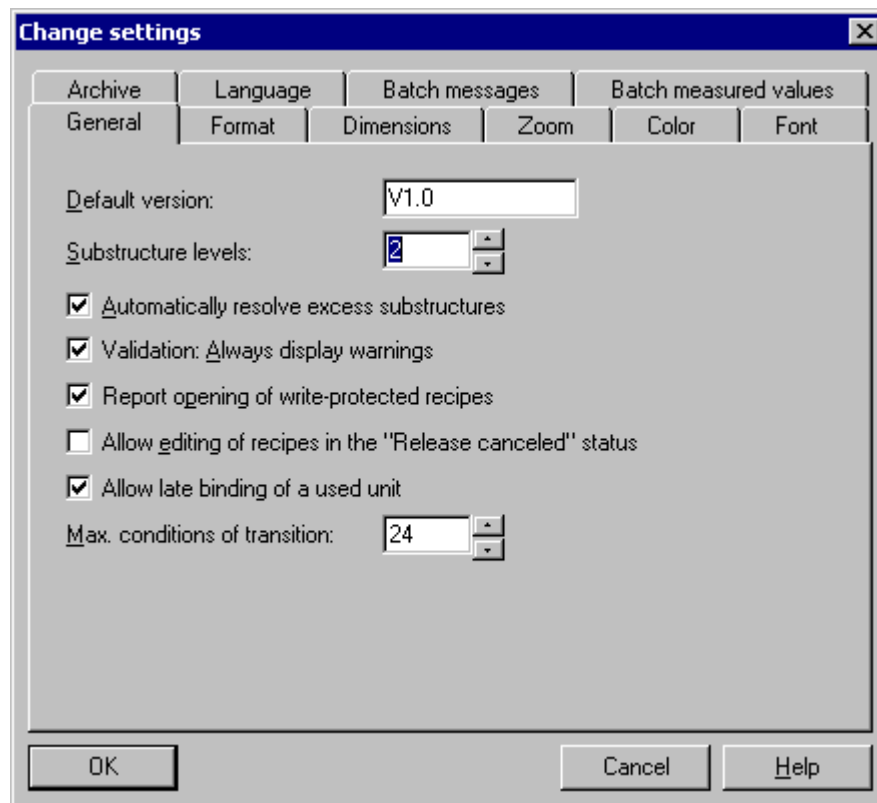
5.1.3.4 Overviews

The Purpose of Overviews

Overviews are available in BatchCC both for greater clarity and to simplify the management of functions.

Which Overviews are Available?

Depending on the context, you can display the following overviews:

- Library overview
- Master recipe overview
- Formula overview
- Job overview lists
- Batch overview lists
- Material overview lists

To select overviews:

Select a folder in the editing window (for example a master recipe folder) and then select the menu command **Edit > Details**.

Example

[Brewh1/Master recipes]			
Recipe	Version △	Status	Modified on
defering simple	V1.0		11/15/2002 10:43:4
Autom	V1.0	ABC Validation	11/15/2002 10:43:4
Perfmon	V1.0	Open	11/15/2002 10:43:4
Recipe_REA1	V1.0	Print	11/15/2002 1:08:3
mr_Reaktor_A1	V1_0	Print preview	11/15/2002 10:43:4
mr_with_lib_formula_lat...	V1_0	Properties	11/15/2002 10:43:4
mr_with_lib_late_binding	V1_0	Release for production	11/15/2002 10:43:4
mr_formula_late_binding	V1_0	Cancel release	11/15/2002 10:43:4
mr_late_binding	V1_0	Delete	11/15/2002 10:43:4

Working with Overviews

By selecting an object from the list and then clicking the right mouse button, you display the context-sensitive menu with the functions available for the object.

If you left-click a column header in the table, the content of the table is sorted alphabetically according to the content of the selected column.

By entering a text in the input field below the column header, you can filter the table.

You can also filter several columns at the same time. The individual filter conditions are then ANDed. This means that all the conditions entered must be satisfied before a list object appears in the table. If, for example, you enter the text "Wa" in the input field of the "Main Product" column, only the entries whose main product start with the letters "Wa" appear in the table.

Anchoring overview lists.

If you click the title bar with the right mouse button, a context-sensitive menu is opened with various options for anchoring the overview.

Lists for batch planning, batch control, and batch data management

There are more lists and special lists for orders and batches as listed below:

List	Description
Order category list	List with all order categories of the process cell.
	Before you select this, you must select the "Orders" folder in BatchCC.
Production order list	List with production orders:
	• If you had previously selected the "Order" folder, all production orders are displayed.
	• If you had previously selected an "order category" folder, only the production orders belonging to this category are displayed.
Batch planning list	List with all batches that are planned or released. Using the context-sensitive menu for the batch planning list, you can control or start the batches.
	Note: The batch planning list normally displays only the planned or released batches. If you start a batch from this list, it remains visible in the list and is shown with its new status (for example, running). If you open the batch planning list again, however, this batch is no longer displayed (see batch status list).
Batch Status List	List with all batches with the released, running, held, waiting for unit, or error status. The display is updated dynamically. Using the context-sensitive menu for the batch status list, you can control the batches.
Batch Result List	List with all, completed, aborted, and canceled batches. The display is updated dynamically. Using the context-sensitive menu for the batch result list, you can archive closed batches and then remove them.

To select lists:

> Depending on the selection in the order hierarchy (an order, an order category, or all orders), you can open different batch overview lists with all batches of an order, of an order category, or all orders.

> Select the object in the "Orders" folder in the editing window and then select the required list in the **Planning** menu.

Select All

> With CRTL+A or the menu command **Edit > Select All you can select** all the objects of a list, for example, to release all batches using the context-sensitive menu.

5.1.3.5 Window for Displaying Messages

Requirement

> A PCS 7 OS (WinCC) runs on the BATCH client computer during run time.

Display window

> All the messages for batch control (system messages, process messages, error messages) that are managed in the WinCC archives can also be displayed in BatchCC.

> To display these messages, you can open the message window of the PCS 7 OS (WinCC Alarm Control) in a separate display window.

> - You open the message window with the menu command **View > Message window**.

Customizing

- You can customize the properties of the message window (familiar from WinCC), for example the columns displayed and the selection of messages.

- User settings are entered in the global database and restored the next time you start BatchCC. Certain settings that are essential for SIMATIC BATCH are exceptions to this, for example selection of BATCH messages.

- Using the **Open control recipe** menu command, the control recipe that matches the message can be opened. This function corresponds to the "LoopInAlarm" function in the WinCC message window.

5.1.3.6 Logbook

To document all deletions, you can display these in a logbook in BatchCC.

To open the logbook in BatchCC:

- Select the menu command **Options > Log**.

This function opens the dialog box shown below in which you can search for specific delete actions according to filter criteria. Enter the name, type, date range, user, and path and then click the "Filter" button.

The current "Time window" is displayed on the right-hand side of the window. The zoom of the time window is automatically adapted to the required area of the applications and objects to be displayed. If you move the cursor over the time bar, a tooltip is displayed showing the time at which it was opened.
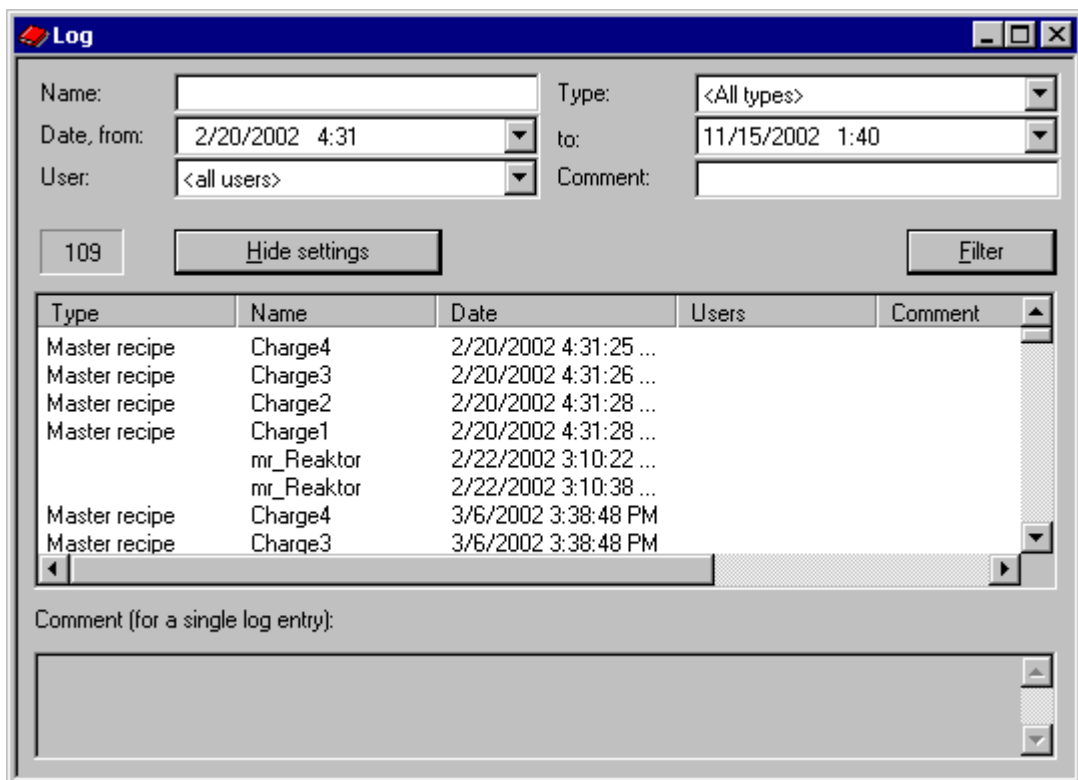
5.1.3.7   Window for Displaying Active Applications

To check the active batch applications on the individual computers, you can display the applications in BatchCC.

To open the display window with the active applications:

• Select the menu command **Options > Active applications**.

This function opens a dialog box with the currently active applications. You can see the duration and date/time at which the individual batch applications were in operation or are still in operation on computer x. The logged in users are also displayed.
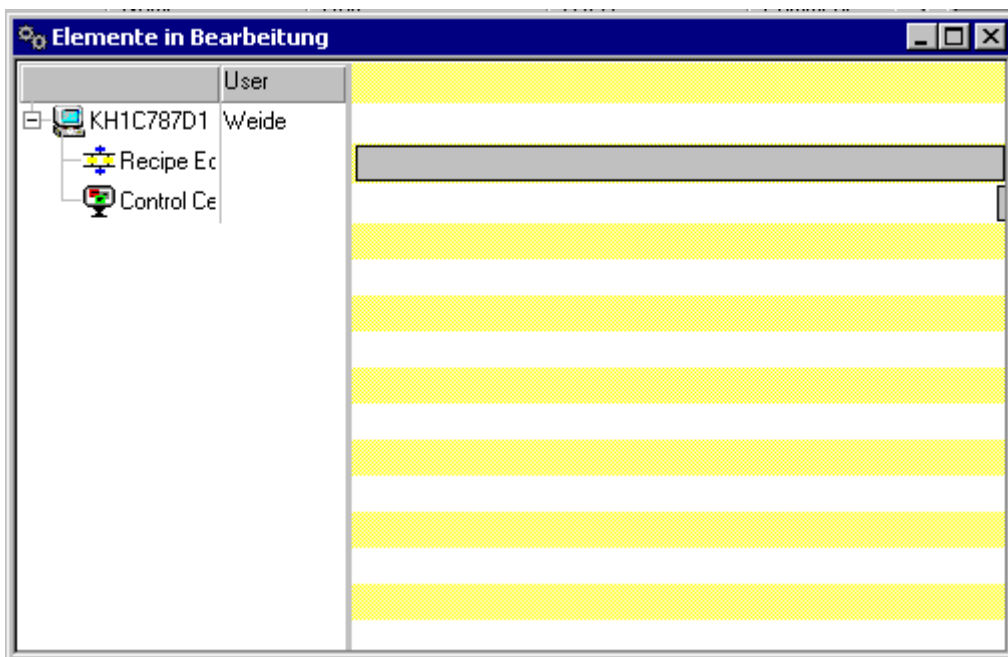
5.1.4 Objects and Object Hierarchy

The object hierarchy for library operations, master recipes, formulas and production orders can be structured in BatchCC in much the same way as the folder structure of the Windows Explorer with folders and files.

The screen shot below shows the appearance and **typical positioning** of these objects within BatchCC.

Objects	Positioning in BatchCC
• Process Cell (Process cell objects) • Libraries with library operations • Master Recipes • Formulas • Production orders • Materials • Permission Management	

User-Defined Structure of Objects and Folders

As default, the objects are at one level below the libraries, master recipes, formulas, production orders, and materials folders.

Note:

To allow a more suitable structure and adaptation to your plant, you can also create a different, user-defined hierarchy structure for the BATCH objects in BatchCC.

The highest level cannot be changed or freely defined. This applies to "process cell", "libraries", "master recipes", "formulas", "orders", "materials", and "permission management".

The following description, however, is based on the structure shown in the figure above.
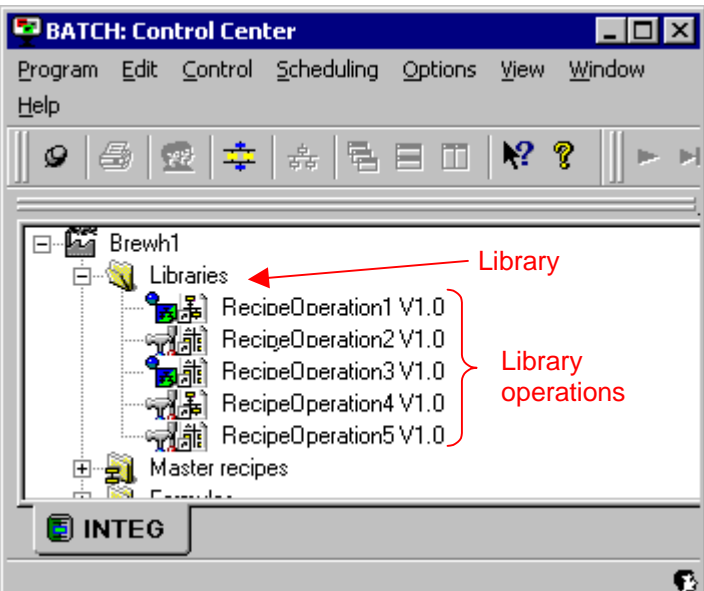
Showing References between BATCH Objects

With the menu command **View > Related objects in tree view**, the references to the other batch objects and the configured unit allocations are displayed below the library operation, master recipe and formula objects.
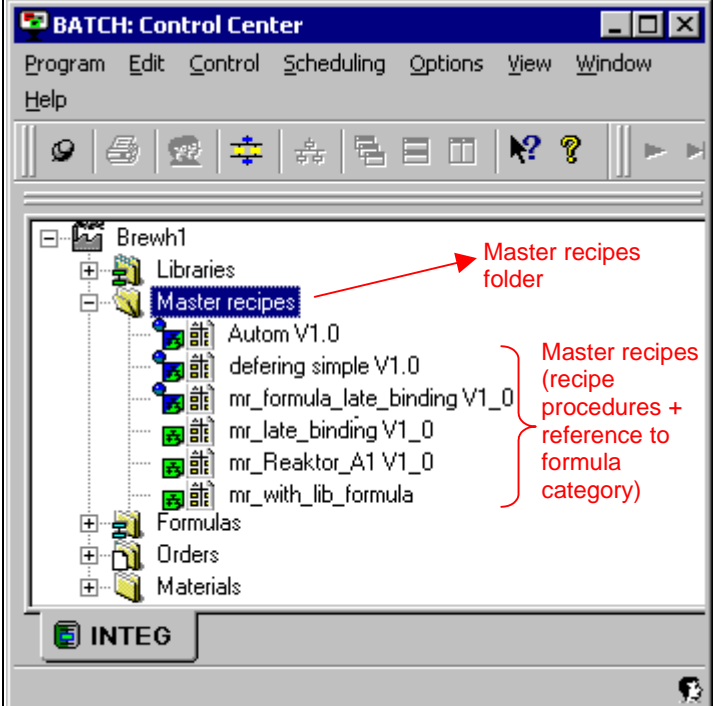
5.1.4.1   Libraries with Library Operations

You can use libraries to store recipe elements created with the BATCH Recipe Editor that you require often in the master recipes. You can store and manage recipe operations (for hierarchical recipes) and substructures (for flat recipes) in libraries. In the following descriptions, recipe operations or substructures from libraries are called library operations or library substructures.

Available Functions	Position of the objects
• Opening and Editing Recipes • Specifying the Properties of Master Recipes • Validating Recipes • Releasing Recipes for Testing • Releasing Recipes for Production • Status of the Recipes and Status Changes	

5.1.4.2   Master Recipes

In this area, you can store the recipe procedures created with the BATCH Recipe Editor according to the technological structure of your process cell. With the reference (can be set in a dialog box) to a formula category and ultimately to a concrete formula, you have a complete master recipe. There are both flat and hierarchical master recipes. If you have large numbers of master recipes, these can be stored in different folders (without semantics) to achieve a better structure.

Available Functions	Position of the objects
• Creating a New Master Recipe • Opening and Editing Recipes • Specifying the Properties of Master Recipes • Interconnecting Master Recipe Header Parameters with an External Formula • Working with the Recipe Overview • Validating Recipes • Releasing Recipes for Testing • Releasing Recipes for Production • Status of the Recipes and Status Changes	

5.1.4.3   Formulas

In this area, you create the formula categories with the formulas belonging to them according to the technological needs of your plant. If you have large numbers of formulas of a category, these can be stored in different folders (without semantics) to achieve a better structure.

Available Functions	Position of the objects
• Creating a New Formula Category • Specifying the Properties of the Formula Category • Creating a New External Formula • Specifying the Formulas of the Master Recipes • Interconnecting Master Recipe Header Parameters with an External Formula • Working with the Formula Overview • Validating Formulas	

5.1.4.4 Production orders

In this area, you create the production order categories with the lower level production orders. You can create batches for a production order. You also make the settings for batch processing, for example the start mode.

Available Functions	Position of the objects
 • Creating a New Production Order • Specifying the Properties of a Production Order • Adding Batches to a Production Order • Specifying the properties of a batch (e.g. quantity) • Setting the Start Mode for Batch Processing • Displaying and Modifying Unit Allocation • Setting the Order of Batches • Displaying the Running Time of a Batch • Working with Overviews • Status of the Batches	

5.1.4.5 Materials

To be able to use input and output materials in recipes and formulas, these must first be entered in BatchCC.

Available Functions
• Defining Materials
• Changing the Quality

5.1.4.6 Permission management

Permission management is set up by the system administrator. Here, you can specify the user permissions of the user roles for specific computers and for specific units for all the functions of BatchCC and the BATCH Recipe Editor. This is only possible if the *SIMATIC Logon* PCS 7 software is installed. Without this additional product, every user in SIMATIC BATCH has all permissions (comparable with a "Super user").

Available Functions
• Specifying User Permissions
• Changing User Permissions
• Displaying User Permissions

5.2 Setting User Permissions

5.2.1 Introduction to Permission Management

SIMATIC BATCH supports the central user management *SIMATIC Logon* of PCS 7, which in turn is based on the mechanisms of the user management in Windows 2000.

Basic Procedure

- You define users and user groups (available on the particular Windows server) and define passwords centrally in Windows.

- You can define user roles for SIMATIC BATCH and assign them to Windows user groups using the Software *SIMATIC Logon* software.

- Within SIMATIC BATCH (BatchCC), you can make the following extra specifications:

  - User permissions for one user role (global)

  - Permitted user roles per computer (computer-specific)

  - Permitted user roles per unit (unit-specific)

- The components of SIMATIC BATCH contained in PCS 7 are provided with the data of users as they log in from a central logon service and are informed of logon changes etc.

User Roles for SIMATIC BATCH

The following user roles and associated user permissions are set as default for SIMATIC BATCH. These can be extended with further roles using *SIMATIC Logon*.

User role (default)	User permissions (default)
Automation engineer	Reading in an updating process cell data
Factory manager	Can edit, modify and release recipes and create batches
Emergency operator	No permissions (must be configured)
Operator	Can block batches
Shift manager	Can modify recipes, create batches
Super user	All functions including permission management (administrators)
Process engineer	Can create and modify recipes

Super user

The system administrator of SIMATIC BATCH takes on the role of "Super user". The super user has all user permissions in SIMATIC BATCH and only the super user can make changes in the permission management.

5.2.2 Specifying User Permissions

Requirements

SIMATIC Logon is installed on every computer with a batch application. SIMATIC Logon consists of two components:

- Simatic Logon Admin Tool
- SIMATIC Logon Service

Basic requirements for working with *SIMATIC Logon*:

- It is obligatory that you create the following groups in Windows 2000: "Logon_Administrator" and "Extended_Logon_Administrator". Only users of one of these two groups can open the Roles management and define user roles in BatchCC via the menu command **Options > Roles management**.

Defining Windows and user groups

1. Select the menu command Start > Settings > Control Panel > Administrative Tools > Dialog "Computer Management" > System > Local Users and Groups > Users/Groups.

2. With **Action > New User/New Group**, create all users (with passwords) and user groups in the Windows network (Windows server).

To define user roles for SIMATIC BATCH:

1. Open BatchCC: The logon dialog for SIMATIC Logon Service is displayed.

2. Here, enter the user name, password and domain of Windows user, who is a member of the "Logon Administrator" group and confirm your entery with OK.

3. Launch the Roles management dialog in BatchCC with the menu command **Options > Roles management**.

The dialog box "SIMATIC Logon Service" is displayed:

- You can create user roles for SIMATIC BATCH in the upper half of the dialog box and then assign Windows user groups/Windows users to these user roles. This way, Windows users in SIMATIC BATCH will receive the assigned rights of BATCH user roles.

- In the lower half of the dialog box, you can browse through Windows user groups/Windows users in the available computers and domains. You can assign Windows user groups/Windows users to BATCH user roles using Drag&Drop, for example.

4. Create user roles for SIMATIC BATCH and connect the user roles to a Windows user group/a Windows user.

The user roles listed here can be used as a template for creating a new role. Each default user role has defined user permissions within SIMATIC BATCH. The user permissions are passed on to the new user role.

Note:

You will find detailed information the procedure in the *SIMATIC Logon*online help and manual. You can find the manual via in the Windows Start menu via the menu command **Start > SIMATIC > Documentation > "<Language>" > SIMATIC Logon**.

5.   Confirm your settings with OK.

Note:

After you have **restore** the backup files in BatchCC, the assignment of user roles (permissions management) made in the SIMATIC Logon must be repeated.

To define user permissions for SIMATIC BATCH:

1. Log in with your "Super user" logon.

Note:

As default, only members of the "Super user" group have the privilege of defining and changing user permissions. The right of editing user permissions can, however be assigned to a different user group from the "Super user" group.

---

2. Click on the icon 🦹 in the toolbar of BatchCC (as an alternative: Menu command **Options > Permission management** or the command **Open permission management** in the context-sensitive menu for the 🦹 object in the tree structure).

The "Permission management" dialog box appears.

3. In the "Individual permissions" tab, you specify the user permissions for each user role:
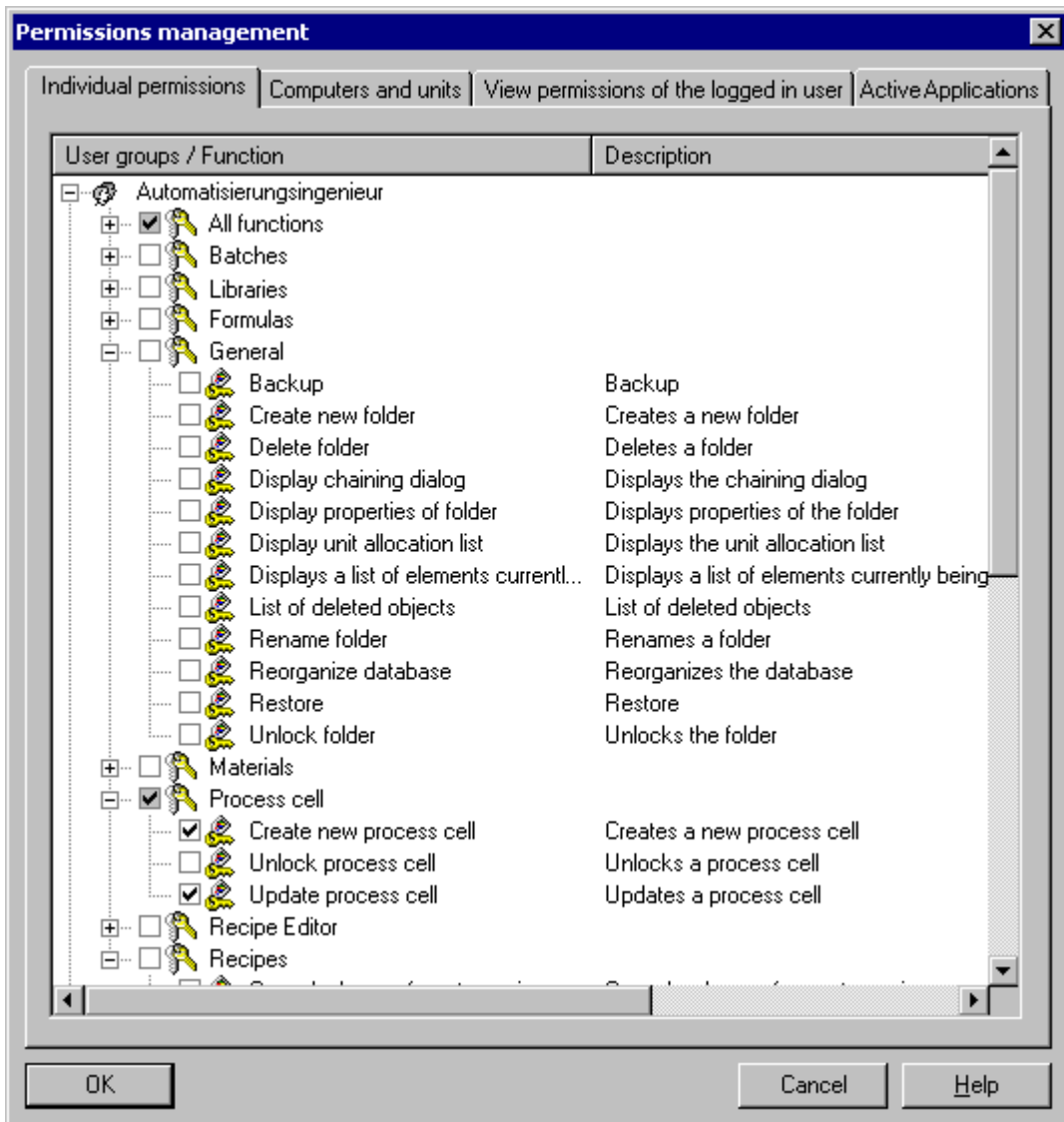
4. In the "Computers and units" tab, you specify which user roles are possible on which computer or unit.

- In the "All computers" folder, the computer names are displayed and the user roles below them.

- In the "Units of the <Process cell>" folder, the units are displayed and the user roles below them.
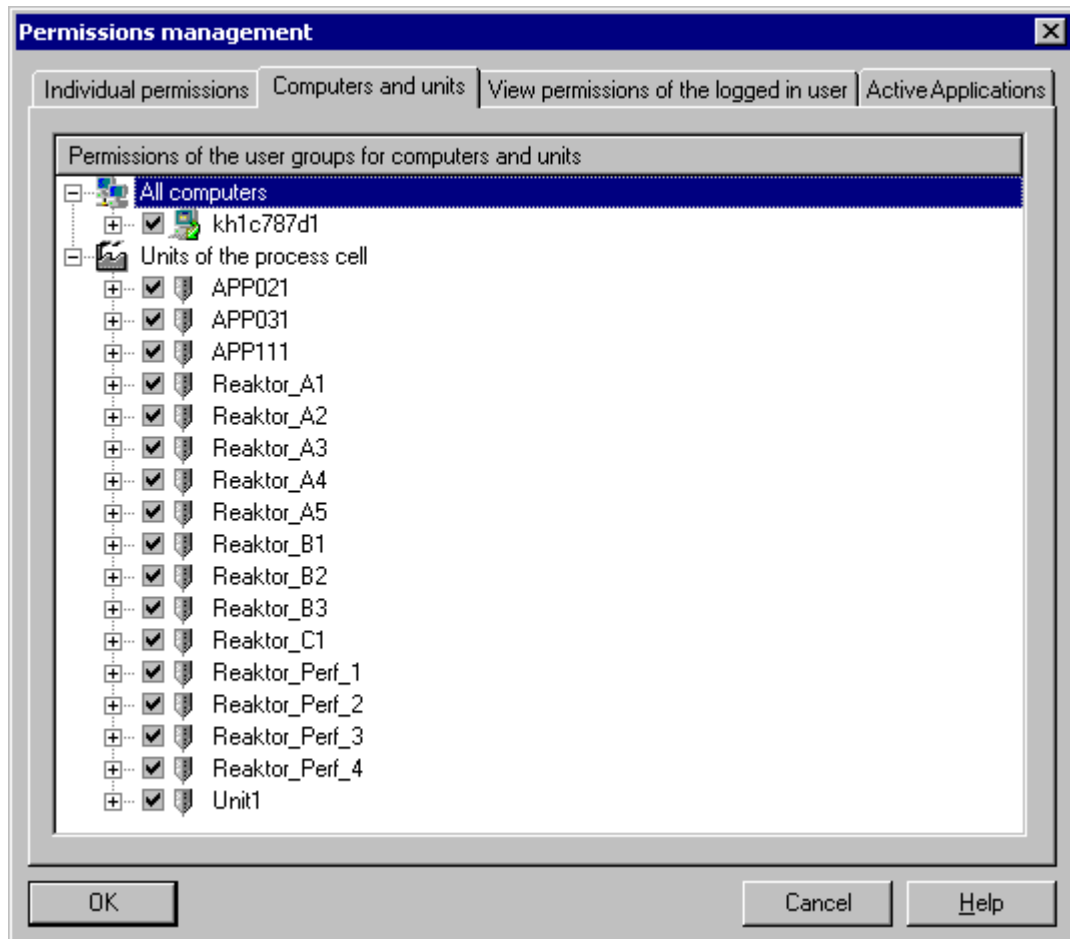
5. Save the new user permissions with "OK".

Change of User

To change the logon in a batch application (BATCH Recipe Editor, BatchCC), double-click on the logon display to the bottom right of the status line of the batch application. Result: The PCS 7 logon service is started and a new logon dialog is opened.

5.2.3 Changing User Permissions

General

The user permissions can be modified during operation, for example while creating a recipe or processing a batch. At any one time, the user rights can only be modified by one person (with the "Super user" user role).

Follow the steps outlined below:

1. Click on the icon ![icon] in the toolbar of BatchCC (as an alternative: Menu command **Options > Permission management** or the command **Open permission management** in the context-sensitive menu for the ![icon] object in the tree structure).

   Result: The "Permission management" dialog is opened.

2. Make the changes you require to the user permissions:

3. Save the new user permissions with "OK".

5.2.4 Displaying User Permissions

Follow the steps outlined below:

1. Click on the icon ![icon] in the toolbar of BatchCC (as an alternative: Menu command **Options > Permission management** or the command **Display Permission management** in the context-sensitive menu for the ![icon] object in the tree structure).

   Result: The "Permission management" dialog is opened.

2. You can display information about the user permissions of the user roles in the "permissions" tab.

3. In the "Computers and units" tab, you can see which user roles are possible on which computer or on which unit.

5.3 Reading in ES Data

5.3.1 Reading Process Cell Data into SIMATIC BATCH

Importing the Process Cell Data for the First Time

When you first open BatchCC, no Batch objects are visible in the left editing window. To be able to use the batch-relevant process cell data created in the Engineering System (ES), they must first be read into SIMATIC BATCH. To do this , you create a new process cell object in BatchCC.

Requirement

The batch process cell data created in the Engineering System (ES) have been downloaded from the engineering station to the run time computer of the BATCH Server.

Follow the steps outlined below:

1. Select the menu command Program > New process cell.

2. In the dialog, select the row for the process cell you want to read in and confirm with OK.

Result: The process cell data are read in and are not available in BatchCC and in the BATCH Recipe Editor. You can now start to configure the recipes and plan the batches.

5.3.2 Updating Process Cell Data after Changes in the Engineering System

Updating the Process Cell Data

If you have made changes to the batch-relevant process cell data in the Engineering System (ES) or have entered new data (for example added a new unit), you must also make such changes known in SIMATIC BATCH by reading the process cell data into BatchCC again. When you do this, all the batch data is updated.

Note:

The updating of the process cell data takes place only on the BATCH client on which this phase has just been started. All other BATCH clients continue to have access to the BATCH Server (batch process).

Changes in master recipes, library operations, formulas, and formula categories are not, however, possible at this point. If you attempt this, a dialog indicates that it is not possible.

Requirement

The batch process cell data created in the Engineering System (ES) have been downloaded from the engineering station to the run time computer of the BATCH Server.

What has been changed or added?

Before you update the process cell data, you can print out a log containing all the changes, in other words, the differences between the old and new process cell data. This allows you to decide on a suitable time for the update. If the changes would be too great a risk at the current time you can simply abort the update.

Effects on the Status of the Recipes and Formulas

After updating, all the recipes (master recipes, library operations) and formulas of this process cell that were "released for production" and "released for testing" are changed to the "Testing release" status. After updating the process cell data, the objects in the "Testing release" status are checked automatically. If the check is successful, the objects are returned to their original status. If the check is unsuccessful, the objects are changed to the "Release invalid" status. They can now be edited and released again.

In the overview lists you can, for example, release the recipes with one action by selecting several rows and the command **Release for production** (context-sensitive menu).

Follow the steps outlined below:

1.   Select the menu command Edit > Updating the process cell.

2.   In the dialog, select the row with the modified process cell project and confirm with OK.

Result: The "Update process cell" dialog appears. After confirming this dialog, the process cell data are updated. Changed object data are overwritten. New objects are added.

Display of the assignments:

☐	not assigned
☑	element assigned and at least lower-level object not assigned
✓	element and all lower-level objects assigned

3.   If there are any assignments missing between the objects of the old and new process cell configuration, make the necessary assignments, as follows:

-   Return to a selected object in the process cell tree -> a dialog appears with the objects that are not yet assigned.

-   Select the required object and make the assignment with Return.

4.   Confirm all added assignments with OK.

Result: The process cell data is updated. Master recipes, library operations, and formulas in the "Release invalid" status must be modified and released again.

5.4 Specifying Materials

5.4.1 Editing Materials

Purpose

At the start of batch planning, you must define the following in SIMATIC BATCH for materials (products, by-products, waste products):

- The materials for input materials and output materials
- The quality of the main product

You define the materials in the list boxes displayed in the subsequent dialogs for recipe creation and batch planning.

Materials and qualities must be assigned a unique alphanumeric code (for example an internal company code) in the form of a string. 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.

Note:

If you have a central material management department in your company, you can also write the materials to the batch data management via the user interface (API) of SIMATIC BATCH.

Rules

- A material or quality can have a maximum of the 32 characters.
- The material code is alphanumeric and can have a maximum of 16 characters.
- The quality code is numeric and possible in the range 0 to 2147483647.
- Both the material name and the material code must be unique.
- The quality and the quality code must be unique within a material.
- If a material is deleted, this is only deactivated. If you use the name again, it is reactivated along with its qualities.
- When you delete a material, the system checks which recipes, libraries, and formulas contain use it. If the material still exists in one of these, it cannot be deleted.

To create a new material:

1. Select the "Materials" folder in BatchCC.
2. Select the menu command **Edit > New**.

Result: the dialog box "Properties of <materials>" is opened.

3. In the "Materials" tab, specify the following:
   - Name of the material
   - Unique alphanumeric code (string) for the material
   - Whether or not it is an input or output material
4. Select the "Qualities" tab.
5. Add new qualities with the "New" button. Several qualities are possible for a material.

Note:

The definition of qualities for a material is optional.

---

6. Confirm the new materials with OK.

Note:

As an alternative, you can also make these settings with the commands **New** and **Properties** in the context-sensitive menu for the "Materials" folder in the tree structure.

Modifying and Deleting

Using the context-sensitive commands **Properties** and **Delete** , you can modify or delete existing materials.

5.4.2 Changing the Quality

Follow the steps outlined below:

1. Select the quality BatchCC (in the "Materials" folder).
2. Select the menu command **Edit > Properties**.
3. Change the settings for the quality in the "Quality" dialog.
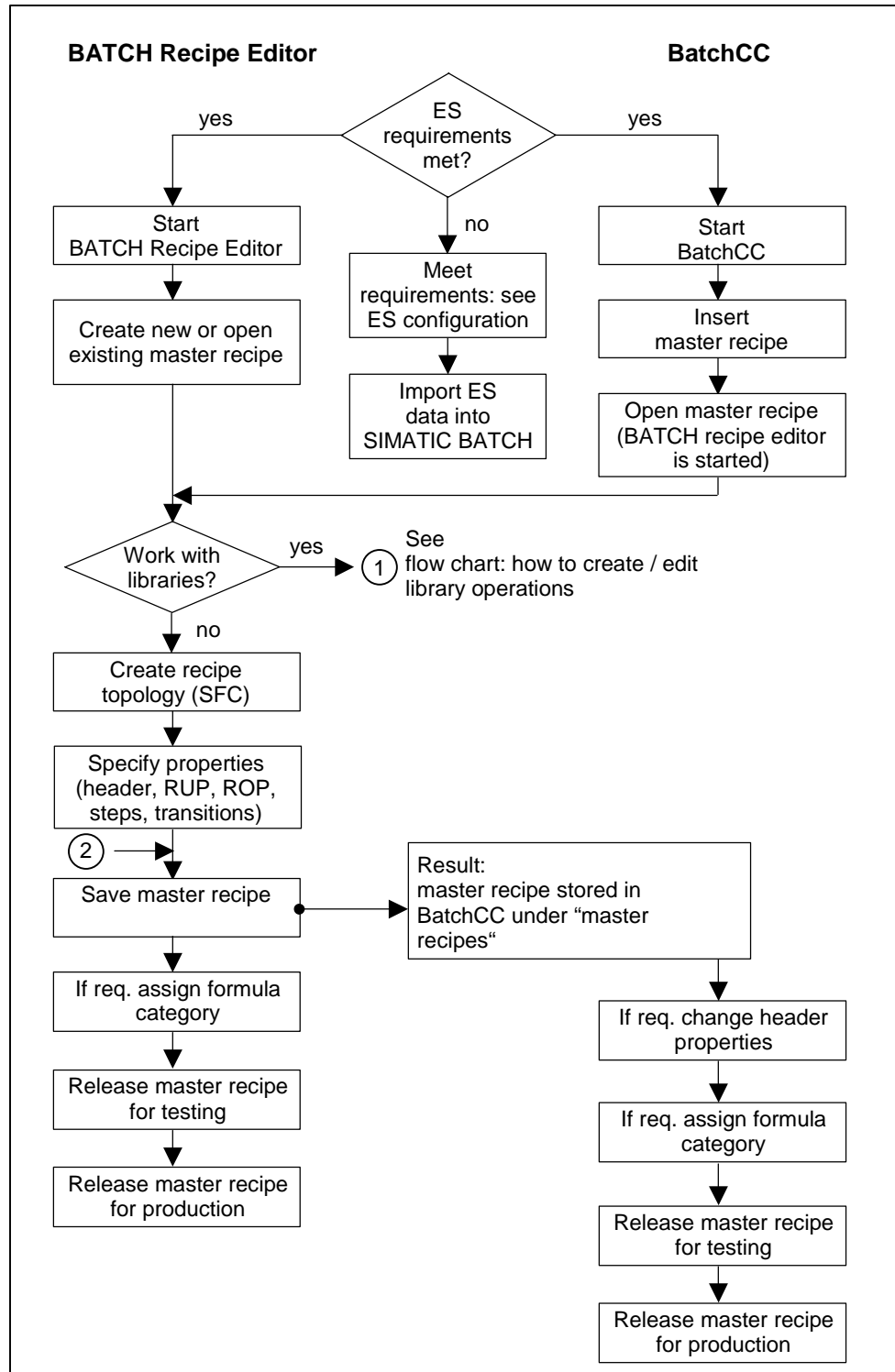4. Save you new input with OK.

Note:

As an alternative, you can also perform this settings in the tree structure via the command **Properties** in the context-sensitive menu of the object {bmct Qualität_icon.bmp}.
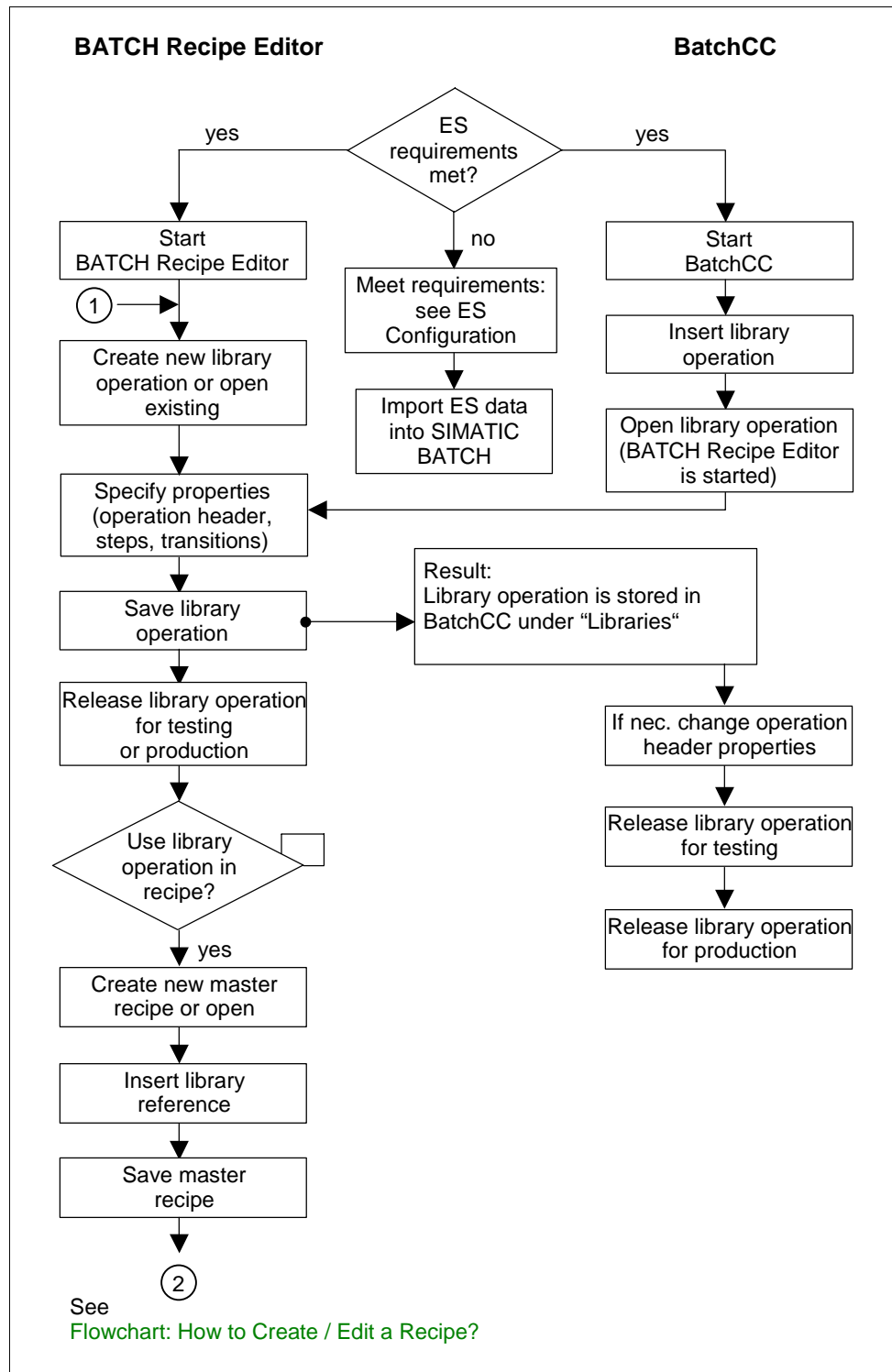

5.5 Recipes

5.5.1 Flowchart: How to Create and Edit a Master Recipe

How to Create and Edit a Master Recipe

5.5.2 Flowchart: How to Create or Edit a Library Operation

How to Create / Edit Library Operations and Insert them in Master Recipes

```
┌─────────────────────────────────────────────────────────────────────────┐
│                                                                           │
│   BATCH Recipe Editor                              BatchCC                 │
│                                                                           │
│                              ┌─────────────┐                              │
│         yes  ◄───────────────┤     ES      ├───────────────► yes          │
│                              │ requirements│                              │
│                              │    met?     │                              │
│                              └──────┬──────┘                              │
│                                     │ no                                  │
│   ┌──────────────┐           ┌─────────────┐         ┌──────────────┐     │
│   │   Start      │           │    Meet     │         │   Start      │     │
│   │ BATCH Recipe │           │requirements:│         │   BatchCC    │     │
│   │   Editor     │           │  see ES     │         └──────┬───────┘     │
│   └──────┬───────┘           │Configuration│                │            │
│  ( 1 )──►│                   └──────┬──────┘         ┌──────────────┐     │
│   ┌──────────────┐                  │                │   Insert     │     │
│   │ Create new   │           ┌─────────────┐         │  library     │     │
│   │ library      │           │ Import ES   │         │  operation   │     │
│   │operation or  │           │ data into   │         └──────┬───────┘     │
│   │open existing │           │  SIMATIC    │         ┌──────────────┐     │
│   └──────┬───────┘           │   BATCH     │         │Open library  │     │
│   ┌──────────────┐           └─────────────┘         │operation     │     │
│   │   Specify    │◄──────────────────────────────────│(BATCH Recipe │     │
│   │  properties  │                                   │Editor is     │     │
│   │(operation    │                                   │started)      │     │
│   │header, steps,│                                   └──────────────┘     │
│   │ transitions) │                                                        │
│   └──────┬───────┘           ┌────────────────────┐                       │
│   ┌──────────────┐           │ Result:            │                       │
│   │Save library  │●─────────►│ Library operation  │                       │
│   │ operation    │           │ is stored in       │                       │
│   └──────┬───────┘           │ BatchCC under      │                       │
│   ┌──────────────┐           │ "Libraries"        │                       │
│   │Release       │           └────────────────────┘                       │
│   │library       │           ┌────────────────────┐                       │
│   │operation for │           │If nec. change      │                       │
│   │testing or    │           │operation header    │                       │
│   │production    │           │properties          │                       │
│   └──────┬───────┘           └─────────┬──────────┘                       │
│   ┌──────────────┐           ┌────────────────────┐                       │
│   │Use library   │           │Release library     │                       │
│   │operation in  │           │operation for       │                       │
│   │recipe?       │           │testing             │                       │
│   └──────┬───────┘           └─────────┬──────────┘                       │
│          │ yes               ┌────────────────────┐                       │
│   ┌──────────────┐           │Release library     │                       │
│   │Create new    │           │operation for       │                       │
│   │master recipe │           │production          │                       │
│   │or open       │           └────────────────────┘                       │
│   └──────┬───────┘                                                        │
│   ┌──────────────┐                                                        │
│   │Insert library│                                                        │
│   │reference     │                                                        │
│   └──────┬───────┘                                                        │
│   ┌──────────────┐                                                        │
│   │Save master   │                                                        │
│   │recipe        │                                                        │
│   └──────┬───────┘                                                        │
│        ( 2 )                                                              │
│   See                                                                     │
│   Flowchart: How to Create / Edit a Recipe?                               │
│                                                                           │
└─────────────────────────────────────────────────────────────────────────┘
```

5.5.3 Basics of Recipe Creation

5.5.3.1 Overview of the Properties of Master Recipes

Definition

By "Properties of Master Recipes", we mean all the information complying with the standard ISA S88.01 (1995) that must or can be specified for a recipe in addition to the recipe procedure. These properties include the recipe name/version/status, material and production data (formula), parameters, measured values and unit allocations.

Selectable Master Recipe Properties

The table below lists all the properties that can be displayed and/or modified for each master recipe in the "Properties of <Recipename>" dialog. These master recipe parameters are also known as **recipe header parameters**.

Tab	What is set or displayed	Meaning/comment
General	Name and version	Name of the master recipe, cannot be changed
	Status	Status display of the master recipe, e.g. "In progress"
	Duration	Here, the longest time for one execution of the recipe is calculated. It is the sum of the step times of the path through the recipe.
	Category	There may be a reference to an existing formula category.
Allocations	Allocation Map	The unit allocations of the recipe specified by the detailed configuration of the recipe unit procedures (RUP) are listed here along with the calculated start time and duration.
		In the "Start allocation" field, you can specify whether or not a unit will be occupied at the start of the batch."
		In a follow-on dialog, you can modify the unit class and preferred unit (along with the selection strategy).
Product	Product, Quality	Settings for the main product
	Reference quantity	The reference quantity is meant for quantity scaling, this means, the parameters in the recipe relate to this value and they have to be adjusted in the event of discrepancies in the reference quantity.
	Minimum Scale, Maximum Scale	Limits the upper and lower limits of the batch quantity. In batch planning, the quantities specified are checked to make sure they are not lower/higher than the values entered here.

Tab	What is set or displayed	Meaning/comment
Input Material	Material List	For the steps with the connection to EOP, EPH or for the operator dialogs, the entries for the basic automation are applied for the library reference from the library operation. New materials can also be created. Per input material, the material, quality, scaling function and concrete quantity are specified. Either concrete values (internal formula) or reference to values of an external formula
Output Material	Material List	For the steps with the connection to EOP, EPH or for the operator dialogs, the entries for the basic automation are applied for the library reference from the library operation. New materials can also be created. Per output material, the material, quality, scaling function and concrete quantity are specified. Either concrete values (internal formula) or reference to values of an external formula
Parameter	Parameter list	For the steps linked to EOPs, EPHs or for the operator dialogs, the parameters are taken from the basic control; for a library reference from the library operation. New parameters of the type real, bool, integer, string and enumeration can also be created. Either concrete values (internal formula) or reference to values of an external formula
Measured Variables	Measured variables that will be logged	Measured variables for the batch report: You can select measured variables for archiving. As measured variables, the process values of the parameter blocks (EPAR_) linked via the EOP, EPH and TAG_COLL blocks are available.
Change Log	List of modifications	List in which the modifications made to the recipe are documented.
ESIG	Electronic signature	Specifying electronic signatures in compliance with FDA or 21 CFR Part 11: The "electronic signatures" function allows the operator to enter one or more signatures in the form of dialogs similar to the logon prompts normal in Windows at defined status changes or when operator input is made to recipes, recipe steps etc.

5.5.3.2 Relationship between Header Parameters, Formula Category and External Formula

Header Parameters (internal formula)

If you want to keep your material and production data directly in the master recipe, you can do this in the recipe header. This is then known as an internal formula. The material and production data can be set there during the creation of the master recipe and modified during batch planning and/or also while a batch is executing. These parameters can be passed on from the recipe header to individual recipe steps or from the recipe steps to the recipe header.

Interaction between Header Parameters, Formula Category and External Formula

If you want to manage several material and production data lists for a master recipe, you must do this outside the master recipe in "external" formulas belonging to a formula category.

In this case, if a formula category is assigned to a master recipe and the parameters of the master recipe are then interconnected with those of the formula category, the parameters that can be manipulated by an operator using a formula during batch planning are effectively masked. In the formula category, the parameters are listed with the data type and physical unit. In the formula, the parameters have concrete values, a high and low limit and a reference to the procedure (master recipe).

The parameters of external formulas can also be modified during batch planning and/or while a batch is executing.
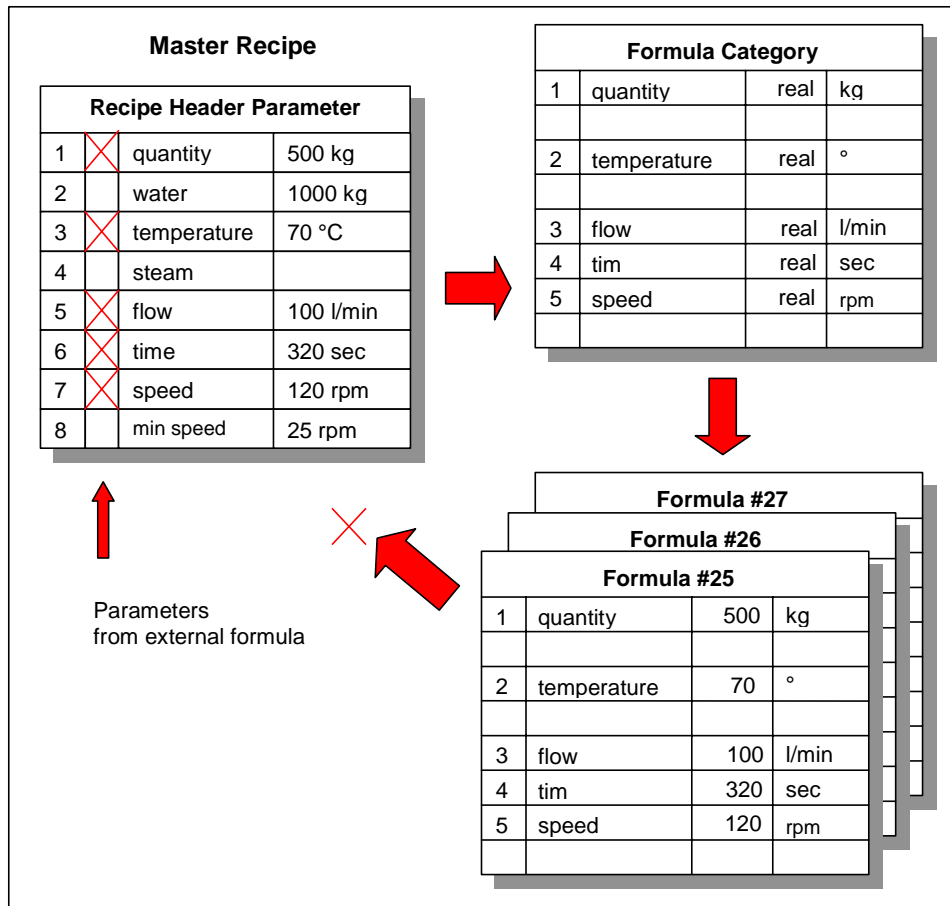

Note:

Internal and external formula must not be congruent, this means, all recipe header parameters must not be interconnected to an external formula. and not all the parameters of an external formula need to be used in a master recipe.

Example of Interaction

Master Recipe

Recipe Header Parameter

1	☒	quantity	500 kg
2		water	1000 kg
3	☒	temperature	70 °C
4		steam	
5	☒	flow	100 l/min
6	☒	time	320 sec
7	☒	speed	120 rpm
8		min speed	25 rpm

Parameters
from external formula

Formula Category

1	quantity	real	kg
2	temperature	real	°
3	flow	real	l/min
4	tim	real	sec
5	speed	real	rpm

Formula #27

Formula #26

Formula #25

| 1 | quantity | 500 | kg |
2	temperature	70	°
3	flow	100	l/min
4	tim	320	sec
5	speed	120	rpm

5.5.3.3 Interconnecting Parameters

Interconnecting Parameters between the Master Recipe and External Formula

After assigning the master recipe and formula category, the parameters for the input materials, output materials, and process parameters still need to be interconnected.

The advantage of this is that you can use independent parameter names in the formula category of a master recipe. After assigning a formula category to a master recipe, you specify the reference to the parameters in the formula category in the Properties dialog. Parameters of the same data type and same physical unit are made available from the formula category.
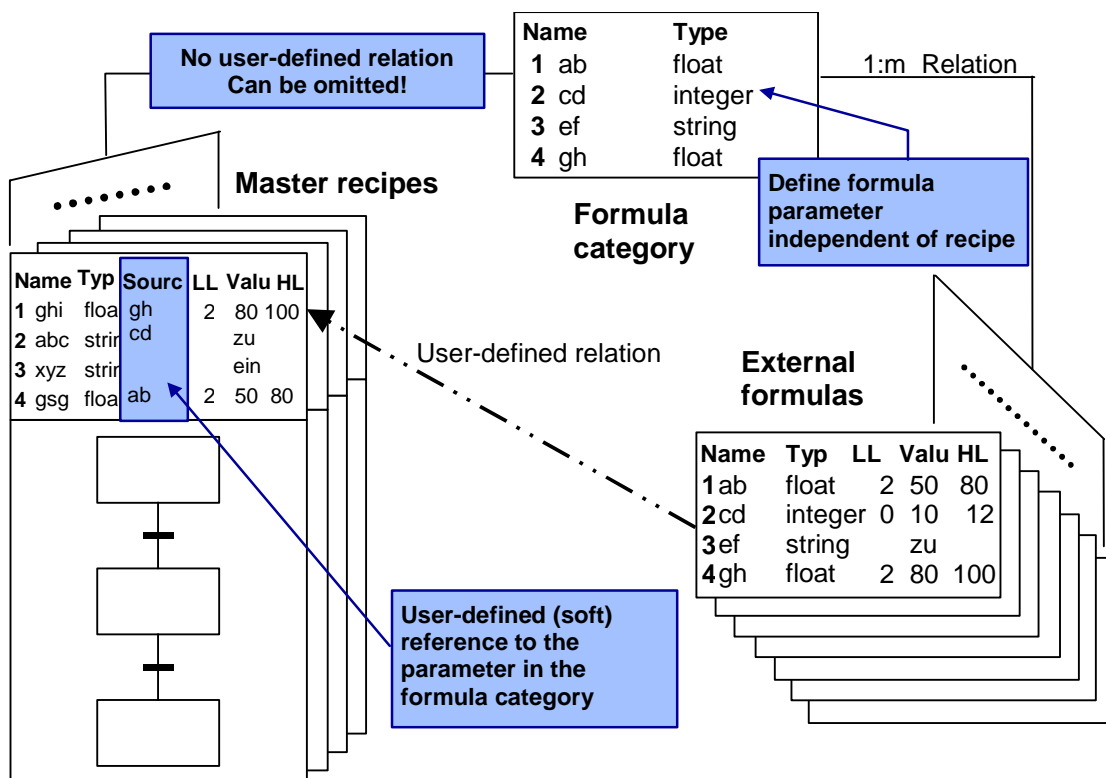
5.5.4 Editing Master Recipes

5.5.4.1 How to Configure a Master Recipe

Note:

The order of the steps shown in the schematic is not absolutely necessary. We have selected a method on which the more detailed description of the actions is oriented.
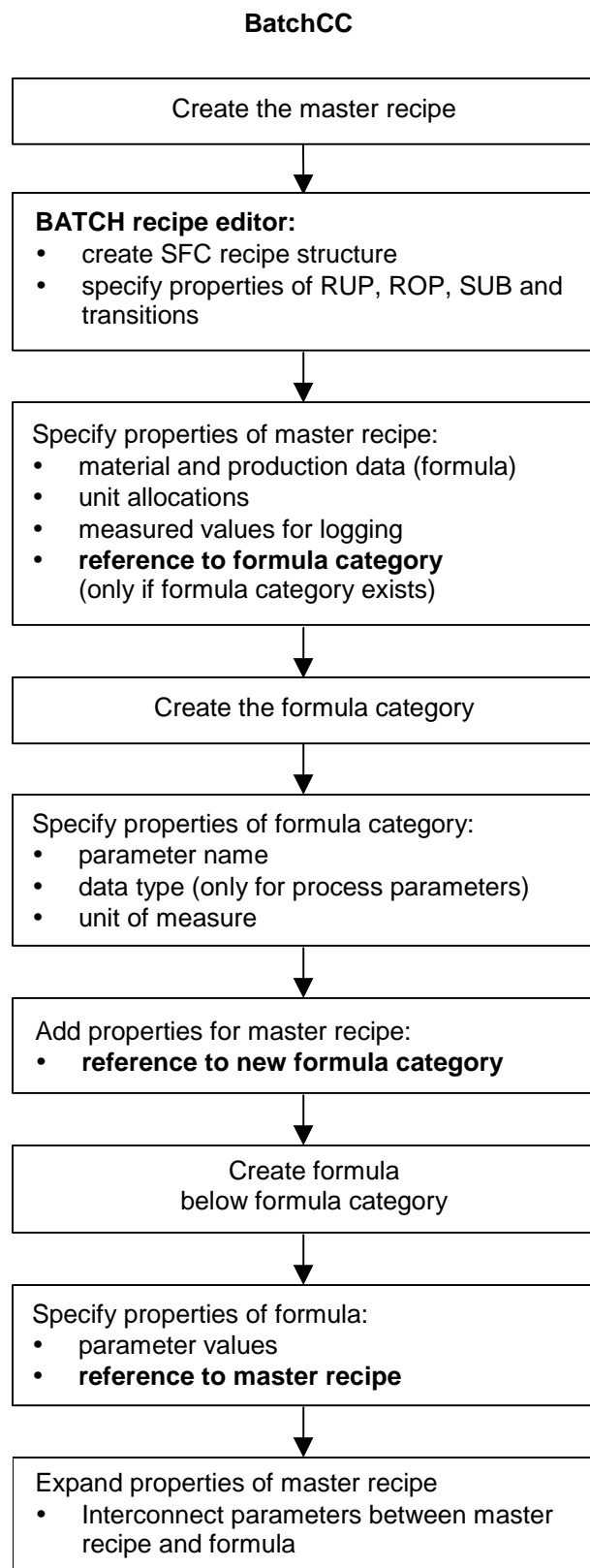
Note:

You can also use master recipes without using the "formula category" and "formulas" objects. In this case, the material and production data (formula) are set in the properties of the master recipe.

Configuring a Master Recipe

The schematic below shows a **recommended sequence** for configuring a master recipe **in BatchCC**. Illustrates clearly how to configure the assignments between the master recipe, formula category and formula.

You create the actual recipe structure and set the properties of the recipe elements (Step 2) in the BATCH Recipe Editor. All the other steps can be made in BatchCC.

BatchCC

```
┌─────────────────────────────────────────────────┐
│           Create the master recipe               │
└─────────────────────────────────────────────────┘
                         │
                         ▼
┌─────────────────────────────────────────────────┐
│ BATCH recipe editor:                             │
│ •   create SFC recipe structure                  │
│ •   specify properties of RUP, ROP, SUB and      │
│     transitions                                  │
└─────────────────────────────────────────────────┘
                         │
                         ▼
┌─────────────────────────────────────────────────┐
│ Specify properties of master recipe:             │
│ •   material and production data (formula)       │
│ •   unit allocations                             │
│ •   measured values for logging                  │
│ •   reference to formula category                │
│     (only if formula category exists)            │
└─────────────────────────────────────────────────┘
                         │
                         ▼
┌─────────────────────────────────────────────────┐
│           Create the formula category            │
└─────────────────────────────────────────────────┘
                         │
                         ▼
┌─────────────────────────────────────────────────┐
│ Specify properties of formula category:          │
│ •   parameter name                               │
│ •   data type (only for process parameters)      │
│ •   unit of measure                              │
└─────────────────────────────────────────────────┘
                         │
                         ▼
┌─────────────────────────────────────────────────┐
│ Add properties for master recipe:                │
│ •   reference to new formula category            │
└─────────────────────────────────────────────────┘
                         │
                         ▼
┌─────────────────────────────────────────────────┐
│           Create formula                         │
│           below formula category                 │
└─────────────────────────────────────────────────┘
                         │
                         ▼
┌─────────────────────────────────────────────────┐
│ Specify properties of formula:                   │
│ •   parameter values                             │
│ •   reference to master recipe                   │
└─────────────────────────────────────────────────┘
                         │
                         ▼
┌─────────────────────────────────────────────────┐
│ Expand properties of master recipe               │
│ •   Interconnect parameters between master       │
│     recipe and formula                           │
└─────────────────────────────────────────────────┘
```

Underlying Principle

You create the master recipes in the BATCH Recipe Editor

- If you are using hierarchical recipes: as a structure of recipe unit procedures (RUPs), recipe operations (ROPs) and recipe phases (RPHs)

- If you are using flat recipes: as a structure of substructures (SUBs)

In BatchCC, you can specify the reference to a formula category in the properties of the master recipe (header parameters). In the properties of the formula, you specify the reference to the procedure (master recipe). After these steps, you have a complete master recipe for batch planning.

5.5.4.2 Creating a New Master Recipe

There are two ways of creating a new master recipe:

- In the BATCH Recipe Editor: see "BATCH Recipe Editor"

- In BatchCC: described below

Follow the steps outlined below in BatchCC:

1. Select the "Master Recipes" folder.

2. Select the menu command Edit > New > Hierarchical/Flat.

3. Enter the name and version of the new master recipe in the dialog displayed and confirm with OK.

Result: The new master recipe is inserted as an object . The master recipe is in the initial status "In Progress" and can now be edited.

Editing

You can now continue to edit the master recipe either using the context-sensitive menu for the object or alternatively using the **Edit** menu of the menu bar:

- Creating the Recipe Topology

To edit the master recipe, open the object with the **Open** menu command. The BATCH Recipe Editor is then opened. In the BATCH Recipe Editor, you create the topology of the master recipe with steps and transitions and define the properties of the recipe elements (RUPs, ROPs, RPHs, SUBs and transitions).

- Specifying the Master Recipe

To specify the properties of the header parameters, select the **Properties** menu command.

- Working with the Recipe Overview

As an alternative to the tree structure, the "master recipe" objects can also be edited in the recipe overview. Open the recipe overview list with the **Details** menu command. First select the folder with the desired master recipe in the tree structure.

- Validating Recipes

- Releasing Recipes for Testing

- Releasing Recipes for Production

5.5.4.3   Opening and Editing Recipes

Editing Recipes

The recipe procedures of the master recipes and the library operations are created with the BATCH Recipe Editor.

With the exception of deleting that is only possible with the BatchCC, you can make any modifications to recipe procedures and library operations with the BATCH Recipe Editor.

Follow the steps outlined below in BatchCC:

To edit master recipes and library operations, the objects must first be **opened**:

1. Select the master recipe or library operation in the BatchCC

2. Select the menu command **Edit > Open**.

Result: The BATCH Recipe Editor is opened displaying the graphic structure of the highest hierarchical level of the recipe object.

5.5.4.4 Specifying the Properties of Master Recipes

Opening the Tab

There are two ways in which you can open the "Properties of <Recipe name>" tab:

- In the BATCH Recipe Editor: see "BATCH Recipe Editor"
- In BatchCC: described below

Follow the steps outlined below in BatchCC:

1. Select the master recipe in the "Master Recipes" or in one of its subfolders in the BatchCC.

2. Select the menu command **Edit > Properties**.

   Result: The "Properties of the <recipe name>" dialog is displayed with the header parameters. In the dialog tabs, all the Properties of the master recipe are available, which must/can be specified for a recipe in addition to the master recipe structure.

   Some of the properties (parameters) already have a fixed value due to the detailed configuration of the individual recipe elements (RUPs, ROPs, RPHs, SUBs transitions) based on the process cell configuration in the engineering system. You can recognize parameters or settings that can still be modified by the white editing fields.

3. Make the settings you require in the tabs and confirm with OK.

Entering Properties

You enter the properties of the master recipes in the following tab. Click the "Help" button for context-sensitive help on each individual input or output box in the tab.

```
┌─────────────────────────────────────────────────────────────────────────┐
│ Properties of 'Recipe_REA1'                                          [×]  │
├─────────────────────────────────────────────────────────────────────────┤
│  🔷 Output material │ ⏱ Parameters │ ⬚ Process tags │ ✏ Modifications │  │
│  General        │ 🛡 Allocations  │  🔧 Product   │ 🔷 Input material │  │
│                                                                           │
│   Name:                           Status:                                 │
│   ┌──────────────────────────┐    ┌──────────────────────────┐          │
│   │ Recipe_REA1              │    │ in progress              │          │
│   └──────────────────────────┘    └──────────────────────────┘          │
│                                                                           │
│   Version:                        Formula category                        │
│   ┌──────────────────────────┐    ┌────────────────────────────────┐    │
│   │ V1.0                     │    │ Formula_300701              [▼] │    │
│   └──────────────────────────┘    └────────────────────────────────┘    │
│                                                                           │
│   Duration:                                                               │
│   ┌──────────────────────────┐                                           │
│   │ 00                       │                                           │
│   └──────────────────────────┘                                           │
│   Sec                                                                     │
│   Description:                                                            │
│   ┌───────────────────────────────────────────────────────────────┐ ▲  │
│   │                                                                 │    │
│   │                                                                 │    │
│   │                                                                 │    │
│   │                                                                 │ ▼  │
│   └───────────────────────────────────────────────────────────────┘    │
│                                                                           │
│   ┌──────────┐                        ┌──────────┐    ┌──────────┐       │
│   │   OK     │                        │  Cancel  │    │   Help   │       │
│   └──────────┘                        └──────────┘    └──────────┘       │
└─────────────────────────────────────────────────────────────────────────┘
```

Reference to Formula Category

With the "Category" input box in the "General" tab, you assign the formula category with the required structure for material and production data (formula) to the master recipe. It is assumed that the formula category has already been created.

See section: Connection between the recipe header parameter, formula category and formula

Interconnecting Parameters

After assigning the master recipe and formula category, the parameters must still be interconnected. After assigning a formula category to a master recipe you specify the reference to the parameters in the formula category in the Properties dialog ("input materials", "output materials" and "parameters" tabs).

See section: Interconnecting Parameters between Master Recipe and Formula

Electronic Signatures

Actions and status changes of recipes and recipe elements can be signed. You configure electronic signatures in the "ESIG" tab.

See also section: Specifying the Electronic signature

5.5.4.5   Creating a New Formula Category

Follow the steps outlined below in BatchCC:

1. Select the "Formulas" folder.

2. Select the menu command **Edit > New**.

3. Enter the name of the new formula category in the dialog displayed and confirm with OK.

Result: The new formula category is inserted as an object . With the formula category, you can now create a class of formulas with the same raw material and production data structure.

Editing

You can now continue to edit the formulas as follows:

• Specifying the Properties of the Formula Category

• Creating a New External Formula

5.5.4.6 Specifying the Properties of the Formula Category

Follow the steps outlined below in BatchCC:

1. Select the formula category in the "Formulas" folder or in one of its subfolders.

2. Select the menu command **Edit > Properties**.

Result: the dialog box "Properties of <category name>" is displayed. In the tab dialogs, the structure of the material and production data (formula) can be specially created for this formula category (external formula).

3. Enter the structure of the formula category consisting of the parameter names, data type (only for process parameters) and physical unit and confirm with OK.

Result: With the formula category, you can now create formulas with the same raw material and production data structure by creating new formulas under this formula category in the tree structure.

Entering Properties

You enter the properties of the formula category in the following tab. Click the "Help" button for context-sensitive help on each individual input or output box in the tab.

5.5.4.7   Creating a New External Formula

Follow the steps outlined below in BatchCC:

1. Select the required formula category in the "Formula" folder. If the formula does not match any formula category, you have to create the corresponding formula category first.

2. Select the menu command **Edit > New**.

3. Enter the name and version of the new formula in the dialog that follows.

Result: The new formula is inserted as an object 🐎 🖧 . In the Properties dialog for the formula, you can now enter the concrete information on the materials, quantities and quality. |The parameters of the higher level formula category are displayed in each case. If parameters are missing, the formula category needs to be adapted.

Editing

You can now continue to edit the formulas as follows:

• Specifying the Properties of a Formula

• Interconnecting Master Recipe Header Parameters with an External Formula

5.5.4.8   Specifying the Properties of a Formula

Follow the steps outlined below in BatchCC:

1. Select the formula under the formula category.

2. Select the menu command **Edit > Properties**.

Result: the dialog box "Properties of <formula name>" is displayed. The possible range of values for the parameters of the formula are displayed as the upper and lower limits.

3. Enter concrete parameter values and select the corresponding master recipe.

Note:

The "Master recipe" input field you can select those master recipes to which the formula category of the present formula has already been assigned. If the required master recipe is not listed, change to the Properties dialog of the master recipe and enter the reference to the formula category there.

Entering Properties

You enter the properties of the formula in the following tab. Click the "Help" button for context-sensitive help on each individual input or output box in the tab.

Reference to the Master Recipe

In the "Master recipe" input box in the "General" tab, you assign a specific master recipe to the formula. After these steps, you have a complete master recipe for batch planning.

See section: Connection between the recipe header parameter, formula category and formula

5.5.4.9 Interconnecting Master Recipe Header Parameters with an External Formula

Interconnecting Parameters

After assigning the master recipe and formula category, the parameters of the input materials and process parameters must still be interconnected. Perform the parameter interconnection for the master recipe in the properties dialog, provided the formula category was assigned there (see also section Specifying the Properties of the Master Recipe_).

Follow the steps outlined below:

1. Select the master recipe in the "Master Recipes" or in one of its subfolders in the BatchCC.

2. Select the menu command **Edit > Properties**.

Result: the dialog box "Properties of <recipe name>" is displayed.

3. Change to the tabs for input materials, output materials, or parameters.

4. Create the reference to a parameter in the formula category in the "Source" column.

   - Left click: The list box contains all the formula parameters of the same data type and same physical unit for selection. It may be necessary to assign the unit first in the "Phys. unit" column. "E" is shown under Value indicating external (see figure).

   - Right click: A further dialog box opens. When creating new parameters, you can use this to check whether a parameter of the same name at a different level will be overwritten and if this is the case, you can see the level at which the parameter exists.

Batch Control Center (BatchCC)

Properties of 'Recipe_REA1'

Tabs: Output material | Parameters | Process tags | Modifications
General | Allocations | Product | Input material

List:

	Name	Source	Material	Code	Low limit	C
1	Recipe_REA1_mat1	▼	Material7	34		0
2	Recipe_REA1_mat2		erial7	34		0
3	Recipe_REA1_mat3		erial7	34		0

Input material1
Input material3

Description from row 1:

New
Delete

OK   Cancel   Help

5. Confirm the references with OK.

The header parameter is connected to the parameter of the external formula via the parameter of the formula category provided this master recipe was already assigned to a formula (see also section Specifying the Properties of the Formula). The values of the formula are used in the parameters of the master recipe.

Display of Parameter Interconnection

The interconnection is displayed in the properties dialog of the formula with a connection icon in the "Usage" column:

⊫◻⊨ : interconnected

⊫◻◻⊨ : not interconnected (or no longer connected)
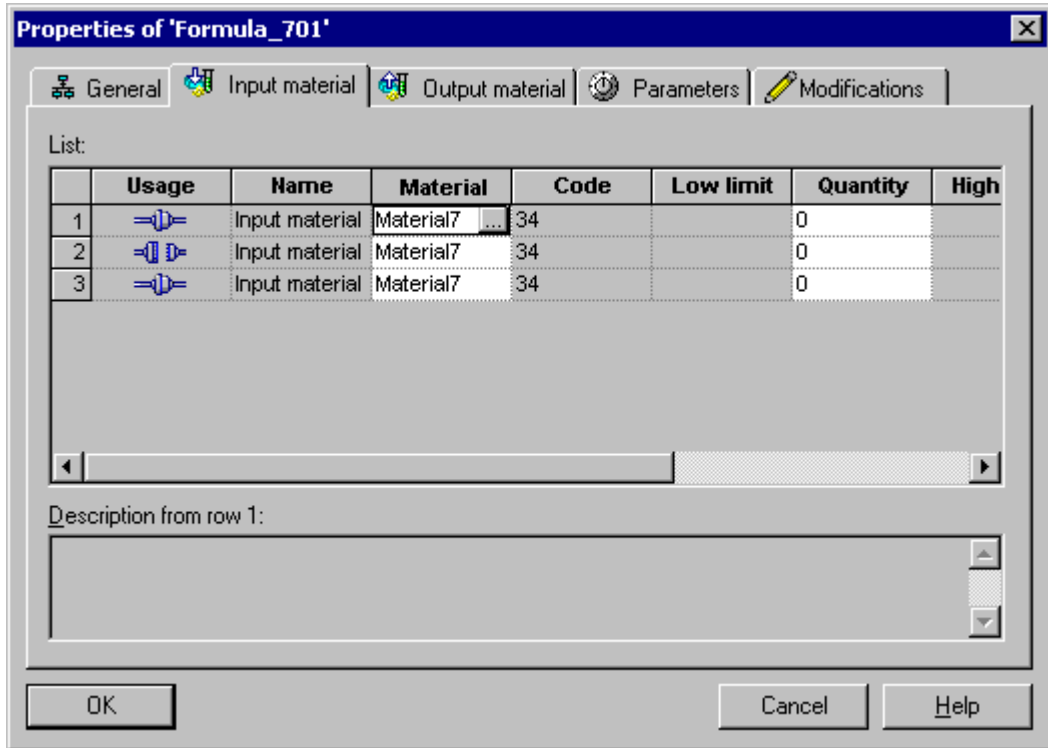
5.5.4.10   Working with the Recipe Overview

Recipe Overview

The recipe overview provides you with a list of the master recipes of a selected area. Apart from the properties from the tree structure, this list also shows the author and date of the last modification.

Using the context-sensitive menu with the object listed, you can select the available functions in the same way as in the tree structure (alternative editing method).
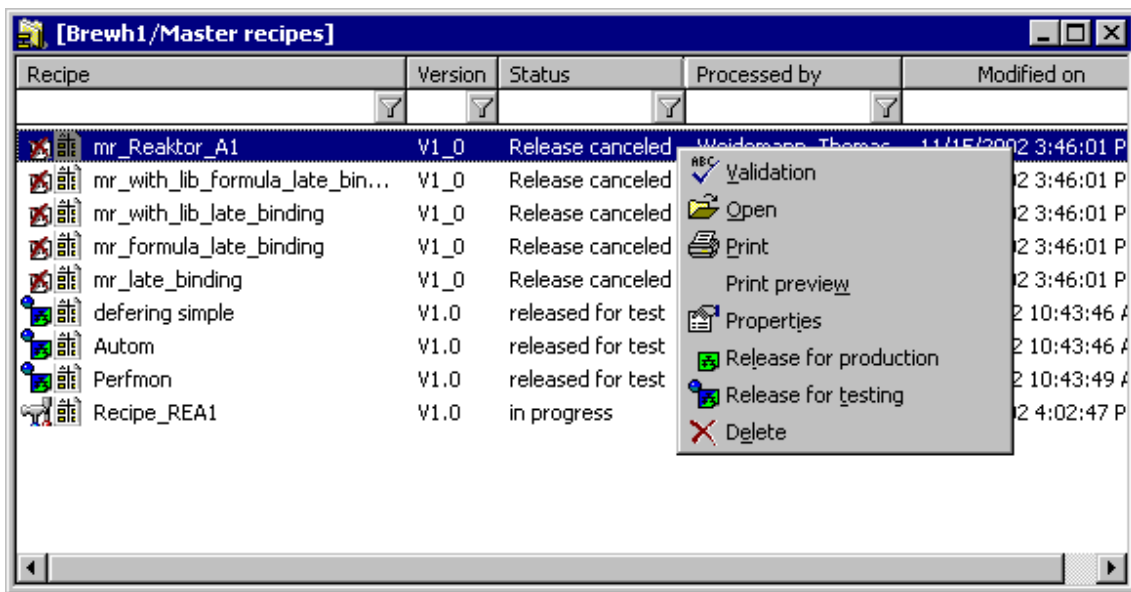
Selecting the Recipe Overview

- Select the required area by first selecting a master recipe folder in the tree structure and then selecting the menu command **Edit > Details**.

5.5.4.11 Working with the Formula Overview

Formula Overview

The formula overview provides you with a list of all the formulas of a selected area. Apart from the properties from the tree structure, this list also shows the author and date of the last modification.

Using the context-sensitive menu with the object listed, you can select the available functions in the same way as in the tree structure (alternative editing method).
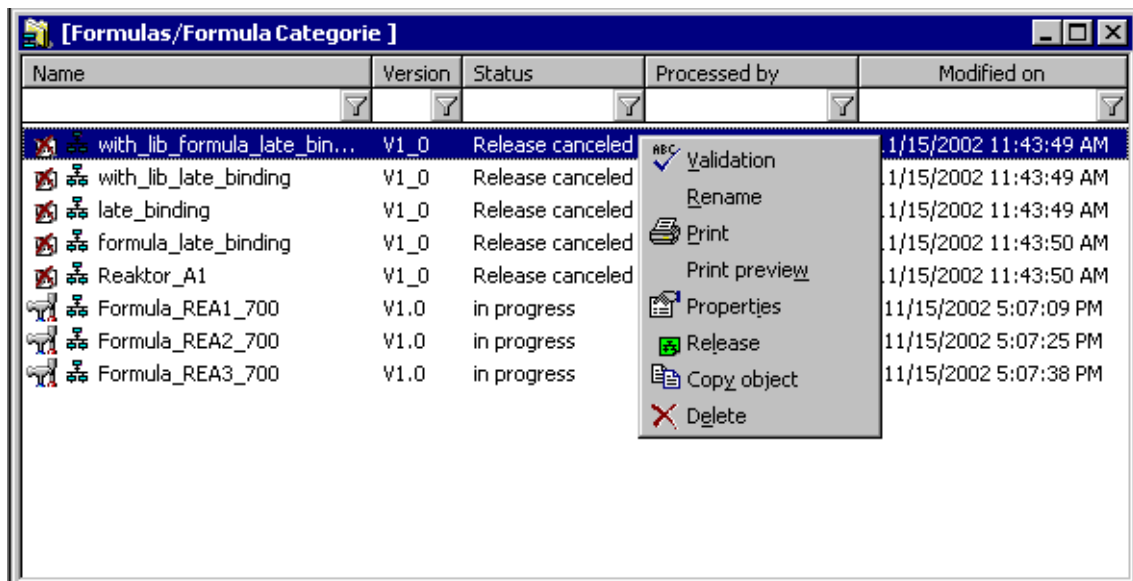
Selecting the Formula Overview

• Select the required area by first selecting a formula folder in the tree structure and then selecting the menu command **Edit > Details**.

5.5.5 Working with Libraries

5.5.5.1 How to Configure Library Operations

Configuring Library Operations

The schematic below is a **recommended sequence** for configuring a library operation in the BATCH Recipe Editor. You manage library operations in the BatchCC. All the other steps can be made in the BATCH Recipe Manager.

BATCH Recipe Editor

```
┌─────────────────────────────────────────┐
│       Create a new library operation     │
│        in the BATCH Recipe Editor        │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│ Create topology of the library operation:│
│ •  Create the recipe structure           │
│ •  Specify the properties of the steps and│
│    transitions                           │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│ Specify the properties of the library    │
│ operation:                               │
│ •  Material and production data (formula) │
│ •  **Reference to unit class**           │
│                                          │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│ Save library operation in the <Library> folder│
│            in BatchCC                     │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│       Insert a library reference in       │
│  the master recipe in BATCH Recipe Editor │
└─────────────────────────────────────────┘
```

Underlying Principle

You create reusable library operations in the BATCH Recipe Editor

- In hierarchical recipes: as a structure of recipe phases (RPHs)

- In flat recipes: as a structure of substructures, recipe operations (ROPs) and recipe phases (RPHs)

A library operation for hierarchical recipes is created for each specific unit class. The unit class is referenced in the header of the library operation.

In the BATCH Recipe Editor, you store the library operations created in this way in the "Libraries" folder in the BatchCC using a menu command.

When you create the recipe structure in the BATCH Recipe Editor you insert the required library operation using a library reference. The library operation is **not** copied but a link to the library operation within the library is created.

Any modifications required must always be made to the library operation stored in the library. Any changes made to the library operation always affect all links (library references) in the master recipes of the process cell.

Multiple Use

A library operation can be used in the following ways:

- More than once in a process cell

- More than once in a recipe procedure (RP)

- More than once within a recipe unit procedure (RUP) only with hierarchical recipes

- More than once within a substructure (SUB) only with flat recipes
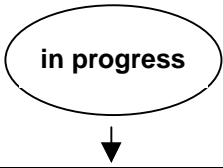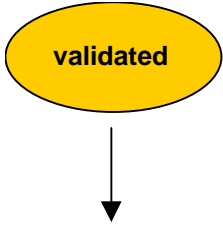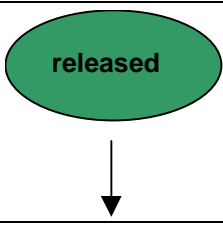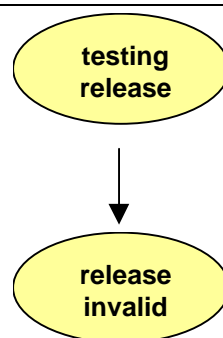
See also

Specifying the Properties of Master Recipes

5.5.6　Status and Validity of Recipes

Status Changes and Validation of Master Recipes and Library Operations

The initial status of a newly created master recipe or library operation is always "In Progress". You can bring about status changes using the appropriate commands. For batch planning, the master recipe must be valid.

Status	Triggered by	Meaning
in progress	Menu command **New**	A master recipe or a library operation always has the status **In Progress** after it has been created.
validated	Menu command **Validity check**	The plausibility (validity) of the parameters in the process cell data is checked. A results list or error list is displayed that indicates, for example, which parameter settings are missing. **Requirement:** The master recipe or library operation has header parameters and a recipe structure.
released	Menu Commands **Release for testing** **Release for production**	The two releases differ only in that different permissions and different user routines can be used. Both releases can be started without first running the validation check. In this case, a validation is run automatically in the background.
release revoked	Menu command **To revoke the release:**	If a master recipe or library operation had already been released for production, the release can be revoked (for example to make modifications).
testing release / **release invalid**	When updating the process cell data	After updating, all the recipes (master recipes, library operations) of this process cell that were "released for production" and "released for testing" are changed to the "Testing release" status. After updating the process cell data, the recipes and library operations in the "Testing release" status are checked automatically. If the check is successful, the master recipes and library operations are returned to their original status. If the check is unsuccessful, the elements are changed to the "release invalid" status. They can now be edited and released again.

Difference between Releasing for Testing and for Production

In the validation for release of a recipe, you can include you own test routines. Due to the distinction between release for testing and release for production, separate test routines can be processed. You could, for example, only allow water as the product for recipes released for testing. Different user permissions can also be defined.

Recipes released for testing can also be edited directly after revoking the release. If a recipe is released for production, editing is possible only with certain settings in BatchCC (**Options > Settings**).

Validity of the Formula

For batch planning, the formula (with assigned master recipe) must be validated.

Status	Triggered by	Meaning
in progress	Menu command **New**	A formula always has the status **In progress** after it has been created.
validated	Menu command **Validity check**	The assignment of a master recipe and the validity of the formula parameters are checked. A result or error list is displayed that indicates, for example, which parameters are not interconnected. **Requirements** • ·• A master recipe released for testing or production is assigned to the formula. • • The formula parameters were interconnected successfully The formula parameters are within the upper and lower limit values
released	Menu command**Release**	The release can be started without first running the validation check. In this case, a validation is run automatically in the background.
release revoked	Menu command **To revoke the release:**	If a formula had already been released, the release can be revoked (for example to make modifications). This is also the status if you make modifications in the Properties dialogs.

Requirements for Batch Control

Note:

Only validated formulas with master recipes released for production can be used for batch control.

Only test batches (for example, test operation with water) can be created with the master recipes and library operations released for testing.

5.5.6.1 Validating Recipes

Definition

The validation covers the consistency of the library operations and process cell data used in the created recipe.

Requirement:

This is only possible when the recipe is edited with the elements step, transition, and structure elements along with the corresponding configuration of the recipe data (header).

Follow the steps outlined below in BatchCC:

1. Select the recipe you want to validate (master recipe or library operation) in the tree structure.

2. Select the menu command **Edit > Validate**.

Result: A results list or error list is displayed that indicates whether or not the recipe header is completed, whether materials exist, whether steps and transitions in the recipe are configured and whether the normalized batch quantity is correct. Validation is also possible in the BATCH Recipe Editor.

Note:

If the recipe is open in the BATCH Recipe Editor, you can also jump to the part of the recipe that caused the problem by double-clicking the entry in the error list.

Note:

You can use the validation function at any time. Validation does not change the recipe status.

5.5.6.2 Releasing Recipes for Testing

Requirement:

The requirement for this function is the validation of the recipe. The validity of the recipe is first checked automatically when you start this command.

Follow the steps outlined below in BatchCC:

1. Select the recipe (master recipe or library operation) in the tree structure.

2. Select the menu command Edit > Release for Testing.

Result: After it has been released, the recipe has the status "Released for testing" . If errors occur in the validation, the problems are displayed and the recipe status remains "In Progress...". Release is also possible in the BATCH Recipe Editor.

Note:

If the recipe is open in the BATCH Recipe Editor, you can also jump to the part of the recipe that caused the problem by double-clicking the entry in the error list.

5.5.6.3 Releasing Recipes for Production

Requirement:

The requirement for this function is the validation of the recipe. The validity of the recipe is first checked automatically when you start this command.

Follow the steps outlined below in BatchCC:

1. Select the recipe (master recipe or library operation) in the tree structure.

2. Select the menu command Edit > Release for Production.

Result: After it has been released, the recipe has the status "Released for production" . If errors occur in the validation, the problems are displayed and the recipe status remains "In Progress...". Release is also possible in the BATCH Recipe Editor.

Note:

If the recipe is open in the BATCH Recipe Editor, you can also jump to the part of the recipe that caused the problem by double-clicking the entry in the error list.

5.5.6.4   Validating Formulas

Definition

During validation, the formula is checked to make sure that a released master recipe is assigned. The consistency of the formula parameters and their interconnections with the parameters of the master recipe are also checked.

Requirements:

- A master recipe released for testing or production is assigned.
- The formula parameters were interconnected successfully
- The formula parameters are within the upper and lower limit values

Follow the steps outlined below in BatchCC:

1. Select the formula you want to check in the tree structure.
2. Select the menu command **Edit > Validate**.

Result: A result or error list is displayed that indicates, for example, whether or not the assigned master recipe is released.

Note:

You can use the validation function at any time. The validation does not change the status of the assigned master recipe.

5.5.6.5 Status of the Recipes and Status Changes

The initial status of a new recipe is always "In progress". You can bring about status changes using the appropriate commands. You must first open the context-sensitive menu and select the appropriate commands to change the recipe.

Meaning of the icon: On the left is the status icon (for example, released/release revoked/ ....), on the right is the type icon (for example hierarchical / flat).

Status Displays of the Recipes and Their Meaning

Status	Meaning
In progress	Initial status of a newly created and status after modifying a recipe.
Released for testing	Recipes that have been released for testing can be used for creating a batch for test purposes. If the function is given graded permissions, a distinction can be made between testing the functionality (for example a test mode with water...) and production.
Released for production	This status indicates that the recipe has been tested for normal production. Following the command Revoke Release, or Configure Process Cell, the recipe changes to the "Release Revoked" status.
Release revoked	If a recipe has already been released for production, it can be changed to this status using "Revoke release", for example to correct errors.
testing release	After updating, all the recipes (master recipes, library operations) of this process cell that were "released for production" and "released for testing" are changed to the "Testing release" status.
release invalid	After updating the process cell data, the recipes and library operations in the "Testing release" status are checked automatically. If the check is unsuccessful, the elements are changed to the "release invalid" status.

A recipe that is already open and being edited is locked for other employees. This is indicated by an additional icon *locked* .

Released recipes are displayed in the BatchCC when you create batches.

5.5.6.6 Status of the Formula and Status Changes

The initial status of a new formula is always "In progress". You can bring about status changes using the appropriate commands. You must first open the context-sensitive menu and select the appropriate commands to change the formula.

Meaning of the icon: On the left is the status icon (for example, released/release revoked/ ....), on the right is the type icon.

Status Displays of the Formula and Their Meaning

Status	Meaning
In progress	Initial status of a newly created formula.
Released for production	This status indicates that the formula is intended for normal production. Following the command Revoke Release, or Configure Process Cell, the recipe changes to the "Release Revoked" status.
Release revoked	If a formula has already been released for production, it can be changed to this status using "Revoke release", for example to correct errors.

A formula that is already open and being edited is locked for other employees. This is indicated by an additional icon   *locked* .

5.5.7   Recipe Reports

5.5.7.1   Recipe Reports

Definition of a Recipe Report

The "off-the-shelf" recipe report contains all the data required for production. These include the recipe header data, the recipe topology, the input materials, the output materials, the parameter list and the procedural rules.

Principle

The recipe report data is available centrally in the batch database. In BatchCC, you can print out the recipe report as documentation or view a print preview.

Follow the steps outlined below in the BatchCC:

1. Select the menu command **Edit >** Print preview in BatchCC with a master recipe selected (in the tree structure). As an alternative, you can also select a print preview with the right mouse button when the master recipe is selected.

Result: The user interface of BATCH Report is opened. The recipe report for the master recipe is displayed. On the left-hand side of BATCH Report you can see the structure of the content of the master recipe with the RUPs, ROPs, RPHs and transitions.

2. Double-click on one of these recipe elements.

The report data belonging to the recipe element are displayed in the right-hand window of BATCH Report.

3. You can print out the displayed report data to provide documentation with the menu command **Edit > Print**.

Printing a Recipe Directly

In BatchCC, you can print the entire report data of a recipe without a print preview.

5.6 Planning Batches

5.6.1 Flowchart: How to Create/Edit a Batch

BatchCC

```
┌─────────────────────────┐
│     Start BatchCC        │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│ Create new production    │
│ order                    │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│ Create batches for       │
│ production order         │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│ Assign formula to each   │
│ batch                    │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│ Set quantities for the   │
│ batches                  │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│ Set start mode of the    │
│ batches                  │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│ If nec. change formula   │
│ and unit allocation      │
└─────────────────────────┘
            │
            ▼
        ╱ Chain ╲       yes      ┌───────────────────────┐
       ╱ batches? ╲─────────────▶│ Specify order of batch │
        ╲        ╱               │ processing             │
            │ no                 └───────────────────────┘
            ▼         ◀───────────────────┘
┌─────────────────────────┐
│     Release batches      │
└─────────────────────────┘
            │
            ▼
Result:
**Control recipe** for making
batches is created
```
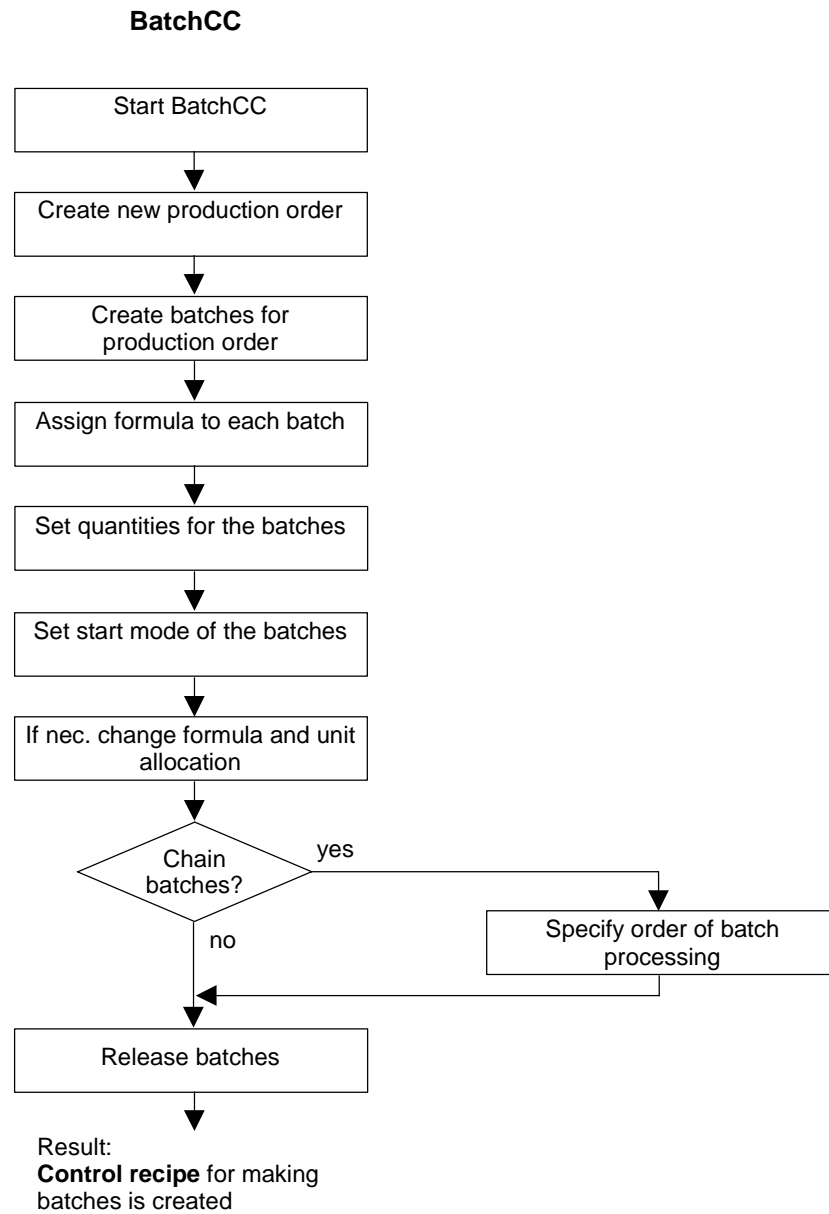
What can be planned?

A production order specifies which product will be manufactured. Batches can be assigned to a production order manually or automatically.

The recipe on which the batch is based specifies the production process and the duration of the unit allocation.

The following can also be selected for a specific batch:

*   Batch quantity

*   Formula/master recipe

*   Units used

*   Start mode and start time

The sequence in which batches are executed can be selected by chaining the batches.

5.6.2   Order of Batch Processing

Order of Processing

In SIMATIC BATCH , the order in which created batches (status: planned) are processed is decided by the order in which they are released. All released batches are included in batch control in the order or their releases. Batches that do not use the same units and equipment modules can also be processed at the same time.

The batches are started when the units and the start of the control recipe are free depending on the selected start mode **immediately**, **time-driven** or after **manual** intervention by the operator. If "time-driven" is set, the set time is started. Once the time has elapsed, the batch whose start time is furthest in the past is started first.

Scenario based on an example: If A "Start allocation" was selected for a unit, the batch starts only when it can occupy unit A. If the unit is allocated to another batch, the batch does not change to the "in progress" or "waiting" status. Different response when "Start allocation" was not selected: The batch then changes to the "waiting" status. In other words, the batch starts and waits until unit A is released.

Chaining Batches

If you want the batches to be processed in a specific order (regardless of the order in which they were released), you can also chain batches. For each planned batch, you can specify which batch must be started and which batch must be completed before the planned batch is started (see "Chaining Batches").

5.6.3   Planning Batches

5.6.3.1   How to Configure Batches

Note

You can create batches by using master recipes or formulas (with assigned master recipes). The procedure is identical in both cases. The procedure for working with formulas is described below.

Configuring Batches

With SIMATIC BATCH, you can plan batches and specify the chronological order of several batches without having to release the batches immediately for production. Batches can be derived from production orders.

The sequence shown below is the recommended order for configuring production orders with batches in BatchCC. The diagram shows which settings must be made for batches.

```
┌─────────────────────────────────────────────┐
│          Create a new production order        │
└─────────────────────────────────────────────┘
                      │
                      ▼
┌─────────────────────────────────────────────┐
│ Specify the properties of the order:          │
│ •   Order name                                │
│ •   Total quantity for the order              │
│ •   Earliest start and latest completion      │
│                                               │
└─────────────────────────────────────────────┘
                      │
                      ▼
┌─────────────────────────────────────────────┐
│ Specify properties for each batch:            │
│ •   Change preset quantity                    │
│ •   Start mode and time (if time-driven)      │
│ •   Reference to formula (with assigned       │
│     master recipe)                            │
│ •   If nec, change formula, unit allocation   │
│ •   If nec. change processing sequence by     │
│     chaining with other batches               │
└─────────────────────────────────────────────┘
                      │
                      ▼
┌─────────────────────────────────────────────┐
│ Check:                                        │
│ •   Total quantity over all batches           │
│ •   Run time of each individual batch         │
└─────────────────────────────────────────────┘
```

Underlying Principle

You create the batches for the production orders in BatchCC. By defining and selecting a master batch, numerous batches with similar properties can be created quickly. In the properties of each batch, you specify the reference to a released formula with assigned master recipe or to a released master recipe without a formula category assignment. You can specify the batch quantity and start mode for every batch. By chaining the batches, you can define the order in which they are processed.

5.6.3.2 Creating a New Production Order

Follow the steps outlined below in BatchCC:

1. Select the "Orders" folder.

2. Select the menu command **Edit > New**.

A dialog with the "General" and "Batches" tabs is opened.

3. Make the following settings for the production order in the "General" tab:

- Name of the production order

- Planned total batch quantity for the order

- Earliest start and latest end of the batches

4. You then have two options as to how you continue the configuration.

Option 1:

You do not want to create concrete batches yet. Simply confirm the settings made up to now with OK at this point.

Result: The production order is inserted asl an object ⬜️🗒 in BatchCC. Later, you can add batches to this order and set the actual properties for each batch.

See also section: Batches for production order supplemented

Option 2:

You move on immediately to the "Batches" tab.

For further settings:

See section: Assigning Batches to a Production order

5.6.3.3   Assigning Batches to a Production Order

Follow the steps outlined below in BatchCC:

1. While creating a new order, change to the "Batches" tab (properties dialog for the order).
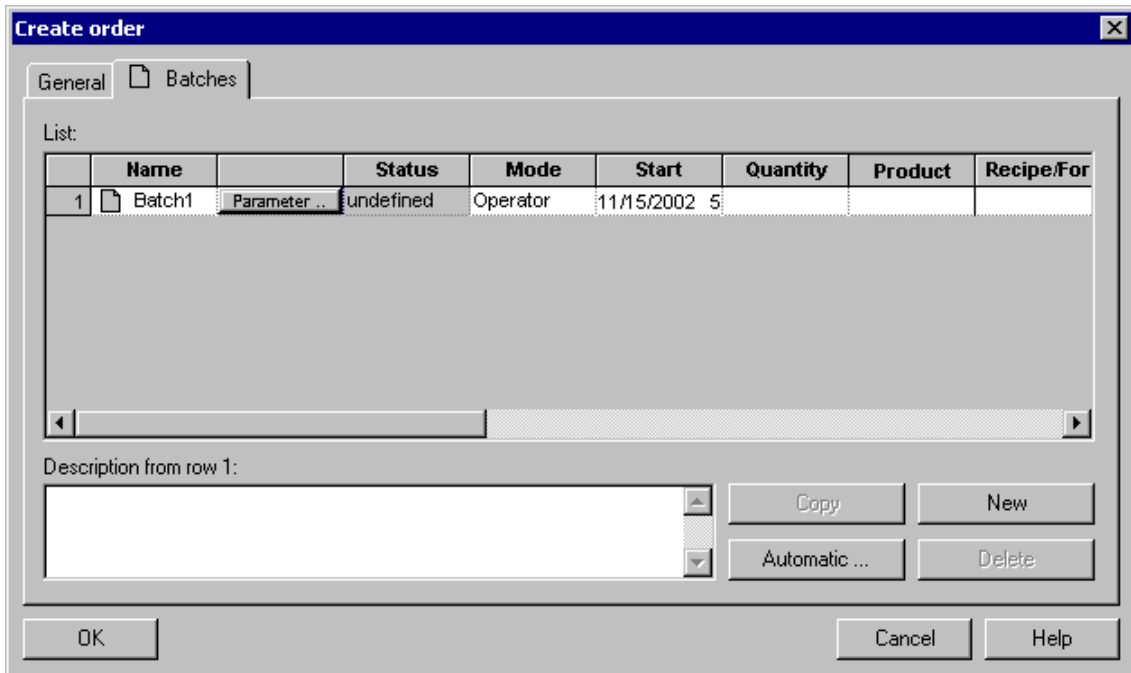
2. Create the batches for the production order as follows:

   - You can create new batches with the "New" button. You then make the settings for the batch quantity, start mode, formula etc.

   - To work with a master batch: Select a batch in the table and then click the "Copy" button so that the selected batch is given the status of a master batch and all batches created afterwards have the properties of the master batch.

   - Automatic: Using the "Automatic" button is a convenient method of calculating batches for a specific amount of material.

3. If necessary, change the assignment to a unit or to a master recipe or formula by clicking on one of the table cells "Allocations", "Product", or "Recipe/Formula".

Result:

- In this dialog, you enter the product, the formula or the formula category. As a result, all the assignments with a released master recipe and/or validated formula are listed.

- Select the row with the correct assignment and confirm with OK.

Result: The batch is assigned to the new formula/master recipe in the "Batches" tab.

Tip: First set all the properties (batch quantity, start mode, formula) of the master batch in the "Batches" tab or make another batch the master batch by selecting it and then create the further batches with the "Copy" button.

4. Set the batch quantity in the "Quantity" cell. The reference scale standard quantity is already entered. If you set a value outside the limits set by the minimum and maximum scale, the value is corrected to the limit value.

5. If necessary, change the start mode and start time in the "Mode" and "Start" table cells.

6. Confirm all your entries with OK.

Result: The information about the number of batches and the total batch quantity of the production order is updated in the "General" tab. The batches are created as ☐ ▧ objects below the production order. The batches are in the "Planned" status.

Creating Batches Automatically

In the "Batches" tab, you can also create batches automatically using the "Automatic" button.

To create batches automatically:

1. Select a batch as the master batch.

2. Click the "Automatic" button.Result: The dialog for selecting the formula/master recipe is displayed.

3. Here, you select the formula/master recipe and confirm with OK.

4. Result: The "Generate batches" dialog appears.

5. Make all the required entries and confirm with OK.

Result: The number of batches and the amount of each batch is calculated automatically and created so that the total amount is produced.

5.6.3.4 Displaying the Properties of a Production Order

Follow the steps outlined below in BatchCC:

1. Select the production order in the "Orders" folder in BatchCC.

2. Select the menu command **Edit > Properties**.

Result: You can see the current status of the production order in the dialog. All the batches created for the order are listed with their properties in the "Batches" tab. The "General" tab contains the following properties of the order.

Properties of the Production Order

Property	Meaning	Modifiable
Name	Name of the order	Can be modified with **Rename**
Status	Processing status of the order	This is updated by BatchCC.
Planned Size	Planned total batch quantity for the order	Cannot be modified
Current quantity	Batch quantity: Here, the sum of all the quantities of all batches of the order is displayed	This is updated by BatchCC.
Unit of measure	Unit of measure for the amounts**	This is updated by BatchCC.
Earliest start and latest end of the batches	Time window for processing the batches	Cannot be modified
Batches	Number of batches for this order	This is updated by BatchCC.

* Changes can only be made with the creation of a new production order.

** If batches have different units or different materials, "***" is displayed.

5.6.3.5 Adding Batches to a Production Order

There are several ways in which you can add batches to the production order.

- When creating a new production order: see Section "Assigning Batches to a Production Order"

- By adding batches to an existing production order as described below.

Follow the steps outlined below in BatchCC:

1. Select the production order in the "Orders" folder.

2. Select the menu command **Edit > New**.

Result: The "Batches" properties dialog for the production order appears.
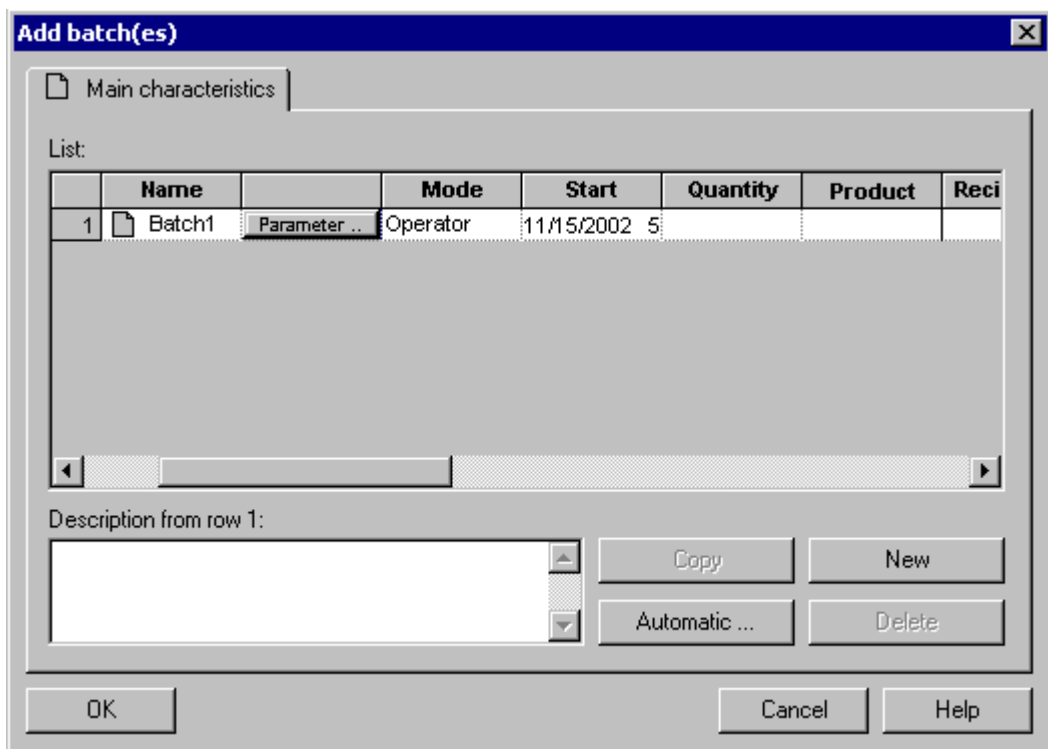
3. Follow the same procedure as described in the section "Assigning Batches to a Production Order".

5.6.3.6 Specifying the Properties of the Batch

There are three ways in which you can specify the properties of batches:

- When creating a new production order: see Section "Assigning Batches to a Production Order"

- When adding a Batch to the production order: see Section Adding Batches to the Production Order

- Afterwards for an existing batch as described below.

Follow the steps outlined below in BatchCC:

1. Select the "Batch" object below the production order in the "Orders" folder in BatchCC.

2. Select the menu command **Edit > Properties**.

Result: the dialog box "Properties of <Batch name>" is displayed. In this dialog, you can do the following:

  - Display and, if required, modify the batch quantity

  - Setting the Start Mode for Batch Processing

  - Displaying and Modifying Unit Allocation

  - Displaying and Modifying Formula Parameters

  - Displaying and, if necessary, Modifying the Batch

  - Displaying the Running Time of a Batch

3. Make all the settings you require for the batch and confirm with OK.

Result: After it is enabled, the batch can be processed depending on the selected start mode and the unit allocation.

Entering Properties

You enter the properties of the batches in the following dialog. Click the "Help" button for context-sensitive help on each individual input or output box in the tab.

```
Properties of 'Charge7'                                          ×

 📄 General | 🔋 Allocations | 🔧 Input material | 🔧 Output material | ⏲ Parameters | 🔩 Chaining |

        Name:  Charge7                        Batch ID:    12
 Master recipe:  mr_Reaktor_A1 V1_0
      Formula:  Reaktor_A1 V1_0
       Status:  released
      Product:  Output material 1           Run time:    35
     Quantity:  100        Liter               Area:  [90.000 ... 110.000]
    Start mode:  Operator        ▼         Start time:  11/15/2002 5 :19   ▲▼ ▼

  Description:

  ┌──────────────────────────────────────────────────────────┐ ▲
  │                                                          │
  │                                                          │ ▼
  │ ◄                                                      ► │
  └──────────────────────────────────────────────────────────┘

                                              Close        Help
```

5.6.3.7 Setting the Start Mode for Batch Processing

Follow the steps outlined below in BatchCC:

1. Select the "Batch" object below the production order in the "Orders" folder in BatchCC.

2. Select the menu command **Edit > Properties**.

Result: the dialog box "Properties of <Batch name>" is displayed.

3. In the "Start Mode" input field, select either **manual**, **immediate**, or **time-driven**.

4. You must also set a start time and start date.

5. Confirm with OK.

Possible Start Modes

Start Mode	Meaning
Manual	You can start the released Batch with the menu command **Control > Start** .
Immediately	The batch is started when it is released as soon as the units required at the start of the control recipe are free.
Time-driven	The batch is started on a particular day at a particular time. The start time and date must be specified.

Note

Batches with the "immediate" start mode are started **before** batches with the "time-driven" start mode (have higher priority) if the same units are involved.

5.6.3.8   Displaying and Modifying Unit Allocation

Unit Allocation and Duration

A unit can only ever be involved in the production of one batch at any one time. The unit allocation is displayed along with the duration of the allocation and is not related to any particular recipe. The length of time required by units involved in a batch is set when the recipe is created. The times are relative to the start of the batch and take into account the actual quantity of the batch.

If necessary, you can adapt the unit allocation in the Properties dialog of the batch.

Note

The allocation times of the units are planning values used to optimize the use of facilities. Please remember that these allocation times are not exactly the same as the actual times required for batch control.

Follow the steps outlined below in BatchCC:

1. Select the "Batch" object below the production order in the "Orders" folder in BatchCC.

2. Select the menu command Edit > Properties.
    Result: the dialog box "Properties of <Batch name>" is displayed.

3. Select the "Allocation" tab.
    Result: The units reserved for the recipes are displayed in the table.

4. If required, modify the unit allocation. The "Unit" list box shows only the units that also have the recipe phases being used.

5. Confirm your changes with OK.

Overview of the Unit Allocations

Eine Übersicht (read only) über die Teilanlagenbelegungen können Sie auch mit dem Menübefehl **Planung > Teilanlagenbelegung** öffnen.

5.6.3.9   Displaying and Modifying Formula Parameters

Changing a Formula

In the properties dialog for the batch, you can make the final modifications to the formula parameters.

Note

Formula parameters modified at this point apply only to this batch. The parameter values are not changed in the formula used or in the master recipe used in the tree structure of BatchCC.
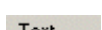

Follow the steps outlined below in BatchCC:

1. Select the "Batch" object below the production order in the "Orders" folder in BatchCC.

2. Select the menu command **Edit > Properties**.
   Result: the dialog box "Properties of <Batch name>" is displayed.

3. Change to the "Input material", "Output material", or "Parameters" tab.
   Result: Tables are opened displaying all the header parameters of the master recipe with the current values of the formula parameters.

4. If required, change the values of the formula parameters. The possible range of values are displayed as the upper and lower limits.

5. Confirm your changes with OK.

5.6.3.10   Setting the Order of Batches

Chaining

If you want to make sure that a batch is only started after a previous batch has been completed, you can also chain planned and not yet released batches. You can, for example, specify a predecessor batch and specify whether the predecessor batch must already be started or already be completed.

Follow the steps outlined below in BatchCC:

1. Select the menu command **Planning > Set batch order**.
   Result: The "Set batch order" dialog appears. All batches and their start and end times are displayed on the left-hand side.

2. Select the correct time area on the right.

3. Select a planned batch ⬜ in the time window that will be chained with another batch.

4. Select one of the commands **Chain with predecessor** or **Chain with successor** in the context-sensitive menu.

5. Then select the predecessor or the successor batch.

Result: Chained batches are displayed with a connecting line in the time window. By selecting the batches and then the context-sensitive menu command **Cancel connection to predecessor**, the chaining is broken again.

Note

Tips:

• You can zoom the time scale CTRL and the right mouse button.

• If you select a Batch and **display** in the context-sensitive menu command, the time slice belonging to the batch is displayed in the time window.

• If you select a batch and then the **Go to predecessor** context-sensitive command, you can jump to the predecessor in the time window.

Chaining Mode

Using the **Properties**command (context-sensitive menu) in the "Chaining" tab, you can also specify the following modes for the chaining of the batch:

• Start chaining: This batch starts up as soon as the predecessor batch is started.

• End chaining: This batch starts up as soon only after the predecessor batch is completed. If the charge is aborted or stopped, a query is displayed asking whether the next batch should be started.

5.6.3.11 Displaying the Running Time of a Batch

Follow the steps outlined below in BatchCC:

1. Select the "Batch" object below the production order in the "Orders" folder in BatchCC.

2. Select the menu command **Edit > Properties**.

Result: the dialog box "Properties of <Batch name>" is displayed. The duration of the control recipe calculated from the individual step times in the recipe editor is displayed in the "Running time" box.

Note

These batch running times can be used to optimize planning. Please remember that these times are not exactly the same as the actual times required for batch control.

5.6.3.12   Planning the Unit Allocation

Unit Allocation

An overview dialog provides you with a complete overview of all batches and their unit allocation. Symbols indicate whether or not there is a conflict or will be a conflict in the future due to double allocation of the units by pending batches.

To select the unit allocation overview:

- Select the menu command **Planning > Unit allocation**.

In the upper left area, you can display the units and corresponding batches. In the lower left area, the batches are displayed at the first level and then the required units. This allows you to optimize the unit allocation with various options. A time conflict is indicated by the icon ⚡. Time conflicts can be eliminated in this overview dialog by simply moving the batches in the right-hand time window.
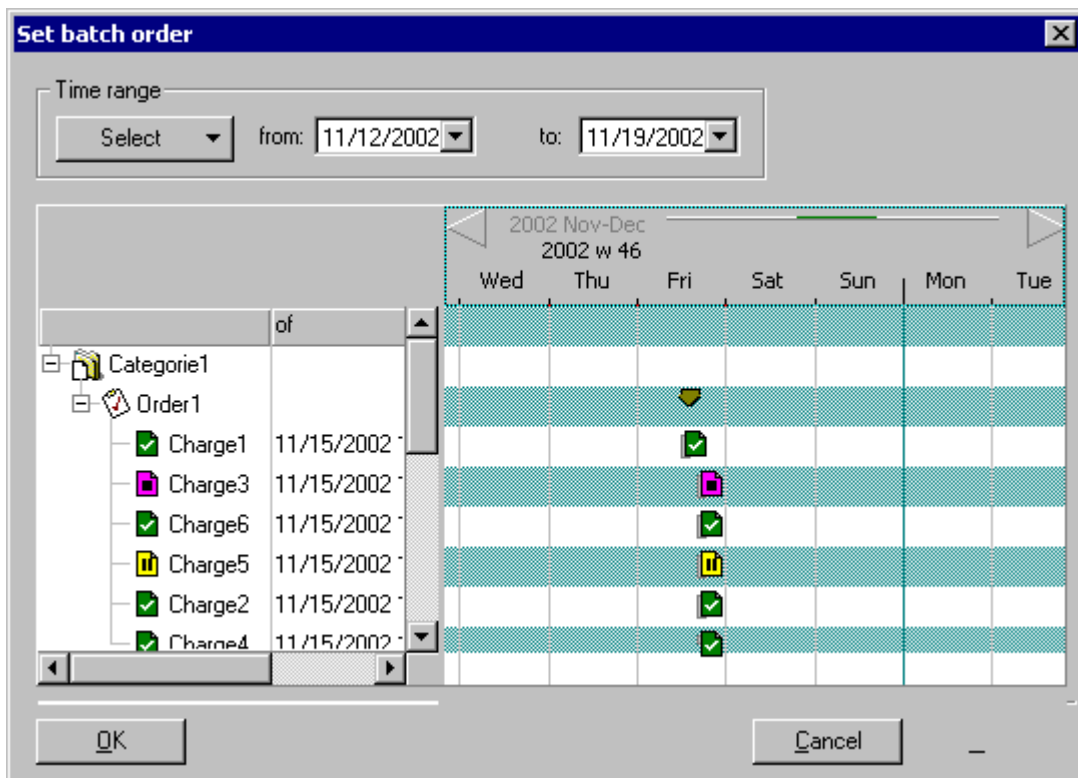
Meaning of the Symbols

- Yellow bar: Unit without conflict

- Gray bar: Batches with a run time longer than 6 hours. The symbol to the left of the bar indicates the current status of the batch.

- Blue bar: Batches with a run time shorter than 6 hours. These batches are always displayed with the same length. In other words, zooming does not enlarge/reduce the size of the time elements of these batches.

- Red bar: Unit with conflict. The same unit is planned to be used by more than one batch at the same time.

Note

As long as a batch is in the "planned" status, it can be dragged and dropped in a horizontal direction (time scale) in this view.

Below a unit, all the batches that have not yet completed and for which the unit is used are displayed. A batch can therefore occur more than once under "Units".

Moving the Time Scale

The time range can be moved using the button symbols at the left and right ends of the scale:

- Left arrow: Moves the time scale towards the past.

- Right arrow: Moves the time scale towards the future.

As an alternative, the time range can also be moved by clicking on the area between the two arrows.

Continuous Expansion and Reduction of the Time Scale

The visible time range (for example one week) can be reduced (for example two hours) or expanded (for example ten days).

By clicking on the area between the two arrows while holding down the "Ctrl" button at the same time you can zoom the time scale.

- Move the mouse left: The time scale is reduced

- Move the mouse right: The time scale is expanded

5.6.4　Opening the Control Recipe for the Batch

Even during the batch planning, you can open the graphic recipe structure of the control recipe to check it. In this case (batch is still planned), a validation is performed when it is opened! If the batch is released, there is no validation.

Follow the steps outlined below in BatchCC:

1. Select the "Batch" object below the production order in the "Orders" folder in BatchCC.

2. Select the menu command Control > Open control recipe.

5.6.4.1　Overview of the Control Recipe

In BatchCC, you can open not only the control recipe but also a structural overview of the control recipe (**View** > **Overview of control recipe**). With more complex control recipes, you can go to the relevant point in the control recipe window by clicking on a recipe element in the overview.

A recipe element shown in the table with a cross can have the following properties:

	Electronic signature necessary
	Operator dialog exists
	Recipe element locked (being processed)
	Recipe element running
	Breakpoint set
	Error
Element	Path of the recipe element
Text	Comment on the property

5.6.5 Status of Batches

The status of the batch provides you with information about the current processing of the batch (batch completed or aborted?). The status is updated in the tree structure and in the list display.

Status		Meaning
🗋	*planned*	The batch was recreated in batch planning again.
🖹	*release prepared*	While releasing the batch, an error occurred in communication between BatchCC and the BATCH Server (Batch Control Server).
🖺	*released*	The batch has been created and released. A control recipe exists.
🛑	*locked*	The batch has been created and released but was locked by batch control to prevent it being started.
🗙	*canceled*	The batch was canceled. Further processing is no longer possible.
🔼	*waiting*	The batch was started and is now waiting for the unit or units required at the start of the recipe to become free.
▶	*running*	The batch was started or resumed and is being processed.
⏸	*paused*	The batch was paused, the steps currently being executed are completed.
⏹	*held*	The batch was held.
🗙	*aborted*	The batch was aborted by operator intervention. Processing can no longer be resumed.
■	*stopped*	The Batch was stopped due to a operation. Resumption is no longer possible
✅	*completed*	The batch was completed correctly.
⚠	*testing release*	After updating the process cell data, released batches change to the "testing release" status. After the update, the batches in the "testing release" status are checked automatically. If the check is successful, the batches are returned to their original status. If the check is unsuccessful, the elements are changed to the "release invalid" status. Such batches must no longer be used and can only be deleted!
🚫	*release invalid*	
ⓘ	*Operator prompt*	Queued operationrequests in the control recipe: • Operator instruction/ dialog or • Electronic signature (ESIG) or • Breakpoints

Additional Status

The following icons indicate other statuses in addition to those listed above. These icons are superimposed on the batch icon.

chained	The batch is chained with a predecessor.
closed	The batch is closed and can be archived.
archived	The batch is archived. The batch can now be deleted.
error	At least one recipe phase in the control recipe of the batch has reported an error or the batch control itself is in an exceptional state.
locked	The batch is locked for processing (already open and in progress)

5.6.5.1 Status of Production Orders

The status of the production order provides the first information about the execution of the batch for an order. The status is updated in the tree structure and in the list display.

Status	Meaning
empty	The order does not contain any batches.
planned	There is or was no corresponding batch active; in other words, the batches have the status planned, released, release invalid, or canceled.
running	• At least onebatch belonging to the order is active • At least one Batch was already active and planned/released Batches still exist. Active means waiting, running, holding, held, pausing, paused, stopping, aborting, and completing.
completed	All corresponding batches are completed, aborted, or stopped.

Additional Status

The following icons indicate other statuses in addition to the production order status listed above. These icons are superimposed on the order icon.

Operator prompt	Queued operator prompts of a Batch of a production order: • Operator instruction/ dialog or • Electronic signature (ESIG) or • Breakpoints
closed	All batches in the job are completed.
archived	All batches in the job are archived.

5.6.5.2 Releasing Batches

Follow the steps outlined below:

1. Select the batch in the batch overview list or in the tree structure (BatchCC).

2. Select the menu command **Control > Release**.

Result: The batch is released for production . If errors occur in the validation, the problems are displayed and the recipe status remains "planned". If no errors occur, the control recipe is compiled. Processing of the batch is started depending on the start mode. This assumes that the units required at the start of the control recipe are free.

If errors occur in communication between BatchCC and the BATCH Server (Batch Control Server), the batch only changes to the "release prepared" status. After communication between BatchCC and BATCH Server (Batch Control Server) is functioning again, the release can be completed by executing "Release" again.

5.6.5.3 Locking a Batch

To prevent a released batch being started (by operator command or automatically), you can lock it.

Follow the steps outlined below:

1. Select the batch in the batch overview list or in the tree structure (BatchCC).

2. Select the menu command **Control > Lock**.

Result: The batch changes to the "locked" state .

With the menu command **Control > Cancel lock**, you can return a locked batch to the "Released" status again.

5.6.5.4 Canceling a Batch

Batches can also be canceled. After it has been canceled, the batch can no longer be released or started.

Follow the steps outlined below:

1. Select the batch in the batch overview list or in the tree structure (BatchCC).

2. Select the menu command **Control > Cancel**.

Result: The batch changes to the "canceled" state .

5.7 Electronic Signature

5.7.1 Specifying Electronic Signatures

SIMATIC BATCH supports the function "Electronic signature" according to the requirements as regards FDA or 21 CFR Part 11.

The function "Electronic signature" offers the user the possibility of entering one or more signatures in form of dialogs according to usual logon entry prompt for defined status transitions of Batches, recipe phases etc. or for Batch objects (recipes, Batches etc.) actions defined by the operator.

The entered signature data is saved in the batch history or in the relevant object being manipulated and is available for subsequent evaluation (logging).

The actions or status transitions of objects, for which the function "Electronic signature" is to be activated can be defined via the "ESIG" dialog box subject to the user roles (permissions). The acronym "ESIG" stands for "Electronic Signature".

Requirement

The logon data is verified based on the *SIMATIC Logon Service* software. This assumes that the *SIMATIC Logon Service* software is installed on the BATCH clients.

What can be signed?

- Status changes of batches, control recipes, unit recipes, recipe operations, recipe phases, and transitions
- Operator action relating to batches, control recipes, unit recipes, recipe operations, recipe phases, and transitions

The possible status changes and operator actions can be selected in the "ESIG" dialog box.

Follow the steps outlined below:

1. Select the batch, the master recipe, or library operation in BatchCC and select the menu command **Edit > Properties**.

or

In the BATCH Recipe Editor, select the recipe procedure, the recipe unit procedure, the recipe operation, the recipe phase, or the transition and then select the menu command **Edit > Object Properties**.

Result: the dialog box "Properties of <Object name>" is displayed.

2. Change to the "ESIG" tab.

3. Select the "Activate" check box.

4. Click the "New" button.

Result: The upper table displays all the possible operator actions that can be signed.

5. Select the actions that you want to have signatures for in the "Active" column.

6. Enter the time within which all the necessary signatures must be entered after the action in the "Time" column. If the time expires, a message to this effect is displayed in the message window of the PCS 7 OS.

7. In the "sequence" column, select the actions for which the signatures must be entered in a specific order per action (assuming that more than one signature is required per action).

8. In the "All at once" column, select the conditions, for which - if several signatures are to be made per operator input – all signatures are to be entered simultaneously, this means, in one opened signing dialog box.

9. Click in the "Roles" column to define the signatures that must be entered based on the user roles.

Result: The "Configure roles" dialog appears.

10. Select the user roles here:

‹·· →›	... with this symbol, you move the "available roles" to the "configured roles" or back again to cancel already configured user roles.
↑ ↓	... with this button, you specify the sequence in which multiple signatures must entered. First click on a user role in the "Configured roles" list.

11. Confirm the settings with OK.

Result: All the signatures required and the necessary sequence of signatures are displayed in the "Configured roles" table in the "ESIG" dialog box.

12. Follow the same procedure for status changes (step 4 to 11). You make these settings in the second table of the "ESIG" dialog box.

   - Click in the "From" and "To" columns to select the status change to be signed. You can only select status changes that are possible for the BATCH object.

   - Using the "New" button, you can add further rows for status changes.

13. When you have completed configuration, click OK.

Result: When the object runs (batch, RPH, ROP, RUP, transition), the "SIMATIC BATCH: Sign" dialog box opens after each operator action or status change. To find out how to enter the electronic signature, refer to section "Signing operator actions and status changes".

5.7.2   **Signing Operator Actions and Status Changes**

When the object runs (batch, RPH, ROP, RUP, transition), the "SIMATIC BATCH: Sign" dialog box opens after each operator action or status change

The signature requirement of the corresponding object is also visualized in the control recipe with the symbols and in the BatchCC tree structure view with the symbol . With a right-mouse click on the object to be signed and the context-sensitive menu command **Sign**, this dialog box can also be opened.

Via the "Sign" button in the dialog box "SIMATIC BATCH: Sign", you can start the signature entry. assuming that you have configured electronic signatures for the object.

Requirement

The logon data is verified based on the *SIMATIC Logon Service* software. This assumes that the *SIMATIC Logon Service* software is installed on the BATCH clients.

Initial situation:

After an operator action or during a status change, the "SIMATIC BATCH: Sign" dialog box opens automatically. As the representative of a user role, you are prompted to sign the action.

Follow the steps outlined below:

Your user role appears in the "Signatures" table of the "SIMATIC BATCH: Sign" dialog box:

1.   Click the "Sign" button.

Result: the "SIMATIC Logon Service - Signature" dialog box opens.

2.   Enter your user name and your password and then select the correct domain or correct computer.

3.   Confirm with OK.

Result: The information for the signature is displayed in the "Signatures" table.

-   If several signatures are required and the "All" option is active, all the signatures must be entered at the same time in one open "SIMATIC Logon Service - Signature" dialog box before clicking "OK".

-   If several signatures are required and the "Individually" option is active, the open "SIMATIC Logon Service - Signature" dialog box can be closed again with "OK" after entering a signature.

In both cases, the signature is complete, only when all signatures have been entered.

4.   Confirm the "SIMATIC Logon Service - Signature" dialog box with OK.

Note:

Remember that it may be necessary to complete the signatures within a specified time. The time available and the expiry of the time is displayed in the "Times" group in the "SIMATIC Logon Service - Signature" dialog box.

5.8 Batch Control

5.8.1 Requirements for Making Batches

Requirements

Batch control with SIMATIC BATCH requires the PCS 7 OS (WinCC) system. Before a batch can be made, the following requirements must be met:

- The PCS 7 OS system must be operating in the runtime mode (online).
- The SFC type instances or BATCH-interface blocks must be known to the PCS 7 OS data manager.
- The bus connection between the PCS 7 operator stations and the programmable controllers (PLC) must be active.
- The batches for the control recipes must have been generated already; in other words, the batches have the "Released" status.
- The operator has the necessary permissions for batch control in the user management of SIMATIC BATCH.

5.8.2 Starting the BATCH Server

Startup

When you start the computer on which the BATCH Server (BATCH Control Server, batch data management) is installed, the SIMATIC BATCH Start Coordinator, the Batch Control Server, and batch data management are started automatically.

The Batch Control Server and the batch data management are then in the "**READY**" status.

Changing the BATCH Server to the "RUNNING" Status

How the BATCH Server changes from "READY" to "RUNNING" is set with the SIMATIC BATCH Start Coordinator.

1. Right-click on the "SIMATIC BATCH Start Coordinator" in the status bar (bottom right) of the Windows window.

2. Select the context-sensitive menu command **Settings** and select one of the following start options:

Setting	Meaning
SIMATIC BATCH starts automatically after WinCC starts:	Each time WinCC is started up online, the Batch Control Server and batch data management change to "RUNNING" automatically.
SIMATIC BATCH starts automatically regardless of WinCC	The Batch Control Server and batch data management change to "RUNNING" automatically whenever the computer starts up regardless of WinCC.
SIMATIC BATCH is started manually	The Batch Control Server and batch data management change to "RUNNING" when this is triggered manually using the context-sensitive command **Startup/shut down** regardless of WinCC.

Note:

Requirement: The batch process cell data is valid, correctly compiled, and downloaded.

3. Following this, you can start a BATCH client application, for example BatchCC using the menu command **Start > Simatic > SIMATIC BATCH > Batch Control Center**.

Behavior in a Distributed System

If BATCH and PCS 7 OS run on separate computers in a distributed system, the BATCH Server automatically starts up completely after the computer starts up if one of the following options is set for the SIMATIC BATCH Start Coordinator:

• SIMATIC BATCH starts automatically after WinCC starts:

• SIMATIC BATCH starts automatically regardless of WinCC

This means, the BATCH Server changes to RUNNING regardless of the WinCC status on the other computer.

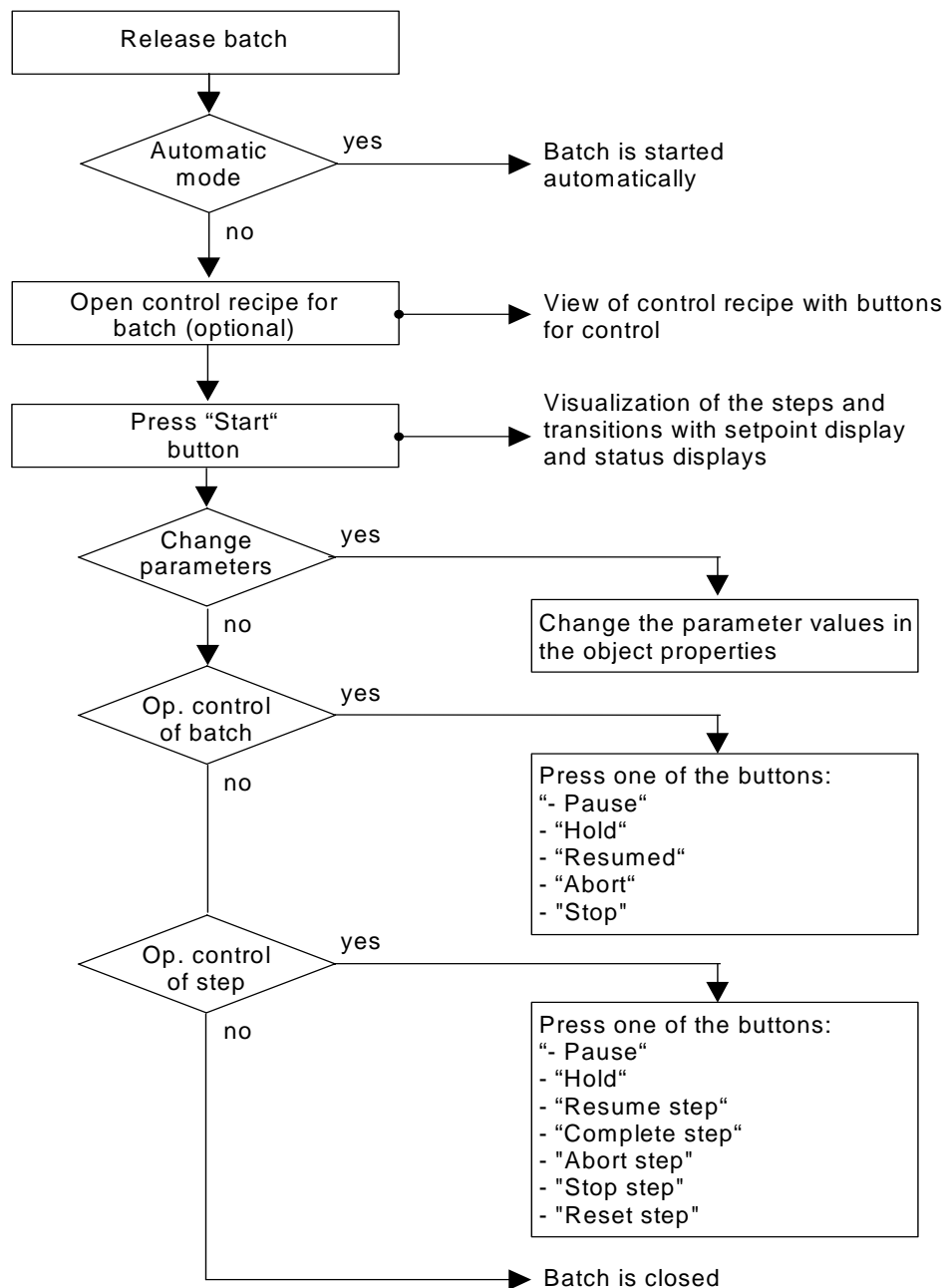### BATCH Server and BATCH Client on a Computer

Note:

If the BATCH Server PC is used additionally as an operating and monitoring station (BATCH Client), this may reduce performance during certain functions (e.g. when printing out a large Batch log).

5.8.3   Flowchart: How is a Batch Started and Controlled?

How is a Batch Started and Controlled?

BatchCC / Batch Overview List

```
┌─────────────────────────┐
│     Release batch       │
└─────────────────────────┘
             │
             ▼
         ╱─────────╲        yes      Batch is started
        ╱ Automatic ╲ ─────────────▶ automatically
        ╲   mode    ╱
         ╲─────────╱
             │ no
             ▼
┌─────────────────────────┐          View of control recipe with buttons
│ Open control recipe for │ ───────▶ for control
│   batch (optional)      │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐          Visualization of the steps and
│     Press "Start"       │ ───────▶ transitions with setpoint display
│        button           │          and status displays
└─────────────────────────┘
             │
             ▼
         ╱─────────╲        yes
        ╱  Change   ╲ ──────────────────────────┐
        ╲ parameters╱                            │
         ╲─────────╱                             ▼
             │ no                    ┌──────────────────────────────┐
             │                       │ Change the parameter values in│
             ▼                       │ the object properties         │
         ╱─────────╲        yes      └──────────────────────────────┘
        ╱ Op. control╲ ─────────────────────────┐
        ╲  of batch  ╱                           │
         ╲─────────╱                             ▼
             │ no                    ┌──────────────────────────────┐
             │                       │ Press one of the buttons:     │
             │                       │ "- Pause"                     │
             │                       │ - "Hold"                      │
             │                       │ - "Resumed"                   │
             ▼                       │ - "Abort"                     │
         ╱─────────╲        yes      │ - "Stop"                      │
        ╱ Op. control╲ ──────────────└──────────────────────────────┘
        ╲  of step   ╱                           │
         ╲─────────╱                             ▼
             │ no                    ┌──────────────────────────────┐
             │                       │ Press one of the buttons:     │
             │                       │ "- Pause"                     │
             │                       │ - "Hold"                      │
             │                       │ - "Resume step"               │
             │                       │ - "Complete step"             │
             │                       │ - "Abort step"                │
             │                       │ - "Stop step"                 │
             │                       │ - "Reset step"                │
             │                       └──────────────────────────────┘
             │
             └──────────────────────▶ Batch is closed
```

The activities involved in batch control are as follows:

- Opening the Control Recipe
- Starting Production of a Batch
- Changing Setpoints
- Commands for Controlling Batches
- Commands for Recipe Steps
- Locking a Batch
- Canceling a Batch

5.8.4   Basics of Batch Control

5.8.4.1   Principle of Batch Control

Definition

By batch control, we mean the following:

- Executing the Batches
- Visualization and control of the batches on the PCS 7 OS

Executing the Batches

The program checks which units are required to start each released batch. Based on the IUNIT_BLOCK interface blocks, a check is made to find out whether the units required by SIMATIC BATCH are released and are not allocated to other batches. If the units are free and released, the batch can be started, otherwise the relevant parameters are reported for monitoring.

Batch control is always ready to receive OS messages about parameter changes. If a monitored parameter changes, batch control is informed and takes the required action.

Visualization and Operator Control of the Batches

In BatchCC, the control recipe for a batch can be opened. The presentation of the control recipe represents that of the BATCH Recipe Editor. While a batch is being made, the states of steps and transitions are displayed color-coded. The dynamic display of events on the monitor also allows an operator to intervene.

5.8.4.2 Processing the Recipe Structure

Principle

The recipe structure of a control recipe is executed on the predecessor-successor principle at all hierarchical levels. This means, when the execution of a recipe element is completed, the execution of the successor step in the sequence is activated.

Hierarchical recipe: Within a recipe unit procedure (RUP), the individual recipe operations (ROPs) are also executed sequentially. If the ROPs of different RUPs of a recipe procedure are synchronized, several recipe operations (in different RUPs) can be started at the same time. Within a recipe operation, the individual steps (recipe phases -> EPHs) and transitions (step enabling conditions) also execute sequentially.

Example of a Hierarchical Recipe

The following schematic shows the color coding used to visualize the execution of a control recipe with a typical hierarchical recipe structure. A synchronization is currently active in the left window. In the right-hand window you can see the execution of a recipe operation. This recipe operation is given the status *complete* only when the synchronization is satisfied.

5.8.4.3 Status Changes of a Batch

The schematic below shows the possible statuses and status changes of a batch depending on the existing status.
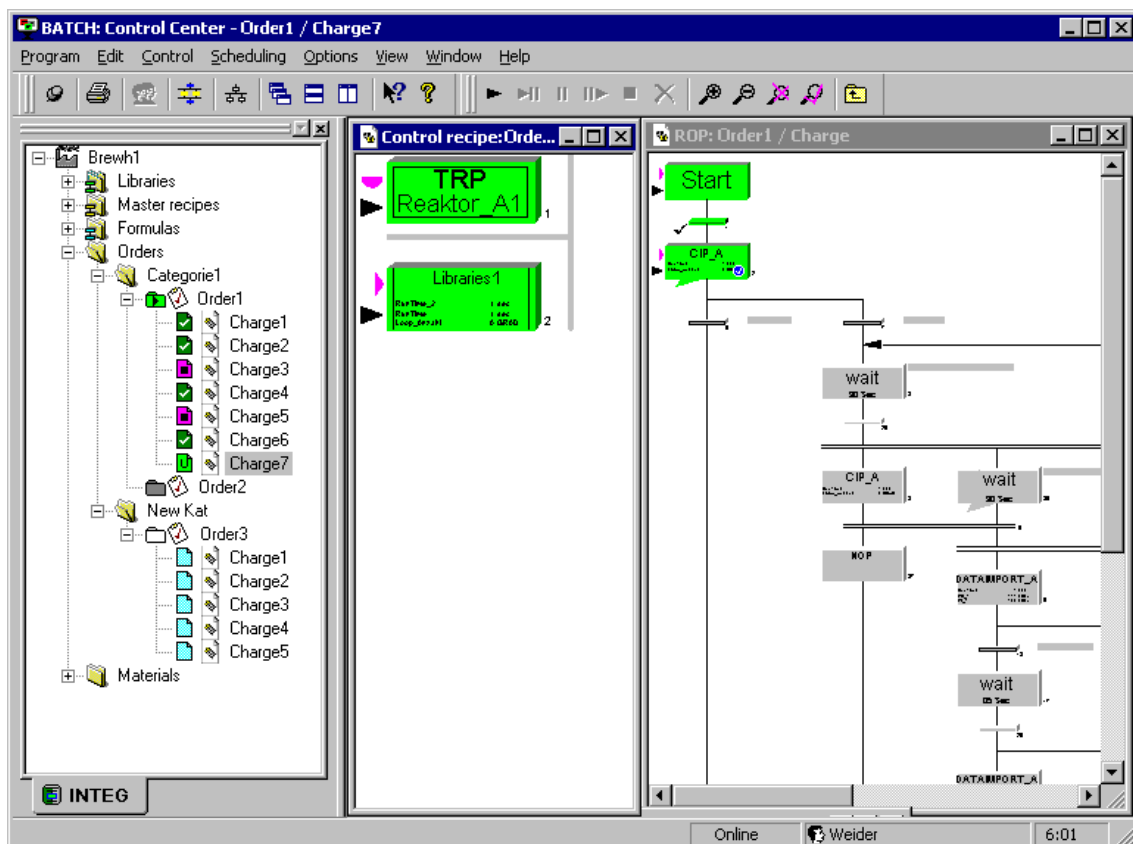
5.8.4.4   State Transition Diagram of an Equipment Phase

To execute a recipe, SIMATIC BATCH uses equipment procedural elements (EPE). This can be of the type EPH or EOP.

To ensure problem-free cooperation with the overlying control, the equipment phase must provide the following basic states, the transitional states (framed with a broken line) are optional and not absolutely necessary:
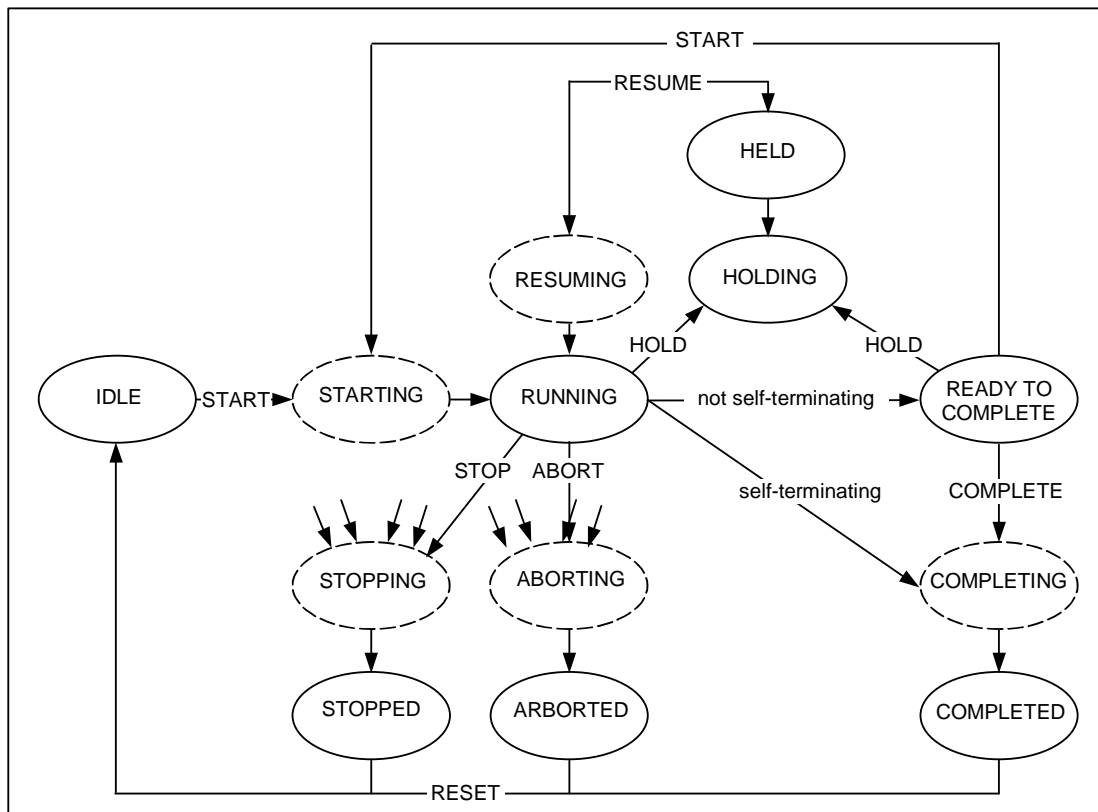
READY TO COMPLETE and COMPLETED

As regards, equipment phase, the following distinction must be made:

*   A self-terminating equipment phase

After it has run, such a phase changes to the COMPLETED status

*   Non-self-terminating equipment phase

Once it has run, such a phase changes to the READY TO COMPLETE status. In the READY TO COMPLETE status, an EPE signals that it must be terminated actively by the control.

Control in the Manual Mode ("Operation" Start Mode)

Via the Recipe steps operating commands you can manually execute these state transitions, for example, during commissioning.

5.8.4.5 Self-terminating and Non Self-terminating Recipe Phase

Self-terminating Recipe Phase

For a self-terminating recipe phase, the normal transitions are from IDLE through RUNNING to COMPLETED. The diagram shown below illustrates a self-terminating recipe phase:

Non Self-terminating Recipe Phase

A non self-terminating recipe phase changes from IDLE through RUNNING to READY TO COMPLETE and then waits for the TERMINATE command from the overlying controller. With the READY TO COMPLETE status, the recipe phase signals that it needs to be terminated actively by the control (non self-terminating recipe phase). Below, you can see the flowchart of a non self-terminating recipe phase:
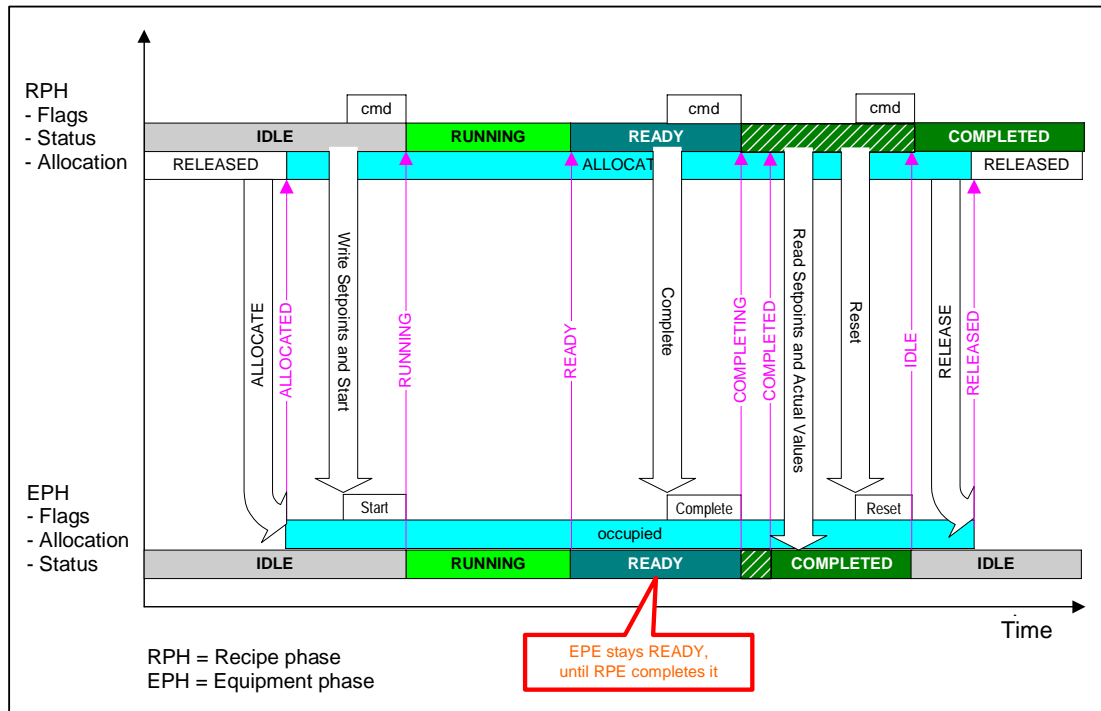
5.8.4.6   Parameter Trigger and Start Lock

For the control strategy change function, the equipment phase must be capable of checking new setpoints and if necessary preventing the start.

If the start lock is already set after the equipment phase is allocated, the recipe phase only rights the setpoints **without** the ISTART input. Instead, the recipe phase writes the IPARAM input to inform the equipment phase that there are new setpoints. The equipment phase then checks the setpoints and resets the IPARAM input and the start lock.

Even when the equipment phase reaches the HELD status, it can still set the start lock to prevent a RESUME. No parameter trigger is necessary because the recipe phase does not permit a parameter change while a step is active.
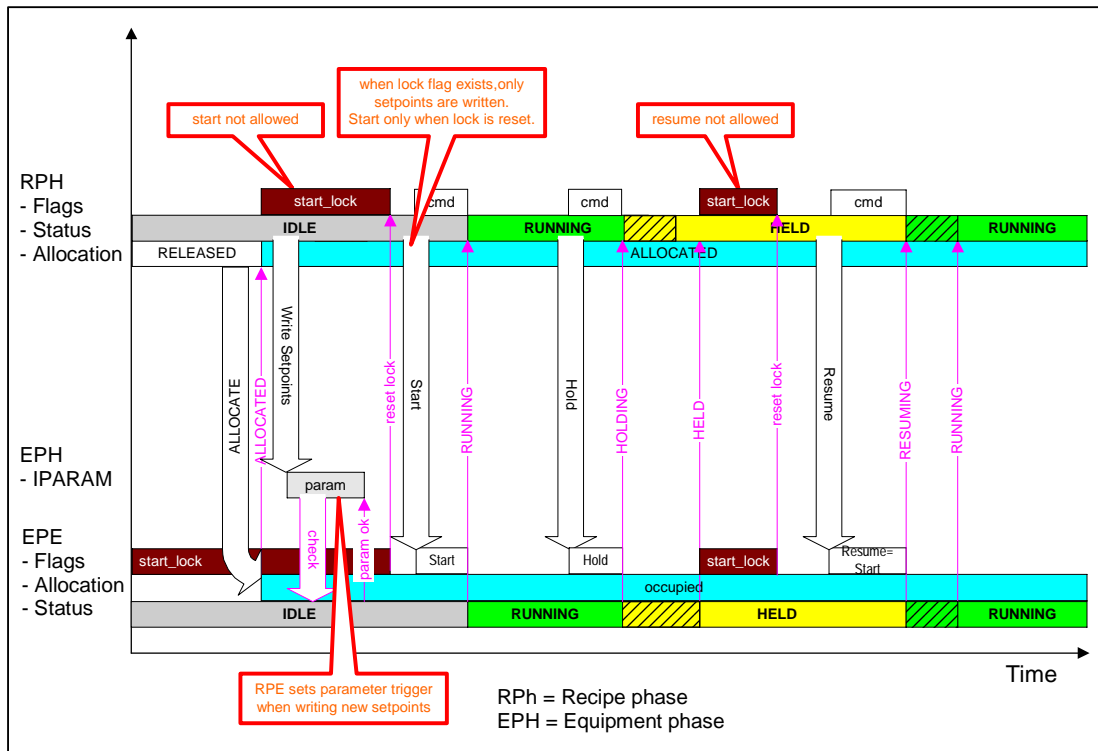
5.8.4.7 Continuous Operation of Equipment Phases

With SIMATIC BATCH V6.0 it is possible to

- set different parameters for an equipment phase within the recipe without having to deactivate the equipment phase and reactivate it again afterwards.

- to continue secondary activities such as agitating, temperature control or pressure control beyond the end of recipe operations. This means, for example, that an agitator does not need to be turned off at the end of an ROP and turned on again at the beginning of the next ROP.

Technical Implementation of Continuous Operation

If you want the equipment phase to continue after the end of the recipe phase, you must check the "Continue" box in the properties dialog of the recipe phase when creating the recipe.

As soon as the equipment phase signals READY TO COMPLETE during execution of the recipe, the batch control sets the CONTINUOUS status ID in the block and resets this as soon as another recipe phase occupies the same equipment phase.
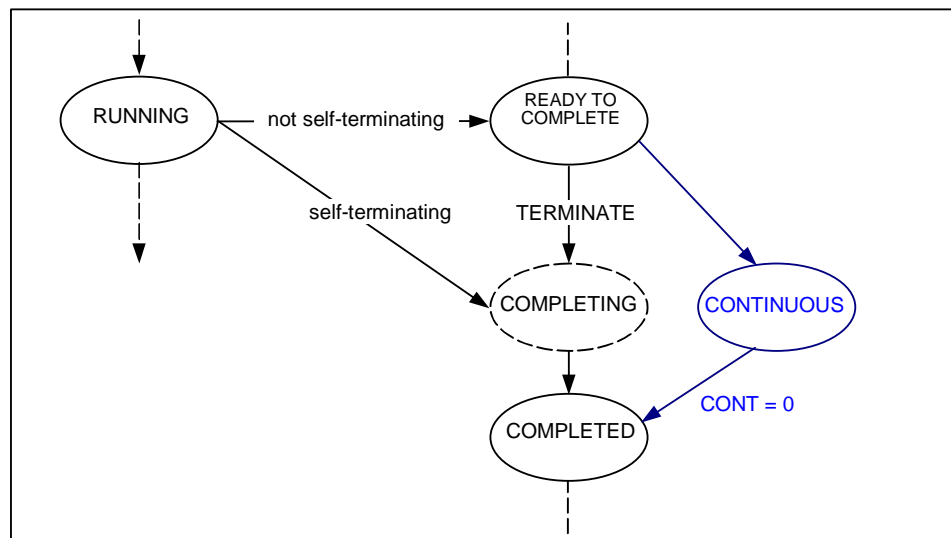
Flowchart

Below, you can see the flow chart of a non self-terminating equipment phase set to continuous operation:

During the changeover, the equipment phase remains in the READY TO COMPLETE status. Instead of terminating the equipment phase, the first recipe phase simply sets the CONTINUOUS ID via the ICONT input **in addition to the basis status**. The setpoints/actual values are read prior to this. The sequence logic handles CONTINUOUS and READY TO COMPLETE in the same way as COMPLETED, in other words the recipe continues.

Because the CONTINUOUS ID is set, the second recipe phase can occupy the equipment phase although its status is not IDLE. Once it is occupied, the CONTINUOUS ID is reset. To allow the second recipe phase to start the equipment phase, it is possible to START from READY TO COMPLETE in the equipment phase status transition diagram.

RPH = Recipe phase
EPH = Equipment phase
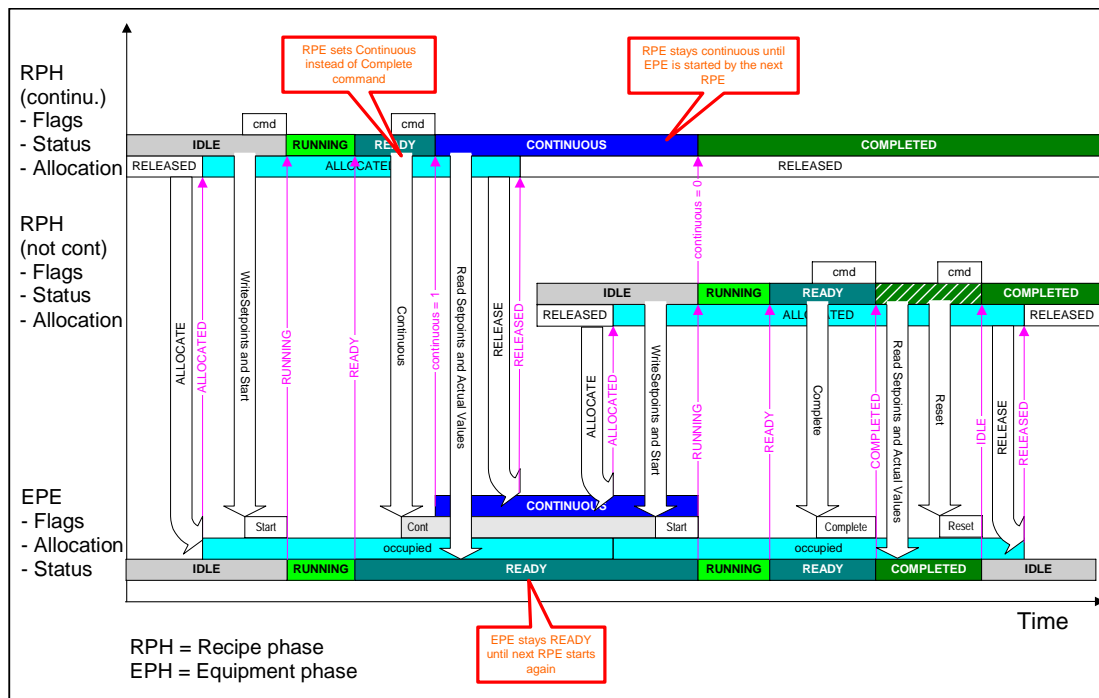
5.8.5 Starting Batch Control

5.8.5.1 Working with Lists for Batch Control

Selecting Lists for Batch Control

Select an object in the "Orders" folder in the editing window and then select the required list in the **Planning > ...**menu.

- **Batch planning list**

- Batch Status List

- Batch Result List

Batch planning list

The Batch planning list shows all planned and released Batches. You can also start the Batches via the Batch planning list context-sensitive menu command. When a Batch is started, this Batch remains visible in the Batch planning list and gets a new status (e.g. running). However, when you reopen the Batch planning list, this Batch will no longer be displayed.

If you want to display all batches during batch control, work with the batch status list.

Batch Status List

The batch status list shows the processing status of each individual batch and allows the batches to be controlled using the context-sensitive menu for the listed object (right mouse button) or using the **Control** menu.

As an alternative, you can, of course, select all the functions relating to batches in the tree structure (once again using the context-sensitive menu for the object). Working in the tree structure can, for example, be an advantage if a control recipe window is open at the same time.

Batch Result List

> The Batch result list shows all the completed, aborted, stopped and cancelled Batches. The display is updated dynamically. Using the context-sensitive menu for the batch result list, you can archive closed batches and then remove them.

5.8.5.2 Opening the Control Recipe

You can see detailed information about the processing of the batch in the control recipe window. The control recipe of the batch is displayed as it was created in the BATCH Recipe Editor.

Follow the steps outlined below:

1. Select the batch in the batch status list or in the tree structure.

2. Select the command **Control recipe Open** in the context-sensitive menu for the batch (right mouse button) or in the **Control** menu.

Result: The corresponding control recipe is opened and displayed graphically (analogous to the view in the BATCH Recipe Editor). The toolbar of BatchCC displays buttons for controlling the processing of the batch. When planned batches are opened, a validation check is run!

Overview of the Control Recipe

In BatchCC, you can open not only the control recipe but also a structural overview of the control recipe. With more complex control recipes, you can go to the relevant point in the control recipe window by clicking on a recipe element in the overview.

*   Select the menu command **View > Overview of control recipe**.

Result: The overview belonging to the active control recipe window is opened (in the screen shot below: bottom left). If no control recipe is open, the overview remains empty (gray).

Example
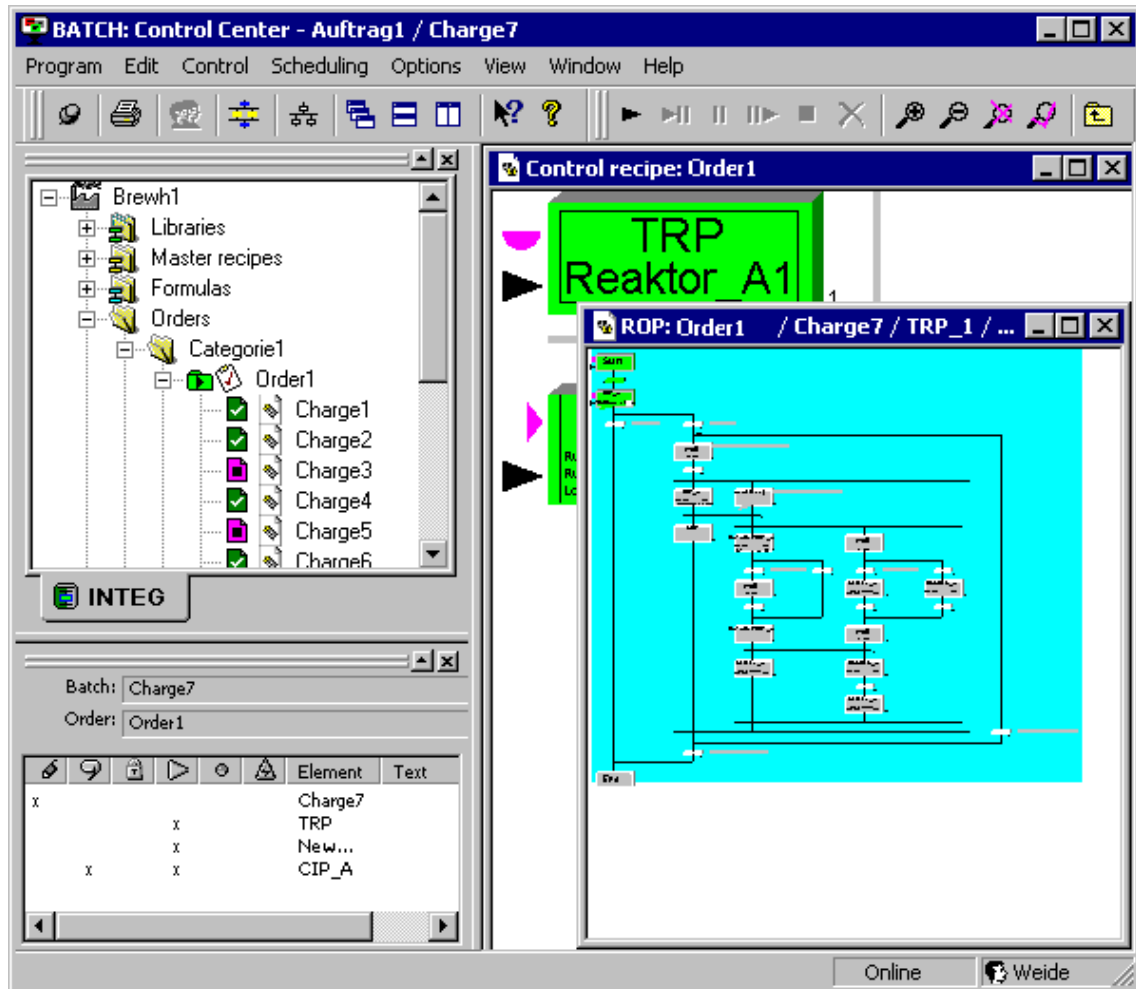
5.8.5.3 Starting Production of a Batch

Starting a Batch

Only released batches can be started. Batches in the "immediate" and "time-driven" start modes are started automatically (a manual start is also possible in these situations and has the same effect as a batch with the "operator" start mode). Batches with the "operator" start mode must be started explicitly in BatchCC. Below, you will find the options available for the "operator" start mode.

Note:

You cannot start a batch if it is chained to another batch and this predecessor batch has not yet started or is not completed (depending on the chaining mode)!

Starting the Entire Control Recipe (Batch)

1. Open the control recipe.

2. Click the ► button or select the menu command **Control > Start**.

Result: The batch is started. The execution of the control recipe is visualized by the color coding of the individual steps and transitions.
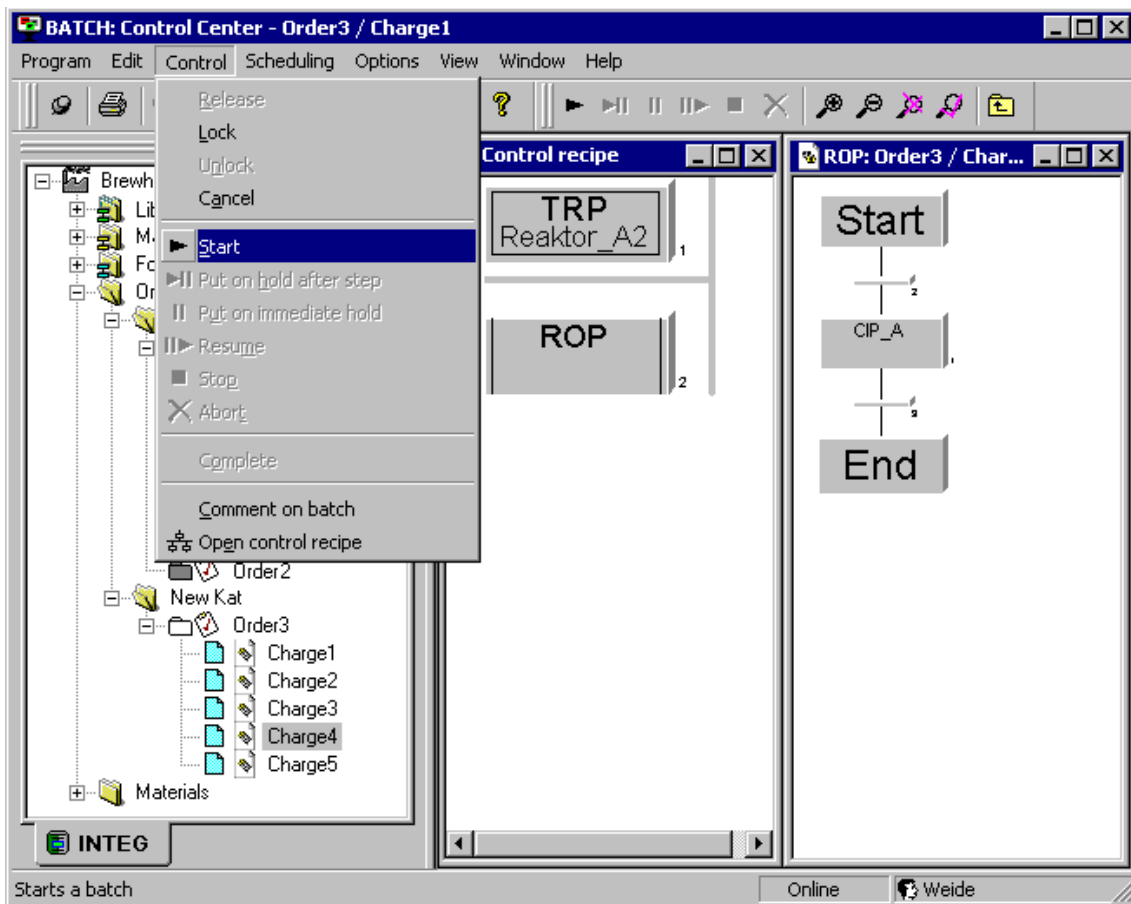
Starting Individual Recipe Elements

To do this, select the recipe element in the control recipe and via the context-sensitive menu, select **Start step**.

Rules

- A recipe element within a control recipe can only be started when the recipe element in the next higher hierarchy level has already been started. For example, a ROP at the next level down from a RUP can only be started when the RUP has already been started.

- It is always possible to abort or halt a lower level recipe element.

- Within a sequence, only one recipe element can be executing. This means, for example, that if a recipe operation (ROP) is active, no further ROP can be started at the same time in the same sequence within the same RUP. An attempt to start a further ROP would be rejected with an error message.

5.8.6 Operation During Batch Control

5.8.6.1 Commands for Controlling Batches

With the commands for controlling batches, you can start (only in the "operator" start mode), hold, resume or abort (only in the "operator" start mode) the selected batch.

Buttons for Controlling a Batch (also available in the context-sensitive menu of the batch)
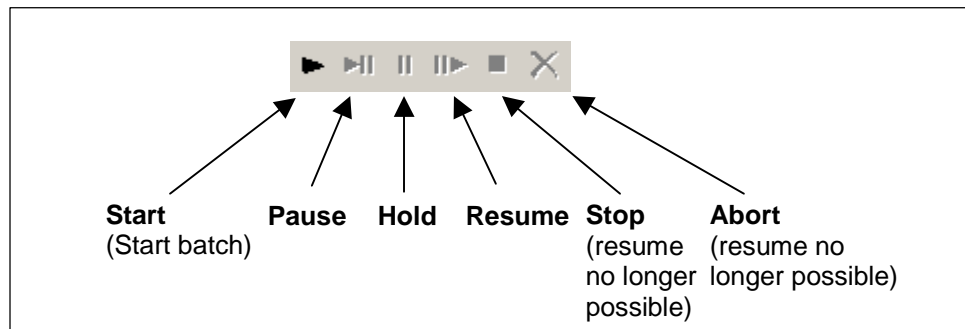

Controlling a Batch

The following table describes the functions of the control buttons and the reaction of the batches.

Button	Meaning	Reaction
Start	Starts execution of the control recipe	With this command, you can start a released batch in the "Operation" start mode. Batches with the start mode "immediately" and "time-driven" are started automatically. You cannot start a batch if the batch is chained to another batch and the preceding batch has not yet been started!
Pause	Control recipe execution is being held, the steps in progress will be completed	You can pause active batches using the "Pause" command. In contrast to the "Hold" command, this command simply prevents the control recipe from passing control to the next step. Active recipe phases are not affected and continue until they are complete. Batch control waits with the processing of the next transition or the start of the next recipe step until the Resume command is received.
Hold	Control recipe execution is being held, the steps in progress will **not** be completed	You can stop batches immediately with the "Hold" command. In contrast to the "Pause" command, not only the batch itself but also all the recipe phases currently active in the control recipe are held.
Resume	Execution of the control recipe is resumed at the point at which it was stopped.	This command resumes batches that have been held in the batch control. If the recipe phases were also stopped, these also return to the "Active" state.

Button	Meaning	Reaction
Stop	Execution of the control recipe is aborted	The "Stop" command terminates batches that cannot be completed correctly. Stopped: You cannot resume stopped batches! When batches are stopped, remnants may remain in the units used for the batch! **Caution:** When you stop a batch, all the units occupied by the batch are released. First remove any remnants of the batch from the units involved before you use the "Stop" function in batch control so that the units can then be used by a later batch.
Cancel	Execution of the control recipe is aborted	The "Abort" command terminates batches that cannot be completed correctly. You cannot resume aborted batches! When batches are aborted, remnants may remain in the units used for the batch! **Caution:** When you abort a batch, all the units occupied by the batch are released. First remove any remnants of the batch from the units involved before you use the "Abort" function in batch control so that the units can then be used by a later batch.

Completing a Batch

A batch is completed:

- automatically when all the recipe steps of the batch were executed successfully
- with the operator command "Abort" or "Stop"

Example of Controlling Batch Processing
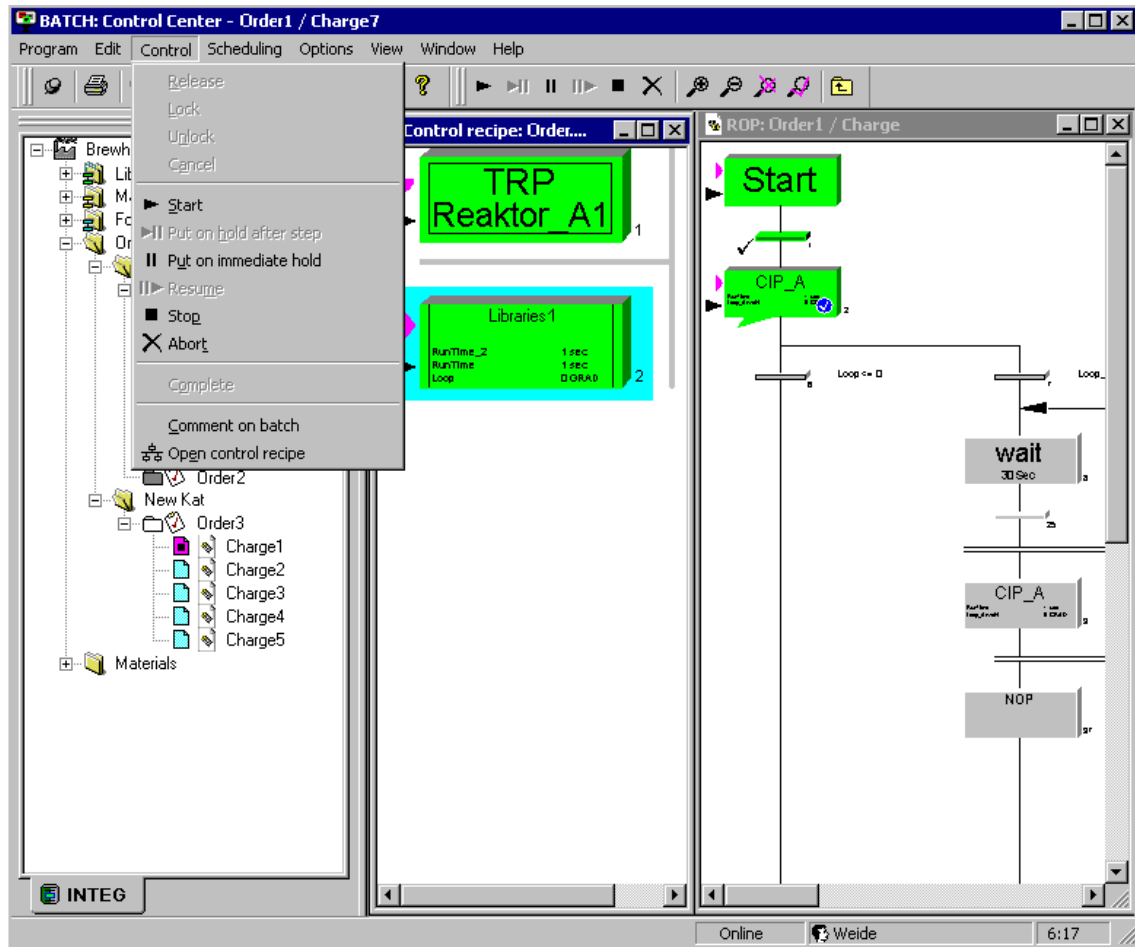
5.8.6.2   Commands for Recipe Steps

During the commissioning phase, you can also hold, resume or abort all the recipe procedural elements (RUP, ROP, NOP, RPH) within the hierarchical control recipe. The commands "Complete step" and "Reset step" are also available. With these commands, you can also force transitions to enable the next step.

Menu Commands for Controlling Individual Recipe Elements

Select any recipe procedural element (RUP, ROP, RPH, transition) within the control recipe and select the required command in the context-sensitive menu. Commands that are not possible in the current status of the element are gray and cannot be activated.

Open object	
Start step	← —— Start step
Put step on hold (after step)	← —— Pause
Put step on hold (immediate)	← —— Hold
Resume step	← —— Resume step
Finish step	← —— Close step
Stop step	← —— Stop step, cannot be resumed
Abort step	← —— Abort step, cannot be resumed
Reset step	← —— Reset step, cancel allocated ID
Breakpoint ▶	
Comment on batch element ...	
Comment on messages...	
Object properties Alt+Return	
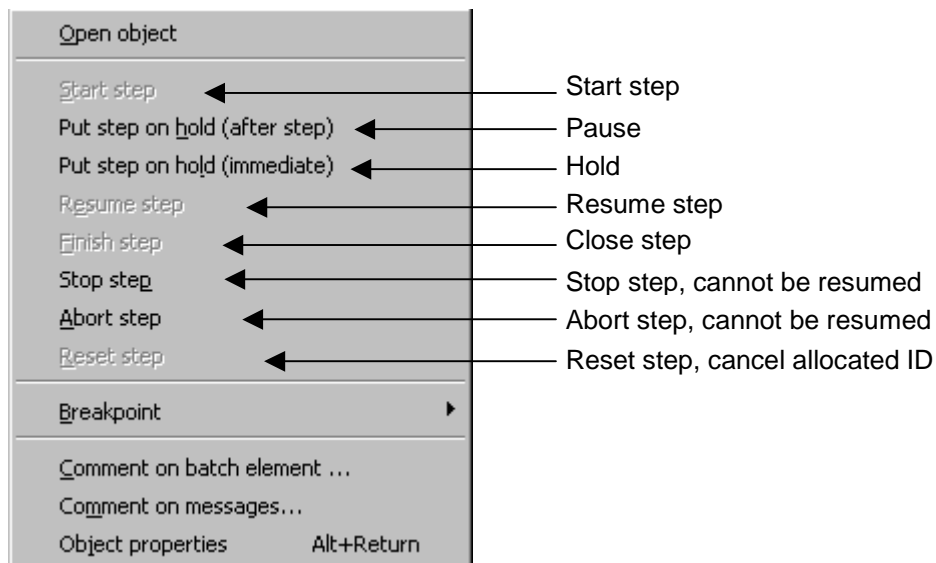
Controlling Steps

The following table describes the functions of the buttons and the reaction of the recipe steps.

Button	Meaning	Reaction
Start step	Start execution of the control recipe at this step	Inactive or completed steps (RUP, ROP, EPH, transition) can be restarted with this command.
Pause	The execution of the control recipe is held at this step, the currently active step is executed until it is completed.	You can stop active steps (RUP, SUB, ROP) immediately with the "Pause" command. In contrast to the "Hold" command, this command simply prevents the control recipe from passing control to the next step. Active recipe phases of the step are not stopped but continue until they are finished. Batch control before evaluating the next transition or starting the next recipe step in the same level (RUP, SUB, ROP) until the "Resume step" command is received.
Hold	The execution of the control recipe is held at this step, the currently active step will **not** be completed.	You can stop active steps (RUP, SUB, ROP, RPH, transition) immediately with the "Hold" command. All the active recipe phases in the step are held.
Resume step	Execution of the control recipe is resumed at the held step.	The "Resume step" command resumes steps on hold (RUP, SUB, ROP). If the recipe phases were also stopped, these also return to the "Active" state. **Note:** Steps in the error state can be reactivated with "Resume step".
Complete step	Execution of the step is terminated	This command terminates the recipe phase of a step (RUP, SUB, ROP, RPH) that are not self-terminating (requirement: READY status)
Stop step	Execution of the control recipe is stopped at this step	Use the "Stop step" command to terminate steps (RUP, SUB, ROP, RPH, transition) that cannot be terminated correctly. Stopped steps cannot be resumed! When steps are stopped, remnants may remain in the units used for the step!
Abort step	Execution of the control recipe is aborted at this step	Use the "Abort step" command to terminate steps (RUP, SUB, ROP, RPH, transition) that cannot be terminated correctly. You cannot resume aborted steps! When steps are aborted, remnants may remain in the units used for the step!
Reset step	Execution of the step is reset	Following an abort, the unit or the equipment modules of the step are normally still allocated. "Reset step" cancels the allocation IDs of all the recipe phases in the step (RUP, SUB, ROP, RPH).

Example of Controlling Recipe Steps
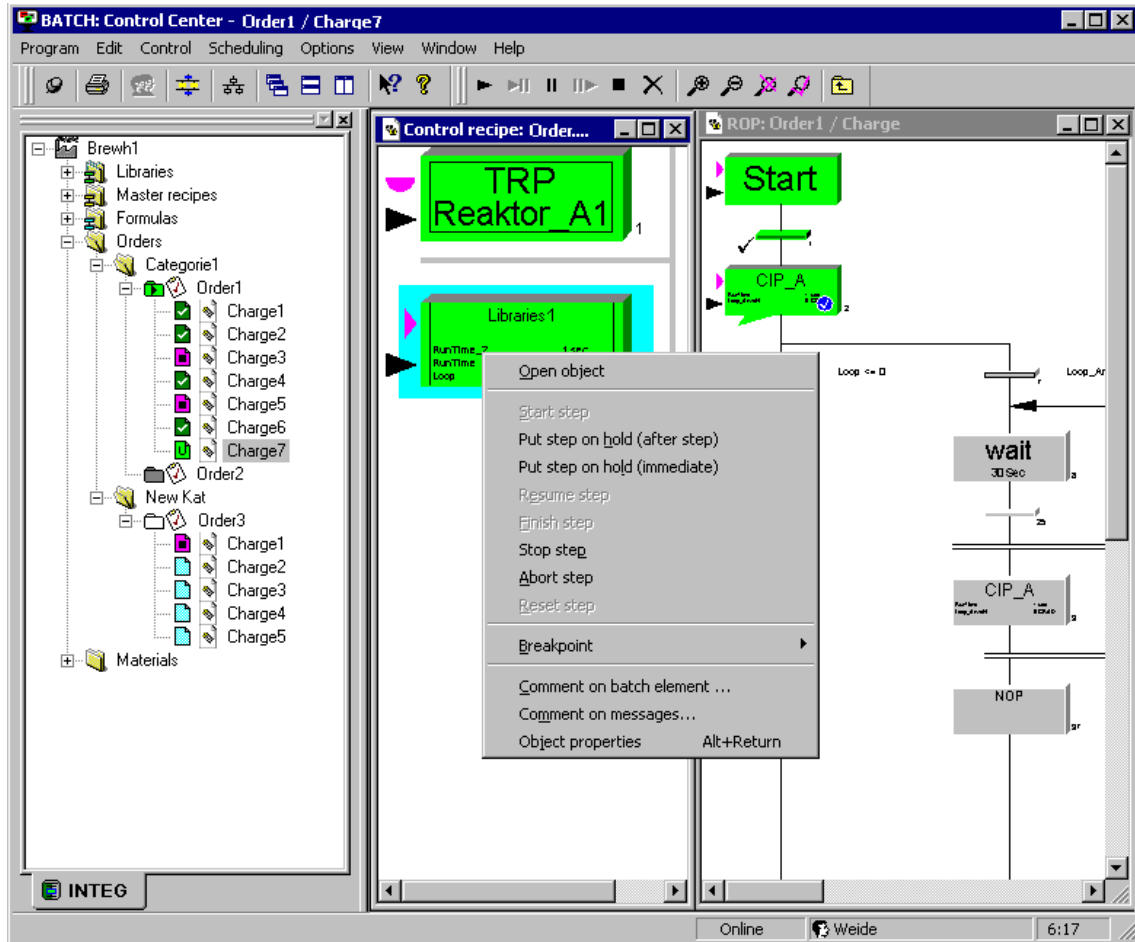
5.8.6.3 Entering Comments on a Running Batch

During or after batch control, the operator can enter comments for each control recipe element (RUP, SUB, ROP, RPH) or for the entire batch (control recipe header) **without** needing to put the batch on hold (for example entry of laboratory values or comments on important events).

Rules

- Comments made on a current batch do not change or delete the original recipe comments.

- Multiple comments can be entered for the control recipe elements or the entire Batch, for example, to correct errors or to add new information.

- The previous recipe comment appears "Read only" beside the input field for new texts.

- You can enter comments on running batches until the batch is closed.

Follow the steps outlined below:

1. Open the control recipe for the running batches (if not already open).

2. Select a control recipe element or the entire control recipe (appears on a light blue background).

3. Select the **Comment on batch** command or **Comment on batch element** in the context-sensitive menu.

4. Enter any text you require in the dialog box and close the dialog box with OK.

5.8.6.4   Displaying Operator Dialogs During Run Time

Using the "Operator instruction" recipe structure element, you can display instructions for the operator while batches are running or configure the information for manual intervention (for example manual dosing).

Requirements

• The Operator instruction was configured during creation of the master recipe as described in section Operator instruction (Insert Menu).

• The control recipe is open.

Principle

An operator instruction during run time is displayed on all active BatchCCs on which the control recipe is open. On all other BatchCCs, there is simply a display in the message window. An operator confirms responsibility for the operator instruction by clicking the Accept button (input is then locked in the dialogs on the other BatchCCs).

All other operators who are not responsible for acting on the operator instruction can minimize or close the dialog. This means that the operator dialog disappears from their screens but nevertheless remains for the process.

After the operator has executed the operator instruction and, for example entered required process values, the operator confirms with "OK" in the operator dialog to indicate that the instruction has been executed. Once the operator dialog is acknowledged in this way, it disappears automatically from all the message windows. A process value can be entered in the "Input Material", "Output Material", and "Parameters" tabs of the operator dialog (refer to the figure below).

As an option, acknowledgment by the operator can be configured as a condition for continuing the batch. Actual values that have been entered can be used in steps and transitions during the remaining execution of the recipe.

Display in WinCC

In WinCC, an operator request appears indicating that operator intervention is required. The operator is therefore informed of operator requests even when the control recipe is closed.

Branching after the Operator Dialog

After the operator has entered the actual values, it is possible to branch in the control recipe after the operator dialog.
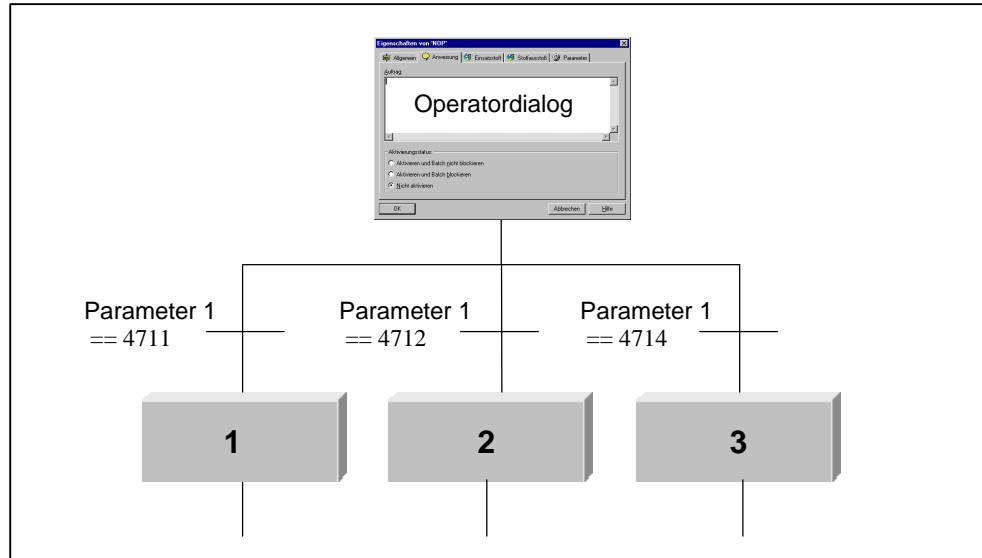
5.8.6.5 Operator Requests using Group Displays in WinCC

Requests to the operator regarding processing of the batch are displayed in WinCC using the group display. The operator can then open BatchCC and take the requested action.

The following requests are triggered using a group display:

- Acknowledge operator dialog
- Enter the Electronic signature (ESIG)
- Acknowledge breakpoint

How it Works

1. The BATCH Control Server determines that an Operator dialog or a Breakpoint is to be acknowledged or that an Electronic signature is required.

2. From the unit recipe, the Batch Control Server finds out the unit involved and sets an input to trigger a WinCC message (entering state) of the type "Operator Request" in IUNIT_BLOCK.

3. In the WinCC picture, a group display is interconnected with Unitname.EventState so that the operator request is visible.

4. Using the corresponding IUNIT_BLOCK faceplate, the operator can open BatchCC and take the action required.

5. The Batch Control Server then resets the input in IUNIT_BLOCK that in turn triggers an operator request (exiting state).

Note:

The area-specific group display can only indicate SIMATIC BATCH operator prompts that occur within a unit recipe.

With flat recipes, the group display appears only with operator instructions when these were configured with unit allocation.

Note:

Breakpoints cause a group display when they are **within a unit recipe** in hierarchical recipes. With flat recipes, this is unfortunately not possible because the unit allocation is linked to the individual steps.

Configuring Pictures

Within the WinCC picture tree, there are group displays interconnected with the individual IUNIT_BLOCK blocks (Unitname.EventState tag).

As a practical measure, there should also be a button in a unit group display that displays the IUNIT_BLOCK faceplate.

5.8.6.6 Setting Breakpoints

During batch control, the operator can set breakpoints for each control recipe element in the open control recipe. The breakpoint appears as a red dot beside the control recipe element. If execution of the recipe reaches a recipe element with a breakpoint, the recipe is not activated. Only the run marker is set and the

breakpoint is turned into a control button ▶ . The recipe element can be started with this button and the control recipe continued. It is also possible to activate the element with the start command for the recipe step.

Follow the steps outlined below:

1. Open the control recipe for the running batches (if not already open).

2. Select a control recipe element.

3. Select the **Breakpoint > Set** command in the context-sensitive menu.

Result: The breakpoint appears as a red dot beside the control recipe element. With the **Breakpoint > Remove** menu command, you can clear the breakpoint again.

Note: When an active breakpoint is removed (the control button is displayed), the corresponding recipe element is started automatically.

5.8.6.7 States of a Transition

A transition can adopt the following states:

UNDEFINED

EDITED
Transition
without
conditions

IDLE
Transition
with
conditions

RUNNING
Transition checks
its conditions

HELD
Transition does
not evaluate
conditions

STOPPED
Transition
stopped

ABORTED
Transition
aborted

READY
Transition occupies
successor

COMPLETING
Transition terminates
predecessor

COMPLETED
Transition
complete

Transition with
conditions, e.g. in
HELD state
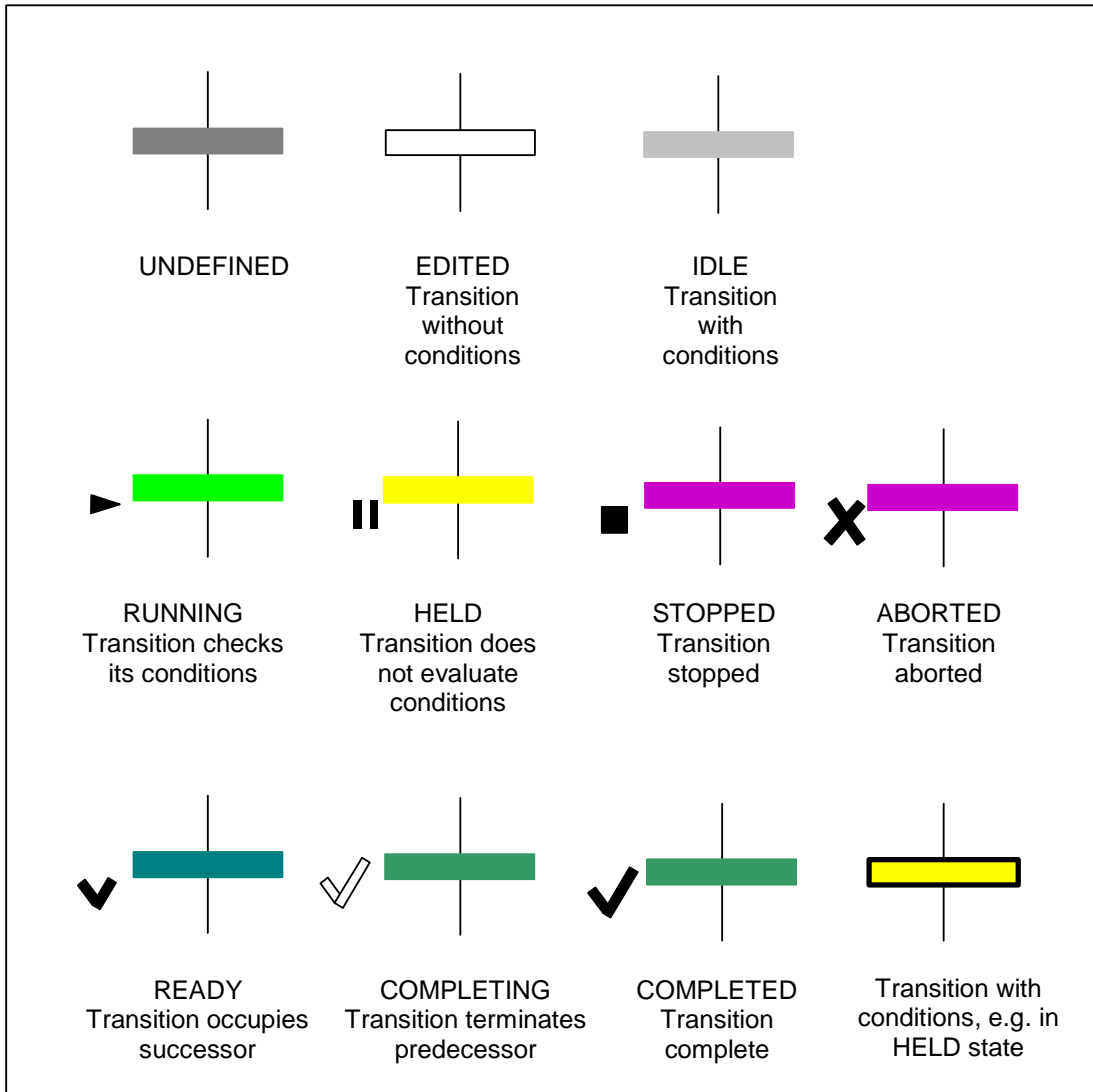
Note:

You can change the colors with the menu command **Options> Settings**.

5.8.6.8 States of the Batch Steps

The state of a batch step is influenced from two sides:

- On the one hand, by a processing block for the step functions in the controller:

This sets the states: Running, completed, terminated, error, held, aborted

- On the other hand, by the batch control:

This sets the states: Waiting for unit, unit allocated, activated, (terminated), passed
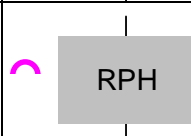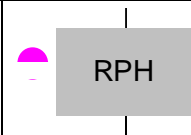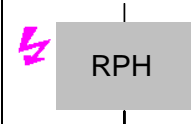
Structure of the Status Display of a Batch Step

There are two basic parallel statuses and additional status identifiers:
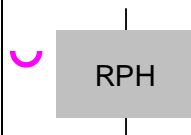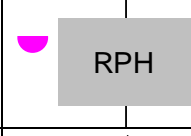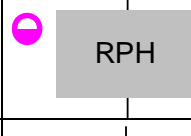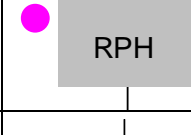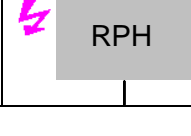
- Allocation status

- Basic status

- Added status identifiers
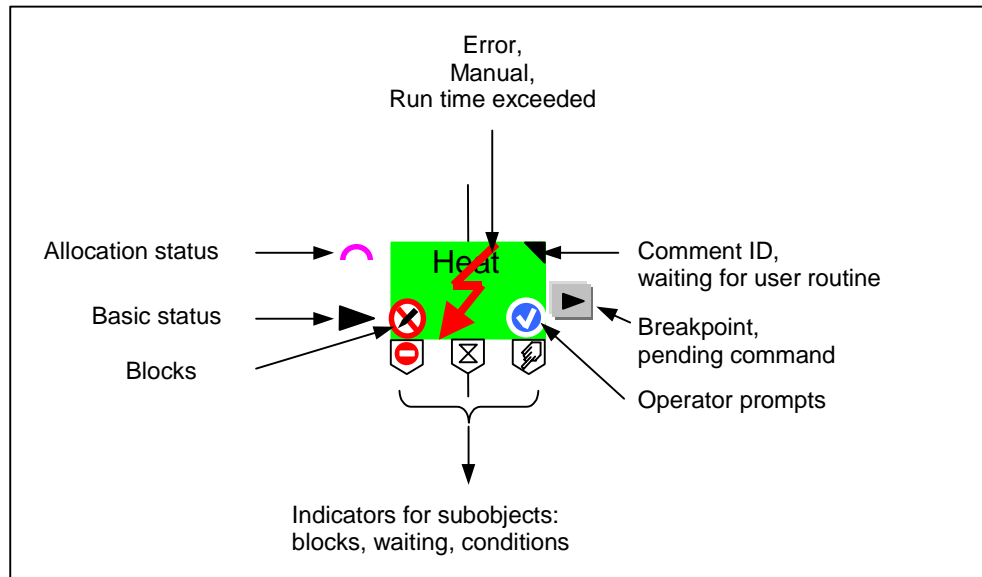
Display of the Allocation Status - Hierarchical Recipe

Appearance	Label	Meaning
RUP Mixer	*waiting for unit*	The control wants to allocate the unit required by the RUP
RUP Mixer	*unit allocated*	The control has allocated the unit to the RUP
ROP	*ROP running*	The control has allocated the ROP
RPH	*waiting for equipment phase*	The control wants to allocate the equipment phase required by the RPH
RPH	*equipment phase allocated*	The control has allocated the RPH
RPH	*Allocation error*	Allocation error or connection down

Display of the Allocation Status – Flat Recipe

Appearance	Label	Meaning
RPH	*waiting for unit*	The control wants to allocate the unit required by the RPH
RPH	*unit allocated*	The control has allocated the unit required by the RPH
RPH	*unit allocated and waiting of equipment phase*	The control wants to allocate the equipment phase required by the RPH
RPH	*unit and equipment phase allocated*	The control has allocated the RPH
RPH	*Allocation error*	Allocation error or connection down

Display of the Basic Status

Unlabeled icon = transitional status

Heat	Heat	Heat
UNDEFINED	EDITED	IDLE

▷ Heat	► Heat	⫿⫿▷ Heat
STARTING	RUN	RESUMING

⫿⫿ Heat	❚❚ Heat	▷⫿⫿ Heat	►❚❚ Heat
HOLDING	HELD	PAUSING	PAUSED

✕ Heat	✗ Heat	☐ Heat	■ Heat
ABORTING	ABORTED	STOPPING	STOPPED

↻ Heat	✔ Heat	✓ Heat	✔ Heat
CONTINUOUS	READY	COMPLETING	COMPLETED
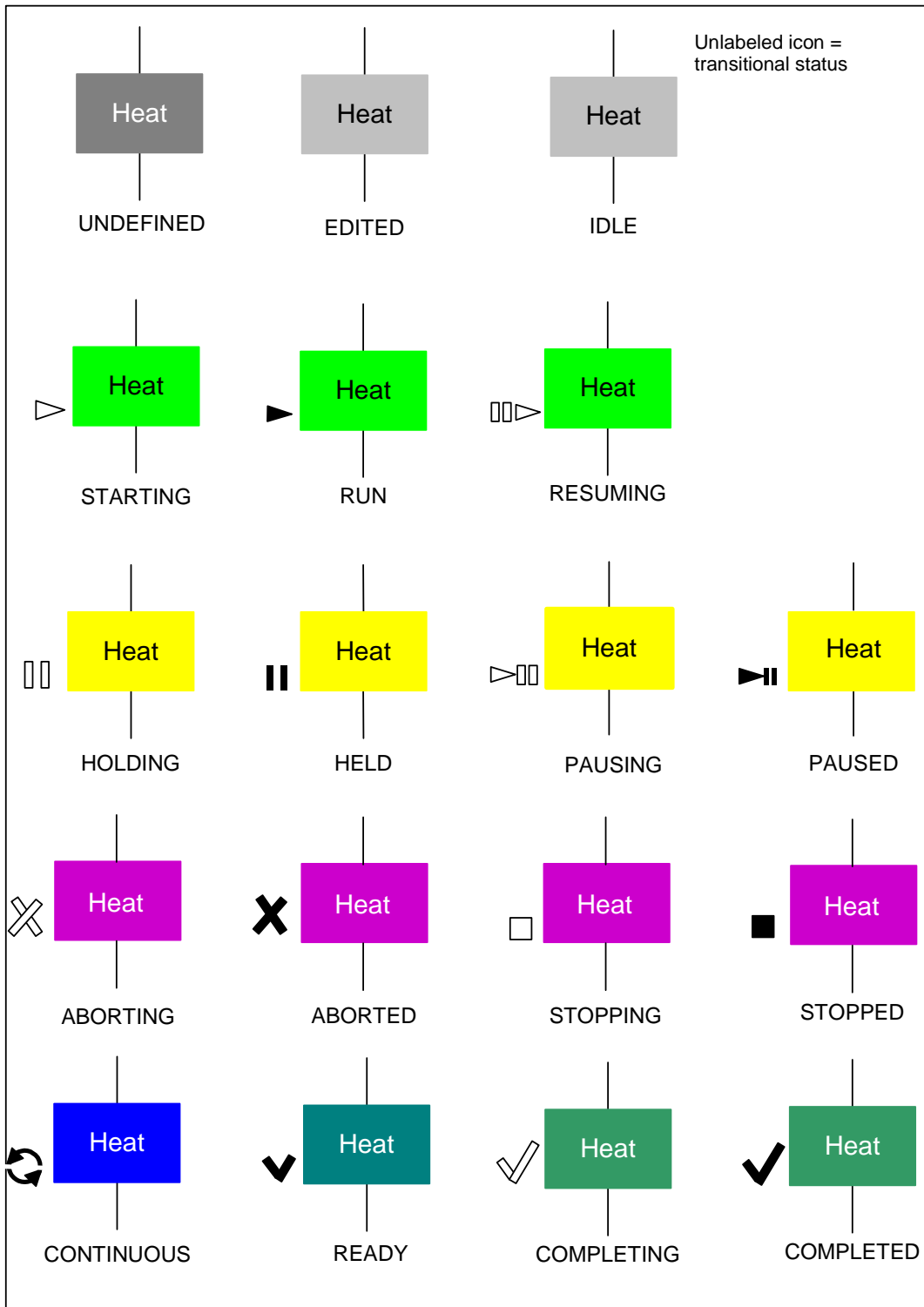
Additional Status IDs - Breakpoint and Command

The icon of the breakpoint operator button corresponds to the start button in the toolbar. The pending command is displayed with an icon corresponding to the operator button. The batch control sets the transitional state (for example HOLDING), only when this is sent by the block.

Breakpoint

Breakpoint button

Example:
HOLD command
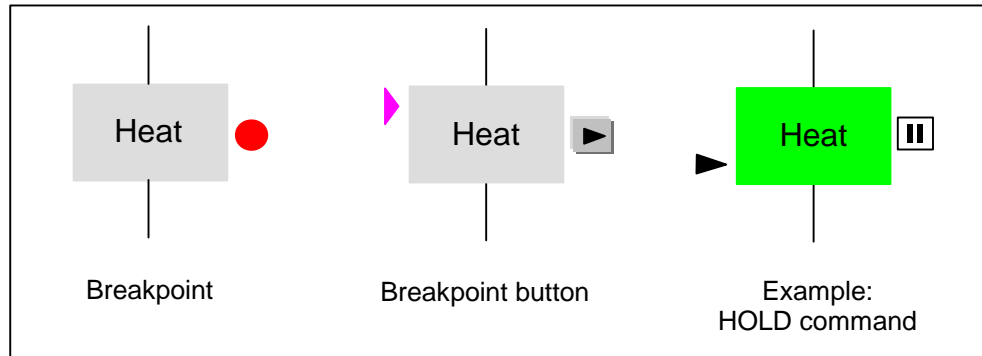
Additional Status Identifiers - Locks

Priority: Write lock before start lock

The write lock is set when a BATCH client is currently making online parameter changes or input in operator dialogs. The start lock is set when the PLC block signals the LOCK flag.

Write lock

Start lock
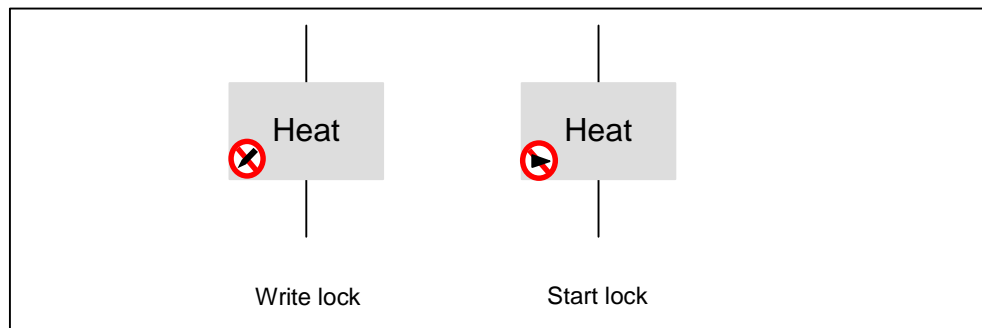
Additional Status Identifiers - Operator Prompts

Priority: Signature before operator dialog

Heat — Electronic signature required

Heat — Operator dialog to acknowledge
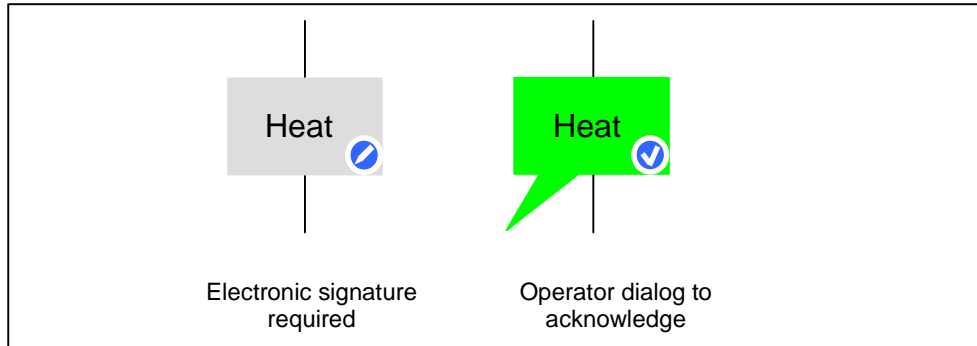
Additional Status Identifiers - Command, Wait for User Routine and Comment

Priority: User routine before comment

Heat — waiting for user routine

Heat — comment added
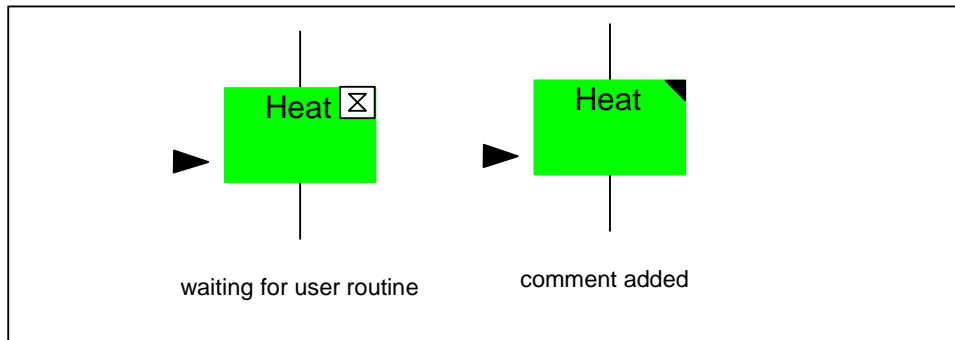
Additional Status Identifiers - Group Display (Traffic Light) for Container Objects

With container objects, the group display provides information as to whether individual objects in the container are preventing processing:

- Locks are displayed on the left: The lower-level object is held, aborted, or stopped.

- Operator prompts are displayed on the right: The lower-level object is waiting for input (operator dialog, breakpoint, electronic signature)

- Waiting events are displayed in the middle: The lower-level object is waiting for an external event (equipment module allocation, end of a user routine).

Group display for hindering subobjects
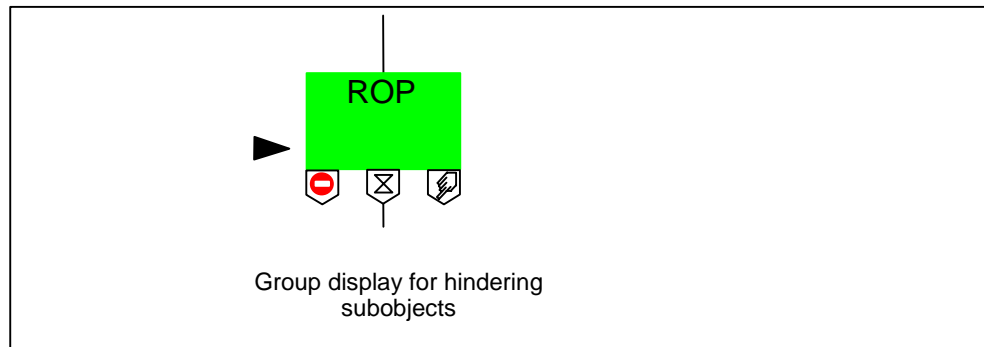
Additional Status Identifiers - Error, Manual, Run Time Exceeded

Priority: Error before run time exceeded before manual

Note: These icons can be displayed one superimposed on the other (for example error + manual).

ERROR ID occupying equipment phase

ERROR ID in basic status RUNNING and ALLOCATED

Manual

Run time exceeded
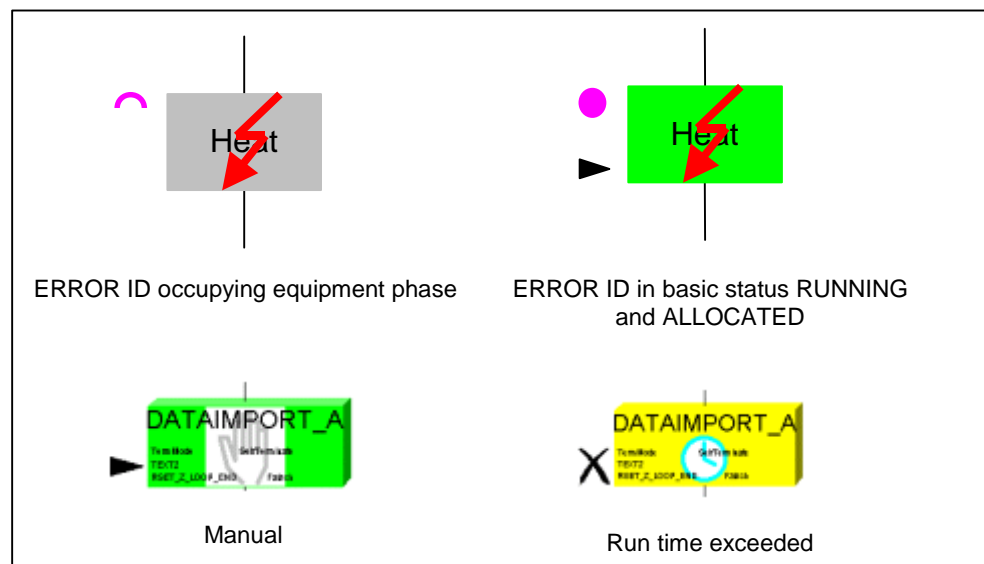
Note:

Note the following points about status visualization:

- If at least one recipe element in a level has the "In progress" status, the recipe elements of the higher levels are also indicated as "In progress".

- If no recipe element is in the "In progress" status, the highest priority state is reported to the higher levels. The only higher priority state reported is "Hold".

- If a recipe element changes to the "Error" status, this state is reported to the higher levels immediately. If the entire batch is to be discontinued, this must be aborted at the batch level.

Note:

You can change the colors with the menu command **Options> Settings**.

5.8.7 Changes During Batch Processing

5.8.7.1 Changing Setpoints

Introduction

During batch control, the parameters (setpoints) of the control recipe can be modified by the operator (for example the speed of an agitator can be changed without stopping it). The following parameter values can be changed:

- Input materials

- Output materials

- Process parameters

Provided the online modification was configured for the corresponding parameter during recipe creation (see section "Allowing Online Modification of Setpoints")

How Modification Affects RPHs and the Operator Dialog

The new values are immediately available for all Recipe phases (EPH, EOP) and Operator dialogs not yet active.

If recipe phases (EPH, EOP) and operator dialogs are running, this has the following effects:

- Parameters is "modifiable":
  If the recipe step is currently being processed there will be no reaction to the operator modifying the parameter. The modified parameter only becomes effective when the step is processed again.

- Parameter will be "Effective immediately":
  If the recipe step is currently being processed, parameter values changed by the operator will become effective immediately; in other words, they are transferred from the running recipe step in the control recipe directly to the controller where they take effect in the executing block.

How Modification Affects ROPs and the RUPs

The new values are available immediately for all not yet active recipe elements (ROP, RUP) and operator dialogs.

Parameters is "modifiable":
If the recipe element is currently being processed there will be no reaction after modifying the parameter via the operator. Modified parameter values only take effect the next time the element is executed (for example positioning within a loop).

Note:

If another BatchCC currently has the recipe element open, not modification can be made on other BatchCCs.

Changing Setpoints

You make the setpoint changes during batch control in the Properties dialog of the recipe element. The screen shot below is an example of the dialog for changing the parameters of the "Agitate1" recipe step.

You open the properties dialog by selecting the recipe element and the **Properties** command in the context-sensitive menu.

Then only the "Input materials", "Output materials" and "Parameters" tabs are displayed if there are parameters.

If you press the "Modify" button, the parameter fields with the option "Modifiable" becomes editable (displayed in white). If applicable, modify the Setpoint value and then press the "OK" button.

Beside the parameter fields, there is a check box. If the setpoints are changed, this check box is set. Only setpoints with an activated check box are transferred to batch control with a changed value. If you do not want the change to become effective immediately, deactivate this check box temporarily.

Result: the modified setpoint values are applied. Depending on the settings, the setpoints take effect immediately or when the recipe element is processed again.
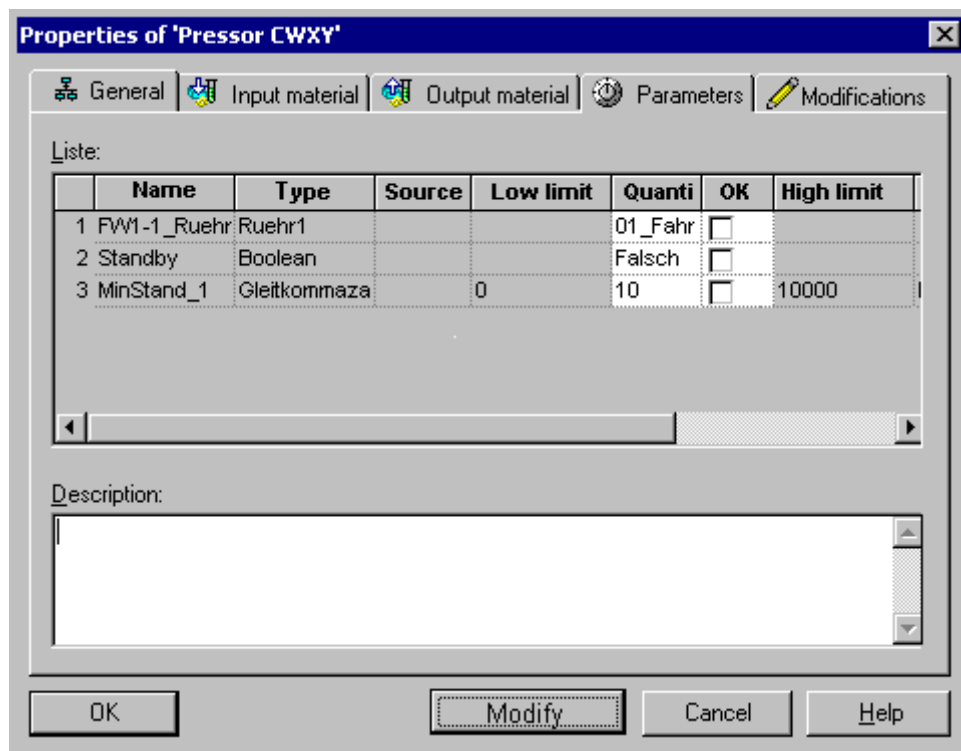
Properties of 'Pressor CWXY'

General | Input material | Output material | Parameters | Modifications

Liste:

	Name	Type	Source	Low limit	Quanti	OK	High limit
1	FW1-1_Ruehr	Ruehr1			01_Fahr	☐	
2	Standby	Boolean			Falsch	☐	
3	MinStand_1	Gleitkommaza		0	10	☐	10000

Description:

| OK | | Modify | Cancel | Help |

Response with Parameter References

With parameter references (data source, data target), the response is as follows:

- If parameters are marked as "Modifiable", the operator is permitted to enter new values.

- Implicit modification by the control recipe remains possible for parameters not marked as modifiable. If, for example, an interconnected parameter in a recipe phase is not modifiable, it can nevertheless be modified by an operator making a change in the recipe operation.

Even if the parameter is locked against modification in the recipe operation, a modification by target interconnections is still possible.

5.8.8　Displaying and Reacting to Status Messages

5.8.8.1　Displaying Messages

Requirement

A PCS 7 OS (WinCC) runs on the BATCH client computer during run time. In other words, either an OS client application and/or an OS server application runs on the BATCH client computer.

Principle

All the messages for batch control (system messages, process messages, error messages) that are managed in the WinCC archives can also be displayed in BatchCC.

To display these messages, you can open the message window of the PCS 7 OS (WinCC Alarm Control) in BatchCC in a separate display window.

Displaying Messages

- You can open the message window of the PCS 7 OS (WinCC Alarm Control) with the menu command **View > Output window**.

Setting the WinCC Alarm Control

To allow messages to be displayed, the PCS 7 OS must still be assigned. Follow the steps below:

1. Right-click in the message window and select **Properties**. context menu command.

Result: The "Properties of WinCC Alarm Control" dialog box opens.

2. Select the "Selection" button under "Server Selection".
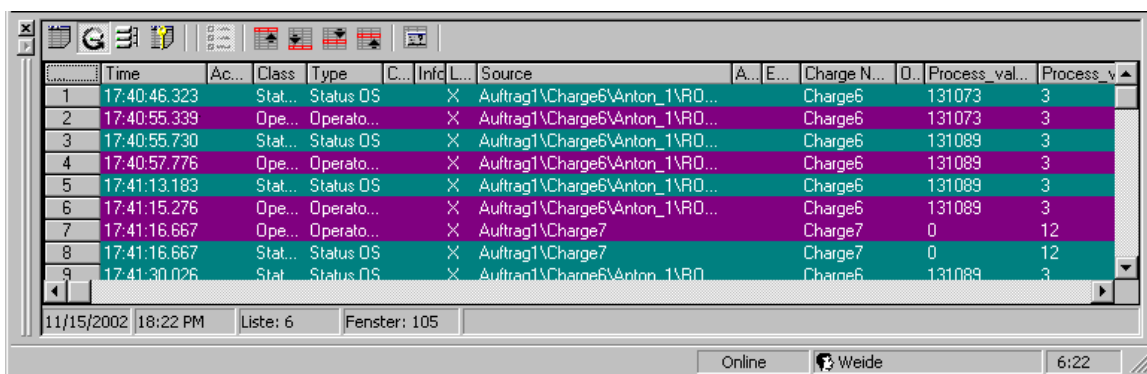
Result: The "Select Server" dialog box opens.

3. Here, select the PCS 7 OS (message OS).

4. Confirm your selection with OK.

Customizing

- You can customize the properties of the message window (familiar from WinCC), for example the columns displayed and the selection of messages.

- User settings are entered in the global database and restored the next time you start BatchCC. Certain settings that are essential for SIMATIC BATCH are exceptions to this, for example selection of BATCH messages.

- Using the **Open control recipe** menu command, the control recipe that matches the message can be opened. This function corresponds to the "LoopInAlarm" function in the WinCC message window.

Example

5.9 Batch Management

5.9.1 Batch Reports

Definition of a Batch Report

The batch report contains all the information required for the reproducibility of the batch process, the quality assurance and the fulfillment of legal requirements. These include the identification data, control recipe data, effective production data, chronological sequence of the steps, status, error and disturbance messages as well as operator intervention.

Principle

The batch report can be viewed or printed out at any time from the planning of a batch until its completion. This means that the report always includes the data up to the latest completed control recipe phase including the corresponding messages and measured values.

Note: There is a delay when collecting the data for messages and measured values. Die Verzögerungszeit beträgt fünf Minuten.

The batch report can be opened and printed in BatchCC by selecting the batch in BatchCC and opening the context-sensitive menu:

- **Print preview > Complete**: Preview of the batch report

- **Print preview > Summary**: Preview of the summary batch report

- **Print > Complete**: The batch report is printed immediately without a preview

- **Print > Summary**: Summary batch report is printed immediately without a preview.

Batch Summary Report

The batch summary report is an excerpt of the complete batch report and contains the report data from the top level (recipe). Das Chargensummenprotokoll ist eine Übersicht über der Charge.

Time-of-day synchronization

Note:

The batch management collects all messages from the start of the batch until the message "Batch closed". The start and close messages include the time of day of the computer on which the batch data management is running. To allow all messages to be detected in this time window, the time of day of all network nodes must be synchronized.

Time-of-day synchronization: See manual *PC Configuration and Authorization*

Display of Messages and Measured Values

The display of messages and measured values for BATCH Report can be set in BatchCC using the menu commands **Options > Settings > Batch messages/measured values** tab:

Possible Settings for Displaying Messages:
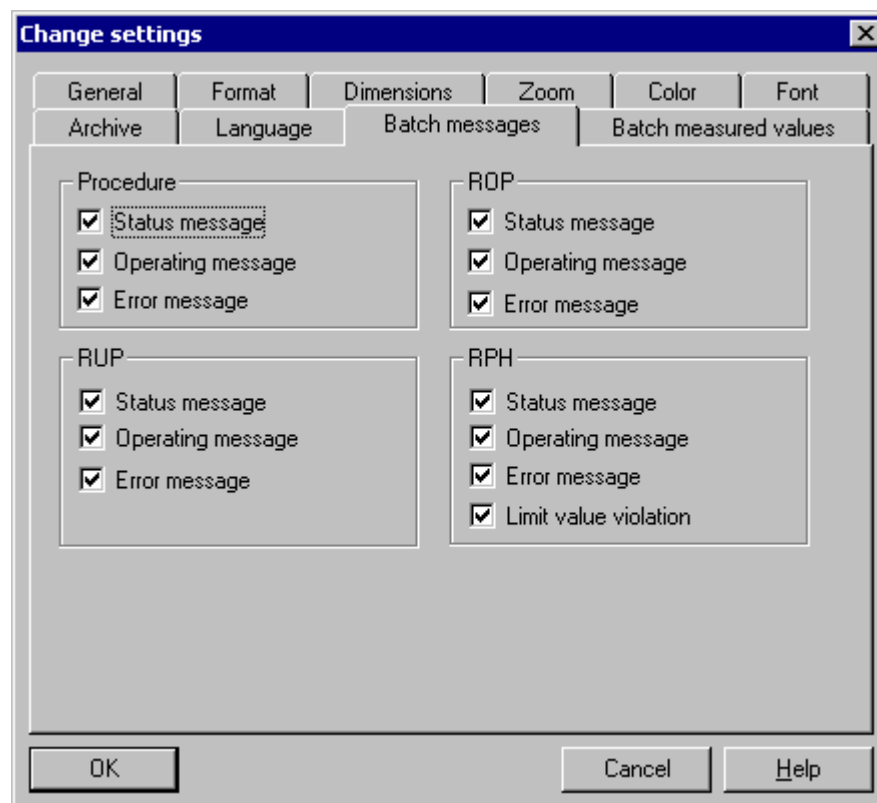
Possible Selection of Measured Value Trends:
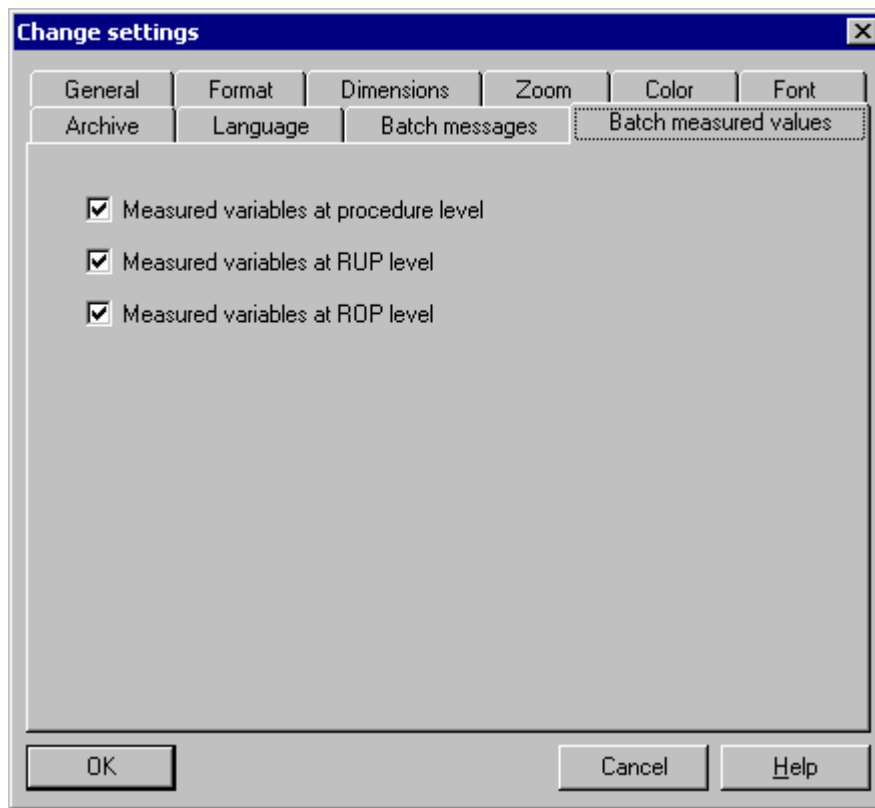
The batch report lists the minimum and maximum values of the process tags in a table for each of the levels listed above for the time for which the level was active; this is then followed by the trend diagrams.

Displaying Batch Reports on Computers without SIMATIC BATCH Installation

The application BATCH Report integrated in BatchCC converts the data from the archived Batch data to a Batch report. This application can also run on a computer, on which no SIMATIC BATCH is installed (on PCS 7 CD_3 under Additional_Products).

Start the program via **Start > Simatic > BATCH > SBReport**.

A window,in which you can select the file with the Batch data from the archive can be opened via **File> Open**. A Batch report is then created from this file.

The displayed Batch report can be printed to a printer via **File> Print Report**.

5.9.2   Archiving Batches

Introduction

In BatchCC, you can also archive batches in long-term archives. These archives are used for long-term storage of batch data in compliance with FDA rules and these are not imported back into SIMATIC BATCH.

You can only archive closed batches.

Archiving Individual Objects

With the context-sensitive menu, you can archive each closed batch individually by selecting the object in the tree structure and then selecting the menu command **Archive** in the context-sensitive menu (right mouse button).

Archiving Several Objects

You can also archive several closed batches at one time by opening a batch overview list and selecting the batches to be archived. You then select the **Archive** menu command in the context-sensitive menu (right mouse button).

Defaults in BatchCC

Date is archived on a configured storage path that can be set or modified globally in the "Settings" > "Archive" tab.

You can make the following settings in the "Archive" tab:

- Archive batches in XML format: You specify the target path (computer)

- Archive batches in an ODBC (user data source): You specify the user data source

You can open the "Settings" dialog with the **Options > Settings** menu command.

5.9.3 Archiving with SQL Server

If the batches in an ODBC (user data source) are to be archived, set the user data source, for example, Sybase SQL server in BatchCC before starting the archiving.

Follow the steps outlined below:

1. Open the SQL Server Enterprise Manager with the menu command **Start > Programs > MS SQL Server > Enterprise Manager**.

2. Create a local user in the SQL Server Enterprise Manager.

3. Open the dialog box "SQL Server Login Properties <User>" of the new user.

4. Assign the user role (SQL server) to the new user and define access to the data source (BATCH).

5. Start BatchCC.

6. Select the **Options > Settings** menu command in BatchCC.

7. Change to the "Archive" tab.

8. Select the "ODBC" option in the "Technology" tab.

9. Click on the button to the right of the "Data source" field.

10. In the "SQL Server Login" dialog box, select the SQL server and enter your login and password.

11. Click the "Options" button.

12. Enter the computer name.

13. Start archiving the Batches: see Section Archiving Batches

14. Result: In the Windows Explorer, the archived batches are stored under ...\siemens. The archived batches can be queried in the SQL Query Analyzer.

5.10   Data Backup

5.10.1   Backup (Options Menu)

Using this menu command, you can create a complete backup of your configured data (Libraries, Master recipes, Materials, user rights etc.) as a backup file in XML format:

With the **Options > Restore** menu command, you can restore the backup files in BatchCC.

5.10.2   Restore (Options Menu)

With this command, you can completely restore backup data (command **Options > Backup**) from a backup file (XML). This assumes that the batch database is still empty (does not yet exist). The restore function can only be used if this is the situation.

Follow the steps outlined below:

To execute the **Restore** function, the following steps are necessary:

1.   Start BatchCC.

Result: The editing window in BatchCC is still empty.

2.   Select the menu command **Options > Restore**. Select the backup file (XML) you require.

3.   Click the "Open" button.

Result: The data is restored in BatchCC. The current database for SIMATIC BATCH is recreated with the data of the backup file.

Note:

After you have **restored** the backup files in BatchCC, the assignment of user roles (permissions management) made in the SIMATIC Logon must be repeated

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6　BATCH Recipe Editor

6.1　Introduction

The BATCH Recipe Editor allows the graphic creation and modification of recipes.

When editing recipes, a distinction is made between the following:

- Flat recipes
- Hierarchical recipes
- Library object: Recipe operations
- Library object: Substructure

Flat Recipe

A flat recipe is made up of substructures. The substructure is used to make large recipes clearer to read.

The recipe steps of a substructure can be as follows:

- A further substructure
- A reference to a library object: Substructure
- ROP (recipe operation) with direct access to a recipe phase of the type EOP (equipment operation)
- RPH (recipe phase) with direct access to a recipe phase of the type EPH (equipment phase)
- Operator instruction: Recipe phases of the type EOP and EPH configured for the operator instruction and NOP for a simple operator instruction

---

Note:
The run-time properties of the recipe are not influenced by the substructures.

Hierarchical Recipe

A hierarchical recipe consists of recipe unit procedures (RUP) that are assigned to a unit. The recipe unit procedures are processed parallel to each other in a recipe. The execution of the recipe unit procedures can be coordinated using graphic synchronization lines.

The recipe steps of a RUP can be as follows:

- ROP (recipe operation) with direct access to a recipe phase of the type EOP (equipment operation)

- ROP with an underlying sequence of recipe steps of the type RPH (recipe phase).

    - RPH with direct access to a recipe phase of the type EPH (equipment phase) or

    - Operator instruction with or without direct access to a recipe phases of the type EPH

- Operator instruction: Recipe phases of the type EOP and EPH configured for the operator instruction and NOP for a simple operator instruction

- Library reference

Library Object: Recipe Operations

A library of library operations can be created for **hierarchical** . A library operation is an ROP consisting of steps of the type RPH. When creating the library step sequence, this is assigned to a unit class so that the recipe steps access the equipment phases (EPH) of this unit class. The unit allocation is made when you bind in the recipe step sequence of a recipe unit procedure (RUP).

Library Object: Substructure

A library consisting of substructures, in turn consisting of operator instructions, recipe operations of the type EOP or recipe phases of the type EPH can be created for **flat recipes** . Different unit classes/units can be assigned to the recipe steps of the substructure.

6.2 Starting and Operating

6.2.1 Starting the BATCH Recipe Editor

There are three different ways in which you can start the BATCH Recipe Editor:

- From the Start menu of Windows

- Using the menu command in BatchCC

- Automatically by opening a recipe in BatchCC

Starting in the Start Menu of Windows

- Go to the Start menu of Windows and select the menu command **Start> Simatic > SIMATIC BATCH > BATCH Recipe Editor** .

Starting in BatchCC

- In BatchCC select the ⬥ button or the menu command **Options > Start Recipe Editor to open the Batch Recipe Editor**.

- If you select a master recipe or a library object in BatchCC and then select the **Open** command (right mouse button) or double-click, the BATCH Recipe Editor is automatically started with the recipe.

Note:

With the exception of deleting and renaming recipes that is only possible with BatchCC, you can make all possible modifications to recipes using the BATCH Recipe Editor.

6.2.2 Requirements for Working with the BATCH Recipe Editor

Before you can work with the BATCH Recipe Editor, the following requirements must be met:

- A recipe operates on the basis of the block instances of the SFC types or the BATCH interface blocks IUNIT_BLOCK, IEOP, IEPH, IEPAR_xxx and TAG_COLL created in the CFC charts and the additional data in the batch hierarchy folders (SIMATIC Manager).

The Process cell data created this way has to be downloaded to the Batch Server and read in BatchCC via the menu command **Program > New process cell** or with the menu command **Edit > Updating the process cell** after modifying the Process cell data.

Note:

It is possible to create recipes **before** configuration of the block instances is completed. To allow this, you can edit the type description (batch types) the first time manually (without a CFC synchronization) and download it as part of the process cell data to the BATCH Server.

At a later point in time when the CFC charts have been finalized, you must then repeat the menu command **Edit > Update process cell** in BatchCC.

- You must have the relevant permissions with an entry in the user list (user rights) allowing you to use recipe creation functions.

6.2.3 User Interface and Operation

6.2.3.1 Layout of the Main Window

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.

The first editing window displays either the structure of a recipe or a library object (editing level 1). In the other editing windows, you can edit the lower-level ROP sequences (in hierarchical recipes this is editing level 2) or substructures (in flat recipes this is editing layer 2 to 10).

Title bar   Menu bar   Toolbar   Buttons for
                                          changing the view

Status bar with
context-sensitive
information

Editing window with recipe
structure of a hierarchical master
recipe with ROPs
(editing level 1)

Editing window with a ROP
sequence (editing level 2)
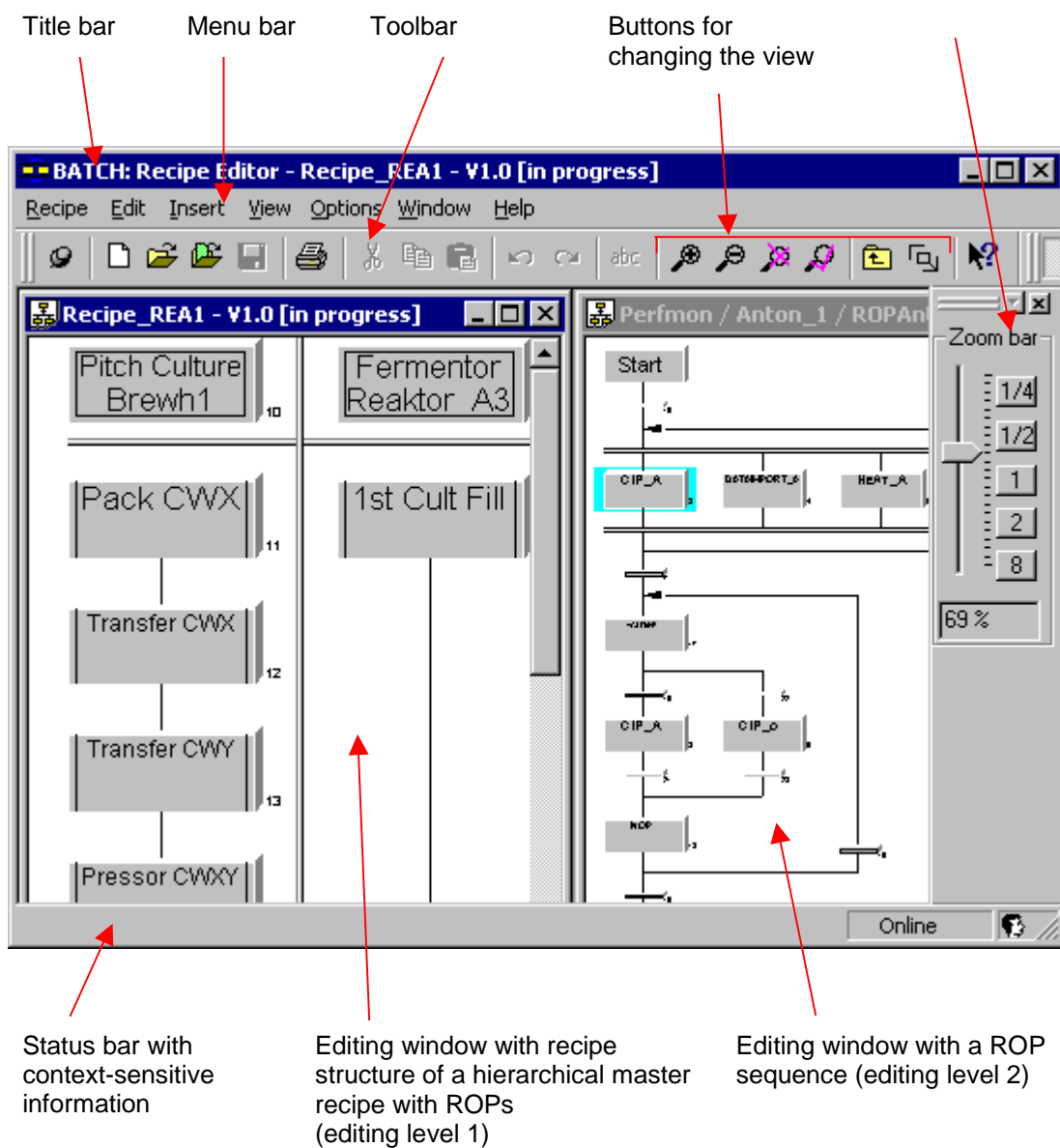
Title Bar

The title bar of the main window displays the name of the master recipe, the recipe operation (ROP) or the library object. Here, you will also find system buttons with which you can do the following:

- Close the BATCH Recipe Editor,

- minimize the main window to its icon,

- restore the window to its normal size again, and

- maximize the display of the main window.

Menu Bar

The menu bar is located at the top edge of the main window. Its functions relate to the currently editing window. You can only select menu commands that are feasible in the current status of the object. As an example, you can only select the menu command **Edit > Delete** when at least one object is selected. Menu items that cannot be selected are displayed in gray.

Toolbar

The toolbar is located below the menu bar. It contains a series of buttons that trigger the more commonly required functions of the menu bar. You can see which function is triggered by a button in the toolbar by positioning the mouse pointer on the button (without clicking). A box appears with the name of the button. In the status bar, you can see more detailed information about the function. Clicking the button triggers the function. Buttons that cannot be selected are displayed in gray.

Status Bar

At the lower edge of the user interface, you will see the status bar that displays important information and statuses. The information displayed changes depending on the particular operation and object status.

In the **left** part of the status bar you will see context-sensitive information, for example explanations of menu commands, operator prompts or error messages.

In the **right** part of the status bar, you can see the current user and the current time. In some situations, a progress bar is also displayed for processes that require longer.

Context-Sensitive Menu

With the right mouse button, you can display the context-sensitive menu containing functions from the menu bar frequently required in the current situation. Only the functions that are feasible for recipe element can be selected, all others are displayed in gray.

Assigning Names to Recipe Elements

Beside each recipe element, there is a number that, in conjunction with the freely selected name of the recipe element chosen by the user, forms the unique system name. Even if the same name is assigned, the name within the system will still be unique.

6.2.3.2   Options for Customizing the Editing Window

Changing the View

←	Stufenweises Vergößern, bis die gewünschte Größe erreicht ist.
←	Stufenweises Verkleinern, bis die gewünschte Größe erreicht ist.
←	mittlere Zoomstufe (Normalgröße) einstellen
←	Einpassen auf genutzte Fläche
←	übergeordnete Ebene wird angezeigt
←	Zoomausschnitt wählen für optimale Anpassung an Fenstergröße
←	Direkthilfe einschalten
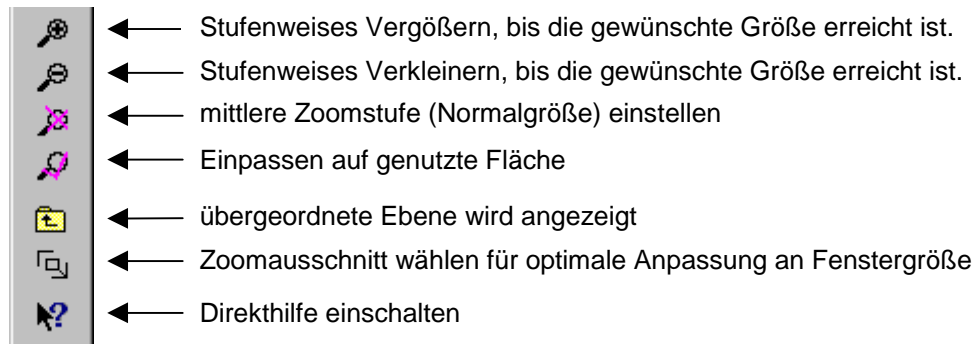
In addition to the functions shown above, you can also use the **View > Fit automatically** menu command to activate automatic window adaptation. If you increase the size of the recipe structure or the editing window, the content is automatically increased or reduced in size.

Zoom Bar

This is an extra zoom bar with which you can adapt the size quickly. To save space, you can also hide the zoom bar.

6.2.3.3   Creating and Manipulating Objects

Selecting Functions

All important functions relating to an object are available in the context-sensitive menu.

As an alternative, the same functions are also available in the **Edit** menu. Functions that cannot be executed in the current status of an object are deactivated (displayed in gray) in the **Edit** menu.

General Functions

Some basic functions are common to all objects. These common functions are listed below. The descriptions of other functions assume that you know how to use these functions.

The normal sequence of activities involving objects is as follows:

*   Creating the object

*   Selecting the object

*   Performing actions with the object (for example, open, delete).

Creating Objects

All objects of the master recipe are created with the **Insert** menu.

As an alternative, you can also use the corresponding object icons in the toolbar. You display the toolbar with **View > Toolbars > Insert**.

Opening Objects

There are several ways of opening an object:

*   Double-click on the object icon

*   Select the object and then the menu command **Edit > Open object**.

After opening an object, you can create or modify its content.

Properties of Objects

Object properties are data belonging to the object that decide its behavior, for example the properties of a recipe operation.

The menu command **Edit > Object properties** opens a dialog box in which you can see and set the properties of the selected object.

Cut, Paste or Copy

You can also cut, paste, or copy most objects as normal in Windows. The menu commands for this are in the "Edit" menu.

You can also copy objects using (Drag-and-drop). If you point to an illegal target, the cursor changes to a forbidden sign.

When you copy an object, the entire hierarchy below it is also copied. As a result you have wide options open to you if you want to use your developed components more than once.

Note:

When you insert, the target position must be specified by mouse click.

Renaming Objects

You can change the name of an object at a later point in time in the Object Properties.

Deleting Objects

You can delete all objects. Deleting can be undone. A master recipe or a library operation can only be deleted in BatchCC.

Undoing/Redoing Actions

With the Undo/Redo menu commands, you can reverse modifications step-by-step.

After undoing "n" actions, you can also redo "n" actions.

6.2.3.4   Selecting Objects

Selecting by Clicking

If you activate the selection mode with ![cursor], you have the following options:

*   By simply clicking with the mouse, all objects (Structure Elements), which were selected, will be deselected.

*   You can select RUPs, ROPs, RPHs, SUBs, library references, and transitions by simply clicking on them with the left mouse button.

*   Select sequences, diverging sequences and loops not by clicking a step or a transition but on the line between the step and transition (to select a sequence), on the upper or lower horizontal line (to select a simultaneous or alternative sequence) or on the upper or lower horizontal line of the return path (to select a loop).

*   Select an open ROP by selecting the initial step, the final step or the sequence containing the initial or final step.

*   When you make a selection, other selected objects are deselected.

Selecting with a Lasso

To open a lasso, drag the mouse while holding down the left mouse button. All the elements completely enclosed in the lasso frame are selected when you release the mouse button. Previously selected elements are deselected if they are outside the lasso frame.

Selecting Further Objects

If you want to select several objects, hold down the CTRL key and click the objects with the mouse. The element you have clicked is selected without deselecting previously selected elements.

Deselecting

If you have accidentally selected an object, you can deselect it by clicking it again while holding down the CTRL key.

6.3 Topology of Recipes

6.3.1 Flat Recipes

Flat Recipes

With the BATCH Recipe Editor, you create flat recipes. To make the structure clearer, you can move existing sequences of recipe elements into a substructure.

Note:

The run-time properties of the recipe are not influenced by the substructures.

Basic Structure

The following figure illustrates the basic structure of a flat recipe that can contain both recipe operations (ROPs) that use EOPs, as well as recipe operations made up of recipe phases (RPHs) and that use EPHs. These EOPs and EPHs are created during engineering of the basic control (refer to the section on configuring the ES).
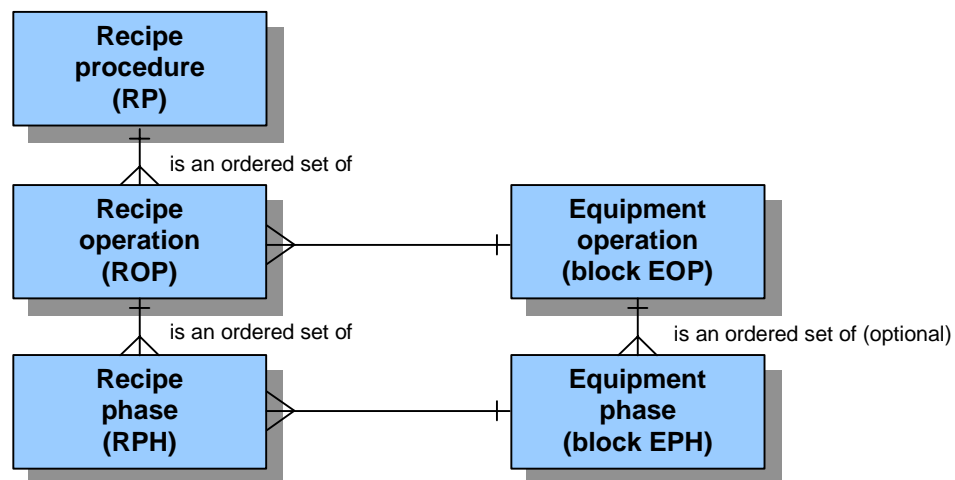
6.3.1.1   Using Substructures in the BATCH Recipe Editor

Principle

The schematic below shows the basic use of substructures when editing flat recipes with the BATCH Recipe Editor. A substructure itself can be made up of other substructures.

The structure of a flat recipe can be edited in a maximum of 10 levels when using substructures.

Editing level 1
Recipe procedure (RP) with substructures (SUB), ROP and RPH

Editing level 2
Substructure (SUB) with substructures (SUB), ROP and RPH

Editing levels 3 ... 10
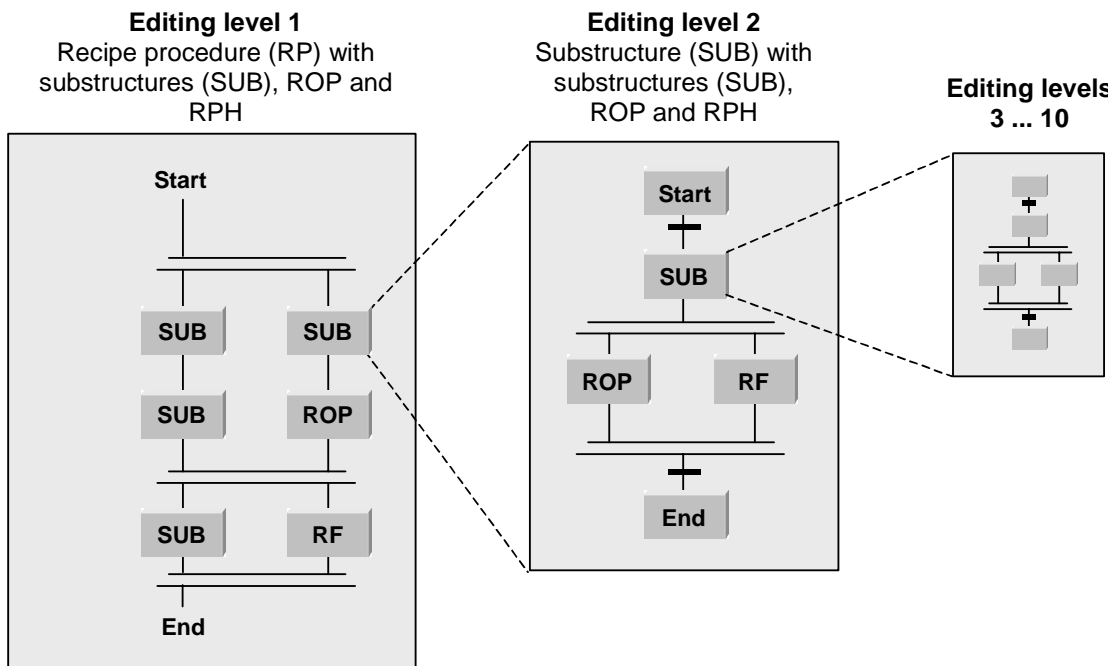
Synchronization

Using the synchronization functions, you can coordinate the execution of recipe sequences. In flat recipes, synchronization in sequences of the same simultaneous sequence are possible.

At each synchronization point, you can decide whether or not the sequence is halted. If you select lock, the sequence waits until the other sequences involved have reached the synchronization line or have already passed it. If you do not select a lock, the sequence does not wait for the other sequences. The fact that the synchronization point was reached is nevertheless recorded.

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6.3.2 Hierarchical Recipes

Hierarchical Recipes

With the BATCH Recipe Editor, you create hierarchical recipes. The following recipes are possible:

- Hierarchical Recipes with ROPs

- Hierarchical Recipes with RPHs

- Hierarchical Recipes with ROPs and RPHs

6.3.2.1 Hierarchical Recipes with ROPs

The schematic below shows the basic structure of a hierarchical recipe with EOPs. Below the recipe unit procedure (RUP), there may be several recipe operations (ROPs). The recipe operations use the EOP blocks directly. These EOPs are created during engineering of the basic control (refer to the section on configuring the ES).
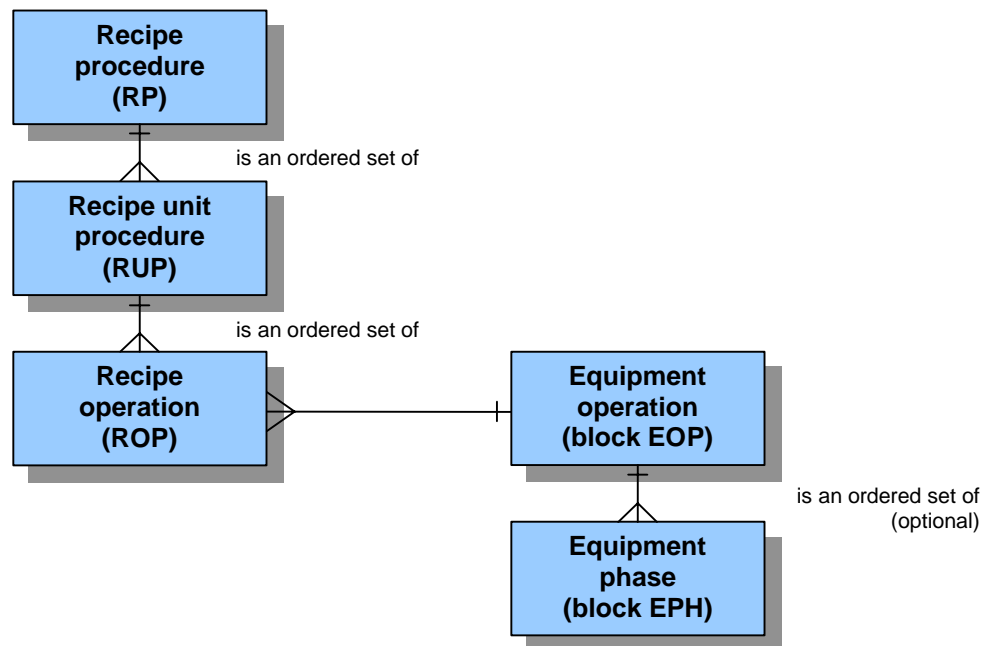
6.3.2.2   Hierarchical Recipes with RPHs

The schematic below shows the basic structure of a hierarchical recipe with recipe phases RPHs. In this model, the process cell is structured in greater detail during engineering with the ES. A unit has several equipment modules that can contain several EPHs.

No recipe phases are possible directly below a recipe unit procedure (RUP). Recipe phases can, however, be used in the underlying substructure of the ROP. EPHs are assigned to these recipe phases.
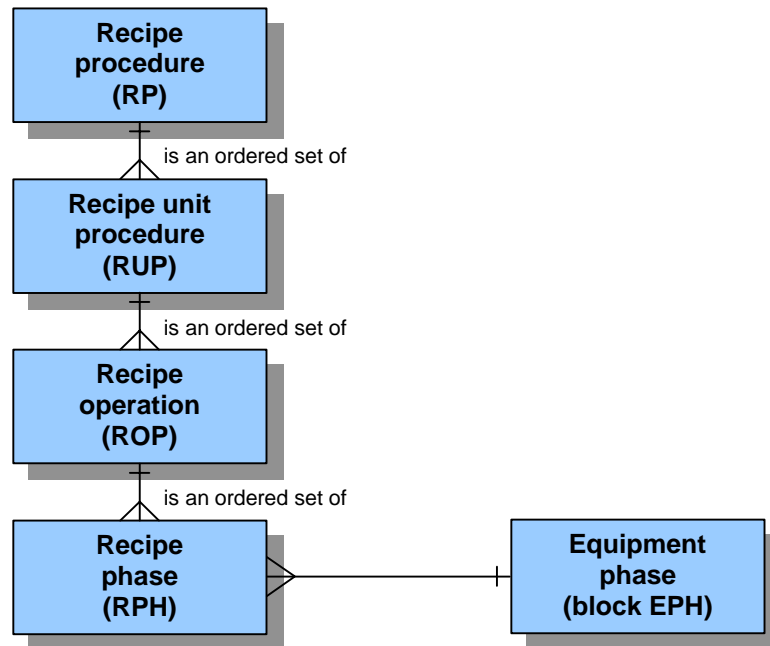
6.3.2.3 Hierarchical Recipes with ROPs and RPHs

With SIMATIC BATCH, you can also create recipes that contain both recipe operations (ROPs) that use EOPs as well as recipe operations that are made up of recipe phases (RPHs).
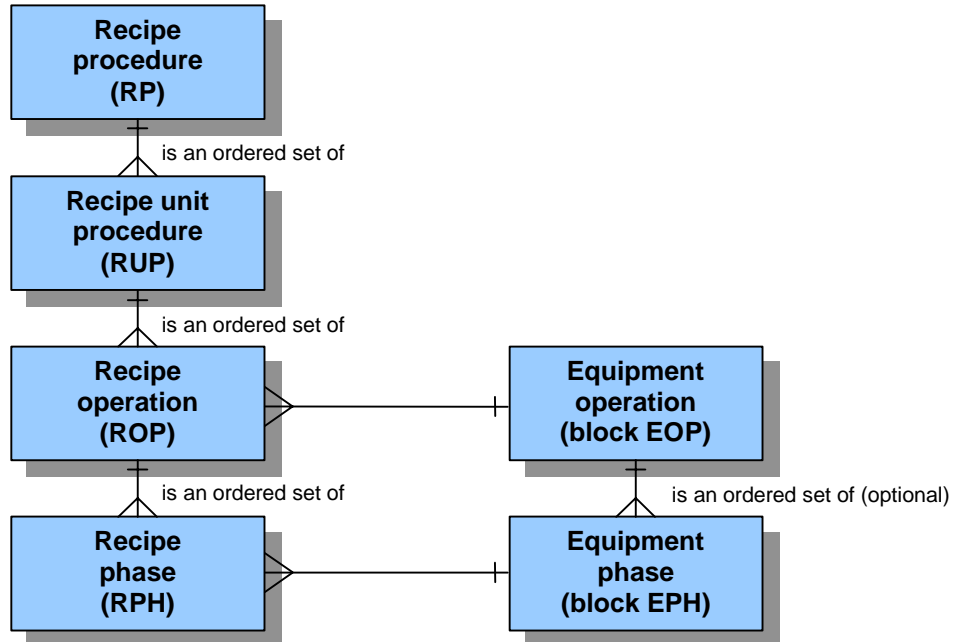
6.3.2.4 Representation of the Hierarchy in the BATCH Recipe Editor

Principle

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
Recipe procedure (RP)
(with recipe unit procedures
(RUP 1 ...))

Editing level 2
Recipe operation
(ROP)
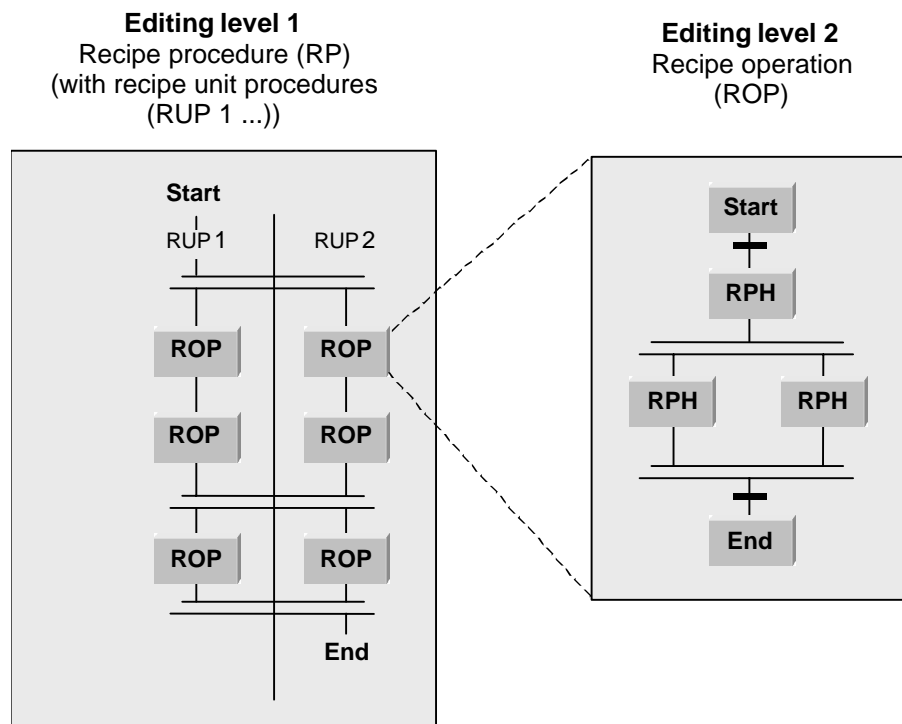
Editing Level 1

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.

Note:

Free editing mode:

In this mode, you can use all the structure elements of editing level 2 at editing level 1 (parallel ROPs, loops, transitions,...).

Since this mode does not correspond to the standard, this mode will not be described in any greater detail. The way in which the structure elements function is the same at both editing levels.

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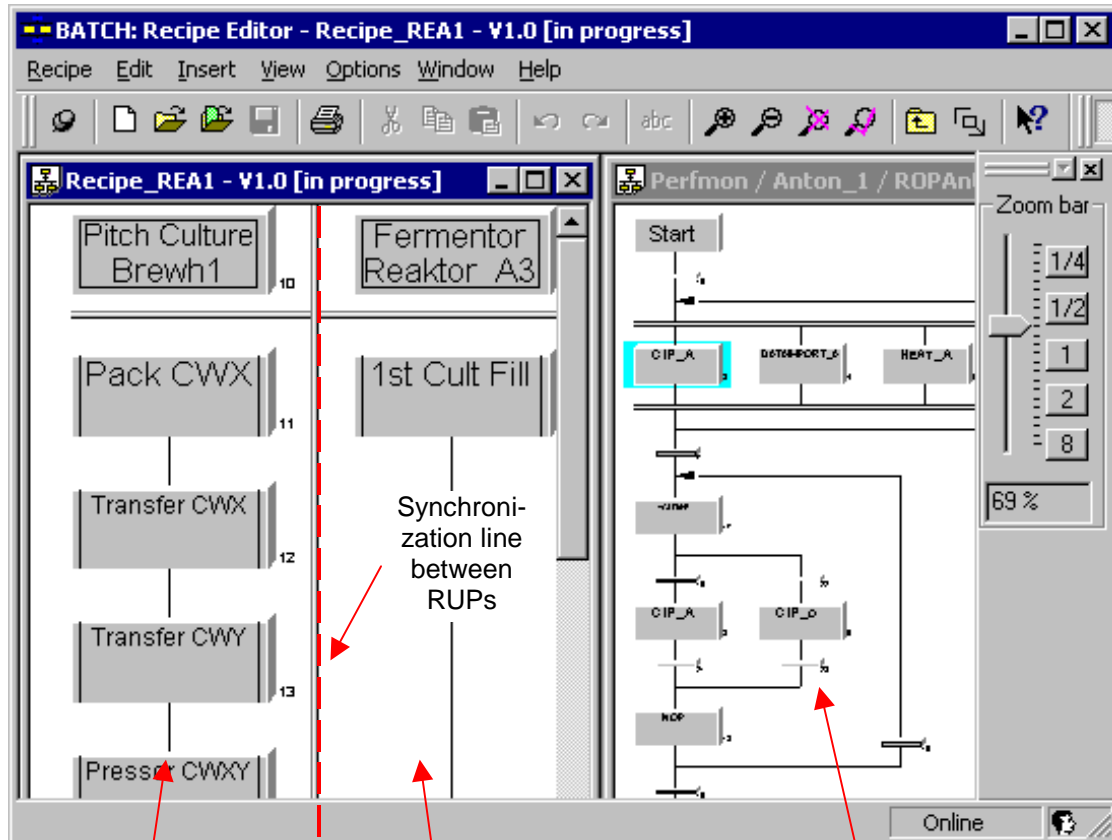
1. Recipe unit procedure (RUP 1) with ROPs and recipe operations

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

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

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

Editing level 1   **Editing level 2**

6.3.2.5   Synchronization between Recipe Unit Procedures

Principle

Using synchronization, you can synchronize the ROPs of several recipe unit
procedures (RUPs) with each other at editing level 1. Each position where a
synchronization line connects a recipe unit procedure can have a blocking or non-
blocking effect. If blocking is required, the recipe unit procedure continues only
when all recipe unit procedures involved in the synchronization have reached the
synchronization point.

Example of Synchronization (Blocking)

In the screen chart shown below, the synchronization lines (blocking) between the
two recipe unit procedures (RUPs) shown cause the following reactions:

- Line 1: ROP 10 and ROP 6 start steps 20, 5, 13

- Line 0: ROP 5 and ROP 14 start steps 11, 16

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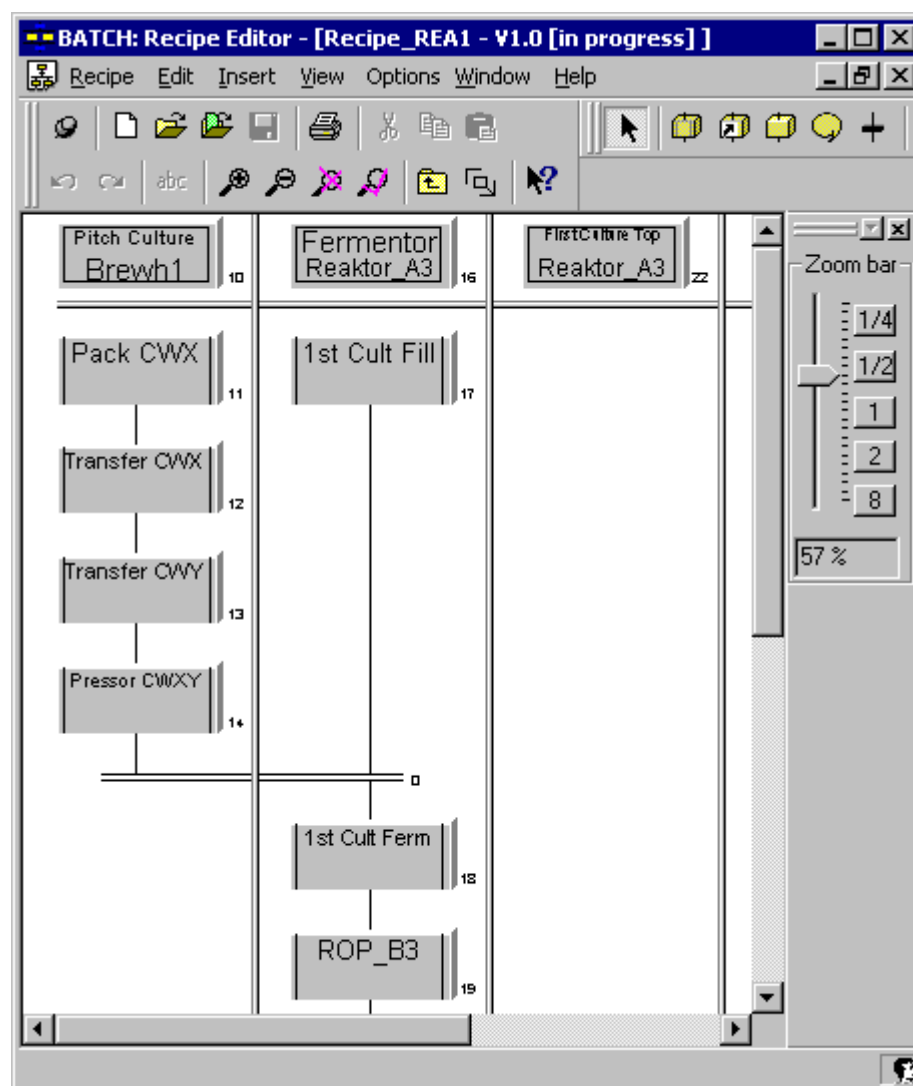
Changing Over Between Blocking and Non-Blocking

You can change the blocking or non-blocking effect of each synchronization point. Follow the steps outlined below:

1. Select the synchronization point.

2. Select the **Properties** command in the synchronization point context-sensitive menu.

3. Enable or disable the "Blocking" check box.

4. Confirm with OK.

Result: The synchronization point is displayed with a **single line** . ROPs/NOPs in the sequence following this are started immediately (without waiting for synchronization).

Example of Synchronization (Non-Blocking)

The non-blocking positions below "Material entry 10" means

- that ROP 20 is processed further by RUP "Dosing setpoint" Immediately when ROP 10 is completed.

- that ROP 5 and ROP 13 are only started when ROP 10 and ROP 6 are completed.
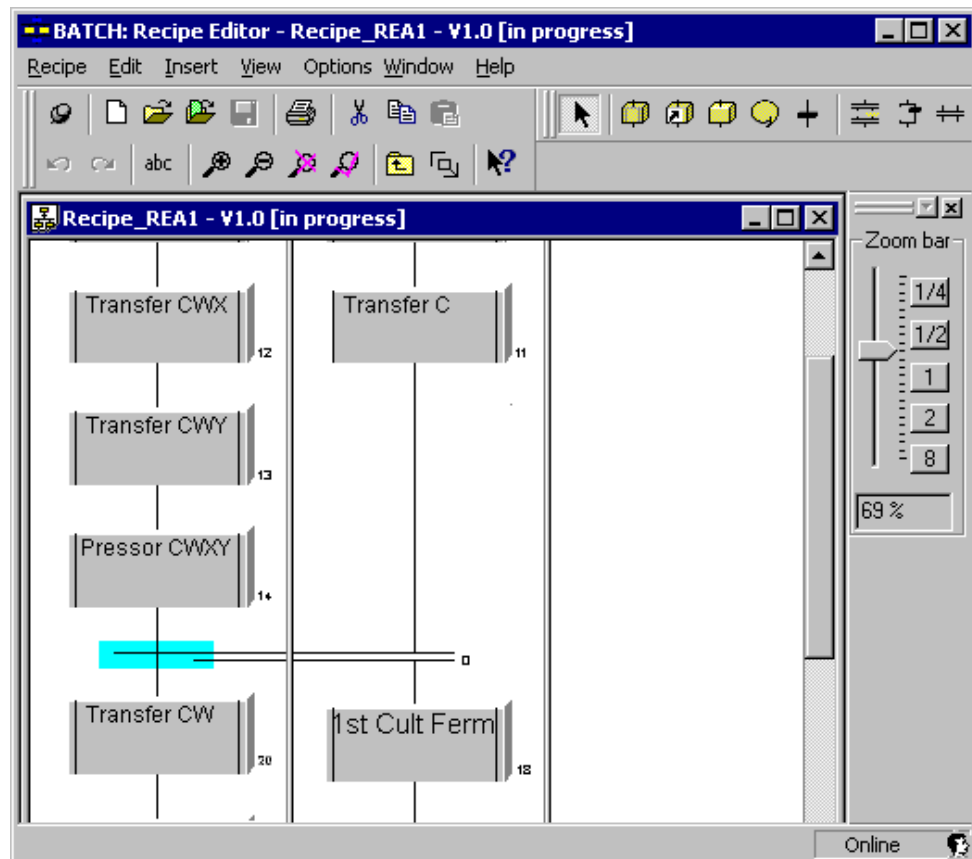
6.3.3 Necessary and Possible Structure Elements in Recipes

6.3.3.1 Structure Elements of Recipes

The following structure elements can be inserted in the sequences:

Structure Element	Inserted with Button/Menu Command ...
Recipe Procedure (RP)	**Recipe > New**
Recipe Unit Procedure (RUP)	Recipe procedural element (Insert Menu)
Recipe Operation (ROP)	Recipe procedural element (Insert Menu)
Recipe phase (RPH)	Recipe procedural element (Insert Menu)
	Recipe phase (Insert Menu)
Substructure (only for flat recipes)	Recipe procedural element (Insert Menu)
Library reference	Library reference (Insert Menu)
Operator instruction	Operator instruction (Insert Menu)
Transition	Transition (Insert Menu)
Simultaneous Sequence	Simultaneous sequence (Insert Menu)
Alternative Sequence	Alternative sequence (Insert Menu)
Synchronization line	Synchronization (Insert Menu)
Synchronization point	Synchronization (Insert Menu)
Loop	Loop (Insert Menu)
Step Placeholder	(automatically by BATCH Recipe Editor)
Transition Placeholder	(automatically by BATCH Recipe Editor)

Working with Sequences

The structure elements are inserted in sequences. A sequence is a vertical series of structure elements. The elements in the sequence are separated by a vertical line.

Meaning:

Actions to be executed one after the other must be arranged vertically in a sequence. A transition is evaluated only when the recipe phase above is completed (ready to complete, or similar). The next recipe step is only triggered when the transition above it evaluates to true.

6.3.3.2   Recipe Procedure (RP)

The recipe procedure includes the procedural elements required for the process engineering in a process cell. When creating a recipe procedure, the equipment-related procedural elements are used that are provided by the basic control.

Recipe Procedure Window

The recipe procedure window displays the required units in columns. The structure elements, steps, transitions, loops etc. that determine the process sequence can be included in the columns. The processes in the unit are coordinated by the "synchronization line" structure element.

Properties

The properties of the recipe procedure reflect the header parameters of a recipe. This includes specifications such as the product, parameters, reference scale, input and output materials,....

6.3.3.3   Recipe Unit Procedure (RUP)

The recipe unit procedure includes the procedural elements required for the process engineering in a unit.

The recipe unit procedures are the columns in the recipe procedure window. The recipe operations of the unit are the steps in the recipe procedure window. The name and selected unit are displayed in the column title. By double-clicking the column title, the properties dialog of the recipe unit procedure is opened.

The steps in a recipe unit procedure can have the following functions:

- Steps with access to a recipe phase of the type EOP
- Substitute for a step sequence for this unit integrated in the recipe
- Library reference for a library operation
- Operator instruction

6.3.3.4   Recipe Operation (ROP)

The recipe operation includes the procedural elements required for the process engineering of a recipe operation. When creating a recipe procedure, the equipment-related procedural elements are used that are provided by the basic control.

Steps can take the following forms:

- Operator instruction
- Steps with access to a recipe phase of the type EPH

6.3.3.5   Recipe Steps in a Recipe Operation (RPH)

At this level, recipe phases are entered in the form of operator instructions or recipe phases of the type EPH.

6.3.3.6   Substructure

A flat recipe is made up of substructures. The substructure is used to make large recipes clearer to read. Units of the recipe that belong together can be moved to their own section and abstracted using the substructure box SUB.

A substructure can consist of recipe steps in the form of operator instructions, recipe operations of the type EOP or recipe phases of the type EPH. A different unit can be assigned to every recipe step.

Note:
The run-time properties of the recipe are not influenced by the substructures.

6.3.3.7   Library reference

A library operation is not linked directly into a recipe procedure (RUP) but uses a library reference. The library operation cannot be modified within the master recipe; the library operation must always be opened explicitly in the BATCH Recipe Editor.

6.3.3.8   Operator instruction

The operator instruction allows instructions for the operator to be displayed during the processing of a recipe. A distinction is made between output of

- pure instructions (NOP step):

    - - without acknowledgment; in other words the recipe is not stopped.
      Example: Please put on protective glasses!

    - - with acknowledgment; in other words, the recipe is stopped until the operator acknowledges.
      Example: Please close valve V127.

- an instruction with input option (operator dialog)

    - - No acknowledgment
      Example: Entry of analysis process values.

    - - With acknowledgment
      Example "manual dosing": The operator is instructed which material and how much to add. The operator then enters the actual values that have been added and confirms the input (acknowledgment).

Entered values (actual values) can be used as setpoints for subsequent recipe phases/operations. The actual values can also be evaluated in transitions, example: Sample good? yes/no. In this case, an acknowledgment must be set in the parameters

6.3.3.9 Transition

Along with the step, a transition is a second element type used in structuring a recipe. It contains the step enabling conditions between the steps.

6.3.3.10 Simultaneous Sequence

A simultaneous sequence consists of at least two horizontally arranged sequences joined at top and bottom by double lines.

Function:

A simultaneous sequence leads to simultaneous processing of several sequences. This allows processes to be executed at the same time.

With simultaneous sequences, the sequence paths are processed only when all paths can be processed. This ensures, for example, that it is only possible to "heat" when the "agitator" is active.

Note:

If 2 equipment phases of the same unit are installed in one simultaneous sequence and one of the two phases is in automatic mode and the other in manual, during processing, the unit will be occupied by the equipment phase in automatic mode.

At this point, execution of the simultaneous sequence stops. Even the equipment phase in the automatic mode, that is occupying the unit is not processed.

Synchronization Lines

Another method of coordinating sequences is to create synchronization linesbetween the recipe steps.

6.3.3.11 Alternative Sequence

An alternative sequence consists of at least two vertically arranged sequences joined at top and bottom by a single horizontal line.

Function:

With alternative sequences, you can adapt the execution of the recipe to states in the process. The conditions in the top transitions of the sequences decide which sequence is executed.

6.3.3.12 Synchronization line

The synchronization lines coordinate the execution of recipe sequences in the units or of the recipe operations (ROPs) between the units.

6.3.3.13 Synchronization point

In each synchronization point, you can decide whether execution is continued or halted.

6.3.3.14 Loop

A loop consists of a sequence with at least one recipe step and a return path with a transition.

Meaning:

The loop allows multiple iteration of a sequence structure.

The transitions following the loop and in the return path decide how often the sequence is repeated. If the condition in the transition following the loop is satisfied, control exits the loop. The conditions of the two transitions should be mutually exclusive so that it is not the order in which the transitions are evaluated that is relevant but rather the logic itself.

6.3.3.15 Step Placeholder

Incomplete structures must be completed dynamically so that they are always syntactically correct and complete. To make sure this is done, the BATCH Recipe Editor automatically inserts placeholders for recipe phases and transitions.

A recipe phase placeholder appears like an empty recipe phase. By double-clicking or inserting a recipe phase using the menu or the toolbar, the placeholder becomes a recipe phase.

These dynamically generated placeholders are removed again when they are no longer required or they become NOP (no operation) recipe phases when the recipe is saved.

NOP elements can also be used, for example to specify a defined runtime.

6.3.3.16 Transition Placeholder

Incomplete structures must be completed dynamically so that they are always syntactically correct and complete. The recipe editor therefore automatically inserts placeholders recipe phases and transitions.

A transition placeholder has the appearance of an empty transition.

To convert a transition placeholder to a transition, simply double-click on symbol, or insert a transition into the placeholder via the **Insert** menu or the Toolbar.

6.4 Recipe Creation

6.4.1 How to Edit a Flat Recipe

Follow the steps outlined below in the BATCH Recipe Editor:

1. Select the menu command Recipe > New > Flat recipe (for a master recipe) or Library element: Substructure .

   Result: A new editing window is displayed for editing level 1.

2. Enter the topological structure of the recipe in editing window 1 and any nested editing windows (substructures).
   Required substructures (= SUB) can be created with the "recipe procedural element". By double-clicking on a "SUB", opens the editing window for the substructure.

   - To create a new recipe element, select one of the following buttons in the toolbar:

     Result: The element attaches to the mouse pointer.

   - Move the mouse to the required position in the editing window and click.

     Result. The element is inserted. The icon for the recipe element is still attached to the mouse pointer. The function of the mouse pointer changes only when you select a different element.

   - Click (selection arrow) or press the ESC button to change from the editing to the select mode again.

3. Assign the unit to a unit class in the Properties dialog for each recipe step. Select with the **Object properties** command in the context-sensitive menu for the recipe step.

4. Select the recipe elements one after the other and make the other settings you require in the corresponding Properties dialog By selecting the **Object properties** command in the relevant context-sensitive menu (selected with the right mouse button).

5. Check the validity of the recipes By selecting the menu command **Recipe > Validate**.

6. Save the recipe at the required location in the tree structure of BatchCC By selecting the menu command **Recipe > Save As**.

Result: After creating/inserting the recipe, its status is "in progress". In this status, it can be modified at any time or can be released for testing or production.

Help

Make use of the integrated online help when editing recipes:

- Each Properties dialog has a "Help" button.

- You can obtain direct help on any structure element by selecting the recipe

    element in the editing window + <F1> or with ![help cursor icon]

Options when Editing Recipes

You edit the recipe and the recipe elements generally using either the context-sensitive menu for the object or using the **Edit** menu of the menu bar:

- Assignment of the Unit with a Flat Recipe

- Necessary and possible recipe structure elements

- Setting the Properties of the Header Parameters

- Setting the Properties of Steps

- Setting the Properties of Transitions

- Validating Recipes

- Releasing a Recipe for Testing or Production

- Revoking a Release

6.4.2 How to Edit a Hierarchical Recipe

Follow the steps outlined below in the BATCH Recipe Editor:

1. Select the menu command Recipe > New > Hierarchical recipe (for a master recipe) or Library element: Recipe operation .

Result: When you create a hierarchical recipe, a new editing window for an RUP is displayed (editing level 1). When you create a recipe operation, a window is displayed with a basic ROP structure (with Start and End) (editing level 2).

2. If you have a hierarchical recipe, first insert a recipe procedural element (**Insert > Recipe procedural element**).

The first RUP is displayed.

3. Assign the unit to a unit class in the Properties dialog for the recipe unit procedure (RUP) Select with the command **Properties** in the RUP or Library operation context-sensitive menu ("Assignment" tab).

Note:

Always make the assignment between the unit class and unit before configuring the individual recipe steps. As a result, only the phases actually available in the unit class/unit are displayed for selection in the Properties dialogs of the phases.

---

4. Enter the remaining topological structure of the recipe in the editing windows.

   - Select one of the following buttons in the toolbar:

     Result: The element attaches to the mouse pointer.

   - Move the mouse to the required position in the editing window and click.

     Result. The element is inserted. The icon for the recipe element is still attached to the mouse pointer. The function of the mouse pointer changes only when you select a different element.

   - Click (selection arrow) or press the ESC button to change from the editing to the select mode again.

5. Select the recipe elements one after the other and make the settings you require in the corresponding Properties dialog By selecting the **Object properties** command in the relevant context-sensitive menu (selected with the right mouse button).

6. Check the validity of the recipes By selecting the menu command **Recipe > Validate**.

7. Save the recipe at the required location in the tree structure of BatchCC By selecting the menu command **Recipe > Save As**.

Result: After creating/inserting the recipe, its status is "in progress". In this status, you can modify it at any time or released it for testing or production.

Help

Make use of the integrated online help when editing recipes:

*   Each Properties dialog has a "Help" button.

*   You can obtain direct help on any structure element by selecting the recipe

    element in the editing window + <F1> or with

Options when Editing Recipes

You edit the recipe and the recipe elements generally using either the context-sensitive menu for the object or using the **Edit** menu of the menu bar:

*   Assignment of the Unit with a Hierarchical Recipe

*   Necessary and possible recipe structure elements

*   Setting the Properties of the Header Parameters

*   Setting the Properties of Steps

*   Setting the Properties of Transitions

*   Validating Recipes

*   Releasing a Recipe for Testing or Production

*   Revoking a Release

6.4.3 Unit Assignment

6.4.3.1 Assignment of the Unit with a Flat Recipe

The unit class and the unit are specified individually in the object properties for each recipe step. The unit assignment is made according to the structure of the plant hierarchy in the engineering system. This means that when additional levels were added to the 3-level batch hierarchy, for example an area level between process cell and unit, these are also available as selection criteria in the unit assignment to help make the hierarchy clearer.

If you are not using the online assignment of a unit, proceed as described below.

Steps Required in the BATCH Recipe Editor

1. Open the recipe.

2. Select a recipe step.

3. Select the **Object properties** command in the context-sensitive menu (with the right mouse button).

4. Select the "New assignment" button.

The "Allocations" dialog opens.

5. First select the representation of the tree structure:

   - Class view: All unit classes without an area structure are listed in the "Unit selection" field.

   - Area view: All areas with the units they contain are listed in the "Unit selection" field.

   - Class view without instances: All unit classes (without the units they contain) are displayed. This setting allows recipes to be created even when no units are configured in the basic engineering.

6. Select the unit class in the "Unit selection" field and deselect the units (unit candidates) that are not suitable for this recipe unit procedure.

The unit classes and units available originate from the basic engineering. By selecting a unit class and then deselecting the unit candidates, you restrict the phases that can be used in the execution of this recipe unit procedure (displayed in the "Available functions" field).

7. If necessary, select a preferred unit in the "Preferred unit" field.

If no other allocation is made before creating a batch, the unit specified as preferred will be used to make the batch.

8. Confirm your selection with OK.

Result: This assignment is displayed in the Properties dialog of the recipe element. When assigning phases to the recipe element only the phases that can be executed by all the units selected are available.

6.4.3.2 Assignment of the Unit with a Hierarchical Recipe

A recipe unit procedure (RUP) is designed for a unit class and a specific unit. The unit class and the unit are specified in the object properties of the RUP. The unit assignment is made according to the structure of the plant hierarchy in the engineering system. This means that when additional levels were added to the 3-level batch hierarchy, for example an area level between process cell and unit, these are also available as selection criteria in the unit assignment to help make the hierarchy clearer.

If you are not using the online assignment of a unit , proceed as described below.

Steps Required in the BATCH Recipe Editor

1. Open the recipe.

2. Select a RUP (the column is shown on a light blue background).

3. Select the **Object properties** command in the context-sensitive menu (with the right mouse button).

4. Select the "Allocation" tab.

5. First select the representation of the tree structure:

   - Class view: All unit classes without an area structure are listed in the "Unit selection" field.

   - Area view: All areas with the units they contain are listed in the "Unit selection" field.

6. Select the unit class in the "Unit selection" field and deselect the units (unit candidates) that are not suitable for this recipe unit procedure.

The unit classes and units available originate from the basic engineering. By selecting a unit class and then deselecting the unit candidates, you restrict the phases that can be used in the execution of this recipe unit procedure (displayed in the "Available functions" field).

7. If necessary, select a preferred unit in the "Preferred unit" field.

If no other allocation is made before creating a batch, the unit specified as preferred will be used to make the batch.

8. Confirm your selection with OK.

Result: This allocation is displayed in the Properties dialog of the recipe elements shown (where it cannot be changed). When assigning phases, only the phases that can be executed by the units still selected are available.

6.4.3.3 Process Cell Optimization with Online Assignment of a Unit

Definition

When optimizing the process cell with online assignment, the unit recipe is assigned to the unit at the last possible moment. If the unit is not assigned when the batch is being made, the "online assignment" function becomes active.

"Online assignment" provides the following three options (strategies) for optimizing the utilization of units:

- Default unit: If no other selection is made before the batch is created, the default unit is used for the batch.

- Unit longest not used: The unit longest out of use is used

- Process parameter: The variable selected in the process parameter field decides the unit to be used.

Steps Required in the BATCH Recipe Editor

1. Open the recipe.
2. Select
   - the recipe step of a flat recipe
   - the RUP of a hierarchical recipe (column shown on a light blue background).
3. Select the **Object properties**command in the context-sensitive menu (with the right mouse button).
4. Select the "Allocation" tab.
5. In the "Strategy" box, enter one of the options described above for online assignment.
6. If you select the process parameter option, select the relevant formula parameter.

You can select the parameter with the "Unit" data type from a list box that will decide which unit is selected when the batch is made.

7. Confirm your selection with OK.

6.4.4 Inseting and Labeling Recipe Elements

6.4.4.1 Recipe procedural element (Insert Menu)

With this function, you can insert recipe steps of the type recipe procedural element within a recipe. This step element is a substitute object for the steps and step sequences stored within the nested hierarchy level.

- Hierarchical recipe: RUP, ROP, RPH
- Flat recipe: Substructure

Open or double-click:

The window for editing the recipe steps or step sequences in the nested hierarchy level is opened for the selected object.

Properties

The properties of the step elements and the underlying step sequence are identical. The data in the "General", "Input material", "Output material", "Parameters" (process parameters), and "Process tags" tabs can be edited.

- Hierarchical Recipe
  By installing it in the corresponding unit column, the unit class and, if selected, a preferred unit for creating a batch are specified.

- Flat Recipe
  The unit class/unit can be assigned singly (even a different unit class/unit) to each recipe step in the "General" tab.

Insert function:

The insert function is closed for this object by clicking the selection arrow or a different object to be inserted (menu or toolbar) or with ESC.

6.4.4.2   Library reference (Insert Menu)

With this function, you can insert recipe steps of the type library reference within a recipe unit procedure (RUP). This step element is the substitute object for a sequence (library operation) stored in the recipe library. In the Properties window of the library reference, you specify the link to the library operation. You can only select the library operations available for the selected unit class.

Open:

The window displaying the recipe step sequence stored in the library is opened for the selected object. To change the step chain in the library, you have to open it via Open library object... (Recipe menu).

Properties

The properties of the step elements and the underlying step sequence are identical. By installing it in the corresponding unit column of a hierarchical recipe, the unit class and, if selected, a preferred unit for creating a batch are specified. The data in the "General", "Input material", "Output material", "Parameters" (process parameters), and "Process tags" tabs can be edited.

Insert function:

The insert function is closed for this object by clicking the selection arrow or a different object to be inserted (menu or toolbar) or with ESC.

6.4.4.3   Recipe phase (Insert Menu)

This function inserts recipe steps of the recipe phase type (RPH). In the Properties dialog in the sequence window for the recipe unit procedure, you can link a step with a recipe phase of the type EOP or EPH. In the sequence window for the recipe operation or a single level recipe, you can link a step with a recipe phase of the type EPH.

Properties

By installing it in the corresponding unit column of a hierarchical recipe, the unit class and, if selected, a preferred unit for creating a batch are specified. The data in the "General", "Input material", "Output material", "Parameters" (process parameters), and "Process tags" tabs can be edited.

To link the recipe steps with the data of the basic control, the configuration data of the corresponding process cell must be read in or updated with the BATCH object manager.

Insert function:

The insert function is closed for this object by clicking the selection arrow or a different object to be inserted (menu or toolbar) or with ESC.

6.4.4.4   Operator instruction (Insert Menu)

This function inserts recipe steps of the operator instruction type.

The operator instruction allows instructions to be displayed to operators during the processing of a recipe. A distinction is made between output of

- pure instructions (NOP step):
    - without acknowledgment; in other words the recipe is not stopped. Example: Please put on protective glasses!
    - with acknowledgment; in other words, the recipe is stopped until the operator acknowledges. Example: Please close valve V127.
- an instruction with input option (operator dialog)
    - without acknowledgment, example: input of actual analysis values.
    - with acknowledgment, example "manual dosing": The operator sees which material and how much should be added. The operator enters the actual values of the material added and confirms (acknowledges).

Entered values (actual values) can be used as setpoints for subsequent recipe phases/operations. The actual values can also be evaluated in transitions, example: Sample good? yes/no. In this case, an acknowledgment must be set in the parameters

Properties

Regardless of the unit, only those phases are available that were released for operator instructions in the engineering system. It is advisable to configure special manual operations with the Engineering System that are then available for all units.

The data in the "Instruction", "General", "Input materials", "Output materials", and "Parameters" (process parameters), and tabs can be edited.

Depending on the phase selected in the "General" tab, it is possible for the operator to enter parameter values (= instruction with input option). The parameter values set in the "Input material", "Output material", "Parameter" (process parameter) tabs are then the setpoints for the operator.

Insert function:

The insert function is closed for this object by clicking the selection arrow or a different object to be inserted (menu or toolbar) or with ESC.

6.4.4.5   Transition (Insert Menu)

With this function, you can insert a Transition in the BATCH recipe editor.

In the recipe window with the units, the recipe operations can be executed without a transition. You can, however, also insert several transitions between steps and synchronization points.

In the sequence window for the recipe operation, when you insert a transition, you also insert a step so that there is always a step between two transitions. Depending on the point at which you insert the transition, the order of the step and transition may be reversed.

Properties

Data in the "General" and "Condition" tabs can be edited. To form the transition conditions, the process variables defined in the corresponding recipe level (parameters from the properties of a ROP or RUP), fixed values and all the values acquired with the TAG_COLL block can be used.

6.4.4.6   Simultaneous sequence (Insert Menu)

In the BATCH Recipe Editor, this function inserts an AND divergence. The steps and transitions of the Simultaneous sequences are executed at the same time. Control is passed to the successor transition or successor step only when the last steps and transitions of the simultaneous sequences have been executed or are satisfied.

With simultaneous sequences, the sequence paths are processed only when all paths can be processed. This ensures, for example, that it is only possible to "heat" when the "agitator" is active.

Note:

If 2 equipment phases of the same unit are installed in one simultaneous sequence and one of the two phases is in automatic mode and the other in manual, during processing, the unit will be occupied by the equipment phase in automatic mode.

At this point, execution of the simultaneous sequence stops. Even the equipment phase in the automatic mode, that is occupying the unit is not processed.

Selection:

Clicking the double line selects the entire simultaneous sequence. If you click one of the lines that join the double lines from within the simultaneous sequence, you select a sequence.

To select an parallel sequence with a lasso, both double lines and a certain amount of space to the right and left between the individual objects (structure elements) must be included within the lasso frame.

Inserting:

Follow the steps below to insert simultaneous sequences in the diagram in the BATCH Recipe Editor:

1.   Select the menu command **Insert > Simultaneous** sequence or click the corresponding button in the toolbar.

2.   Click between two objects in the diagram.

Follow the steps below if you require a parallel procedure to an existing structure in the BATCH Recipe Editor:

1. Select the menu command **Insert > Simultaneous** sequence or click the corresponding button in the toolbar.

2. Position the mouse pointer above the first object for which you require a simultaneous sequence.

3. Hold down the mouse button and drag the mouse pointer below the last object to be enclosed in the simultaneous sequence.

Notes:

- While you drag the mouse pointer, a line is displayed that indicates which parts will be included if you release the button at the present position.

- Depending on whether you release the button to the left or right of the vertical line, a new simultaneous sequence is added to the left or right.

- You can cancel this operation by returning the mouse pointer to the initial position or by pressing the ESC key.

6.4.4.7 Alternative sequence (Insert Menu)

In the BATCH Recipe Editor, this function inserts an OR divergence.

An alternative sequence consists of at least two vertically arranged sequences joined at top and bottom by a single horizontal line. Each alternative sequence begins with a transition whose evaluation decides whether the sequence is executed or not. The transitions should be created so that the results select only one path.

Selection:

If you click one of the two horizontal lines, you select the entire alternative sequence. If you click one of the lines that join the horizontal lines, a sequence is selected.

To select an alternative sequence with a lasso, both horizontal lines and a certain amount of space to the right and left of the individual objects (Structure Elements must be included in the lasso frame.) must be included in the lasso frame.

Inserting:

Follow the steps below to insert alternative sequences in the diagram in the BATCH Recipe Editor:

1. Select the menu command Insert **>** Alternative sequence or click the corresponding button in the toolbar.

2. Click between two objects in the diagram.

If you require an alternative procedure to an existing structure in the BATCH Recipe Editor, follow the steps outlined below:

1. Select the menu command **Insert > Alternative sequence or** click the corresponding button in the toolbar.

2. Position the mouse pointer above the first object for which you require an alternative sequence.

3. Hold down the mouse button and drag the mouse pointer below the last object to be included in the alternative sequence.

Notes:

- While you drag the mouse pointer, a line is displayed that indicates which parts will be included if you release the button at the present position.

- Depending on whether you release the button to the left or right of the vertical line, a new alternative sequence is added to the left or right.

- You can cancel this operation by returning the mouse pointer to the initial position or by pressing the ESC key.

6.4.4.8   Synchronization (Insert Menu)

With synchronization, you can coordinate the execution of recipe sequences in the units and between the units (hierarchical recipe). Synchronization is also possible in the sequences of the same simultaneous sequence (hierarchical recipe, flat recipe).

At each synchronization point, you can decide whether or not the sequence is halted. If you select Blocking , the sequence waits until the other involved sequences have reached or had reached the synchronization line (may have continued during). if Blocking is not selected, the sequence does not wait for the other sequences. The fact that the synchronization point was reached is nevertheless recorded.

Inserting:

Follow the steps outlined below if you require synchronization between the units of a hierarchical recipe in the BATCH Recipe Editor:

1. Select the menu command **Insert > Synchronization** or click the corresponding button in the toolbar.

2. Drag the mouse starting between two objects of the first recipe unit procedure (RUP) to a point between two objects of the recipe unit procedure (RUP) you want to synchronize. If there are other sequences between the RUPs, these are not included in the synchronization.

Extending:

1. Select the menu command **Insert > Synchronization** or click the corresponding button in the toolbar.

2. Beginning at a synchronization point (junction between the sequence line and synchronization lines) drag the mouse pointer until it is located between two objects of the recipe unit procedure (RUP) you want to add in to the synchronization.

To remove a synchronization point:

You can select and delete individual synchronization points or the synchronization line.

Properties

You can assign a name to the synchronization and decide whether or not execution is to be halted individually for each synchronization point.

Appearance of the synchronization point:

Synchronization point is displayed as a double line and the sequence line is interrupted if a synchronization point is for the sequence and lock was selected.

A Synchronization point is displayed as a single line, if it is a Synchronization point for the sequence and if the property lock **was not not** selected.

A synchronization point is displayed as a double line and the sequence line is not interrupted if it is **not** a synchronization point for the sequence.

Note:

A synchronization line cannot begin or end in alternative sequences, simultaneous sequences or loops. All intersections must be located directly in the RUPs or in sequences of the same simultaneous sequence

---

6.4.4.9   Loop (Insert Menu)

With this function, you can insert a loop in the Batch Recipe Editor . In the return path, a transition is inserted first. In the straight sequence, there must also be a transition following the loop. In these transitions, you must define conditions that clearly specify the sequence.

Inserting:

Follow the steps below to insert loops in the diagram in the BATCH Recipe Editor:

1. Select the menu command **Insert > Loop** or click the corresponding button in the toolbar.

2. Click between two individual objects (structure elements) to insert a loop with a step placeholder and a transition in the return path. By selecting the required recipe element and clicking on the placeholder, this is replaced by the required function.

Follow the steps below if you want to iterate an existing sequence of objects with a loop in the BATCH Recipe Editor:

1. Select the menu command **Insert > Loop** or click the corresponding button in the toolbar.

2. Press the left mouse button with the pointer located in the gap after the last object to be included in the loop.

3. Hold down the button and drag the mouse pointer upwards until all the required objects are included and then release the mouse button.

Deleting:

Select the entire loop and press the delete key to delete the content. If you only select the transition in the return path, the loop body remains after deleting.

Notes:

*   While you drag the mouse pointer, a line is displayed that indicates which parts will be included if you release the button at the present position.

*   You can cancel this operation by returning the mouse pointer to the initial position or by pressing the ESC key.

Select:

You can select a loop as follows:

*   by clicking on one of the horizontal lines at the top or bottom,

*   by clicking on the return path line,

*   by clicking on one of the lines of the sequence in the body of the loop, or

*   by opening a lasso while holding down the left mouse button that includes the entire body of the loop as well as the transition in the return path.

6.4.4.10 Working with Substructures

By clicking on the icon or selecting with a lasso, you can select a substructure. To change to the substructure, double-click on the icon of the substructure. A new window opens showing the content of the substructure.

Note:

Substructures can only be created in flat recipes!

Note:

Substructures have the same functional possibilities as ROPs in hierarchical recipes (parameter assignment options, process tag definition, upload and download formula parameters in the recipe, library objects)

Inserting:

Follow the steps below to insert substructures in the BATCH Recipe Editor:

1. Select the menu command **Insert > Recipe procedural element** or click the corresponding button in the toolbar.

2. Click between two individual objects (structure elements) or on a substructure placeholder.

Deleting:

Select the substructure box and press the delete key to delete the content.

If you do not want to delete the content of the substructure, select the menu command **Edit > Resolve substructure**. The content of the substructure is then embedded in the diagram instead of the substructure box.

Nesting depth:

A substructure itself can contain other substructures. The permitted nesting depth can be set with the menu command **Options > Settings**.

Once the maximum depth is reached, two reactions can be configured:

• The action (pasting from the clipboard, inserting a substructure, including in a substructure) is rejected with an error message,

• the deepest substructures are resolved (embedded).

The latter can lead to an inserted substructure disappearing again before it becomes visible because it would cause the nesting depth to be exceeded.

6.4.4.11 Adding Comments to Structure Elements

With the menu command **Edit > Text**, you open a dialog box in the BATCH Recipe Editor in which you can enter a comment for the object (structure element) selected in the recipe.

Note:

The text of the comment is displayed beside the objects if you activate the object comments with the menu command **View >**Comment.

6.4.5 Setting Recipe Properties

6.4.5.1 Passing Formula Parameters in the Recipe

Passing Formula Parameters in the Recipe

The same formula parameter can be used more than once in different recipe steps of various types. A formula parameter can also be used at the same time in transition conditions.

The schematic below shows the possible use of a formula parameter.
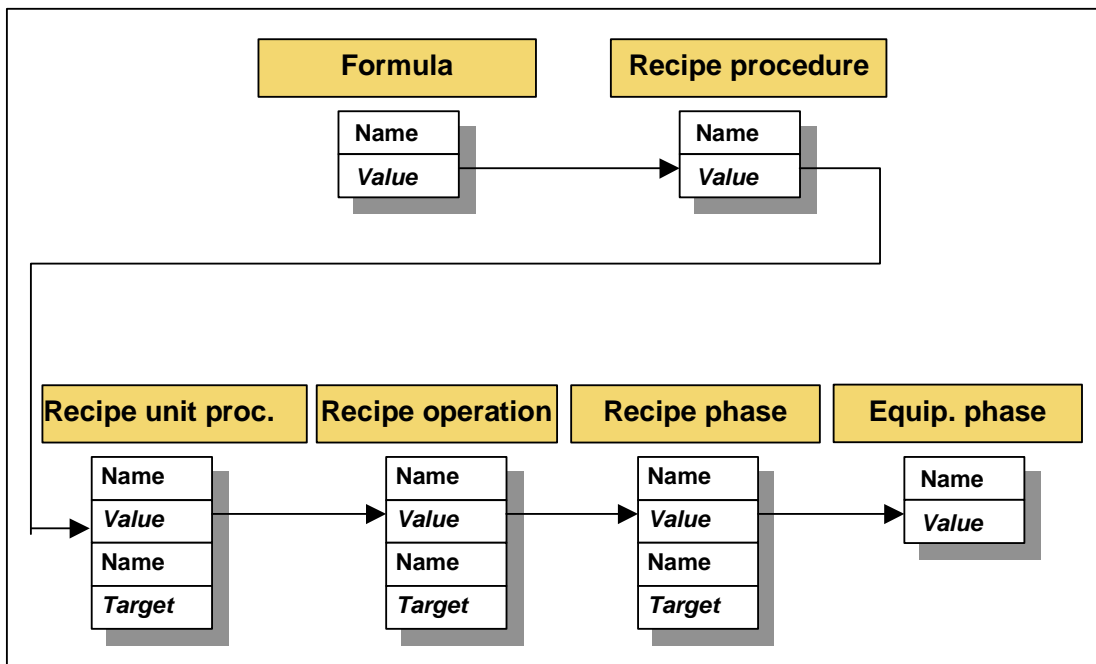
6.4.5.2 Uploading and Downloading Formula Parameters in the Recipe

Uploading and Downloading Formula Parameters in the Recipe (= defer relations)

Parameter values (setpoint and process value) can be passed between the structure elements of the recipe hierarchy in both directions while the recipe is executing. During the creation of the Recipe properties and the individual recipe steps, you can enter the corresponding comment for each input material/output material and process parameters:

- Source

- Target

Reference to Source

A source (setpoints) from the next higher level can be assigned for the recipe objects RUP, ROP, RPH and SUB.

Example: An input material in RUP can be the source for an input material in a ROP. The name of the input material is referenced.

Source = recipe procedure (RP)

Note:

Only parameters of the recipe steps and transitions that reference the level of the recipe procedure as the source ("uploaded" recipe header parameters) can be used as formula parameters for batch planning.

Reference to Target

For the RUP, ROP, RPH, and SUB recipe objects, the recorded process values can be passed on to the next higher level.

Example: A process value in the ROP can have a parameter in a RUP as its target. This allows the process value of a step to be used as the setpoint for a subsequent step. The name of the parameter is referenced.

Note:

Parameters with a reference to a data source cannot be used as target parameters.

Example of a Hierarchical Recipe

Recipe operation 1 (ROP)	Recipe unit procedure(RUP)

Name ABC
Value
Source
Target — Name

Name XYZ
Value
Source
Target — Name

①

②

Recipe operation 2 (ROP)

Name ABC
Value
Source — Name
Target

① Recipe operation 1 uploads the process value fetched from the equipment phase to the recipe unit procedure

② Recipe operation 2 reads the setpoint used as recipe phase parameter or transition variable from the recipe unit procedure (download)

6.4.5.3 Setting the Properties of the Header Parameters

In the properties of the recipe header (recipe header parameter), configure the Properties of the recipe . The material and production data and the process parameters contain all the parameters passed up for operator instructions (formula) from those in the recipe procedure elements (RUPs, ROPs and RPHs) lower in the hierarchy. Further parameters can be added to these.

Opening the Tab

There are two ways in which you can open the "Properties of <Recipe name>" tab:

- in the BATCH Control Center: See the section on "BatchCC"
- In the BATCH Recipe Editor: As described below

Follow the steps outlined below in the BATCH Recipe Editor:

1. Open the recipe.
2. Select the menu command Recipe > Header parameters.

Result: The "Properties of the <recipe name>" dialog is displayed with the header parameters. In the dialog tabs, all the Properties of the recipe are available, which must/can be specified for a recipe in addition to the recipe structure. This is the same Properties dialog that you can select with the **Edit > Properties** menu command in BatchCC.

Some of the properties (parameters) already have a fixed value due to the detailed configuration of the individual recipe elements (RUPs, ROP, EPHs, transitions) following the basic control. You can recognize parameters or settings that can still be modified by the white editing fields.

3. Make the settings you require in the tabs and confirm with OK.

Entering Properties

You enter the properties of the recipes in the following tab. Click the "Help" button for context-sensitive help on each individual input or output box in the tab.

```
Properties of 'Recipe_REA1'                                              [X]
┌──────────────────────────────────────────────────────────────────────┐
│  📲 Output material │ 🕘 Parameters │ 📷 Process tags │ ✏ Modifications │
│   General    │ 🗓 Allocations │ 📲 Product │ 📲 Input material │
│                                                                        │
│  Name:                            Status:                              │
│  ┌──────────────────────────┐     ┌──────────────────────────┐        │
│  │Recipe_REA1               │     │in progress               │        │
│  └──────────────────────────┘     └──────────────────────────┘        │
│                                                                        │
│  Version:                         Formula category                     │
│  ┌──────────────────────────┐     ┌──────────────────────────┐ ▼      │
│  │V1.0                      │     │Formula_300701            │        │
│  └──────────────────────────┘     └──────────────────────────┘        │
│                                                                        │
│  Duration:                                                             │
│  ┌──────────────────────────┐                                         │
│  │00                        │                                         │
│  └──────────────────────────┘                                         │
│  Sec                                                                   │
│  Description:                                                          │
│  ┌────────────────────────────────────────────────────────┐ ▲        │
│  │                                                          │          │
│  │                                                          │          │
│  │                                                          │          │
│  │                                                          │ ▼        │
│  └────────────────────────────────────────────────────────┘          │
│                                                                        │
│  ┌────────────┐                      ┌──────────┐    ┌──────────┐     │
│  │    OK      │                      │  Cancel  │    │   Help   │     │
│  └────────────┘                      └──────────┘    └──────────┘     │
└──────────────────────────────────────────────────────────────────────┘
```

Reference to Formula Category

With the "Category" input box in the "General" tab, you assign the formula category with the required structure for material and production data (formula) to the master recipe. This is only possible when the formula category has already been created in BatchCC. You can set this option in BatchCC later.

See section: Connection between the recipe header parameter, formula category and formula

Electronic Signatures

Actions and status changes of recipes can be signed. You configure electronic signatures in the "ESIG" tab.

See also section: Specifying the Electronic signature

6.4.5.4 Setting the Properties of Steps

Properties of the Steps

In the object properties of the recipe procedure elements (RUP, ROP, NOP, RPH, SUB) you define the material and production data (formula) and the parameters for each individual element. The parameters for input materials, output materials and process parameters for the recipe phases in the sequences are specified by assigning the recipe phase (of the type EOP, EPH). Further parameters can be added to these.

Follow the steps outlined below in the BATCH Recipe Editor:

1. Open the master recipe.

2. Select a recipe procedure element.

3. Select the **Object properties** command in the context-sensitive menu (with the right mouse button).

Result: the dialog box "Properties of <Batch name>" is displayed. The tabs in the dialog contain all the properties that must or can be specified for the relevant recipe procedural element.

4. Make the settings you require in the tabs and confirm with OK.

Entering Properties

You enter the properties of the steps in the tabs displayed. Click the "Help" button for context-sensitive help on each individual input or output box in the tab.

	Name	Source	Material	Code	Low limit	Quantity	High
1	Input material		Material7	34		0	
2	Input material		Material7	34		0	

Properties of 'Pressor CWXY'

Tabs: Parameters | Process tags | General | Input material | Output material

List:

Description from row 1:

New
Delete

OK   Cancel   Help
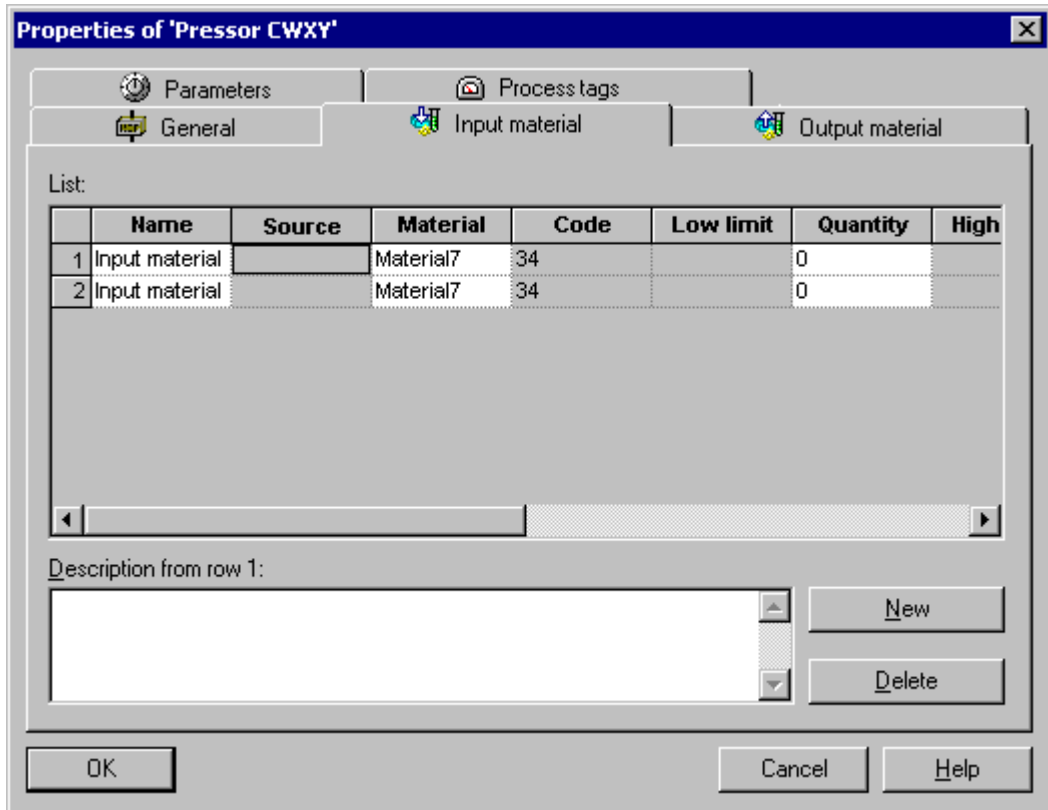
Passing Parameters

Using the "Source" and "Target" table columns, you can interconnect the parameters of different hierarchical levels in both directions (mouse click on the button beside the parameter):

- For the recipe objects RUP, ROP, and RPH, you can select a source from the next higher level. Example: A parameter in the recipe procedure can be the source for a parameter in an RUP.

Note:

Parameters of the recipe steps that reference the recipe procedure level as the source ("uploaded" header parameters) can be used as formula parameters for batch planning.

- For the RUP, ROP, RPH, and SUB recipe objects, the recorded process values can be passed on to the next higher level. Example: A process value in the RUP can have a parameter in the recipe procedure as its destination. This allows the process value of a step to be used as the setpoint for a subsequent step.

Note:

Parameters can only be passed when the parameter types and units of measure match.

Note:

Parameters with a reference to a data source cannot be used as target parameters.

Properties of Library References

Note:

In the Properties dialog of a library reference, most properties of the library operation are displayed and cannot be modified. To modify the properties, you must open the library operation explicitly in the BATCH Recipe Editor.

Scaling with Minimum and Maximum Limit

The physical limits of the process cell instance is displayed as limit values. If you the setpoint value is adjusted, the possible minimum and maximum setpoint values are displayed additionally in the tool tip.

If you remain within these limits (tooltip), the permissible quantities of a Batch between the "minimum quantity of a Batch" and the "maximum quantity of a Batch" is guaranteed.

Setpoints outside the limits specified in the tooltip are also possible. In the event of this, warnings are issued during Plausibility and the quantity of a Batch is limited.

Minimum limit:

This displays the minimum value of the parameter that would be of practical value as the setpoint. If a discrete parameter type or text parameter is set for this parameter (in other words not "floating point" type!), there is no minimum limit since only permitted entries are displayed as the value. If scaling is selected, the value depends on the reference scale and the minimum limit of the actual amount from the recipe header.

The minimum limit is calculated so that the parameter value cannot fall below the lower limit of the block following scaling.

Value:

Here, you can enter the set point. A default value is displayed that is taken from the data of the basic control. The value entered must be between the upper and lower limits.

There are several possible reasons for a violation of the limits:

- The limits in the process cell data are too narrow.

- Scaling is too extreme.

- The limits for the batch quantity (see header parameters) are too far away from the reference quantity.

Upper limit:

This displays the maximum value of the parameter that would be of practical value as the setpoint. If a discrete parameter type or text parameter is set for this parameter (in other words not "floating point" or "integer" type!), there is no upper limit since only permitted entries are displayed as the value. If scaling is selected, the value depends on the reference scale and the upper limit of the actual amount from the recipe header.

The upper limit is calculated so that the parameter value cannot exceed the upper limit of the block following scaling.

If the upper limit is lower than the lower limit so that it is not possible to enter a correct value, the reason is that the range between the upper and lower limit in the header parameters is too great or that the scaling used would push the value beyond the limits.

Electronic Signatures

Actions and status changes of recipes steps can be signed. You configure electronic signatures in the "ESIG" tab.

See also section: Specifying the Electronic signature

6.4.5.5 Setting a Recipe Phase for "Continuous Operation"

During creation of a recipe, a flag can be set to define a recipe phase that is not self-terminating so that this recipe phase (equipment phase) is not terminated in run time until it receives a termination command from another recipe phase or until the unit recipe procedure that it is in completes.

- This is necessary when an equipment phase (for example, agitating) is required to continue after recipe operations.

- A second application is the setting of different parameters for the equipment phase without having to turn it off and on again (for example during a flying control strategy change).

Follow the steps outlined below in the BATCH Recipe Editor:

1. Open the master recipe.
2. Select a recipe procedure element.
3. Select the **Object properties** command in the context-sensitive menu (with the right mouse button).

Result: the dialog box "Properties of <Batch name>" is displayed.

4. Activate the "Continue" check box
5. Confirm with OK.

6.4.5.6 Setting the Control Strategy of a Recipe Phase

Recipe phases can be implemented with various control strategies (set of setpoints) that can be used by in the manual mode or in the automatic mode (recipe mode). The control strategies are configured along with their parameters in the engineering system. In the Recipe Editor, the control strategies defined in this way are available in plain language under the name of the control strategy. During parameter assignment, only the parameters belonging to the selected control strategy are displayed.

Follow the steps outlined below in the BATCH Recipe Editor:

1. Open the master recipe.

2. Select a recipe procedure element.

3. Select the command **Object Properties** in the context-sensitive menu (selection via right-mouse button).

Result: the dialog box "Properties of <Batch name>" is displayed.

4. Select the required control strategy of the recipe step in the "Control strategies" field.

Result: In the tabs "Input material", "Output material" and "Parameters", only the parameter values belonging to the selected control strategy and thus the valid parameter for this recipe step are displayed.

5. Confirm with OK.

6.4.5.7   Allowing Online Modification of Setpoints

Introduction

During batch control, the parameters (setpoints) of the control recipe can be modified by the operator (for example the speed of an agitator can be changed without stopping it). The following parameter values can be changed:

- Input materials

- Output materials

- Process parameters

How Modification Affects RPHs and the Operator Dialog

The new values are immediately available for all recipe phases (EPH, EOP) and operator dialogs not yet active.

If recipe phases (EPH, EOP) and operator dialogs are running, you can choose between the following two options:

- If the recipe step is currently being processed there will be no reaction to the operator modifying the parameter. The modified parameter only will become effective when the step is processed again.

- If the recipe step is currently being processed, parameter values changed by the operator will become effective immediately; in other words, they are transferred from the running recipe step in the control recipe directly to the controller where they take effect in the executing block.

How Modification Affects ROPs and the RUPs

The new values are available immediately for all not yet active recipe elements (ROP, RUP) and operator dialogs.

If the recipe element is currently being executed, there is no immediate reaction to the parameter change. Modified parameter values only take effect the next time the element is executed (for example positioning within a loop).

Specifying Whether Parameters can be modified for RPHs, Operator Dialogs, ROPs and RUPs

You specify whether or not parameter values can be modified in the Properties dialogs of the recipe elements RPH, operator dialog, ROP and RUP.

You open the properties dialog by selecting the recipe element and the **Properties** command in the context-sensitive menu.

You make the settings governing online changes to parameter values in the "Input materials", "Output materials" or "Process parameters" tabs in the "Modifiable" and "Effective immediately" columns (extra only for RPH and operator dialog).

Tip: via the system settings (**Options> Settings**), you can set the default value in the "Modifiable" and "Effective immediately" columns in the "General" tab of the properties dialogs of new parameters.

Result: During batch control, the parameter input fields can be edited and parameter values modified.

Online Response with Parameter References

With parameter references (data source, data target), the response is as follows:

- If parameters are marked as "Modifiable", the operator is permitted to enter new values.

- Implicit modification by the control recipe remains possible for parameters not marked as modifiable. If, for example, an interconnected parameter in a recipe phase is not modifiable, it can nevertheless be modified by an operator making a change in the recipe operation.

Even if the parameter is locked against modification in the recipe operation, a modification by target interconnections is still possible.

Modifications in Transitions

Process parameters updated at runtime can also be used in the evaluation of transitions.

You can specify that the modification should take immediate effect in the Properties dialog of the transition. Using the "Effective immediately" column for address 1 and 2, you can specify that the value of the process parameter will take immediate effect if it is changed.

6.4.5.8   Setting the Properties of Transitions

Properties of Transitions

In the properties of the transitions, you configure the step enabling conditions. The step enabling conditions are specified as **Boolean expressions**. A single condition always consists of two addresses (first address = variable, second address = variable or number) logically combined by a comparison operator.

Follow the steps outlined below in the BATCH Recipe Editor:

1. Open the recipe.
2. Select a transition.
3. Select the command **Object Properties** in the context-sensitive menu (selection via right-mouse button).

Result: the dialog box "Properties of <transition name>" is displayed. Configure the step enabling conditions in the "Condition" tab dialog.

4. Make the settings you require and confirm with OK.

Entering Properties

You enter the properties of the transitions in the tabs displayed. Click the "Help" button for context-sensitive help on each individual input or output box in the tab.
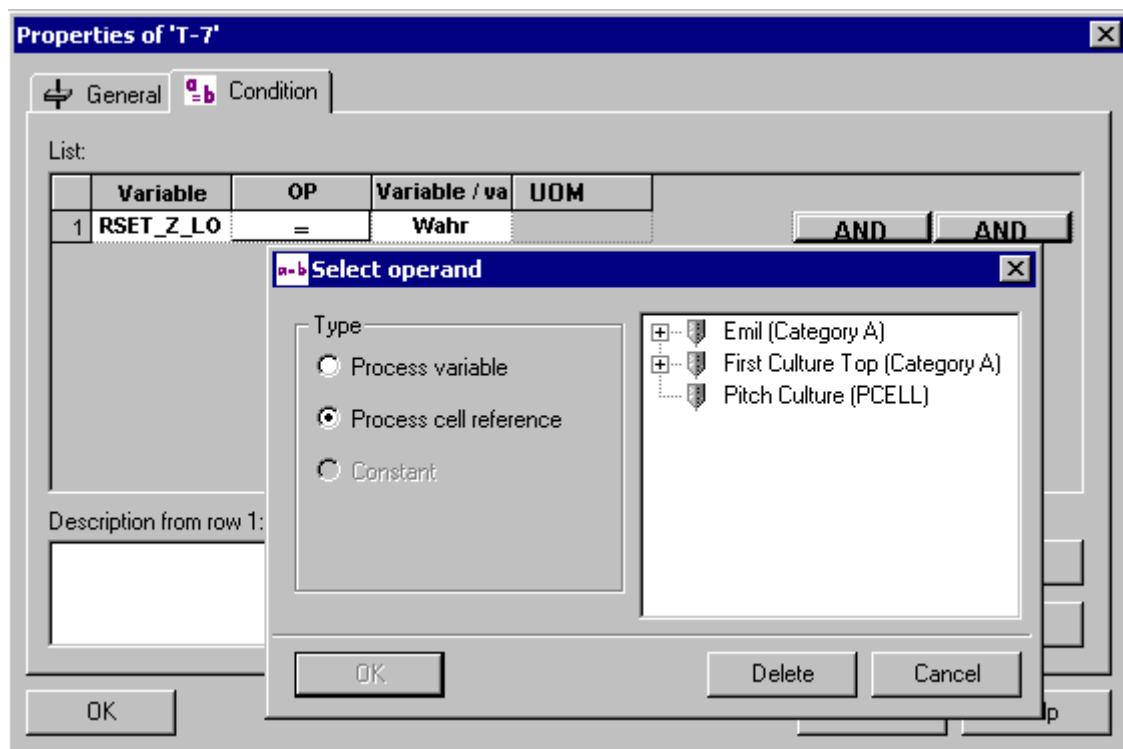
Parameter selection, independent of units

If you right-click when the pointer is on a new parameter and select "Variable" **>** Edit Cell, the "Select Address" dialog appears. Here you can select the parameters from basic control regardless of the units. When the batch is made, the required unit is selected along with the parameters specific to the unit.

Electronic Signatures

Actions and status changes of transitions can be signed. You configure electronic signatures in the "ESIG" tab.

See also section: Specifying the Electronic signature

6.4.5.9   Specifying the Properties of the Library Objects

Properties of Steps and Transitions

The properties of the steps and transitions within the library objects are entered in the relevant properties dialogs in the same way as with master recipes:

- Setting the Properties of Steps
- Setting the Properties of Transitions

Properties of the Header Parameters

The header parameters of the library operation in hierarchical recipes differ from those of master recipes only in the following way:

Unit class

A library operation is always created for a specific unit class. When you create a recipe in the BATCH Recipe Editor, the unit class is referenced in the "General" tab of the Properties dialog. A unit is not allocated. This occurs only when the operation is bound into the recipe unit procedure (RUP) of a master recipe as a library reference.

All other header parameters are configured in the same way as for a master recipe:

Setting the Properties of the Header Parameters

6.5 Other Functions

6.5.1 Saving Recipes and Library Objects

A new recipe is always opened with a default name after opening it with the menu command **New**. Before you complete editing, the recipe must be saved.

Follow the steps outlined below:

1. When you save for the first time, select the menu command **Recipe > Save As**.

2. In the next dialog you enter the name and version.

Result: The next time you save, you can use the **Save** command unless you want to change the name or version.

6.5.2 Validating Recipes

Definition

The validation covers the consistency of the library operations and process cell data used in the created recipe.

Requirement:

This is only possible when the recipe is edited with the elements step, transition, and structure element along with the corresponding configuration of the recipe data (header).

Steps Required in the BATCH Recipe Editor

1. Open the recipe you want to validate (master recipe or library object).

2. Select the menu command **Recipe > Validate**.

Result: A results list or error list is displayed that indicates whether or not the recipe header is completed, whether materials exist, whether steps and transitions in the recipe are configured and whether the normalized batch quantity is correct. Incorrect elements are displayed in red in the graphic recipe structure. Validation is also possible in BatchCC.

Note:

By double-clicking an entry in the error list, you can jump to the part of the recipe that caused the problem.

Note:

You can use the validation function at any time. Validation does not change the recipe status.

6.5.3　Releasing a Recipe for Testing or Production

Requirement:

The requirement for this function is the validation of the recipe. The validity of the recipe is first checked automatically when you start this command.

Follow the steps outlined below in the BATCH Recipe Editor:

1. Open the recipe you want to validate (master recipe or library object).

2. Select the menu command Recipe > Release for Testing or Release for Production.

Result: When it is released, the recipe has the status "released for testing" or "released for production". If errors occur in the validation, the problems are displayed and the recipe status remains "In Progress...". You can also release a recipe in BatchCC.

Note:

By double-clicking an entry in the error list, you can jump to the part of the recipe that caused the problem.

6.5.4 Revoking a Release

Note:

Only recipes that have not been released can be edited. If you want to edit master recipes or recipe objects that have already been released, the release must be revoked explicitly.

This is possible only when the option "Allow editing of recipes in the "Release revoked" status" is activated in the general settings of BatchCC. Navigate to this option via the menu command **Options > Settings** in the "General" tab.

Follow the steps outlined below in the BATCH Recipe Editor:

1. Open the recipe (master recipe or library objects).

2. Select the menu command **Recipe > Revoke release**.

Result: After revoking the release, a recipe released for testing has the status "being processed" and recipe released for production has the status "Release revoked" and can be edited.

You can also revoke a release in BatchCC.

7 Redundancy

7.1 Introduction

Availability

To increase the availability of the batch control and to allow a software update during operation, SIMATIC BATCH provides the option of installing a redundant BATCH Server. If there is a failure in the redundant system, there is a standby/master failover between the redundant BATCH Servers.

Redundancy is achieved with redundant BATCH Servers each with **local data management**. To safeguard data and to allow the batch applications to access the current data, the data is constantly synchronized between the two local data management systems (**data replication**).

It is guaranteed that after the failure of one BATCH Control Server or DB server, the redundant server can continue to work with the same data.

Configuration and Commissioning

Note:

To establish the software and hardware requirements and when configuring and commissioning redundant servers with the cluster solution in the PCS 7 V6.0 system, you should always consult your Siemens contact.

Further Reading Redundant PCS 7 OS

The manual Process Control System PCS 7; fault-tolerant process control systems contains an introduction to the general redundancy mechanisms in PCS 7. This documentation is on the "PCS 7; Electronic Manuals" CD. This is general documentation describing the overall concept of availability in PCS 7. This also includes, for example, more information on the redundant PCS 7 OS.

7.2 Sample Configuration - Fault-Tolerant Batch Control

The picture below shows a sample configuration with a redundant BATCH server and redundant PCS 7 OS (WinCC):
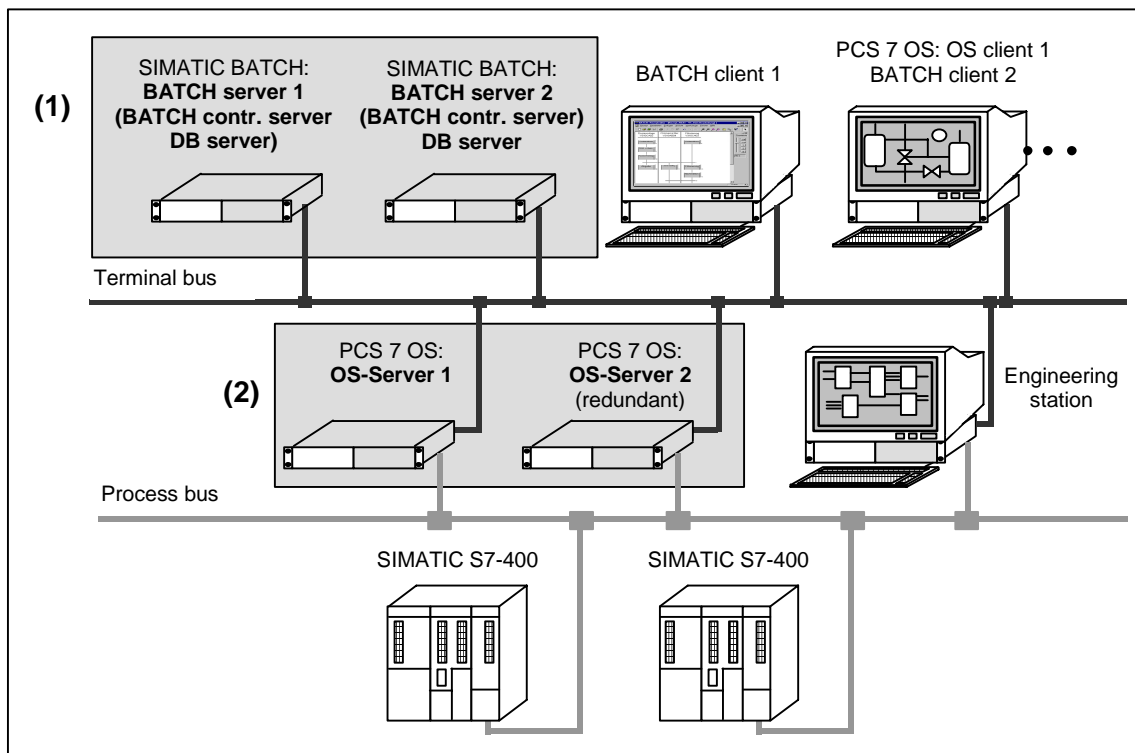
(1) Redundant BATCH Server

Redundancy is achieved with two BATCH Servers with a standby/master failover. The redundancy of the BATCH Servers guarantees that if a BATCH Server fails

- all BATCH clients (with the BATCH Recipe Editor and BatchCC (batch planning, batch control)) are immediately operable again following the failover and

- permanent acquisition of the batch data continues.

(2) OS Redundancy of the Standard PCS 7 Operator Stations

The redundancy of the distributed PCS 7 operator stations with an interface to the SIMATIC S7-400 is achieved by interconnected OS servers with data synchronization and backup of the archive data. The WinCC archives of the redundant OS servers are synchronized and contain the same data. The functionality is implemented with the "Redundancy" optional software of WinCC. For a description of the "Redundancy" optional software, refer to the manual *SIMATIC HMI; Options*.

The redundancy of the PCS 7 operator stations guarantees that the batch processes continue uninterrupted even if one of the two OS servers fails and the operator remains informed about the status of the process cell and can still intervene in the process.

7.3 Response in Run Time

Failover of the BATCH Server

The BATCH Control Server and batch data management are permanently active on both redundant BATCH Servers. From the prospective of the BATCH Server, there is no preferred server; in other words, both BATCH Servers access the same OS server when there are no failures in the system.

If the BATCH Server configured as the master fails, there is a failover to the BATCH Server (standby). This then becomes the master.

Possible Causes of a Failover

- Failure of the BATCH server PC (master), for example hardware fault or blue screen

- Failure of the network connection of the BATCH Server PC (BATCH Server no longer detects a client or its redundant BATCH Server)

- Failure of an application (BATCH Control Server, batch data management, Launch Coordinator)

Failover of the BATCH Clients

If BATCH Server (master) fails, the BATCH clients automatically fail over to the standby BATCH Server.

Startup, Restart of the BATCH Clients

Note:

Following a failover of the BATCH Servers, the BATCH clients can only be operated again after a certain time has elapsed.

A message window opens informing you that the BATCH Server is currently not obtainable. Once the failover is completed, the message window disappears indicating that the server application is operational again.

As long as the message window is displayed, the BATCH client cannot be operated. You can, however, close the client application by clicking the "Quit application" button. On completion of the failover, the BATCH client can be started again.

Loss of Data

Note:

During a BATCH Server failover, data can be lost. The states that can be lost are those

- resulting from operator intervention on the PCS 7 OS client (for example due to an operator setting a binary value twice with one setting canceling out the other) or

- are generated from data of the programmable controllers and that cannot be recorded during the failover.

Example: During the failover, the limit value of a process value is exceeded but the value returns within the limits during the time required for the failover. If this limit violation is queried in a transition condition, the transition must be triggered manually by the operator.

Process Control Messages

In the event of a failover, a process control message is displayed on the message OS.

7.4   Data Synchronization with Data Replication

Data Synchronization with Data Replication

In this solution, each of the two redundant BATCH Servers 1 and 2 has its own local database. The databases are synchronized with each other and therefore have the same data. With this solution, no additional hardware or software is necessary.

Note:

A BATCH Control Server always works with the DB servers assigned in the configuration. In other words, if a BATCH Control Server (master) fails and the standby BATCH Control Server takes over the master role, it continues to work with the standby DB servers.
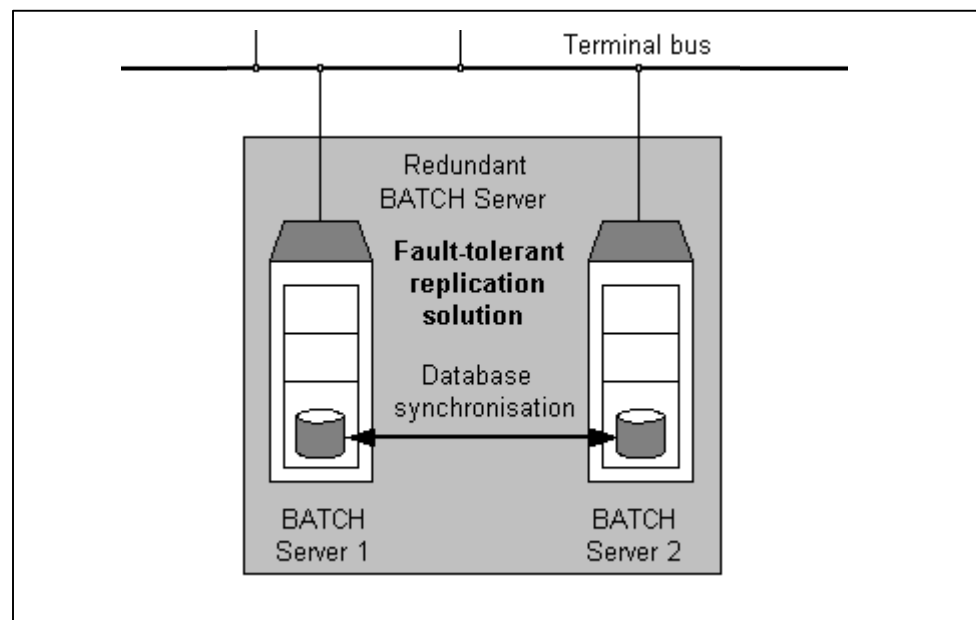
7.5   Configuration of the Redundant BATCH Server

⚠	**Warning**
	Configuring applications (WinCC, SIMATIC BATCH, ...) on separate "SIMATIC PC station" objects and then merging them to create one PC station by assigning the same computer name to the "SIMATIC PC station" objects is not permitted!

Follow the steps outlined below in the SIMATIC Manager:

1. Select the project in the component view.

2. Select the menu command Insert > Station > SIMATIC PC Station.

Result: A new SIMATIC PC station is inserted in the current project.

3. Set the computer name of the PC station.

    - Select the SIMATIC PC station.

    - Select the menu command **Edit > Object Properties**.

    - Enter the computer name in the last field.

4. Configure this SIMATIC PC station in HW Config.

    - Select the SIMATIC PC station.

    - Select the menu command **Edit > Open Object**.

      Result: HW Config opens.

    - Insert a batch application from the hardware catalog:

      Path in the hardware catalog: Standard **> SIMATIC PC Station > HMI > BATCH Application (stby)**.

5. Select the menu command Station > Save and Compile.

Result: In the component view, the object ![BATCH Application (stby)] is displayed below the configured SIMATIC PC station.

7.6   Time Monitoring on the PCS 7 OS

Time Monitoring

When configuring the time monitoring on the distributed PCS 7 operator stations, take the the following points into consideration:

- The times involved in a failover

- The critical times in the process

The time monitoring for the batch functionality on the PCS 7 OS (batch control) is adopted along with the UNIT blocks IUNIT_BLOCK (FB 251) (UNIT watchdog).

UNIT Watchdog

The time monitoring of the IUNIT_BLOCK blocks is controlled by the BATCH Control Server. If the update does not take place, IUNIT_BLOCK signals a connection abort to which the programmable controller can react. Time monitoring is active only when the unit is occupied by a batch. If a unit is occupied manually using the UNIT faceplate, the UNIT watchdog is not activated.

Using the UNIT Watchdog

The watchdog supplements the redundancy concept of the PCS 7 OS, it can, however, be used without OS redundancy (for example when the PCS 7 OS is operated in the stand alone mode). It is also unnecessary to activate the watchdog for a failover. The watchdog should be used in particular to protect a critical automation process.

Setting the UNIT Watchdog

Note:

If both mechanisms (redundancy and UNIT watchdog) are active, please remember the following points when setting the watchdog interval:

The watchdog interval should always be selected to suit the process tolerance so that a significant delay in the failover time is always detected so that a suitable reaction can be started.

Depending on the backup measures of the process initiated as a result, the synchronization of batches by batch control may take longer following the failover or is no longer possible automatically. In this case, the operator will need to intervene manually to continue the batches.

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8 Migration V4.02 -> V6.0

8.1 Basics of Migration

Introduction

Note:

A BATCH *flexible* V4.02 project can be migrated to SIMATIC BATCH V6.0. All the functions configured in the V4.02 project can continue to be used in SIMATIC BATCH V 6.0.

The basis for migration is the BATCH *flexible* V4.02 database. This contains the required batch data. This topic describes how to migrate the batch data.

In addition to migration of the batch data, the STEP 7 project must also be adapted to PCS 7 V6.0. You will find more detailed information on this topic in the documentation *Process Control System PCS 7; Software Update* on the PCS 7 toolset CD.

Adopted data

The following data is adopted from the BATCH *flexible* V4.02 database in SIMATIC BATCH V6.0:

- Process cell data (including units of measure, user data types, and materials)
- Unit recipes (now known as master recipes in V6.0:)

Data that is Not Adopted

The following data is **not** adopted from the BATCH *flexible* V4.02 database to SIMATIC BATCH V6.0:

- Production orders
- Batches (including control recipe)
- Users/user permissions

Note:

- Since the batches are not migrated, you should save these in the form of a batch report on paper or in PDF format!

- If the migration is on the same computer, you must save the batch data **before** installing SIMATIC BATCH V6.0!

- Any exported unit recipes that no longer exist in the V4.02 database but that you will require in the future must be imported again prior to migration!

Other Conditions for Migration

- BATCH *flexible* V4.02 blocks remain usable after migration (unchanged)

- Mixed operation of BATCH *flexible* V4.02 and SIMATIC BATCH V6.0 blocks within a unit is possible.

- Instances of a phase, operation or process tag type cannot be mixed; in other words a type has either V4.02 or V6.0 instances.

- Flat V4.02 recipes are automatically converted to flat V6.0 recipes.

- Flat V4.02 recipes can only be converted to hierarchical V6.0 recipes manually!

Options for Conversion

Based on the conditions listed above, the following options are open when migrating a V4.02 project to SIMATIC BATCH V6.0:

Option	Aim	Consequences
1	**Continuing with V4.02 Functionality Only** no extensions are made to the project	**AS data is retained,** **This means that** • recompilation of the charts is not necessary • new download to the PLC not necessary • new compilation of the OS not necessary • recommissioning not necessary • revalidation of the PLC not necessary
2	**Using the New V6 Functions** Gradual conversion to the V6 functionality, old functions remain implemented with V4.02 blocks, expansions will be made with V6.0 blocks (mixed operation of V4.02 and V6.0 blocks possible) It is also possible to extend a project using V4.02 blocks or to make changes to the existing V4.02 configuration.	**Mixed operation with V4.02 and V6.0 blocks, i.e.** • Charts must be recompiled • New download to the PLC necessary • New compilation of the OS necessary

8.2   Migration Requirements

Data Compatibility

Note:

If you kept to the rules for data compatibility in the BATCH flexible V4.02 project (also described in the BATCH flexible V4.02 readme), you can migrate the batch data with the support of the migration tool "SIMATIC BATCH Migrator".

If these guidelines are kept to, it is possible to migrate without compiling the OS or downloading again to the programmable controller!

If you did not keep to the guidelines, the project must be converted manually according to the guidelines before you can start the actual migration.

Principle

To avoid having to recompile the OS, download to the programmable controller again, and adapt the WinCC pictures, you must make sure that the "Compiled" WinCC tags do not change.

To achieve this, you either kept to the guidelines in the BATCH *flexible* V4.02 project as described below or you must make adaptations to meet these requirements before you start the actual migration.

If these requirements are not met, it will **not** be possible to avoid subsequent compilation of the OS, downloading to the PLC, and adaptation of the WinCC pictures!

Rule 1: Use of the UNIT block

There must not be more than one instance of this block below the "Unit" plant hierarchy.

Rule 2: Use of the TRANS block

- There must only be instances of TRANS blocks in a CFC chart if these are assigned to a unit.
- The value of the UNITNAME attribute must always correspond to the UNITNAME of the UNIT block.
- The chart must be located below the plant hierarchy folder of the corresponding unit.
- There must be no AF_x blocks or a UNIT block located in the chart that are assigned to another unit.

Rule 3: Use of the AF_x blocks

- There must only be instances of AF_X blocks in a CFC chart if these are assigned to a unit.

- The value of the UNITNAME attribute must always correspond to the UNITNAME of the UNIT block.

- The chart must be located below the plant hierarchy folder of the corresponding unit.

- There must be no TRANS blocks or a UNIT block located in the chart that are assigned to another unit.

Plant Hierarchy

In the BATCH *flexible* V4.02 readme, it was also recommended that you configure the plant hierarchy of the batch process cell in the SIMATIC Manager. The top level corresponds to the project: The next three hierarchy levels must be as follows:

- Level 2 must have the technological significance of a process cell (S88.01).

- Level 3 must have the technological significance of a unit (S88.01).

- Level 4 must have the technological significance of an equipment module ((S88.01).

All charts belonging to a unit or equipment module in terms of technology must be located below the corresponding hierarchy folder.

Result: If your batch process cell V4.02 already has the structure in the plant hierarchy as described above, this will make migration much easier. The next topic describes which migration step that you can omit if this is the case.

8.3 Basic Procedure

Overview of Basic Procedure for Migration

V4.02 Database

1. Adaptation of the V4.02 project according to the guidelines for later data compatibility (when necessary)

2. Use of the SIMATIC BATCH Migrator

Batch types

Unit recipes (and process cell data with batch types and instances)*

Generate the **batch.orl** file with the type description

Generate the **Archiv.xml** file with the recipe data

3. Copy batch.orl to suitable subfolder of the project folder

4. Adapt the STEP 7 project

5. Compile Batch process cell data and download to target system

*.xml

6. Import process cell recipes in BatchCC with **Options > Restore**

*.eqm

7. Update Batch process cell data in BatchCC with **Edit > Update process cell**

*: The Archiv.xml file contains not only the recipe data but also the process cell data and instances. If no expansions whatsoever are made to the project, you only need to import the Archiv.xml in BatchCC . In this case, omit step 7.

8.4   Migrating Step-by-Step

Follow the steps outlined below:

1. Create a backup of your project data so that you have a current version of your: BATCH *flexible* V4.02 database and STEP 7 project

2. Update the software of your STEP 7 project to PCS 7 V6.0. This is described in detail in the documentation *Process Control System PCS 7; Updating Software* on the PCS 7 toolset CD.

3. After successfully converting the STEP 7 project, adapt the plant hierarchy for SIMATIC BATCH:

Note:

You only have to perform step 3 if you have **not** yet configured a plant hierarchy for your Batch process cell in SIMATIC Manager (see also section "Requirements for Migration".

- Select the first object below the S7 project name in the plant hierarchy and assign the object type "Process cell" to it using the context-sensitive command **Object Properties** > "**BATCH Attributes**" tab.

- Insert the "Batch types" object below the process cell in the plant hierarchy. To do this, select the "Process cell" object and then select the context-sensitive menu command **New Object Insert > Batch Types**.

4. Create a SIMATIC PC station for the BATCH Server and each of the BATCH clients in the component view and configure them with HW Config with the BATCH Server application or BATCH client application.

5. Create a SIMATIC PC station for each PCS 7 operator station in the component view and configure them with the WinCC applications using HW Config.

6. Delete the automatically generated OS below the WinCC application in the component view.

7. Include the original OS below the WinCC application.

8. Insert a "Unit" folder with any name (recommended: Name of the UNIT block instance) for each UNIT block in the plant hierarchy.

9. Then insert all the CFC charts with the blocks of the corresponding unit in the individual unit folders.

Note:

If a CFC chart contains more than one UNIT block or more than one AF-/TRANS instances belonging to different units, these must be split since only blocks of the unit itself are permitted below a unit.

If this step is necessary, it will not be possible to avoid a download to the PLC and compiling the OS since this step will change the tag names.

If, however, you kept to the guidelines described in Section "Requirements for Migration", this problem should not occur!

10. Make sure that all hierarchy folders are marked as forming part of the HID or not exactly as they were in your original project (select **Options > Plant Hierarchy > Settings**).

This is important because the WinCC tag names could otherwise change and the references to modified WinCC tags, for example in the OS pictures would be lost when the OS is recompiled!

11. Export the type information, process cell data and recipe data from the SIMATIC BATCH V4.02 database and import this into the converted STEP 7 project:

    - Open the SIMATIC BATCH Migrator tool from the Toolset CD PCS 7 V6.0 (path ...\siemens\BATCHflexible\BFMIGRATION

    - Enter the path of the BATCH *flexible* V4.02 database.

    - Enter a destination path for storage of the migration data.

    - Specify the OS name of the WinCC project.

    - Select the "Process cell data type information (batch.orl)" option to generate the **batch.orl** file with the type description.

    - Select the "Process cell/recipe instances (archiv.xml)" option to generate the **Archiv.xml** file with the recipe data.

    - Click the "Start" button.

      Result: New batch.orl and archiv.xml files are generated and stored on the destination path.

    - Copy the **batch.orl** file to the relevant folder of the STEP 7 project directory. Procedure: Search for the batch.orl file in the STEP 7 project and overwrite it with the new batch.orl file.

    - Open the SIMATIC Manager.

    - Open the type dialog by selecting the "Batch Types object in the plant hierarchy under process cell and then selecting the context-sensitive command **Open Object**.

Result: All batch types of the V4.02 project are displayed. A dummy unit class was created automatically in the "Unit classes" folder. The process tag types are also displayed.

12. Assign the dummy unit class to each unit folder in the plant hierarchy by selecting the unit folder and then selecting the context-sensitive menu command Object Properties > "BATCH attributes" tab.

13. Configure the process tags from the WinCC archives:

- To configure the tags, the Migrator automatically creates the Tagimport.txt text file. This text file contains the assignment of the type parameter to the WinCC tags.

- In the plant view, select the menu command **Options > SIMATIC BATCH > Edit measured variables**. Here, you then assign the type parameters to the WinCC archive tags. You will see the assignments in the Tagimport.txt file.

   Before making the batch archive assignment, it is advisable to run a validation. This provides you with information about the instance parameters that require assignment to WinCC archive tags.

14. Start the validation to check the batch data by selecting the process cell in the plant hierarchy and then selecting the context-sensitive menu command SIMATIC BATCH validation.

Result: If the validation does not report any further errors, the conversion of the PCS7 project is complete.On this basis, the batch process cell data must now the compiled with the standard functions in the SIMATIC Manager and downloaded to the target systems. If error messages occur, the causes must first be eliminated and the validation run again.

If no further validation errors occur, you can start BatchCC after "Downloading to the target systems" and update the recipe data with the menu command **Options > Restore** and then the process cell data with the menu command **Edit > Update process cell**.

Assignment List for TRANS Block Instances

After migration, the file TransImport.txt is also available. This contains a list of the TRANS block instances used BATCH *flexible* V4.02 referencing them to the SIMATIC BATCH generated TRANS types.

A Appendix

A.1 Abbrevations

Abbrevation	Meaning
AS	Programmable logic controller (PLC)
CFC	Continuous Function Chart
EPE	Equipment Procedural Element
ES	Engineering system
NOP	Placeholder (empty step / empty transition)
OS	Operator station
RPH	Recipe Phase
ROP	-Recipe Operation
RP	-Recipe Procedure
SFC	Sequential Function Chart
EPH	Equipment Phase
EOP	Equipment Operation
RUP	Recipe Unit Procedure
VAB	Processing block

A.2   S88 Terms German - English

German	English		German	English
Ablaufsteuerung	sequential control		Prozedurmodell	procedural model
Process Cell	process cell		Prozedursteuerung	procedural control
Anlagenkomplex	area		Prozess	process
Anpassroutine	scaling function		Prozessabschnitt	process stage
Basisautomatisierung	basic control		Prozessausstoß	process output
Bediener	operator		Prozesseinsatz	process input
Belegung	allocation		Prozessoperation	process operation
Belegung	resource		Prozessparameter	process parameter
Charge	batch		Prozessschritt	process action
Chargenplan	batch schedule		Rezept	recipe
Chargenprotokoll	batch report		Rezeptersteller	recipe creator
Chargenprozess	batch process		Rezepterstellung	recipe creation
Chargensteuerung	batch control		Rezeptfunktion	recipe phase
Einrichtung	equipment		Rezeptkopf	recipe header
Einsatzstoff(e)	input material		Rezeptoperation	recipe operation
Einzelsteuereinheit	control module		Rezeptprozedur	recipe procedure
Fahrweise	mode of operation		Rezeptverwaltung	recipe management
Formula	Formula		Sollwert	setpoint
Formula category	formula category		Steuerfunktion	control recipe phase
Phase	phase		Steueroperation	control recipe operation
Geräte	process equipment		Steuerrezept	control recipe
Grundfunktion	master recipe phase		Stoff	material
Grundoperation	master recipe operation		Stoffausstoß	output material
Master Recipe	master recipe		Strang	line
Istwert	process value		Techn. Einrichtung	equipment modul
Messstelle	tag		Technische Funktion	equipment phase
Nebenprodukt	by-product		Technische Operation	equipment operation
Normansatz	reference scale		Teilanlage	unit
Operation	operation		Teilanlagenprozedur	equipment unit procedure
Produktionsauftrag	production order		Teilprozedur	unit procedure
Produktionsstrang	line		Teilrezept	unit recipe
Prozedur	procedure		Teilrezeptprozedur	recipe unit procedure
Prozedurelement	procedural element		Verfahrensrezept	general recipe
Prozedurmodell	procedural model		Werksrezept	site recipe

Glossary

Sequential control

Control in which device-oriented actions are controlled in an ordered fashion to allow a process-oriented task to be performed.

Alternative sequence

Structure element of a recipe with which an OR branch or an OR divergence is achieved. An alternative sequence consists of at least two vertically arranged sequences joined at top and bottom by a single horizontal line. With alternative sequences, you can adapt the execution of the recipe to states in the process. The conditions in the top transitions of the sequences decide which sequence is executed.

Process cell

A logical grouping of facilities/devices that includes the equipment for creating one or more batches. It determines the spectrum of logical control options for a set of process equipment within a plant.

Within the plant hierarchy, the process cell is the highest level. This is followed by units and equipment phases.

Area

An area consists of several equal-ranked or interacting industrial processes with corresponding auxiliaries (according to DIN 28004). This is part of a factory with batch production that is defined by physical, geographical or logical boundaries within the factory.

Scaling function

Using scaling functions, you can influence the quantities used. Depending on the concrete quantity for the batch, the parameters are corrected using the selected scaling function. As default, there are two scaling routines available:

- Linear: The value is multiplied by the quotient batch quantity/reference quantity.

- Quadratic: The value is multiplied twice with the quotient batch quantity/reference quantity.

Programmable logic controller (PLC)

A programmable controller (PLC) consisting of a central rack, a CPU and various input/output modules.

Abbreviation: PLC

Basic control

Basic control means the configuration of the programmable controller system. This must be done separately from the recipe control strategy. As tools, you have the CFC or SFC editor available.

Batch Control Center (BatchCC)

The Batch Control Center (BatchCC) is a component of SIMATIC BATCH and provides you with a graphic user interface for monitoring and controlling batch processes. The Batch Control Center manages all the data relevant to SIMATIC BATCH.

BATCH Control Server

The BATCH Control server is a component of SIMATIC BATCH. The BATCH Control server handles communication with the process and controls and monitors execution of the current batches.

The BATCH Control Server does not have its own user interface. The BATCH Control Server is started on the run-time computer.

BATCH Report

BATCH Report is a component of SIMATIC BATCH and is responsible for documentation of the recipes and batch data in the form of reports: The recipe report with its predefined layout contains all the data required for production. The batch report contains all the information required for the reproducibility of the batch process, the quality assurance and the fulfillment of legal requirements.

BATCH Recipe Editor

The BATCH Recipe Editor is a component of SIMATIC BATCH and provides you with a graphic user interface for creating and modifying master recipes and library operations. Recipe creation is based on the BATCH objects from the Batch process cell configuration in the engineering system of SIMATIC PCS 7, for example, units and equipment phases.

BatchCC

See Batch Control Center (BatchCC)

Operator

see Operator

Resource

Resources are units (including transport and cleaning equipment, input materials, products etc. and even personnel)

Library operation

You can use libraries to store recipe elements created with the BATCH Recipe Editor that you require often in the recipes of the process cell. Only recipe operations (ROPs) can be stored as recipe elements. Recipe operations that are managed in libraries are known as library operations.

Library reference

A library operation is not linked directly into a recipe procedure (RUP) but uses a library reference. The library operation cannot be modified within the master recipe; the library operation must always be opened explicitly in the BATCH Recipe Editor.

CFC

Continuous Function Chart (CFC): Programming language for convenient description of continuous processes by graphic interconnection of complex functions.

Batch

- Material that is being produced or that has been produced by a single execution of a batch process.
- An "imaginary" object representing the procedure for producing material at any point within the process.

Note: Batch means both the material created by and during the process as well as the unit that represents the manufacturing procedure for this material. Batch is used as an abstract contraction of the words "the production of a batch".

Production order

A production order contains information on the product, quantity, required quality, and deadline.

Batch plan

A list of batches to be produced in a specific process cell. This contains information about when and in which order batches representing the required quantity of a product will be produced and which equipment will be used.

Batch report

A selection of data relating to one or more batches. A batch report documents the manufacture of a batch and contains selected recipe data, process data, and events.

Batch process

A discontinuous process in which a required product is manufactured in a chronological sequence of production tasks involving one or more batches according to a set of rules (recipe).

Batch control

Allows online monitoring and control and execution of the control recipe.

Unit of measure

The unit of measure is a dimension or quantity with a specific value. Examples of units of measure: 1 m, 1 kg, 1 DM.

Equipment

Generic term for: process sells, units, equipment phases, and control modules

Input material

Raw material or other resource required to manufacture a product.

Control module

The lowest level of the grouping of equipment in the physical model that can implement basic control.

Engineering station

PC station on which the process control system is adapted to the task in hand using the engineering system (ES).

Engineering System

Configuration system (ES) PC-based with which the process control system can be adapted visually to the task in hand.

Control strategy

Different equipment phases that are mutually exclusive in terms of simultaneous operation belonging to the same equipment module are known as the control strategies of this equipment module, for example,

Equipment module: Inertization

CS 1: Pressure overlay

CS 2: Rinsing

Formula

Material and production data: Part of the recipe containing the following recipe information: input materials (resources for creating the product), output materials: (expected results), process parameter is (global recipe parameters).

Formula category

A formula category can be assigned a class of formulas with the same raw material and production data structure. The only differences between the formulas of a formula category are the concrete parameter values.

The formula category contains the parameters that can be controlled by the operator during batch planning with SIMATIC BATCH using the formula. These parameters are included in the formula category with their data type and unit of measure.

Phase

The smallest element of a procedural control that can execute a process-oriented task.

Device

See equipment module

Master Recipe

Recipe stage that takes into account the capabilities of the equipment and contains process cell-specific information. A master recipe is an indispensable recipe level without which control recipes cannot be created or batches produced.

Master recipe is can contain material and collection parameters as normalized, calculated, or fixed values. A master recipe can be derived from a general or site recipe from the enterprise level (refer to the standard IEC 61512-1: 1997).

Pause

A batch (control recipe execution) is paused, all active steps continue until they are completed, no new steps are started. In contrast to the "Hold" command, this command simply prevents the control recipe from passing control to the next step.

Hold

The batch (control recipe execution) is held and all active steps are also held.

Hierarchy folder

The hierarchy folder is used to achieve hierarchical structuring of a process cell (of a project). It can contain further hierarchy folders or objects such as CFC/SFC charts, pictures, reports and additional documentation.

Reference quantity

The reference scale is the reference quantity for quantity scaling. All quantity-dependent values in the recipe relate to this quantity.

The quantity scaling back to results from the ratio of the concrete quantity to be produced and the reference quantity.

Operation

A procedural element that controls an independent processing activity consisting of the required algorithms for triggering, organizing, and controlling phases.

Operator

The operator is the user of this software coordinates the batch during run time.

Operator station

Operator control and monitoring station

Acronym: OS

Operator instruction

The operator instruction allows instructions to be displayed to the operator during execution of a recipe. A distinction is made between the display of pure instructions (NOP step) and an instruction that allows operator input (operator dialog). The operator may also be required to acknowledge the instruction.

Operator dialog

Input and display option for an operator instruction

- No acknowledgment
  Example: Entry of analysis process values.

- With acknowledgment
  Example "manual dosing": The operator is instructed which material and how much to add. The operator then enters the actual values that have been added and confirms the input (acknowledgment).

Simultaneous sequence

Structure element of a recipe that implements an AND branch or an AND divergence. A simultaneous sequence consists of at least two horizontally arranged sequences connected and the top and bottom by double lines. A simultaneous sequence results in the simultaneous execution of more than one sequence. This allows processes to be executed at the same time.

Product

> Contains the specified production order data to produce a certain quantity of a product with a certain required quality at a certain time.

Project

> A container for all objects of an automation solution regardless of the number of stations, modules and how they are networked.

Procedure

> The strategy according to which a process is executed. This can relate to the production of a batch or to a non-productive process, for example a cleaning process.

Procedural element

> A block for procedural control defined by the model of the procedural control.

Procedural control

> A control that controls equipment-oriented actions in an ordered fashion to allow execution of a process-oriented task.

Process

> A sequence of chemical, physical, or biological activities for the conversion, transportation, or storage of material or energy.

Process stage

> A part of a process that normally executes independent of other process stages and results in a planned sequence of chemical and physical conversions of the material being processed.

Process output

> The name and amount of material or energy expected as the result of executing a recipe.

Process input

> The name and quantity of a raw material or other resource required to manufacture a product.

Process operation

A larger processing activity that usually involves a chemical or physical conversion of the material being processed and that is specified without taking into account the target equipment configuration to be used.

Process parameter

Information required to manufacture a material that does not fall into the category of input material or output material. Typical information in the process parameters includes temperature, pressure, and time.

Process step

Smaller processing activities that are combined to form a process operation.

Recipe

The required amount of information necessary to define the production requirements for a specific product. A recipe is the set of rules and information required to define how a product is manufactured. The following recipes exist: General recipe, site recipe, master recipe, and control recipe.

In SIMATIC BATCH, the following recipe types are used:

- Master Recipe

- Control recipe

Recipe control strategy

In a recipe control strategy, the sequence of production steps for making a product can vary from one batch to the next.

The essential aspect of a genuine recipe control strategy is that new recipes can be specified and executed ...

- by the chemist or process technician (not a programmer or control system specialist)

- using a user interface adapted to his/her needs (not using the programming/configuration user interface of the control system)

- without interventions in the software structure of the control system (in other words, without the risk of changing interlocks or validated structures)

- during operation (without reloading/restarting) of the control system.

Such changes, nevertheless, mean changes in the sequences of the process steps and not simply changes to parameter values.

Recipe phase

A phase that is part of a recipe procedure in a master or control recipe. Depending on the recipe type, this becomes the master recipe phase or the control recipe phase.

Acronym: RPH

Recipe header

> Information on the purpose, the source, and the version of the recipe, for example recipe and product identification, author, and output date.

Recipe operation

> An operation that is part of a recipe procedure in a master or control recipe. Depending on the recipe type, this becomes the master recipe operation or the control recipe operation.
>
> Acronym: ROP

Recipe procedure

> The part of a recipe that describes the strategy for producing a batch.
>
> Acronym: RP

Loop

> Structure element of a recipe consisting of a sequence with at least one recipe step and one return path with a transition.

Step

> A step is the smallest functional unit of an SFC chart. The smallest structural unit in a recipe is known as a recipe step.

SFC

> Sequential Function Chart (SFC): A graphic representation of a sequential program consisting of interconnected steps, actions, and specific links with step enabling conditions.
>
> SFC is a suitable method of representation (description of the processing sequence) of the entire procedural rules with sequential and parallel steps providing clarity in the process controls.

Control recipe

> A type of recipe which, through its execution, defines the manufacture of a single batch of a specific product.
>
> The control recipe is a copy of a particular version of the master recipe that is then modified as necessary with information for planning and execution making it specific to a single batch.

Output material

> A material (product, by-product, or waste product) expected as the result of executing a recipe.

Structure element

Structure elements of a recipe consist of an arrangement of basic elements. These include, for example, simultaneous sequences, alternative sequences and loops.

Synchronization line

The synchronization lines coordinate the execution of recipe sequences in the units or of the recipe operations (ROPs) between the units.

Synchronization point

At each synchronization point, it is possible to decide whether the execution of the recipe sequence should be held.

Equipment module

A functional grouping of equipment that can execute a limited number of specific smaller processing activities.

Plant hierarchy

The plant hierarchy consists of hierarchy folders that in turn can contain further hierarchy folders, CFC/SFC charts, pictures, reports, and additional documentation. It represents the functional structured hierarchy of the plant regardless of the assignment of programmable controllers or operator control and monitoring systems. This is displayed in the plant view of the SIMATIC Manager.

Unit

A grouping of related control modules and/or equipment modules and their equipment in which one or more larger processing activities can be performed.

Only one batch is ever processed at any one time in a unit. Units generally operate independent of each other. Examples of larger units include caustic soda, carbene addition, extraction, distillation.

Unit class

Each unit can be assigned to a unit class in the plant hierarchy.

In the BATCH Recipe Editor, the candidates that can be selected as the unit and the possible associated phases (EOP/EPH) is restricted to a unit class. The great advantage of this is that when you convert the master recipe to the control recipe, the actual unit allocation is always successful since the master recipe contains only the permitted unit candidates.

Unit procedure

A strategy for executing a related process within a unit. It consists of a sequence of operations and the required algorithms for triggering, organizing and controlling these operations.

Unit recipe

A part of a (control) recipe that uniquely specifies the sequence of production requirements for a unit. The unit recipe contains the unit procedure and the corresponding material and production parameters, recipe header, requirements of the equipment and other information.

Recipe unit procedure

A unit procedure that is part of a recipe procedure in a master or control recipe.

Acronym: RUP

Transition

A transition contains conditions that must be satisfied so that the controller can move on from one state to the next or pass control from one step to the next.

Process

Definiert in DIN 28004: Ablauf von chemischen, physikalischen oder biologischen Vorgängen zur Gewinnung, Herstellung oder Beseitigung von Stoffen oder Produkten.

In everyday language a process is a method of achieving a target. In industry a process is used along with chemical, physical, and biological knowledge and methods to obtain, produce, convert or eliminate materials. Example: Synthesis of ammoniac according to Haber and Bosch.

General recipe

Recipe type describing processing requirements independent of equipment and location.

Processing block

The equipment phase/operation in SIMATIC BATCH consists of the BATCH interface block (CFC) and the processing block (usually SFC).

Site recipe

A site-specific recipe type. Site recipes can be derived from general recipes taking into account regional constraints such as language or available materials.

WinCC

WinCC is a neutral Windows-based system for solving visualization and process control tasks in production and process automation.

WinCC provides function modules designed for industry for graphic representation, messaging, archiving and logging. With its powerful process interface, fast picture updating and secure data archiving, it guarantees high availability.

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