

Application Example • 02/2015

# PCS 7 Unit Template “CIP – Cleaning in Place”

SIMATIC PCS 7 V8.1

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# 1 Automation Task

## Introduction

If we consider a facility for the production of food or pharmaceutical products and its technical processes, we will realize that certain process steps, procedures and devices are repeated in the same or similar form.

An important process in this regard is the automated cleaning of the apparatus and plant sections.

This process is becoming more and more important with increasing plant size, since manual cleaning is no longer possible. One efficient process is the "Cleaning in Place" process, called "CIP Process" for short.

The CIP process enables the cleaning of apparatus and plant sections in place. Disassembly is not necessary. As a result of this kind of automated cleaning, valuable working time is also saved.

## Overview of the automation task

The CIP system is used for cleaning the other plant sections and fittings. The individual fittings are controlled by the automation program.

## Description of the automation task

The fluids required for cleaning are prepared and held ready in the CIP system. There are different fluids for the different cleaning phases, and these must always be available in sufficient quantities. For this reason, the fill level in the storage tanks must be continuously monitored. If the levels are too low, fluid must be supplied to the tanks.

In addition to the fill level, the quality of the fluid is also important. For this reason, the fluids in the tanks are controlled to a predefined temperature and concentration of detergent. Consequently the temperature and concentration are also continuously monitored and adjusted if necessary.

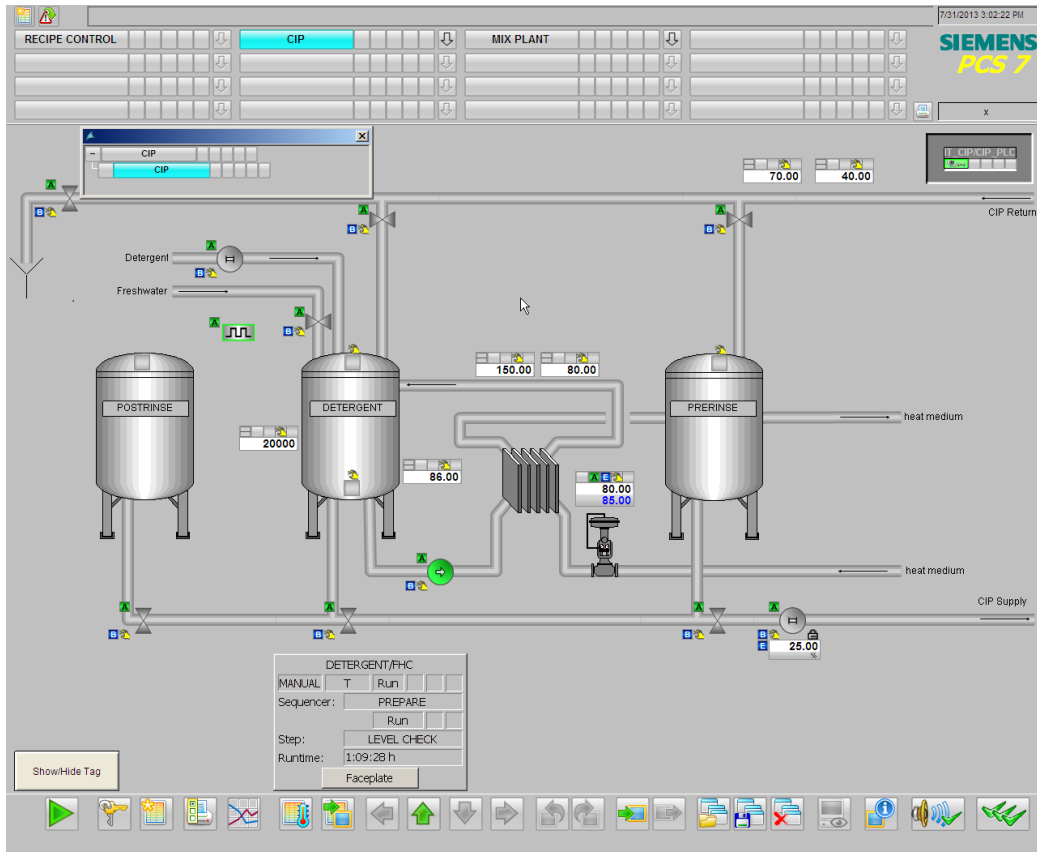
A further task is to reuse as much cleaning fluid as possible after use. To this end, the quality in the return line is checked again. If the quality meets the specifications, the fluid will be automatically fed back to the tanks provided they are not full. If the quality is not adequate or the tanks are full, the fluid will be disposed of.

## 2 Automation Solution

### 2.1 Overview of the complete solution

The figure below shows schematically the structure of the solution:

Figure 2–1



The "CIP" application example is implemented as a SIMATIC PCS 7 multiproject in accordance with ISA S88.01.

The multiproject consists of an AS project (user program), an OS project (visualization with process pictures), as well as a SIMATIC BATCH system (production and cleaning recipes).

The AS project has been created with the APL library (Advanced Process Library), the BRAUMAT library - and SIMATIC BATCH blocks.

### **Advantages**

This application offers you the following advantages:

- Implementation of a CIP system conforming to ISA S88.01
- Description of the most important automation functions for a CIP system

### **Limitation**

The following special cases are not covered by the "CIP" application example:

- Simultaneous cleaning of plant sections
- Technical process simulation

### **Required knowledge**

Fundamental knowledge of the following specialist fields is a prerequisite:

- Configuring with SIMATIC PCS 7, SIMATIC BATCH and the APL library
- Knowledge of control technology
- Basic knowledge of process technology

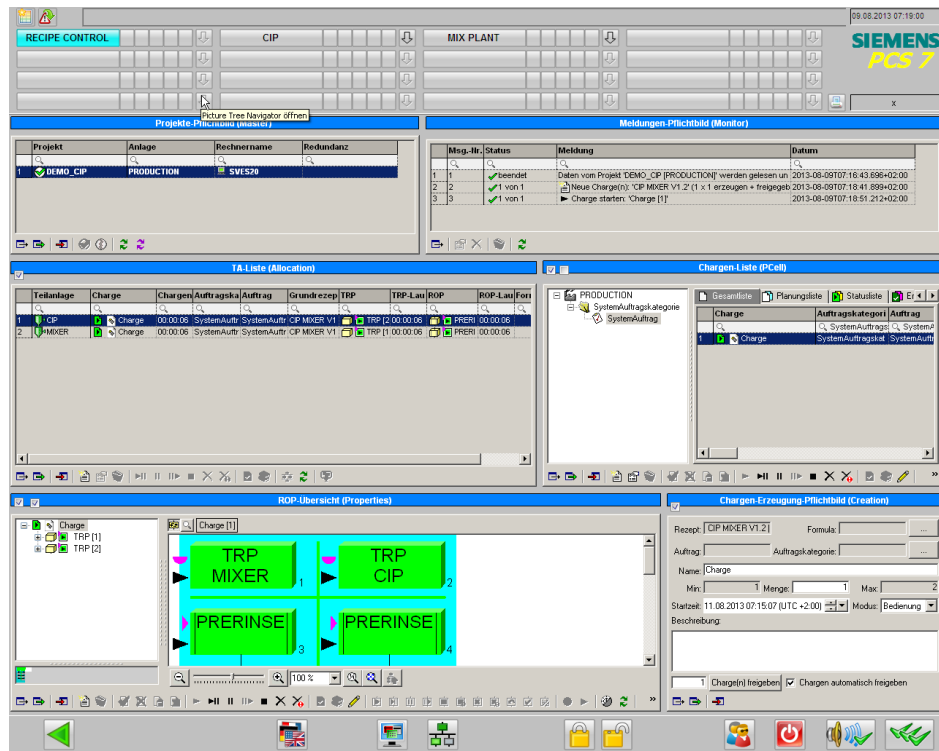
## 2.2 Core functionality

The "CIP" application example includes the user program with typical measurement points for a CIP system.

The plant hierarchy (PH) is constructed according to ISA S88.01. The equipment modules necessary for the CIP system are defined. A plant overview picture and an overview picture with BATCH OCXn are included for operation.

The figure below shows the BATCH OCX overview picture:

Figure 2–2



A SIMATIC BATCH backup with a sample recipe is included for creating cleaning batches.

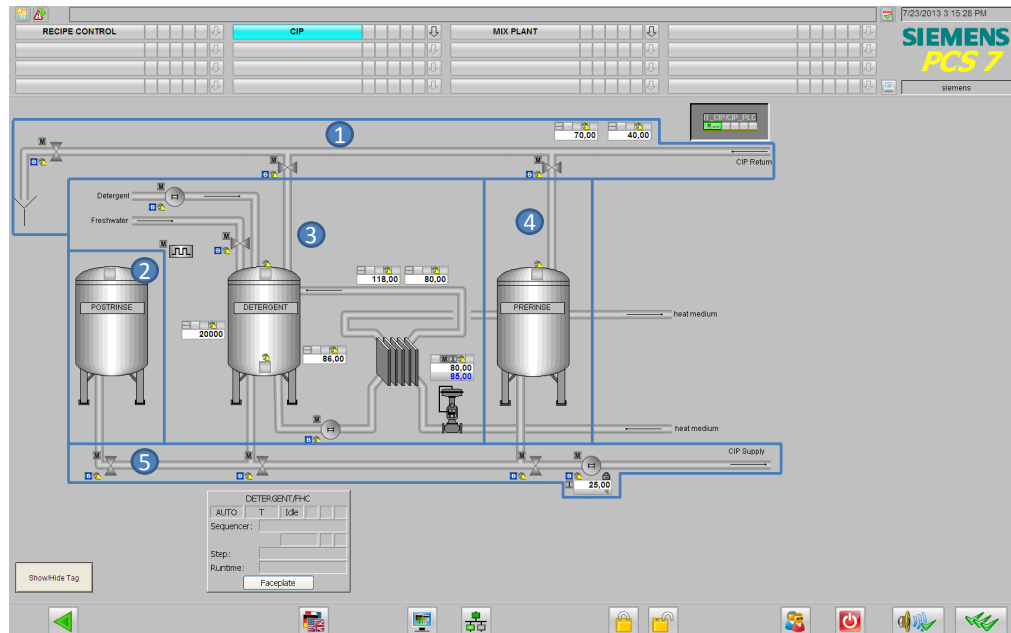
The application example does not include any simulation. For this reason, changes to process values must be made manually to produce changes in the program sequence. The setpoints in the recipes are freely selected and may deviate depending on the plant. The equipment modules and measurement points are used as an exemplary template and with plant-specific adaptations can be applied to a real production plant.

The cleaning recipes must be created for the plant sections to be cleaned depending on construction and product. The example recipe merely describes the basic construction.

### 2.2.1 Description of the individual functions

The individual parts of a CIP system are described in the following. The entry point is the process picture of the visualization screen.

Figure 2–3



The process picture of the CIP system consists of the following main parts:

1. CIP return modules
2. Post-rinse tank
3. Detergent tank
4. Pre-rinse tank
5. CIP supply modules

#### 1. CIP return

The CIP return is used to recover the used CIP fluids. Depending on the fill level in the tanks, the quality (temperature and detergent concentration) and also the current cleaning phase, the fluid is fed into the appropriate tanks or into the drain. This takes place with the aid of sensors and valves.

#### 2. Post-rinse tank

The cleaning fluid (e.g., water) for the final cleaning phase is stored in the post-rinse tank. Fluid can be drawn off provided the level does not fall below the minimum fill level.

### 3. Detergent tank

The detergent tank contains the cleaning fluid for the second cleaning phase. In this tank the fluid is heated up to the prescribed temperature and the necessary detergent concentration is established. The fluid is permanently pumped through a heating circuit so that it will always be at the specified temperature. Depending on the temperature, the detergent concentration is measured (from its conductance). If this is too low, detergent is added.

The detergent tank can also be filled with fresh water. This is possible when there is no CIP phase active, as the temperature and the concentration have to be adjusted to the correct values again.

#### Note

The detergent tank is an example of an acid or lye tank.

### 4. Pre-rinse tank

The pre-rinse tank contains the cleaning fluid for the first cleaning phase. The fluid removes contamination and product residues from the pipes and apparatus.

The tank is filled with fresh water or CIP fluid from the other cleaning phases.

The tank can be filled provided the maximum fill level has not been reached.

If a particular temperature and/or detergent concentration for the fluid is necessary for process-related reasons, the fluid can be prepared in the same way as described for the detergent tank.

### 5. CIP supply

The CIP fluids are fed from the CIP tanks through the CIP supply line into the parts of the plant that are to be cleaned. The flow from the tanks into the supply line is controlled by valves. The appropriate valve is opened depending on which cleaning phase is active. The flow quantity is controlled by a pump.

Before the fluid is drawn off, it is checked to confirm that it meets the quality requirements or that sufficient fluid is available.

#### Additional functions

In addition to the "CIP" CIP system, the example project also contains the "MIX PLANT" plant section. This is used to demonstrate cleaning with a CIP system. The plant section consists of the mixer to be cleaned as well as the "TANK\_IN" (tank inlet) and "TANK\_OUT" (tank outlet) equipment modules.

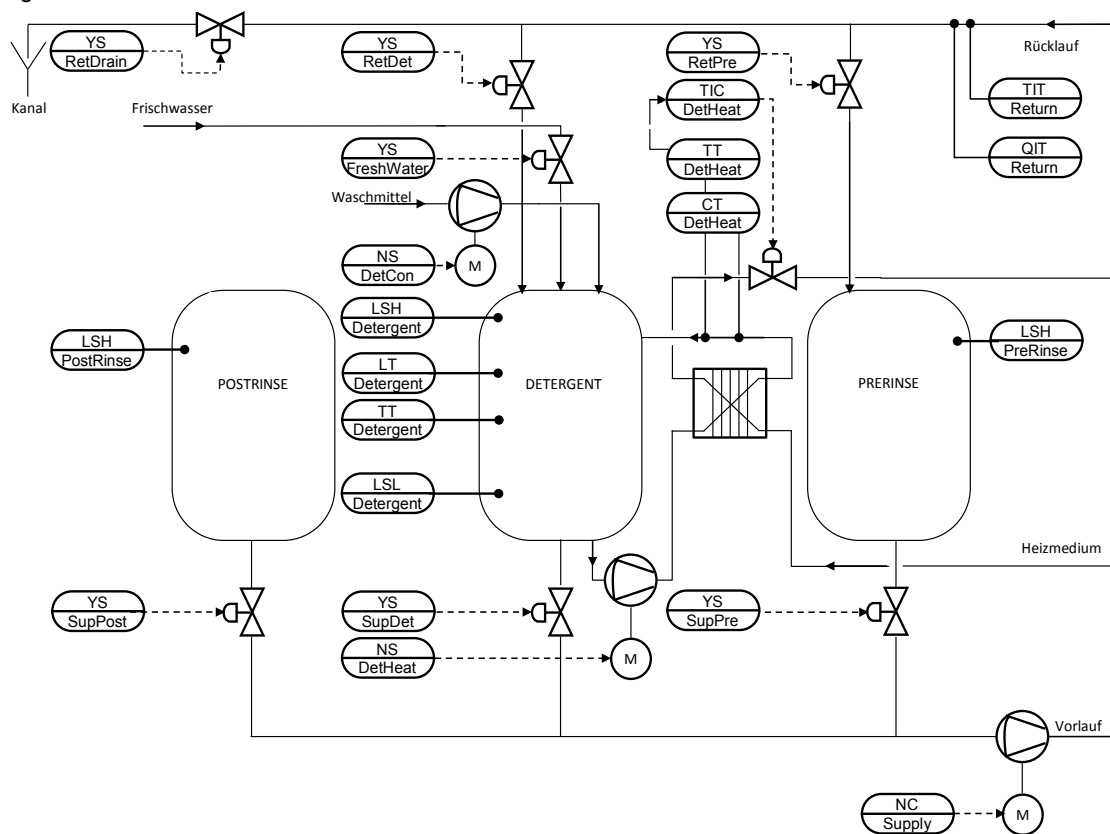
#### Advantages of this solution

- A reduction of the knowledge necessary to develop applications
- A reduction in the configuration effort
- More flexible setup and adaptation due to technical functions
- Standardized structures

### 2.2.2 PI process picture

The figure below shows the PI flow diagram of the CIP system. The measurement points that are contained in the project have been entered.

Figure 2-4



## 2.3 Hardware and software components used

The application example has been created with the following components:

### Hardware components

Table 2–1

Component	Note
SIMATIC PCS 7 ES/OS IPC847D W7	For the PCS 7 V8.1 example project

#### Note

In case of different hardware, please take heed of the minimum requirements for installing the software components. The minimum requirements can be found in the Read Me file of the PCS 7.

### Standard software components

Table 2–2

Component	Note
SIMATIC PCS 7 V8.1	Part of SIMATIC PCS 7 ES/OS IPC847D W7
S7-PLCSIM	Not part of SIMATIC PCS 7; appropriate licenses are required.
APL library V8.1	Part of SIMATIC PCS 7 V8.1
SIMATIC BATCH V8.1	Not part of PCS 7; appropriate licenses are required.
BRAUMAT Library V7.1	Not part of PCS 7; appropriate licenses are required.

### Example files and projects

The following list contains all the files and projects used in this example.

Table 2–3

Component	Note
78463886_CIP_PCS7V81.zip	PCS 7 V8.1 example project
78463886_CIP_de.pdf	This document

## **3 Basics**

### **3.1 Process engineering**

#### **Cleaning in Place (CIP)**

The term "Cleaning in Place", or CIP for short, describes a process which is used in the process industry for cleaning plant parts. The advantage of the process is that the cleaning takes place directly on the plant part in situ, without it having to be dismantled.

A separate plant section is added to the plant for the CIP process. The cleaning fluid is prepared and stored here. The plant sections to be cleaned are designed so that they can be connected to the CIP plant section. The CIP plant section is positioned so that the paths to the plant sections to be cleaned are as short as possible.

### **3.2 Automation technology**

#### **The "unit" concept**

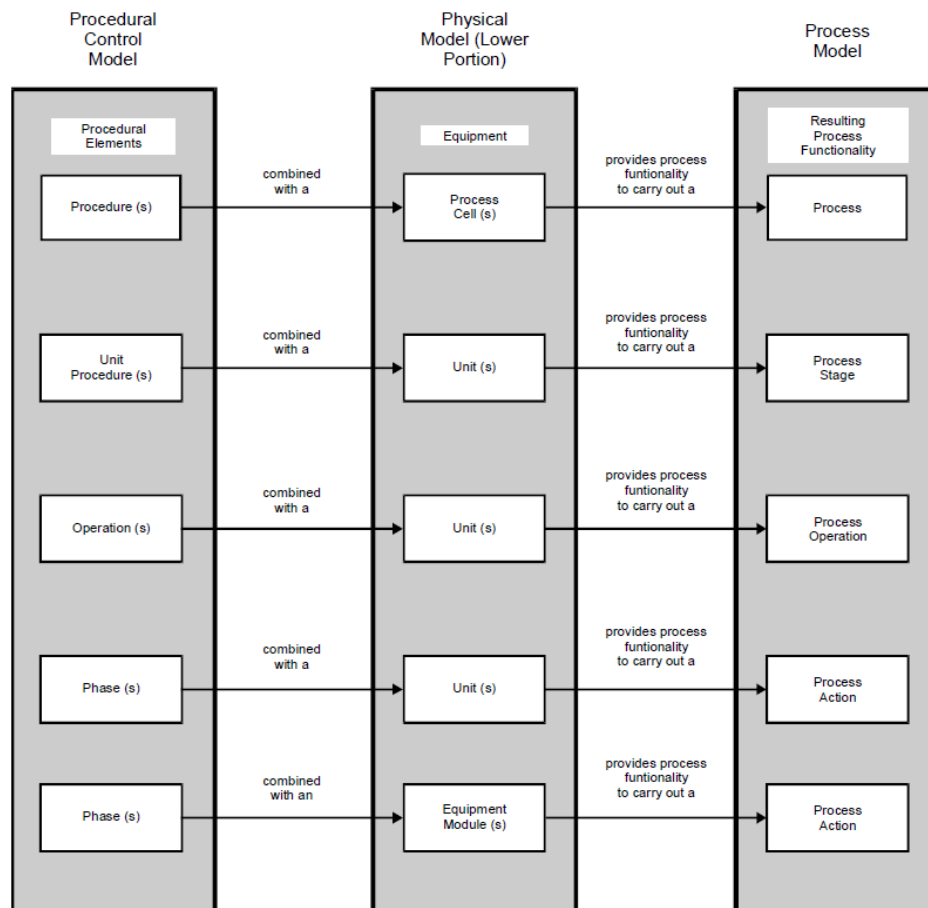
In this application example, the "CIP" plant section can be regarded as a unit.

The term "unit" means a unit in process-related plants (plant section, apparatus, machines) including the sensors, actuators and the assigned automation software that is frequently required in this configuration of components. The unit as a "Type" is used as a template for generating many different programmable instances.

## ISA-88

The application example is configured in accordance with the ISA-S88 standard. The standard describes a process with reference to the equipment available (physical model), the defined technical process (process model) and the equipment that is used to produce a batch (procedural control model). The figure below describes the structure of the ISA-S88 standard.

Figure 3–1

**Note**

You will find detailed information on ISA-S88.01 in the manual "SIMATIC Process Control System PCS 7 SIMATIC BATCH V8.1", in the chapter "Technological basics complying with ISA-88.01". You will find this manual at the following link: <http://support.automation.siemens.com/WW/view/en/103173731>

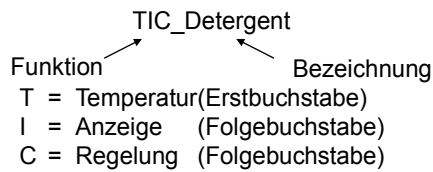
## 4 Design and principle of operation

### 4.1 Project structure

#### 4.1.1 CFC chart structures

A uniform naming convention has been used for identifying the measurement points - the function is named according to the European standard EN 62424. The following figure shows the composition of a measurement point name:

Figure 4–1



The following table contains the letters used in the application and their meanings:

Table 4–1

First letter	Meaning
F	Flow
L	Level
N	Motor
P	Pressure
Q	Master value
C	Speed (velocity, rotational speed, frequency)
T	Temperature
X	Freely selectable first letter
Y	Control valve

Table 4–2

Subsequent letter	Meaning
C	Control
F	Fraction
I	Indication
S	Switching binary control function or switching function (non-safety-related)
T	Monitoring (transmitter, analog value processing)
H	High (top)
L	Low (bottom)

### 4.1.2 Technological perspective

The plant hierarchy of the "CIP" application example is configured according to ISA S88.01.

#### AS Project

In the AS project, "CIP\_AS", the first plant hierarchy level, "PRODUCTION", is defined as the plant and contains the neutral hierarchy folders.

- "CIP" contains the "CIP" hierarchy folder, defined as a plant section
- "MIXER PLANT" contains the "MIXER" hierarchy folder, defined as a plant section
- "RECIPE CONTROL" contains no other objects

The "CIP" plant section contains the "UNIT\_CIP" CFC diagram with the "UNIT\_PLC" block, the hierarchy folders for the "CIP\_SUPPLY" and "CIP\_RETURN" equipment modules and the neutral hierarchy folders for the tanks in the CIP system. The necessary measurement points are located in these folders.

The "MIXER" plant section contains the "UNIT\_MIXER" CFC diagram with the "UNIT\_MIXER" "UNIT\_PLC" block and the hierarchy folders for the "TANK\_IN" and "TANK\_OUT" equipment modules. The necessary measurement points are located in these folders.

The following figures show the structure of the AS project:

Figure 4–2

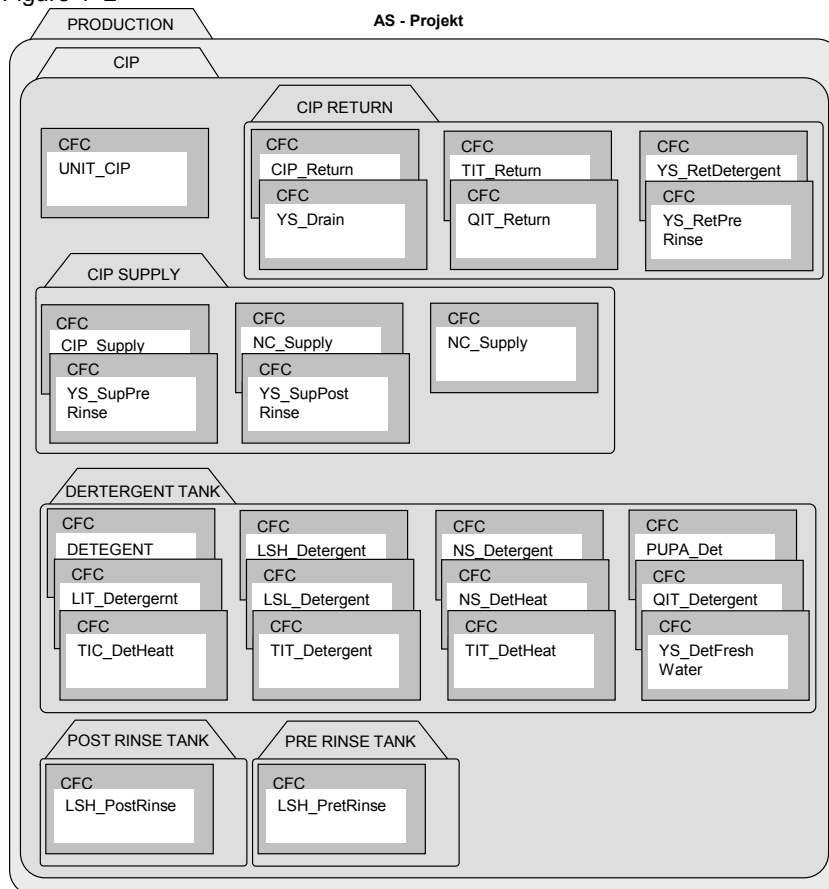
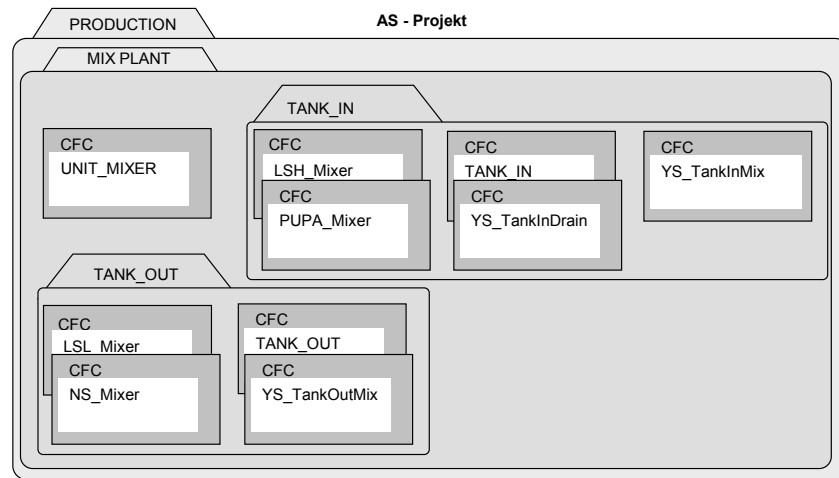


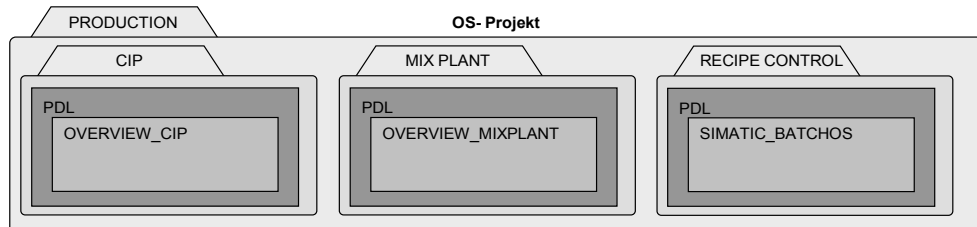
Figure 4–3



### OS project

The plant hierarchy in the OS project is derived from the plant hierarchy for the AS project. The "IP", "MIX PLANT" and "RECIPE CONTROL" neutral hierarchy folders contain the "OVERVIEW\_CIP.pdl", "OVERVIEW\_MIXPLANT.pdl" and "SIMATIC\_BATCHOS.pdl" overview images. The "IP" and "MIX PLANT" hierarchy folders, defined as plant sections, contain the "CIP.pdl" and "MIXER.pdl" images.

Figure 4–4



## 4.2 Technical functions and measurement points

The "CIP" application example is composed of various technical functions and measurement points. In a PCS 7 project, all measurement points, including the measurement points for the technical functions, are based on measurement point types from the master data library. The process tag types that are used in the project are taken from the APL library. SFC types, which are also included in the master data library, are used to describe the technical functions.

In the following chapters you will find information on the structure of the individual technical functions. You will also find a description of the SFCs used.

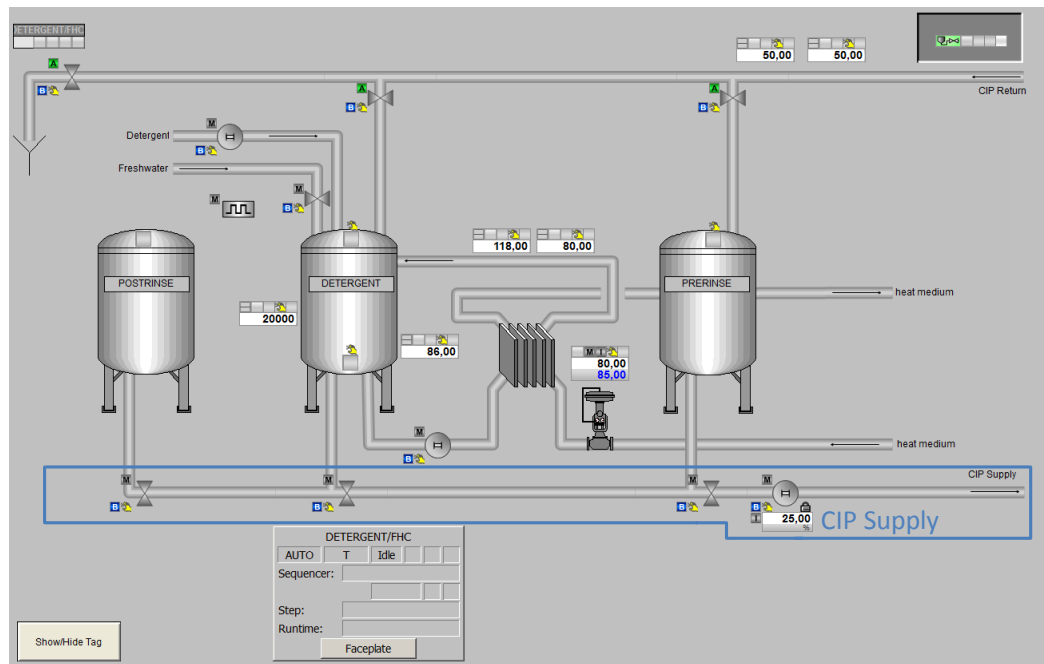
### 4.2.1 CIP SUPPLY

The detergent is fed from the tanks to the individual sections of the plant via the CIP supply. Which detergent is used is implemented by means of an SFC type instance. The fluid is taken from the appropriate tank, depending on which control strategy is selected. The quantities taken are defined by cleaning recipes in SIMATIC BATCH. The cleaning is carried out using cleaning batches and thus is also logged.

### Design

The figure below shows the design of the supply apparatus:

Figure 4–5



The supply valves for the tanks are opened and closed by an instance of the "CIP SUPPLY" SFC type.

The following table provides you with an overview of the elements and measurement point types used.

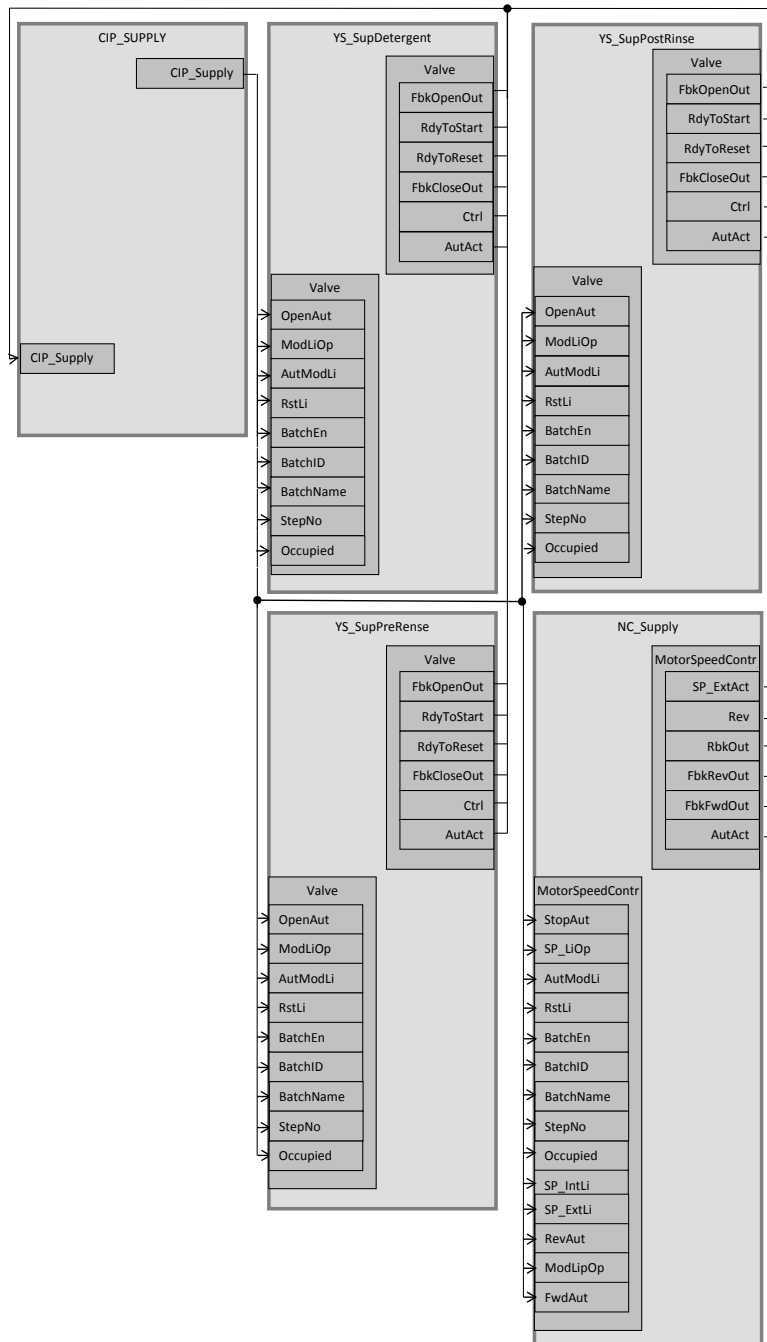
Table 4–3

Name	Process tag type	Description
CIP_Supply	"CIP SUPPLY" SFC type	<ul style="list-style-type: none"><li>• Opening and closing the valves according to the specified control strategy</li><li>• Starting and stopping the pump</li></ul>
NC_Supply	"MotorSpeedControlled"	Motor for driving the pump
YS_SupDetergent	"ValveLean"	"Detergent tank valve" process tag
YS_SupPostRinse	"ValveLean"	"Fresh water tank valve" process tag
YS_SupPreRinse	"ValveLean"	"Pre-rinse tank valve" process tag

### Connecting the process tags

The following figure shows schematically the supply apparatus including the connections or SFC accesses that span the CFC diagram.

Figure 4–6



### Parameter assignment

The parameter assignment for the individual process tags is described in the following. A detailed description of the SFC type can be found in Chapter 4.3.1, "Sequencers".

### NC\_Supply

The flow quantity of the cleaning fluid is controlled in the "NC\_Supply" process tag. The setpoint is specified by means of the "CIP SUPPLY" SFC type instance. The "NC\_Supply" process tag is an instance of the "MotorSpeedControlled" process tag type.

The following table shows the configuration of the instance from "MotorSpeedControlled".

Table 4–4

Block	Connection	Value	Usage
FbkFwd	SimPV_In	1	Simulated process value
RbkSpeed	PV_InUnit	1342	Unit of measure of input signal, percent %
RbkSpeed	SimOn	1	Simulation switched on
RbkSpeed	SimPV_In	28.0	Simulated process value
Interlock	-	-	Removed
Intlk04	-	-	Inserted as IntlkMot
IntlkMot	In01	-	Connection to YS_SupPostRinse\Valve.FbkOpenOut)
IntlkMot	In02	-	Connection to YS_SupDetergent\Valve.FbkOpenOut
IntlkMot	In03	-	Connection to YS_SupPreRinse\Valve.FbkOpenOut
IntlkMot	Out	-	Logic result connected to NC_Supply\MotorSpeedContr.Intlock
Protect	In01	1	Connection removed, value "1"
OR_OOS	In7	-	Visible connection to NC_Supply\2.OosAct
MotorSpeedContr	FwdAut	-	Switch on forward in automatic mode (CIP_Supply\CIP SUPPLY.M1_FwdAut)
MotorSpeedContr	StopAut	-	Stop motor in automatic mode (CIP_Supply\CIP SUPPLY.M1_StopAut)
MotorSpeedContr	RevAut	-	Switch on reverse in automatic mode (CIP_Supply\CIP SUPPLY.M1_StopAut)
MotorSpeedContr	ModLiOp	-	Switching between modes (operator or connection/SFC (CIP_Supply\CIP SUPPLY.M1_ModLiOp)
MotorSpeedContr	SP_ext	-	External setpoint (CIP_Supply\CIP SUPPLY.M1_SP_Ext)
MotorSpeedContr	SP_HiLim	60.0	Upper limit of the setpoint

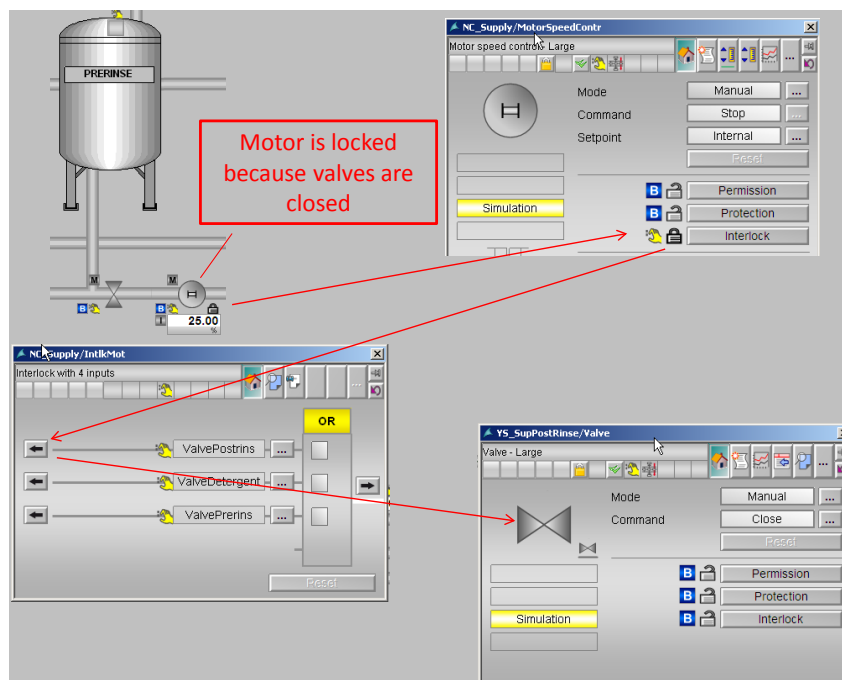
Block	Connection	Value	Usage
MotorSpeedContr	SP_LiOp	-	Setpoint source internal/external (CIP_Supply\CIP SUPPLY.M1_SP_LiOp)
MotorSpeedContr	SP_ExtLi	-	External setpoint via the CIP_Supply\CIP SUPPLY.M1_SP_ExtLi connection
MotorSpeedContr	SP_IntLi	-	Internal setpoint via the CIP_Supply\CIP SUPPLY.M1_SP_IntLi connection
MotorSpeedContr	Monitor	0	Monitoring of checkback signals deactivated
MotorSpeedContr	RstLi	-	Reset via the CIP_Supply\CIP SUPPLY.M1_RstLi connection
MotorSpeedContr	Interlock	-	Interlocking without resetting (CIP_Supply\IntlkMot.out)
MotorSpeedContr	BatchEN	-	Occupation release (CIP_Supply\CIP SUPPLY.QBA_EN)
MotorSpeedContr	BatchID	-	Batch number (CIP_Supply\CIP SUPPLY.QBA_ID)
MotorSpeedContr	BatchName	-	Batch name (CIP_Supply\CIP SUPPLY.QBA_NA)
MotorSpeedContr	StepNo	-	Batch step number (CIP_Supply\CIP SUPPLY.QSTEP_NO)
MotorSpeedContr	Occupied	-	Occupied by batch (CIP_Supply\CIP SUPPLY.QOCCUPIED)
MotorSpeedContr	AV	-	Additional analog value (NC_Supply\FLOW.AV_Tech)
MotorSpeedContr	GrpErr	-	Group error (CIP_Supply\CIP SUPPLY.M1_GrpErr)
MotorSpeedContr	RdyToStart	-	Ready to start (CIP_Supply\CIP SUPPLY.M1_RdyToStart)
MotorSpeedContr	RdyToReset	-	Ready to reset (CIP_Supply\CIP SUPPLY.M1_RdyToReset)
MotorSpeedContr	Fwd	-	Activate forward (CIP_Supply\CIP SUPPLY.M1_Fwd)
MotorSpeedContr	Rev	-	Activate reverse (CIP_Supply\CIP SUPPLY.M1_Rev)
MotorSpeedContr	AutAct	-	Automatic mode (CIP_Supply\CIP SUPPLY.M1_AutAct)
MotorSpeedContr	FbkFwdOut	-	Feedback message "Forward mode" (CIP_Supply\CIP SUPPLY.M1_FbkFwdOut)
MotorSpeedContr	FbkRevOut	-	Feedback message "Reverse mode" (CIP_Supply\CIP SUPPLY.M1_FbkRevOut)
MotorSpeedContr	SP_ExtAct	-	External setpoint active (CIP_Supply\CIP SUPPLY.M1_SP_ExtAct)
MotorSpeedContr	RbkOut	-	Output "Readback value" (CIP_Supply\CIP SUPPLY.M1_RbkOut)
Error	In8	-	(NC_Supply\ ScalePV.Bad)

Block	Connection	Value	Usage
Pcs7AnIn	-	-	Inserted as "ScalePV"
ScalePV	Scale	70	Scaling of the process value
ScalePV	PV_InUnit	1349	Unit of measure of the process value in cubic meters per hour m³/h
ScalePV	SimOn	1	Simulation on
ScalePV	SimPV_In	26	Simulated process value
ScalePV	Mode	16#00	Status of value and measurement type
ScalePV	MS_Release	-	Release for maintenance (NC_Supply\FLOW.MS_Release)
AV	-	-	Inserted as FLOW for additional analog value
FLOW	AV	-	Additional analog value (NC_Supply\ScalePV.PV_Out)
FLOW	AV_Unit	-	Unit of measure for an additional analog value (NC_Supply\ScalePV.PV_OutUnit)
FLOW	AV_OpScale	-	Limiting value for the scales on the bar graph display (NC_Supply.ScalePV\ScaleOut)
FLOW	SV_Out	-	Output for the analog value (CIP_Supply\CIP_SUPPLY.RINSE_FLOW_AI)

The IntlkMot block is used to interlock the motor. This ensures that the motor only runs if one of the valves is open as well.

The following figure describes the interlocking and how it can be canceled.

Figure 4–7



## YS\_SupDetergent

The "YS\_SupDetergent" process tag controls the discharge from the detergent tank into the supply inlet. The valve block receives the command to open or close from the "CIP SUPPLY" SFC type instance. The "YS\_SupDetergent" process tag is an instance of the "ValveLean" process tag type.

The following table shows the configuration of the instance from "ValveLean":

Table 4–5

Block	Connection	Value	Usage
FbkOpen	PV_In	0	Feedback message "Valve open", connection removed
FbkClose	PV_In	0	Feedback message "Valve closed", connection removed
Permit	In01	0	Release to open or close from the neutral position, connection removed
Interlock	In01	0	Interlock, connection removed
Protect	In01	0	Protective interlock, connection removed
Valve	OpenAut	-	Open valve in automatic mode, (CIP_Supply\CIP SUPPLY.V2_OpenAut)
Valve	ModLiOp	-	Switch between operator/connection modes (CIP_Supply\CIP SUPPLY.V2_ModLiOp)
Valve	RstLi	-	Reset via the (CIP_Supply\CIP SUPPLY.V2_RstLi) connection
Valve	BatchEn	-	Occupation release (CIP_Supply\CIP SUPPLY.QBA_EN)
Valve	BatchID	-	Batch number (CIP_Supply\CIP SUPPLY.QBA_ID)
Valve	BatchName	-	Batch name (CIP_Supply\CIP SUPPLY.QBA_NA)
Valve	StepNo	-	Batch step number (CIP_Supply\CIP SUPPLY.QSTEP_NO)
Valve	Occupied	-	Occupied by batch (CIP_Supply\CIP SUPPLY.QOCCUPIED)
Valve	RdyToStart	-	Ready to start (CIP_Supply\CIP SUPPLY.V2_RdyToStart)
Valve	RdyToReset	-	Ready to reset (CIP_Supply\CIP SUPPLY.V2_RdyToReset)
Valve	Ctrl	-	Control output (CIP_Supply\CIP SUPPLY.V2_Ctrl)
Valve	AutAct	-	Automatic mode active (CIP_Supply\CIP SUPPLY.V2_AutAct)
Valve	FbkOpenOut	-	Valve open (CIP_Supply\CIP SUPPLY.V2_FbkOpenOut)
Valve	FbkClosedOut	-	Valve closed (CIP_Supply\CIP SUPPLY.V2_FbkCloseOut)

**YS\_SupPostRinse**

The "YS\_SupPostRinse" process tag controls the discharge from the fresh water tank into the supply inlet. The valve block receives the command to open or close from the "CIP SUPPLY" SFC type instance. The "YS\_SupPostRinse" process tag is an instance of the "ValveLean" process tag type.

The following table shows the configuration of the instance from "ValveLean":

Table 4–6

Block	Connection	Value	Usage
FbkOpen	PV_In	0	Feedback message "Valve open", connection removed
FbkClose	PV_In	0	Feedback message "Valve closed", connection removed
Permit	In01	0	Release to open/close from the neutral position, connection removed
Interlock	In01	0	Interlock, connection removed
Protect	In01	0	Protective interlock, connection removed
Valve	OpenAut	-	Open valve in automatic mode, (CIP_Supply\CIP SUPPLY.V3_OpenAut)
Valve	ModLiOp	-	Switch between operator/connection modes (CIP_Supply\CIP SUPPLY.V3_ModLiOp)
Valve	RstLi	-	Reset via the (CIP_Supply\CIP SUPPLY.V3_RstLi) connection
Valve	BatchEn	-	Occupation release (CIP_Supply\CIP SUPPLY.QBA_EN)
Valve	BatchID	-	Batch number (CIP_Supply\CIP SUPPLY.QBA_ID)
Valve	BatchName	-	Batch name (CIP_Supply\CIP SUPPLY.QBA_NA)
Valve	StepNo	-	Batch step number (CIP_Supply\CIP SUPPLY.QSTEP_NO)
Valve	Occupied	-	Occupied by batch (CIP_Supply\CIP SUPPLY.QOCCUPIED)
Valve	RdyToStart	-	Ready to start (CIP_Supply\CIP SUPPLY.V3_RdyToStart)
Valve	RdyToReset	-	Ready to reset (CIP_Supply\CIP SUPPLY.V3_RdyToReset)
Valve	Ctrl	-	Control output (CIP_Supply\CIP SUPPLY.V3_Ctrl)
Valve	AutAct	-	Automatic mode active (CIP_Supply\CIP SUPPLY.V3_AutAct)
Valve	FbkOpenOut	-	Valve open (CIP_Supply\CIP SUPPLY.V3_FbkOpenOut)
Valve	FbkClosedOut	-	Valve closed (CIP_Supply\CIP SUPPLY.V3_FbkCloseOut)

**YS\_SupPreRinse**

The "YS\_SupPreRinse" process tag controls the discharge from the fresh water tank into the supply inlet. The valve block receives the command to open or close from the "CIP SUPPLY" SFC type instance. The "YS\_SupPreRinse" process tag is an instance of the "ValveLean" process tag type.

The following table shows the configuration of the instance from "ValveLean":

Table 4–7

Block	Connection	Value	Usage
FbkOpen	PV_In	0	Feedback message "Valve open", connection removed
FbkClose	PV_In	0	Feedback message "Valve closed", connection removed
Permit	In01	0	Release to open/close from the neutral position, connection removed
Interlock	In01	0	Interlock, connection removed
Protect	In01	0	Protective interlock, connection removed
Valve	OpenAut	-	Open valve in automatic mode, (CIP_Supply\CIP SUPPLY.V1_OpenAut)
Valve	ModLiOp	-	Switch between operator/connection modes (CIP_Supply\CIP SUPPLY.V1_ModLiOp)
Valve	RstLi	-	Reset via the (CIP_Supply\CIP SUPPLY.V1_RstLi) connection
Valve	BatchEn	-	Occupation release (CIP_Supply\CIP SUPPLY.QBA_EN)
Valve	BatchID	-	Batch number (CIP_Supply\CIP SUPPLY.QBA_ID)
Valve	BatchName	-	Batch name (CIP_Supply\CIP SUPPLY.QBA_NA)
Valve	StepNo	-	Batch step number (CIP_Supply\CIP SUPPLY.QSTEP_NO)
Valve	Occupied	-	Occupied by batch (CIP_Supply\CIP SUPPLY.QOCCUPIED)
Valve	RdyToStart	-	Ready to start (CIP_Supply\CIP SUPPLY.V1_RdyToStart)
Valve	RdyToReset	-	Ready to reset (CIP_Supply\CIP SUPPLY.V1_RdyToReset)
Valve	Ctrl	-	Control output (CIP_Supply\CIP SUPPLY.V1_Ctrl)
Valve	AutAct	-	Automatic mode active (CIP_Supply\CIP SUPPLY.V1_AutAct)
Valve	FbkOpenOut	-	Valve open (CIP_Supply\CIP SUPPLY.V1_FbkOpenOut)
Valve	FbkClosedOut	-	Valve closed (CIP_Supply\CIP SUPPLY.V1_FbkCloseOut)

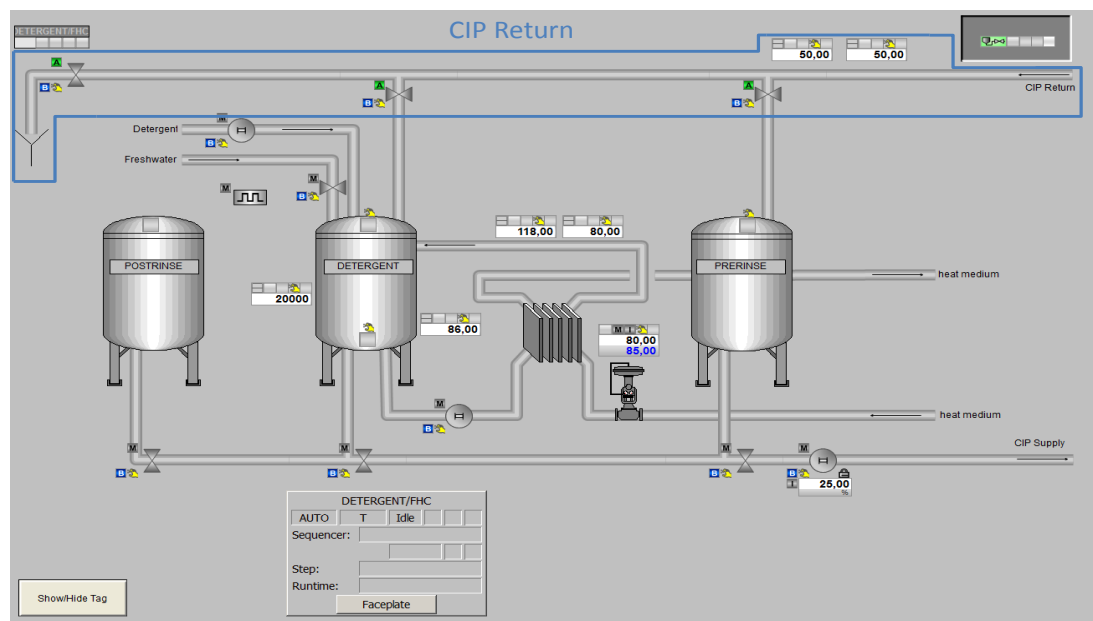
### 4.2.2 CIP RETURN

The temperature and concentration of the fluid are determined in the return line and, depending on the measured values, it is fed back into the CIP tanks. The valves to the tanks are opened depending on what the quality of the fluid is like. The fluid from the pre-rinse phase is fed directly into the drain. If the tanks are full or if the quality is not good enough, the fluid is also discharged into the drain.

#### Design

The figure below shows the design of the return apparatus:

Figure 4–8



The valves are controlled by an instance of the "CIP RETURN" SFC type.

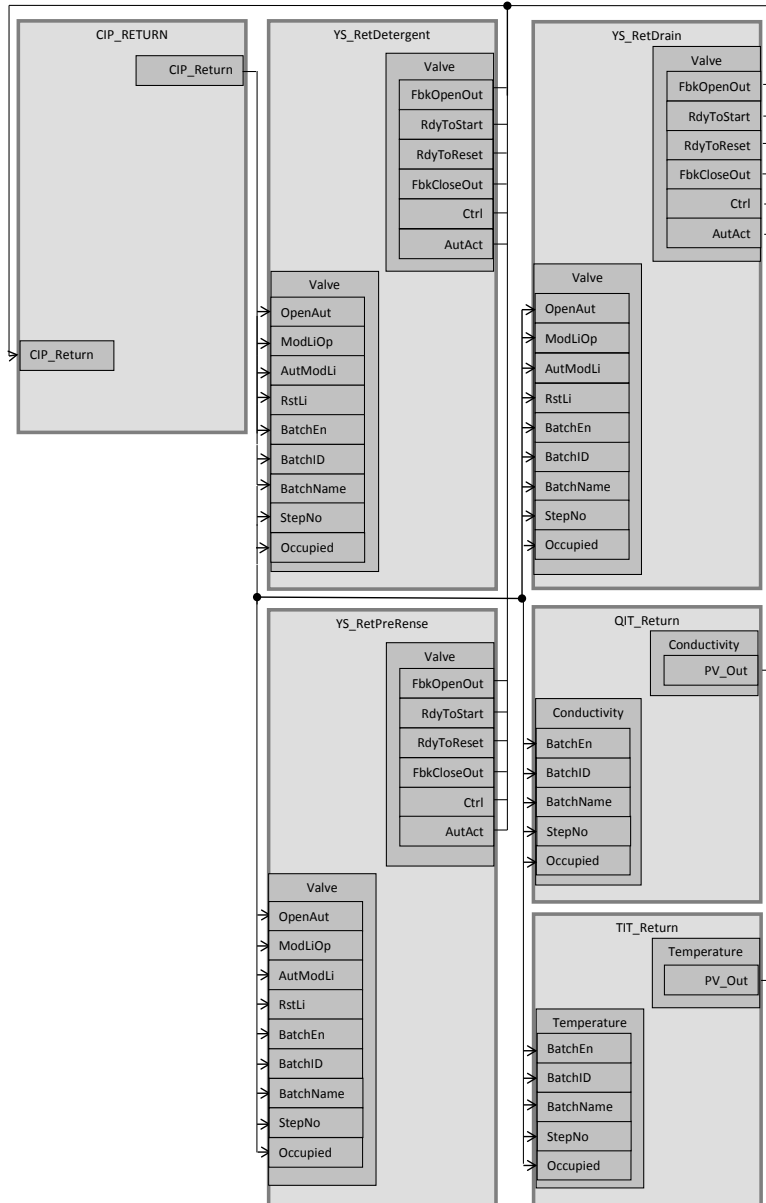
The following table provides you with an overview of the elements and process tag types used:

Table 4–8

Name	Process tag type	Description
QIT_Return	"AnalogMonitoring"	Determining the alkali concentration
TIT_Return	"AnalogMonitoring"	Determining the fluid temperature
YS_RetDetergent	"ValveLean"	Valve for the return flow to the detergent tank
YS_RetDrain	"ValveLean"	Valve for the return flow to the drain
YS_RetPreRinse	"ValveLean"	Valve for the return flow to the pre-rinse tank
CIP_Return	SFC type instance	<ul style="list-style-type: none"> <li>Opens and closes the valves</li> <li>Interface for connecting to SIMATIC BATCH</li> </ul>

The following figure shows schematically the return apparatus including the connections or SFC accesses that span the CFC diagram.

Figure 4–9



### Parameter assignment

The parameter assignment for the individual process tags is described in the following. A detailed description of the SFC type can be found in Chapter 4.3.2, "Sequencers".

### QIT\_Return

The concentration of detergent in the fluid in the return line is determined in the "QIT\_Return" process tag. This value is passed to the instance of the "CIP RETURN" SFC type. Based on the measured value, the controller decides which tank the fluid will be fed into. The "QIT\_Return" process tag is an instance of the "AnalogMonitoring" process tag type.

The following table shows the configuration of the instance from "AnalogMonitoring".

Table 4–9

Block	Connection	Value	Usage
Input1	PV_InUnit	1289	Unit of measure of the measured quantity, millisiemens, mS
Conductivity	PV_Hyst	3.0	Hysteresis for the PV alarm
Conductivity	MsgLock	1	Suppress process messages
Conductivity	BatchEn	-	Occupation release (CIP_Return\CIP RETURN.QBA_EN)
Conductivity	BatchID	-	Batch number (CIP_Return\CIP RETURN.QBA_ID)
Conductivity	BatchName	-	Batch name (CIP_Return\CIP RETURN.QBA_ID)
Conductivity	StepNo	-	Batch step number (CIP_Return\CIP RETURN.QSTEP_NO)
Conductivity	Occupied	-	Occupied by batch (CIP_Return\CIP RETURN.QOCCUPIED)

### TIT\_Return

The temperature of the fluid in the return line is determined in the "TIT\_Return" process tag. This value is passed to the instance of the "CIP RETURN" SFC type. Based on the measured value, the controller decides which tank the fluid will be fed into. The "TIT\_Return" process tag is an instance of the "AnalogMonitoring" process tag type.

The following table shows the configuration of the instance from "AnalogMonitoring":

Table 4–10

Block	Connection	Value	Usage
Input1	PV_InUnit	1001	Unit of measure of the measured quantity, degrees Celsius °C
Temperature	BatchEn	-	Occupation release (CIP_Return\CIP RETURN.QBA_EN)
Temperature	BatchID	-	Batch number (CIP_Return\CIP RETURN.QBA_ID)
Temperature	BatchName	-	Batch name (CIP_Return\CIP RETURN.QBA_ID)
Temperature	StepNo	-	Batch step number (CIP_Return\CIP RETURN.QSTEP_NO)
Temperature	Occupied	-	Occupied by batch (CIP_Return\CIP RETURN.QOCCUPIED)

### YS\_RetDetergent

The "YS\_RetDetergent" valve process tag controls the return flow to the detergent tank. The process tag receives the command for opening or closing the valve from the instance of the "CIP RETURN" SFC type. The "YS\_RetDetergent" valve process tag is an instance of the "ValveLean" process tag type.

The following table shows the configuration of the instance from "ValveLean":

Table 4–11

Block	Connection	Value	Usage
FbkOpen	PV_In	0	Feedback message "Valve open", connection removed
FbkClose	PV_In	0	Feedback message "Valve closed", connection removed
Permit	In01	0	Release to open or close from the neutral position, connection removed
Interlock	In01	0	Interlock, connection removed
Protect	In01	0	Protective interlock, connection removed
Valve	OpenAut	-	Open valve in automatic mode, (CIP_Return\CIP RETURN.V2_OpenAut)
Valve	ModLiOp	-	Changeover of operating mode between operator and connection (CIP_Return\CIP RETURN.V2_ModLiOp)

Block	Connection	Value	Usage
Valve	RstLi	-	Reset via the CIP_Return\CIP RETURN.V2_RstLi connection
Valve	BatchEn	-	Occupation release (CIP_Return\CIP RETURN.QBA_EN)
Valve	BatchID	-	Batch number (CIP_Return\CIP RETURN.QBA_ID)
Valve	BatchName	-	Batch name (CIP_Return\CIP RETURN.QBA_ID)
Valve	StepNo	-	Batch step number (CIP_Return\CIP RETURN.QSTEP_NO)
Valve	Occupied	-	Occupied by batch (CIP_Return\CIP RETURN.QOCCUPIED)
Valve	RdyToStart	-	Ready to start (CIP_Return\CIP RETURN.V2_RdyToStart)
Valve	RdyToReset	-	Ready to reset (CIP_Return\CIP RETURN.V2_RdyToReset)
Valve	Ctrl	-	Control output (CIP_Return\CIP RETURN.V2_Ctrl)
Valve	AutAct	-	Automatic mode active (CIP_Return\CIP RETURN.V2_AutAct)
Valve	FbkOpenOut	-	Valve open (CIP_Supply\CIP SUPPLY.V2_FbkOpenOut)
Valve	FbkClosedOut	-	Valve closed (CIP_Return\CIP RETURN.V2_FbkCloseOut)

**YS\_RetDrain**

The "YS\_RetDrain" valve process tag controls the return flow to the drain. The process tag receives the command for opening or closing the valve from the instance of the "CIP RETURN" SFC type. The "YS\_RetDrain" valve process tag is an instance of the "ValveLean" process tag type.

The following table shows the configuration of the instance from "ValveLean":

Table 4–12

Block	Connection	Value	Usage
FbkOpen	PV_In	0	Feedback message "Valve open", connection removed
FbkClose	PV_In	0	Feedback message "Valve closed", connection removed
Permit	In01	0	Release to open/close from the neutral position, connection removed
Interlock	In01	0	Interlock, connection removed
Protect	In01	0	Protective interlock, connection removed
Valve	OpenAut	-	Open valve in automatic mode, (CIP_Return\CIP RETURN.V3_OpenAut)
Valve	ModLiOp	-	Changeover of operating mode between operator and connection (CIP_Return\CIP RETURN.V3_ModLiOp)
Valve	RstLi	-	Reset via the CIP_Return\CIP RETURN.V3_RstLi connection
Valve	BatchEn	-	Occupation release (CIP_Return\CIP RETURN.QBA_EN)
Valve	BatchID	-	Batch number (CIP_Return\CIP RETURN.QBA_ID)
Valve	BatchName	-	Batch name (CIP_Return\CIP RETURN.QBA_ID)
Valve	StepNo	-	Batch step number (CIP_Return\CIP RETURN.QSTEP_NO)
Valve	Occupied	-	Occupied by batch (CIP_Return\CIP RETURN.QOCCUPIED)
Valve	RdyToStart	-	Ready to start (CIP_Return\CIP RETURN.V3_RdyToStart)
Valve	RdyToReset	-	Ready to reset (CIP_Return\CIP RETURN.V3_RdyToReset)
Valve	Ctrl	-	Control output (CIP_Return\CIP RETURN.V3_Ctrl)
Valve	AutAct	-	Automatic mode active (CIP_Return\CIP RETURN.V3_AutAct)
Valve	FbkOpenOut	-	Valve open (CIP_Return\CIP RETURN.V3_FbkOpenOut)
Valve	FbkClosedOut	-	Valve closed (CIP_Return\CIP RETURN.V3_FbkCloseOut)

**YS\_RetPreRinse**

The "YS\_RetPreRinse" valve process tag controls the return flow to the pre-rinse tank. The process tag receives the command for opening or closing the valve from the instance of the "CIP RETURN" SFC type. The "YS\_PreRinse" valve process tag is an instance of the "ValveLean" process tag type.

The following table shows the configuration of the instance from "ValveLean":

Table 4–13

Block	Connection	Value	Usage
FbkOpen	PV_In	0	Feedback message "Valve open", connection removed
FbkClose	PV_In	0	Feedback message "Valve closed", connection removed
Permit	In01	0	Release to open or close from the neutral position, connection removed
Interlock	In01	0	Interlock, connection removed
Protect	In01	0	Protective interlock, connection removed
Valve	OpenAut		Open valve in automatic mode, (CIP_Return\CIP RETURN.V1_OpenAut)
Valve	ModLiOp	-	Changeover of operating mode between operator and connection (CIP_Return\CIP RETURN.V1_ModLiOp)
Valve	RstLi	-	Reset via the CIP_Return\CIP RETURN.V1_RstLi connection
Valve	BatchEn	-	Occupation release (CIP_Return\CIP RETURN.QBA_EN)
Valve	BatchID	-	Batch number (CIP_Return\CIP RETURN.QBA_ID)
Valve	BatchName	-	Batch name (CIP_Return\CIP RETURN.QBA_ID)
Valve	StepNo	-	Batch step number (CIP_Return\CIP RETURN.QSTEP_NO)
Valve	Occupied	-	Occupied by batch (CIP_Return\CIP RETURN.QOCCUPIED)
Valve	RdyToStart	-	Ready to start (CIP_Return\CIP RETURN.V1_RdyToStart)
Valve	RdyToReset	-	Ready to reset (CIP_Return\CIP RETURN.V1_RdyToReset)
Valve	Ctrl	-	Control output (CIP_Return\CIP RETURN.V1_Ctrl)
Valve	AutAct	-	Automatic mode active (CIP_Return\CIP RETURN.V1_AutAct)
Valve	FbkOpenOut	-	Valve open (CIP_Return\CIP RETURN.V1_FbkOpenOut)
Valve	FbkClosedOut	-	Valve closed (CIP_Return\CIP RETURN.V1_FbkCloseOut)

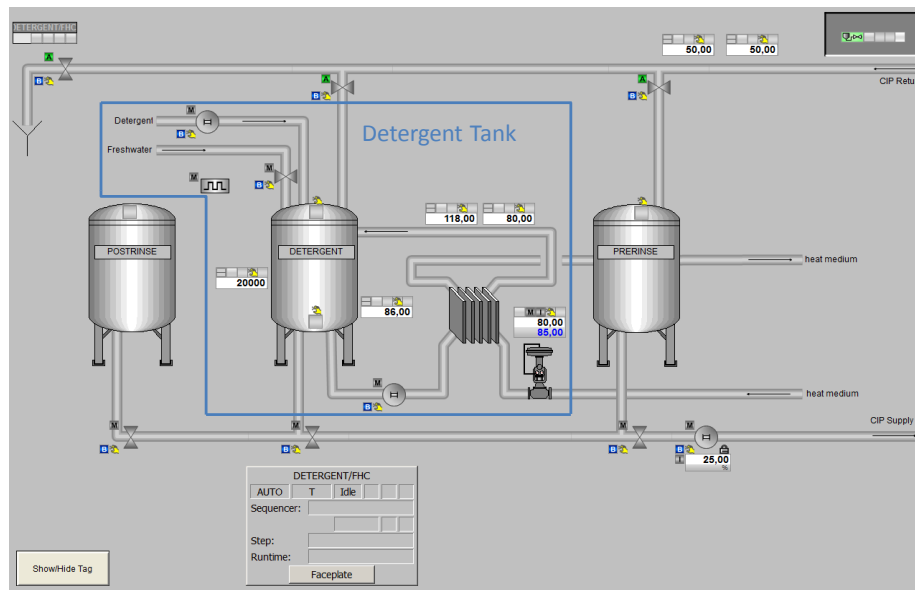
### 4.2.3 Detergent tank

The detergent tank contains the detergent used for cleaning. The detergent is heated to the required temperature in the tank. The required detergent concentration is also set. The detergent tank is continuously filled, either from the return line during the cleaning phases or by supplying fresh water and alkali. The temperature of the fluid in the tank is continuously regulated at a specified value.

#### Design

The figure below shows the design of the detergent tank:

Figure 4–10



The tank contains two level sensors which detect the maximum and minimum fill levels. The fluid is pumped via pipes through a heat exchanger in order to control the temperature. The concentration of the alkali is also measured in the pipes. The circulation of the fluid is controlled by means of an instance of the DETERGENT SFC type. This is also used to control the concentration and to pass the setpoints for the pid controller for temperature control.

The following table provides you with an overview of the elements and process tag types used:

Table 4–14

Name	Process tag type	Description
QIT_Detergent	"AnalogMonitoring"	Process tag for the alkali concentration
LIT_Detergent	"AnalogMonitoring"	Process tag for the fill level
TIT_DetHeat	"AnalogMonitoring"	Process tag for the temperature of the fluid in the circuit
TIT_Detergent	"AnalogMonitoring"	Process tag for the temperature of the fluid in the tank
LSH_Detergent	"DigitalMonitoring"	Process tag for max. fill level reached
LSL_Detergent	"DigitalMonitoring"	Process tag for min. fill level reached
NS_DetCon	"MotorLean"	Process tag for activation of the pump to add detergent
NS_DetHeat	"MotorLean"	Process tag for activation of the pump for the heating circuit
YS_DetFreshWater	"ValveLean"	Process tag to control the valve for fresh water addition
TIC_DetHeat	"PIDControlLean"	Process tag for controlling the fluid temperature
PUPA_Det		Process tag for metering the addition of detergent
DETERGENT		Instance of the "DETERGENT" SFC type

### Parameter assignment

The parameter assignment for the individual process tags is described in the following. A detailed description of the SFC type can be found in Chapter 4.3.3, "Sequencers".

### QIT\_Detergent

The concentration of detergent in the fluid in the heating circuit is determined in the "QIT\_Detergent" process tag. This value is passed to the instance of the "FILL\_HEAT\_CONC" SFC type. The supply of detergent in the tank is controlled on the basis of the measured value. The "QIT\_Detergent" process tag is an instance of the "AnalogMonitoring" process tag type.

The following table shows the configuration of the instance from "AnalogMonitoring":

Table 4–15

Block	Connection	Value	Usage
Input1	Scale	200	Scaling of the process value
Input1	PV_InUnit	1289	Unit of measure of the process value, millisiemens, mS
Conductivity	PV_Out		Output of process value (DETERGENTFHC.CONC_AI)

**LIT\_Detergent**

The current fill level of the detergent tank is measured in the "LIT\_Detergent" process tag. The value is passed on to the instance of the "FILL\_HEAT\_CONC" SFC type. Based on this value, the fill level of the detergent tank is set.

The "LIT\_Detergent" process tag is an instance of the "AnalogMonitoring" process tag type.

The following table shows the configuration of the instance from "AnalogMonitoring":

Table 4–16

Block	Connection	Value	Usage
Input1	Scale	25000	Scaling of the process value
Input1	PV_InUnit	1038	Unit of measure of the process value, liter, l
Level	-	-	MonAnL replaced by MonAnS
Level	PV_Out	-	Process value output (DETERGENT\FHC.LEVEL_AI, DETERGENT\FHC.L_HYS_AI)

**TIT\_DetHeat**

The current temperature of the fluid in the heating circuit for the detergent tank is measured in the "TIT\_DetHeat" process tag. The value is passed on to the instance of the "FILL\_HEAT\_CONC" SFC type. The temperature of the fluid in the detergent tank is regulated on the basis of this value. The "TIT\_DetHeat" process tag is an instance of the "AnalogMonitoring" process tag type.

The following table shows the configuration of the instance from "AnalogMonitoring":

Table 4–17

Block	Connection	Value	Usage
Temperature	PV_Out	-	Process value output (TIC_DetHeat\PV.SimPV_IN)

**TIT\_Detergent**

The current temperature of the fluid in the detergent tank is measured in the "TIT\_Detergent" process tag. The value is passed on to the instance of the "FILL\_HEAT\_CONC" SFC type. The temperature of the fluid in the detergent tank is regulated on the basis of this value. The "TIT\_Detergent" process tag is an instance of the "AnalogMonitoring" process tag type.

The following table shows the configuration of the instance from "AnalogMonitoring":

Table 4–18

Block	Connection	Value	Usage
Temperature	PV_Out	-	Output of process value (DETERGENT\FHC.TEMP_AI)

**LSH\_Detergent**

The upper fill level limit of the detergent tank is monitored in the "LSH\_Detergent" process tag. The value is passed on to the instance of the "FILL\_HEAT\_CONC" SFC type. This is used to regulate the fill level in the detergent tank. The "LSH\_Detergent" process tag is an instance of the "DigitalMonitoring" process tag type.

The following table shows the configuration of the instance from "DigitalMonitoring":

Table 4–19

Block	Connection	Value	Usage
MonDigital	In	-	Digital input value (DETERGENT\FHC.LS1_In)
MonDigital	Out	-	Digital output value (YS_DetFreshWater\Permit.In02)

**LSL\_Detergent**

The lower fill level limit of the detergent tank is monitored in the "LSL\_Detergent" process tag. The value is passed on to the instance of the "FILL\_HEAT\_CONC" SFC type. This is used to regulate the fill level in the detergent tank. The "LSL\_Detergent" process tag is an instance of the "DigitalMonitoring" process tag type.

The following table shows the configuration of the instance from "DigitalMonitoring":

Table 4–20

Block	Connection	Value	Usage
MonDigital	In	-	Digital input value (DETERGENT\FHC.LS2_In)
MonDigital	Out	-	Digital output value (NS_DetHeat\Protect.In01)

**YS\_DetFreshWater**

The "YS\_DetFreshWater" valve process tag controls the supply of fresh water to the detergent tank. The process tag receives the command for opening or closing the valve from the instance of the "FILL\_HEAT\_CONC" SFC type. The "YS\_DetFreshWater" process tag is an instance of the "ValveLean" process tag type.

The following table shows the configuration of the instance from "ValveLean":

Table 4–21

Block	Connection	Value	Usage
Valve	OpenAut	-	Valve open in automatic mode (DETERGENT\FHC.V1_OpenAut)
Valve	CloseAut	-	Valve closed in automatic mode (DETERGENT\FHC.V1_CloseAut)
Valve	ModLiOp	-	Switching between operator/connection (DETERGENT\FHC.V1_ModLiOP)
Valve	AutModLi	-	Automatic mode via connection (DETERGENT\FHC.V1AutModLi)
Valve	ManModLi	-	Manual operation via connection, inverted (DETERGENT\FHC.V1_AutModLi)
Valve	Ctrl	-	Control output (DETERGENT\FHC.V1_Ctrl)
Valve	AutAct	-	Automatic mode is active (DETERGENT\FHC.V1_AutAct)
Valve	FbkOpenOut	-	Feedback message "Valve open" (DETERGENT\FHC.V1_FbkOpenOut)
Valve	FbkCloseOut	-	Feedback message "Valve closed" (DETERGENT\FHC.V1_FbkCloseOut)

**NS\_DetCon**

The "NS\_DetCon" motor process tag is used for metering the detergent supply. The motor is pulse-driven from the "PUPA\_Det" process tag. The "NS\_DetCon" motor process tag is an instance of the "MotorLean" process tag type.

The following table shows the configuration of the instance from "MotorLean":

Table 4–22

Block	Connection	Value	Usage
Motor	StartAut	-	Starting the motor in automatic mode (NS_DetCon\2.Out)
Motor	StopAut	-	Stopping the motor in automatic mode (NS_DetCon\3.Out)
Motor	ModLiOP	-	Switching between operator/connection (DETERGENT\FHC.M2_ModLiOP)
Motor	Start	-	Activating the motor, "Start" (DETERGENT\FHC.M2_Start)
Motor	FbkRunOut	-	Feedback message for "Start" (DETERGENT\FHC.M2_FbkRunOut)
Or04	-	-	Added as "2" to start the motor
2	In01	-	Pulsed starting of the motor (PUPA_Det\STRENGT.ActGrp01)
2	In02	-	Starting the motor (DETERGENT\FHC.M2_StartAut)
Or04	-	-	Added as "3" to stop the motor
3	In01	-	Pulsed starting of the motor, inverted (PUPA_Det\STRENGT.ActGrp01)
3	In02	-	(DETERGENT\FHC.M2_StopAut)

**NS\_DetHeat**

The "NS\_DetHeat" motor process tag is used to activate the pump for the heating circuit. The process tag receives the command for starting and stopping the motor from the instance of the "FILL\_HEAT\_CONC" SFC type. The motor process tag is an instance of the "MotorLean" process tag type.

The following table shows the configuration of the instance from "MotorLean":

Table 4–23

Block	Connection	Value	Usage
Motor	StartAut	-	Starting the motor in automatic mode (DETERGENT\FHC.M1_StartAut)
Motor	AutModLi	-	Automatic mode via connection (DETERGENT\FHC.M1_AutModLi)
Motor	ManModLi	-	Manual operation via connection, inverted (DETERGENT\FHC.M1_AutModLi)
Motor	ModLiOP	-	Switching between operator/connection (DETERGENT\FHC.M1_ModLiOP)
Motor	start	-	Activating the motor, "Start" (DETERGENT\FHC.M1_Start)
Motor	FbkRunOut		Feedback message for "Start" (DETERGENT\FHC.M1_FbkRunOut)
Protect	In01	-	Inverted
Protect	In02	1	-

**TIC\_DetHeat**

The temperature of the fluid is determined in the "TIC\_DetHeat" process tag. The setpoint is specified via the instance of the "FILL\_HEAT\_CONC" SFC type. The process tag passes the control variable to the "YC\_DetHeat" valve process tag. The process tag is an instance of the "PIDControlLean" process tag type.

The following table shows the configuration of the instance from "PIDControlLean":

Table 4–24

Block	Connection	Value	Usage
PID	SP_LiOp	-	Setpoint source internal/external (DETERGENT\FHC.PID1_SP_LiOp)
PID	ModLiOp	-	Switchover of operating mode, operator/automatic (DETERGENT\FHC.PID1_ModLiOp)
PID	AutAct	-	Automatic mode active (DETERGENT\FHC.PID1_AutAct)
PID	LoopClosed	-	Control loop closed (DETERGENT\FHC.PID1_LoopClosed)
PID	PV_Out	-	Process value output (DETERGENT\FHC.PID1_PV_Out)
PV	SimOn	1	Simulation switched on
PV	SimPV_In	-	Simulated process value (TIC_DetHeat\Temperature.PV_Out)

**PUPA\_Det**

The "PUPA\_Det" process tag is used for pulsed activation. The process tag receives the start command for activation from the instance of the "FILL\_HEAT\_CONC" SFC type. The "PUPA\_Det" process tag passes the pulsed control command on to the "NS\_DetCon" motor process tag.

The following table shows the configuration of the process tag:

Table 4–25

Block	Connection	Value	Usage
BIPuPa	-	-	Inserted as "STRENGTH" for pulse/pause function
STRENGTH	ModLiOp	-	Switchover between operating modes operator/automatic (DETERGENT\FHC.PUPA1_ModLiOp)
STRENGTH	AutModLi	-	Automatic mode via connection DETERGENT\FHC.PUPA1_AutModLi
STRENGTH	ManModLi	-	Manual operation via connection DETERGENT\FHC.PUPA1_ManModLi
STRENGTH	StartAut	-	Start signal in automatic mode (DETERGENT\FHC.PUPA1_StartAut)
STRENGTH	IntLock	1	Valve interlocked (1= no)
STRENGTH	GroupCnt	1	Number of activated groups
STRENGTH	LoopCnt	8	Reiterations of activated groups
STRENGTH	Pulse01	5.0	Pulse duration for Group 1
STRENGTH	AutAct	-	Automatic mode active (DETERGENT\FHC.PUPA1_AutAct)
STRENGTH	ManAct	-	Manual operation active (DETERGENT\FHC.PUPA1_ManAct)
STRENGTH	StartOut	-	Status of signal (DETERGENT\FHC.PUPA1_StartOut)
STRENGTH	ActiveOut	-	Status of reiteration (DETERGENT\FHC.PUPA1_ActiveOut)
STRENGTH	ActGrp01	-	Activated device group (DETERGENT\FHC.PUPA1_ActGrp01, NS_DetCon\2.In1, NS_DetCon\3.In1)
STRENGTH	CurLpCnt	-	Current reiteration (DETERGENT\FHC.PUPA1_CurLpCnt)
STRENGTH	AllLpDone	-	All reiterations satisfied (DETERGENT\FHC.PUPA1_AllLpDone, DETERGENT\FHC.SIG_2)

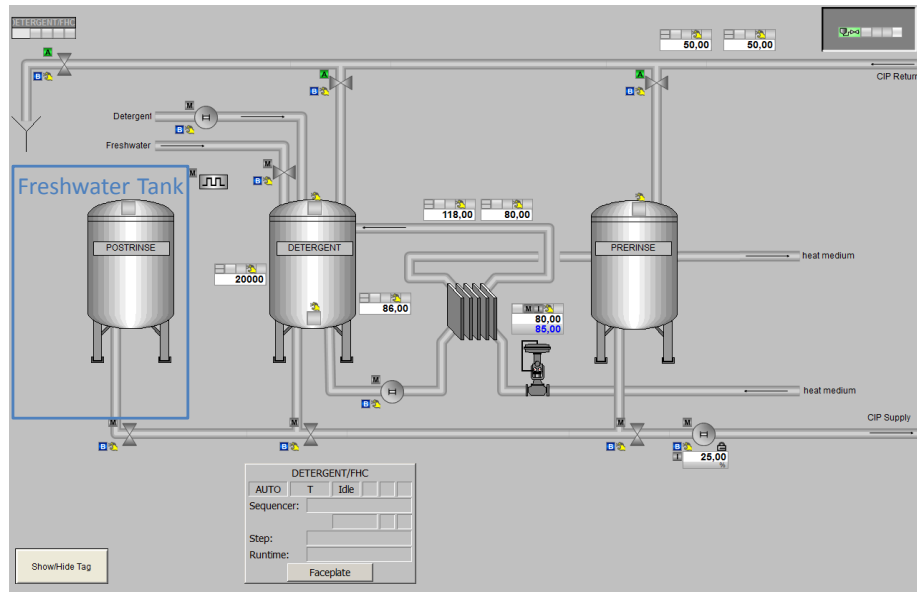
#### 4.2.4 Fresh water tank (post rinse tank)

Fresh water for post-rinsing is stored in the fresh water tank. It is drawn off during the post-rinse phase. No water is fed into this tank from the return line. The water is not reprocessed and can be used at ambient temperature. Fluid can be drawn from the fresh water tank at any time, provided the level does not fall below the minimum fill level.

#### Design

The figure below shows the design of the fresh water tank:

Figure 4–11



In the "CIP" application example, the process tags for the fresh water tank are only partially included. Furthermore, the included process tags are not functional and are provided for demonstration purposes.

The design depends strongly on the requirements of the cleaning process. The detergent tank (process tags and "FILL\_HEAT\_CONC" SFC type) can be taken as a template for configuration. The elements that are not needed can be removed. In the application example, only the "LSH\_PostRinse" process tag is included. The "LSH\_PostRinse" process tag is an instance of the "DigitalMonitoring" process tag type.

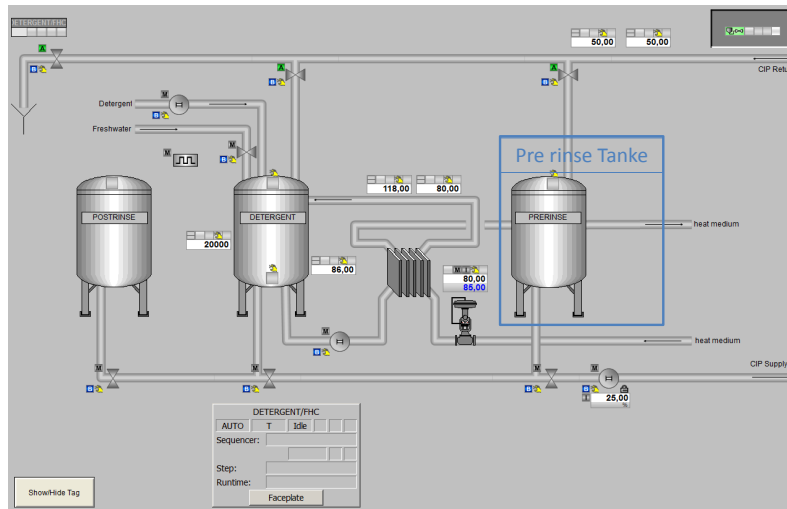
### 4.2.5 Pre rinse tank

The fluid for pre rinsing is stored and reprocessed in the pre rinse tank. It is drawn off during the pre rinse phase. Fluid can be fed into the tank via the return line. It is also possible to supply fresh water.

#### Design

The figure below shows the design of the pre rinse tank:

Figure 4–12



In the "CIP" application example, the process tags for the pre rinse tank are only partially included. The reprocessing of the fluid (e.g., temperature) is not considered.

The design of the pre rinse tank depends strongly on the requirements of the cleaning process. The detergent tank (process tags and "FILL\_HEAT\_CONC" SFC type) can be taken as a template for configuration. The elements that are not needed can be removed. In the application example, only the "LSH\_PreRinse" process tag is included. The "LSH\_PreRinse" process tag is an instance of the "DigitalMonitoring" process tag type.

## Parameter assignment

The parameter assignment for the individual process tags is described in the following.

### LSH\_PreRinse

The maximum fill level of the pre rinse tank is monitored in the "LSH\_PreRinse" process tag. The value is passed on to the instance of the "CIP RETURN" SFC type. This is used to regulate the fill level in the pre rinse tank. The "LSH\_PreRinse" process tag is an instance of the "DigitalMonitoring" process tag type.

The following table shows the configuration of the instance from "DigitalMonitoring":

Table 4–26

Block	Connection	Value	Usage
LSH03	In	-	Digital input value (CIP_Return\CIP RETURN.LS2_In)
LSH03	Out	-	Digital output value (CIP_Return\CIP RETURN.LS2_Out)

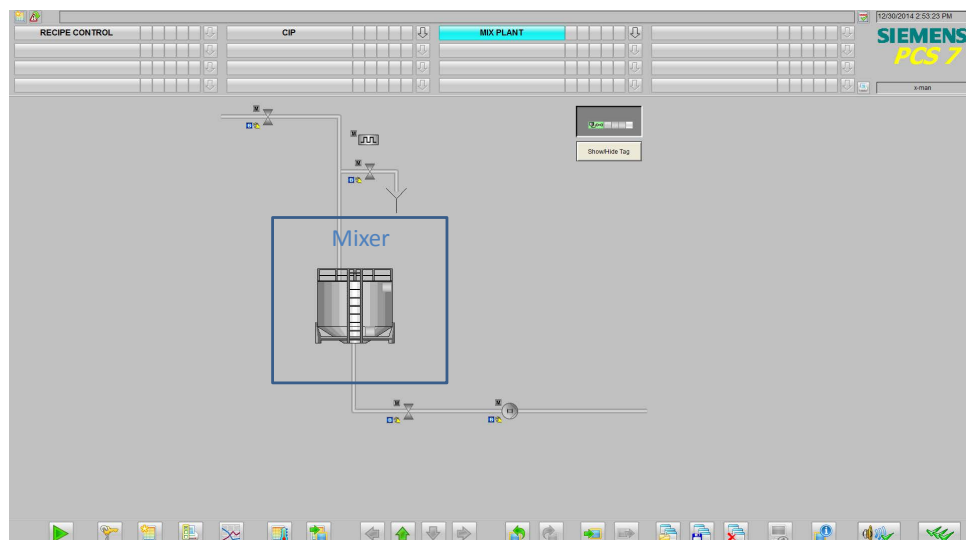
## 4.2.6 Mixer

The mixer is the part of the plant to be cleaned in the "CIP" application example and is used to demonstrate the process. There are no process tags configured for the mixer in the application example.

## Design

The figure below shows the design of the mixer:

Figure 4–13



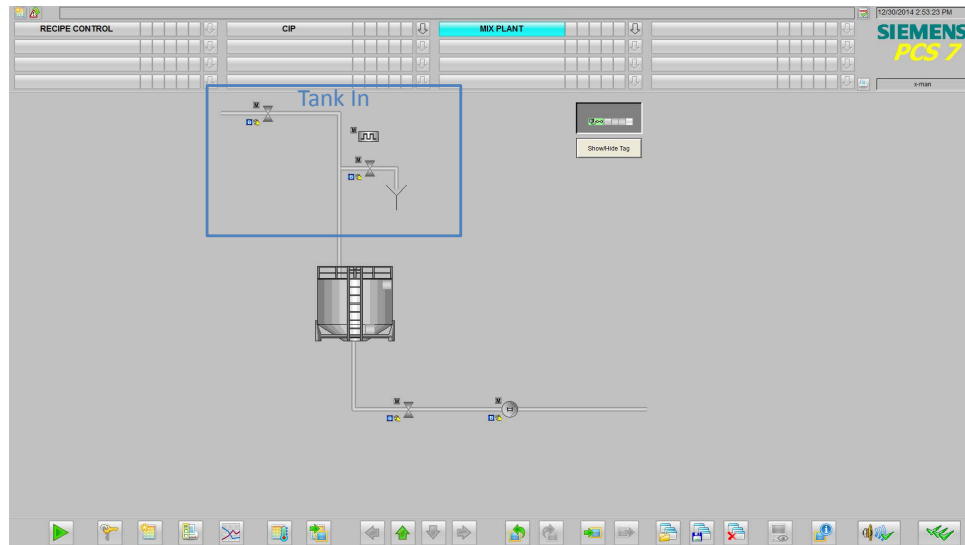
### 4.2.7 Mixer supply (TANK\_IN)

The cleaning fluid is fed from the CIP system into the mixer via the supply line. Furthermore, an additional valve is cleaned. The additional valve is controlled by an instance of the BIPuPa block.

#### Design

The figure below shows the design of the mixer supply:

Figure 4–14



The valves are controlled by an instance of the "TANK\_IN" SFC type.

The following table provides you with an overview of the elements and process tag types used:

Table 4–27

Name	Process tag type	Description
TANK_IN	Instance of "TANK_IN" SFC type	Control of valves in supply to mixer
PUPA_Mixer	Instance of BIPuPa function block	Pulsed control of additional valve
YS_TankInMix	"ValveLean"	Valve for the supply to the mixer
YS_TankInDrain	"ValveLean"	Additional valve
LSH_Mixer	"DigitalMonitoring"	Process tag for max. fill level reached

#### Parameter assignment

The parameter assignment for the individual process tags is described in the following. A detailed description of the SFC type can be found in Chapter 4.3 "Sequencers".

**PuPa\_Mixer**

The "PUPA\_Mixer" process tag is used for pulsed activation. The process tag receives the start command for activation from the instance of the "TANK\_IN" SFC type. The "PUPA\_Mixer" process tag passes the pulsed control command on to the "YS\_TankInMix" valve process tag.

The following table shows the configuration of the process tag:

Table 4–28

Block	Connection	Value	Usage
BIPuPa	-	-	Inserted as "BIPuPa" for pulse/pause function
BIPuPa	ModLiOp	-	Switchover of operating mode, operator/automatic (TANK_IN\MX_TANK_IN.PUPA_ModLiOp)
BIPuPa	AutModLi	-	Automatic mode via connection TANK_IN\MX_TANK_IN.PUPA_AutModLi
BIPuPa	ManModLi	-	Manual operation via connection TANK_IN\MX_TANK_IN.PUPA_ManModLi
BIPuPa	StartAut	-	Start signal in automatic mode (TANK_IN\MX_TANK_IN.PUPA_StartAut)
BIPuPa	IntLock	1	Valve interlocked (1= no)
BIPuPa	GroupCnt	1	Number of activated groups
BIPuPa	LoopCnt	8	Reiterations of activated groups (TANK_IN\MX_TANK_IN.PUPA_LoopCnt)
BIPuPa	Pulse01	5.0	Pulse duration for Group 1
BIPuPa	AutAct	-	Automatic mode active (TANK_IN\MX_TANK_IN.PUPA_AutAct)
BIPuPa	ManAct	-	Manual operation active (TANK_IN\MX_TANK_IN.PUPA_ManAct)
BIPuPa	StartOut	-	Status of signal (TANK_IN\MX_TANK_IN.PUPA_StartOut)
BIPuPa	ActiveOut	-	Status of reiteration (TANK_IN\MX_TANK_IN.PUPA_ActiveOut)
BIPuPa	ActGrp01	-	Activated device group (TANK_IN\MX_TANK_IN.PUPA__ActGrp01, YS_TankInDrain\1.In1)
BIPuPa	CurLpCnt	-	Current reiteration (TANK_IN\MX_TANK_IN.PUPA_CurLpCnt)
BIPuPa	AllLpDone	-	All reiterations satisfied (TANK_IN\MX_TANK_IN.PUPA_AllLpDone,)
BIPuPa	OvwBatchInfo	1	CMDData can be overwritten with BATCH data
BIPuPa	BatchEnLi	-	Occupation release TANK_IN\MX_TANK_IN.PUPA_QBA_EN
BIPuPa	BatchOccLi	-	Occupied by batch TANK_IN\MX_TANK_IN.PUPA_QOCCUPIED
BIPuPa	BatchIdLi	-	Batch number TANK_IN\MX_TANK_IN.PUPA_QBA_ID
BIPuPa	BatchNameLi	-	Batch name TANK_IN\MX_TANK_IN.PUPA_QBA_NA
BIPuPa	StepNoLi	-	Batch step number TANK_IN\MX_TANK_IN.PUPA_QSTEP_NO

### LSH\_Mixer

The maximum fill level of the mixer is monitored in the "LSH\_Mixer" process tag. The "LSH\_MIXER" process tag is an instance of the "DigitalMonitoring" process tag type. In the "CIP" application example, the process tag is used for demonstration purposes and has no function. No changes have been made to the process tag type.

### YS\_TankInMix

The "YS\_TankInMix" valve process tag controls the supply from the CIP system to the mixer. The process tag receives the command for opening or closing the valve from the instance of the "TANK\_IN" SFC type. The "YS\_TankInMix" valve process tag is an instance of the "ValveLean" process tag type.

The following table shows the configuration of the instance from "ValveLean":

Table 4–29

Block	Connection	Value	Usage
FbkOpen	PV_In	0	Feedback message "Valve open", connection removed
FbkClose	PV_In	0	Feedback message "Valve closed", connection removed
Permit	In01	0	Release to open or close from the neutral position, connection removed
Interlock	In01	0	Interlock, connection removed
Protect	In01	0	Protective interlock, connection removed
Valve	OpenAut	-	Open valve in automatic mode, (TANK_IN\MX_TANK_IN.V1_OpenAut)
Valve	ModLiOp	-	Switchover of operating mode between operator/automatic (TANK_IN\MX_TANK_IN.V1_ModLiOp)
Valve	RstLi	-	Reset via connection TANK_IN\MX_TANK_IN.V1_RstLi
Valve	BatchEn	-	Occupation release (TANK_IN\MX_TANK_IN.QBA_EN)
Valve	BatchID	-	Batch number (TANK_IN\MX_TANK_IN.QBA_ID)
Valve	BatchName	-	Batch name (TANK_IN\MX_TANK_IN.QBA_NA)
Valve	StepNo	-	Batch step number (TANK_IN\MX_TANK_IN.QSTEP_NO)
Valve	Occupied	-	Occupied by batch (TANK_IN\MX_TANK_IN.QOCCUPIED)
Valve	RdyToStart	-	Ready to start (TANK_IN\MX_TANK_IN.V1_RdyToStart)
Valve	RdyToReset	-	Ready to reset (TANK_IN\MX_TANK_IN.V1_RdyToReset)
Valve	Ctrl	-	Control output (TANK_IN\MX_TANK_IN.V1_Ctrl)
Valve	AutAct	-	Automatic mode active (TANK_IN\MX_TANK_IN.V1_AutAct)

Block	Connection	Value	Usage
Valve	FbkOpenOut	-	Valve open (TANK_IN\MX_TANK_IN.V1_FbkOpenOut)
Valve	FbkClosedOut	-	Valve closed (TANK_IN\MX_TANK_IN.V1_FbkCloseOut)

### YS\_TankInDrain

The "YS\_TankInDrain" valve process tag controls an additional valve, leading to the drain, in the supply from the CIP system to the mixer. The process tag receives the command for opening or closing the valve from the instance of the "TANK\_IN" SFC type and the "PuPa\_Mixer" process tag. The "YS\_TankInDrain" process tag is an instance of the "ValveLean" process tag type.

The following table shows the configuration of the instance from "ValveLean":

Table 4–30

Block	Connection	Value	Usage
FbkOpen	PV_In	0	Feedback message "Valve open", connection removed
FbkClose	PV_In	0	Feedback message "Valve closed", connection removed
Permit	In01	0	Release to open or close from the neutral position, connection removed
Interlock	In01	0	Interlock, connection removed
Protect	In01	0	Protective interlock, connection removed
Or04	-	-	Inserted as "1" to open the valve via the SFC or the PuPa
1	In1	-	Open using the PuPa (PuPa_Mixer\BIPuPa.ActGrp01)
1	In2	-	Open using the SFC (TANK_IN\MX_TANK_IN.2_OpenAut)
1	Out	-	(TANK_IN\YS_TankInDrain\Valve.OpenAut)
Valve	AutModLi	-	Automatic mode via connection TANK_IN\MX_TANK_IN.V2_AutModLi
Valve	ModLiOp	-	Switchover of operating mode between operator/connection (TANK_IN\MX_TANK_IN.V2_ModLiOp)
Valve	RstLi	-	Reset via connection TANK_IN\MX_TANK_IN.V2_RstLi
Valve	BatchEn	-	Occupation release (TANK_IN\MX_TANK_IN.QBA_EN)
Valve	BatchID	-	Batch number (TANK_IN\MX_TANK_IN.QBA_ID)
Valve	BatchName	-	Batch name (TANK_IN\MX_TANK_IN.QBA_NA)
Valve	StepNo	-	Batch step number (TANK_IN\MX_TANK_IN.QSTEP_NO)
Valve	Occupied	-	Occupied by batch (TANK_IN\MX_TANK_IN.QOCCUPIED)
Valve	RdyToStart	-	Ready to start (TANK_IN\MX_TANK_IN.V2_RdyToStart)

Block	Connection	Value	Usage
Valve	RdyToReset	-	Ready to reset (TANK_IN\MX_TANK_IN.V2_RdyToReset)
Valve	Ctrl	-	Control output (TANK_IN\MX_TANK_IN.V2_Ctrl)
Valve	AutAct	-	Automatic mode active (TANK_IN\MX_TANK_IN.V2_AutAct)
Valve	FbkOpenOut	-	Valve open (TANK_IN\MX_TANK_IN.V2_FbkOpenOut)
Valve	FbkClosedOut	-	Valve closed (TANK_IN\MX_TANK_IN.V2_FbkCloseOut)

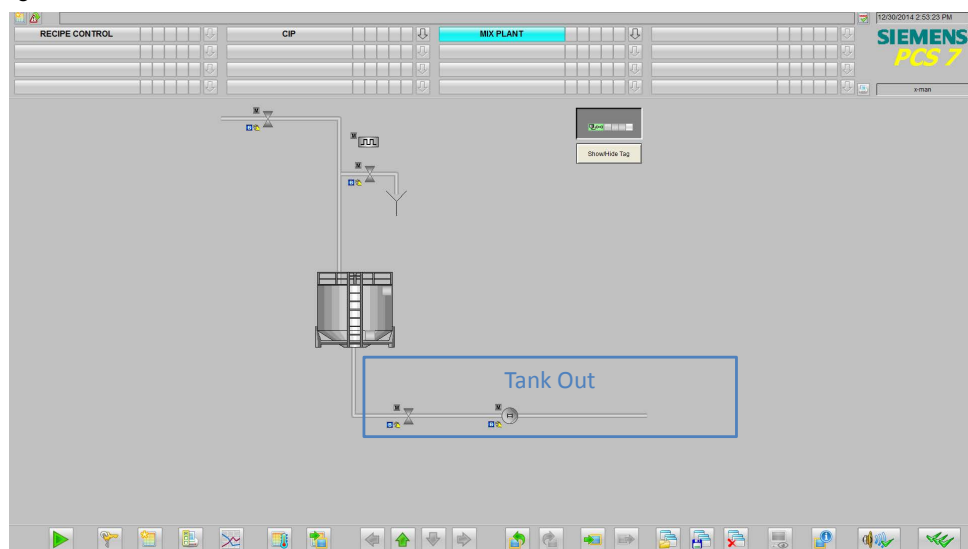
#### 4.2.8 Mixer discharge (TANK\_OUT)

From the discharge outlet, the cleaning fluid is fed from the mixer back into the CIP system or into the drain.

#### Design

The figure below shows the design of the mixer discharge:

Figure 4–15



The valve and the pump are controlled by an instance of the "TANK\_OUT" SFC type.

The following table provides you with an overview of the elements and process tag types used:

Table 4–31

Name	Process tag type	Description
TANK_Out	Instance of "TANK_IN" SFC type	Control of the valve and pump in the mixer discharge outlet
LSL_Mixer	"DigitalMonitoring"	Process tag for min. fill level reached
YS_TankOutMix	"ValveLean"	Valve for the mixer discharge outlet
NS_Mixer	"MotorLean"	Pump for the mixer discharge outlet

### Parameter assignment

The parameter assignment for the individual process tags is described in the following. A detailed description of the SFC type can be found in Chapter 4.3.5 "Sequencers".

### LSL\_Mixer

In the "LSL\_Mixer" process tag, the fill level of the mixer is monitored to ensure that the minimum value has not been reached. The "LSL\_MIXER" process tag is an instance of the "DigitalMonitoring" process tag type. In the "CIP" application example, the process tag is used for demonstration purposes and has no function. No changes have been made to the process tag type.

### NS\_Mixer

The "NS\_Mixer" motor process tag is used for emptying the mixer. The motor is controlled by an instance of the "TANK\_OUT" SFC type. The "NS\_Mixer" motor process tag is an instance of the "MotorLean" process tag type.

The following table shows the configuration of the instance from "MotorLean":

Table 4–32

Block	Connection	Value	Usage
Permit	In01	-	Connection removed
Interlock	In01	-	Connection removed
Protect	In01	-	Connection removed
Motor	StartAut	-	Starting the motor in automatic mode (TANK_OUT\MX_TANK_OUT.M1_StartAut)
Motor	ModLiOp	-	Switchover of operating mode between operator and connection (TANK_OUT\MX_TANK_OUT.M1_ModLiOp)
Motor	AutModLi	-	Automatic mode via connection TANK_OUT\MX_TANK_OUT.M1_AutModLi
Motor	BatchEn	-	Occupation release (TANK_OUT\MX_TANK_OUT.QBA_EN)
Motor	BatchID	-	Batch number (TANK_OUT\MX_TANK_OUT.QBA_ID)
Motor	BatchName	-	Batch name (TANK_OUT\MX_TANK_OUT.QBA_NA)
Motor	StepNo	-	Batch step number (TANK_OUT\MX_TANK_OUT.QSTEP_NO)
Motor	Occupied	-	Occupied by batch (TANK_OUT\MX_TANK_OUT.QOCCUPIED)
Motor	Start	-	Activating the motor, "Start" (TANK_OUT\MX_TANK_OUT.M1_Start)
Motor	FbkRunOut	-	Feedback message for "Start" (TANK_OUT\MX_TANK_OUT.M1_FbkRunOut)

**YS\_TankOutMix**

The "YS\_TankOutMix" valve process tag controls the flow of the cleaning fluid from the mixer back into the CIP system. The process tag receives the command for opening or closing the valve from the instance of the "TANK\_OUT" SFC type. The "YS\_TankInDrain" process tag is an instance of the "ValveLean" process tag type.

The following table shows the configuration of the instance from "ValveLean":

Table 4–33

Block	Connection	Value	Usage
Valve	OpenAut	-	"Valve open" in automatic mode (TANK_OUT\MX_TANK_OUT.V1_OpenAut)
Valve	CloseAut	-	"Valve closed" in automatic mode (TANK_OUT\MX_TANK_OUT.V1_CloseAut)
Valve	ModLiOp	-	Switchover of operating mode between operator and connection (TANK_OUT\MX_TANK_OUT.V1_ModLiOp)
Valve	AutModLi	-	Automatic mode via connection TANK_OUT\MX_TANK_OUT.V1_AutModLi
Valve	Ctrl	-	Control output (TANK_OUT\MX_TANK_OUT.V1_Ctrl)
Valve	FbkOpenOut	-	Feedback message "Valve open" (TANK_OUT\MX_TANK_OUT.V1_FbkOpenOut)
Valve	FbkCloseOut	-	Feedback message "Valve closed" (TANK_OUT\MX_TANK_OUT.V1_FbkCloseOut)
Valve	GrpErr	-	Group error is "active" (TAN_OUT\MX_TANK_OUT.V1_GrpErr)
Valve	BatchEn	-	Occupation release (TANK_OUT\MX_TANK_OUT.QBA_EN)
Valve	BatchID	-	Batch number (TANK_OUT\MX_TANK_OUT.QBA_ID)
Valve	BatchName	-	Batch name (TANK_OUT\MX_TANK_OUT.QBA_NA)
Valve	StepNo	-	Batch step number (TANK_OUT\MX_TANK_OUT.QSTEP_NO)
Valve	Occupied	-	Occupied by batch (TANK_OUT\MX_TANK_OUT.QOCCUPIED)

### 4.3 Sequencers (SFC type instances)

The CIP system is designed for batch operation. Within the system there are various SFC type instances with various tasks. According to ISA 88, the SFC type instance describes the equipment module. These will be described in the following sections.

The SFC types for the "CIP" example application are summarized in the following table:

Table 4–34

SFC type name	Comment
CIP RETURN	The return line for the CIP system
CIP SUPPLY	The supply line for the CIP system
FILL_HEAT_CONC	The reprocessing of the fluid (no SIMATIC BATCH functionality)

#### 4.3.1 CIP RETURN

The SFC type instance is started by SIMATIC BATCH in the cleaning recipes and opens or closes the valves in the return line of the CIP system which lead to the tanks and the drain. This takes place according to the selected control strategy (defined in the recipe) and the quality of the fluid.

##### Control strategies

The control strategies for the "CIP RETURN" SFC type are summarized in the following table:

Table 4–35

Control strategy name	Comment
PRE RINSE	Control strategy for pre rinse phase
DETERGENT	Control strategy for wash phase
POST RINSE	Control strategy for post rinse phase

## Setpoints

The setpoints for the "CIP RETURN" SFC type are summarized in the following table:

Table 4–36

Setpoint name	Data type	I/O name	Units	Comment
TEMP_RINSE	REAL	PRE_TEMP	°C	Temperature of pre rinse fluid
TEMP_DETERGENT	REAL	DET_TEMP	°C	Temperature of washing fluid
HYSTERESIS_TEMP	REAL	T_HYS	°C	Temperature hysteresis
PRE_CONC	REAL	PRE_CONC	mS	Detergent concentration in pre rinse fluid
DET_CONC	REAL	DET_CONC	mS	Detergent concentration in washing fluid
HYSTERESIS	REAL	C_HYS	mS	Concentration hysteresis

## Process values

The process values for the "CIP RETURN" SFC type are summarized in the following table:

Table 4–37

Process value name	Data type	I/O name	Comment
TEMP_PRE_SUB	REAL	TEMP_PRE_SUB	Temperature of pre rinse fluid
TEMP_DET_SUB	REAL	TEMP_DET_SUB	Temperature of washing fluid
CONC_PRE_SUB	REAL	CONC_PRE_SUB	Detergent concentration in pre rinse fluid
CONC_DET_SUB	REAL	CONC_DET_SUB	Detergent concentration in washing fluid

## Block contacts

The block contacts for the "CIP RETURN" SFC type are summarized in the following table:

Table 4–38

Name	Block	I/O name	Comment
V1	VivL	V1	Valve to pre rinse tank
V2	VivL	V2	Valve to detergent tank
V3	VivL	V3	Valve to the drain
LS1	MonDiL	LS1	Level monitoring in pre rinse tank
LS2	MonDiL	LS2	Level monitoring in detergent tank

## Sequencers

The following sequencers are configured in the "CIP RETURN" SFC type:

- PRE RINSE Switches all valves to automatic mode, closes the valves to the tanks, opens the valve to the drain.
- DETERGENT: Switches all valves to automatic mode, opens the valves to the relevant tanks and closes the valve to the drain. Opens the valve to the drain if the tanks are full or if the fluid is not OK.
- POST RINSE: see DETERGENT
- COMPLETING\_ABORT: Closes all valves and enables them for manual operation once again.

## COMPLETING\_ABORT

The "COMPLETING\_ABORT" sequence closes all valves and enables them for manual operation and sets the SFC in the "IDLE" state.

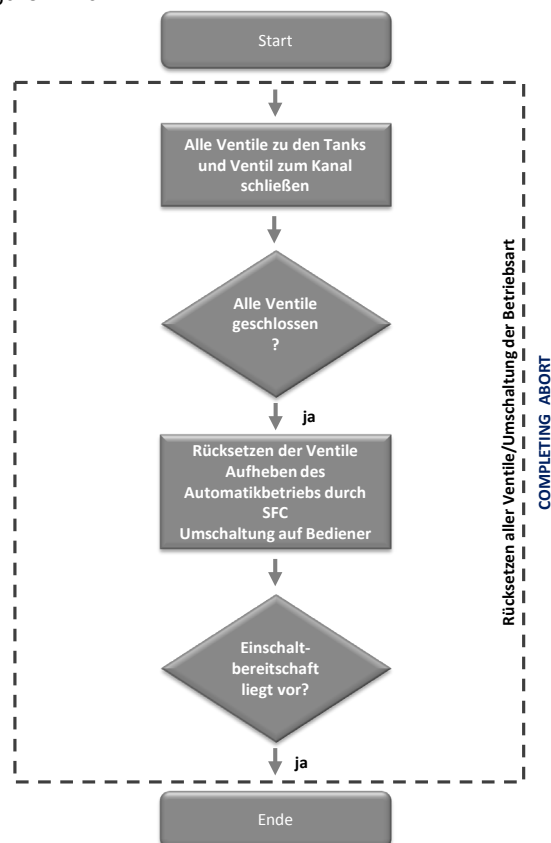
The start conditions for the "COMPLETING\_ABORT" sequence are summarized in the following table:

Table 4–39

SFC status	=	Value	Logic
ABORTING	=	Aborting	OR
COMPLETING	=	Completing	

The design of the "COMPLETING\_ABORT" sequence is summarized in the following table:

Figure 4–16



## PRERINSE

The "PRERINSE" sequence performs the following actions in the pre rinse phase:

- Sets valves in the return line to automatic mode
- Closes all the valves to the tanks
- Opens the valve to the drain
- Sets the SFC to the "Ready to Complete" state at the end of processing

The start conditions for the "PRERINSE" sequence are summarized in the following table:

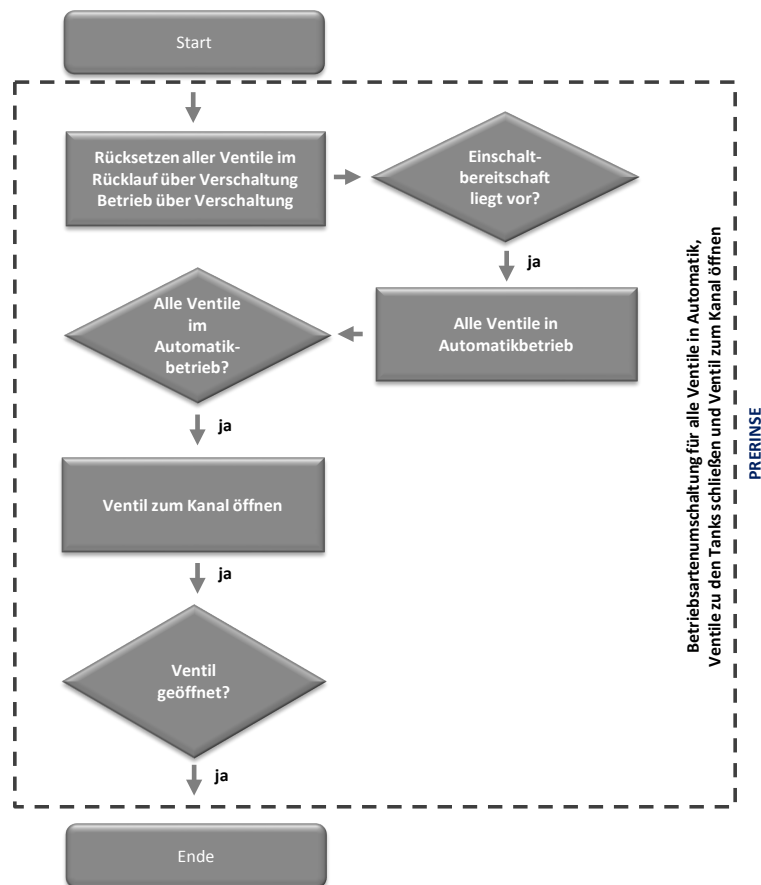
Table 4–40

SFC status	=	Value	Logic
Run	=	Run	AND
QCS	=	1	
READY_TC	=	0	

The sequencer remains active until it is terminated by the higher level controller (SIMATIC BATCH).

The design of the "PRERINSE" sequencer is summarized in the following table:

Figure 4–17



## DETERGENT

The "DETERGENT" sequencer performs the following actions in the wash phase:

- Sets valves in the return line to automatic mode
- Opens or closes the valves depending on the fill levels in the tanks and the quality of the fluid
- Sets the SFC to the "Ready to Complete" state (in each "valve step")

There is a separate step ("valve step") for each valve that is opened or closed. In this step, the corresponding valve is opened and all other valves are closed. In the subsequent transition, a check is made to see whether the conditions have changed. If the conditions have changed, the sequencer jumps accordingly to another valve step.

The start conditions for the "DETERGENT" sequencer are summarized in the following table:

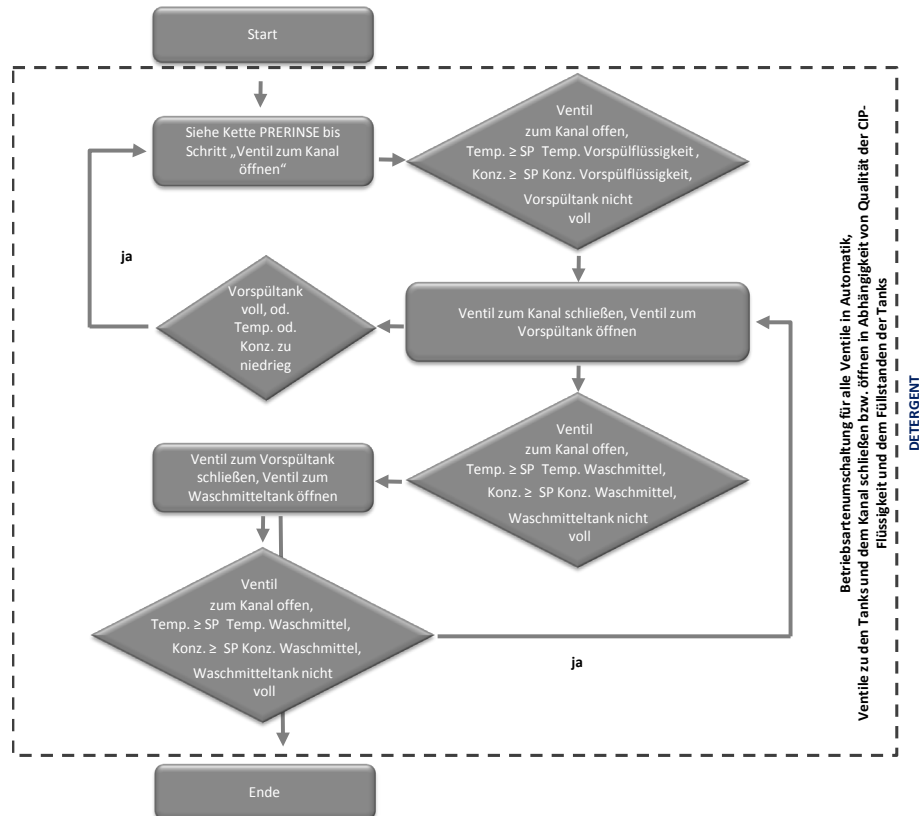
Table 4–41

SFC status	=	Value	Logic
RUN	=	Run	AND
QCS	=	2	
READY_TC	=	0	

The sequencer remains active until it is terminated by the higher level controller (SIMATIC BATCH).

The design of the "DETERGENT" sequencer is summarized in the following figure:

Figure 4–18



## POSTRINSE

The "POSTRINSE" sequencer performs the following actions in the post rinse phase:

- Sets valves in the return line to automatic mode
- Opens or closes the valves depending on the fill levels in the tanks and the quality of the fluid
- Sets the SFC to the "Ready to Complete" state (in each "valve step")

There is a separate step ("valve step") for each valve that is opened or closed. In this step, the corresponding valve is opened and all other valves are closed. In the subsequent transition, a check is made to see whether the conditions have changed. If the conditions have changed, the sequencer jumps accordingly to another valve step.

The start conditions for the "POSTRINSE" sequencer are summarized in the following table:

Table 4–42

SFC status	=	Value	Logic
RUN	=	Run	AND
QCS	=	3	
READY_TC	=	0	

The sequencer remains active until it is terminated by the higher level controller (SIMATIC BATCH).

The design of the "POSTRINSE" sequencer is identical to that of the "DETERGENT" sequencer.

### 4.3.2 CIP SUPPLY

The SFC type instance is started by SIMATIC BATCH in the cleaning recipes and opens or closes the valves from the tanks of the CIP system which lead to the supply line. This takes place according to the selected control strategy (defined in the recipe). In addition, a pump is started to pump the fluid from the tanks into the plant sections that are to be cleaned. Before the fluid is drawn from the tanks, a check is made to ensure that the relevant conditions are satisfied.

#### Control strategies

The control strategies for the "CIP SUPPLY" SFC type are summarized in the following table:

Table 4–43

Control strategy name	Comment
PRERINSE	Control strategy for pre rinse phase
DETERGENT	Control strategy for wash phase
POSTRINSE	Control strategy for post rinse phase

#### Setpoints

The control strategies for the "CIP SUPPLY" SFC type are summarized in the following table:

Table 4–44

Setpoint name	Data type	I/O name	Units	Comment
RINSE_TIME	REAL	RINSE_TIME	s	Duration of rinsing in the phase
RINSE_FLOW	REAL	RINSE_FLOW	m³/h	Flow rate

#### Process values

The process values for the "CIP SUPPLY" SFC type are summarized in the following table:

Table 4–45

Process value name	Data type	I/O name	Comment
PRERINSE_READY	BOOL	PRERINSE_READY	Pre rinse fluid OK
DETERGENT_READY	BOOL	DETERGENT_READY	Washing fluid OK
POSTRINSE_READY	BOOL	POSTRINSE_READY	Post rinse fluid OK

### Block contacts

The block contacts for the "CIP RETURN" SFC type are summarized in the following table:

Table 4–46

Name	Block	I/O name	Comment
V1	VlvL	V1	Valve to pre rinse tank
V2	VlvL	V2	Valve to detergent tank
V3	VlvL	V3	Valve to post rinse tank
M1	MotSpdCL	M1	Supply pump
TIMER1	BITimer	TIMER1	Supply timer

### Sequencers

The following sequencers are configured in the "CIP SUPPLY" SFC type:

- **PRERINSE:** Sets all valves and the pump to automatic mode, opens the discharge valve from the pre rinse tank, closes the discharge valves from the detergent tank and post rinse tank, starts the pump.
- **DETERGENT:** Sets all valves and the pump to automatic mode, opens the discharge valve from the detergent tank, closes the discharge valves from the pre rinse tank and post rinse tank, starts the pump.
- **POSTRINSE:** Sets all valves and the pump to automatic mode, opens the discharge valve from the post rinse tank, closes the discharge valves from the detergent tank and pre rinse tank, starts the pump.
- **Resuming:** Starts the pump after one of the "run sequences" has been paused.
- **Holding:** Stops the pump when one of the "washing sequences" is stopped
- **Completing\_Abort:** Closes all valves, stops the pump and enables it for manual operation

The instance of the "CIP SUPPLY" SFC type is connected to the "RINSETIMER" block. This ensures that the specified exposure time for the cleaning fluid in the plant section to be cleaned is maintained. The "RINSETIMER" block is an instance of the "BITimer" function block from the BRAUMAT library.

## PRERINSE

The "PRERINSE" sequence performs the following actions in the pre rinse phase:

- Sets the valves in the supply line and the pump to automatic mode
- Checks that the pre rinse fluid meets the quality requirements and is available in sufficient quantity.
- Closes the valves from the detergent and post rinse tanks
- Opens the valve from the pre rinse tank
- Starts the timer

The "PRERINSE" sequence performs the following actions in the pre rinse phase:

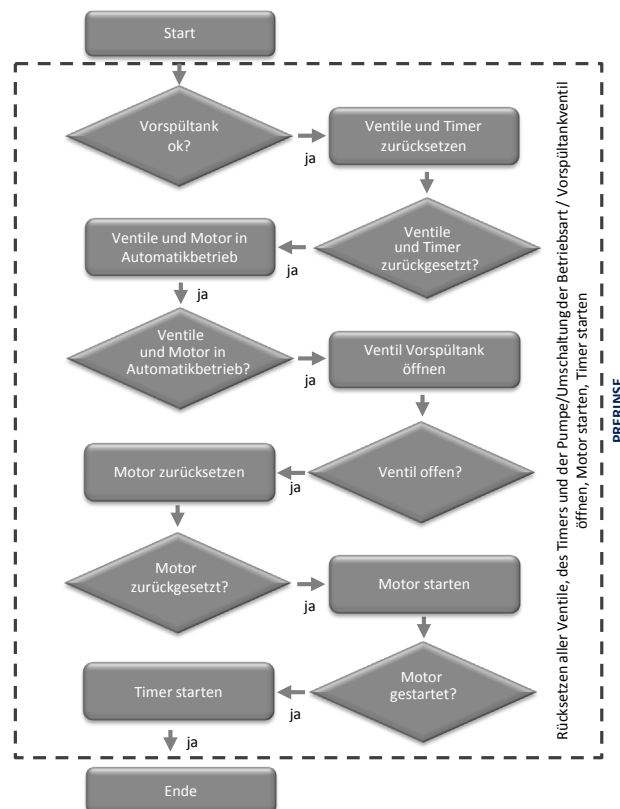
Table 4–47

SFC status	=	Value	Logic
RUN	=	Run	AND
QCS		1	

The "PRERINSE" sequencer remains active until the time specified on the timer has elapsed.

The design of the "PRERINSE" sequencer is summarized in the following table:

Figure 4–19



**DETERGENT**

The "DETERGENT" sequencer performs the following actions in the wash phase:

- Sets the valves in the supply line and the pump to automatic mode.
- Checks that the detergent fluid meets the quality requirements and is available in sufficient quantity.
- Closes the valves from the pre and post rinse tanks.
- Opens the valve from the detergent tank.
- Starts the timer.

The start conditions for the "DETERGENT" sequencer are summarized in the following table:

Table 4–48

SFC status	=	Value	Logic
RUN	=	Run	AND
QCS	=	2	

The "DETERGENT" sequencer remains active until the time specified on the timer has elapsed.

The design of the "DETERGENT" sequencer corresponds to that of the "PRERINSE" sequencer, with the following differences:

- The valve to the post rinse tank is opened instead of the valve to the pre rinse tank
- Different setpoints for the timer

**POSTRINSE**

The "POSTRINSE" sequencer performs the following actions in the post rinse phase:

- Sets the valves in the supply line and the pump to automatic mode.
- Checks that the post rinse fluid meets the quality requirements and is available in sufficient quantity.
- Closes the valves from the pre rinse and detergent tanks.
- Opens the valve from the post rinse tank.
- Starts the timer

The start conditions for the "PRERINSE" sequencer are summarized in the following table:

Table 4–49

SFC status	=	Value	Logic
RUN	=	Run	AND
QCS	=	3	

The "POSTRINSE" sequencer remains active until the time specified on the timer has elapsed.

The design of the "POSTRINSE" sequencer corresponds to that of the "PRERINSE" sequencer, with the following differences:

- The valve to the post rinse tank is opened instead of the valve to the pre rinse tank
- Different setpoints for the timer

## Completing\_Abort

The "Completing\_Abort" sequence closes all valves, enables them for manual operation and sets the SFC to the "IDLE" state.

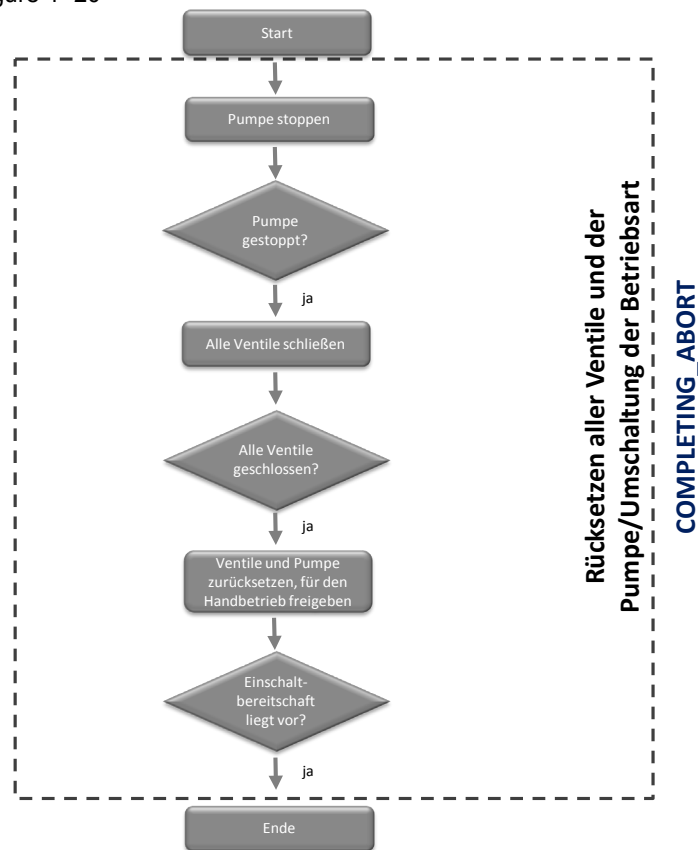
The start conditions for the "Completing\_Abort" sequence are summarized in the following table:

Table 4–50

SFC status	=	Value	Logic
ABORTING	=	Aborting	OR
COMPLETING	=	Completing	

The design of the "Completing\_Abort" sequence is summarized in the following table:

Figure 4–20



## Holding

The "Holding" sequencer stops the pump in the supply line when one of the run sequencers is paused. The pump is stopped so that no more fluid is drawn. The timer is paused.

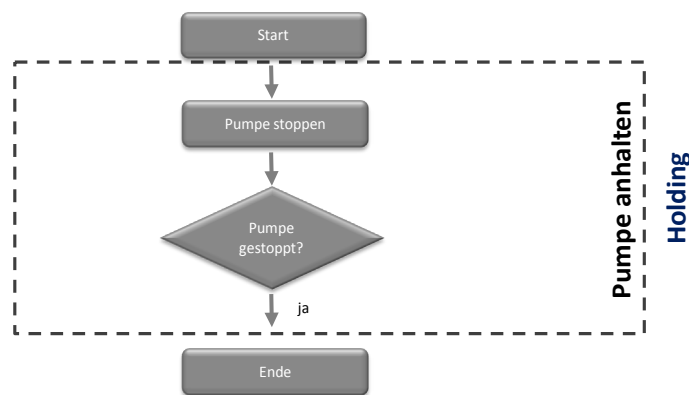
The start conditions for the "Holding" sequencer are summarized in the following table:

Table 4–51

SFC status	=	Value	Logic
HOLDING	=	Holding	OR

The design of the "Holding" sequencer is summarized in the following table:

Figure 4–21



## Resuming

The "Resuming" sequencer starts the pump in the supply line when a run sequencer is started again. The timer is resumed.

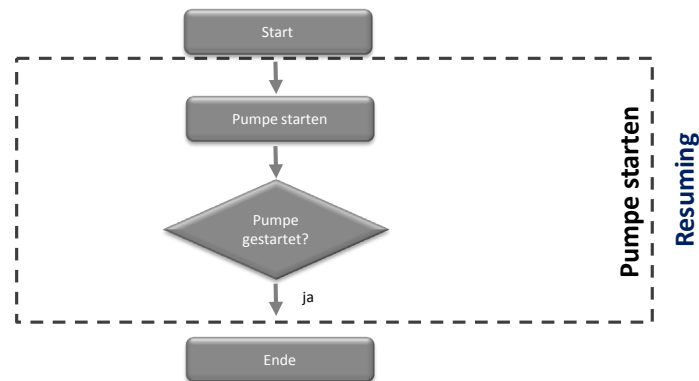
The start conditions for the "Resuming" sequencer are summarized in the following table:

Table 4–52

SFC status	=	Value	Logic
RESUMING	=	Resuming	OR

The design of the "Resuming" sequencer is summarized in the following table:

Figure 4–22



### 4.3.3 FILL\_HEAT\_CONC

The "FHC" SFC type instance is started by the operator. It must be permanently active so that the cleaning fluid is always available in sufficient quantities of the prescribed quality.

By means of the "FHC" SFC type instance from the "FILL\_HEAT\_CONC" SFC type, the fill level, the temperature and the detergent concentration of the fluid are determined and adjusted as required.

The fluids in the pre and post rinse tanks are not reprocessed in the "CIP" application example. These fluids can be reprocessed with the "FILL\_HEAT\_CONC" SFC type.

#### Control strategies

The control strategies for the "FILL\_HEAT\_CONC" SFC type are summarized in the following table:

Table 4–53

Control strategy name	Comment
PREPARE	Reprocessing of the fluid

## Setpoints

The setpoints for the "FILL\_HEAT\_CONC" SFC type are summarized in the following table:

Table 4–54

Setpoint name	Data type	I/O name	Units	Comment
LEVEL	REAL	LEVEL	L	Tank level
HYSTERESIS_LEVEL	REAL	L_HYS	L	Fill level hysteresis
TEMPERATURE	REAL	TEMP	°C	Temperature of fluid
HYSTERESIS_Temp	REAL	T_HYS	°C	Temperature hysteresis
CONCENTRATION	REAL	CONC	mS	Detergent concentration
HYSTERESIS_Conc	REAL	C_HYS	mS	Detergent hysteresis

## Parameters

The parameters for the "FILL\_HEAT\_CONC" SFC type are summarized in the following table:

Table 4–55

Parameter name	Data type	I/O name	Comment
LEVEL_SP_HYS	REAL	LEVEL_SP_HYS	-
TEMP_SP_HYS	REAL	TEMP_SP_HYS	-
CONC_SP_HYS	REAL	CONC_SP_HYS	-
LEVEL_CHECK	BOOL	LEVEL_CHECK	-

## Note texts

The information texts for the "FILL\_HEAT\_CONC" SFC type are summarized in the following table:

Table 4–56

Name	Number	Display text
CIP_Ready	1	CIP ready?

### Block contacts

The block contacts for the "FILL\_HEAT\_CONC" SFC type are summarized in the following table:

Table 4–57

Name	Block	I/O name	Comment
V1	VlvL	V1	Fresh water valve
V2	VlvL	V2	
M1	MotL	M1	Circulation pump motor
M2	MotL	M2	Metering pump motor
LS1	MonDiL	LS1	Level monitoring high
LS2	MonDiL	LS2	Level monitoring low
PID1	PIDConL	PID1	Temperature controllers
PUPA1	BIPuPa	PUPA1	Pulse pause for metering
ANA1	MonAnL	ANA1	

### Sequencers

The following sequencers are configured in the "FILL\_HEAT\_CONC" SFC type:

- PREPARE: Sets fill level, temperature and detergent concentration
- ABORTING Closes the valves and stops the pumps

### PREPARE

The "PREPARE" sequencer is the run sequencer for the SFC type instance and is permanently active.

The "PREPARE" sequencer performs the following actions:

- Sets the valves and pumps to automatic mode.
- Measures the fill level and tops up the fluid.
- Measures the temperature of the fluid and controls it
- Measures the concentration of the detergent and controls it

The sequencer is started by the operator.

The start conditions for the "PREPARE" sequencer are summarized in the following table:

Table 4–58

SFC status	=	Value	Logic
RUN	=	Run	AND
QCS	=	1	

The sequencer remains active until it is stopped by the operator. In the sequencer, a check is first made as to whether the fill level is adequate or if it needs to be readjusted. If the fill level is adequate, a check is made as to whether the temperature is high enough or if it needs to be readjusted. If the fill level and the temperature are set, the concentration of the detergent is checked and readjusted as necessary.

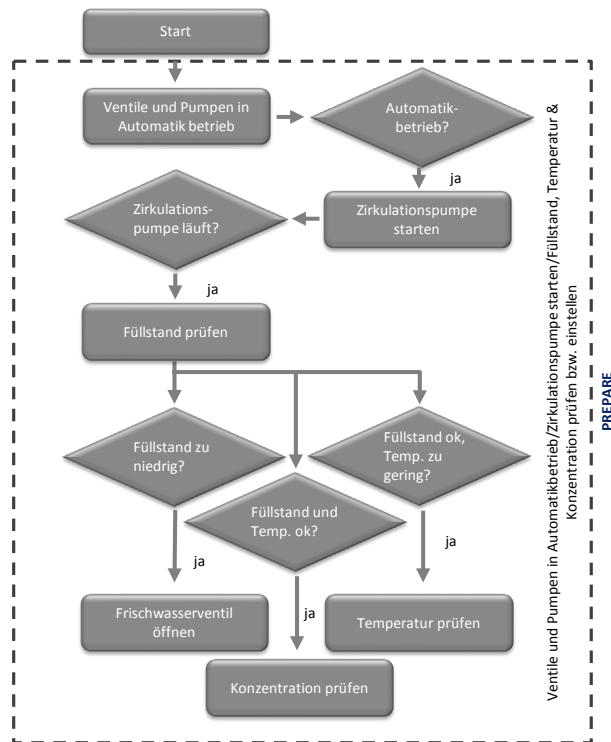
The detergent is metered with the aid of the BIPuPa block (BRAUMAT library) which is connected to the SFC type instance. This is used to pulse-drive the metering pump over a predefined cycle.

The design of the "PREPARE" sequencer is described in the following four figures.

The sequence of the following actions is shown in Figure 4-23.

- Set the valves and pumps to automatic mode
- Start the circulation pump
- Check the fill level
- Adjust the fill level or jump to the step for checking the temperature or the concentration

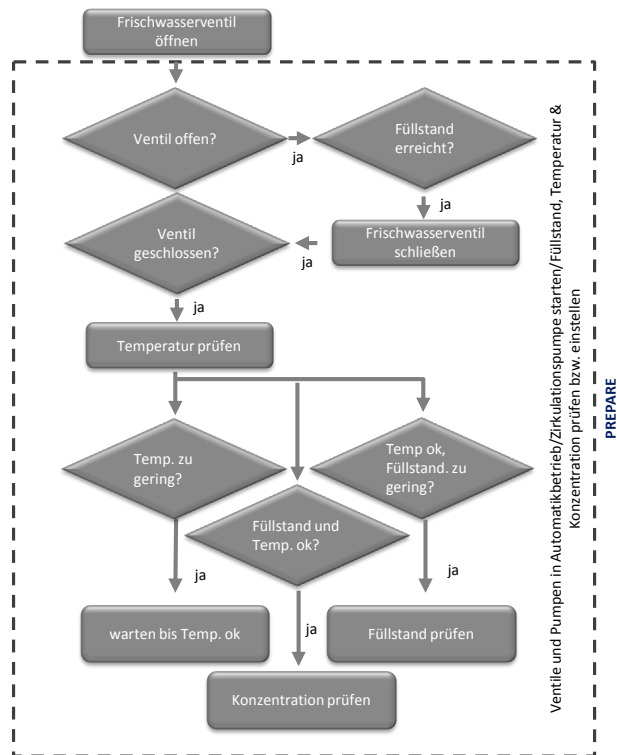
Figure 4–23



The sequence of the following actions is shown in Figure 4-24.

- Set the fill level (open /close the fresh water valve)
- Check the temperature
- Adjust the temperature or jump to the step for checking the fill level or the concentration

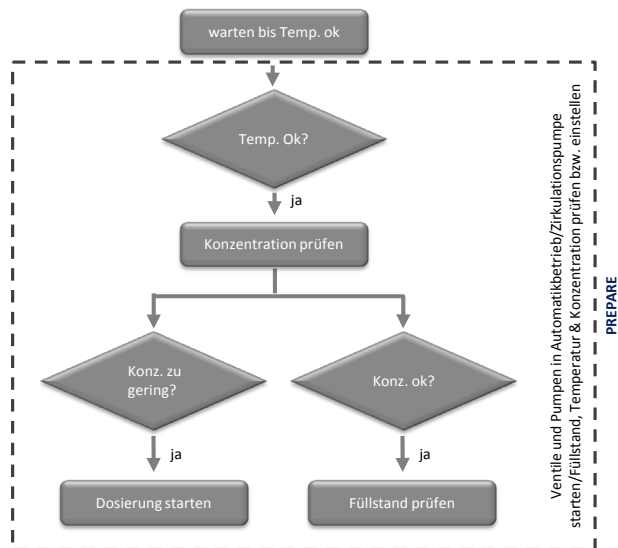
Figure 4–24



The sequence of the following actions is shown in Figure 4-25.

- Set the temperature (circulate the fluid)
- Check the concentration
- Adjust the concentration or jump to the step for checking the fill level

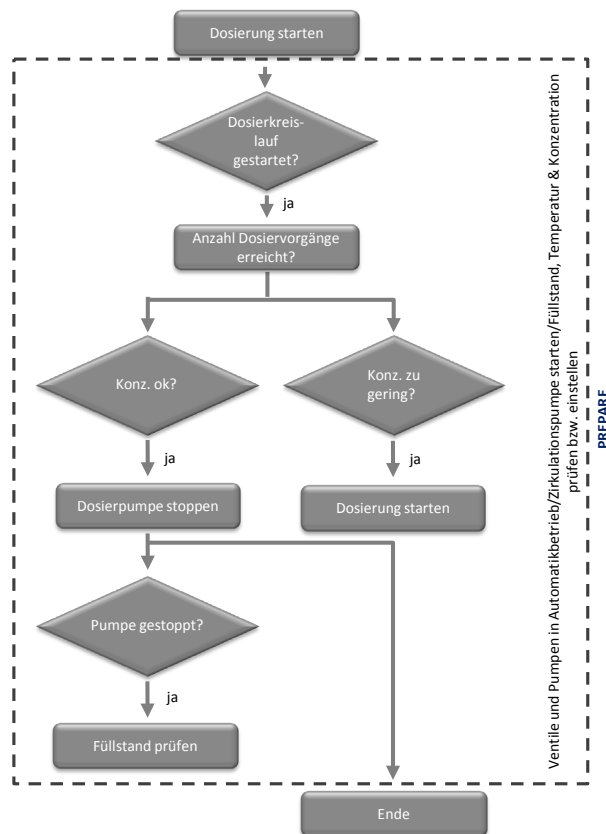
Figure 4–25



The sequence of the following actions is shown in Figure 4-26.

- Set the concentration (start pulse-pause control of the metering pump)
- Check the concentration
- Start metering again or jump to the step for checking the fill level

Figure 4–26



### ABORTING

The "ABORTING" sequencer is executed when the "PREPARE" run sequence is aborted.

The "ABORTING" sequencer performs the following actions:

- Closes all valves
- Stops all pumps

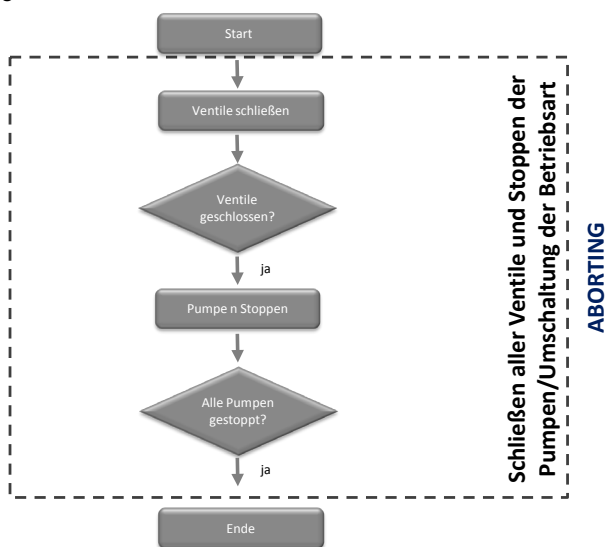
The start conditions for the "ABORTING" sequencer are summarized in the following table:

Table 4–59

SFC status	=	Value	Logic
ABORTING	=	Aborting	OR

The design of the "ABORTING" sequencer is summarized in the following table:

Figure 4–27



#### 4.3.4 TANK\_IN

The SFC type instance is started by SIMATIC BATCH in the cleaning recipes and opens or closes the valve to the mixer and activates the BIPuPa block for the valve to the drain.

##### Control strategies

The control strategies for the "TANK\_IN" SFC type are summarized in the following table:

Table 4–60

Control strategy name	Comment
PRODUCTION	For the production phase
CIP	For cleaning the mixer

##### Block contacts

The block contacts for the "TANK\_IN" SFC type are summarized in the following table:

Table 4–61

Name	Block	I/O name	Comment
V1	VivL	V1	Mixer valve
V2	VivL	V2	Drain valve
PUPA	BIPuPa	PUPA	Connection for pulse-pause block

## Sequencers

The following sequencers are configured in the "TANK\_IN" SFC:

- PRODUCTION: Opens and closes the valves
- CIP: Opens and closes the valves; starts the pulse-pause block
- COMPLETING\_ABORT: Closes the valves; resets the pulse-pause block

## PRODUCTION

The "PRODUCTION" sequencer performs the following actions during production:

- Resets the valves
- Sets the valves to automatic mode.
- Opens the valves

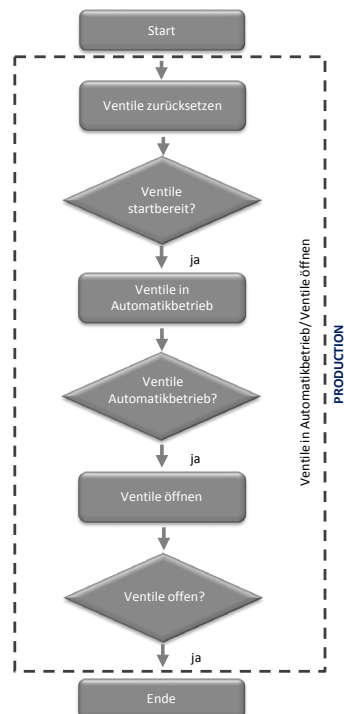
The start conditions for the "PRODUCTION" sequencer are summarized in the following table:

Table 4–62

SFC status	=	Value	Logic
RUN	=	Run	AND
QCS	=	1	

The design of the "PRODUCTION" sequencer is summarized in the following figure:

Figure 4–28



## CIP

The "CIP" sequencer performs the following actions during the cleaning phase:

- Resets the valves and the pulse-pause block
- Sets the valves and the pulse-pause block to automatic mode.
- Opens the valve to the mixer and starts the pulse-pause block

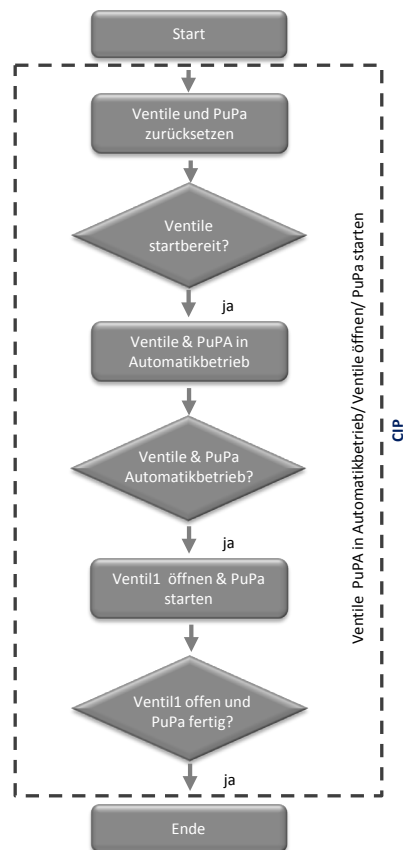
The start conditions for the "CIP" sequencer are summarized in the following table:

Table 4- 63

SFC status	=	Value	Logic
RUN	=	Run	AND
QCS	=	2	

The design of the "CIP" sequencer is summarized in the following figure:

Figure 4–29



### COMPLETING\_ABORT

The "COMPLETING\_ABORT" sequencer is executed when a run sequence ends or has been aborted. The "COMPLETING\_ABORT" sequencer performs the following actions:

- Closes all valves and enables them for manual operation.
- Resets the PuPa and enables it for manual operation.
- Sets the SFC to the "IDLE" state.

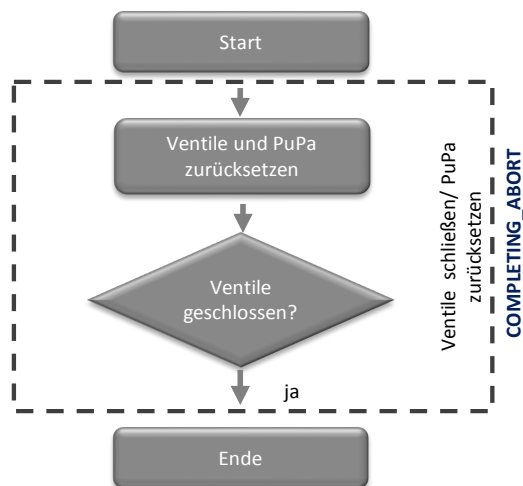
The start conditions for the "COMPLETING\_ABORT" sequence are summarized in the following table:

Table 4–64

SFC status	=	Value	Logic
ABORTING	=	Aborting	OR
COMPLETING	=	Completing	

The design of the "CIP" sequencer is summarized in the following figure:

Figure 4–30



### 4.3.5 TANK\_OUT

The SFC type instance is started by SIMATIC BATCH in the cleaning recipes and opens or closes the discharge valve from the mixer and starts or stops the pump for pumping out the mixer.

#### Control strategies

The control strategies for the "TANK\_OUT" SFC type are summarized in the following table:

Table 4–65

Control strategy name	Comment
PRODUCTION	For the production phase
CIP	For cleaning the mixer

#### Block contacts

The block contacts for the "TANK\_OUT" SFC type are summarized in the following table:

Table 4–66

Name	Block	I/O name	Comment
V1	VivL	V1	Mixer valve
V2	VivL	V2	Valve freely available
M1	MotL	M1	Motor for pump

#### Sequencers

The following sequencers are configured in the SFC:

- PRODUCTION: Opens and closes the valve; starts and stops the motor
- CIP: Opens and closes the valve; starts and stops the motor
- COMPLETING\_ABORT: Closes the valve and resets it; stops the motor and resets it
- RESUMING: Starts the motor
- HOLDING: Pauses the motor

#### PRODUCTION

The "PRODUCTION" sequencer performs the following actions during production:

- Resets the valve and the motor
- Sets the valve and the motor to automatic mode
- Opens the valve
- Starts the motor

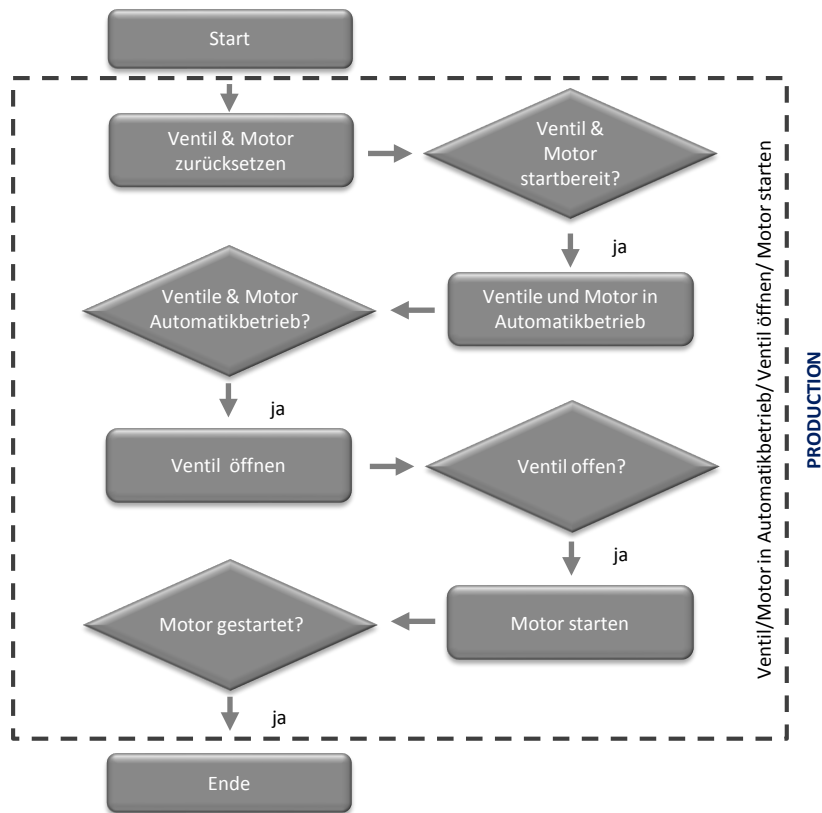
The start conditions for the "PRODUCTION" sequencer are summarized in the following table:

Table 4–67

SFC status	=	Value	Logic
RUN	=	Run	AND
QCS	=	1	

The design of the "CIP" sequencer is summarized in the following figure:

Figure 4–31



## CIP

The "CIP" sequencer performs the following actions during the cleaning phase:

- Resets the valve and the motor
- Sets the valve and the motor to automatic mode
- Opens the valve
- Starts the motor

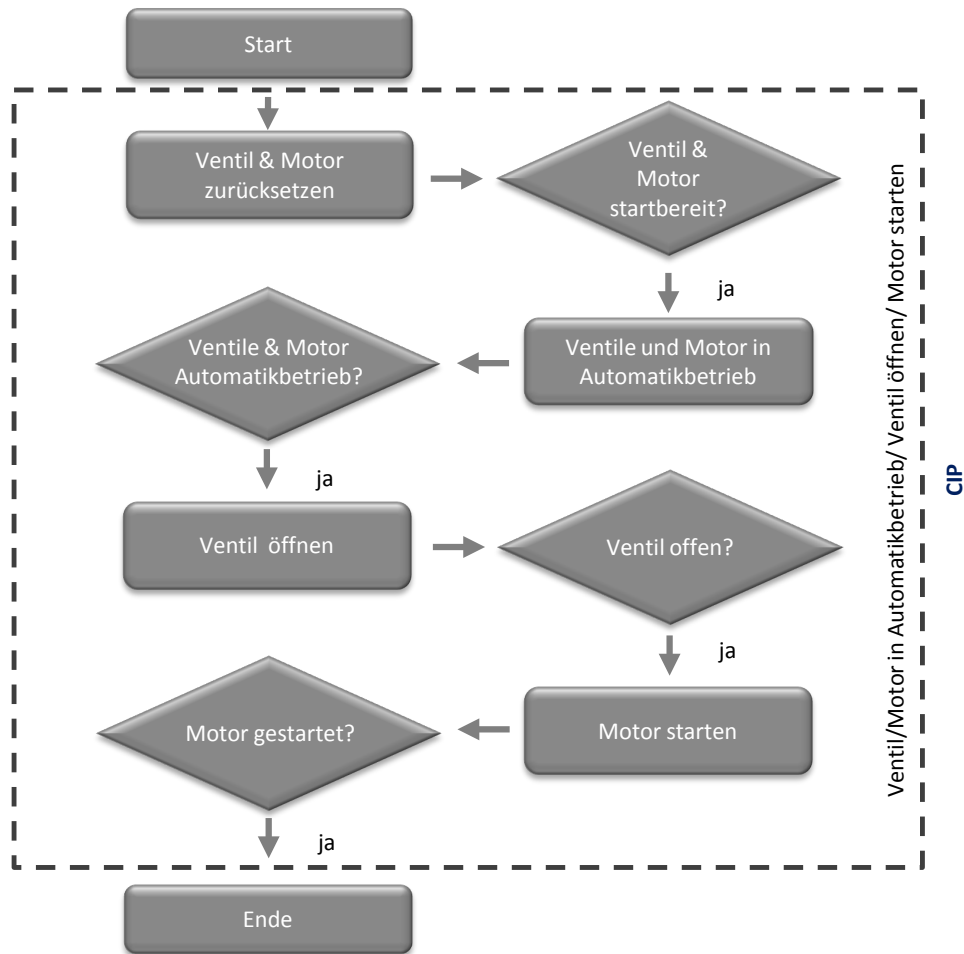
The start conditions for the "CIP" sequencer are summarized in the following table:

Table 4–68

SFC status	=	Value	Logic
RUN	=	Run	AND
QCS	=	2	

The design of the "CIP" sequencer is summarized in the following figure:

Figure 4–32



### COMPLETING\_ABORT

The "COMPLETING\_ABORT" sequencer is executed when a run sequence ends or has been aborted. The "COMPLETING\_ABORT" sequencer performs the following actions:

- Stops the motor and enables it for manual operation
- Closes the valve and enables it for manual operation
- Resets the valve and the motor
- Sets the SFC to the "IDLE" state.

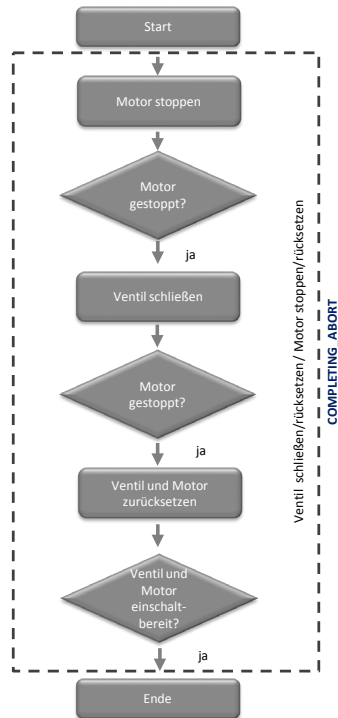
The start conditions for the "COMPLETING\_ABORT" sequencer are summarized in the following table:

Table 4–69

SFC status	=	Value	Logic
ABORTING	=	Aborting	OR
COMPLETING	=	Completing	

The design of the "COMPLETING\_ABORT" sequencer is summarized in the following figure:

Figure 4–33



## HOLDING

The "HOLDING" sequencer is executed when a run sequence has been paused. The "HOLDING" sequencer performs the following actions:

- Stops the motor

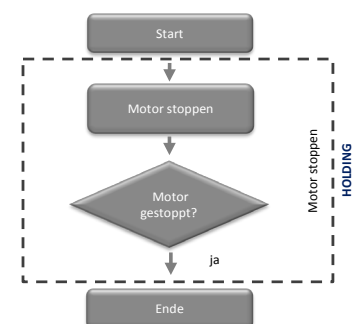
The start conditions for the "HOLDING" sequencer are summarized in the following table:

Table 4–70

SFC status	=	Value	Logic
HOLDING	=	Holding	AND

The design of the "HOLDING" sequencer is summarized in the following figure:

Figure 4–34



## RESUMING

The "RESUMING" sequencer is executed when a paused run sequence is started again. The "RESUMING" sequencer performs the following actions:

- Starts the motor

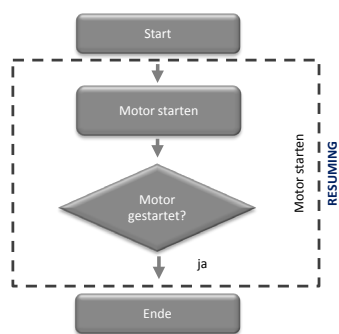
The start conditions for the "RESUMING" sequencer are summarized in the following table:

Table 4–71

SFC status	=	Value	Logic
RESUMING	=	Resuming	AND

The design of the "RESUMING" sequencer is summarized in the following figure:

Figure 4–35



### 4.4 SIMATIC BATCH

SIMATIC BATCH is used for discontinuous production. With the aid of SIMATIC BATCH, various products can be produced on one system. Manufacture is carried out by means of recipes. The recipes contain the knowledge required for production. The recipes can be modified by the operating personnel. The complete recipe procedure with messages and measurements, as well as the operator interventions, is logged.

In addition to the recipes for manufacturing the product, there are also recipes that are used for cleaning the plant sections.

#### 4.4.1 Cleaning recipes

Cleaning recipes are used for cleaning the plant sections that are necessary for production.

##### Information contained in the recipe

The following information may be contained in the cleaning recipe:

- Plant section to be cleaned
- The duration of the cleaning (setpoints for the exposure time for the fluids in the plant section)
- The temperature of the cleaning fluid
- The detergent concentration in the cleaning fluid
- The quantity of cleaning fluid (flow rate)

Various cleaning recipes can be created for a plant section. These differ in the above-mentioned details. These differences depend, e.g., on the degree of soiling of the plant or on the product that previously was contained in the plant.

### Structure of a sample recipe

The "CIP MIXER" sample cleaning recipe in the "CIP" application example is intended for cleaning the "Mixer" plant section. It consists of the "TRP MIXER" and "TRP CIP" recipe unit procedures (TRP).

The TRPs and plant sections are summarized in the following table:

Table 4–72

TRP	Occupied plant section
TRP MIXER	MIXER
TRP CIP	CIP

For each TRP there exist the three recipe operations (ROP) "PRERINSE", "DETERGENT" and "POSTRINSE". The names of the recipe operations correspond to the current cleaning phase. The recipe phases (RFs) are called up within the ROPs. Each ROP contains two RFs, which run in parallel.

The RFs are summarized in the following table:

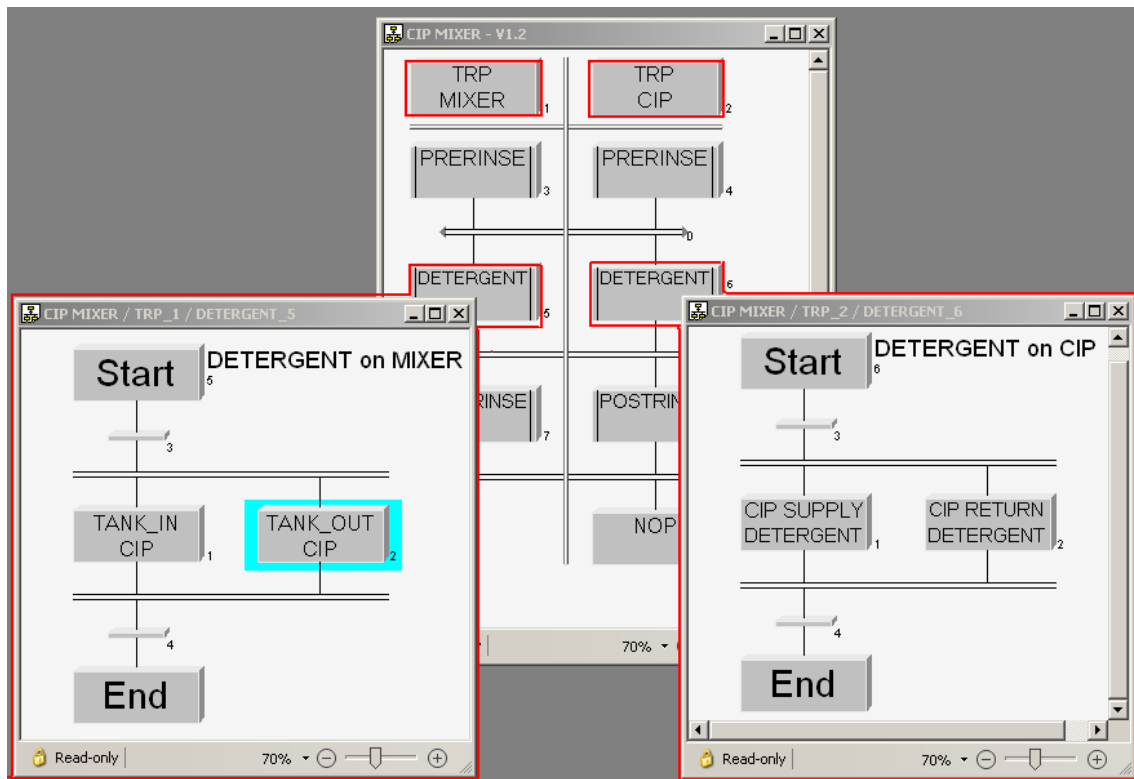
Table 4–73

TRP	ROP	SCRL	Control strategy
MIXER	PRERINSE	TANK_IN	CIP
		TANK_OUT	CIP
	DETERGENT	TANK_IN	CIP
		TANK_OUT	CIP
	POSTRINSE	TANK_IN	CIP
		TANK_OUT	CIP
CIP	PRERINSE	CIP_SUPPLY	PRERINSE
		CIP_RETURN	PRERINSE
	DETERGENT	CIP_SUPPLY	DETERGENT
		CIP_RETURN	DETERGENT
	POSTRINSE	CIP_SUPPLY	POSTRINSE
		CIP_RETURN	POSTRINSE

There are synchronization lines between the ROPs so that the process runs synchronously in the TRPs. There is a NOP step at the end of the recipe. This is necessary so that the last two ROPs will also run synchronously with one another.

The following Figure 4-36 describes the design of the cleaning recipe contained in the "CIP" application example.

Figure 4–36



### 4.4.2 Cleaning batches

The cleaning batches are created as requests in SIMATIC BATCH. The recipe for cleaning is defined when the batch is created.

It is possible to start the cleaning batch automatically immediately at the end of a production batch. This ensures that the plant is clean again after the production of a product and can be used for further production.

## 5 Launching the application example

### 5.1 Preparation

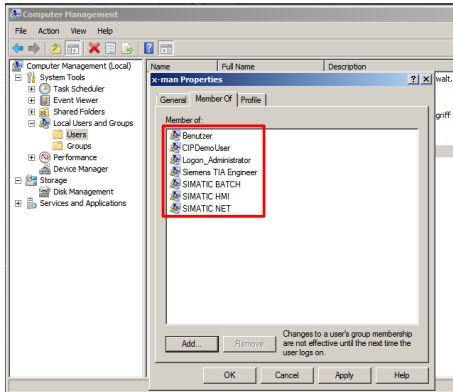
The following instructions describe putting the application example into service by simulating the controller with the "S7-PLCSIM" program. If there is a real controller, you must configure existing hardware components in the HW ConFigure

#### Preparation in Windows

The following instructions describe the steps that must be performed in Windows.

Table 5–1

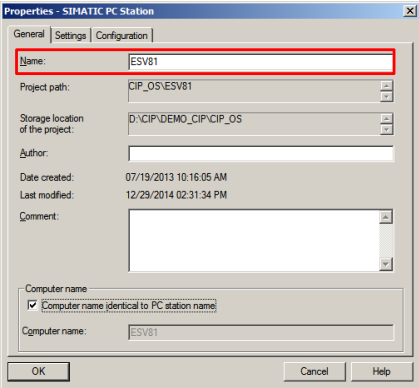
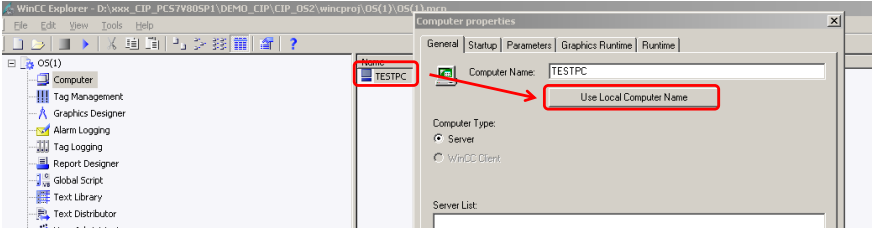
No.	Action
1.	Click on "Start".
2.	Right-click on "Computer" and open the "Administrate" menu item. The computer administration will be opened.
3.	Right-click on the left side of the window on the "Local users and groups > Groups" menu item. Select the "New group" menu command. The "New group" window will open.
4.	Enter "CIPDemoUser" in the "Names" box.
5.	Add the user name with which you are currently logged in to Windows to this group.
6.	Click on "Create".
7.	On the left side of the window, select the "Local users and groups > Users" item. On the right side, right-click on the user name with which you are currently logged in. Select the "Properties" menu item. This opens the "Properties" window.
8.	Switch to the "Member of" tab and check whether the user is a member of the listed groups.

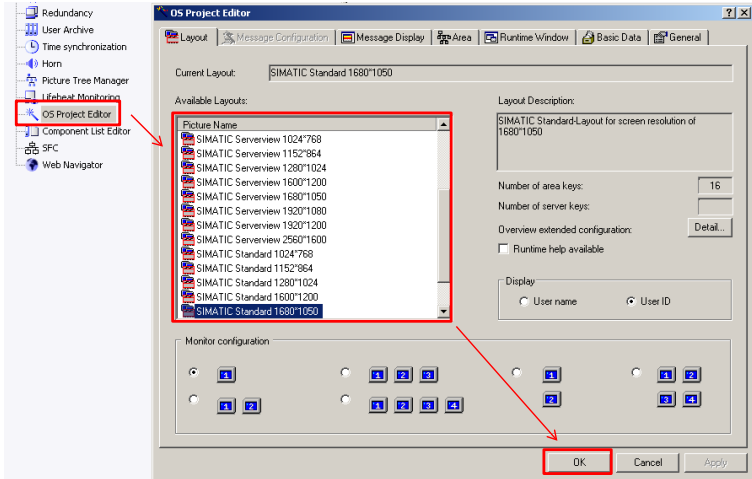
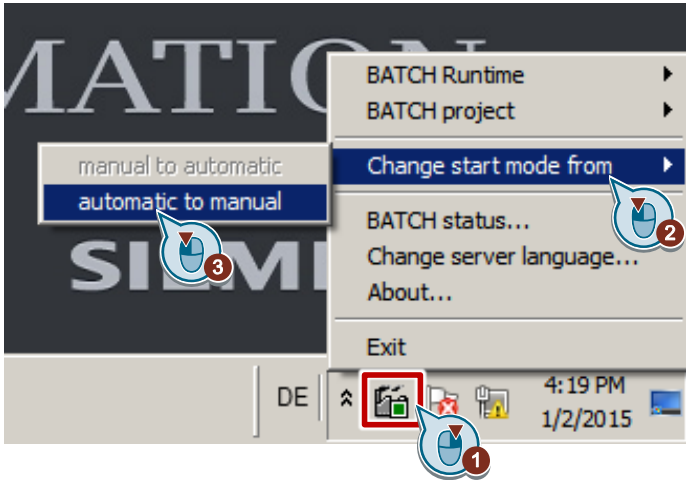


If the user is not included in all the groups, add him to the missing ones.

## Preparing the project

Table 5–2

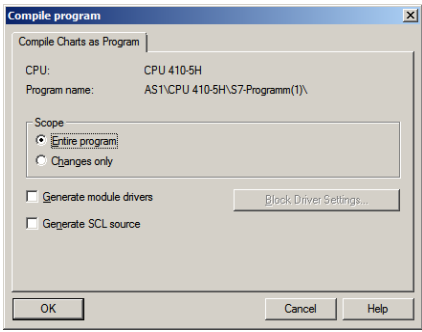
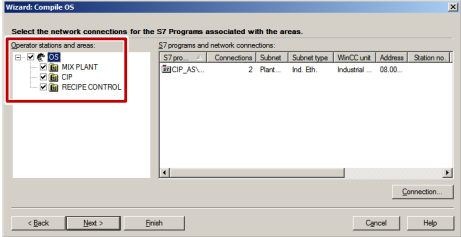
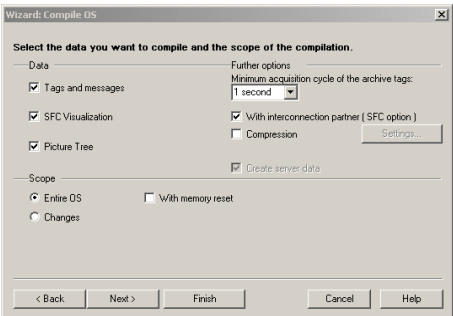
No.	Action
1.	Copy the files "78463886_CIP_PCS7V81.zip" and "78463886_CIP_PCS7V8SP1_BATCH_BACKUP.sbb" into any folder on the configuration PC and then open the SIMATIC Manager.
2.	In the menu bar, click on "File > Dearchive" and select the file "78463886_CIP_PCS7V81.zip". Then confirm with "Open".
3.	Select the folder in which the project will be saved and confirm with the "OK" button. The project will be extracted.
4.	In the "Retrieve" dialog, click on the "OK" button and then click on "Yes" in the dialog to open the project.
5.	Right-click on "CIP_OS > ESV81" and click on the "Object properties" menu item.
6.	Enter the name of your PC in the "Name" box and click on "OK". 
7.	Right-click on "CIP_OS > Name of your PC > WinCC Appl > OS" and click on the "Open object" menu command.
8.	Confirm the "Configured server not available" dialog with "OK".
9.	In the WinCC Explorer, open the characteristics of your computer and, in the opened Characteristics dialog, click on the "Use local computer name" button. Confirm the "Change computer name" messages with "OK". 
10.	In WinCC Explorer, click on "File > End" and, in the subsequent dialog, select "Terminate WinCC Explorer and close project" with "OK".
11.	Reopen the WinCC Explorer as described in step 7.
12.	Open by double-clicking the "OS project editor".

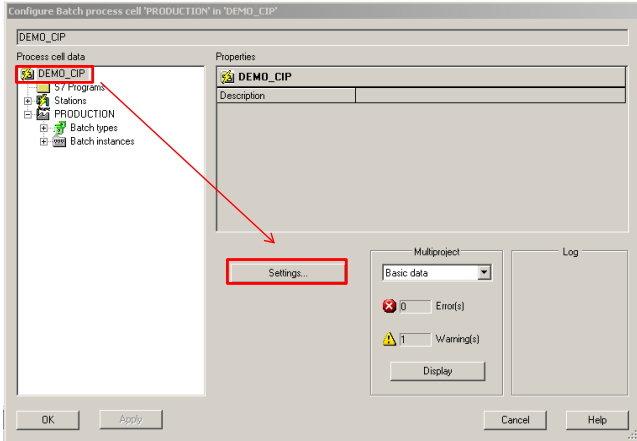
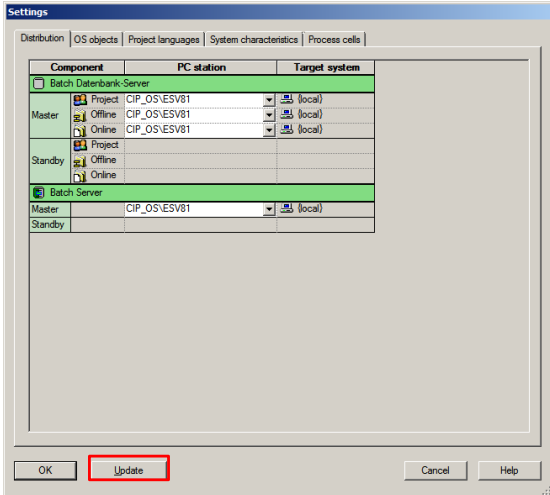
No.	Action
13.	<p>In the "Layout" tab under "Available layouts", select the "SIMATIC Standard" screen corresponding to the screen resolution that is set.</p>  <p>Click on "OK" to accept the settings and close the "OS project editor".</p>
14.	<p>Exit WinCC Explorer as described in step 10.</p>
15.	<p>In the windows task bar, right-click on the icon for the SIMATIC BATCH Launch Coordinator and select the "Change start mode from &gt; Automatic to manual" menu command.</p>  <p><b>Note</b> The SIMATIC BATCH Launch Coordinator starts automatically when the PC is started. If SIMATIC BATCH does not start, proceed as follows: Click on "Start &gt; All programs &gt; Siemens Automation &gt; SIMATIC &gt; BATCH Launch Coordinator".</p>

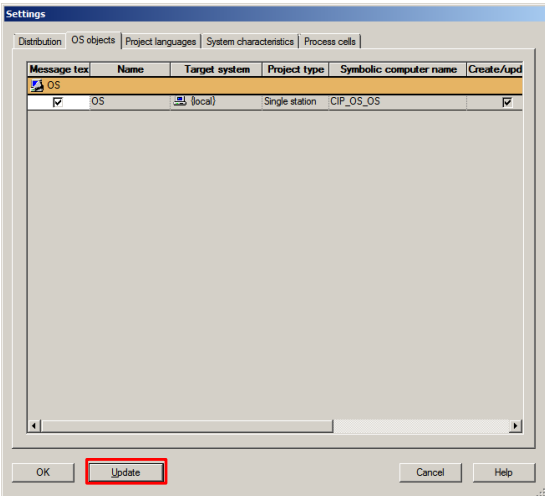
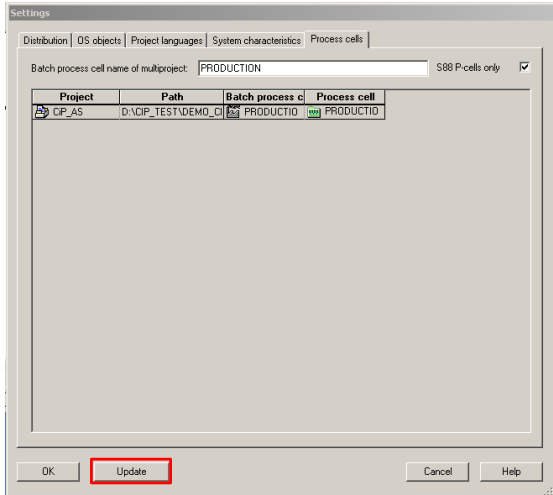
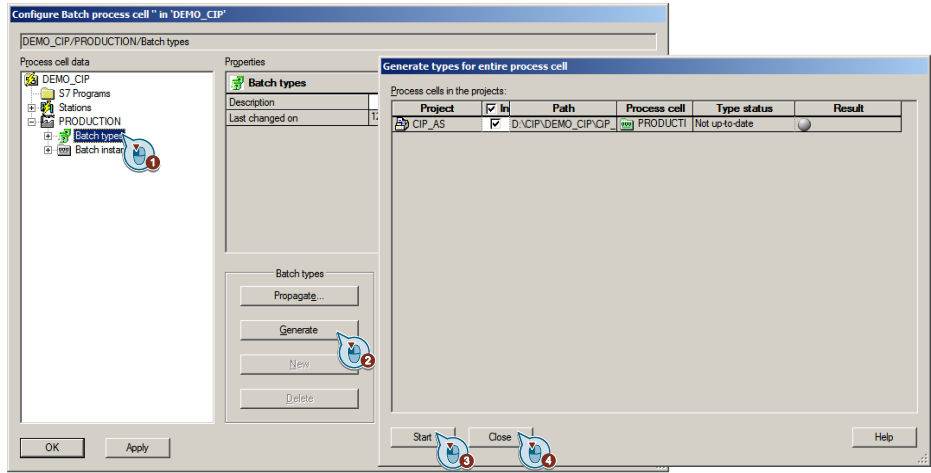
## 5.2 Working on the multiproject

The following instructions describe the work that must be performed on the multiproject. It is required that SIMATIC Manager is already open and that the project has been selected in the component view.

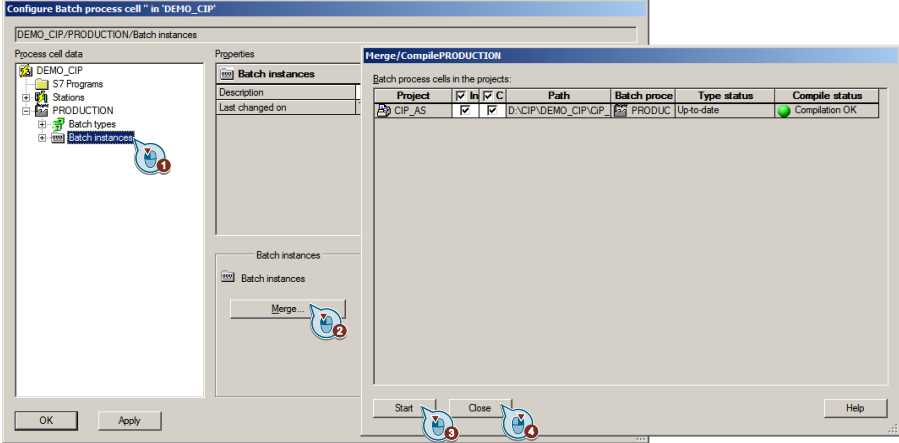
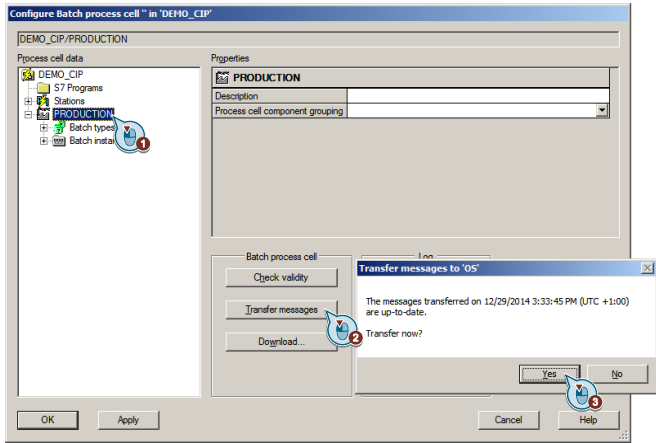
Table 5–3

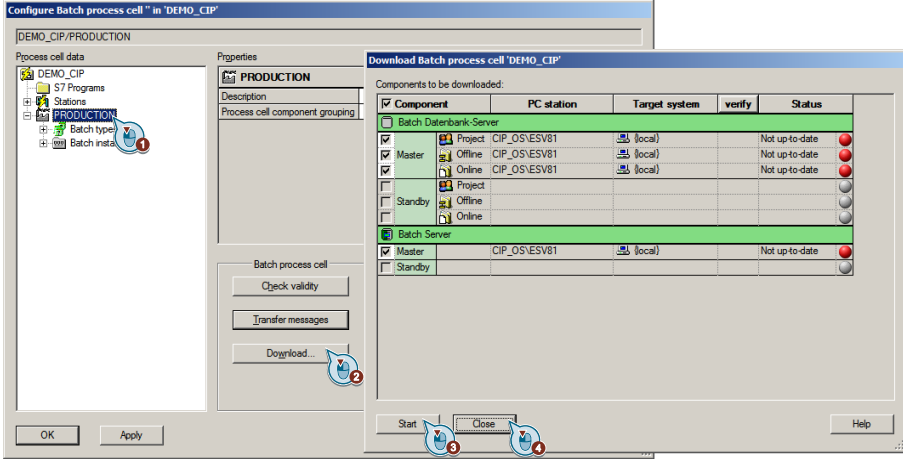
No.	Action
1.	Right-click on CIP_AS > AS1 > CPU 410-5H > S7-program(1) > Charts and click the menu command "Compile".
2.	In the "Compile program" dialog, select the "Entire program" item and deactivate the "Generate module drivers" option then confirm it with "OK". 
3.	Close the compiler log.
4.	Right-click on CIP_OS > ESV81 (Name of PC station) > WinCC Appl. > OS and click on the menu command "Compile". The compiler dialog opens.
5.	Press "Next".
6.	Press "Next".
7.	Make sure that all areas are selected and press "Next". 
8.	Select the following settings and press "Next". 
9.	Then press "Compile".
10.	Confirm the "Compile OS" dialog with "OK".

No.	Action
11.	In SIMATIC Manager, right click on the "DEMO_CIP > SIMATIC BATCH" multiproject and select the "Open configuration dialog" menu command. The SIMATIC BATCH configuration dialog is opened.
12.	<p>In the BATCH dialog, select the "DEMO_CIP" multiproject and then click on "Settings".</p>  <p>The "Settings" window opens.</p>
13.	<p>In the "Distribution" tab, click on "Update".</p> 

No.	Action
14.	<p>In the "OS objects" tab, click on "Update".</p> 
15.	<p>In the "Process cells" tab, click on "Update".</p> 
16.	<p>Click on "OK" to quit the "Settings" window.</p>
17.	<p>Select the "BATCH types" item and click on "Generate" and then on "Start".</p>  <p>Then click on "Close".</p>

5 Launching the application example

No.	Action
18.	Select the "BATCH types" item and click on "Propagate" and then on "Start". Then click on "Close".
19.	<p>Select the "BATCH instances" item and click on "Merge" and then on "Start".</p>  <p>Then click on "Close".</p>
20.	<p>Select the "PRODUCTION" item and click on "Transfer messages". Confirm the "Transfer messages to OS" dialog with "Yes".</p> 

No.	Action
21.	<p>Select the "PRODUCTION" item and click on "Download".</p>  <p>Click on "Start". Then click on "Close".</p>
22.	<p>End the SIMATIC BATCH configuration dialog with "OK".</p>

### 5.3 Start-up

The following instructions describe how the "CIP" application example is initialized:  
To put into service, it is required that SIMATIC Manager is already open and that the project has been selected in the component view.

#### Starting the simulation (S7-PLCSIM)

To start the simulation, proceed according to the following instructions:

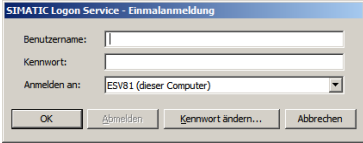
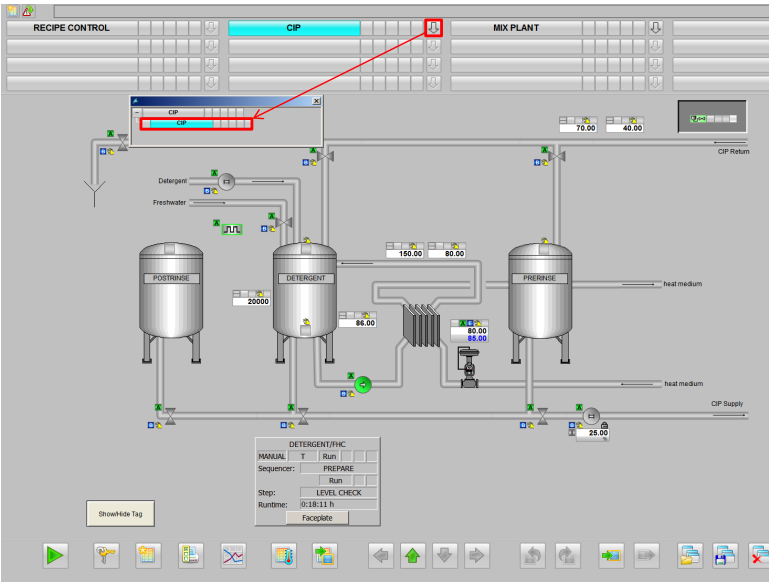
Table 5–4

No.	Action
1.	Select "Extras > Simulate module" from the menu. The "S7-PLCSIM" dialog window opens.
2.	In the menu, select "Execute > Key-switch position > Run-P".
3.	Switch to the component view of SIMATIC Manager and select "CiP_AS > AS1 > CPU 410-5H > S7-program > Charts".
4.	In the menu bar, click on "Target system > Load" and confirm the "Load" dialog with "Yes". Confirm the "Stop target group" dialog with "OK" and the subsequent "Load" dialog with "Yes".

#### Activate OS (WinCC Runtime)

To activate the OS, proceed according to the following instructions:


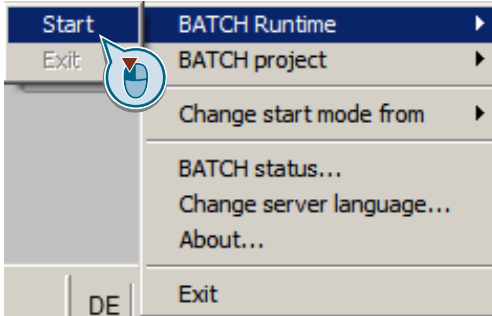


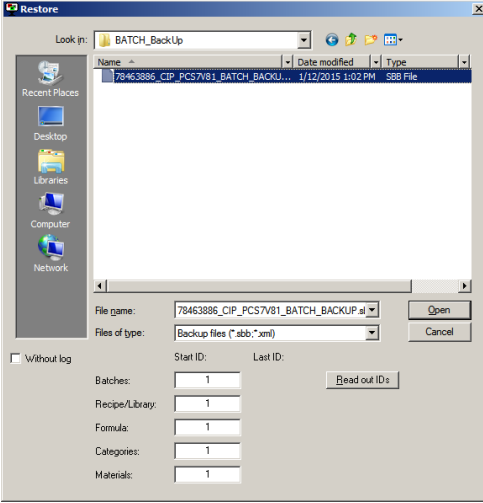
Table 5–5

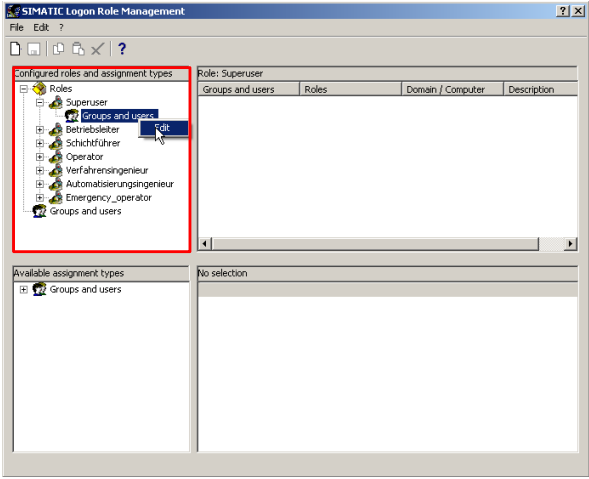
No.	Action
1.	Right-click on "CIP_OS > ESV81 > WinCC Appl. > OS" and click on the menu command "open object".
2.	To activate the OS (WinCC Runtime), select "File > Activate" in the WinCC Explorer menu.
3.	Log into the SIMATIC Logon Dialog using your Windows user ID. 
4.	Select "CIP" in the icon area. 

## Activating SIMATIC BATCH

To activate SIMATIC BATCH, proceed according to the following instructions:

Table 5–6

No.	Action
1.	Click on the Windows logo key on your keyboard to bring up the Windows task bar.
2.	There is a green "Stop" symbol in the icon for the SIMATIC BATCH Launch Coordinator  . The currently loaded "DEMO_CIP" project is displayed as a tool-tip text.
3.	<p>Right-click on the icon for the SIMATIC BATCH Launch Coordinator and select the "BATCH Runtime &gt; Start" menu command to start SIMATIC BATCH Runtime.</p>  <p>There will be an "hourglass"  in the icon for the SIMATIC BATCH Launch Coordinator. This indicates that the SIMATIC BATCH server is about to be started. The "hourglass" turns into a "Play" symbol . The SIMATIC BATCH server is now in the "Run" state.</p>
4.	Click on "Start > All programs > Siemens Automation > SIMATIC > BATCH Control Center". The BATCH Control Center opens.
5.	<p>Click on the "Extras" menu item and select the "Restore" menu command. The Restore dialog opens.</p> 
6.	Navigate to the storage location of the "78463886_CIP_PCS7V81_BATCH_BACKUP" file and select it. Click on "Open".
7.	Click on the "PRODUCTION" process cell symbol and click on the menu command "Update the process cell".
8.	Confirm the "Update the process cell" dialog with "OK".
9.	Click on the "Extras" menu item and select the "Role management" menu command. The "SIMATIC Logon Role Manager" will open.

No.	Action
10.	<p>In the "Configured roles and assignment types" window, right-click on "Roles &gt; Superusers &gt; Groups and users". Select the "Edit" menu command.</p>  <p>The "Edit groups and users" window will open.</p>
11.	<p>Click on the "List" button. All the available groups and users will be listed for you.</p>
12.	<p>Add the group "CIPDemoUsers" to "Configured groups and users".</p>
13.	<p>Click on the "OK" button to exit the "Edit groups and users" window.</p>
14.	<p>In the "SIMATIC Logon Role Management" window, click on "File &gt; Save".</p>
15.	<p>In the "SIMATIC Logon Role Management" window, click on "File &gt; Exit".</p>

## **6 Operation of the application**

### **6.1 Overview**

The following sections describe the operation of the application example. Three different scenarios will be described.

- Manual operation of the individual functions in the WinCC overview picture
- Creating and starting a cleaning batch from the SIMATIC BATCH Control Center
- Creating and starting a cleaning batch with the SIMATIC BATCH controls directly from WinCC Runtime

### **6.2 Scenario A**

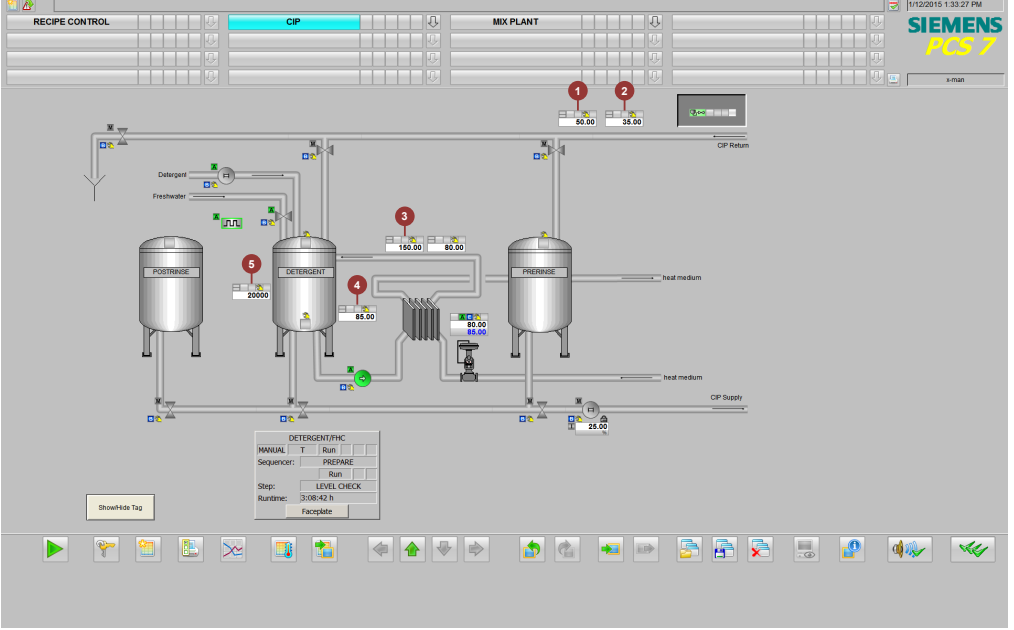
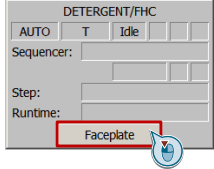
#### **Description**

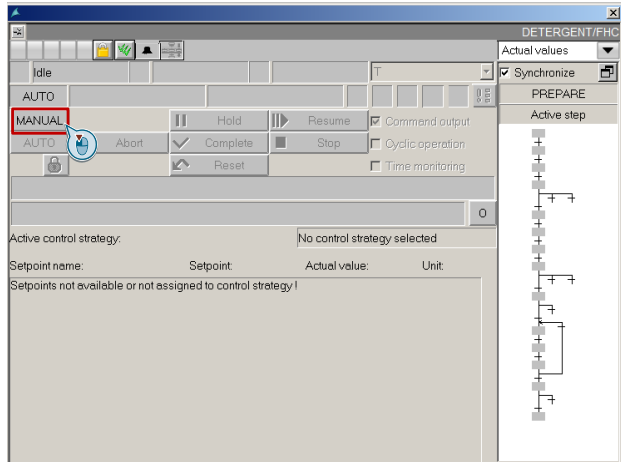
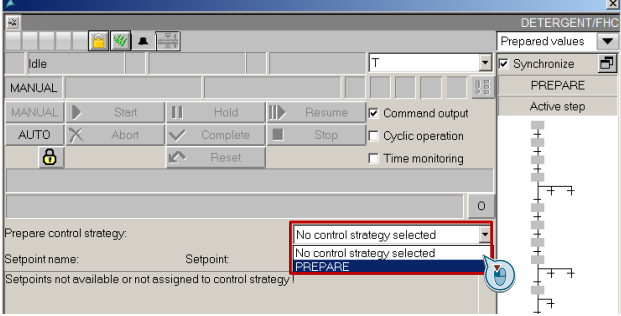
In this scenario, dealing with the plant in manual mode is explained. Here you will be able to operate the individual components of the CIP system and, e.g., perform an adjustment of the detergent concentration in the detergent tank.

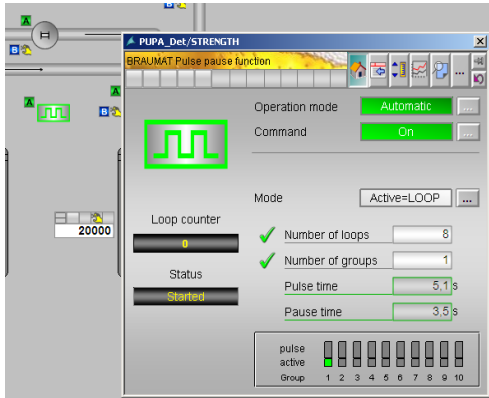

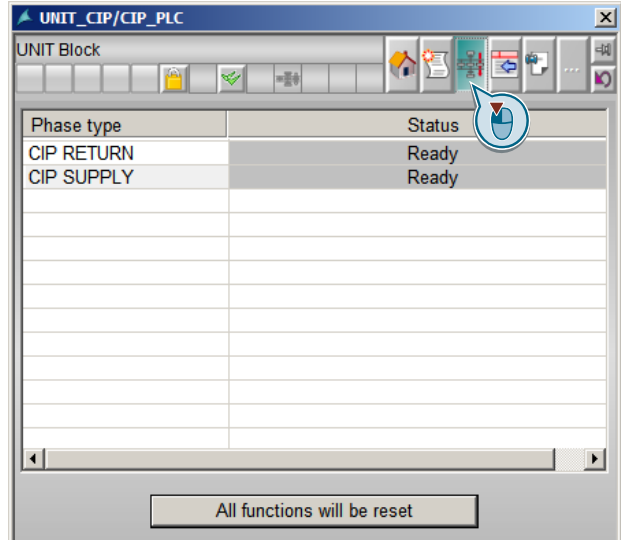
The following instructions describe starting the reprocessing of the washing fluid in the detergent tank. The following points are a prerequisite:

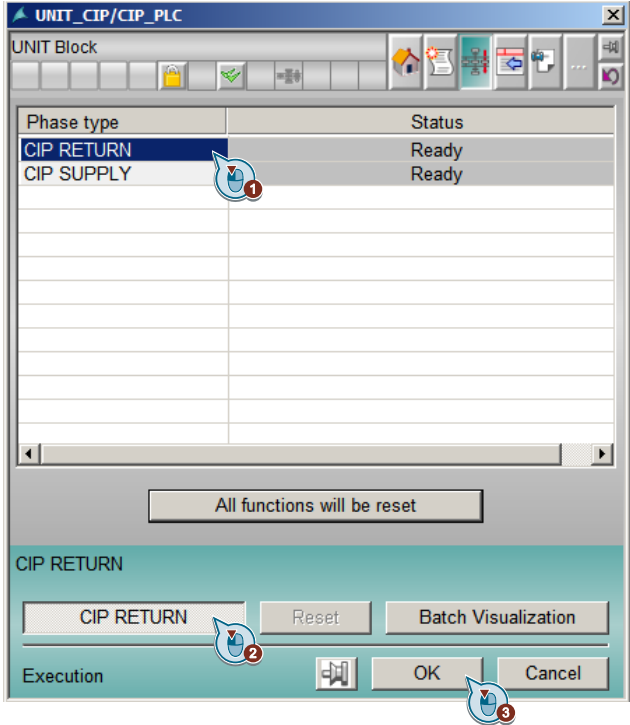
- WinCC Runtime is active
- The S7 program is loaded in "S7-PLCSIM" and the key switch is set to Run(-P)

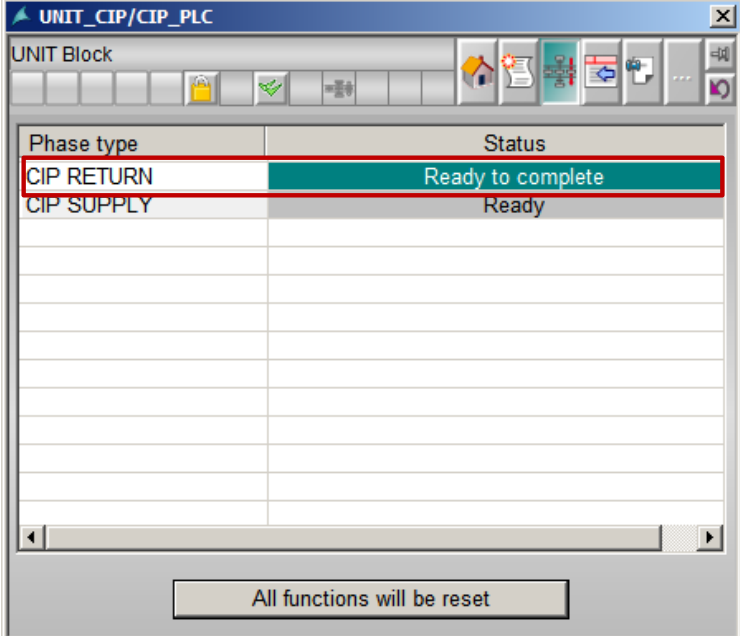
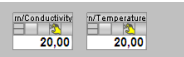
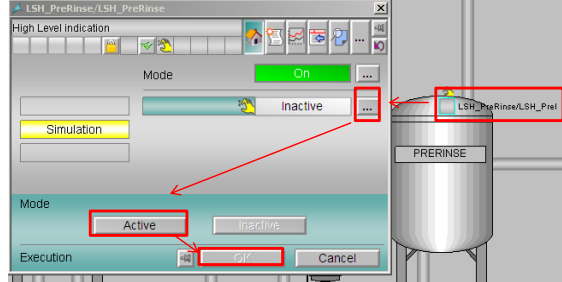
Table 6–1

No.	Action
1.	Open the plant overview picture.for the CIP system.
2.	<div>Set the following values at the marked process tags: </div> <div>1. Concentration in return line to 50 mS 2. Temperature in return line to 35 °C 3. Concentration in heating circuit to 150 mS 4. Temperature in tank to 85 °C 5. Tank capacity to 20000 L</div>
3.	<div>Click on the "Faceplate" button in the "DETERGENT/FHC" SFC control </div> <div>The faceplate for the "DETERGENT/FHC" SFC opens.</div>

No.	Action
4.	<p>Click on "MANUAL" to switch the SFC from automatic mode to manual mode,</p>  <p>Confirm the "SFC operation" dialog with "OK".</p>
5.	<p>Select the "PREPARE" control strategy.</p>  <p>Confirm the "SFC operation" dialog with "OK". The setpoints and current actual values will be displayed.</p>
6.	<p>Start the SFC by clicking on the "Start" button on the "DETERGENT/FHC" SFC faceplate. Confirm the "SFC operation" dialog with "OK". The SFC starts and remains at the "LEVEL CHECK" step.</p>
7.	<p>Change the process value for the current temperature in the tank to 75°C (see Point 4 in Step 2). The SFC changes to the "TEMP CHECK" step.</p>
8.	<p>Change the temperature again to 85°C. The SFC jumps to the "LEVEL CHECK" step.</p>
9.	<p>Change the value for the fill level to less than 17500 L (see Point 5 in Step 2). The SFC jumps to the "LEVEL REACHED?" step and the fresh water valve is opened.</p>
10.	<p>Change the value for the fill level again to 20000 L. The SFC jumps back to the "LEVEL CHECK" step.</p>
11.	<p>Change the value for the concentration in the heating circuit to 115 mS (see Point 3 in Step 2). The SFC jumps to the "CHECK PUPA" step. The BIPuPa module is started. This pulse-drives the metering pump.</p>

No.	Action
12.	<p>Click on the PUPA block icon to open the associated faceplate. You can see the pulse and pause times in the faceplate.</p>  <p>If the value for the concentration is still not adequate after a predefined number of loops, a message is transmitted.</p>
13.	Set the values for temperature, concentration and fill level so that the "LEVEL CHECK" step is active.
14.	<p>Click on the block icon for the "UNIT_CIP" UNIT_PLC block in order to open the UNIT_PLC faceplate.</p> 
15.	<p>Switch to the "Functions" view.</p> 

No.	Action
16.	<p>Click "CIP RETURN". Then click on the "CIP RETURN" button. To open the faceplate for the "CIP RETURN" SFC, confirm the entry by clicking on the "OK" button.</p> 
17.	Click on the "MANUAL" button to switch the SFC from automatic mode to manual mode. Confirm the "SFC operation" dialog with "OK".
18.	Select the "PRERINSE" control strategy and start the SFC. Confirm the "SFC operation" dialog with "OK".
19.	Click on the "Start" button to start the SFC. Confirm the "SFC operation" dialog with "OK". The valve to the drain opens.

No.	Action
20.	<p>The SFC is not self-terminating and is in the "Ready to complete" state.</p> 
21.	<p>Click on the "Exit" button on the SFC faceplate to exit the SFC. Confirm the "SFC operation" dialog with "OK".</p>
22.	<p>Click on the "Reset" button to set the SFC to the "IDLE" state. Confirm the "SFC operation" dialog with "OK".</p>
23.	<p>Switch to the "DETERGENT" control strategy. Confirm the "SFC operation" dialog with "OK". Start the SFC. Confirm the "SFC operation" dialog with "OK".</p>
24.	<p>Alter the process values for concentration and temperature in the return line of the CIP system.</p>
25.	<p>To do this, click on the block icons for the "QIT_Return" and "TIT_Return" analog monitoring blocks (see Points 1 and 2 in Step 2).</p> 
26.	<p>Change the values and observe the valves in the return line. Depending on the values, the valves to the tanks or to the drain will be opened.</p>
27.	<p>Activate the level monitoring for the pre rinse or detergent tank.</p>  <p>No more fluid will be fed into the tank for which the level monitoring is active.</p>
28.	<p>Click on the "Exit" button to exit the "CIP_RETURN" SFC. Confirm the "SFC operation" dialog with "OK".</p>

No.	Action
29.	Click on the "Reset" button to set the SFC to the "IDLE" state. Confirm the "SFC operation" dialog with "OK". Note The "POSTRINSE" control strategy behaves identically to the "DETERGENT" control strategy.
30.	Click on the "AUTO" button to switch the "CIP_RETURN" SFC from manual mode to automatic mode. Confirm the "SFC operation" dialog with "OK".
31.	Click on the block icon for the "UNIT_CIP" UNIT_PLC block in order to open the UNIT_PLC faceplate.
32.	Switch to the "Functions" view.
33.	Click on the "CIP SUPPLY" button to open the faceplate for the "SUPPLY" SFC.
34.	Click on the "MANUAL" button to switch the SFC from automatic mode to manual mode. Confirm the "SFC operation" dialog with "OK".
35.	Select the "PRERINSE" control strategy. Confirm the "SFC operation" dialog with "OK".
36.	Click on the "Start" button to start the SFC. Confirm the "SFC operation" dialog with "OK". The valve from the pre rinse tank opens and the supply pump is started. The sequencer remains active until the time set on the timer has elapsed. If the sequencer is paused with the "Pause" button, the timer will also be paused. On resuming with the "Resume" button, the timer will run again. Note: The "DETERGENT" and "POSTRINSE" control strategies behave identically.
37.	All three control strategies are started if the "LEVEL CHECK" step is active in the "DETERGENT" SFC.
38.	When the sequencers have run to the end, the SFC is in the "Ended" state. Click on the "Reset" button to set the SFC to the "IDLE" state. Confirm the "SFC operation" dialog with "OK".
39.	Click on the "AUTO" button to switch the SFC from manual mode to automatic mode. Confirm the "SFC operation" dialog with "OK".



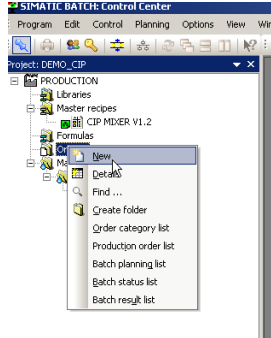
## 6.3 Scenario B

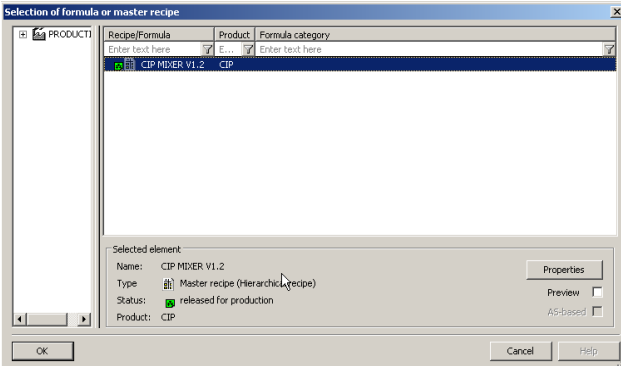
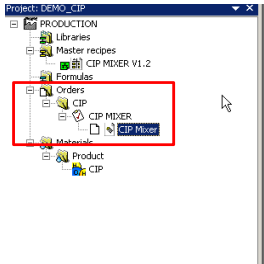
In Scenario A you were acquainted with the individual functions of the CIP system in manual operation. The following will describe how to use these functions with SIMATIC BATCH. Here, operation is carried out from the SIMATIC BATCH Control Center.

The following points are a prerequisite:

- WinCC Runtime is active
- The S7 program is loaded in "S7-PLCSIM" and the key switch is set to Run(-P)
- The SIMATIC BATCH server is in the "Run" state
- The "DETERGENT" SFC is in the "Run" state (active "LEVEL CHECK" step)
- The supplied backup has been imported
- Role management has already been carried out

Table 6–2

No.	Action
1.	In the key area, click on the "Key set change" button. 
2.	In the key area, click on the "BATCH Control Center" button.  The SIMATIC BATCH Control Center opens.
3.	Right-click on "Orders" and select the "New" menu command.  This opens the "Generate order category" window.
4.	Enter a suitable name (e.g. CIP) in the "Names" box and click on the "OK" button.
5.	Right-click on "CIP" and select the "New" menu command. The "Create order" window opens.
6.	In the "General" tab, enter a suitable name (e.g. CIP MIXER) in the "Names" box.
7.	Switch to the "Batches" tab.
8.	Click on the "New" button. The "Selection of formula or master recipe" window opens.

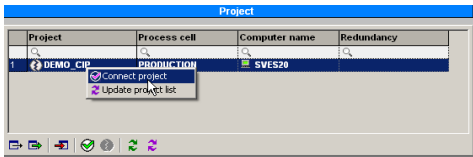
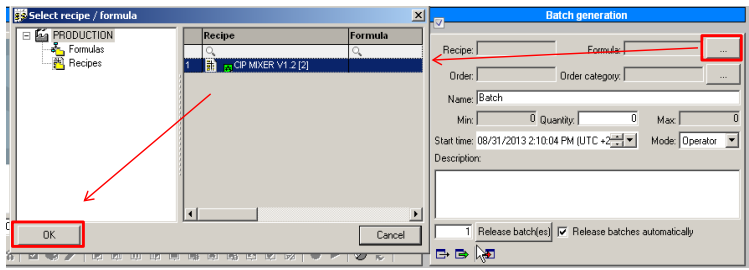
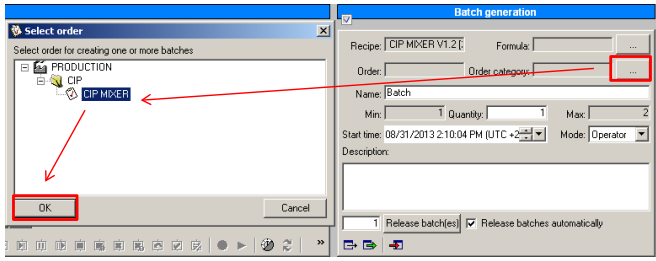
No.	Action
9.	<p>Select the "CIP MIXER V1.2" master recipe and then click on the "OK" button.</p> 
10.	<p>Give the batch in the "Create order" window a suitable name. Click on the "OK" button in the "Create order" window. You have now created a new order with a batch.</p> 
11.	<p>Right-click on the batch and select the "Release" menu command. Confirm the dialog window that opens with "Yes".</p>
12.	<p>Double click on the batch. The control recipe will be displayed for you.</p>
13.	<p>Right-click on the batch and select the "Start" menu command. Confirm the dialog window that opens with "Yes". The batch will be started. SIMATIC BATCH now occupies the plant sections and starts the SFCs. All the control strategies are run through one after another.</p>
14.	<p>Switch to WinCC Runtime and observe the individual valves and pumps being actuated.</p>
15.	<p>Change the values for the temperature and concentration in the return line (see Points 1 and 2 in Step 2 in Scenario A) The valves to the tanks and to the drain will be opened or closed according to the change.</p>
16.	<p>Switch to the "Mixer" process picture. Here also the valves and the pump on the mixer are actuated.</p>
17.	<p>The batch ends automatically. The SFCs that were started are terminated and reset to the "IDLE" state by SIMATIC BATCH.</p>

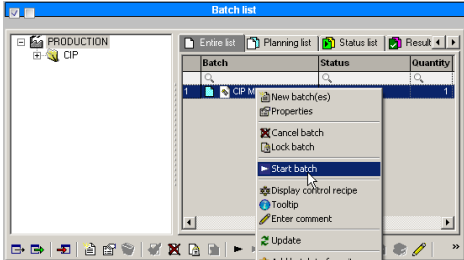
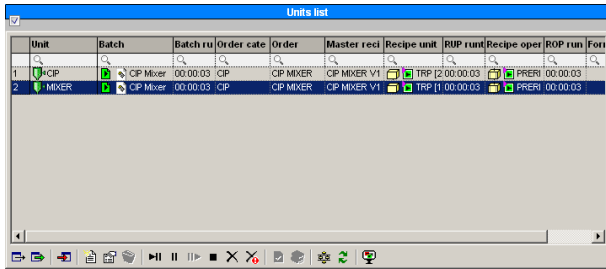
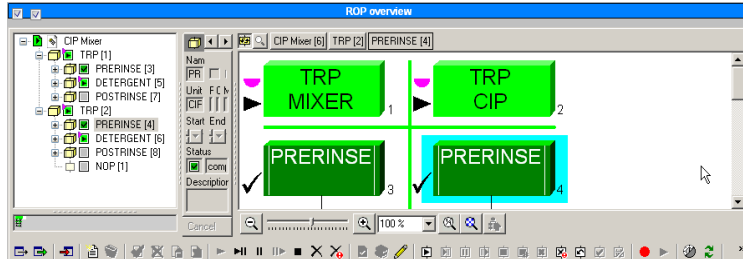
## 6.4 Scenario C

In Scenario A you were acquainted with the individual functions of the CIP system in manual operation. The following will describe how to use these functions with SIMATIC BATCH. Operation takes place here in WinCC Runtime via the SIMATIC BATCH OS controls (BATCH OCXs). The following points are a prerequisite:

- WinCC Runtime is active
- The S7 program is loaded in "S7-PLCSIM" and the key switch is set to Run(-P)
- The SIMATIC BATCH server is in the "Run" state
- The "DETERGENT" SFC is in the "Run" state (active "LEVEL CHECK" step)
- The supplied backup has been imported
- Role management has already been carried out
- The order has been created in SIMATIC BATCH Control Center

Table 6–3

No.	Action
1.	Open the "RECIPE CONTROL" screen in WinCC Runtime.
2.	Right-click on the "DEMO_CIP" project in the "Projects" BATCH OCX and select the "Connect project" menu command. 
3.	Click on the button next to "Formula" in the "Batch generation" BATCH OCX.
4.	Select the "CIP MIXER V1.2" recipe in the "Select recipe/formula" window. Click on "OK". 
5.	Click on the button next to "Order category" in the "Batch generation" BATCH OCX.
6.	Select the order "CIP MIXER" (needs to have been created previously in BATCH Control Center) in the "Select order" window. Click on "OK". 
7.	Enter a suitable name in the "Name" box in the "Batch generation" BATCH OCX.
8.	Adjust the start time in the "Batch generation" BATCH OCX.

No.	Action
9.	Click on the "Release batch(es)" button in the "Batch generation" BATCH OCX.
10.	Click on "Yes" in the "Confirmation" dialog. The batch will be created and released.
11.	In the "Batch list" BATCH OCX, right-click on the batch that you created previously and select the "Start batch" menu command. 
12.	Click on "Yes" in the "Confirmation" dialog box.
13.	You can see the plant sections occupied by the batch in the "TA list" BATCH OCX. 
14.	Double click on the occupied plant sections. The control recipe will be displayed for you in the "ROP overview" BATCH OCX. 

## 7 Literature

### 7.1 Related documents

This list is by no means complete and merely reflects a selection of suitable literature.

Table 7–1

	Subject area	Title
/1/	Practical manual for controllers with SIMATIC S7 and SIMATIC PCS7 for process automation	Controlling with SIMATIC Müller, Jürgen / Pfeiffer, Bernd-Markus / Wieser, Roland Publicis Kommunikationsagentur ISBN 978-3895783401
/2/	Process engineering	TECHNOLOGIE Brauer & Mälzer Kunze, Wolfgang / Manger, Hans-Jürgen Publicis Kommunikationsagentur ISBN 978-3-921690-56-7

### 7.2 Internet links

This list is by no means complete and merely reflects a selection of suitable information.

Table 7–2

	Subject area	Title
\1\	Siemens Industry Online Support	<a href="http://support.automation.siemens.com">http://support.automation.siemens.com</a>
\2\	Integration of S7-300 Package Units and Operator Panels in SIMATIC PCS 7 with PCS 7 Industry Library	<a href="http://support.automation.siemens.com/WWW/view/en/78463886">http://support.automation.siemens.com/WWW/view/en/78463886</a>
\1\	SIMATIC PCS 7 in Industry Online Support - Overview page	<a href="http://www.siemens.de/industry/onlinesupport/pcs7">www.siemens.de/industry/onlinesupport/pcs7</a>
\2\	SIMATIC Process Control System PCS 7 Compendium Part C - Technical Functions with SFC Types	<a href="https://support.industry.siemens.com/cs/ww/en/view/109098121">https://support.industry.siemens.com/cs/ww/en/view/109098121</a>
\3\	SIMATIC PCS 7 overview (collection of links for FAQ, manuals, compendium, forum, application examples and multimedia)	<a href="http://support.automation.siemens.com/WWW/view/en/63481413">http://support.automation.siemens.com/WWW/view/en/63481413</a>
\4\	SIMATIC Process Control System PCS 7 SIMATIC BATCH V8. 1"	<a href="http://support.automation.siemens.com/WWW/view/en/106471750">http://support.automation.siemens.com/WWW/view/en/106471750</a>
\5\	PCS 7 V8. 1 Manual Collection	<a href="http://support.automation.siemens.com/WWW/view/en/59538371">http://support.automation.siemens.com/WWW/view/en/59538371</a>
\6\	SIMATIC Process Control System PCS 7 PCS 7 BRAUMAT Library V7.1	<a href="http://support.automation.siemens.com/WWW/view/en/60307664">http://support.automation.siemens.com/WWW/view/en/60307664</a>

## 8 History

Table 8–1

Version	Date	Change
V1.0	10/2013	First edition
V2.0	02/2015	Updating to PCS 7 V8.1