SIEMENS

SIMATIC

# Process Control System PCS 7 V7.0
# PCS 7 - Getting Started - Part 2

Getting Started




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## Safety Guidelines

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

**⚠DANGER**

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

**⚠WARNING**

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

**⚠CAUTION**

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

**CAUTION**

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

**NOTICE**

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

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

## Qualified Personnel

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

## Prescribed Usage

Note the following:

**⚠WARNING**

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

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## Disclaimer of Liability

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

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# Table of contents

# Preface

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## Purpose of this documentation

*Getting Started - Part 2* introduces the PCS 7 functions you can use for fast and effective configuration of you plant. These functions are especially convenient for configuring large, complex plants.

*Getting Started - Part 2* is intended for users who have already worked through *Getting Started - Part 1*.

## Required basic knowledge

You should already have knowledge in the following areas:

- Microsoft operating system Windows XP, Windows Server 2003
- Basic knowledge in the field of process automation
- Functions and configuration of SIMATIC S7 (S7-400, STEP 7)
- Functions and configuration of SIMATIC NET (network components, transmission media)

You should also be familiar with the basic functions of PCS 7. This includes all functions described in *Getting Started - Part 1*. Detailed instructions are provided for all functions that were not covered in *Getting Started - Part 1*. If necessary, you can refer back to the detailed descriptions in *Getting Started - Part 1*.

## Validity of the documentation

This documentation is valid for the software package Process Control System; *PCS 7 Toolset V7.0*.

## Guide

*Getting Started - Part 2* is a continuation of *Getting Started - Part 1*. In this Getting Started, you will configure a unit for the color project. In doing so you will become familiar with functions of rational engineering. You will find important background information needed to understand the individual topics and, of course, detailed step-by-step instructions for performing the configuration.

You are also provided with a completed "color_gs" example project for *Getting Started 2*, which is archived in "color_gs2.zip". This is installed along with the system documentation of PCS 7. You open this project on an existing engineering station (ES) in order to view the configuration data and compare the data with your own configuration data. You activate the project on an operator station (OS) in order to operate and monitor the process.

**Note**

To test the example project in process mode, the hardware configuration of the project must correspond to your actual hardware configuration. If necessary, replace the hardware components in the example project with the actual hardware components present.

Further information may be found in *Getting Started - Part 1*.

**Start > Simatic > Documentation > English > PCS 7 Getting Started Part 1 (Online Help)** or **PCS 7 Getting Started Part 1 (PDF)**

**Note**

Many preparatory tasks that you will do in *Getting Started - Part 2* were already described in detail in *Getting Started - Part 1*. Therefore, they are only described in outline form in this part of Getting Started. You can find detailed information in *Getting Started - Part 1*. This is part of the system documentation for PCS 7 that is included in the standard installation of PCS 7.

Select the following menu command to open *Getting Started - Part 1*:

**Start > Simatic > Documentation > English > PCS 7 Getting Started Part 1 (Online Help)** or **PCS 7 Getting Started Part 1 (PDF)**

## Conventions

In this Getting Started, all the instructions are given using their full menu commands. You can also activate the majority of functions via the context menu or by double-clicking.

**Note**

In this documentation the designations of elements of the user interface are specified in the language of this documentation. If you have installed a multi-language package for the operating system, some of the designations will be displayed in the base language of the operating system after a language switch and will, therefore, differ from the designations used in the documentation.

In PCS 7, you can use standard Windows functions in many situations:

- Multiple selection using the "CTRL" and "Shift" keys
- Column sorting in tables by clicking on the column header
- Use of drag & drop instead of copy and paste

If you open the HTML version of Getting Started, you can run video sequences. You can follow along step-by-step in these video sequences. Video sequences are indicated by the following icon:

 Video

Click on the word "Video" to start a video sequence. You start and stop the video sequences using the corresponding commands in the context menu.

The individual tutorials in Getting Started build on each other so that you will create your own complete PCS 7 project step-by-step. For this reason, you should work through all the tutorials in the specified sequence.

## PCS 7 glossary

You can find a PCS 7 glossary defining the most important technical terms used in the documentation on the DVD SIMATIC PCS 7; Manual Collection or within the PCS 7 software through the help menu SIMATIC Manager (menu command **Help > Topics >** "Glossary" button).

## Additional information

You will find detailed background information and general context in the following manuals, which you can use for reference purposes:

- Configuration manual *Process Control System PCS 7; Engineering System*
- Configuration manual *Process Control System PCS 7; Operator Station*

These manuals are stored as follows:

- as PDF files on the DVD "PCS 7 Engineering Toolset V7.0"
- In the PCS 7 software in SIMATIC Manager.
  They can be accessed there using **Start > Simatic > Documentation > [required language]** from the menu.

If you wish to familiarize yourself with specific topics in greater depth, refer to the appropriate manuals, for example, for SFC and CFC.

## Additional support

If you have further questions about the use of products presented in this manual, contact your local Siemens representative:

A list of Siemens representatives is available at:

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

A guide to the technical documentation for individual SIMATIC products and systems is available at:

http://www.automation.siemens.com/simatic/portal/html_00/techdoku.htm

## Training center

We offer courses to help you get started with the S7 automation system. Contact your regional training center or the central training center in D 90327 Nuremberg, Federal Republic of Germany.

By phone: +49 (911) 895–3200

Internet: http://www.sitrain.com

## Technical Support

You can contact Technical Support for all A&D products

- using the Support Request Web form

  http://www.siemens.com/automation/support-request

- By telephone: + 49 (180) 5050-222
- By fax: + 49 (180) 5050-223

You can find additional information about our Technical Support online at:
http://www.siemens.com/automation/service

## Service & Support on the Internet

In addition to our paper documentation, our complete knowledge base is available to you on the Internet at:

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

There, you will find the following information:

- Newsletters providing the latest information on your products
- A search engine in Service & Support for locating the documents you need
- A forum where users and experts from all over the world exchange ideas
- Your local contact partner for Automation & Drives in our Contact Partners database
- Information about on-site service, repairs, spare parts, and much more under "Services

# Preparations for Getting Started - Part 2

# 2

## 2.1 Prerequisites for Getting Started

### 2.1.1 Requirements for working through Getting Started - Part 2

**Introduction**

To be able to work through Getting Started, the following requirements must be met for the components below:

- Hardware (Page 14)
- Software (Page 16)

## 2.1.2 Hardware requirements for Getting Started - Part 2

### Hardware components

The hardware requirements for *Getting Started - Part 2* are identical to those for *Getting Started - Part 1*. You require the following hardware components:

| Hardware component | Version used in Getting Started | Other version possible |
|---|---|---|
| PG or PC with a standard network card | 3Com EtherLink III IS | Yes |
| Rack | UR2 | Yes |
| Power supply | PS 407 10A | Yes |
| CPU | CPU 417-4, firmware V 3.1 or higher | No |
| CP 443-1 | 6GK7 443-1 EX11-0XE0,<br>Firmware 2.0 or higher with a fixed MAC address | No |
| Memory card | | |
| Crossover cable | | No |

**NOTICE**

To implement the configuration described in Getting Started, you must have at least have the CPU and the CP.

**Note**

You can find detailed information on the hardware requirements in *Getting Started - Part 1*.

**Note**

You can find detailed information about setting up the PC station in the manual *Process Control System PCS 7; PC Configuration and Authorization*

## Additional hardware components

You also require the following components for an actual simulation using I/O modules:

| Hardware component | Version used in Getting Started | Other version possible |
|---|---|---|
| IM 153-1 | 6ES7 153-1AA03-0XB0 | Yes |
| Digital input module | 6ES7 321-1BH01-0AA0 | Yes |
| Digital output module | 6ES7 322-1BH01-0AA0 | Yes |
| Analog input module | 6ES7 331-7KF01-0AB0 | Yes |
| Analog output module | 6ES7 332-5HD01-0AB0 | Yes |

## 2.1.3 Software requirements for Getting Started - Part 2

### Software components

The following software must be installed:

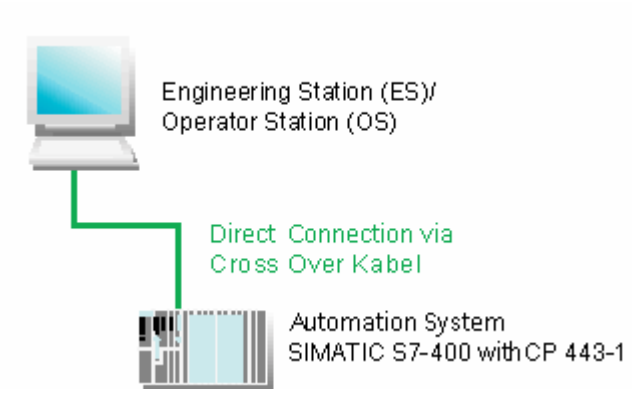
- Windows XP Professional, Windows Server 2003
- Internet Explorer 6.0
- Message Queuing Service
- SQL Server
- Software package *PCS 7 Engineering Toolset*
  If you have questions about installing the PCS 7 software, read the Readme file on the installation DVD or contact Customer Support.

# 2.2 Introduction to the project for Getting Started

## 2.2.1 System configuration for the 'color_gs' project

### Structure

The system configuration for Getting Started - Part 2 is identical to that for Getting Started - Part 1.




You can find detailed information on the system configuration in *Getting Started - Part 1* under "System configuration for the "color_gs" project".

**Note**

Note that the system configuration and the hardware settings are designed specially for the requirements of this Getting Started.

## 2.2.2 Introduction to the overall project

### Plant description

In this Getting Started, you will configure a fully automatic dye production plant. You were already introduced to the overall project in detail in *Getting Started - Part 1*.

The following is a summary of the individual phases of the production process:

### Phase I - Raw materials

The raw materials are fed as follows:

- The liquid raw materials are fed from two raw material tanks selectively to either Reactor 1 or Reactor 2.
- The solid raw materials are fed from three silos to a weigh hopper and from there into a mixing tank.

**Note**

The liquid raw material feed was configured in Getting Started - Part 1.

### Phase II – Production

The products are produced in the reactors by agitating, heating and cooling the raw materials together with the additives. Valves and actuators are used to control the temperature in the reactors.

When necessary, water from a filtration plant can be introduced into the reactors using a flow controller.

### Phase III - Holding phase

The product is pumped to a holding tank for postprocessing.

### Phase IV – Filling

After the holding phase, the product is temporarily stored in a filling tank. From there, it is filled into bulk-tank trucks or small packing drums.

### Phase V – Cleaning

All parts of the plant can be cleaned by a cleaning-in-place (CIP) system. The resulting wastewater is collected in a separate effluent tank and disposed of.

## 2.2.3 Task definition for Getting Started - Part 2

### Task definition for Getting Started - Part 2

You will configure the following for Reactor 1 of the overall plant described above:

- Phase II: Production with agitation and heating
- Phase III: Draining the holding tank

The following sub-processes are not described in Getting Started because you will become acquainted with all functions of rational engineering in phases II and III:

- Phase II: Cooling and the filtration system
- Phase III: Tempering
- Phases IV and V

You provide for all other parts of the plant in the form of hierarchy folders in the plant hierarchy. The actual configuration process is not described in Getting Started.

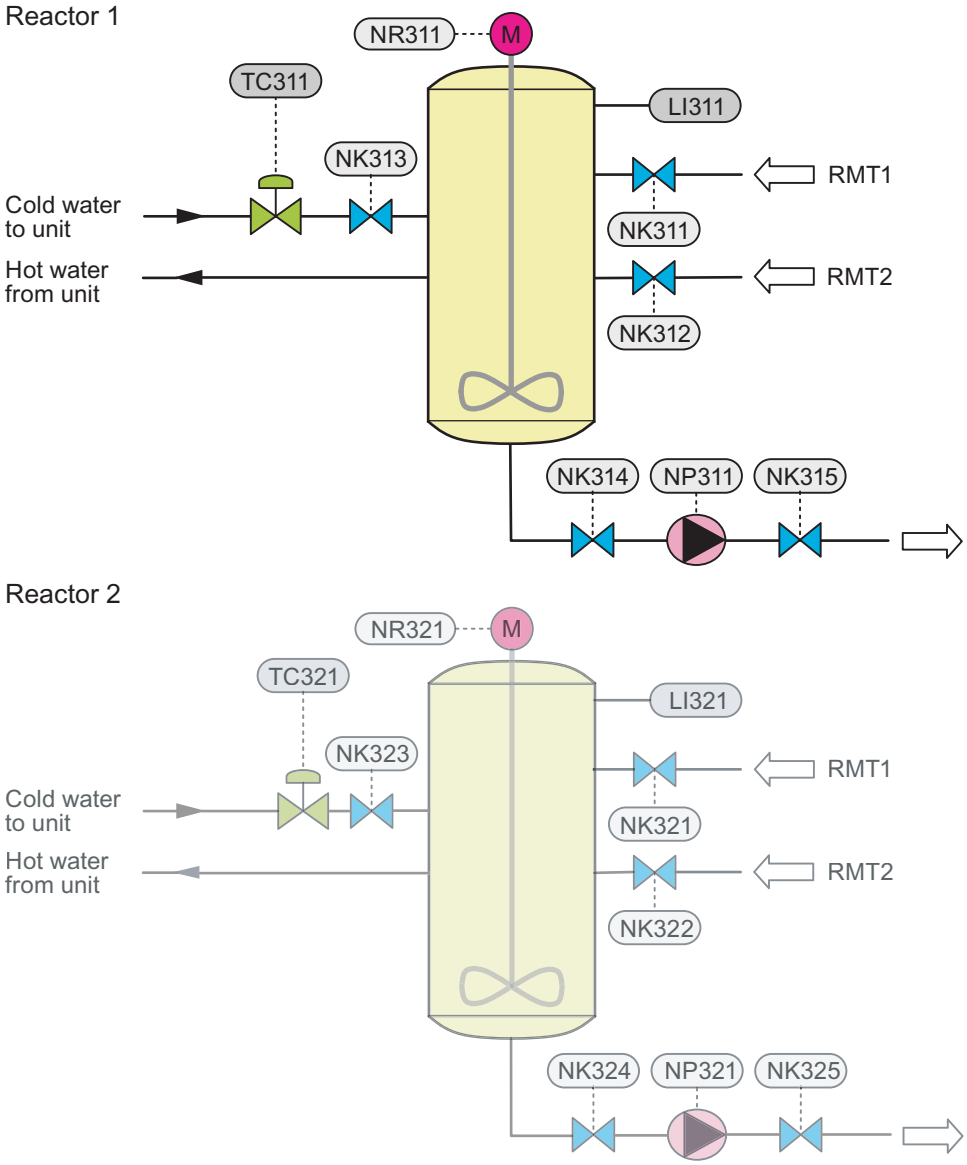
**Note**

Getting Started gives a detailed description of how to configure the REAC1 part of the plant. You will configure REAC2 on your own. In doing so, you use all of the functions that you have learned in Getting Started - Parts 1 and 2.

Examples:

- Using the process object view
- Using process tag types
- Using SFC types

## Graphic representation of the "REAC1" and "REAC2" parts of the plant



## 2.2.4 Overview of configuration tasks

### Configuration sequence

You configure the parts of the plant in the following configuration steps:

- Retrieving the "color_gs" project from the archive
- Adapting the hardware configuration using symbolic names
- Adapting the plant hierarchy
- Creating simulation charts for use with chart-in-chart technique
- Creating process tag types and process tags
- Creating other CFC charts
- Creating an SFC type and an SFC instance
- Compiling and testing
- Creating custom icons for use in process pictures
- Modifying a standard block icon for multiple usage
- Creating a process picture
- Operating SFC instances in process mode

# 2.3 Making the preparations

## 2.3.1 Overview of default settings

### Use of the"color_gs" project from *Getting Started - Part 1*

With the aid of this Getting Started, you will continue the configuration of the "color_gs" example project from *Getting Started - Part 1*.

We recommend using the ready-to-use "color_gs" example project. It is automatically installed with the PCS 7 setup program. This ensures that all configuration steps have been performed and all folders, charts, etc., have been named in accordance with the instructions in Getting Started - Part 1. Getting Started - Part 2 is based on this.

### Settings for the supplied example project

If you use the supplied example project, you must first perform the following configuration steps. You can then continue with configuration and compile, download and test the project.

**Note**

The following configuration steps are presented in brief here. You can find detailed descriptions in *Getting Started - Part 1*.

| Step | What? |
|---|---|
| 1 | Making settings in the Configuration Console (Page 23) |
| 2 | Selecting the communications processor (Page 24) |
| 3 | Retrieving the project from the archive (Page 25) |
| 4 | Adapting the hardware configuration of the AS (Page 26) |
| 5 | Renaming a PC station (Page 29) |
| 6 | Adapting the name of the OS (Page 30) |
| 7 | Adapting the configuration of the OS (Page 31) |
| 8 | Making settings in NetPro (Page 32) |

## 2.3.2 How to make the settings in the Configuration Console

### Procedure

1. Open the Configuration Console using the Windows command **Start > SIMATIC > SIMATIC NET > Configuration Console**.
2. In the tree view, select the network adapter to be used for communication between the automation system and the OS using the entry "SIMATIC NET Configuration/Modules/[name of network adapter]".
3. Select the entry "General".
4. In the detailed window, select the entry "Configured mode" in the "Mode of the module" list.
5. Click the "Apply" button.
   Your settings are entered. The network card is now activated.
6. Select the "Address" entry.
   All the address details of the selected network card are displayed in the detailed window.
7. Make a note of the "Ethernet(MAC) address" because you will need this to subsequently configure the hardware.
8. Select the entry "Access points".
9. Double-click the "S7ONLINE" access point in the detailed window.
   The "Properties of S7ONLINE" dialog box opens.
10. In the "Assigned Interface Configuration" drop-down list, select the entry "PC internal (local)" and save your setting by clicking "OK".
11. Specify "PG mode" as the module operating mode for all other network cards.
12. Close the configuration console.

## 2.3.3 How to select the communications processor in Simatic Shell

### Introduction

Below, you will select the communications processor that is used to configure the PC stations.

**Note**

If a PC station is used as a single-station system with no connection to other PC stations, the following configuration steps are not necessary.

### Procedure

1. Select the PC station (workstation) in the tree view of Windows Explorer.
2. Select the "Simatic Shell" folder.
3. Select **Settings** in the context menu.
   The "Select Terminal bus" dialog opens.
4. Select the network adapter (communications processor) you want to use to establish communication with the engineering station.
5. Click "OK".
6. Confirm the next dialog box.

This initializes the communications processor.

## 2.3.4 How to retrieve the project from the archive

### Introduction

The basic project is supplied in a zip file with PCS 7. You extract the zip file using a PCS 7 function.

**Note**

The following configuration steps are presented in brief here. You can find detailed descriptions in *Getting Started - Part 1*.

### Requirement

SIMATIC Manager is open.

### Procedure

1. Select **File> Retrieve from Archive...** from the menu.
2. Open the"SIEMENS/STEP 7/Examples_MP" folder.
3. Select the "color_gs.zip" file, and click "Open".
4. Select the required destination folder.
   The retrieval starts. On completion of retrieval from the archive, the "Retrieve from Archive" message window opens.
5. Click "OK".
   The message dialog "The multiproject 'color_gs_MP' has been retrieved from the archive. Do you want to start it now?" dialog box opens.
6. Click "Yes".

## 2.3.5 How to adapt the hardware configuration of the AS

**Note**

The following configuration steps are presented in brief here. You can find detailed descriptions in *Getting Started - Part 1*.

### Requirements

- The example project is open in SIMATIC Manager.
- The component view is activated

### Procedure

1. Select the "color_gs_MP/color_gs_Prj/SIMATIC 400(1)" folder in the tree view.
2. Select the "Hardware" object in the detail window and select **Edit > Open Object** from the menu.
3. Select the CP desired from the hardware catalog.
   If you are using another version of the CP in your project, drag it to the same position as the existing CP.
4. Click "Yes" In the first message box and "OK" in the second message box.
5. Select the CP 443-1 and select the menu command **Edit > Object Properties....**.
6. Click the "Properties" button and enter the MAC address that is printed on your CP in the "Properties - Ethernet interface" dialog box.
7. Clear the "IP protocol is being used" check box.
8. Select the entry "Ethernet (1)" in the "Subnet" list.
9. Click "OK" in the "Properties - Ethernet interface" dialog box and then click "OK" in the "Properties – CP 443-1" dialog box.
   The CP is adapted for *Getting Started - Part 2*.
10. Close HW Config.
11. When the "Save changes in SIMATIC 400(1)?" message box appears, click "Yes".

## 2.3.6 How to adapt the blocks for the example project

### Requirements

- The example project is open in SIMATIC Manager.
- The "PCS 7 Library V7.0" is open and selected.

### Procedure

1. Go into the tree view and select the entry "PCS 7 Library V7.0/Blocks+Templates/Blocks" All blocks are displayed in the detailed window.
2. Select all blocks that are also contained in your library.
3. Drag the blocks into the master data library "color_gs_MP/color_gs_Lib/S7 Program(1)/Blocks". The "Insert Function Block" dialog opens.
4. Click "All". This replaces all blocks in the master data library with those from the current version of the PCS 7 library.
5. Select "color_gs_MP/color_gs_Lib/S7 Program(1)/Charts" in the tree view.
6. Select the process tag type "VALVE".
7. Select **Edit > Open Object** from the menu. The process tag type is opened in the CFC Editor.
8. Select **Options > Block Types...** from the menu. The "Block Types" dialog box opens.
9. Select all blocks in the "Chart Folder" group and click "New Version". The "Convert Format" dialog box opens.
10. Click "Yes" to convert the format. If blocks from an older version are in the process tag types, the "Import New Version" dialog box opens.
11. Click "Yes" to update the blocks. The "Import New Version" dialog box opens and all identical block types are displayed.
12. Click "Yes". The dialog box closes.
13. Click "Close".
14. Close the CFC editor.
15. Select "color_gs_MP/color_gs_Lib/S7 Program(1)/Blocks" in the tree view.
16. Select **Options > Charts > Update Block Types...** from the menu. The "Update Block Types" wizard opens.
    - In the "Select the S7 programs to be checked" step, select the "color_gs" project. The check boxes for all folders of all S7 programs are activated by default.
    - Click "Continue".
    - All block types are activated by default in the step "Select the block type to be updated".
    - Click "Finish". The "Convert Format" dialog box closes.
    - Click "Yes" to convert the formats. When the update is completed, the log opens and all the block instances in your project have been updated.
17. Click "Close" in the log.
18. Compile the AS after the block import.

## 2.3.7 How to adapt the project data for the example project

### Requirements

- The example project is open in SIMATIC Manager.
- OS(1) is selected in the Component view.

### Procedure

1. Select **Edit > Open Object** from the menu.
   The "s7omwinx" dialog box opens.
2. Click "Yes" if you want to open the project on the local computer.
   WinCC Explorer opens.
3. Select the entry "OS Project Editor".
4. In the context menu, select the **Open** command.
   The OS project editor opens.
5. Accept the default settings and click "OK".
   The OS project editor updates the project data.
6. Select the menu command **File > Activate**.
   Process mode is activated.

## 2.3.8 How to rename the PC station

### Requirements

- The example project is open in SIMATIC Manager.
- The component view is activated

### Procedure

1. Go to the tree view and select the object "color_gs_MP/color_gs_Prj/SIMATIC PC-Station(1)".
2. Select **Edit > Rename** from the menu.
3. Enter the name of the local computer as it appears in the network and confirm your entry.

**Note**

You will find the name of your local computer under "System Properties" in the Windows Control Panel.

The icon of the PC station is labeled with a yellow arrow in the component view.

**Note**

If the PC station is not labeled with a yellow arrow, update the on-screen display using the <F5> key.

## 2.3.9 How to adapt the name of the OS

### Requirements

- The example project is open in SIMATIC Manager.
- The component view is activated

### Procedure

1. Select the "color_gs_MP/color_gs_Prj/[Name of PC station]/WinCC Application/OS(1)" object in the tree view.
2. Select **Edit > Open Object** from the menu.
3. The message box "The configured server is not available. Do you want to open the project using the local computer as the server?" opens. Click "Yes".
4. Select the entry "OS(1)/computer" in the tree view of WinCC Explorer.
5. Select the displayed computer in the detailed window, and select **Edit > Properties** from the menu.
6. Enter the name of the local computer in the "Computer name" box.
7. Click "OK".

   **Note**

   You will find the name of your local computer under "System Properties" in the Windows Control Panel.

8. The message "The name of the computer '[name of the computer]' has changed. The change....." appears. Click "OK".
9. The message "Change computer name" appears. Click "OK".
10. Close WinCC Explorer.

## 2.3.10 How to adapt the configuration of the OS

### Requirements

- The example project is open in SIMATIC Manager.
- The component view is activated

### Procedure

1. Select the "color_gs_MP/color_gs_Prj/[Name of the PC Station]" object in the tree view.
2. Select the "Configuration" entry in the detail window and select **Edit > Open Object** from the menu.
3. If you are using a different network card in your project, select the desired network card from the hardware catalog. Drag this to slot 2 as well.
   This overwrites the existing network adapter.
4. Click "Yes" In the first message box and "OK" in the second message box.
5. Select the network card and select **Edit > Object Properties...** from the menu.
   The "Properties - IE General" dialog box opens.
6. Click on the "Properties" button in the "General" tab.
7. Enter the MAC address that you noted from the configuration console into the "MAC address" box.
8. Clear the "IP protocol is being used" check box.
9. Select the entry "Ethernet (1)" from the "Subnet" list.
10. Click "OK" in the "Properties – Ethernet Interface IE General" dialog box.
11. Click "OK" in the "Properties – IE General" dialog box.
12. Select **Station > Save and Compile** from the menu.
13. Close HW Config.

## 2.3.11 How to make settings in NetPro

### Requirements

- The example project is open in SIMATIC Manager.
- The component view is activated

### Procedure

1. Go to the tree view and select the object "color_gs_MP/color_gs_Prj/[name of your local computer]/WinCC Application".
2. Select the "Connections" entry in the detailed window and select **Edit > Open Object** from the menu.
   NetPro opens.
3. Select the "WinCC Application" object for the SIMATIC PC station.
4. Select the S7 connection in the lower detailed window and then select the menu command **Edit > Object Properties**.
   The "Properties - S7 Connection" opens.
5. Check if the correct connection partners have been selected:

| Local | Partner |
|---|---|
| Interface "[Network card of the OS]", e.g., IE General | Interface "[CP of the AS]", e.g., CP 443-1 |

6. Click "OK".
7. Select **Network > Save and Compile...** from the menu.
   The "Delete system data completely from the automation system and replace with offline system data. Are you sure?" dialog box opens.
8. Select the "Compile and check everything" check box in the dialog box and click "OK".
   Once the compilation is completed, the "Outputs for consistency check" window opens.
9. Open SIMATIC Manager. Mark the PCstation and select **PLC > Configure...** from the menu.
   The "Configure" dialog opens.
10. Select the required target computer in the "Accessible computers" list. Click "Configure".
    The dialog box “Configure: <Selected Station>” opens.
11. To perform and apply the remote configuration, follow the instructions in the online help of the "Configure: <Selected Station>" dialog box. The configuration data are transferred to the PC station. You must still download the network settings to this PC station to activate the network connections.
12. Select the PC station and then the menu command **PLC > Download**.
    The message dialog "This action will overwrite the configuration data that are already .... Do you still want to download?" opens.
13. Click "Yes".
    The message dialog "Stop Target Modules" opens.
14. Click "OK".
    The download is completed.
15. Exit NetPro.

# Configuring the hardware

# 3

## 3.1 Principle of simulation with hardware components

### 3.1.1 Implementing simulation with hardware

#### Simulation options

In *Getting Started - Part 1*, you worked completely without input/output modules because all values were simulated using CFC charts. In this part of Getting Started, you have two options:

- You can simulate all process values using CFC charts.
  You will configure the required simulation charts as you create CFC charts.
- You can simulate certain states of process tags directly using input/output modules (distributed I/O ).
  You add these input/output modules and interconnect them with the corresponding block inputs/outputs in the CFC charts. To keep the number of input/output modules as low as possible, several block inputs/outputs are interconnected to one input in the case of the digital input module.

#### Bus systems

Due to the additional distributed I/O, you will need two different buses:

- Plant bus - Industrial Ethernet: Bus for communication between the ES/OS and AS
- Fieldbus - PROFIBUS DP: Bus for communication between the distributed I/O and AS

#### Overview

You perform the following steps to add the distributed I/O:

| Step | What? |
|---|---|
| 1 | Modify the name of the plant bus (Page 34) |
| 2 | Adding the distributed I/O (Page 35) |
| 3 | Assigning symbolic names (Page 38) |

## 3.1.2 How to change the name of the plant bus

### Requirements

- The example project is open in SIMATIC Manager.
- The component view is activated

### Procedure

1. Select the "color_gs_MP/color_gs_Prj/SIMATIC 400(1)" folder in the tree view.
2. Select the "Hardware" object in the detail window and select **Edit > Open Object** from the menu.
   HW Config opens.
3. Select the "CP 443-1" in the "UR2" window and then the menu command **Edit > Object Properties...**
   The "Properties - CP 443-1 (R0S5)" dialog box opens and the "General" tab is active.
4. Click the "Properties" button.
   The "Properties - Ethernet Interface CP 443-1 (R0S5)" dialog box opens.
5. If the "Ethernet (1)" entry is not yet selected, select it now in the "Subnet" list and click the "Properties" button.
6. Enter the name "Plant bus" in the "Name" box of the "Properties - Industrial Ethernet" dialog box, and click "OK".
7. Click "OK" in the "Properties - Ethernet interface" dialog box and "OK" in the "Properties - CP 443-1" dialog box.
   The name of the Ethernet bus is changed.

### 3.1.3 How to add the distributed I/O

#### Requirement

HW Config of the example project is open.

#### Procedure

1. Select "PROFIBUS(1)".
   PCS 7 has automatically created this bus when creating the project.
2. Select **Edit > Object Properties...** from the menu.
   The "Properties - DP Master System" dialog box opens.
3. Click "Properties".
   The "Properties - PROFIBUS" dialog box opens, and the "General" tab is active.
4. Enter the name "Fieldbus" in the "Name" box.
5. Change to the "Network settings" tab and check the following settings:
   - Transmission rate: 1.5 Mbps
   - Profile: DP
6. Click "OK".
   The dialog box closes.
7. Click "OK" in the "Properties – DP Master System" dialog box.
   The name "Fieldbus" is now assigned to the subnet.
8. Open the hardware catalog and select the component
   PROFIBUS-DP/ET 200M/IM 153-1" component with order number 6ES7 153-1AA03-0XB0 and move it onto the "Fieldbus" DP Master system using a drag-and-drop operation.
   The "Properties - PROFIBUS Interface IM 153-1" dialog box opens.
9. Select the entry "3" from the "Address" list, and click "OK" .
   The dialog box closes and the IM 153-1 is inserted.

   Video

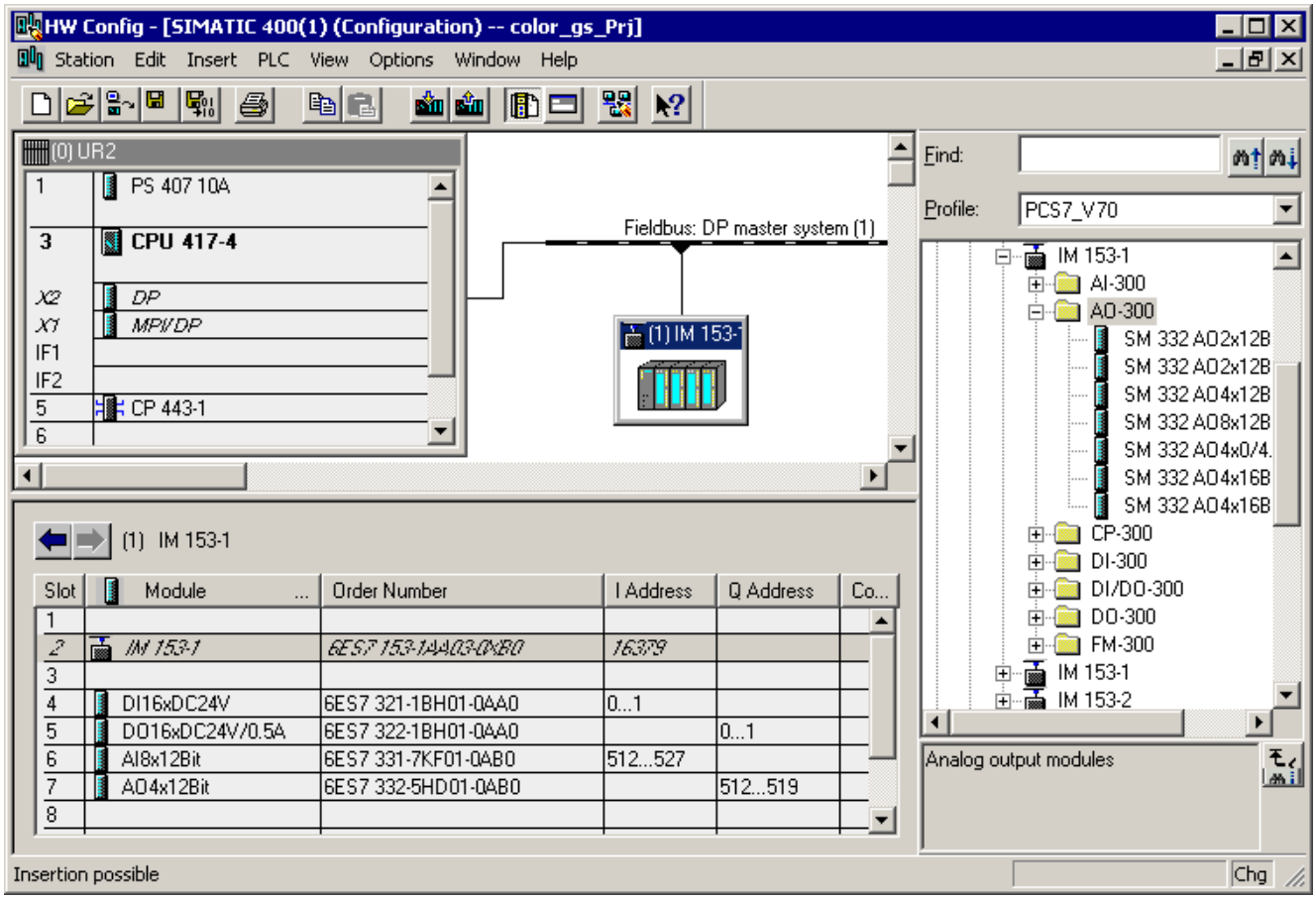
10. Select the "IM 153-1" object.
    The associated slots are displayed in the lower part of the window.

11. Select the following input/output modules from the hardware catalog and move them onto the slots of the IM 153-1 using a drag-and-drop operation:

| Module type | Location in the hardware catalog | Order number | Slot |
|---|---|---|---|
| Digital input module | DI-300/SM 321 DI16xDC24V | 6ES7 321-1BH01-0AA0 | 4 |
| Digital output module | DO-300/SM 322 DO16xDC24V/0.5A | 6ES7 322-1BH01-0AA0 | 5 |
| Analog input module | AI-300/SM 331 AI8x12Bit | 6ES7 331-7KF01-0AB0 | 6 |
| Analog output module | AO-300/SM 332 AO4x12Bit | 6ES7 332-5HD01-0AB0 | 7 |

12. Select **Station > Save** from the menu.

## Result



# 3.2 Function and use of symbolic names

## 3.2.1 Using symbolic names

### Introduction

The input/output modules are inserted in HW Config. You now assign descriptive symbolic names to the inputs and outputs of these modules. You use these names for interconnecting the process tags with the input and output modules. This makes working with the confusing absolute addresses much easier.

**Note**

Note the special feature in this example project:
The inputs and outputs of several process tags of the same type are interconnected to one input/output of an input/output module. The input of a digital input module is, for example, interconnected with several valves. This procedure minimizes the hardware required to implement the example project.

In a real project you always interconnect each block input/output with **just one** input/output of an input/output module.

### Syntax of the symbolic names

The assignments of absolute addresses to the symbolic names are listed in the tables on the following pages. The corresponding process tag for each symbolic name is given in the comments. All variable name components in the symbolic names are represented by an "x".

The symbolic name "NK31x_open" means:

- "NK" stands for the process tag (in this case a "valve")
- "31" stands for the part of the plant (in this case for the "REAC1" part of the plant)
- "x" stands for the variable name component
- "open" stands for the state of the process tag (in this case "open")

## 3.2.2 How to assign symbolic names

### Requirement

HW Config of the example project is open.

### Procedure

1. Select the "IM 153-1" module in the work area.
   All input/output modules that you inserted during hardware configuration are displayed in a list window.
2. Select the "DI16xDC24V" module in the list.
3. Select **Edit > Symbols...** from the menu.
   The "Edit Symbols" dialog box opens. All absolute addresses of the inputs of these modules are specified for you in a list.
4. Position the cursor in the "Symbol" column next to the address "I 0.0".
5. Enter the value "NK31x_open" and press the <TAB> key.
   The value you entered is applied and the system automatically enters the data type as "BOOL".
6. Switch to the "Comment" column.
7. Enter the appropriate comment in the table and press the <TAB> key.
   This automatically moves the cursor to the next line in the "Symbol" column.

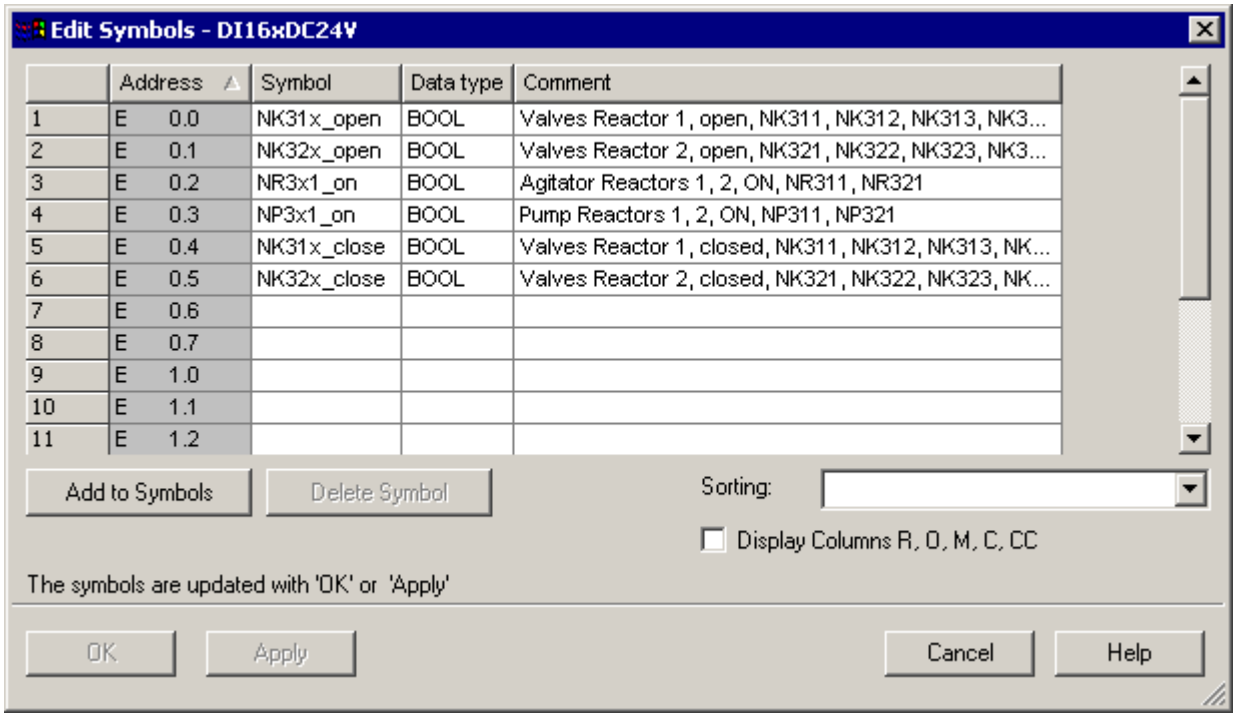
   Video

8. Repeat steps 4 to 6 and enter the values corresponding to the table under "Symbolic Names for the Digital Input Module (Page 40)".

**Note**

Click on the "Apply" button to save the interim statuses of your entries.

Use the Windows "Copy and Paste" function to quickly edit the texts in the "Comment" column.




9. Click "OK" to save your entries.
   The "Edit Symbols" dialog box closes.
10. In the list window, select the following modules and assign them symbolic names. To do so, perform steps 3 through 9. The symbols are listed in the corresponding tables:
    - DO8xDC24V/0.5A - "Symbolic names for the digital output module (Page 41)"
    - AI8x12Bit - "Symbolic names for the analog input module (Page 42)"
    - AO4x12Bit - "Symbolic names for the analog output module (Page 42)"
11. Once you have assigned all of the symbolic names, select **Station > Save and Compile** from the menu.
    Your entire hardware configuration is saved.
12. Close HW Config.

## 3.2.3 Symbolic names for the digital input module

### Overview

All symbolic names for the digital input module are listed in the following table:

| Address | Symbolic name | Data type | Comment |
|---|---|---|---|
| I 0.0 | NK31x_open | BOOL | Valves Reactor 1, open<br>NK311, NK312, NK313, NK314, NK315 |
| I 0.1 | NK32x_open | BOOL | Valves Reactor 2, open<br>NK321, NK322, NK323, NK324, NK325 |
| I 0.2 | NR3x1_on | BOOL | Agitator Reactors 1, 2, ON<br>NR311, NR321 |
| I 0.3 | NP3x1_on | BOOL | Pump Reactors 1, 2, ON<br>NP311, NP321 |
| I 0.4 | NK31x_close | BOOL | Valves Reactor 1, closed<br>NK311, NK312, NK313, NK314, NK315 |
| I 0.5 | NK32x_close | BOOL | Valves Reactor 2, closed<br>NK321, NK322, NK323, NK324, NK325 |

## 3.2.4 Symbolic names for the digital output module

### Overview

All symbolic names for the digital output module are listed in the following table:

| Address | Symbolic name | Data type | Comment |
|---|---|---|---|
| Q 0.0 | NK311_copen | BOOL | Valve Reactor 1 NK311 open |
| Q 0.1 | NK312_copen | BOOL | Valve Reactor 1 NK312 open |
| Q 0.2 | NK313_copen | BOOL | Valve Reactor 1 NK33 open |
| Q 0.3 | NK314_copen | BOOL | Valve Reactor 1 NK314 open |
| Q 0.4 | NK315_copen | BOOL | Valve Reactor 1 NK315 open |
| Q 0.5 | NK321_copen | BOOL | Valve Reactor 2 NK321 open |
| Q 0.6 | NK322_copen | BOOL | Valve Reactor 2 NK322 open |
| Q 0.7 | NK323_copen | BOOL | Valve Reactor 2 NK323 open |
| Q 1.0 | NK324_copen | BOOL | Valve Reactor 2 NK324 open |
| Q 1.1 | NK325_copen | BOOL | Valve Reactor 2 NK325 open |
| Q 1.2 | NR311_con | BOOL | Agitator Reactor 1 NR311 ON |
| Q 1.3 | NR321_con | BOOL | Agitator Reactor 2 NR321 ON |
| Q 1.4 | NP311_con | BOOL | Pump Reactor 1 NP311 ON |
| Q 1.5 | NP321_con | BOOL | Pump Reactor 2 NP321 ON |

## 3.2.5 Symbolic names for the analog input module

### Overview

All symbolic names for the analog input module are listed in the following table:

| Address | Symbolic name | Data type | Comment |
|---|---|---|---|
| IW 512 | LI311 | WORD | Fill level measurement Reactor 1<br>LI311 |
| IW 514 | LI321 | WORD | Fill level measurement Reactor 2<br>LI321 |
| IW 516 | LI311_V | WORD | Drainage rate Reactor 1<br>LI311 |
| IW 518 | LI321_V | WORD | Drainage rate Reactor 2<br>LI321 |
| IW 520 | TC311 | WORD | Temperature control Reactor 1<br>TC311 |
| IW 522 | TC321 | WORD | Temperature control Reactor 2<br>TC321 |

## 3.2.6 Symbolic names for the analog output module

### Overview

All symbolic names for the analog output module are listed in the following table:

| Address | Symbolic name | Data type | Comment |
|---|---|---|---|
| QW 512 | LI311_c | WORD | Fill level Reactor 1<br>LI311 |
| QW 514 | LI321_c | WORD | Fill level Reactor 2<br>LI321 |
| QW 516 | TC311_c | WORD | Temperature Reactor 1<br>TC311 |
| QW 518 | TC321_c | WORD | Temperature Reactor 2<br>TC321 |

# Working in the plant hierarchy

# 4

## 4.1 Adapting the plant hierarchy

### Introduction

You already know how to work with the plant hierarchy (PH) from *Getting Started - Part 1*. In *Getting Started - Part 2*, you extend the PH to include all objects required for the overall project.

You insert all folders and process pictures you require for the overall plant.

Note: Not all charts and process pictures are configured in this Getting Started.

### Task definition

The following folders and process pictures must be added to the existing plant hierarchy:

| Name of the hierarchy folder | Meaning | Process picture | Relevant to Getting Started - Part 2 |
|---|---|---|---|
| WEIGHT | Dosing solids | WEIGHT | no |
| REAC1 | Production | REAC1 | yes |
| HOLD | Holding phase | HOLD | no |
| FILL | Filling | FILL | no |

You performed the generic settings in *Getting Started - Part 1*. Do not make any further settings at this point.

## 4.2 How to expand the plant hierarchy

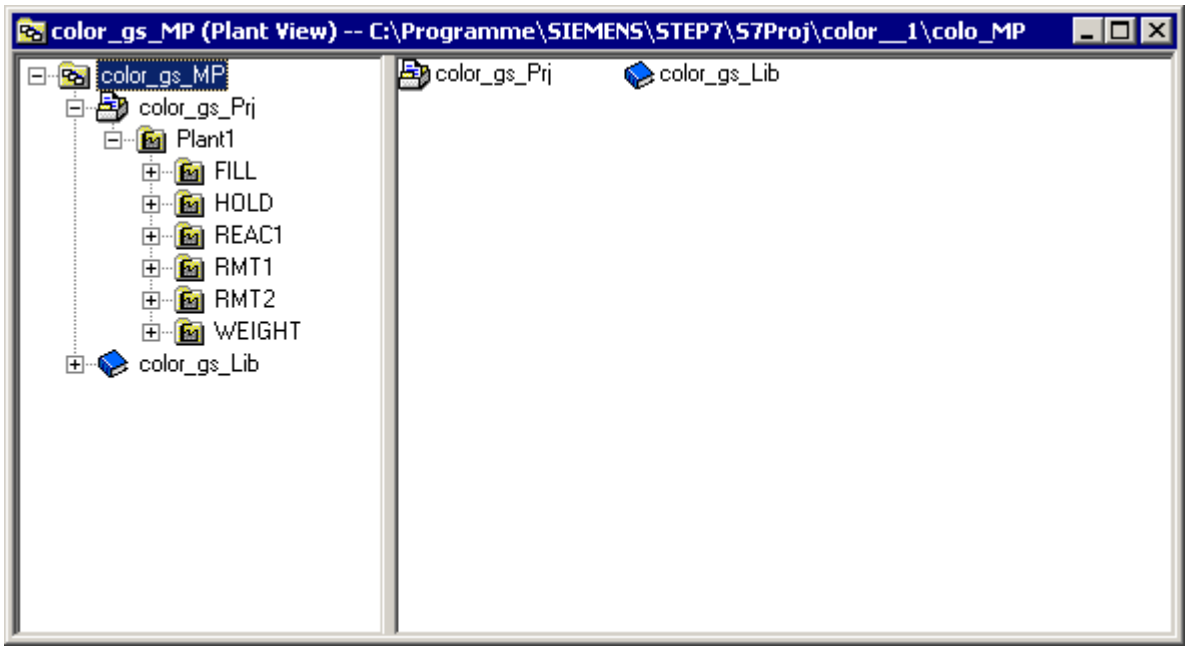
### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Prj/Plant1"
2. Select **Insert > Technological Objects > 1 Hierarchy Folder** from the menu.
   The new hierarchy folder "Unit(3)" is inserted.
3. Change its name to "WEIGHT".
4. Select the hierarchy folder in the detailed window and select **Edit > Object Properties...** from the menu.
   The "Properties - Hierarchy Folder" dialog box opens.
5. Check the following settings in the "OCM Attributes" tab:
   - The "Name of the hierarchy folder is part of the HID" check box is activated.
   - The "No modification when renaming the hierarchy folder" check box is cleared.
6. Click "OK".
   The dialog box closes and the settings are applied.
7. Repeat steps 1 to 6 to create the following hierarchy folders:
   - REAC1
   - HOLD
   - FILL

## Result


color_gs_MP (Plant View) -- C:\Programme\SIEMENS\STEP7\S7Proj\color__1\colo_MP
color_gs_MP
color_gs_Prj
Plant1
FILL
HOLD
REAC1
RMT1
RMT2
WEIGHT
color_gs_Lib
color_gs_Prj
color_gs_Lib

# 4.3 How to add process pictures

## Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

## Procedure

1. Select the "color_gs_MP/color_gs_Prj/Plant1/FILL" folder in the tree view.
2. Select **Insert > Technological Objects > 5 Picture** from the menu.
   The new object "Picture(9)" is inserted.
3. Enter the name "FILL".
4. Insert additional process pictures in the following folders:

| Folder | Name of the process picture |
|---|---|
| HOLD | HOLD |
| REAC1 | REAC1 |
| WEIGHT | WEIGHT |

# Using textual interconnections

# 5

## 5.1 What are textual interconnections?

### Textual interconnections

Textual interconnections are used if no interconnection partner is yet available. If an interconnection is made to the block input/output of a CFC chart that has not yet been created and configured, then a textual interconnection is used.

Textual interconnections can be used in configuring both CFC and SFC charts.

Textual interconnections can only be made to block inputs.

### Types of textual interconnections

There are two basic types of textual interconnections:

- Textual interconnection as path reference:
  You enter the specific path to the block input to which the interconnection is to be made. The syntax is as follows:
  [name of the CFC chart]\[name of the block].[name of the I/O]
  In this case, the chart does not need to exist yet.
- Textual interconnection as character string:
  This textual interconnection functions as a placeholder. This placeholder is given a descriptive name and can be replaced manually at a later time by specifying a path. The path is specified as described previously. This type of textual interconnection is mainly used for the creation of process tag types: You enter a string in the process tag type. This is not a random string: It should indicate the path reference that must be specified when creating individual process tags.

### Textual interconnections in this getting started

In this Getting Started, you will encounter the textual interconnections in the following places:

- When making corrections to the RMT1 and RMT2 parts of the plant:
  Here you delete the default interconnections not required from the PCS 7 process tag types.
- When working with process tag types:
  Here you learn how to use textual interconnections in the import files.
- When working with SFC charts:
  Here you learn how to use textual interconnections when entering the parameters for steps and transitions.

# 5.2 Textual interconnections in CFC charts

## Textual interconnections as path references

During CFC configuration, textual interconnections are used as path references when the corresponding connection partner is not yet available.

**Note**

In CFC configuration, textual interconnections can only be used for block inputs.

## Cross-chart interconnections

During CFC configuration, textual interconnections as path references also enable cross-chart interconnections to already existing connection partners.

Standard creation of a cross-chart interconnection:

1. You click on a block output of chart 1.
2. You change to chart 2.
3. There, you click on the corresponding block output of the interconnection partner.

   Creating a cross-chart interconnection using textual interconnection:
4. You specify the path reference to the block output of the corresponding interconnection partner on the block input of chart 2.

   The textual interconnection is made immediately.

## Representation in the sheet bar

A textual interconnection is shown in the sheet bar of the CFC chart.

- As long as there is no actual interconnection partner to which the textual interconnection refers, it is identified with a yellow triangle.
- As soon as an actual interconnection partner is available, the yellow triangle is deleted and the textual interconnection is replaced by a real interconnection. The complete interconnection at the block output and at the block input of the interconnection partner is displayed.

By double-clicking on the interconnection in the sheet bar, you change to the corresponding I/O in the CFC chart as usual.

# 5.3 Textual interconnections in SFC charts

## Textual interconnections as path references

As in CFC configuration, textual interconnections are used as path references when the corresponding connection partner is not yet available.
You enter the textual interconnection as a path reference to the block input/output in the SFC chart.

**Note**

When using textual interconnections in SFC charts, you can execute textual interconnections to block inputs **and** block outputs.

## Representation in the "Properties [Step]" or "[Transition]" dialog box

As with CFC charts, textual interconnections that are not closed are identified by the color yellow as follows:

- in SFC charts by yellow highlighting
- In CFC charts by a yellow triangle

In this case, this applies to all block inputs/outputs for the "REAC2" part of the plant since you have not yet created any CFC charts for it.

# Configuring CFC charts with the use of rational functions

# 6

## 6.1 Overview of the work in CFC

### Configuration tasks

During CFC configuration, you will perform the following configuration steps:

- Expand the master data library.
  In the "REAC" part of the plant, you use additional blocks that you have previously stored in the master data library.
- Corrections in the plant sections "RMT1" and "RMT2"
  These corrections are necessary to combine the plant sections RMTx and REACx.
- Create and use the simulation charts
  The statuses of the valves, motors, etc., are simulated using these charts.
- Work with process tag types
  Using this function you can conveniently create process tags of the same types.

# 6.2 Expanding the master data library

## 6.2.1 Expanding the master data library

### Introduction

You are familiar with the master data library from *Getting Started - Part 1*: There you stored all the blocks required for the example project "color_gs". For *Getting Started - Part 2*, you require some additional blocks. Before you begin to create the CFC charts, you must save them in the master data library.

### Blocks from the various libraries

| Object name | Symb. name | Meaning | Type of block | Library |
|---|---|---|---|---|
| FB51 | PT1_P | Time delay of an input signal | Technological block | PCS 7 Library V70 |
| FC256 | ADD4_P | Calculates the sum of up to 4 values | Technological block | PCS 7 Library V70 |
| SFB5 | TOF | Delay of output signal for temperature control to maintain the maximum temperature for longer | System function block | Standard library |
| SFB4 | TON | Reset of valves | System function block | Standard library |
| SFB3 | TP | Reset of valves | System function block | Standard library |

## 6.2.2 How to store the additional blocks

### Requirements

- The example project is open in SIMATIC Manager.
- The component view is activated

### Procedure

1. Select **File > Open...** from the menu.
2. Select the "Libraries" tab and select the following libraries:
   – "PCS 7 Library V70"
   – "Standard Library"
3. Click "OK".
4. Click "OK" in the message box "The project or the "Standard Library..." is on a write-protected medium or.....".
   All libraries are opened in the component view.
5. Copy the following blocks from the standard libraries to your master data library in the folder
   "<color_gs_MP>/color_gs_Lib/S7-Program(1)/Blocks".

**Note**

Select the window of the appropriate library.

Activate the detailed view in all of the libraries. It provides you with more information about the blocks.

| Library/folder | Blocks |
|---|---|
| PCS 7 Library V70/Blocks + Templates/Blocks | • FB51<br>• FC256 |
| Standard Library/System Function Blocks/Blocks | • SFB3<br>• SFB4<br>• SFB5 |

6. Close the libraries.

# 6.3 Simulation charts and chart-in-chart technique

## 6.3.1 Implementing simulation with CFC charts

### Simulation options

You simulate the statuses of the process tags, for example, the fill level of the reactor or the valve states. Two options are available:

- Via the input and output modules
  You have already configured these during hardware configuration. You have inserted the input and output modules and assigned the relevant symbolic names.
- Using special simulation charts
  These charts simulate data, such as values for the fill level. You will configure these simulation charts now.

You can choose between these two simulation types. For this purpose you will create the special "GENERAL" CFC chart. It facilitates this selection on the OS in process mode. You can use it to simulate selectively using CFC charts or using input/output modules, provided that you have connected input/output modules.

## 6.3.2 Function of the simulation charts

### Necessary simulation charts

For each process tag type, you create a CFC chart for the simulation. The "REAC1" part of the plant requires the following simulation charts:

- SIMV:
  Simulation of the valve state
  open or closed
- SIMMO:
  Simulation of a motor state
  on or off
- SIMREAC:
  Simulation of the fill level in the reactors

### Chart-in-chart technique

When using the simulation charts, you will become acquainted with a function of rational engineering:

This is the chart-in-chart technique.

This involves inserting one CFC chart into another. The inserted chart then becomes the so-called hierarchical chart and the other the top chart. This enables you to use a CFC chart repeatedly once it has been created.

### Example

You create a simulation chart for a valve.

You can insert this simulation chart as a hierarchical chart in the top chart for the "valve" process tag.

You can open and, if necessary, edit the hierarchical chart from the top chart at any time.

## Chart inputs/outputs

The following procedure simplifies the use of a hierarchical chart in a top chart:

You define the so-called chart inputs/outputs.
These are specific inputs/outputs that you need for interconnecting to the top chart or to other CFC charts. The display of a hierarchical chart is therefore the same as the display of a block: all chart I/Os are shown like the I/Os of a block and are interconnected in the same way.

You store the "hierarchical charts" in your master data library to ensure that you have fast and easy access to them.

| NOTICE |
| --- |
| Note that if you make subsequent changes in the original simulation chart, these changes are **not** automatically applied to all the locations where the chart has been used. |

## 6.3.3 Function of the "General" CFC chart

### "GENERAL" CFC chart

Besides the simulation charts, you require a special chart for the simulation:

This is the "GENERAL" CFC chart.

This CFC chart fulfills two purposes:

- Selection of the simulation mode by the plant operator
- Resetting the monitoring error for the valves

### Selection and activation of the simulation mode

You create the simulation either using input and output modules or using simulation charts. You select the simulation mode via an operator control block. The output of this operator control block is interconnected to the "SIM_ON" input of the input blocks.

The simulation method is automatically set to simulation using CFC charts on CPU startup. It can be switched over to simulation using input/output modules during process mode by means of the operator control block.

### Reset of valves

The "GENERAL" CFC chart also fulfills another function:

It resets the monitoring error for all valves that occurs immediately after starting in process mode.

Without the "GENERAL" CFC chart, the plant operator would have to reset this monitoring error manually for each valve in the faceplate in order for the SFC chart to be executed. This would require too much effort in this project. At CPU startup, the "General" chart sets the "L_RESET" input for every valve temporarily to "1".

## 6.3.4 How to insert CFC charts for REAC1

**Note**

The simulation charts and the "General" CFC chart are stored in different folders:

- Simulation charts are stored in the "Templates" folder of the master data library to ensure fast access for reuse purposes.
- The "General" CFC chart is stored in the "REAC1" folder.

### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

### Procedure

1. Select the "color_gs_MP/color_gs_Prj/Plant1/REAC1" folder in the tree view.
2. Select **Insert > Technological Objects > 2 CFC** from the menu, and insert a new CFC chart with the name "GENERAL".
3. Select the "color_gs_MP/color_gs_Lib/Templates" folder in the tree view.
4. Select **Insert > Technological Objects > 2 CFC** from the menu, and insert new CFC charts there with the names listed below.
   - SIMV
   - SIMMO
   - SIMREAC

## 6.3.5 How to Create the "General" Chart

### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

### Procedure

1. Select the "color_gs_MP/color_gs_Prj/Plant1/REAC1" folder in the tree view, and open the "GENERAL" CFC chart.
   This also opens the catalog.

   **Note**

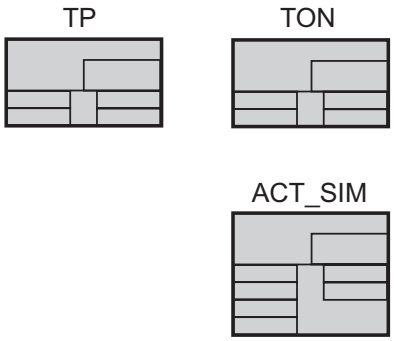
   If the catalog is not open by default, select **View > Catalog** from the menu.
   The catalog is then opened on the right of the window.

2. Select the "Libraries" tab, and drag the "OP_D" block from the "color_gs_Lib\ S7 Program(1)\ Blocks\\Operate" library.
   This is the operator control block for selecting the type of simulation.
3. Select the "OP_D" block and select **Edit > Object Properties...** from the menu.
4. Enter the following parameters as listed in the table:
   - General" tab: Name of the block
   - "I/O" tab: Values of the I/Os

| Name of the block | I/O | Value |
|---|---|---|
| ACT_SIM | LINK_I | 1 |

5. Save your entries by clicking "OK".
   At this point, you will not be creating any further entries or interconnections.
6. Open the "color_gs_Lib\S7 Program(1)\Blocks\IEC_TC" library in the catalog.

7. Use drag-and-drop to insert additional objects, and arrange them according to the graphic below.
   - TP
   - TON




8. Enter the parameters according to the following table:

| Block | Name | I/O | Value |
|---|---|---|---|
| TP | RESET_TP | IN | 1 |
| | | PT | 2s |
| TON | RESET_TON | PT | 1s |

9. Make the following interconnections. You know the procedure from Getting Started - Part 1:

| Block | I/O | Block | I/O |
|---|---|---|---|
| RESET_TP | Q | RESET_TON | IN |
| RESET_TP | Q | ACT_SIM | LINK_ON |

10. Close the "GENERAL" CFC chart.

## 6.3.6 How to create the "SIMV" simulation chart

### Overview

You create the "SIMV" CFC chart in three steps:

| Step | What? |
|---|---|
| 1 | Insert blocks (Page 61) |
| 2 | Configure connections (Page 63) |
| 3 | Make Interconnections (Page 64) |

## 6.3.7 Step 1 - How to insert blocks into "SIMV"

### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

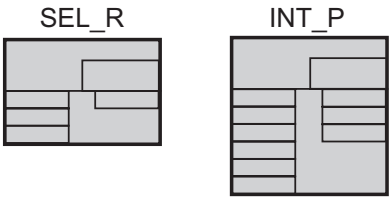
### Procedure

1. Go the the tree view and select the folder "color_gs_MP/color_gs_Lib/Templates", and open the "SIMV" CFC chart. The chart is opened in the CFC editor.
2. Use a drag-and-drop operation to insert the blocks listed in the table in the specified order and arrange them to correspond to the figure below.

**Note**

The table provides information about the name of the storage folder and the function of the blocks.

| Block | Storage in the catalog | | Function |
|---|---|---|---|
| | Tab | Folder | |
| SEL_R | Blocks | "MULTIPLX" | Depending on the value at output VALVE.QCONTROL of the top chart, one of the inputs is activated and interconnected to the input of the integrator. |
| INT_P | Libraries | "color_gs_Lib\S7 Program( 1)\Blocks\Control" | Generates a time integral for the input value |



## 6.3.8 Step 2 - How to assign parameters for the inputs and outputs of "SIMV"

### Requirements

- The example project is open in SIMATIC Manager.
- The "SIMV" CFC chart is open in the CFC Editor.

### Procedure

1. Select the desired block and select **Edit > Object Properties...** from the menu.
2. Enter the following parameters as listed in the table:
   - General" tab: Name of the block
   - "I/O" tab: Values of the I/Os

| Block | Name | I/O | Meaning | Value |
|---|---|---|---|---|
| SEL_R | SEL_OPEN_CLOSE | IN0 | This value is switched through to the INT_P block when input "K" = 1. | 16.0 |
| | | IN1 | This value is switched through to the INT_P block when input "K" = 0. | -16.0 |
| INT_P | SIM_DELAY | V_HL | Upper limit of the integrated value | 100 * |

* default

## 6.3.9 Step 3 - How to interconnect the inputs and outputs of "SIMV"

When interconnecting, you make the interconnection between the individual blocks - you have already done this frequently - as well as the interconnection to the chart inputs/outputs.

### Requirements

- The example project is open in SIMATIC Manager.
- The "SIMV" CFC chart is open in the CFC Editor.

### Procedure

3. Interconnect the inputs and outputs as listed in the table:

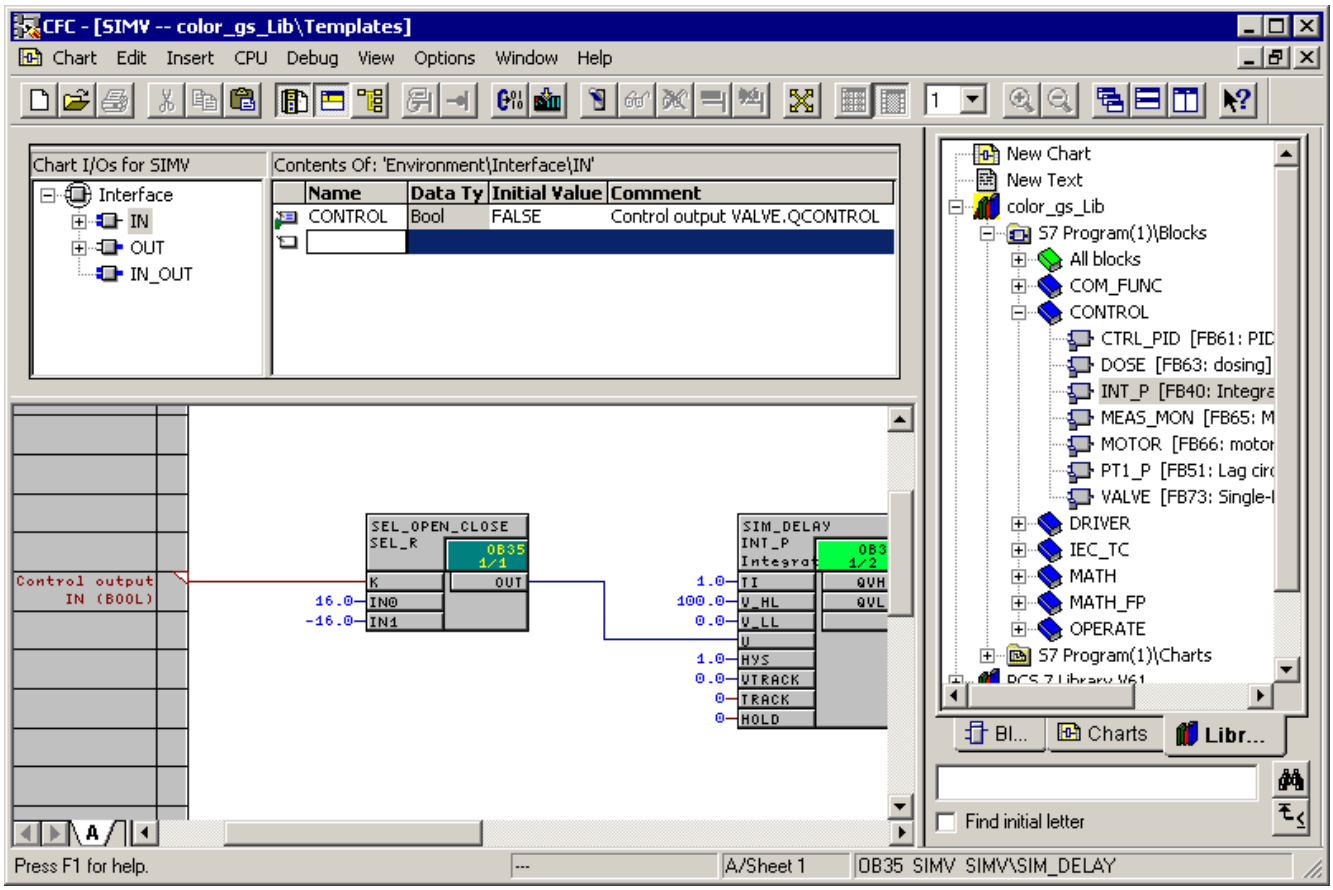
| Block | Output | Block | Input |
|---|---|---|---|
| SEL_OPEN_CLOSE | OUT | SIM_DELAY | U |

4. Select **View > Chart Inputs/Outputs** from the menu.
   The interface editor opens to allow you to edit the chart inputs/outputs.
5. Select the "Interface/IN" entry in the tree view.
   An empty input line is displayed in detailed window.
6. Drag block I/O "K" from the "SEL_OPEN_CLOSE" block to the "Name" field of the interface editor.
   An interconnection is displayed in the sheet bar. It is identified with a white triangle. This interconnection identifies an interconnection to a chart input/output. The name of the block input/output is applied by default in the "Name" box of the interface editor.
7. Click in the "Name" box and change the default name to "CONTROL".

8. Enter the other parameters in the entry line:
   - The "Data type" "Bool" and the initial value "FALSE" are set automatically.
   - Click in the "Comment" field, and enter the text "Control output VALVE.QCONTROL".

**Note**

If the whole text does not fit into the edit box, increase the column width until it fits.




9. Select the "Interface/OUT" entry in the tree view of the interface editor.

10. Use a drag-and-drop operation to move the following block inputs/outputs to the "Name" box, and define the parameters in accordance with the following table:

| Block | Block I/O | Name of chart I/O | Data type of chart I/O | Comment for chart I/O |
|---|---|---|---|---|
| SIM_DELAY | QVHL | FBOPEN | BOOL | Feedback value VALVE.FBOPEN |
| SIM_DELAY | QVLL | FBCLOSE | BOOL | Feedback value VALVE.FBCLOSE |

**Note**

You do not have to enter an initial value for outputs.

Video

11. Select **View > Chart Inputs/Outputs** from the menu.
    The interface editor is closed.
12. Close the "SIMV" CFC chart.

## 6.3.10 How to create the "SIMMO" simulation chart

To create the "SIMMO" simulation chart you use basically the same procedure as described for the "SIMV" chart. Brief instructions for the procedure are given below along with tables containing the required values.

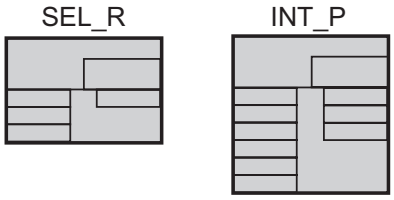
### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Lib/Templates", and open the "SIMMO" CFC chart via the detail view.
2. Drag the following blocks to insert them and arrange them as shown in the figure below:

| No. | Block | Storage in the catalog | | Function |
|---|---|---|---|---|
| | | Tab | Folder | |
| 1 | SEL_R | Blocks | "MULTIPLX" | Depending on the value at output MOTOR.QSTART of the top chart, one of the inputs is activated and interconnected to the input of the integrator. |
| 2 | INT_P | Libraries | "color_gs_Lib\S7 Program(1) \Blocks\Control" | Generates a time integral for the input value |



3. Select each individual block, select **Edit > Object Properties...** from the menu, and enter the following parameters:

| Block | Name | I/O | Meaning | Value |
|---|---|---|---|---|
| SEL_R | SEL_RUN_STOP | IN0 | This value is switched through to the INT_P block when the value of QSTART from the "MOTOR" block is "1". | 50.0 |
| | | IN1 | This value is switched through to the INT_P block when the value of QSTART from the "MOTOR" block = "0". | -50.0 |
| INT_P | SIM_DELAY | V_HL | High limit of the integrated value | 100 * |

* default

4. Make the following output-input interconnection:

| Block | Output | Block | Input |
|---|---|---|---|
| SEL_RUN_STOP | OUT | SIM_DELAY | U |

5. Select **View > Chart Inputs/Outputs** from the menu, and drag the following chart inputs/outputs to associate them with parameters:

| Interface interface editor | Block | Block I/O | Name of chart I/O | Data type of chart I/O | Comment for chart I/O |
|---|---|---|---|---|---|
| IN | SEL_RUN_STOP | K | START | Bool | Control output MOTOR.QSTART |
| OUT | SIM_DELAY | QVHL | FBRUN | Bool | Feedback value MOTOR.FB_ON |

6. Close the CFC chart.

## 6.3.11 How to create the "SIMREAC" simulation chart

As was the case with the CFC chart for motor simulation, we present brief instructions for the procedure along with tables containing the required values.

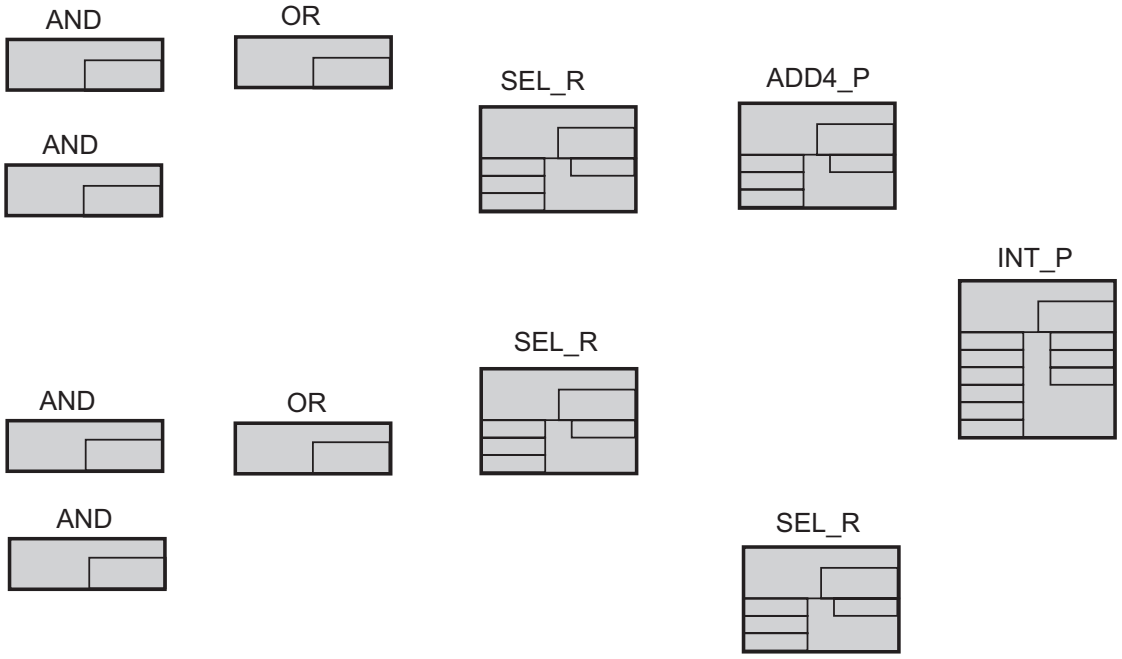
### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Lib/Templates", and open the "SIMREAC" CFC chart via the detail view.
2. Drag the following blocks to insert them and arrange them as shown in the figure below:

| No. | Block | Storage in the catalog | | Function |
|---|---|---|---|---|
| | | Tab | Folder | |
| 1 | AND<br>4 x | Blocks | BIT_LGC | Controls whether RMT1 or RMT2 is feeding REAC1 or REAC2 |
| 2 | OR<br>2 x | Blocks | BIT_LGC | Controls whether RMT1 or RMT2 is feeding REAC1 or REAC2 |
| 3 | SEL_R<br>3 x | Blocks | "MULTIPLX" | The fill level of the reactor is simulated based on which action has just taken place:<br>• If raw material feed is taking place, the dosing amount from RMT1 or RMT2 is used as the input value for the integrator.<br>• When a drainage process is occurring, a negative value is used as the input value for the integrator. |
| 4 | INT_P | Libraries | "color_gs_Lib\S7 Program(1)\<br>Blocks\CONTROL" | Generates a time integral for the respective input value |
| 5 | ADD4_P | Libraries | "color_gs_Lib\S7 Program(1)\<br>Blocks\MATH" | Adder, generates the sum of the input values |




3. Select each individual block, select **Edit > Object Properties...** from the menu, and enter the following parameters:

| Block | Name | I/O | Meaning | Value |
|---|---|---|---|---|
| AND1 | RMT1_REAC1 | | If the pump from RMT1 is running and the valve to REAC1 is open, then the fill level for REAC1 is simulated. | |
| AND2 | RMT1_REAC2 | | If the pump from RMT1 is running and the valve to REAC2 is open, then the fill level for REAC2 is simulated. | |
| AND3 | RMT2_REAC1 | | If the pump from RMT2 is running and the valve to REAC1 is open, then the fill level for REAC1 is simulated. | |
| AND4 | RMT2_REAC2 | | If the pump from RMT2 is running and the valve to REAC2 is open, then the fill level for REAC1 is simulated. | |
| OR1 | RMT1_REAC1_or_2 | | Depending on the AND operation, dosing takes place from RMT1 to REAC1 or to REAC2. | |
| OR2 | RMT2_REAC1_or_2 | | Depending on the AND operation, dosing takes place from RMT2 to REAC1 or to REAC2. | |
| SEL_R1 | RMT1 | IN1 | When no dosing is occurring in RMT1, the value "0" from IN1 is used as the input value for the adder. | 0 * |
| SEL_R2 | RMT2 | IN1 | When no dosing is occurring in RMT2, the value "0" from IN1 is used as the input value for the adder. | 0 * |

| Block | Name | I/O | Meaning | Value |
|---|---|---|---|---|
| SEL_R3 | BOUT | IN1 | When no drainage process is occurring, the value "0" from IN1 is used as the input value for the adder.<br>When the drainage process is occurring, then the value from IN0 is used. This value is negative because it has to represent the reduction of the fill level. | 0 * |
| ADD4_P | ADD | | All outputs of the SEL_R blocks are connected to the adder. | |
| INT_P | SIM_VOL | V_HL | The integrator defines the high limit based on the maximum value of the fill level. | 1200.0 |
| | | TI | Reset time | 2.0 |
| | | HYS | Hysteresis | 1 * |

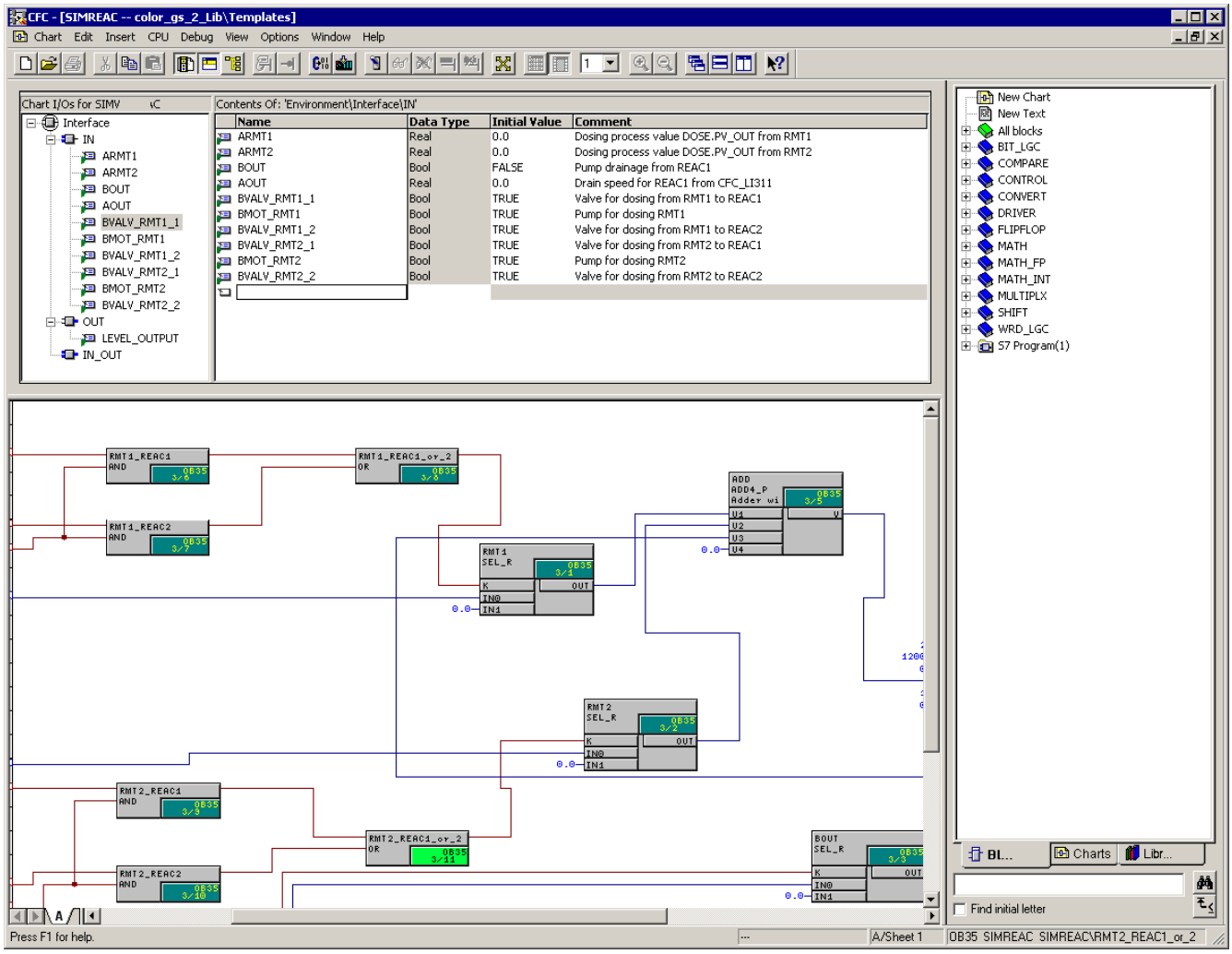
* default

4. Make the following output-input interconnections:

| Block | Output | Block | Input |
|---|---|---|---|
| RMT1_REAC1 | OUT | RMT1_REAC1_or_2 | IN1 |
| RMT1_REAC2 | OUT | RMT1_REAC1_or_2 | IN2 |
| RMT1_REAC1_or_2 | OUT | RMT1 | K |
| RMT1 | OUT | ADD | U1 |
| RMT2_REAC1 | OUT | RMT2_REAC1_or_2 | IN1 |
| RMT2_REAC2 | OUT | RMT2_REAC1_or_2 | IN2 |
| RMT2_REAC1_or_2 | OUT | RMT2 | K |
| RMT2 | OUT | ADD | U2 |
| BOUT | OUT | ADD | U3 |
| ADD | V | SIM_VOL | U |

5. Select **View > Chart Inputs/Outputs** from the menu, and drag the following chart inputs/outputs to associate them with parameters:

| Interface interface editor | Block | Block I/O | Name of chart I/O | Data type of chart I/O | Comment for chart I/O |
|---|---|---|---|---|---|
| IN | RMT1_REAC1 | IN1 | BVALV_RMT1_1 | Bool | Valve for dosing from RMT1 to REAC1 |
| | RMT1_REAC1 | IN2 | BMOT_RMT1 | Bool | Pump for dosing RMT1 |
| | RMT1_REAC2 | IN1 | BVALV_RMT1_2 | Bool | Valve for dosing from RMT1 to REAC2 |
| | RMT1_REAC2 | IN2 | BMOT_RMT1 already created | Bool | Pump for dosing RMT1 |
| | RMT1 | IN0 | ARMT1 | Real | Dosing process value DOSE.PV_OUT from RMT1 |
| | RMT2_REAC1 | IN1 | BVALV_RMT2_1 | Bool | Valve for dosing from RMT2 to REAC1 |
| | RMT2_REAC1 | IN2 | BMOT_RMT2 | Bool | Pump for dosing RMT2 |
| | RMT2_REAC2 | IN1 | BVALV_RMT2_2 | Bool | Valve for dosing from RMT2 to REAC2 |
| | RMT2_REAC2 | IN2 | BMOT_RMT2 already created | Bool | Pump for dosing RMT2 |
| | RMT2 | IN0 | ARMT2 | Real | Dosing process value DOSE.PV_OUT from RMT2 |
| | BOUT | K | BOUT | Bool | Pump drainage from REAC1 |
| | | IN0 | AOUT | Real | Drain speed for REAC1 from CFC_LI311 |
| OUT | SIM_VOL | V | LEVEL_ OUTPUT | Real | Simulation value for fill level |




**Note**

To be able to distinguish the chart inputs/outputs better, the following name convention is used:

- A" prefix means "Analog"
- B" prefix means "Digital"

6. Close the CFC chart.

# 6.4 Working with process tag types

## 6.4.1 Use of process tag types

### Introduction

Process tag types are used if there are many process tags of the same type in the project.

A CFC chart is the basis of a process tag type. You do not have to create a separate CFC for each individual process tag if you use process tag types.

You first create a kind of basic CFC chart with all the generally valid parameters.

You duplicate this chart using import/export functions. By doing so you create instances of the process tag type with its properties.

With the import/export function, you enter the required process tag-specific parameters for each process tag to be created.

PCS 7 offers the advantage that you can also specifically adapt the process tags created in this way. For example, if you are generating several motor process tags, you can add a variety of interlock mechanisms for each process tag. These are not overwritten even when you perform a new import.

| NOTICE |
| --- |
| You must not change the following for the created process tags:<br>• Specific adaptations to the block inputs/outputs for which parameters were assigned via the import file. These adaptations are overwritten with the parameters defined in the import file when a new import operation takes place.<br>• Changes to the block names |

In *Getting Started - Part 1*, you became familiar with process tag types: You used the standard process tag types that PCS 7 makes available for the motor and valves. In this part of Getting Started, you create process tag types yourself.

## Basic procedure for creating process tag types

To create process tag types, proceed as follows:

- First, based on the concrete project, define all of the process tags of the same type that you can create from process tag types.
- Then, create the CFC chart that will be used as the top chart for the process tag type.
- Create a process tag type from this. In so doing you define which block inputs/outputs are to be individually assignable for the process tags created using the process tag type.
- There are two options for creating the process tags:
  - You create an import file.
    You enter the process tags to be created along with their parameters for all block I/Os.
    You then create the individual process tags.
    This option is described in detail in this Getting Started.
  - You place the process tag type at the desired location in the plant hierarchy.
    You enter the relevant parameters.
    This option is not described in this Getting Started.

## Process tag types required for the REAC part of the plant

You can create the following process tags in your example project using process tag types:

- Motors: Agitators and drainage pumps
- Valves: All

## 6.4.2 How to create "MOTOR" process tags using process tag types

### Overview

You create the process tag types and the process tags from a process tag type for motor process tags in five steps:

| Step | What? |
|---|---|
| 1 | Creating the "TYPE_MOTOR" basic chart (Page 76) |
| 2 | Creating the "TYPE_MOTOR" process tag type (Page 79) |
| 3 | Creating the "MOTOR_REAC1" import file (Page 84) |
| 4 | Editing the "MOTOR_REAC1" import file (Page 86) |
| 5 | Generating "TYPE_MOTOR" process tags (Page 90) |

### 6.4.2.1 Step 1 - How to create the "TYPE_MOTOR" top chart

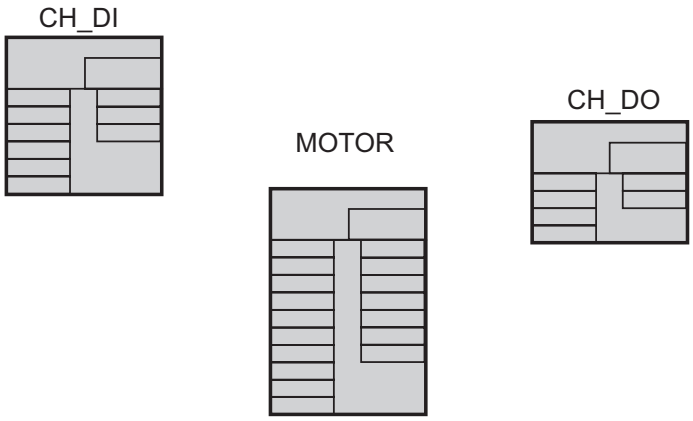
### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Lib/Process Tag Types".
2. Insert a CFC chart and name it "TYPE_MOTOR".
3. Open the "TYPE_MOTOR" CFC chart in the CFC Editor.
4. Open the "color_gs_Lib/S7 Program(1)/Blocks" library in the catalog.

5. Use a drag-and-drop operation to insert the following objects and arrange them according to the graphic below.
   - DRIVER/CH_DI
   - CONTROL/MOTOR
   - DRIVER/CH_DO



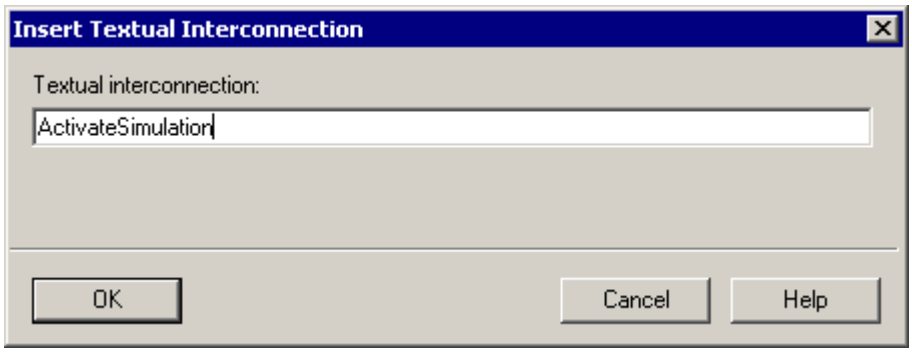

6. Enter the parameters according to the following table:

| Block | Name in project |
|---|---|
| CH_DI | FBON |
| MOTOR | MOTOR |
| CH_DO | COUT |

7. Open "color_gs_Lib/S7 Program(1)/Charts" library in the catalog, and drag the "SIMMO" chart below the "FBON" block.
   This is the chart you created specifically for the simulation. The chart is displayed like a block. You can make interconnections to this chart the same as for a block. The inputs/outputs are chart inputs/outputs that you have defined for the "SIMMO" chart.
8. Make the interconnection according to the following table:

| Block | Output | Block | Input |
|---|---|---|---|
| FBON | Q | MOTOR | FB_ON |
| MOTOR | QSTART | COUT | I |
| | QSTART | SIMMO | START |
| SIMMO | FBRUN | FBON | SIM_I |

9. Click on the "SIM_ON" input of the "FBON" block.
10. Select **Insert > Textual Interconnection...** from the menu.
    The "Insert Textual Interconnection" dialog box opens.
11. Enter the name "ActivateSimulation" in the "Textual interconnection" box.




    This way, you enter a character string as a placeholder. When you create the process tags, these placeholders are replaced by a concrete path reference.
    The textual reference is displayed in the sheet bar and indicated by a yellow triangle.
12. For the "MOTOR" block, click on the "AUTO_ON" input and enter the character string "Level_Reac" as the textual interconnection. When editing the import file this character string signals to you that you must enter the actual path reference for the fill level.
13. Close the CFC editor.
    You have created the top chart.

### 6.4.2.2 Step 2 - How to create the "TYPE_MOTOR" process tag type

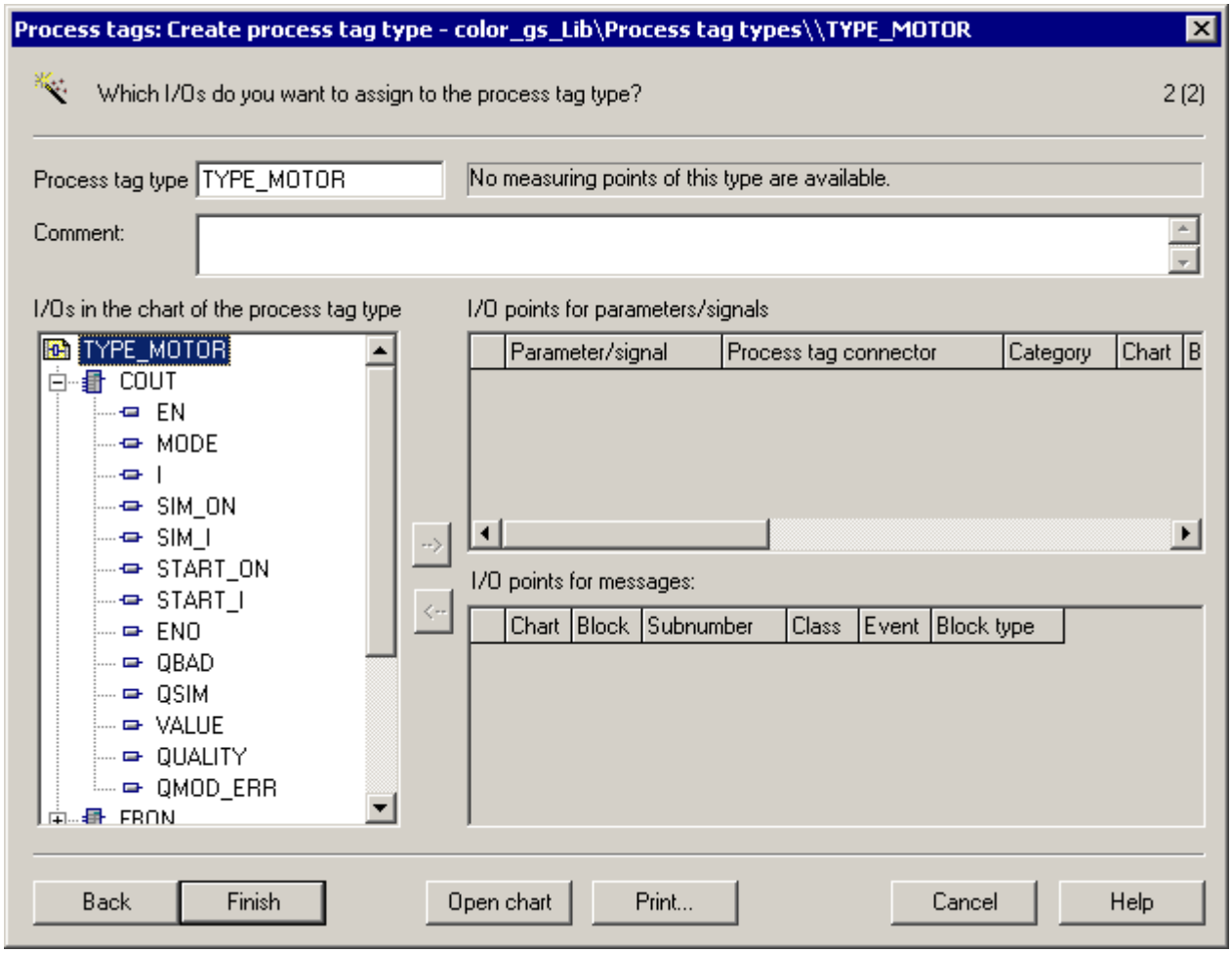
#### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

#### Procedure

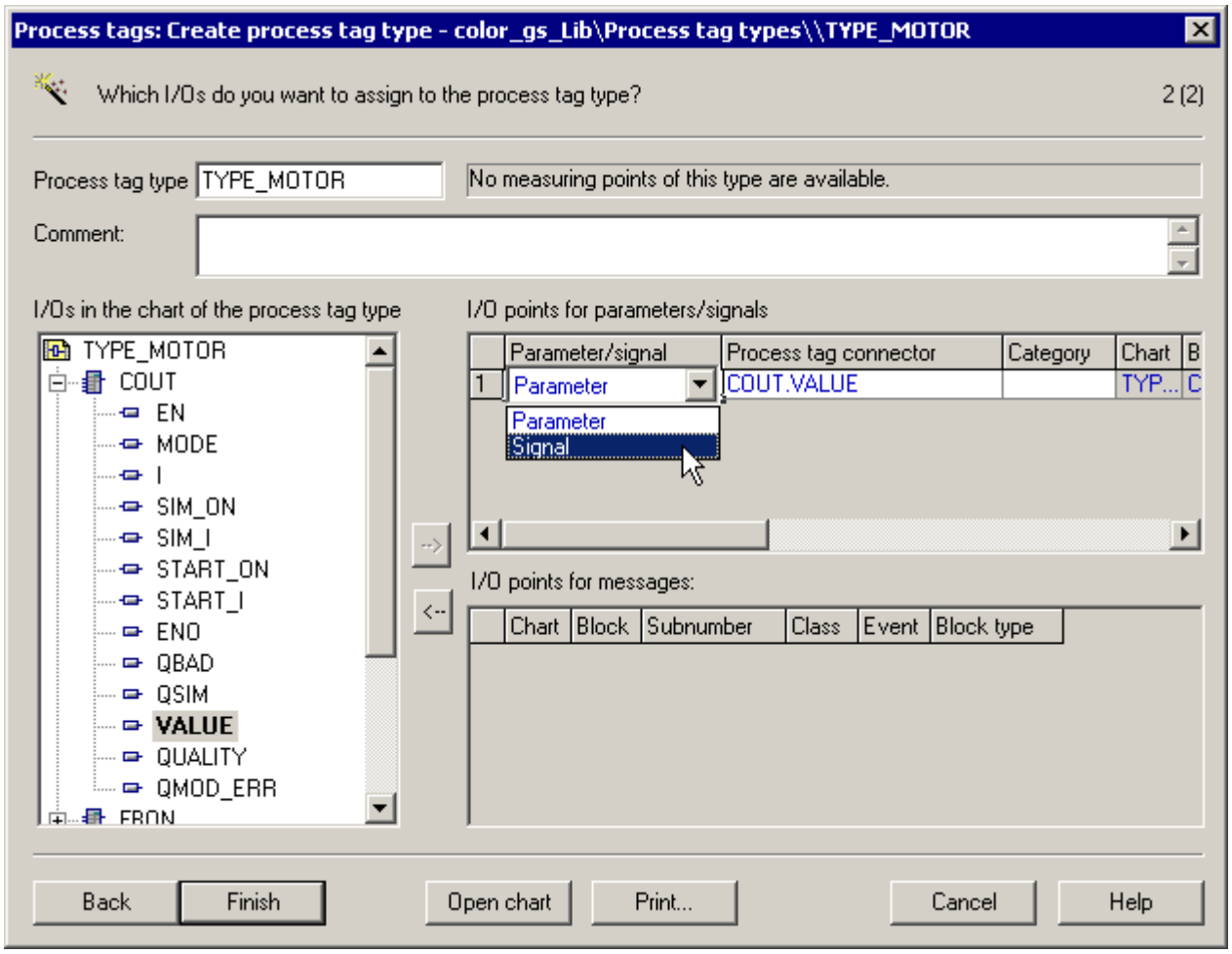
1. Go to the tree view and select the folder "color_gs_MP/color_gs_Lib/Process tag types".
2. Select the CFC chart "TYPE_MOTOR" in the detailed window and select **Options > Process Tags > Create/Change Process Tag Type...** from the menu.
   The "Process Tags - Create Process Tag Type" wizard opens at the "Introduction" step.
3. Click "Next".
   The "Which I/Os do you want to assign to the process tag type?" step opens.
   In the "I/Os in the chart of the process tag type" list, you will find the blocks you inserted in the "TYPE_MOTOR" CFC chart.

4. Double-click on the "COUT" block.
   The tree view opens and displays all inputs/outputs with the "Visible" attribute.



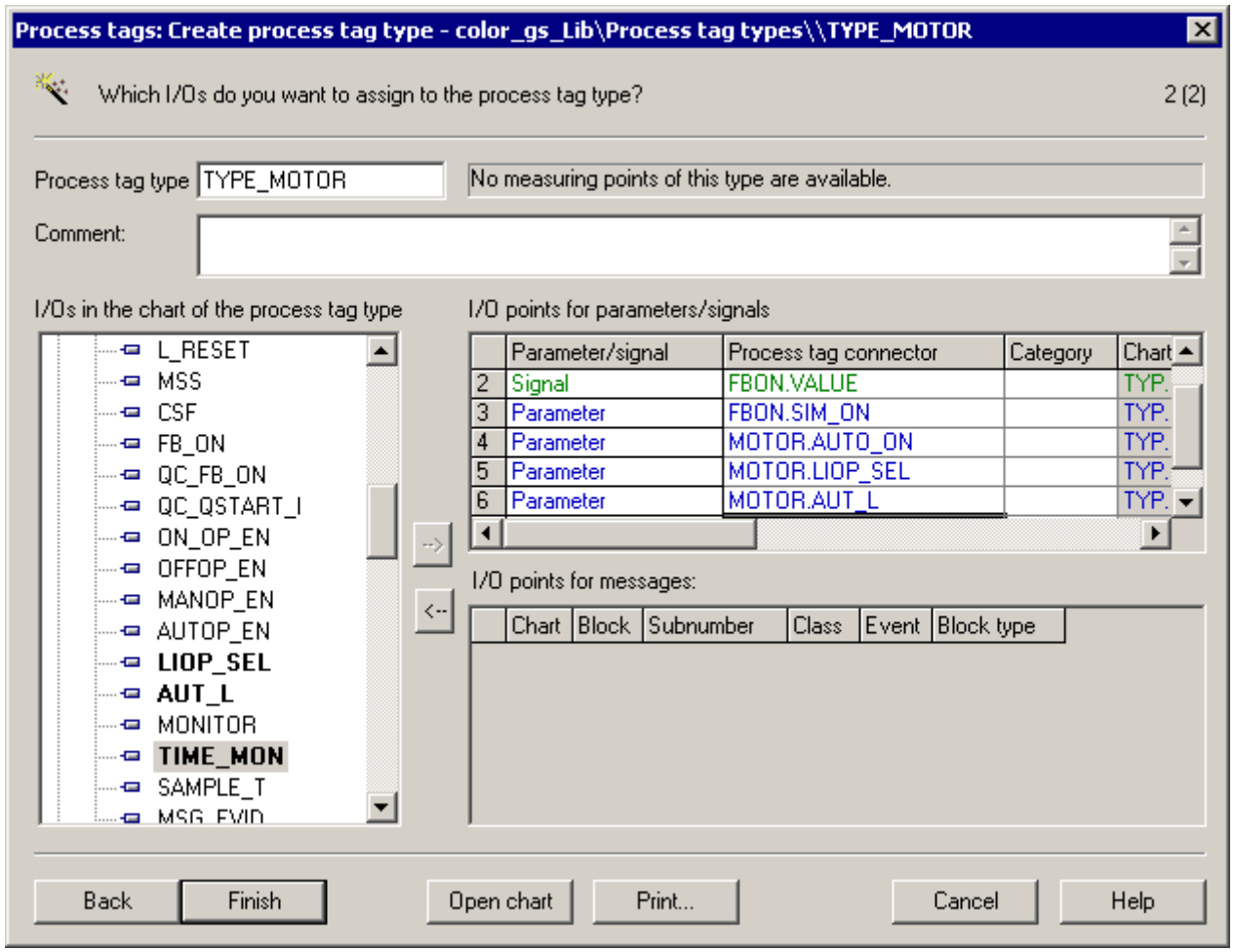

5. Double-click on the "VALUE" I/O.
   This transfers the I/O to the "I/O points for parameters/signals" list.

6. Click in the "Parameter" field in the "Parameter/signal" column.
   A drop-down list opens.
7. Select the entry "Signal" from the drop-down list.

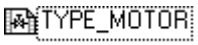


8. Follow exactly the same procedure to enter the following inputs/outputs in the "I/O points for parameters/signals" area and to define the values for the parameters/signals.

| Block | I/O | Meaning | Parameter/ signal |
|---|---|---|---|
| COUT | already done<br>VALUE | Input value of I/O module | Signal |
| FBON | VALUE | Input value of I/O module | Signal |
| | SIM_ON | Activates simulation | Parameter |
| MOTOR | AUTO_ON | Automatic value ON/OFF | Parameter |
| | LIOP_SEL | Switches between Manual/Auto | Parameter |
| | AUT_L | Selects Man/Auto | Parameter |
| | TIME_MON | Monitoring time | Parameter |



9. Click "Finish".
   This creates the CFC chart as a process tag type. The icon changes as follows:




Video

### 6.4.2.3 Step 3 - How to create the "MOTOR_REAC1" import file

## Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

## Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Lib/Process Tag Types".
2. Select the "TYPE_MOTOR" process tag type in the detailed window, and select **Options > Process Tags > Assign/Create Import File... from the menu.**
   **The "Process Tags: Assign/Create Import File", wizard opens.**
3. Click "Next >"
   **The** "Which import file do you want to assign to the process tag type?" step **opens**.
4. Click in an edit box of the "Column title" column and change the default name to match the entries in the following table.
   You will see the column title later in the import file.

| Column header default name | Column header adapted name |
|---|---|
| COUT.VALUE | Output value COUT.VALUE |
| FBON.VALUE | Input value motor on FBON.VALUE |
| FBON.SIM_ON | Simulation motor FBON.SIM_ON |
| MOTOR.AUTO_ON | Auto mode on/off MOTOR.AUTO_ON |
| MOTOR.LIOP_SEL | Man/auto changeover MOTOR.LIOP_SEL |
| MOTOR.AUT_L | Selection man/auto MOTOR.AUT_L |
| MOTOR.TIME_MON | Monitoring time MOTOR.TIME_MON |

5. Since you created the process tag type first, you will now need to create a new import file.
   Click "Create File Template..."
   The "Create File Template" dialog box opens. The default folder in which PCS 7 stored import files is already open.
   PCS 7 proposes a file name for the import file that is identical to the name of the process tag type.
6. Change the name to "MOTOR_REAC1.IEA" and click "OK".
   The "Create File Template" dialog box opens and the "General" tab is active.
7. In the "Create File Template" dialog box, make the settings listed in the following table and then click "OK".

| Tab | Selected check box |
|---|---|
| General | Assigned AS (AS) |
| | Chart comment (ChComment) |
| | Block comment (BlockComment) |
| Parameter | Value (Value) |
| | I/O comment (ConComment) |
| | Textual interconnection (TextRef) |
| Signals | I/O comment |
| | Symbol name |

8. Click "Open File".
   The import file is opened in the IEA file editor. The first line already exists with default settings.
   Each line represents exactly one process tag.

### 6.4.2.4 Step 4 - Editing the "MOTOR_REAC1" import file

The following describes the procedure for editing the import file in the IEA file editor. At the end of the section you will find a short description of the basic procedure for editing the data in Excel.

## Requirement

- The "MOTOR_REAC1.IEA" import file is created and open in the IEA file editor.

## Procedure

1. The first row stands for the concrete process tag NR311.
   Complete the row according to the table below:

**Note**

For space reasons the parameters in the following table are arranged in columns instead of in lines. This is exactly reversed in the IEA file editor.

The order of the columns in the IEA file editor may be different from the order specified in the table. When entering the parameters pay attention to selecting the correct column.

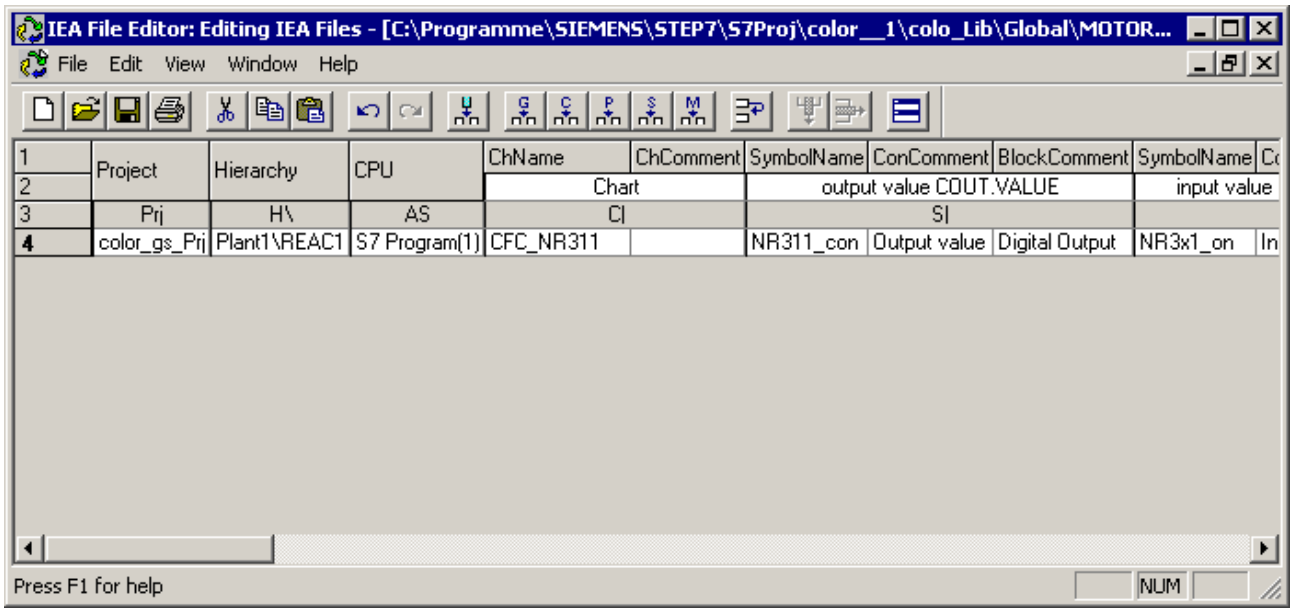
| Column | Sub-column | Default entry | Parameter |
|---|---|---|---|
| Project | | color_gs_Prj | Apply |
| Hierarchy | | Process tags\ | Plant1\REAC1 |
| AS | | S7 Program(1) | Apply |
| Chart | ChName | TYPE_MOTOR | CFC_NR311 |
| | ChComment | | |
| Output value COUT.VALUE | SymbolName | --- | NR311_con |
| | ConComment | Output value | Apply |
| | BlockComment | Digital output | Apply |
| Input value motor on FBON.VALUE | SymbolName | --- | NR3x1_on |
| | ConComment | Input value | Apply |
| | BlockComment | Digital input | Apply |
| Simulation motor FBON.SIM_ON | TextRef | ActivateSimulation | GENERAL\ACT_SIM.Q0 |
| | ConComment | 1=Activate simulation | Apply |
| Auto mode on/off MOTOR.AUTO_ON | TextRef | Level_Reac | "-"CFC_LI311\TANK_LEV_MON.QL_WRN |
| | ConComment | AUTO Mode 1=ON 0=OFF | Apply |
| | BlockComment | MOTOR | Apply |
| Man/auto changeover MOTOR.LIOP_SEL | Value | 0 | 1 |
| | ConComment | Select: 1=Linking, 0=Operator Active | Apply |

| Column | Sub-column | Default entry | Parameter |
|---|---|---|---|
| Selection man/auto MOTOR.AUT_L | Value | 0 | 1 |
| | ConComment | Linkable Input for MANUAL/AUTO Mode | Apply |
| Monitoring time MOTOR.TIME_MON | Value | 3.0 | 10.0 |
| | ConComment | Monitoring Time for ON [s] | Apply |

**Note**

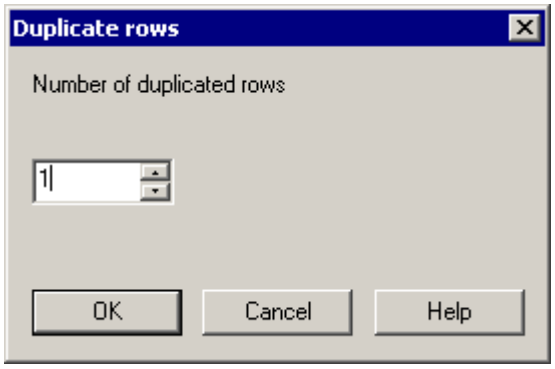
In the sub-column "TextRef" you will find the textual interconnection that you entered in the top chart as a character string. Here you replace the wildcard with the path reference to the "GENERAL" CFC chart, which enables you to activate simulation in process mode.

You have added the "-" character in front of the textual interconnection for the "MOTOR.AUTO_ON" I/O. This means the input is negated.




2. Click on row number 4.
   This selects the row.
3. Select **Edit > Duplicate Row...** from the menu.
   The "Duplicate Row" dialog box opens.

4. Enter a "1" in the "Number of duplicated rows" box and click "OK".
   The row is duplicated with all entries.




5. Enter the deviating parameters as listed in the following table:

**Note**

All deviating parameters are marked in bold in the table.

| Column | Sub-column | Parameter |
|---|---|---|
| Project | | color_gs_Prj |
| Hierarchy | | Plant1\REAC1 |
| AS | | Apply |
| Chart | ChName | **CFC_NP311** |
| | ChComment | |
| Output value COUT.VALUE | SymbolName | **NP311_con** |
| | ConComment | Apply |
| Input value motor on FBON.VALUE | SymbolName | **NP3x1_on** |
| | ConComment | Apply |
| | BlockComment | |
| Simulation motor FBON.SIM_ON | ConComment | Apply |
| | TextRef | GENERAL\ACT_SIM.Q0 |
| | | |
| Auto mode on/off MOTOR.AUTO_ON | TextRef | **---** |
| | | |
| | ConComment | Apply |
| | BlockComment | |
| Man/auto changeover MOTOR.LIOP_SEL | Value | **0** |
| | ConComment | Apply |
| Selection man/auto MOTOR.AUT_L | Value | **0** |
| | ConComment | Apply |
| Monitoring time MOTOR.TIME_MON | Value | 10.0 |
| | ConComment | Apply |

**Note**

The "---" character string deletes a textual interconnection.

6. Select **File > Save** from the menu.

   Video

7. Close the IEA file editor.
   You return to the "Process Tags: Assign/Create Import File" wizard.
8. Click "Finish".
   The wizard closes.

**Note**

Alternatively, as an experienced user of Microsoft Excel, you can edit the data of the import file in Excel. Proceed as follows:

1. You insert as many empty lines in the IEA file editor that are needed to accommodate the number of existing process tags.
2. You select the area in the IEA file editor to be edited in Excel.
3. You insert the data into Excel using copy-and-paste.
4. You edit the data in Excel.
5. Select the edited area in Excel and insert it back into the IEA file editor using copy-and-paste.

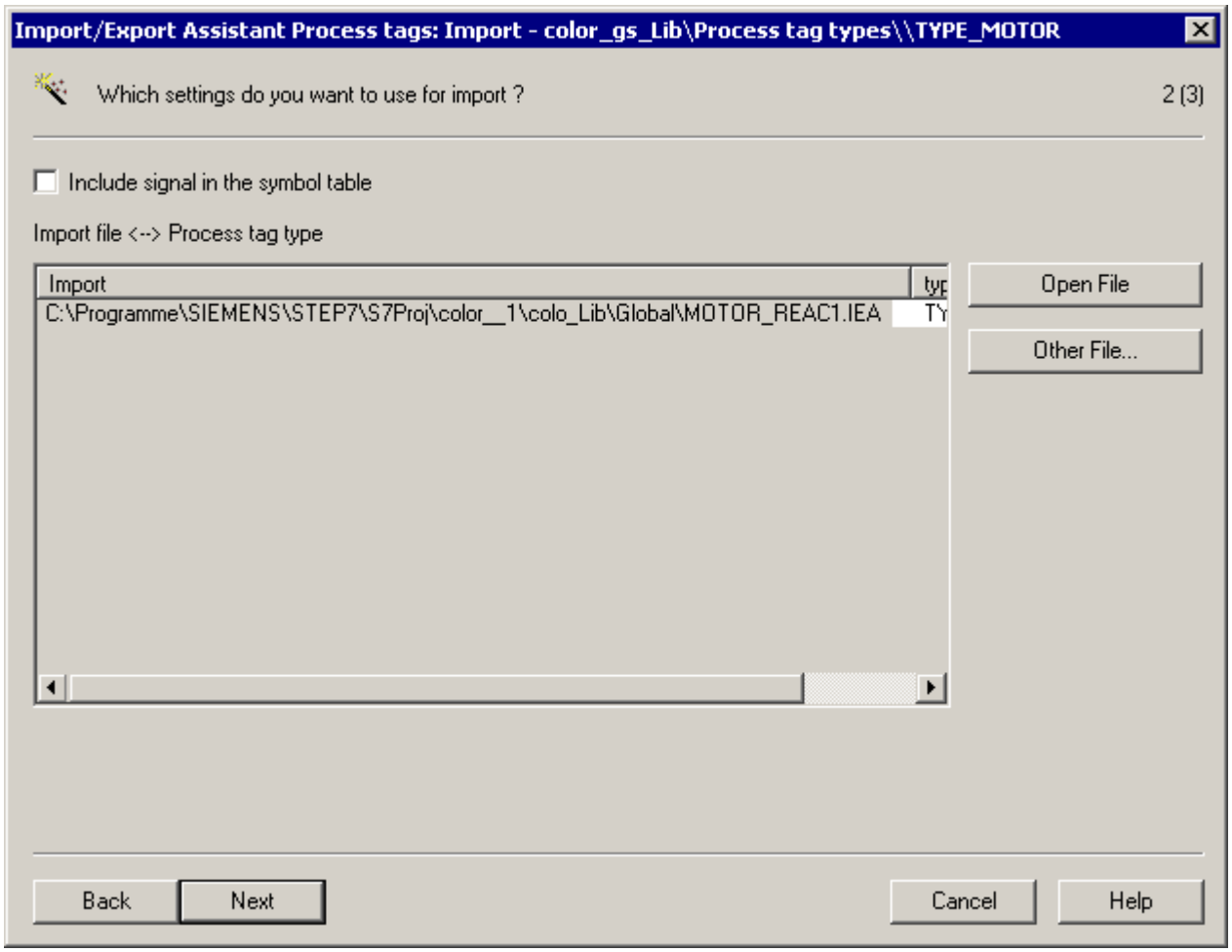
### 6.4.2.5 Step 5 - How to create "TYPE_MOTOR" process tags

#### Requirements

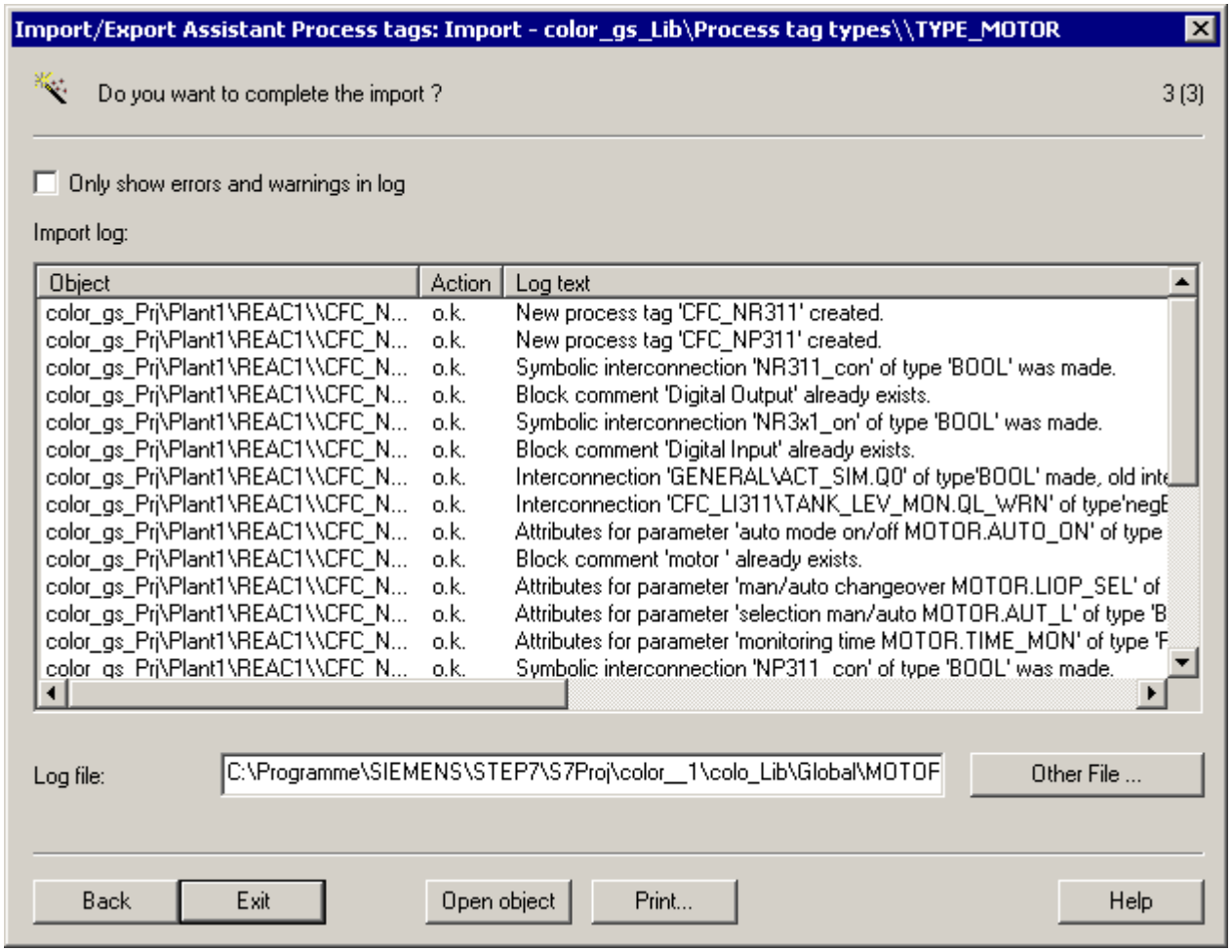
- The example project is open in SIMATIC Manager.
- The plant view is activated.

#### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Lib/Process Tag Types".
2. Select the "TYPE_MOTOR" process tag type in the detailed window, and select **Options > Process Tags > Import...** from the menu.
   The "Import-Export Assistant Process Tags: Import" opens at the "Introduction" step.
3. Click "Next".
   The "Which settings do you want to use for import?" step opens.
   In the "Import file <--> process tag type" list, you will see the assignment import file - process tag type: "[storage path] MOTOR_REAC1 <--> TYPE_MOTOR".



4. Click "Next".
   The "Do you want to complete the import" step opens.
5. Click "Finish".
   The import begins and a progress bar is displayed. When the import is complete, the NR311 and NP311 process tags are created and stored in the "REAC1" folder. The import log is displayed on the screen.




6. Click "Exit".

### 6.4.2.6 The results...

## Procedure

1. Go to the plant hierarchy and select the folder "color_gs_MP/color_gs_Prj/Plant1/REAC1".
2. There you will see two new CFC charts: "CFC_NP311" and "CFC_NR311". These are the process tags that you created through the import operation.
3. Open the newly created process tag "CFC_NR311" in the CFC Editor.
   There you can see the results of the import and the relationship between the entries in the import file and the real process tag:

## "FBON" Block, "SIM_ON" Input

At the "FBON" block, you will relocate the textual interconnection for the "SIM_ON" input. It has been replaced by a concrete interconnection:
"Plant1\REAC1\\GENERAL(A,1)\ACT_SIM.Q0"

Double-click on this interconnection in the side bar. This brings you to the relevant interconnection partner.

This was the following parameter in the import file:

| Column | Sub-column | Default entry | Parameter |
|---|---|---|---|
| Simulation motor FBON.SIM_ON | TextRef | ActivateSimulation | GENERAL\ACT_SIM.Q0 |

## FBON" Block, "VALUE" Input

At the "FBON" block, you will find the interconnection to an input/output module for the "VALUE" input.

This was the following parameter in the import file:

| Column | Sub-column | Default entry | Parameter |
|---|---|---|---|
| Input value motor on FBON.VALUE | SymbolName | | "NR3x1_on" I0.2 |

### "COUT" Block "VALUE" Output

Similarly, at the "COUT" block you will find the interconnection to an input/output module for the "VALUE" output.

This was the following parameter in the import file:

| Column | Sub-column | Default entry | Parameter |
|---|---|---|---|
| Output value COUT.VALUE | SymbolName | | "NR311_con" A1.2 associated block comment |

### "MOTOR" Block, "TIME_MON" Input

For the "MOTOR" block, you will find a specific value for the "TIME_MON" input.

This was the following parameter in the import file:

| Column | Sub-column | Default entry | Parameter |
|---|---|---|---|
| Monitoring time MOTOR.TIME_MON | Value | 3.0 | 10.0 |

### "MOTOR" Block, "AUTO_ON" Input

For the "MOTOR" block, you will find the textual interconnection for the "AUTO_ON" input, which has been replaced by the specific path reference: "Plant1\REAC1\\CFC_LI311 (A1)\TANK_LEV_MON.QL_WRN". This input has also been negated.

This was the following parameter in the import file:

| Column | Sub-column | Standard entry | Parameter |
|---|---|---|---|
| Auto mode on/off MOTOR.AUTO_ON | TextRef | Level_Reac | "-"CFC_LI311\MEAS_MON.QL_WRN |

## 6.4.3 How to create "VALVE" process tags using process tag types

### Overview

You create the process tag types and the process tags from a process tag type for valve process tags in five steps:

| Step | What? |
|---|---|
| 1 | Creating the "TYPE_VALVE" top chart (Page 94) |
| 2 | Creating the "TYPE_VALVE" process tag type (Page 97) |
| 3 | Creating the "VALVE_REAC1" import file (Page 98) |
| 4 | Editing the "VALVE_REAC1" import file (Page 86) |
| 5 | Generating "TYPE_VALVE" process tags (Page 90) |

### 6.4.3.1 Step 1 - How to create the "TYPE_VALVE" top chart

Follow the same basic procedure as for the "TYPE_MOTOR" process tag type. Brief instructions for the procedure are given below along with tables containing the required values.

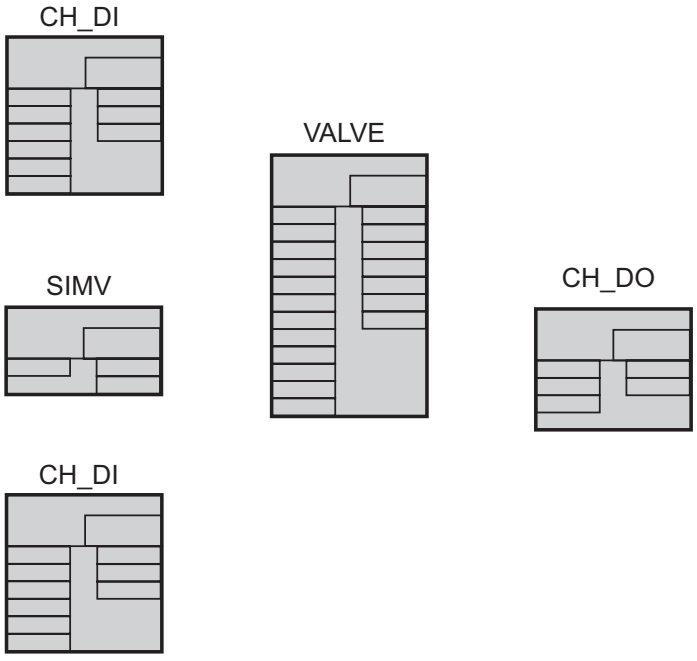
### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

### Procedure

1. Insert the "TYPE_VALVE" CFC chart in the "color_gs_MP/color_gs_Lib/Process Tag Types" folder.
2. Open the "TYPE_VALVE" CFC chart in the CFC Editor.
3. Open the "color_gs_Lib\S7 Program(1)\Blocks" or the "color_gs_Lib/S7 Program(1)\Charts" library in the catalog.

4. Use a drag-and-drop operation to insert the following objects and arrange them according to the graphic below.
   - DRIVER/CH_DI - twice
   - CONTROL/VALVE
   - DRIVER/CH_DO
   - SIMV




5. Enter the parameters based on the following table:

| Block | Name in project | I/O | Invisible |
|---|---|---|---|
| CH_DI1 | FBOP | | |
| CH_DI2 | FBCL | | |
| VALVE | VALVE | QCONTROL | no |
| CH_DO | COUT | | |
| SIMV | | | |

6. Make the interconnections in accordance with the following table:

| Block | Output | Block | Input |
|---|---|---|---|
| FBOP | Q | VALVE | FB_OPEN |
| FBCL | Q | VALVE | FB_CLOSE |
| VALVE | QCONTROL | COUT | I |
| | QCONTROL | SIMV | CONTROL |
| SIMV | FBOPEN | FBOP | SIM_I |
| | FBCLOSE | FBCL | SIM_I |

7. Insert the following textual interconnections as placeholders:

| Block | I/O | Textual interconnection | Meaning |
|---|---|---|---|
| FBOP | SIM_ON | ActivateSimulation | Activates simulation in process mode |
| FBCL | SIM_ON | ActivateSimulation | Activates simulation in process mode |
| VALVE | L_RESET | Reset | Resets monitoring errors |

8. Close the CFC editor.

### 6.4.3.2 Step 2 - How to create the "TYPE_VALVE" process tag type

Follow the same basic procedure as for the "TYPE_MOTOR" process tag type. Brief instructions for the procedure are given below along with tables containing the required values.

## Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

## Procedure

1. Select the "TYPE_VALVE" CFC chart in the "color_gs_MP/color_gs_Lib/Process tag types" folder and select **Options > Process Tags > Create/Change Process Tag Type...** from the menu.
2. In the "Which inputs/outputs do you want to assign to the process tag type?" step, assign the following inputs/outputs to the process tag type:

| Block | I/O | Meaning | Parameter/ signal |
|---|---|---|---|
| COUT | VALUE | Input value of I/O module | Signal |
| FBCL | VALUE | Input value of I/O module | Signal |
| | SIM_ON | Activates simulation | Parameter |
| FBOP | VALUE | Input value of I/O module | Signal |
| | SIM_ON | Activates simulation | Parameter |
| VALVE | L_RESET | Resets the valves | Parameter |
| | TIME_MON | Monitoring time | Parameter |

3. Click "Finish".
   You have completed creation of the process tag type.

### 6.4.3.3 Step 3 - How to create the "VALVE_REAC1" import file

Follow the same basic procedure as for the "TYPE_MOTOR" process tag type. Brief instructions for the procedure are given below along with tables containing the required values.

## Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

## Procedure

1. Select the "TYPE_VALVE" CFC chart in the "color_gs_MP/color_gs_Lib/Process tag types" folder, and select **Options > Process Tags > Assign/Create Import File...** from the menu.
2. In the step "Which import file do you want to assign to the process tag type?", change the column headers as follows:

| Column header default name | Column header adapted name |
|---|---|
| COUT.VALUE | Output value COUT.VALUE |
| FBCL.VALUE | Input value for closing FBCL.VALUE |
| FBCL.SIM_ON | Activates simulation for closing FBCL.SIM_ON |
| FBOP.VALUE | input value for opening FBOP.VALUE |
| FBOP.SIM_ON | Activates simulation for opening FBOP.SIM_ON |
| VALVE.L_RESET | Reset valve VALVE.L_RESET |
| VALVE.TIM_MON | Monitoring time VALVE.TIME_MON |

3. Click the "Create file template..." button.
4. Name the import/export file "VALVE_REAC1.IEA".
5. In the "Create File Template" dialog box, assign the parameters according to the following table and click "OK":

| Tab | Selected check box |
|---|---|
| General | Assigned AS (AS) |
| | Chart comment (ChComment) |
| | Block comment (BlockComment) |
| | Block icon (BlockIcon) |
| Parameter | Value (Value) |
| | I/O comment (ConComment) |
| | Textual interconnection (TextRef) |
| Signals | I/O comment |
| | Symbol name |

6. Click "Open File".

### 6.4.3.4 Step 4 - How to edit the "VALVE_REAC1" import file

The following describes the procedure for editing the import file in the IEA file editor.

## Requirement

The "MOTOR_REAC1.IEA" import file is created and open in the IEA file editor.

## Procedure

1. The first row stands for a concrete process tag.
   Complete the row according to the table below:

| Column | Sub-column | Default entry | Parameter |
|---|---|---|---|
| Project | | color_gs_Prj | Apply |
| Hierarchy | | Process tags\ | Plant1\REAC1 |
| AS | | S7 Program(1) | Apply |
| Chart | ChName | TYPE_VALVE | CFC_NK311 |
| | ChComment | | |
| Output value COUT.VALUE | SymbolName | --- | NK311_copen |
| | ConComment | Output value | Apply |
| | BlockComment | Digital output | Apply |
| Input value for closing FBCL.VALUE | SymbolName | --- | NK31x_close |
| | ConComment | Input value | Apply |
| | BlockComment | Digital input | Apply |
| Activates simulation for closing FBCL.SIM_ON | TextRef | ActivateSimulation | GENERAL\ACT_SIM.Q0 |
| | ConComment | 1=Activate simulation | |
| input value for opening FBOP.VALUE | SymbolName | --- | NK31x_open |
| | ConComment | Input value | Apply |
| | BlockComment | Digital input | Apply |
| Activates simulation for opening FBOP.SIM_ON | TextRef | ActivateSimulation | GENERAL\ACT_SIM.Q0 |
| | ConComment | 1=Activate simulation | Apply |
| Reset valve VALVE.L_RESET | TextRef | Reset | GENERAL\RESET_TON.Q |
| | ConComment | Linkable Input RESET | Apply |
| | BlockComment | Single-Drive/Dual-Feedback Valve | Apply |
| | BlockIcon | | 2 |
| Monitoring time VALVE.TIME_MON | Value | 3.0 | 10.0 |
| | ConComment | Monitoring Time [s] | Apply |

**Note**

Here you will find a new sub-column:
"BlockIcon"
The entries in this column allow you to control which block icon is created. You already know this function from Getting Started - Part 1: There you controlled the display of the valve as a block icon in the Process Object view. Now you apply the same function in the import file.

You used another textual interconnection here:
The interconnection to VALVE.L_RESET. It is also interconnected with the "GENERAL" CFC chart.

2. Select line 4 and duplicate the line four times.
   You then have a total of five process tags.
3. In the "Chart/ChName" and "Output value output module COUT.VALUE\SymbolName" columns, assign the parameters for the individual process tags as follows:

| Row | Column "Chart/ChName" | Column "output value COUT.VALUE\SymbolName" |
|---|---|---|
| 5 | CFC_NK312 | NK312_copen |
| 6 | CFC_NK313 | NK313_copen |
| 7 | CFC_NK314 | NK314_copen |
| 8 | CFC_NK315 | NK315_copen |

**Note**

All other parameters remain unchanged.

In a real project you modify more parameters than this. For example, for each interconnection to an input/output module you enter a separate symbolic name.

In *Getting Started - Part 2*, you interconnected several block inputs/outputs to a single input/output of an input/output module for simulation purposes.

4. Save the file and close the IEA file editor.
5. Click "Finish".

### 6.4.3.5 Step 5 - How to create "TYPE_VALVE" process tags

You have created the "TYPE_VALVE" process tag type. You can now use it to create a process tag for every valve contained in the project. Here in this Getting Started, you will first create the process tags for the "REAC1" part of the plant.

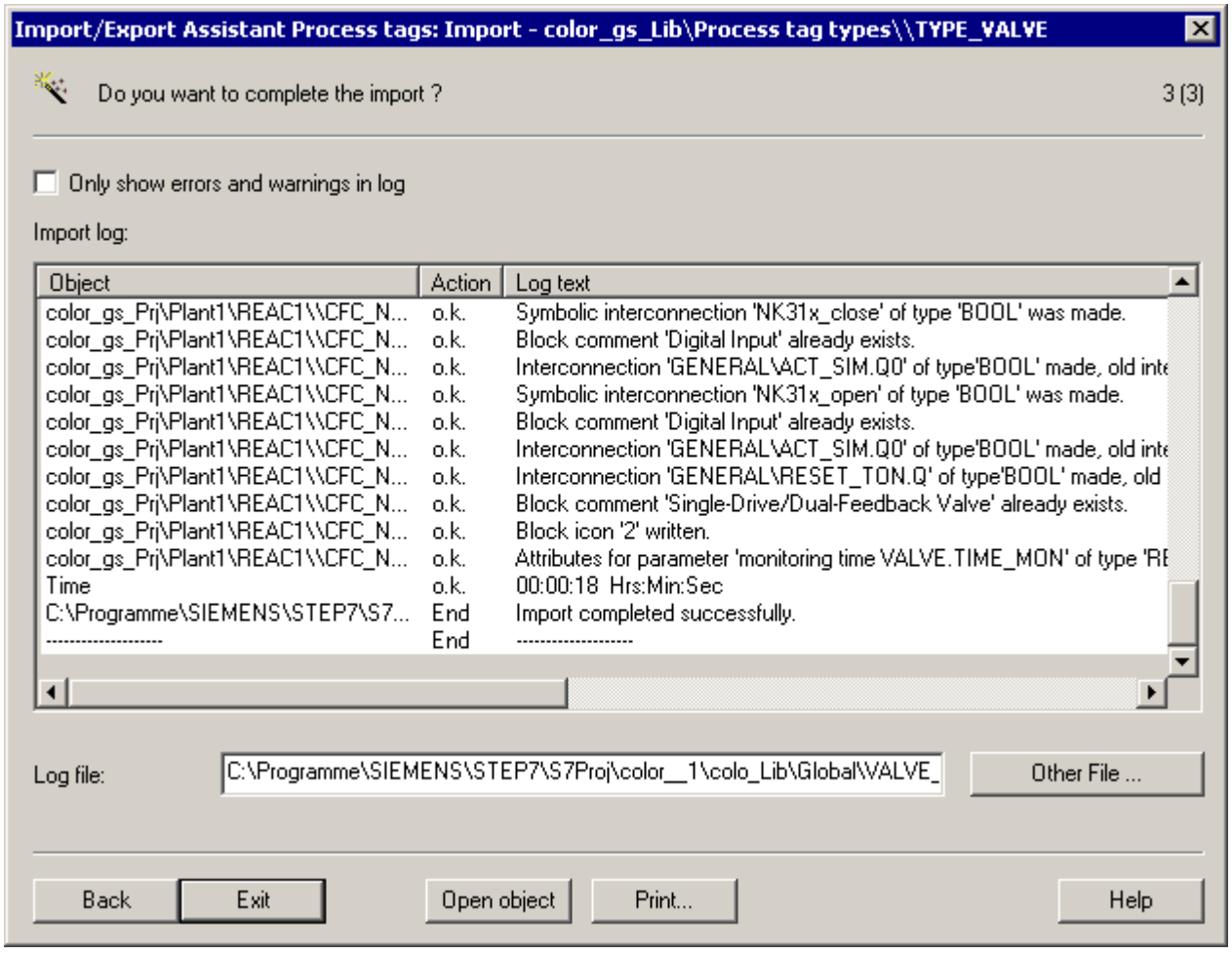
## Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

## Procedure

1. Select the "TYPE_VALVE" CFC chart in the "color_gs_MP/color_gs_Lib/Process tag types" folder, and select **Options > Process Tags > Import...** from the menu.
2. Pay special attention during the "Which settings do you want to use for import?" step that the correct import file - process tag type "[storage path] VALVE_REAC1 <--> TYPE_VALVE" is displayed in the "Import file <--> Process tag type" list.

3. Complete import.
   Following the import, the log file is displayed. It is significantly more detailed than when creating the process tags for the motor.
   The following process tags are set up in the "REAC1" folder of the plant hierarchy:
   - CFC_NK311
   - CFC_NK312
   - CFC_NK313
   - CFC_NK314
   - CFC_NK315




4. Click "Exit".

## 6.4.4 How to close textual interconnections...

You worked with textual interconnections when creating process tags. If these interconnections are not yet closed, you can close all textual interconnections using a special PCS 7 function.

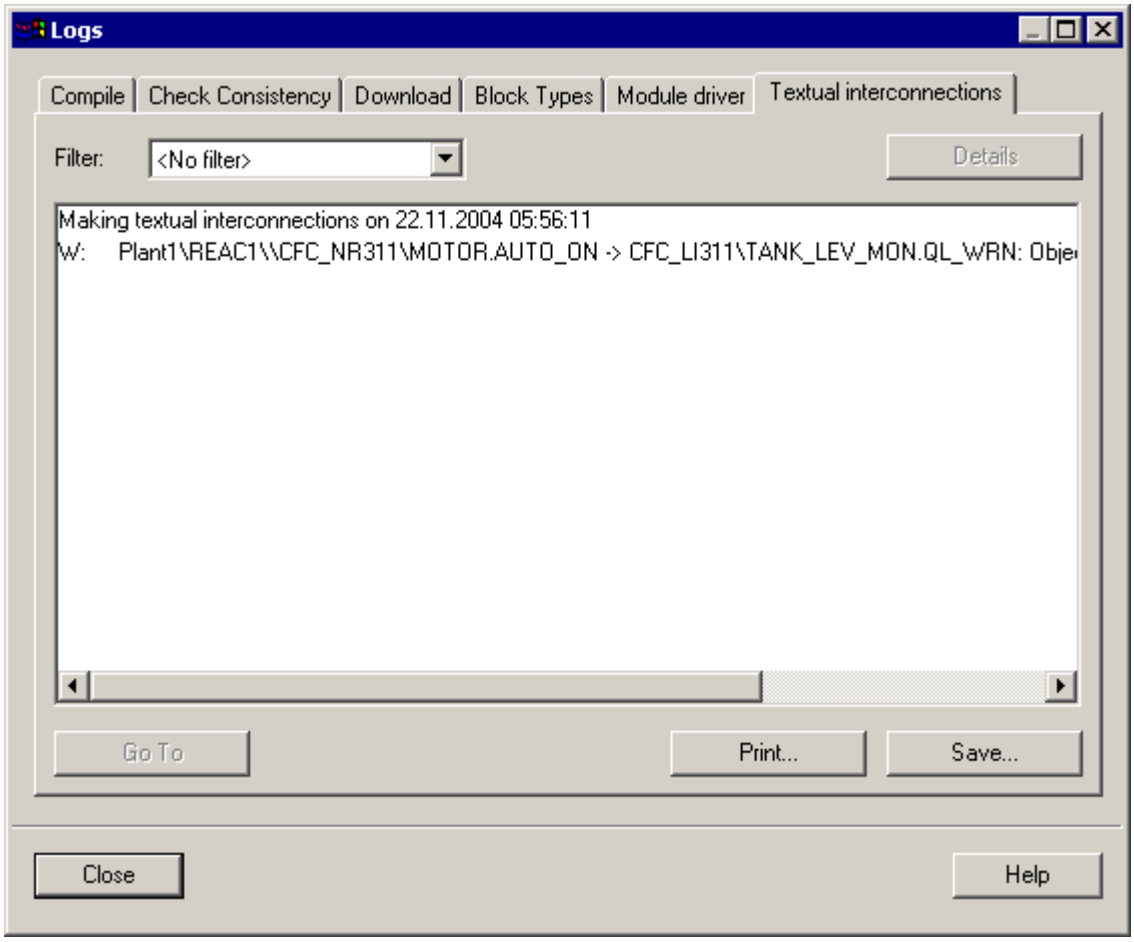
### Requirements

- The example project is open in SIMATIC Manager.
- The "GENERAL" CFC chart is open in the CFC Editor
  The following interconnections exist:
  - Block output "RESET_TON.Q" to all "VALVE.L_RESET" valve inputs
  - Block output "ACT_SIM.Q0" to all valve and motor process tags for the "INPUT.SIM_ON" input.

If the interconnections are not closed, carry out the procedure described below.

## Procedure

1. Select **Options > Make Textual Interconnections**.
   This makes all interconnections from output Q to all valve blocks. The following log file is displayed:




2. Double-click on a path in the sheet bar of the CFC chart.
   You automatically change to the CFC chart "CFC_NK31x". The interconnection flashes and is displayed in magenta. You can now see that the textual interconnection "RESET" that you specified in the process tag type has been replaced by an actual interconnection.
3. Close the CFC editor.

# 6.5 Modifications of process tag types

## 6.5.1 Making subsequent changes

### Possible subsequent changes

Process tag types make it easy to perform changes in the future: You make the changes at the process tag type and in the import file, and transfer the changed information to all newly generated process tag with a new import.

The following changes are possible:

- Adding a New Parameter (Page 107): You may want to display different block icons on the OS for the newly created process tags, for example, and perform this assignment using the import file.
- Deleting all created process tags (Page 110): This function is of interest when you have generated numerous process tags from a process tag type and you do not want to delete them all manually in the plant hierarchy.
- Adding an additional block I/O (Page 110). You require, for example, an additional block I/O, which you wish to configure with the import file.

In this part of Getting Started, you will add a parameter. We will provide an overview of the basic procedures for the other types of corrections.

## 6.5.2 The most important information about the import/export file

When you perform subsequent corrections you work intensively with the import/export file. You should familiarize yourself with the most important operations so that you can work with confidence. These are described briefly below. You may already be familiar with many functions from using spreadsheet software.

### Navigating in the table

You navigate in the table using the following keyboard commands:

- The UP and DOWN arrows move you up and down lines in the columns
- The < TAB > key moves you to the right (forwards) to the next cell and < Shift> + < TAB > moves you to the left (backwards) to the preceding cell in the line
- The <Enter> key is used, for example, to end an edit and to move to the next line in the column.

### Selecting in the table

You can select cells in the table with the following keyboard commands:

- Select multiple cells: Press <Shift> and an arrow key at the same time.
- Select an entire row: Click on the number field at the beginning of the row.
- Select multiple rows: Click while also pressing <Shift> or <Ctrl>.
- Select a column: Click on the field with the column title.
- Select several columns: Click while also pressing <Shift> or <Ctrl>.

### Special considerations for the import/export file

Pay attention to the following when subsequently changing the import file:

| If you want to... | ... then |
|---|---|
| Delete an existing textual interconnection or an interconnection to an input/output | Enter the code word "---" |
| Leave an existing interconnection unchanged | Leave the edit box empty |

### 6.5.3 How to add a parameter

You will now add the "Block icon" parameter for the process tag type "TYPE_MOTOR" because you need this parameter for configuring the OS.

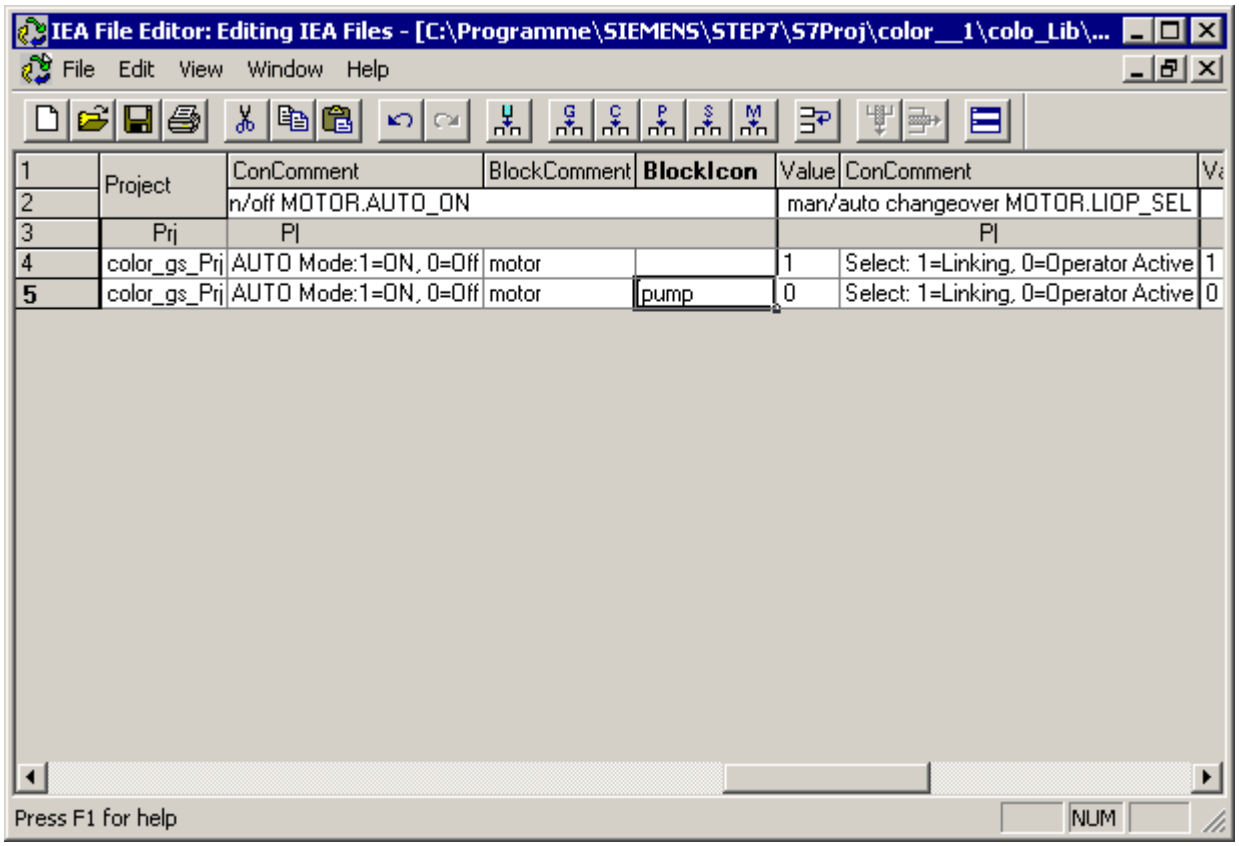
#### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

#### Procedure

1. Select the "TYPE_MOTOR" process tag type in the "color_gs_MP/color_gs_Lib/Process tag types" folder, and select **Options > Process Tags > Assign/Create Import File...** from the menu.
2. Switch to the step "Which import file do you want to assign to the process tag type?" and check if the correct import file, "…\MOTOR_REAC1.IEA", is displayed in the drop-down list.
3. Click "Open File".
   The file is opened in the IEA file editor.
4. Select any field in the column "Auto mode on/off MOTOR.AUTO_ON/BlockComment".
5. Select **Edit > Expand column group** from the menu.
6. In the "Expand Parameter Column Group" dialog box, select the "Block icon" check box and click "OK".
   The "BlockIcon" column is inserted.

7. Enter the name "pump" for the "CFC_NP311" process tag in the "BlockIcon" column. This name represents the display of the block icon in the process image. You create this special block icon yourself during the configuration of the OS.

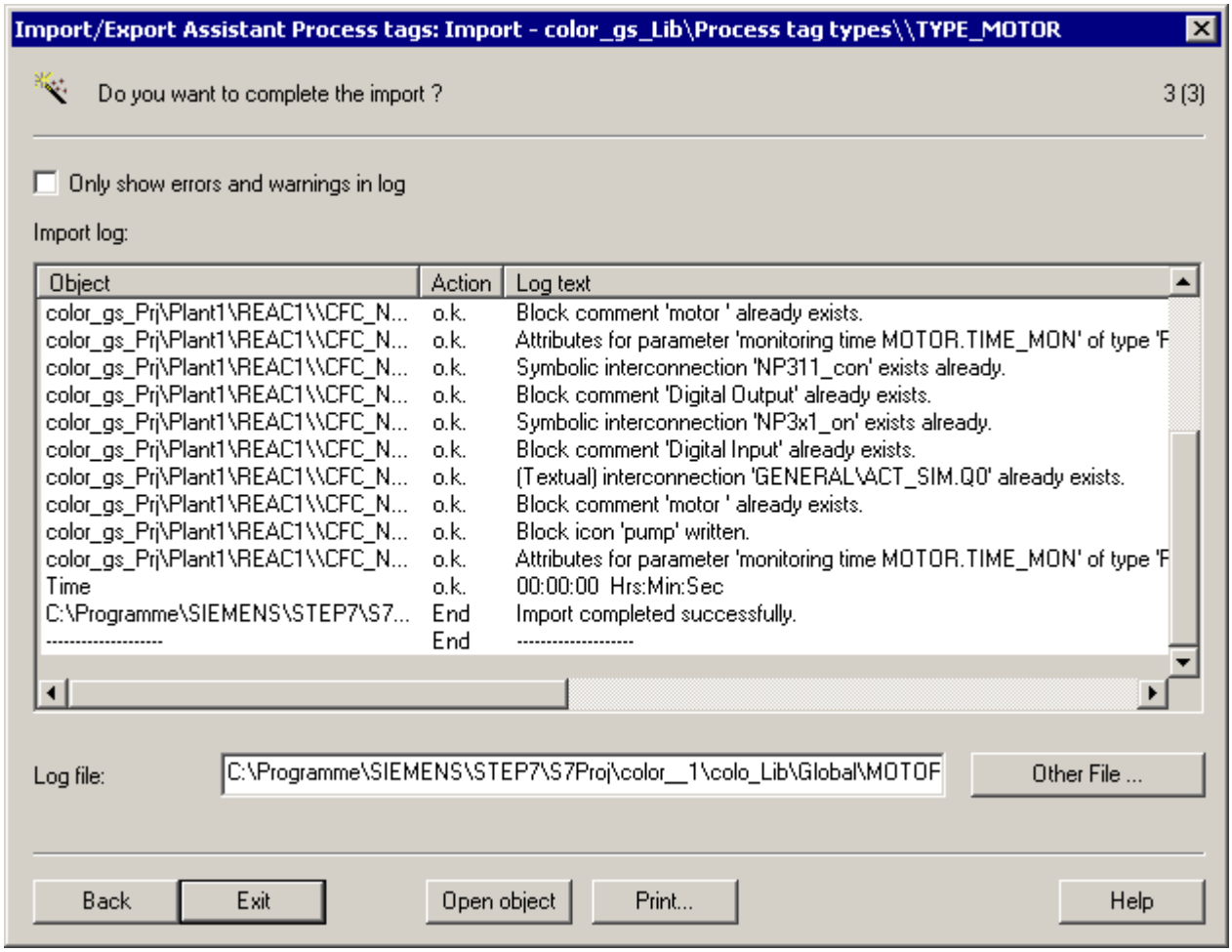



8. Save the file.
9. Close the IEA file editor.
10. Click "Finish".

    Video

11. Select the process tag type "TYPE_MOTOR", and select **Options > Process Tags > Import** from the menu.

12. Make sure that you have selected the correct import file "MOTOR.REAC1.IEA" and start the import.
    The existing process tags are modified according to the parameters in the import/export file. You can see all of the modifications that have been performed in the log.




For this modification this means specifically:
In CFC chart "CFC_NP311", the name "pump" is entered in the "Block icon" text box in the block properties of the "MOTOR" block.
You can check this by opening the CFC chart "CFC_NP311" and viewing the block properties of the "MOTOR" block.

## 6.5.4 How to make corrections - basic procedure

| NOTICE |
| --- |
| The following instructions are **not** part of the scope of the tasks in this Getting Started. The instructions are therefore kept to a minimum and are intended only as an overview of the basic procedure involved. We have included these instructions to show you the wide variety of possibilities offered by process tag types. |

### Options for corrections

The following correction options are described in basic terms:

- Deleting all created process tags
- Adding an I/O point

### Procedure for deleting process tags

1. Make a copy of the original import file and name it "DELETE_[Name of the original import file].IEA".
2. Open the file in the IEA file editor.
3. Select any field in the "Project" column and select the menu command **Edit > Insert Column Group > General...**.
4. In the "Insert General Column Groups" dialog box, select the "Import mode" check box and click "OK".
   The "ImportMode" column is inserted as the first column.
5. For all process tags that you want to delete, enter the command "DELETE" and save the file.
6. Close the IEA file editor.
7. Select the process tag type "TYPE_MOTOR", and select **Options > Process Tags > Import...** from the menu.
8. Open the import to which you added the "DELETE" import mode and start the import.
   All process tags are deleted.

### Procedure for adding a block input/output

1. Select the process tag type, and select **Options > Process Tags > Create/Change Process Tag Type...** from the menu.
2. Insert the additional I/O point and complete the change.
3. Open the corresponding import file, and select **Edit > Insert Column Group > Parameter** or **Signal** from the menu..
   This inserts an additional column.
4. Give the new column a descriptive name and save the import file.
5. Select the process tag type and then the menu command **Options > Process Tags > Assign/Create Import File...**
   The additional column that you inserted from the import file appears in the "Undefined I/O points in import file" list.
6. Drag this column onto the new I/O point in the "I/O points of the process tag type for parameters/signals" list
7. Complete the function.
8. Perform a new import.

# 6.6 Creating other CFC charts

## 6.6.1 How to create the "CFC_LI311" CFC chart

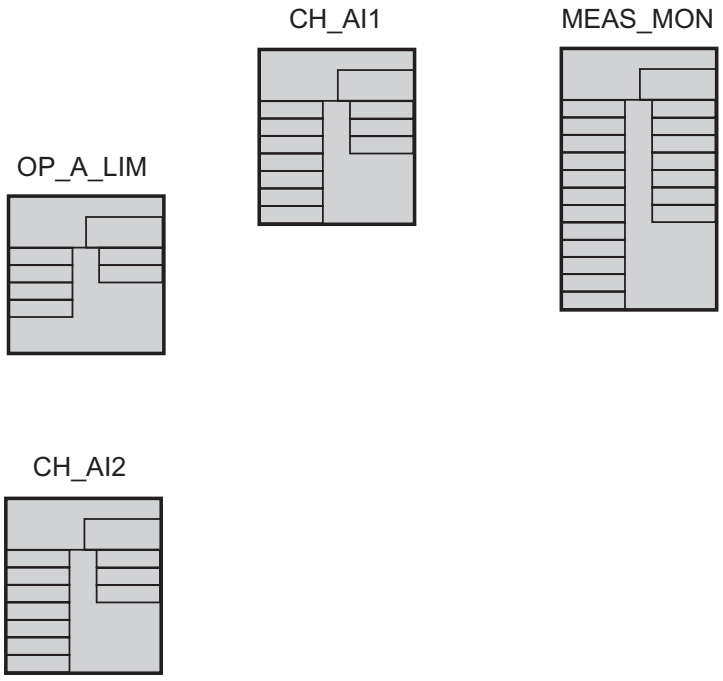
You use this chart to measure and simulate the fill level in REAC1.

### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Prj/Plant1/REAC1".
2. Insert the "CFC_LI311" CFC chart and open it in the CFC Editor.
3. Open the "color_gs_Lib/S7 Program(1)\Blocks" library in the catalog.
4. Use a drag-and-drop operation to insert the following blocks, and arrange them according to the graphic below.
   - OPERATE/OP_A_LIM
   - DRIVER/CH_AI - twice
   - CONTROL/MEAS_MON


CH_AI1
MEAS_MON
OP_A_LIM
CH_AI2

5. Enter the parameters based on the following table:

| Block | Name in project | I/O | Meaning | Value |
|---|---|---|---|---|
| CH_AI1 | TANK_LEV | VH_RANGE | High limit process value fill level | 1200.0 |
| MEAS_MON | TANK_LEV_ MON | U_AH | High alarm limit fill level | 990.0 |
| | | U_WH | High warning limit fill level | 950.0 |
| | | U_AL | Low alarm limit fill level | 20 |
| | | U_WL | Low warning limit fill level | 40 |
| | | MO_PVHR ** | Upper display limit for faceplate in the OS | 1200 |
| | | HYS | Hysteresis | 5 * |
| CH_AI2 | OUTFLOW | VHRANGE | High limit process value | 0 |
| | | VLRANGE | Low limit process value | -100 |
| | | SIM_V | Simulation value for the flow during draining | -10 |
| OP_A_LIM | DRAIN_ MIN_LEV | U_HL | High limit minimum fill level | 1200.0 |
| | | U_LL | Low limit minimum fill level | 50 |
| | | U ** | Default minimum fill level | 60 |

* default

** Input/output must be set as visible

1. Open the "color_gs_Lib/S7 Program(1)\Charts" library in the catalog.
2. Drag the chart "SIMREAC" below the "TANK_LEV_MON" block.
   This is the chart you created specifically for the fill level simulation.
3. Make the interconnection according to the following table:

| Block | Output | Block | Input |
|---|---|---|---|
| TANK_LEV | V | TANK_LEV_MON | U |
| SIMREAC | LEVEL_OUTPUT | TANK_LEV | SIM_V |
| OUTFLOW | V | SIMREAC | AOUT |

4. Make the following textual interconnections with a specific path reference:

| Block | Input | Textual interconnection | Meaning |
|---|---|---|---|
| TANK_LEV | SIM_ON | GENERAL\ACT_SIM.Q0 | Activates simulation |
| SIMREAC | BVALV_RMT1_1 | CFC_NK113\VALVE.QOPENED | Valve to REAC1 open |
| | BMOT_RMT1 | CFC_NP111\MOTOR.QRUN | Pump RMT1 running |
| | ARMT1 | CFC_FC111\INPUT_U.V | Simulation value for flow – this is integrated for the fill quantity. |
| | BVALV_RMT2_1 | CFC_NK117\VALVE.QOPENED | Valve to REAC2 open |
| | BMOT_RMT2 | CFC_NP112\MOTOR.QRUN | Pump RMT2 running |
| | ARMT2 | CFC_FC112\INPUT_U.V | ditto - The values are read from the RMT2 part of the plant |
| | BOUT | CFC_NP311\MOTOR.QRUN | The drain pump must be running |
| OUTFLOW | SIM_ON | GENERAL\ACT_SIM.Q0 | Activates simulation |

**Note**

The inputs BVALV_RMT1_2 and BVALV_RMT2_2 should not be interconnected for the REAC1 part of the plant.

Ensure that these inputs have the input value "0".

**Note**

All textual interconnections are automatically closed because all interconnection partners are available.

5. Select the block inputs/outputs to correspond to the following table, and select **Insert > Interconnection to Address** from the menu.
   The selection list of symbolic names for the block I/Os opens.
6. Double-click on the required block I/O.
   The global address is entered and the interconnection is displayed in the sheet bar.

| Block | Input/output | Address |
|---|---|---|
| TANK_LEV | Input "VALUE" | LI311 |
| OUTFLOW | Input "VALUE" | LI311_V |

7. Close the CFC chart.

## 6.6.2 How to create the "CFC Chart TC 311" CFC chart

This chart regulates the temperature for REAC1.

### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

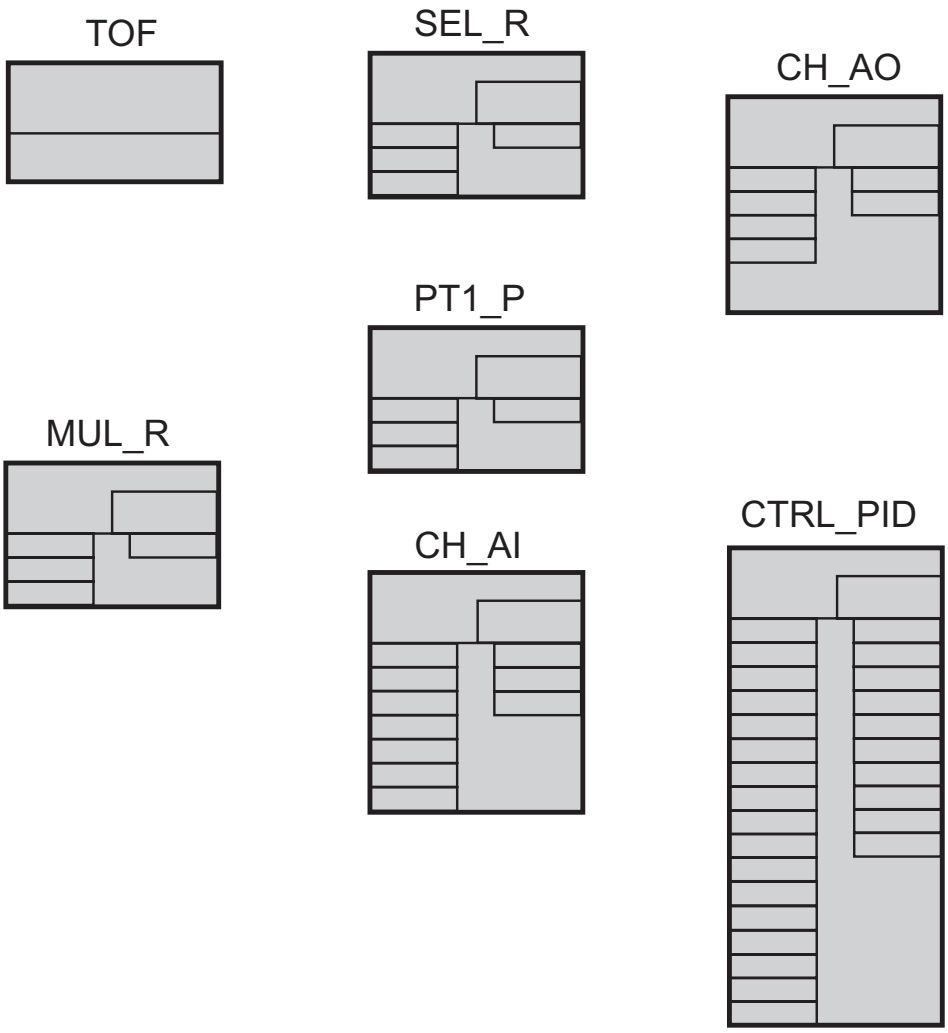
### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Prj/Plant1/REAC1".
2. Insert the "CFC_TC311" CFC chart and open it in the CFC Editor.
3. Use a drag-and-drop operation to Insert the blocks listed in the table in the specified order and arrange them to correspond to the figure below.

**Note**

The table provides information about the name of the storage folder and the function of the blocks.

| Block | Location | |
|---|---|---|
| | Tab | Folder |
| TOF | Libraries | "color_gs_Lib\S7 Program(1)\Blocks\IEC_TC" |
| CTRL_PID | Libraries | "color_gs_Lib\S7 Program(1)\Blocks\CONTROL" |
| MUL_R | Libraries | "color_gs_Lib\S7 Program(1)\Blocks\MATH_FP" |
| SEL_R | Blocks | "MULTIPLX" |
| PT1_P | Libraries | "color_gs_Lib\S7 Program(1)\Blocks\CONTROL" |
| CH_AI | Libraries | "color_gs_Lib\S7 Program(1)\Blocks\DRIVER" |
| CH_AO | Libraries | "color_gs_Lib\S7 Program(1)\Blocks\DRIVER" |


TOF
SEL_R
CH_AO
PT1_P
MUL_R
CH_AI
CTRL_PID

4. Enter the parameters according to the following table:

| Block | Name in project | I/O | In-visi-ble | Meaning | Value |
|---|---|---|---|---|---|
| TOF | TOF | PT | | Maintains the temperature after the maximum value has been achieved | 1m |
| CTRL_PID | CTRL_TEMP | SP_EXT | | External setpoint | 80 |
| | | GAIN | | Proportional-action coefficient | 1 * |
| | | TN | | Integral-action time [s] | 8 |
| | | TV | | Derivative-action time [s] | 0 * |
| | | LIOP_INT_SEL | | Activates basic operator control | 0 * |
| | | LMN_HLM | | High alarm limit | 100 * |
| | | LMN_LLM | | Low alarm limit | 0 * |
| | | SPEXTHLM | | High limit external setpoint | 100 * |
| | | SPEXTLLM | | Low limit external setpoint | 0 * |
| | | PVH_ALM | | Process value: High alarm limit | 140 |
| | | PVH_WRN | | Process value: High warning limit | 130 |
| | | PVL_ALM | | Process value: Low alarm limit | 20 |
| | | PVL_WRN | | Process value: Low warning limit | 25 |
| | | NM_PVHR | | High limit phys. meas. value range proc. value | 150 |
| | | NM_PVLR | | Low limit phys. meas. value range proc. value | 0 * |
| | | MO_PVHR | | High display limit | 150 |
| | | MO_PVLR | | Low display limit | 0 |
| SEL_R | SEL_R | IN1 | | Minimum temperature of the reactor | 30 |
| PT1_P | PT1_P | TM_LAG | | Time delay | 60 |
| CH_AI | INPUT | VHRANGE | | High limit process value | 150 |
| MUL_R | MUL_R | IN2 | | Converts the valve position to temperature feedback | 1 * |
| CH_AO | OUTPUT | UHRANGE | | High limit manipulated variable | 100 * |

* default

5. Make the interconnections in accordance with the following table:

| Block | Output | Block | Input |
|---|---|---|---|
| TOF | Q | SEL_R | K |
| SEL_R | OUT | PT1_P | U |
| PT1_P | V | INPUT | SIM_V |
| INPUT | V | CTRL_TEMP | PV_IN |
| CTRL_TEMP | LMN | MUL_R | IN1 |
| CTRL_TEMP | LMN | CTRL_TEMP | LMNR_IN |
| CTRL_TEMP | LMN | OUTPUT | U |
| MUL_R | OUT | SEL_R | IN0 |

6. Make the following textual interconnections:

| Block | Input | Textual interconnection | Meaning |
|---|---|---|---|
| INPUT | SIM_ON | GENERAL\ACT_SIM.Q0 | Activates simulation |
| TOF | IN | CFC_NK313\VALVE.QOPENED | Valve 313 open |

**Note**

All textual interconnections are automatically closed because all interconnection partners are available.

7. Select the block inputs/outputs in accordance with the following table, and select **Insert > Interconnection to Address** from the menu and make the interconnections.

| Block | Input/output | Address |
|---|---|---|
| INPUT | Input "VALUE" | TC311 |
| OUTPUT | Output "VALUE" | TC311_c |

8. Close the CFC chart and close the CFC Editor.

# 6.7 Summary

## 6.7.1 Summary: "Rational engineering in the CFC configuration"

### New functions

What have you learned while working with CFC charts?

In addition to using textual interconnections, you have learned two important functions for rational engineering:

- Chart-in-chart technique
- Tag types

Both functions offer special advantages and are used according to your own specific requirements.

The following is a brief summary of the most important properties of these two functions.

### Chart-in-chart technique

In Getting Started you use the chart-in-chart technique for the simulation charts. Chart-in-chart technique means that you create generally valid charts for multiple use in other charts. You already inserted the "SIMV" simulation chart into all charts for valve process tags as a hierarchical chart.

Note the following when using the chart-in-chart technique:

- Store the charts you have specified for the chart-in-chart technique in your master data library. In this way, you have convenient access to the charts and they are available to all configuration engineers working decentrally within a multiproject.
- Note that central changes cannot be made with the chart-in-chart technique. Modifications that you implement in the hierarchical chart are **not** automatically applied to all points of use. If you insert the modified hierarchical chart into another top chart, you will have two different versions of the hierarchical chart in your project. When the top chart opens, it is not immediately clear which version of the hierarchical chart you have used. Make sure you always change the name of the chart when you make subsequent changes to a hierarchical chart. Since the name is displayed when you use this chart in the top chart, you will immediately know which version of the hierarchical chart you have used.

## Tag types

In Getting Started, you use process tag types to create process tags of the same type. For example, you created the "VALVE" process tag type and then used it to create all five process tags required for the "REAC1" part of the plant. You can also use this process tag type to create other valve process tags in other parts of the plant. You can also create significantly more process tags using an import file.

Note the following when using process tag types:

- You can modify the created process tags to meet the specific requirements for this process tag.
  Exception: You cannot change the block I/Os for which parameters were assigned via the import file.
- You assign descriptive names to the column headers.
- In order to establish a unique relationship between the process tag types and the created process tags, you assign a descriptive name to the corresponding import file.
- Create a backup copy of the original import file before making critical changes to the import file. In this way you can easily restore the "old status". This procedure is recommended if you create a large number of process tags.
- You can edit the data of the import/export file externally in a spreadsheet program such as Excel. You should only use this option, however, if you are very familiar with the functions of the spreadsheet program. The IEA file editor offers comparable functions that are adequate for the purpose of this configuration work.

## Creating process tags from multiple process tag types simultaneously

When creating process tags, you even have the option of creating process tags from different process tag types in a single operation. The basic procedure is as follows:

1. In the plant view of SIMATIC Manager, select the folder "color_gs\color_gs_lib\Process tag types".
2. Select **Options > Process Tags > Import...** from the menu.
   Step 2(3) of the wizard displays all import files that you have already created.
3. Delete the import files of all the process tag types from which you do not want to create process tags, and complete the import.

# Configuring SFC charts with the use of rational functions

# 7

## 7.1 Overview of configuration steps in the SFC

### Configuration tasks

During SFC configuration, you will perform the configuration steps:

- Modify the RMT plant sections
  These corrections are necessary in order to combine the RMTx and REACx parts of the plant with one another.
- Work with SFC types
  This is a very important function of rational engineering.

# 7.2 Modification of the SFC charts in the 'RMT1/2' plant sections

## 7.2.1 Modifications in the RMT parts of the plant

### Interfaces and valves

You will need to modify the SFC charts from the RMT1 and RMT2 parts of the plant using the interfaces between "RMTx" and "REACx".

- The valves NK311 and NK312 belong to the "REAC1" part of the plant.
- The valves NK321 and NK322 belong to the "REAC2" part of the plant; they also have to be opened when the liquid dosing starts.

These valves are controlled by the SFC charts in RMT1 and RMT2.

## 7.2.2 How to modify the SFC charts of the RMTx parts of the plant

You already know the basic procedures in the SFC editor from Getting Started - Part 1. The only new feature here is the use of textual interconnections.

### Requirements

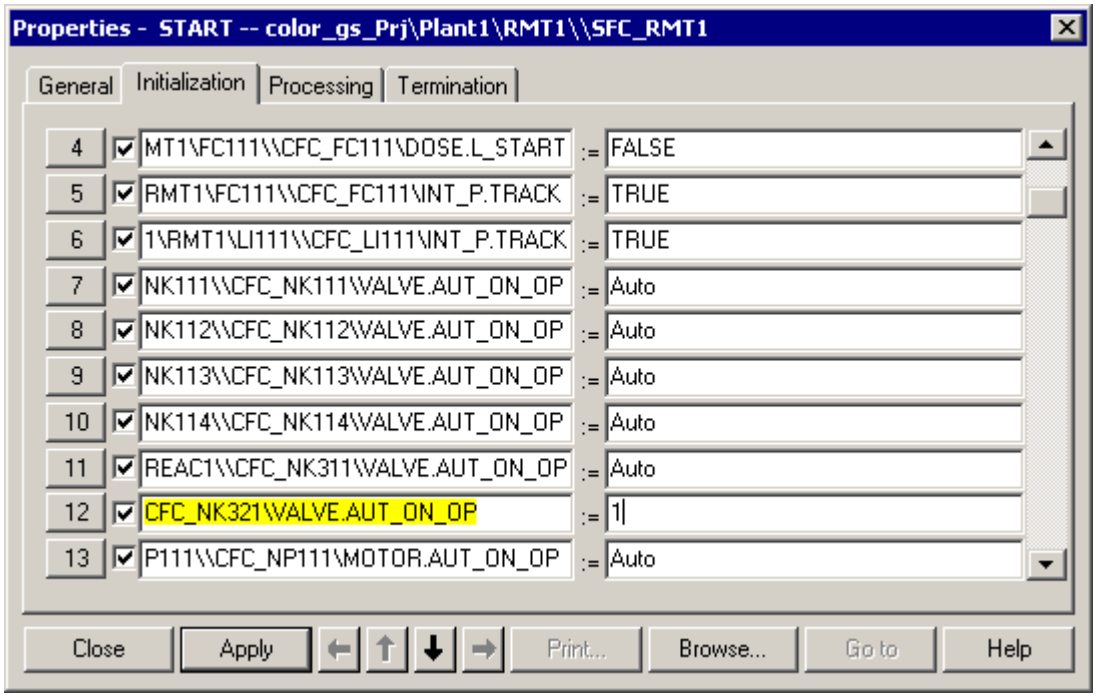
- The example project is open in SIMATIC Manager.
- The plant view is activated.

### Procedure for the "RMT1" part of the plant

1. Go the the tree view and select the folder "color_gs_MP/color_gs_Prj/Plant1/RMT1", and open the "SFC_RMT1" SFC chart in the detailed window.
   The SFC editor opens.
2. Select the "START" step.
3. Select **Edit > Object Properties...** from the menu.
   The "Properties" dialog box opens.
4. Select the "Initialization" tab.
5. Click the button labeled with row number 11.
6. Open the context menu and select the menu command **Insert Empty Line**.
   An empty row is inserted beside the number 11 button.
7. Place the cursor in the edit box for the left address in empty line 11, and click the "Browse" button.
   The "Browse" dialog box opens and the "Plant View" tab is active.
8. Go to the tree view and select the block:
   "Plant1\REAC1\CFC_NK311\VALVE".
   All the associated I/Os of the block are displayed on the right.

9. Double-click on the "AUT_ON_OP" input.
   This brings you back to the "Properties" dialog box, and enters the value for the left address.
10. Set the right address to the value "Auto".
11. Click the "Apply" button.
    The value is entered.
12. Insert another empty line before line 12.
13. Enter the textual interconnection in this line:
    - Left address: "CFC_NK321\VALVE.AUT_ON_OP"
      This entry is highlighted in yellow to identify it as a textual interconnection.
    - Right address: "1".

| NOTICE |
| --- |
| You must enter the numerical value "1" for the textual interconnection – this is the Boolean value for "Auto". On no account should you enter simply "Auto". |




14. Click "Apply".

15. Click the arrow button to move to the next steps and make the other entries for the "RMT1" part of the plant according to the table below.

**Note**

Insert empty lines for new instructions after the existing instructions for the valve controls. The inputs/outputs are grouped efficiently.

| Step | Comment | Left address | Right address |
|---|---|---|---|
| Completed already: START | Direct interconnection | Plant1\REAC1\CFC_NK311\VALVE.AUT_ON_OP | Auto |
| | Textual interconnection | CFC_NK321\VALVE.AUT_ON_OP | 1 |
| INIT_LINE1 | Direct interconnection | Plant1\REAC1\CFC_NK311\VALVE.AUTO_OC | TRUE |
| INIT_LINE2 | Textual interconnection | CFC_NK321\VALVE.AUTO_OC | 1 |
| CLOSE_LINE | Direct interconnection | Plant1\REAC1\CFC_NK311\VALVE.AUTO_OC | FALSE |
| | Textual interconnection | CFC_NK321\VALVE.AUTO_OC | 0 |
| END | Direct interconnection | Plant1\REAC1\CFC_NK311\VALVE.AUTO_OC | FALSE |
| | Textual interconnection | CFC_NK321\VALVE.AUTO_OC | 0 |

### Procedure for the "RMT2" part of the plant

1. Open the "SFC_RMT2" chart.
2. Open the "Properties" dialog box and enter the instructions according to the table below:

| Step | Comment | Left address | Right address |
|---|---|---|---|
| START | Direct interconnection | Plant1\REAC1\CFC_NK312\VALVE.AUT_ON_OP | Auto |
| | Textual interconnection | CFC_NK322\VALVE.AUT_ON_OP | 1 |
| INIT_LINE1 | Direct interconnection | Plant1\REAC1\CFC_NK312\VALVE.AUTO_OC | TRUE |
| INIT_LINE2 | Textual interconnection | CFC_NK322\VALVE.AUTO_OC | 1 |
| CLOSE_LINE | Direct interconnection | Plant1\REAC1\CFC_NK312\VALVE.AUTO_OC | FALSE |
| | Textual interconnection | CFC_NK322\VALVE.AUTO_OC | 0 |
| END | Direct interconnection | Plant1\REAC1\CFC_NK312\VALVE.AUTO_OC | FALSE |
| | Textual interconnection | CFC_NK322\VALVE.AUTO_OC | 0 |

3. Close the "Properties" dialog box, and close the SFC Editor.

# 7.3 Working with SFC types

## 7.3.1 Overview of SFC types

### Introduction

At this point, we will first provide you with a theoretical overview of the SFC types. Of course, SFC types offer you many more options that cannot be described in detail in *Getting Started - Part 2*.

SFC types offer the advantage of "reusability" because they work according to the type-instance concept. This means that you first create the SFC type. From this you then create an SFC instance that is actually connected to the process, by inserting the SFC type into a CFC chart. This means that you can create SFC types for all processes that occur repeatedly in a project, for example, heating, agitating, starting.

The great advantage of the type-instance concept is the capability of centralized editing: For example, if you wish to add process values or setpoints to the SFC type at a later point in time, they are added to all other SFC instances automatically.

### Characteristics of an SFC type

The SFC type has certain properties that distinguish it from an SFC chart:

- The SFC type possesses no runtime properties.
- The SFC type is managed in the component view only and not in the plant hierarchy.
- The SFC type is managed and used as a function block and can therefore be found in the CFC block catalog under "Other blocks" and "All blocks". It is displayed as a block when inserted into a CFC chart.

## 7.3.2 What are the important elements in an SFC type?

### Elements of an SFC type

The following provides a brief overview of the elements of an SFC type that you will need for the configuration in *Getting Started - Part 2*:

- Control strategy
  Control strategies structure an SFC type in terms of the process. You can define control strategies so that they can be used in the sequencers, for example, heating, cooling. Control strategies are optional. However, when you want to run sequencers according to a control strategy, the relevant control strategies must be defined. You assign a control strategy to the sequencer in the properties of the sequencer. If there is to be only one sequencer per control strategy, it is better to give the control strategies and the sequencers similar names. This makes assigning control strategies to sequencers easier.
- Sequencers
  You are already familiar with sequencers from your work in *Getting Started - Part 1*. There you created the SFC chart with exactly one sequence for dosing the raw material. An SFC type can contain up to 32 different sequencers.
  Each sequencer has a start condition.
  The start condition "RUN = TRUE" means that the sequencer can be started when the SFC is active.
  The start condition "QCS = 1" means that this sequencer is started when the control strategy with the number "1" is active.
- SFC interface
  The SFC interface includes all inputs/outputs that are created during the configuration of the SFC type and are made externally visible for the SFC instance in the CFC chart. Here a distinction is made between the interface inputs/outputs created by default for every SFC instance and the interface inputs/outputs that depend on the definition of the characteristics in the SFC type. This distinction is independent of the definitions made in the SFC type.
- Characteristics
  Characteristics include, for example, control strategies, setpoints, process values, block contacts. You can define the exact characteristics needed, for example, the setpoint for a fill level. For every characteristic that you define, PCS 7 automatically creates the required inputs/outputs in the SFC instance. And you can create the actual process interfacing for these inputs/outputs.

## 7.3.3 Planning for the "REAC" SFC type

### Introduction

Create an SFC type in the project "color_gs". This is to be used to control heating and drainage processes in the reactors. Beforehand, you must consider which elements you will need for your SFC type. You require the following elements for the "color_gs" project:

- Control strategies and sequencers
- Setpoints
- Process values
- Block contacts

### Specification of the control strategies and sequencers

First, you define which reusable function units are available for the reactor. A control strategy and a separate sequencer will be created for each of these function units. You require the following control strategies for the "color_gs" project:

- "Heat": This control strategy represents the heating process in the reactor.
- "Drain": The control strategy stands for emptying the reactor

In the "color_gs" project, each control strategy is assigned to exactly one sequencer. This makes a total of three sequencers:

- Reset (default name: Starting): This sequence is automatically started as soon as a sequence control system is started. It sets all valves of this part of the plant to the "closed" state. This is needed so that the simulation can start in the process mode without problems.

**Note**

In actual practice, this sequencer for closing the valves is usually executed at the end of the overall process. In this Getting Started, however, the sequencer is executed at the beginning of the process to ensure reliable performance of the simulation.

- Heating: This sequence regulates the heating process using the controller block and opens/closes the corresponding intake valve.
- Drain: This sequence opens/closes the valves between reactor and filling tank and starts/stops the pump.

### Specification of the setpoints

Next, you define the setpoints for the sequence control system. The plant operator can easily change these setpoints in process mode on the operator station. You can also define the limit values. The setpoints, which can be specified by the plant operator, must be within these limits. Of course, the setpoints and their limit values also apply to automatic mode – but we will not be using this variant in this Getting Started.

For the "color_gs" project, the setpoint "Heating" is defined for the temperature in the heating process. It is used in the "Heating" sequence. The liquid in the reactor is heated until it reaches the setpoint.

### Specification of the process values

Process values can be used for control within sequences. In the "color_gs" project, the process value "fill level" is used in the "Drain" sequence. The drainage pump must stop as soon as the minimum value for the reactor fill level is achieved.

### Specification of the block contacts

Block contacts are defined specifically for individual process tags. This means that you must create block contacts for the necessary process tags to which you want to interconnect the SFC instance at a later time.

Note the following for the block inputs/outputs that are visible in the SFC interface of the SFC instance:
The IN or OUT I/Os are interchanged in the SFC instance. If, for example, you create a block contact for a "MOTOR" process tag, the QRUN I/O for the "MOTOR" block is an OUT I/O. However, in the SFC instance this I/O becomes an IN I/O. This interchange permits you to make the necessary interconnections.

You require block contacts for the following process tags in your "color_gs" project:

- Control valve for the heating process
- Valve for the inflow during the heating process
- Pump for drainage
- Valve for drainage

## 7.3.4 How to create an SFC type

### Overview

You create the SFC type in 11 steps:

| Step | What? |
|---|---|
| 1 | Create an SFC type in SIMATIC Manager (Page 133) |
| 2 | Open an SFC type in the SFC Editor (Page 134) |
| 3 | Define control strategies (Page 135) |
| 4 | Create sequencers (Page 137) |
| 5 | Specify setpoints (Page 139) |
| 6 | Define process values (Page 141) |
| 7 | Define block contacts (Page 142) |
| 8 | Configure "RESET" sequence (Page 144) |
| 9 | Design "Heating" and "Drain" sequencers (Page 147) |
| 10 | Create an SFC instance (Page 150) |
| 11 | Store in master data library (Page 152) |

### 7.3.5 Step 1 - How to create an SFC type

#### Requirements

- The example project is open in SIMATIC Manager.
- The component view is activated

#### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Prj/SIMATIC 400(1)/CPU 417-4/S7 Program(1)/Charts".
2. Select **Insert > S7 Software > A SFC Type** from the menu.
   The SFC type is inserted.
3. Enter the name "REAC".

**Note**

In contrast to the usual procedure, SFC types for creation are not stored in the master data library. Only if it is stored in the aforementioned folder is the SFC type available to you as a block to be inserted in the CFC chart as an SFC instance.

Upon completion, you will save the SFC type in the master data library in order to make it available for all the other engineers working in the multiproject, for example.

## 7.3.6 Step 2 - How to open the "REAC" SFC type

### Requirements

- The example project is open in SIMATIC Manager.
- The component view is activated

### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Prj/SIMATIC 400(1)/CPU 417-4/S7 Program(1)/Charts".
2. Select the "REAC" object in the detailed window.
3. Select **Edit > Open Object** from the menu.
   The SFC editor opens. As with an SFC chart, there is already a sequencer with the "START" and "END" steps and Transition 1 present.

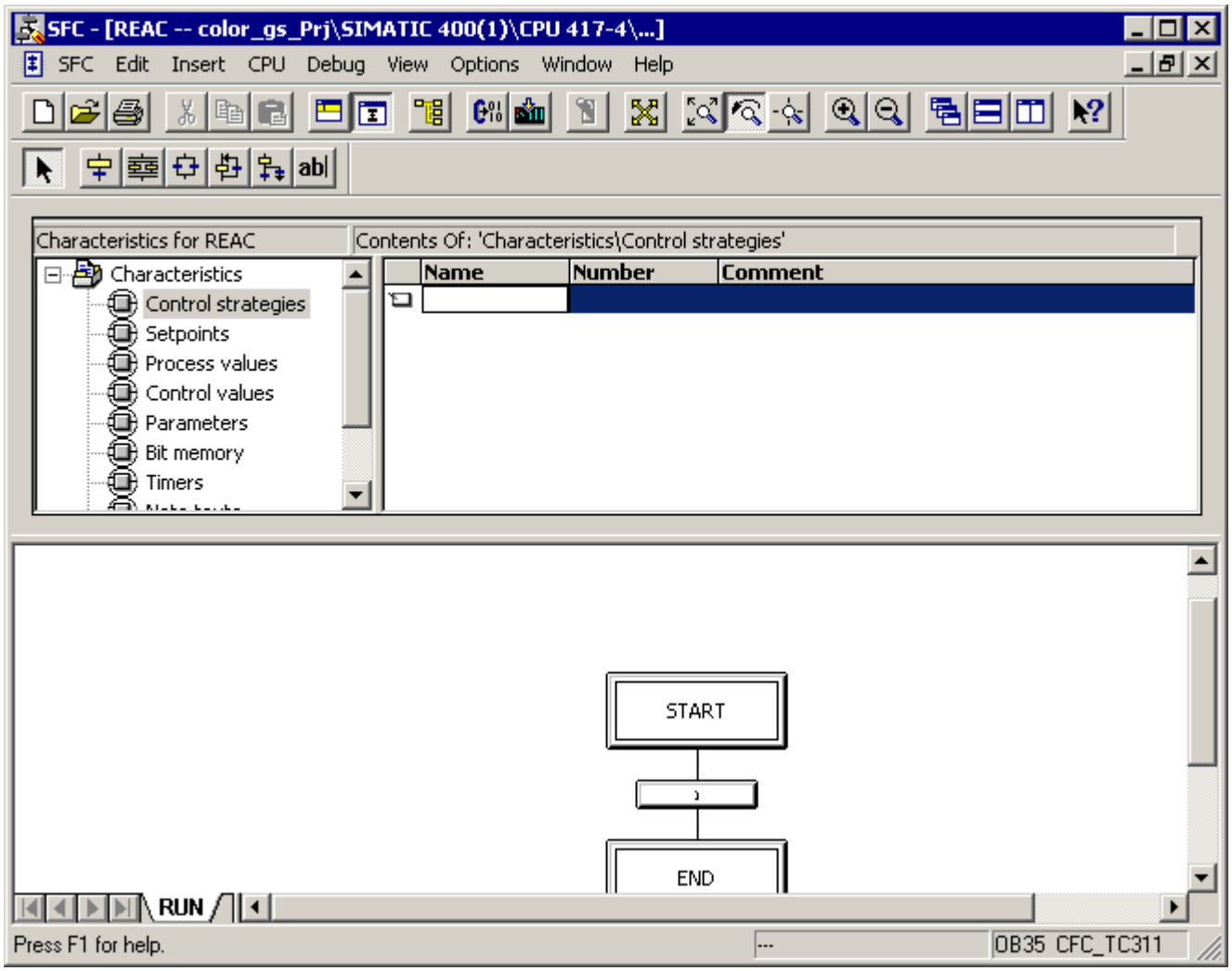
## 7.3.7 Step 3 - How to define the control strategies

### Requirements

- The example project is open in SIMATIC Manager.
- The "REAC" SFC type is open in the SFC Editor.

### Procedure

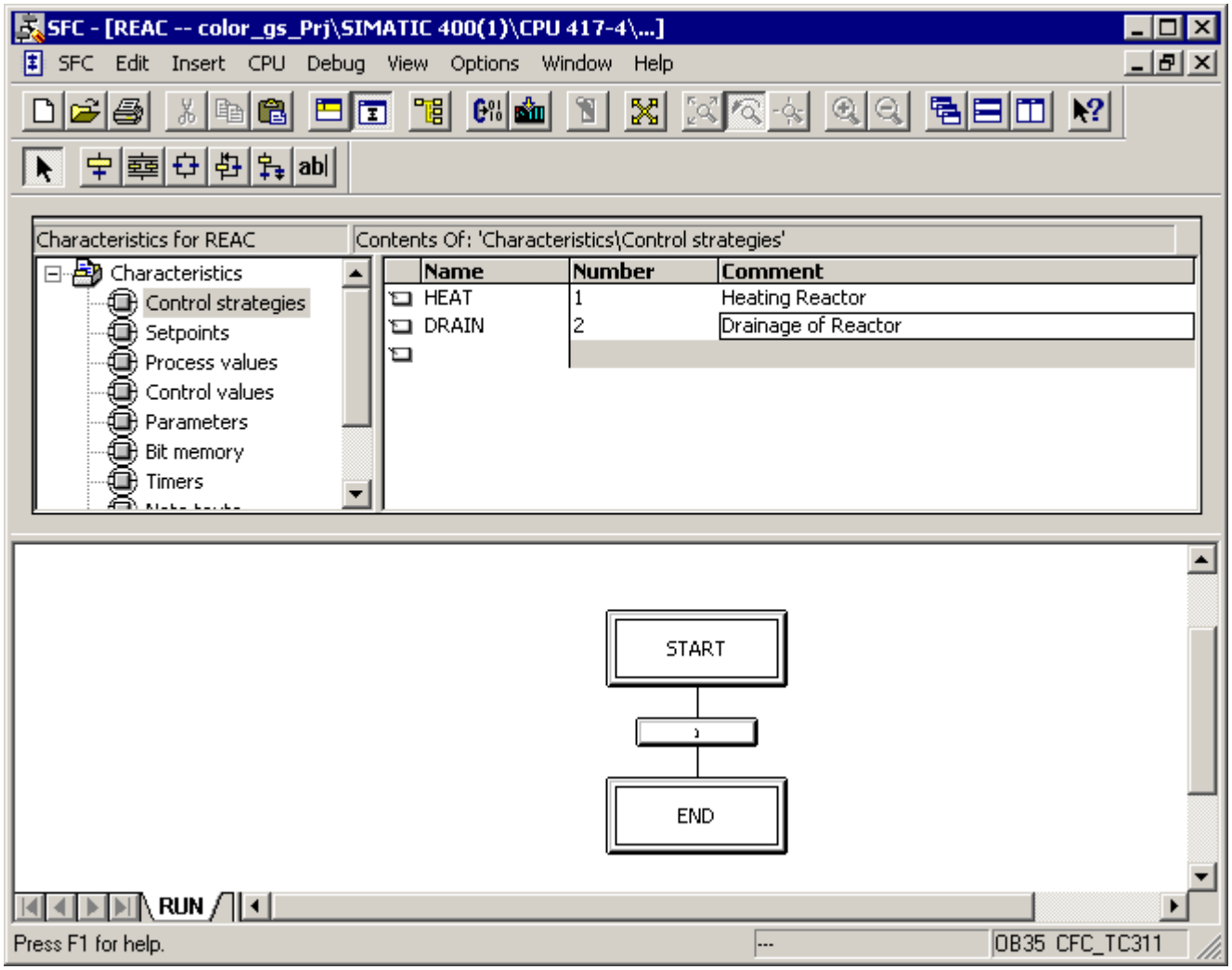
1. Select **View > Characteristics** from the menu.
   The characteristics editor is open in the upper part of the SFC editor.
2. Select the "Control Strategies" entry in the tree view.
   An empty input line is then displayed in detailed window.



3. Position the mouse pointer in the "Name" column and enter the name "HEAT".
   This name is displayed to the operator in process mode, for example, when selecting a control strategy.
   The system assigns the number "1" automatically. You can use this number to logically combine the control strategy and the sequencer, for example.
4. Enter the text "Heating Reactor" in the "Comment" column.
5. Using the same procedure, enter the following control strategy:

| Name | Number automatically | Comment |
|---|---|---|
| DRAIN | 2 | Drainage of Reactor |

You have now defined all required control strategies.



## 7.3.8 Step 4 - How to create the sequencers

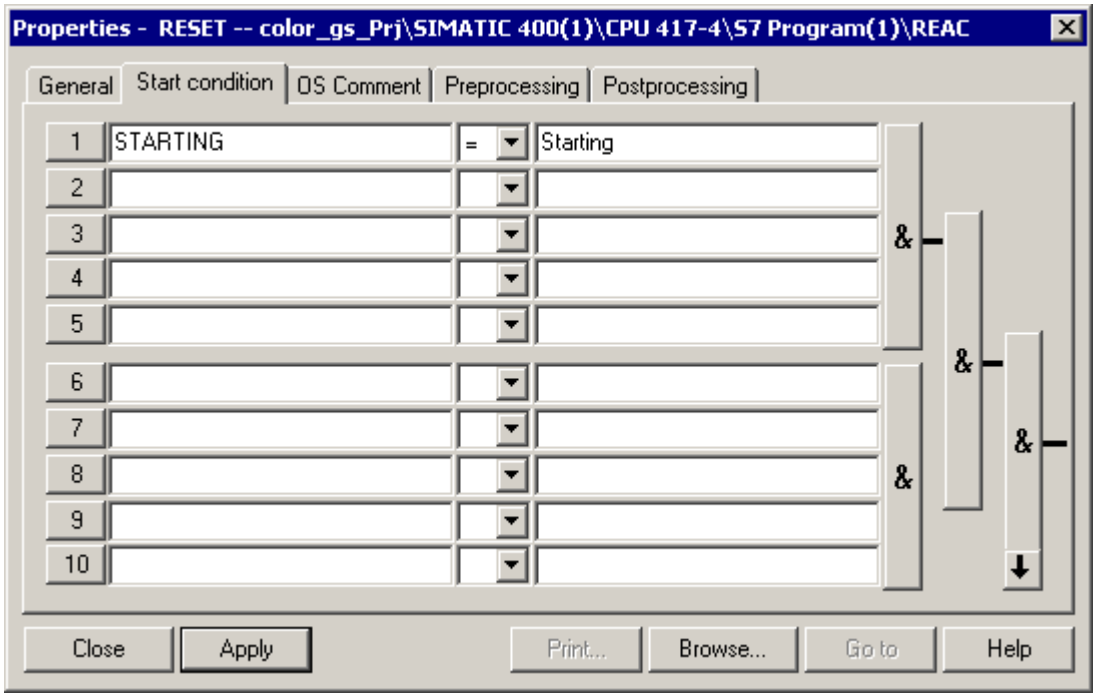
The "RUN" sequencer is automatically created when the SFC type is created. You rename this sequencer and, of course, create additional sequencers.

### Requirements

- The example project is open in SIMATIC Manager.
- The "REAC" SFC type is open in the SFC Editor.
- The tab with the "RUN" sequencer is activated.

### Procedure

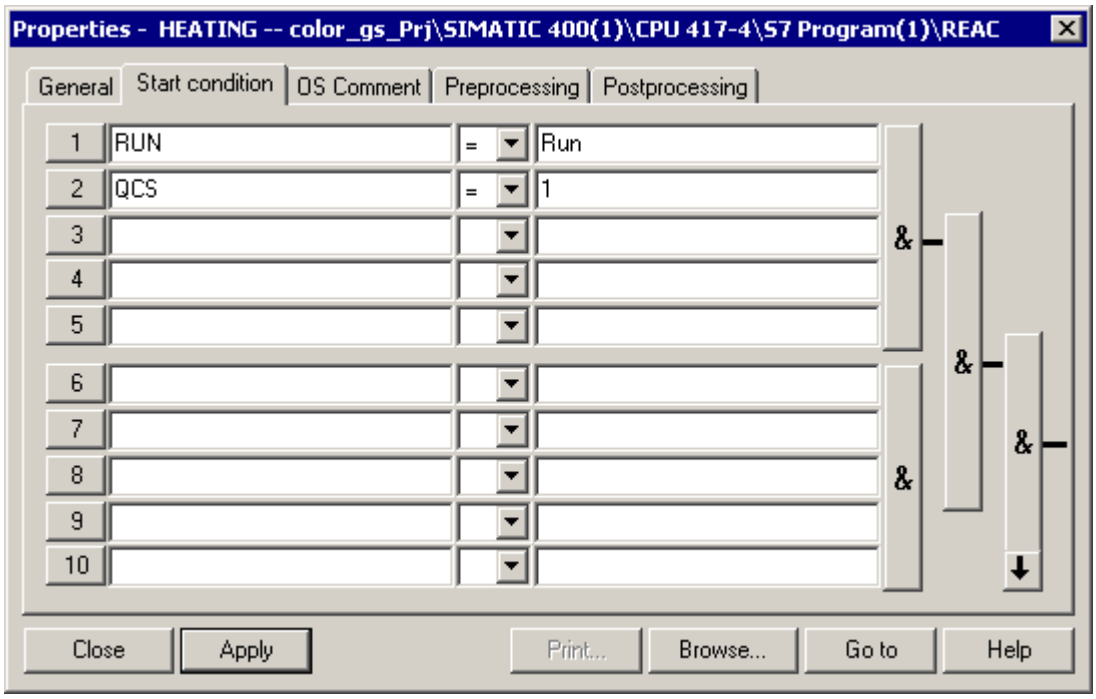
1. Select **Edit > Sequencer Properties...** from the menu.
   The "Properties" dialog box opens and the "General" tab is active.
2. Enter the name "Reset" in the "Name" box.
3. Click "Apply".
4. Change to the "Start condition" tab.
5. Enter the start condition "STARTING" as Address 1.
6. Click in the edit box for Address 2 and select the entry "Starting" from the drop-down list.




7. Click "Apply" and then "Close".
   The dialog box closes.

8. Select **Insert > Sequencer > At End** from the menu.
   The new sequencer "SEQ1" is inserted and displayed in a separate tab. This tab is automatically activated.
9. Select **Edit > Sequence Properties** from the menu, and enter the following parameters:

| Name | Start condition | | |
|---|---|---|---|
| | Address 1 | Operator | Address 2 |
| HEATING | RUN | = | Run |
| | QCS | = | 1 |




10. Click the "Apply" button and then the "Close" button.
11. Repeat steps 8 to 10 to define the "Drain" sequence:

| Name | Start condition | | |
|---|---|---|---|
| | Address 1 | Operator | Address 2 |
| DRAIN | RUN | = | Run |
| | QCS | = | 2 |

12. Click "Apply" and then "Close".
    The "Properties" dialog box closes.

## 7.3.9 Step 5 - How to specify the setpoints

You need to specify a setpoint for the heating temperature.

### Requirements

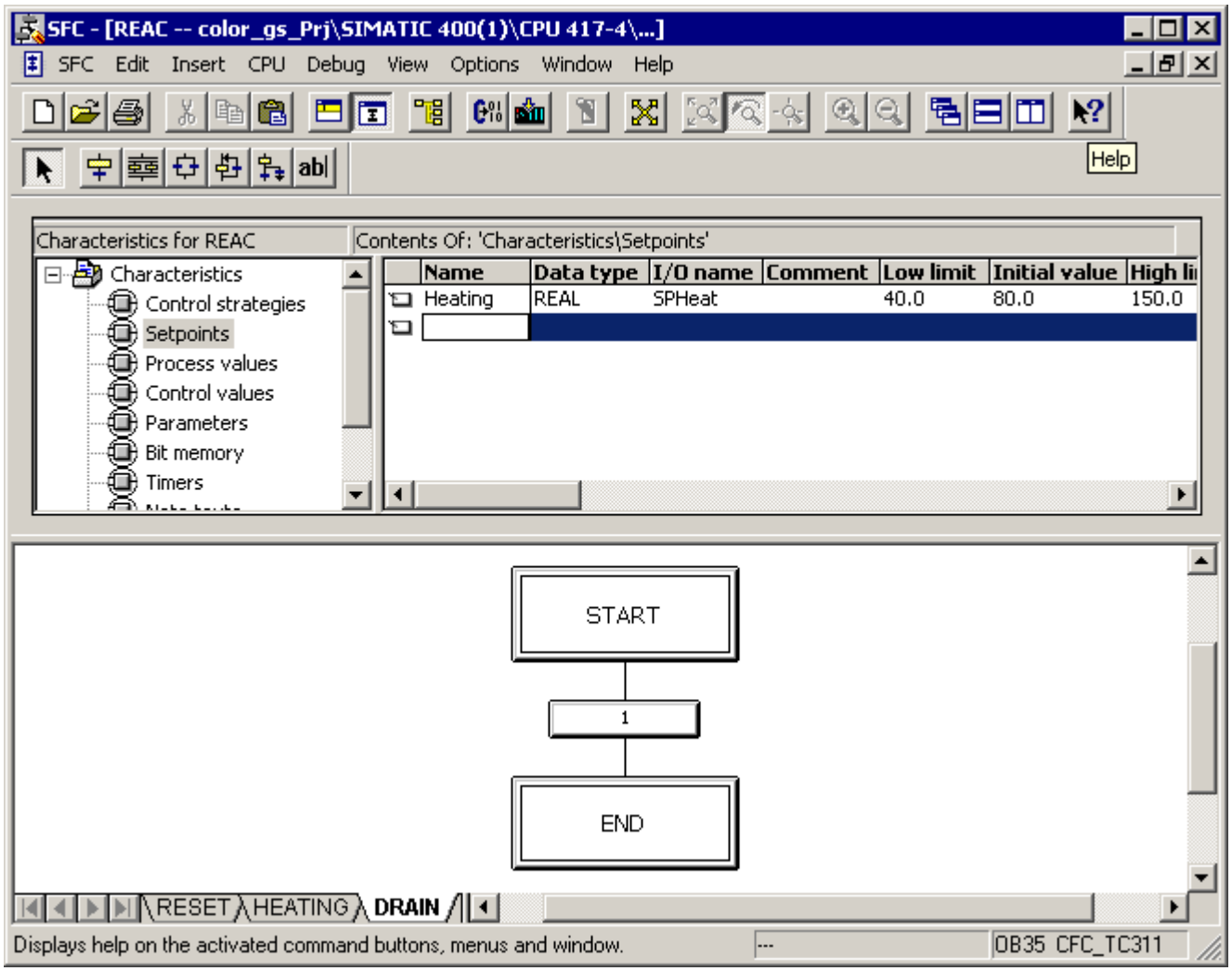
- The example project is open in SIMATIC Manager.
- The "REAC" SFC type is open in the SFC Editor.
- The characteristics editor is open

### Procedure

1. Select the "Setpoints" entry in the tree view.
   An empty input line is then displayed in detailed window.
2. Place the mouse pointer in the edit box in the "Name" column, and enter the name "Heating".
3. Press the <TAB> key.
   A drop-down list is displayed in the edit box of the "Data type" column and the name you have specified is automatically entered in the "I/O name" column. You change it to a descriptive name after the data type has been defined.
4. Select the "REAL" data type from the drop-down list.
5. Enter the following information. To do this, place the cursor in the relevant column and enter the data in accordance with the table:

| Column name | Meaning | Value |
|---|---|---|
| I/O name | Descriptive I/O name for the setpoint value in the SFC interface | SPHeat |
| Initial value | Setpoint with which the control strategies are processed until the plant operator changes the setpoint | 80 |
| Low limit | Minimum setpoint that the plant operator can specify in process mode | 40 |
| High limit | Maximum setpoint that the plant operator can specify in process mode | 150 |

## Result


SFC - [REAC -- color_gs_Prj\SIMATIC 400(1)\CPU 417-4\...]
SFC Edit Insert CPU Debug View Options Window Help
Help
Characteristics for REAC
Contents Of: 'Characteristics\Setpoints'
Characteristics
Control strategies
Setpoints
Process values
Control values
Parameters
Bit memory
Timers
Name
Data type
I/O name
Comment
Low limit
Initial value
High li
Heating
REAL
SPHeat
40.0
80.0
150.0
START
1
END
RESET
HEATING
DRAIN
Displays help on the activated command buttons, menus and window.
---
OB35 CFC_TC311

### 7.3.10 Step 6 - How to create process values

The process value will be set for the fill level.

#### Requirements

- The example project is open in SIMATIC Manager.
- The "REAC" SFC type is open in the SFC Editor.
- The characteristics editor is open

#### Procedure

1. Select the "Process values" entry in the overview.
   An empty input line is then displayed in the detailed window.
2. Place the mouse pointer in the edit box in the "Name" column and enter the name "Level".
3. Place the mouse pointer in the "Data type" column.
   A list box with the possible data types is displayed.
4. Select the "REAL" data type.
   This specifies the parameters for the process value. The I/O name is automatically taken from the "Name" field.
5. Create another process value with the following parameters:
   - Name: Level_min
   - Data type: REAL
   - I/O name: Levmin

### 7.3.11 Step 7 - How to create the block contacts

Next, you specify the block contacts. These inputs/outputs are created in addition to the standard inputs/outputs in the SFC instance.

#### Requirements

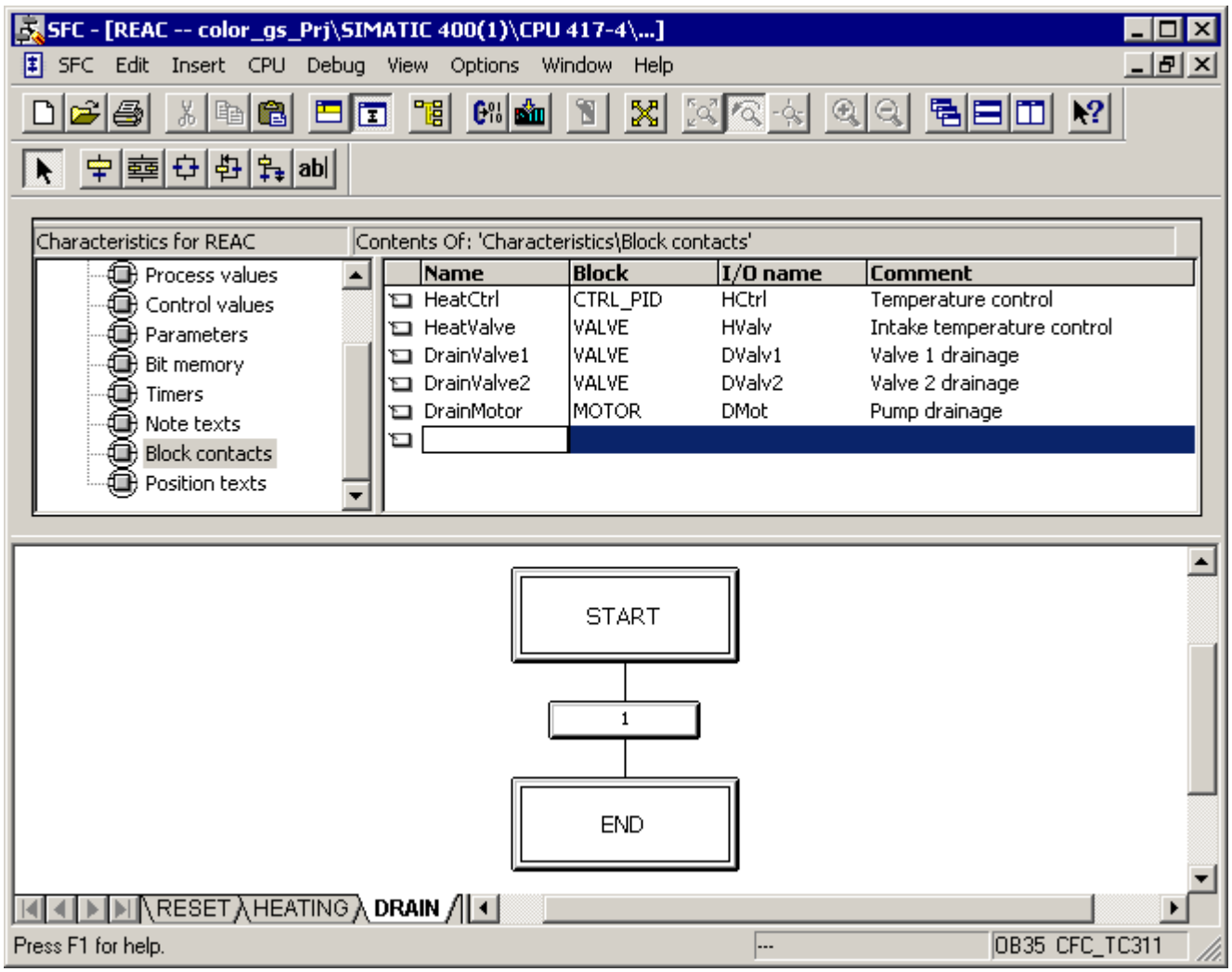
- The example project is open in SIMATIC Manager.
- The "REAC" SFC type is open in the SFC Editor.
- The characteristics editor is open

#### Procedure

1. Select the "Block contacts" entry in the tree view.
   An empty input line is then displayed in detailed window.
2. Place the cursor in the edit box in the "Name" column, and enter the name "HeatCtrl".
3. Press the <TAB> key.
   A drop-down list is displayed in the edit box of the "Block" column and the name you have specified is automatically entered in the "I/O name" column.
4. Select the "CTRL_PID" block from the drop-down list box.
   This drop-down list box contains all the blocks you have used in your project up to now. The chart inputs/outputs for the SFC instance are created based on the selected block.
5. Place the mouse pointer in the "I/O name" column and overwrite the name that was entered automatically with the name "HCtrl".
   The name is short and self-explanatory but contains the essential information, the name of the sequencer and the name of the associated process tag.
6. In the "Comment" column, enter the supplementary information "Temperature control".

7. Enter the following information. To do this, place the cursor in the relevant column and enter the data in accordance with the table:

| Name | Block | I/O name | Comment |
|---|---|---|---|
| Completed already: HeatControl | CTRL_PID | HCtrl | Temperature control |
| HeatValve | VALVE | HValv | Intake temperature control |
| DrainValve1 | VALVE | DValv1 | Valve1 drainage |
| DrainValve2 | VALVE | DValv2 | Valve2 drainage |
| DrainMotor | MOTOR | DMot | Pump drainage |




8. Select **View > Characteristics** from the menu.
This closes the characteristics editor since you have completed all of the required data entries.

## 7.3.12 Step 8 - How to configure the "RESET" sequencer

### Requirements

- The example project is open in SIMATIC Manager.
- The "REAC" SFC type is open in the SFC Editor.
- The tab with the "RUN" sequencer is activated.

### Procedure for defining steps

1. Select **Insert > Step+Transition** from the menu.
2. Insert a new step 3 along with transition 2 below transition 1.
   This sets the structure of the sequencer.
3. Select **Insert > Select** from the menu.
   The mouse pointer changes to a selection cursor.
4. Select the "START" step and then the menu command **Edit > Object Properties...**.
   The "Properties" dialog box opens and the "General" tab is active.
5. Change to the "Processing" tab and enter the following parameters in accordance with the table below.
   Note the following point:

**Note**

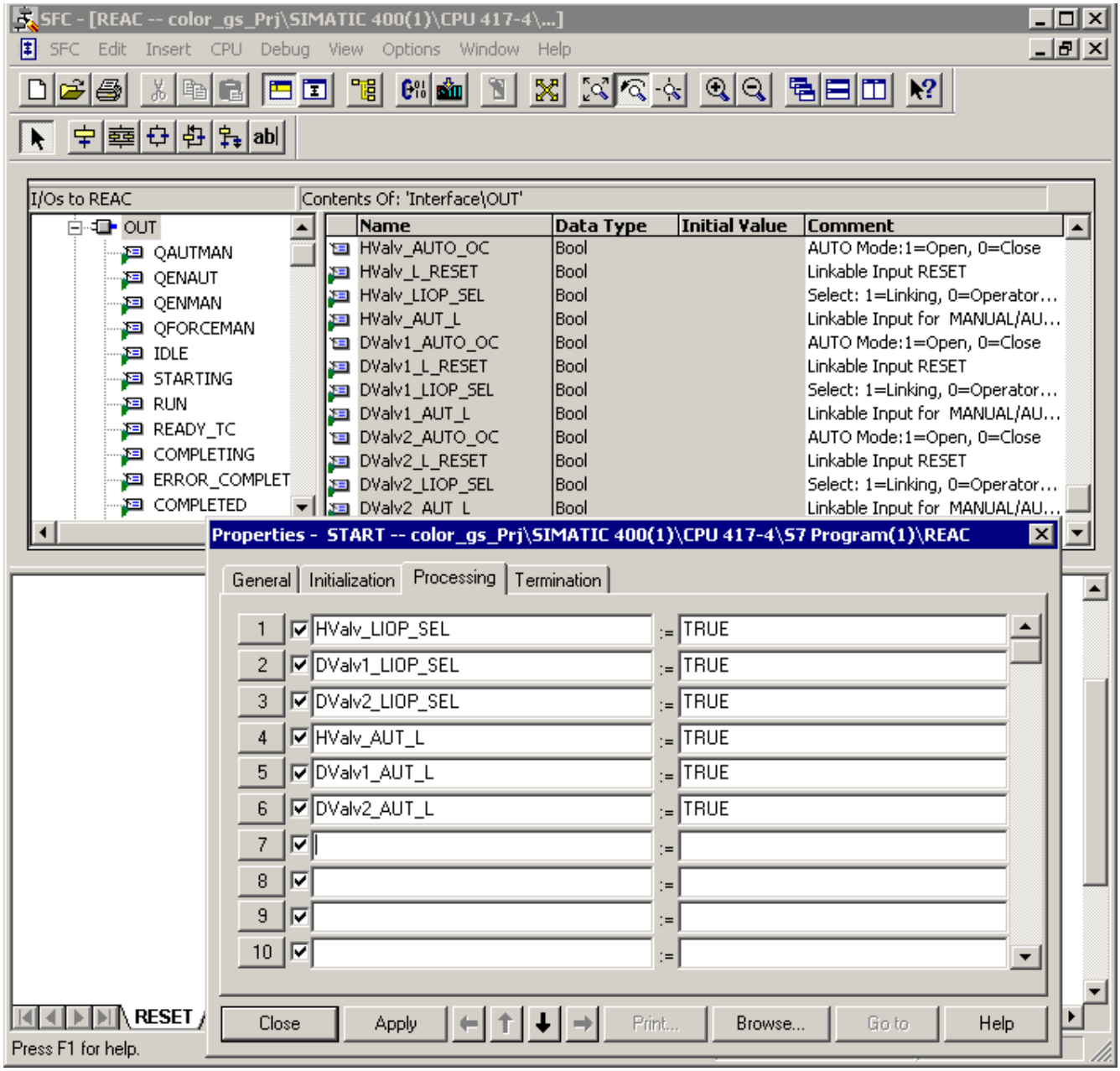
Since you are entering parameters for an SFC type, you will work with the block contacts that you have defined in the characteristics editor. This means that you cannot navigate to the desired block I/O using the "Browse" button and apply it from there.

You will make the work easier by proceeding as follows:

- Select **View > Inputs/Outputs** from the menu.
- Navigate to the corresponding input/output in the overview.
- Drag and drop the I/O name in the input line.

Remember that the "IN" and "OUT" I/Os are interchanged for the SFC type.

| I/O type | Left address | Right address |
|---|---|---|
| OUT | HValv_LIOP_SEL | TRUE |
| OUT | DValv1_LIOP_SEL | TRUE |
| OUT | DValv2_LIOP_SEL | TRUE |
| OUT | HValv_AUT_L | TRUE |
| OUT | DValv1_AUT_L | TRUE |
| OUT | DValv2_AUT_L | TRUE |




6. Click "Apply".

   Video

7. Go to Step 3 using the arrow buttons.
8. Enter the name "CLOSE_VALVE" in the "General" tab and click "Apply".
9. Enter the following parameters in the "Edit" tab:

| I/O type | Left address | Right address |
|---|---|---|
| OUT | HValv_AUTO_OC | FALSE |
| OUT | DValv1_AUTO_OC | FALSE |
| OUT | DValv2_AUTO_OC | FALSE |

10. Click the "Apply" button and then the "Close" button.

## Procedure for defining transitions

1. Select transition "2" and then the menu command **Edit > Object Properties...**.
   The "Properties" dialog box opens and the "General" tab is active.
2. Enter the name "CLOSE_OK".
3. Click "Apply".
4. Change to the "Condition" tab and enter the following parameters:

| I/O type | Left address | Operator | Right address |
|---|---|---|---|
| IN | HValv_QCLOSED | = | TRUE |
| IN | DValv1_QCLOSED | = | TRUE |
| IN | DValv2_QCLOSED | = | TRUE |

5. Click the logic button to logically OR the three addresses.
   The "&" symbol is replaced by the ">1" symbol.
6. Click "Apply" and then "Close".
   All your entries are saved and the "Properties" dialog box closes.

## 7.3.13 Step 9 - How to Configure the "Heating" and "Drain" Sequencers

### Requirements

- The example project is open in SIMATIC Manager.
- The "REAC" SFC type is open in the SFC Editor.

### Procedure for configuring the "HEATING" sequencer

1. Select the "HEATING" tab.
2. Insert four additional steps with transitions below transition 1.
3. Enter the following parameters for the steps:

**Note**

All parameters can be found in the "OUT" inputs/outputs.

| General" tab | | Edit" tab | |
|---|---|---|---|
| Step | Name | Left address | Right address |
| START | Unchanged | HCtrl_LIOP_INT_SEL | TRUE |
| | | HCtrl_SPEXON_L | TRUE |
| | | HCtrl_LIOP_MAN_SEL | TRUE |
| | | HCtrl_AUT_L | TRUE |
| 3 | VALVE_OPEN | HValv_AUTO_OC | TRUE |
| 4 | CONTROL | HCtrl_SP_EXT | SPHeat_Q |
| 5 | SP_DOWN | HCtrl_SP_EXT | 30 |
| 6 | VALVE_CLOSE | HValv_AUTO_OC | FALSE |
| END | Unchanged | HValv_LIOP_SEL | FALSE |
| | | HValv_AUTO_OC | FALSE |
| | | HCtrl_LIOP_INT_SEL | FALSE |
| | | HCtrl_LIOP_MAN_SEL | FALSE |

4. Enter the following parameters for the transitions:

| General" tab | | Condition" tab | | | |
|---|---|---|---|---|---|
| Transition | Name | I/O type | Left address | Operator | Right address |
| 1 | - | - | - | - | - |
| 2 | OPEN_OK | IN | HValv_QOPENED | = | TRUE |
| 3 | TEMP_OK | OUT | SPHeat_AO | >= | SPHeat_Q |
| 4 | SP_LOW | OUT | SPHeat_AO | <= | 60 |
| 5 | CLOSE_OK | IN | HValv_QCLOSED | = | TRUE |

## Procedure for configuring the "Drain" sequencer

1. Select the "Drain" tab.
2. Insert four additional steps with transitions below transition 1.
3. Enter the following parameters for the steps:

**Note**

All parameters can be found in the "OUT" inputs/outputs.

| General" tab | | Edit" tab | |
|---|---|---|---|
| Step | Name | Left address | Right address |
| START | Unchanged | DMot_LIOP_SEL | TRUE |
| | | DMot_AUT_L | TRUE |
| 3 | OPEN_VALVE | DValv1_AUTO_OC | TRUE |
| | | DValv2_AUTO_OC | TRUE |
| 4 | PUMP_ON | DMot_AUTO_ON | TRUE |
| 5 | PUMP_OFF | DMot_AUTO_ON | FALSE |
| 6 | CLOSE_VALVE | DValv1_AUTO_OC | FALSE |
| | | DValv2_AUTO_OC | FALSE |
| END | Unchanged | DValv1_LIOP_SEL | FALSE |
| | | DValv1_AUTO_OC | FALSE |
| | | DValv2_LIOP_SEL | FALSE |
| | | DValv2_AUTO_OC | FALSE |
| | | DMot_LIOP_SEL | FALSE |
| | | DMot_AUTO_ON | FALSE |

4. Enter the following parameters for the transitions:

**Note**

All parameters can be found in the "IN" inputs/outputs.

| General" tab<br>Transition | Name | Condition" tab<br>Left address | Operator | Right address |
|---|---|---|---|---|
| 1 | - | - | - | - |
| 2 | OPEN_OK | DValv1_QOPENED | = | TRUE |
| | | DValv2_QOPENED | = | TRUE |
| 3 | ON_OK | DMot_QRUN | = | TRUE |
| | | Level | < | Levmin |
| 4 | OFF_OK | DMot_QSTOP | = | TRUE |
| 5 | CLOSE_OK | DValv1_QCLOSED | = | TRUE |
| | | DValv2_QCLOSED | = | TRUE |

5. Close the SFC Editor.

## 7.3.14 Step 10 - How to create an SFC instance

### Requirements

- The example project is open in SIMATIC Manager.
- The following CFC charts are open:
  - CFC_TC311
  - CFC_NP311
  - CFC_NK313
  - CFC_NK314
  - CFC_NK315
  - CFC_LI311

### Procedure

1. Select the "color_gs_MP/color_gs_Prj/Plant1/REAC1" folder in the tree view.
2. Insert a CFC chart and name it "SFC_REAC".
3. Open the CFC chart.
4. Select the "Blocks" tab in the catalog and open the "Other blocks" folder.
5. Drag the "REAC" block to the CFC chart.
   This block is the SFC instance that is based on the SFC type you have already created and configured. Here, you will see all I/Os you defined in the block contacts.
   You will also find the setpoints and process values you defined in the Characteristics editor.
6. Select **Edit > Object Properties...** from the menu.
   The "Properties" dialog box opens.
7. Enter the name "REAC" in the "Name" field.
8. Click "OK".
9. Now interconnect to the actual blocks in the corresponding charts:
   - Click on the "HCtrl_SP_Ext" output.
     If the I/O names are not fully visible, move the mouse slowly over the individual inputs/outputs to have the full name of the I/O displayed as a tooltip.
   - Change to the "CFC_TC311" CFC chart.
   - Click on the on the "SP_Ext" input of the "CTRL_TEMP" block.
     **All** inputs and outputs to the control block are closed automatically.

10. Make the following interconnections from the SFC instance to the CFC charts:

| Output SFC_REAC | CFC chart | Block | Input |
|---|---|---|---|
| HValv_AUTO_OC | CFC_NK313 | VALVE | AUTO_OC |
| DValv1_AUTO_OC | CFC_NK314 | VALVE | AUTO_OC |
| DValv2_AUTO_OC | CFC_NK315 | VALVE | AUTO_OC |
| DMot_AUTO_ON | CFC_NP311 | MOTOR | AUTO_ON |

11. Make the following interconnections from the CFC charts to the SFC instance:

| CFC chart | Block | Output CFC chart | Input SFC_REAC |
|---|---|---|---|
| CFC_TC311 | INPUT | V | SPHeat_AI<br>This displays the current control value on the OS of the controller. |
| CFC_LI311 | DRAIN_MIN_LEV | V | Levmin<br>Minimum fill level |
| | TANK_LEV | V | Level<br>Current fill level |

12. Select the menu command **Options > Optimize Run Sequence...**
13. In the "The run sequence of the blocks will be changed and optimized according to the data flow....." message box, click "OK".
    All blocks are then arranged automatically in the correct run sequence.
14. Close the CFC editor.

### 7.3.15 Step 11 - How to store the SFC type in the master data library

#### Requirements

- The example project is open in SIMATIC Manager.
- The component view is activated

#### Procedure

1. Select the "color_gs_MP/color_gs_Prj/SIMATIC 400(1)/CPU 417-4/S7 Program(1)/Charts" folder in the tree view.
2. Copy the "REAC" SFC type.
3. Change to the tree view and select the folder "color_gs_MP/color_gs_Lib/S7 Program(1)/Charts".
4. Insert the SFC type.

# 7.4 Summary

## 7.4.1 Summary of "Rational engineering in the SFC configuration"

### New functions

What have you learned from working with SFC charts?

In addition to using textual interconnections in SFC charts, you have also learned about a very important function for efficient engineering: working with SFC types.

SFC types offer the special advantage of centralized editing. For example, whenever you add a new block contact for an SFC type, this block contact is automatically added to every SFC instance. Changes in the sequencers are also automatically made in every SFC instance.

| NOTICE |
| --- |
| Make changes only to the SFC type that you have saved in the project folder in the component view, and then store the updated version in the master data library. |

# Compiling, downloading, and testing charts

# 8

## 8.1 Compiling, downloading and testing your project

### Introduction

You already know this function from *Getting Started - Part 1*: Compiling and downloading BATCH with the command "Compile and download objects". You enter the required settings in the relevant dialog box.

This part of Getting Started introduces testing of the SFC instance with your specific control strategies. It involves controlling the control strategies through a special connection of the SFC instance.

## 8.2 How to compile and download the project

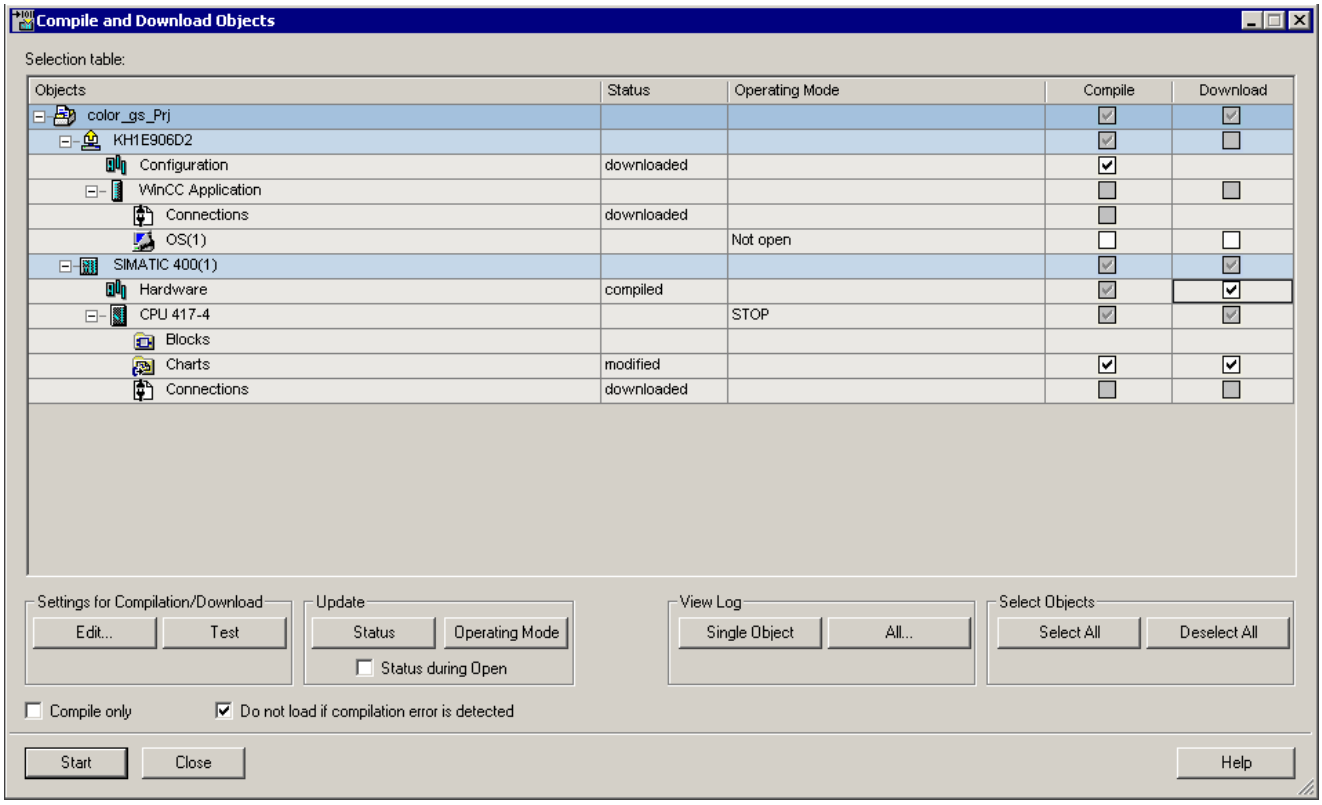
### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.
- The CPU is in STOP.
  The first time you download, you need to download the entire program. It is only possible to download the entire program if the CPU is in STOP mode.

## Procedure

1. Select the "color_gs_MP\color_gs_Prj" folder in the tree view.
2. Select **PLC > Compile and Download Objects** from the menu.
   The "Compile and Download Objects" dialog box opens.
3. Expand the entire tree so that all entries can be seen.
4. Perform the settings in accordance with the following table:

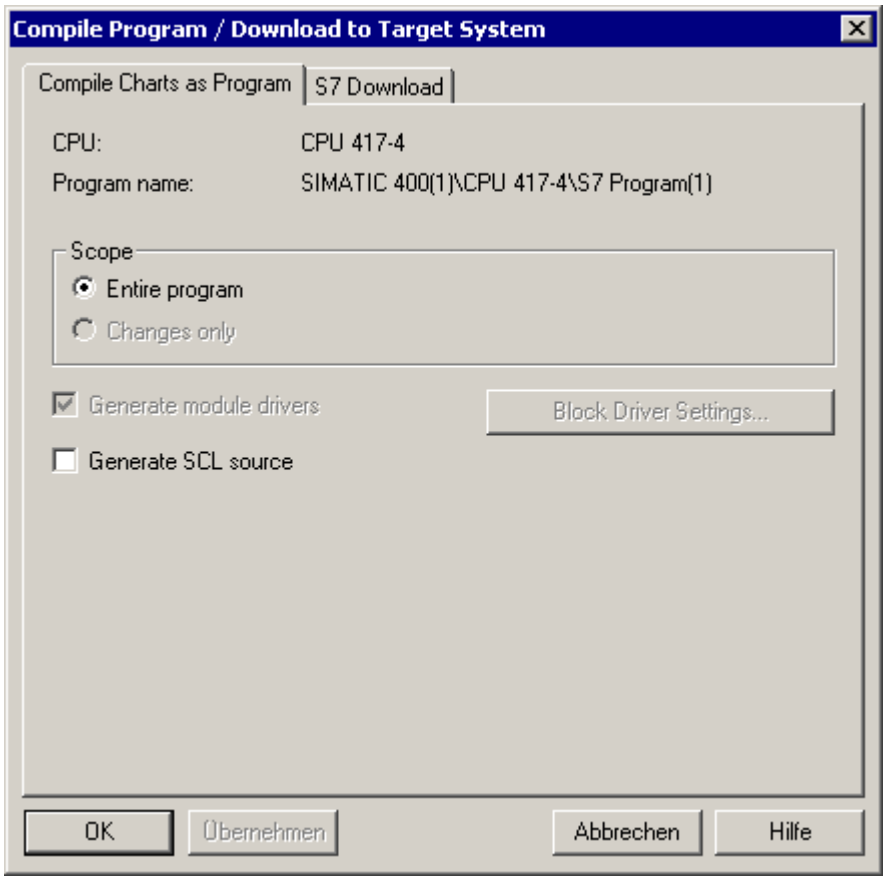
| Object | Compile | Download |
|---|---|---|
| color_gs_Prj/[name of your local PC station]/Configuration | X | - |
| color_gs_Prj/[name of your local PC station]/WinCC Application/OS(1) | - | - |
| SIMATIC 400(1)/Hardware | X | X |
| SIMATIC 400(1)/CPU 417-4/Charts | X | X |




5. Select the "Charts" object in the tree view, and click the "Edit..." button.
   The "Compile Program/Download to Target System" dialog box opens.

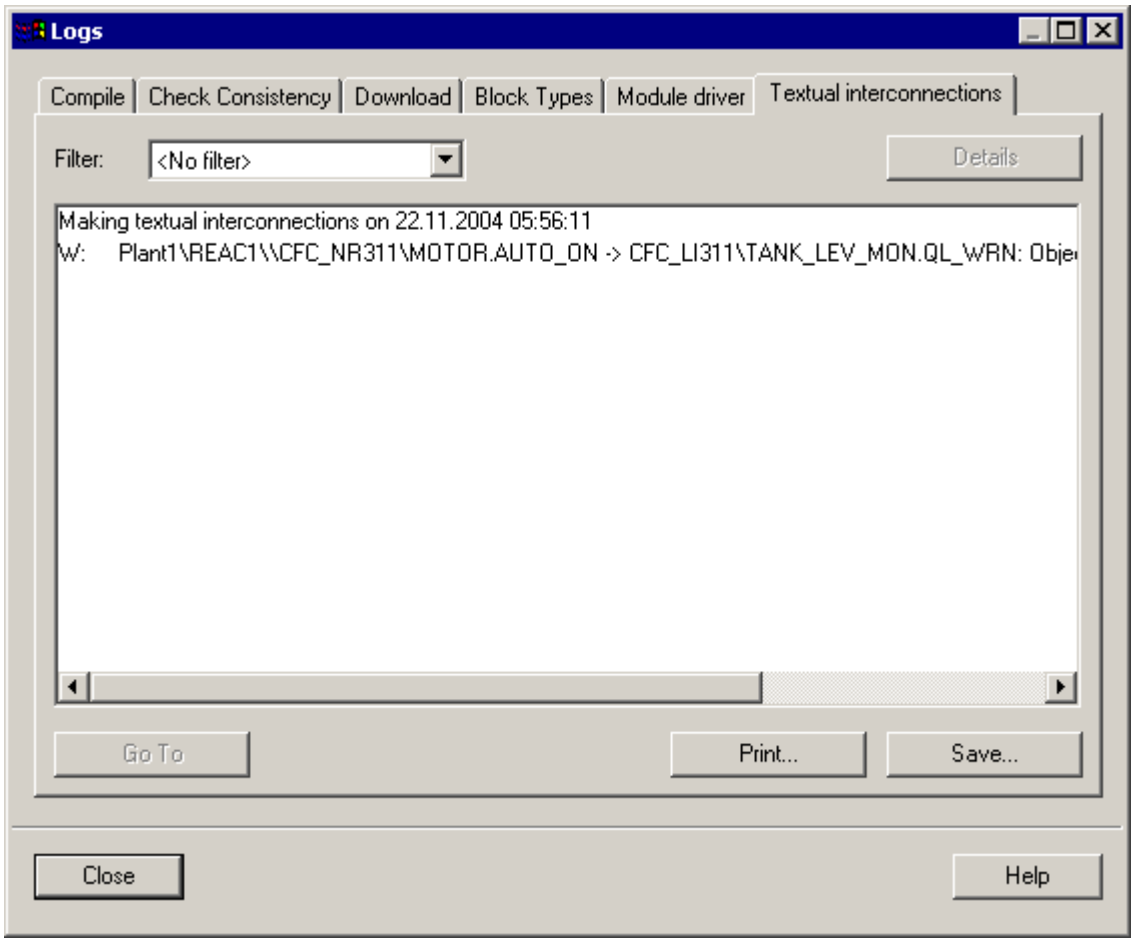
6. Select the following "options":

| Tab | Option | Selected |
|---|---|---|
| Compile charts as program | Entire program | yes |
| | Generate module drivers | yes |
| | Generate SCL source | no |
| Download S7 | Entire program | yes |




7. Click "OK".
8. In the "Remember that if you download later (e.g. in the SIMATIC Manager using...), the blocks will be deleted on the CPU" message box, click "OK".
9. Click the "Start" button.
10. Click "OK" in the first message box "Downloading program changes during operation can, in the case of malfunctions or program errors, cause serious damage to personnel and equipment!...".

11. Click "Yes" in the second message box "If you want to download changes online, please make sure that the prerequisites have been met.... Do you want to continue?"
    The compilation and download are started.
    When the function is completed, the log file is displayed in the text editor: The compilation of the charts completed with warnings.
12. Close the text editor.
13. Select the "Charts" object in the tree view, and click on "Single Object" in the "Display Log" area.
    The "Logs" dialog box opens. The detailed warnings are shown here. These warnings are displayed because the textual interconnections could not be completed with the current project status. These interconnections can only be completed when the configuration of the REAC2 part of the plant is finished. You can still test the project in this condition despite the warnings.




14. Click "Close".
    The "Logs" dialog box closes.
15. Change the CPU back to RUN.
    Since you have configured external I/O in HW Config without closing the connections, the following error LEDs light on the CPU:
    - EXTF – steady light
    - BUS2F – flashing

## 8.3 How to test the program

If you want to test your configured control strategies on the ES, you must connect the corresponding inputs. You have no operator interface on which to select the corresponding control strategy.

### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.

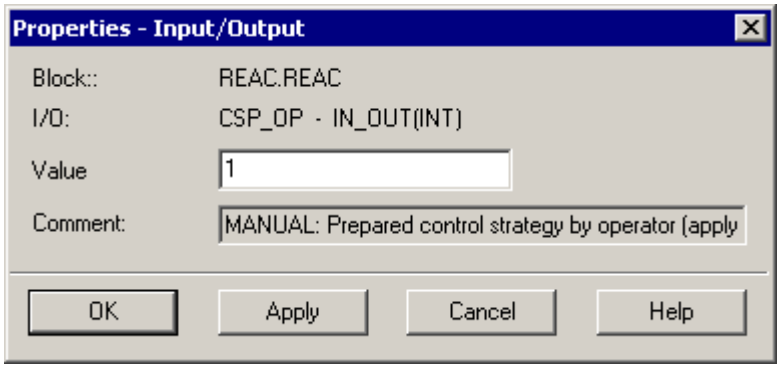
**Note**

If you want to include the RMT1 and RMT2 parts of the plant in the test, make sure that you start a drain operation after every filling operation.

### Procedure

1. Go to the tree view and select the folder "color_gs_MP\color_gs_Prj\Plant1\REAC1".
2. Open the "SFC_REAC" CFC chart in the CFC Editor.
3. Select the "REAC" SFC instance, and select **Edit > Object Properties** from the menu.
4. Set the "CSP_OP" I/O to make it visible, and click "OK".
   As default, the I/O has the value "0".
5. Select **Debug > Test Mode** from the menu.
   This brings you into test mode: you are already familiar with this function from Getting Started - Part 1.
6. Double-click on the "CSP_OP" input.
   The "Properties - Input/Output" dialog box opens.

7. Enter the number of the desired control strategy in the "Properties - Input/Output" dialog box and click "OK".




| CSP_OP | Control strategy |
|---|---|
| 1 | HEATING |
| 2 | DRAIN |

1. Select the SFC instance "REAC" and then select **Edit > Open** from the menu.
   The SFC instance is opened in the SFC editor and the "RESET" tab is active.
2. Select **Debug > Test Mode** from the menu.
   You change to the test mode.
3. Click the "Start" button.
   The "RESET" sequencer is started first.
   Immediately after this, the control strategy you set at the "CSP_OP" input in the CFC editor is started automatically.
4. Enter another control strategy in the CFC chart and start the sequencer again.

**Note**

To monitor the values at the inputs and outputs in the CFC charts, open the desired CFC charts in the CFC Editor and go into test mode there.

Use the following procedure to make the values at the connections visible:

1. Press the shortcut <CTRL+A>.
   This selects all the blocks in the CFC chart.
2. Select **Debug > Watch On** from the menu.
   The values at the I/Os are then displayed.
3. If you want to monitor additional inputs/outputs, select the desired I/O and select **Debug > Input/Outputs > Add to Watch List** from the menu.

5. Enter "0" again at the "CSP_OP" input.

# Configuring the PCS 7 OS

# 9

## 9.1 Overview of work when configuring the OS

### Introduction

You have already made many of the settings for OS configuration in SIMATIC Manager. When configuring the OS, you will access these data conveniently. This includes the following functions, for example:

- You will conveniently interconnect the picture objects with the block inputs/outputs from the CFC charts when creating process pictures.
- You have already assigned block icons to the process tags in the CFC charts enabling you to create the block icons automatically.
- You defined the plant hierarchy in the SIMATIC Manager and made the settings for the OS area. This hierarchy is automatically represented on the OS in process mode.

### Work involved in OS configuration

During OS configuration, you will perform the following configuration steps:

- Creating and using your own icons
  You will create a new icon for the agitator in the reactor and for the pump for draining. For this purpose, you will use the functions for creating graphics that you became familiar with when creating the process pictures in Getting Started - Part 1.
- Creating the status display
  Here, you will combine the newly created icon for the agitator with a status display.
- Adapting the standard block icons
  There are two motors in the "REAC1" unit: One motor acts as an agitator, the other as a pump. These two functions should be easy to recognize by the plant operator based on the block icons. You will therefore modify the default block icon for the motor.
- Creating the process picture for the "REAC1" plant section
  You are already familiar with this work from creating the process picture for the "RMT1" and "RMT2" parts of the plant.
- Adapting the process pictures for the plant sections "RMT1" and "RMT2"
  These corrections are necessary to combine the plant sections RMTx and REACx.

# 9.2 Creation of icons

## 9.2.1 How to create your own icons for process pictures

### Custom icons for process tags

When you create plant-specific process pictures, it may be necessary to create you own special icons, for example, for process tags. You will create these icons once and then be able to use them repeatedly.

In this Getting Started, you will create custom icons for the following process tags:

- Agitator in the reactor
- Pump for drainage

All of the icons that you create will be stored together in a separate file. Each individual icon will then be exported to a separate picture file with the *.emf format. You can then use the picture for representing different states in a status display.

## 9.2.2 How to open the picture file for your icons

You will store all of the icons that you have created yourself in this file.

### Requirements

- The example project is open in SIMATIC Manager.
- The component view is activated

### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Prj/[Name of PC station]/WinCC Application/OS(1)".
2. Select **Edit > Open Object** from the menu.
   The WinCC Explorer opens.
3. In the navigation window, select the "Graphics Designer" object.
4. Open the context menu and select **Open**.
   An empty file opens in the Graphics Designer.
5. Select **File > Save as...** from the menu and save the file with the name "status_display.pdl" in the suggested directory.

## 9.2.3 How to create the icons for the agitator

### Requirement

The "status_display.pdl" file is open in the Graphics Designer.

### Procedure

1. If the object palette is not displayed, select **View > Toolbar** from the menu and select the "Objects" check box.
2. Create a long rectangle.
3. Select **View > Properties...** from the menu.
   The "Object Properties" dialog box opens.
4. Enter the following parameters – for all other parameters accept the default values:

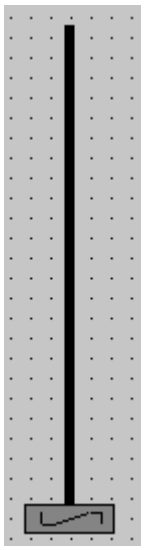
| Property | Attribute | Static" parameter column |
|---|---|---|
| Rectangle | Object name | Axis |
| Rectangle/Geometry | Width | 5 |
| | Height | 240 |
| Rectangle/Colors | Background color | Black |

5. Create a second rectangle with the following parameters

| Property | Attribute | Static" parameter column |
|---|---|---|
| Rectangle | Object name | Background |
| Rectangle/Geometry | Width | 45 |
| | Height | 15 |
| Rectangle/Colors | Background color | Dark gray |

6. Now create an agitator icon from several lines:

7. Position the icon on the small rectangle.
8. Assemble all of the elements to form a symbolic representation for an agitator.

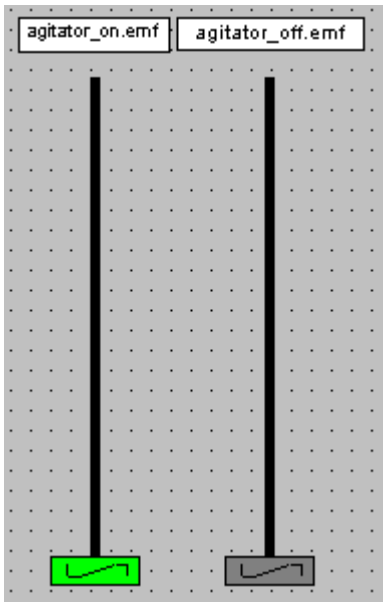


9. Select all of the elements with the mouse and create a copy.
10. Assign the small rectangle the color "green".

11. Add descriptive static text fields:

| Type of agitator icon | Text field/File name |
|---|---|
| Green agitator icon | agitator_on.emf |
| Gray agitator icon | agitator_off.emf |

12. Select all of the elements of the green agitator – except the explanatory text fields – with the mouse, and select **Edit > Group > Group** from the menu.
13. Then select all the elements of the gray agitator - except the explanatory text fields - with the mouse, and select **Edit > Group > Group** from the menu.




14. Save the "status_display.pdl" file.
15. Select the green agitator icon and then select **File > Export...** from the menu
    The "Save as Metafile" dialog box opens and the graphics folder for your project is selected automatically.
16. Enter the file name "agitator_on.emf" and click "Save".
17. Select the gray agitator and export the object to the "agitator_off.emf" file.

## 9.2.4 How to create the icons for the pump

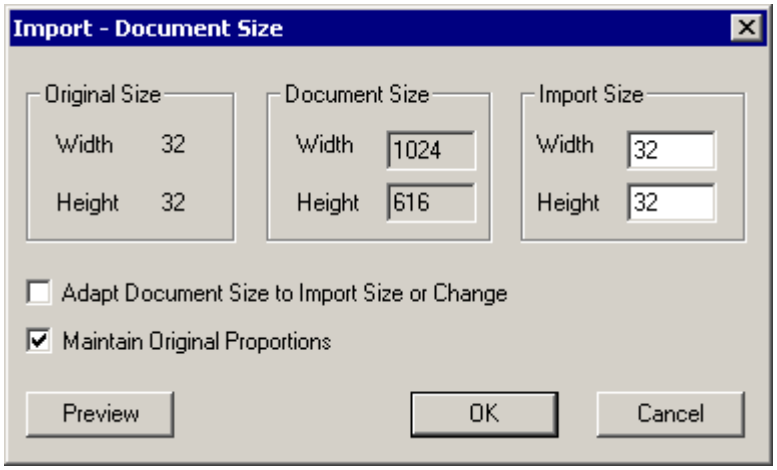
The icons for the pump are also stored in the "status_display.pdl" file. You do not create the icons from scratch; instead, you modify an existing icon.

### Requirement

The "status_display.pdl" file is open in the Graphics Designer.

### Procedure

1. Select **Insert > Import** from the menu.
   The "Load Metafile" dialog box opens.
2. Select the "@motor_on.emf" file and click "Open".
   The "Import - Document Size" dialog box opens.




3. Accept the default settings and click "OK".
   The icon for a motor, which you are already familiar with from Getting Started - Part 1, is imported.
4. Delete the letter "M".
5. Select the "Polygon" object from the object palette and create a triangle roughly in the form of the pump icon as shown in the illustration below.

**Note**

Click once with the mouse for each corner and complete the polygon by double-clicking.

6. Enter the following parameters:

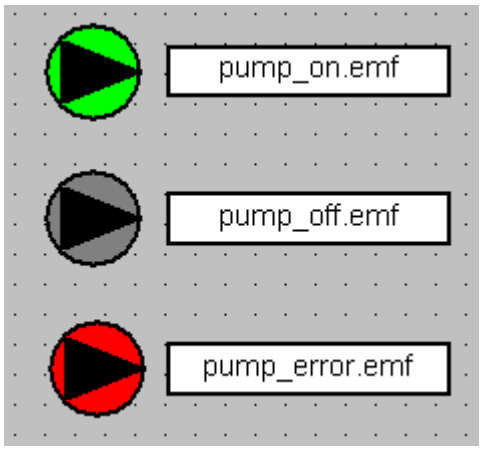
| Property | Attribute | Static" parameter column |
|---|---|---|
| Polygon | Object name | Pump |
| Polygon/Geometry | Width | 25 |
| | Height | 20 |
| Polygon/Colors | Background color | Black |

7. If the triangle is not symmetric, grab the right corner with the mouse and drag it to the correct position.

8. Insert the triangle in the circle.
9. Select all of the elements with the mouse and create a copy.
10. Select the circle and assign it the color "dark gray".
11. Create a third copy and assign the color "red" to the circle in this copy.
12. Group the individual elements for each icon without the explanatory text fields.

13. Create explanatory text fields for each icon:

| Symbol | Text field/File name |
|---|---|
| Green circle | pump_on.emf |
| Dark gray circle | pump_off.emf |
| Red circle | pump_error.emf |




14. Save the "status_display.pdl" file.
15. Export the new icons and assign file names based on the entries in the corresponding text fields.
16. Close the "status_display.pdl" file.

# 9.3 Working with standard block icons

## 9.3.1 Where are the standard block icons stored?

### Modification of block icons

In the next step you will modify the existing default block icons provided by PCS 7. The default block icons are stored in a specific file:
In the "@@PCS7Typicals.pdl" file that is installed automatically when you install PCS 7. You do not, however, save your modified block icons in the original file but in a new one. In *Getting Started - Part 2*, this file is given the name "@PCS7Typicals_gs2.pdl".

Do not confuse the block icons with the icons you have created in the "status_display.pdl" file. The icons that you have already created are pure graphic elements.

Block icons provide many functions:
Starting from one block icon, you can, for example, open faceplates in process mode that will give you extensive information about the process tag. Some block icons already have an integrated group display or status display.

The most important thing about the default block icons is the assignment to specific blocks in the CFC charts so that they are created automatically.

### File Names "@@PCS7Typicals.pdl" and "@PCS7Typicals _gs2.pdl"

The name of the "@@PCS7Typicals.pdl" file must not be changed:
With this name, PCS 7 automatically knows which file it must take the block icons from when executing the "Create/update block icons" function. If only the "@@PCS7Typicals.pdl" file is available, PCS 7 automatically takes the block icons from this file.

If you wish to use modified block icons in your project, you can store them in the corresponding template files. You can use up to 10 different template files.

When assigning the file name, you must ensure that the file name consists of the fixed name component "@PCS7Typicals" plus an additional variable name component. The fixed name component is always at the beginning of the file name and is required for PCS 7 to identify the files in which the additional block icons are stored. You assign the variable name component according to your project requirements.

## 9.3.2 Modification of the default block icons

### Purpose

For *Getting Started - Part 2*, you modify the following default block icons:

- "MOTOR"
- "SFC type"

### "MOTOR" block icon

You are already familiar with the "MOTOR" block icon from *Getting Started - Part 1*. The default block icon represents the motor with an "M" inside a circle. Since motors have a variety of functions in the "REAC" unit, you should make these functions clearly recognizable to the plant operator at first glance. The agitator is represented by an "M" within a circle. Since there is no need to make any changes here, you use the default block icon.

However, the pump requires another block icon. It is displayed as a triangle within a circle. This block icon is the one you will create. You have already done the preparatory work for this in the "status_display.pdl" file, where you created the icons for the graphical display.

### Assignment of block icons to the blocks

You may remember this from *Getting Started - Part 1*. There you entered specific numbers in the process object view to define the vertical or horizontal orientation of the "VALVE" block icon in the process picture. Of course, these numbers are also available in the data for the block icon, enabling the block icons to be assigned to the blocks. You will also make this assignment for the pump and agitator.

### "SFC type" block Icon

You call the faceplate with the help of this block icon. From there you can manipulate the SFC instance in process mode, for example, select control strategies or specify setpoints. Of course, a separate block icon must therefore be available for each SFC instance. Copies of the default block icon "SFC type" are created for this purpose. The corresponding SFC instances are then assigned to each copy.

## 9.3.3 How to create a new template file

### Requirement

The operator station OS (1) in WinCC Explorer is open.

### Procedure

1. Select the "OS(1)\Graphics Designer" object in the tree view.
2. Position the cursor in the detailed window.
3. Open the context menu and select the menu command **New Picture**.
   A new picture with the file name "NewPdl0.Pdl" is added at the end of the list.
4. Select this new picture in the detailed window.
5. Open the context menu and select **Rename Picture** from the menu.
6. Enter the name "@PCS7Typicals_gs2.pdl" in the dialog box and click "OK".
   This renames your new template file.

## 9.3.4 How to modify the default block icons

### Overview

You modify the default block icons in four steps:

| Step | What? |
|---|---|
| 1 | Store copies of the block icons required (Page 172) |
| 2 | Modify properties for the "MOTOR" block icon (Page 173) |
| 3 | Modify the representation of the pump (Page 174) |
| 4 | Modify the "SFC-TYP" block icon (Page 176) |

### 9.3.5 Step 1 - How to store copies of the required block icon

#### Requirement

The operator station OS (1) in WinCC Explorer is open.

#### Procedure

1. Open the "@PCS7Typicals_gs2.pdl" file.
   This is the file in which you save your project-specific block icons.
2. Open the "@@PCS7Typicals.pdl" file in the Graphics Designer.
   This is the file containing the standard block icons.
3. Select the "MOTOR" block icon including the title "MOTOR" in the "MOTOR" line of the "@@PCS7Typicals.pdl" file, and select **Edit > Copy** from the menu.
4. Switch to the "@PCS7Typicals_gs2.pdl" file and select **Edit > Paste** from the menu.
   A copy of the "MOTOR" block icon is inserted.
5. Position the block icon at the upper left of the drawing area.
6. Switch to the "@@PCS7Typicals.pdl" file and mark the block icon "SFC Type" in the "Other" row.
7. Select **Edit > Copy** from the menu.
8. Switch to the "@PCS7Typicals_gs2.pdl" file and select **Edit > Paste** from the menu.
   A copy of the "SFC_Type" block icon is inserted.
9. Position the "SFC_Type" block icon below the "MOTOR" block icon.
10. Save the "@PCS7Typicals_gs2.pdl" file.
11. Close the "@@PCS7Typicals.pdl" file.

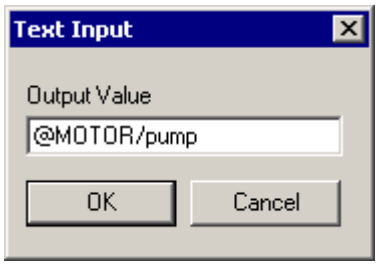
## 9.3.6 Step 2 - How to change the properties of the "MOTOR" block icon

### Requirement

- The "@PCS7Typicals_gs2.pdl" file is open in the Graphics Designer.

### Procedure

1. Change the title to "PUMP" just like in a standard text box.
2. Select the newly inserted block icon.
3. Select the menu command **View > Properties**.
4. Select the "General" property.
5. Double-click on the "Type" attribute.
   The "Text Input" dialog box opens.
6. Enter the following in the "Output value" field: "@MOTOR/pump".




**Note**

You are already familiar with the "pump" value from your work in creating the motor process tags. In that case you changed the existing process tags by adding an additional parameter: the "BlockIcon" parameter. You entered exactly this value in the "BlockIcon" column in the import file.

7. Click "OK" and close the "Object Properties" dialog box.
8. Save the file.

## 9.3.7 Step 3 - How to adapt the representation of the pump

### Requirement

- The "@PCS7Typicals_gs2.pdl" file is open in the Graphics Designer.

### Procedure

1. Select the block icon with the title "PUMP".
2. Select **Edit > Customized Object > Edit...**in the menu
   You use this to divide the block icon, which is implemented as a customized object, into individual elements. You can edit these individually.

| NOTICE |
| --- |
| Do not select "Ungroup" from the menu under any circumstances. This ungroups the customized object, and the entire configuration of the block icon will be deleted. |

3. Select the circle with "M".
   This graphic element has been implemented as a so-called "status display (expanded)".
4. Open the context menu and select the menu command **Configuration Dialog...**
   The "Extended Status Display Properties" dialog box opens.
5. Change to the "Assign pictures" tab.
6. Select "Index 0" in the first row.
   The assigned pictures are displayed in the preview.
7. Make sure that the "*.wmf,*.emf" check box is activated.
   This means that all pictures with the file extension "*.emf" and "*.wmf" are displayed.
8. Double-click on the "pump_off.emf" file in the list of pictures.
   Both the preview and the list show that the original motor representation has been replaced in the basic picture by the pump representation.
9. Now double-click on the "pump_on.emf" file in the list of pictures.
   Both the preview and the list show that the original motor representation has been replaced in the flashing picture by the pump representation.
10. Select the next line "Index 1".

11. Replace all other pictures in similar manner:

| Row | Basic picture | New basic picture | Flashing picture | New flashing picture |
|---|---|---|---|---|
| Completed:<br>Index 0 | @motor_is_off.emf | pump_off.emf | @motor_is_on.emf | pump_on.emf |
| Index 1 | @motor_is_on.emf | pump_on.emf | - | - |
| Index 2 | @motor_is_off.emf | pump_off.emf | - | - |
| Index 3 | @MOTOR_Error.emf | pump_error.emf | - | - |

12. Click "OK".
    You can see that the representation of the pump has already changed in the "@PCS7Typicals_gs2" file.
13. Keeping the mouse button pressed, draw a lasso around all elements of the block icon and select **Edit > Customized Object > Finish Editing** from the menu.
14. Save the "@PCS7Typicals_gs2" file.

## 9.3.8 Step 4 - How to modify the "SFC TYPE" block icon

### Creating block icons for SFC instances

**Note**

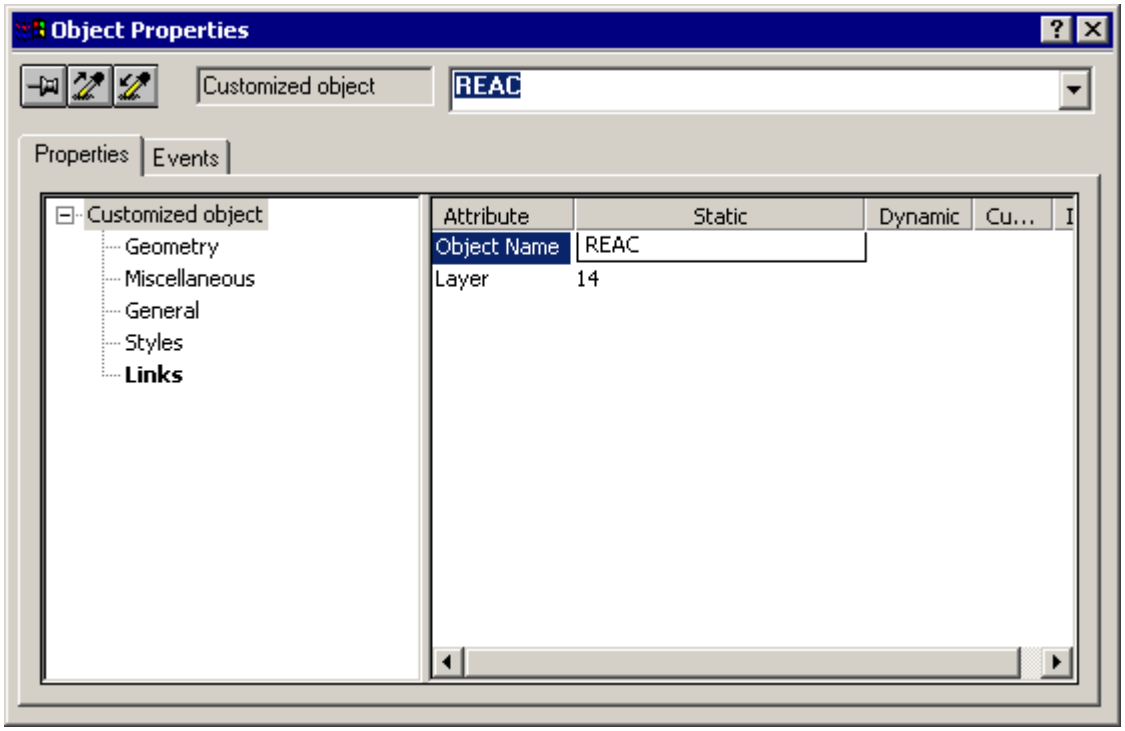
When you execute the "Create/Update Block Icons" function, a block icon is automatically placed in the appropriate picture and interconnected for all SFC instances that are enabled for operator control and monitoring.

### Requirement

- The "@PCS7Typicals_gs2.pdl" file is open in the Graphics Designer.

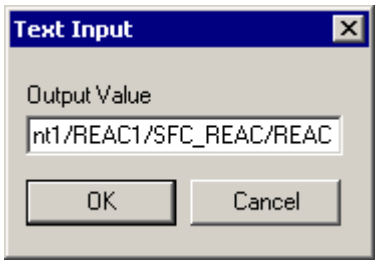
### Procedure

1. Change the title of the "SFC_TYPE" block icon to "SFC_TYPE_REAC".
2. Select the faceplate icon and the **View > Properties...** from the menu.
   The "Object Properties" dialog box opens.
3. Select the "@SFC_Typ/1" property.
4. Double-click the "Object name" attribute and enter the name "REAC".



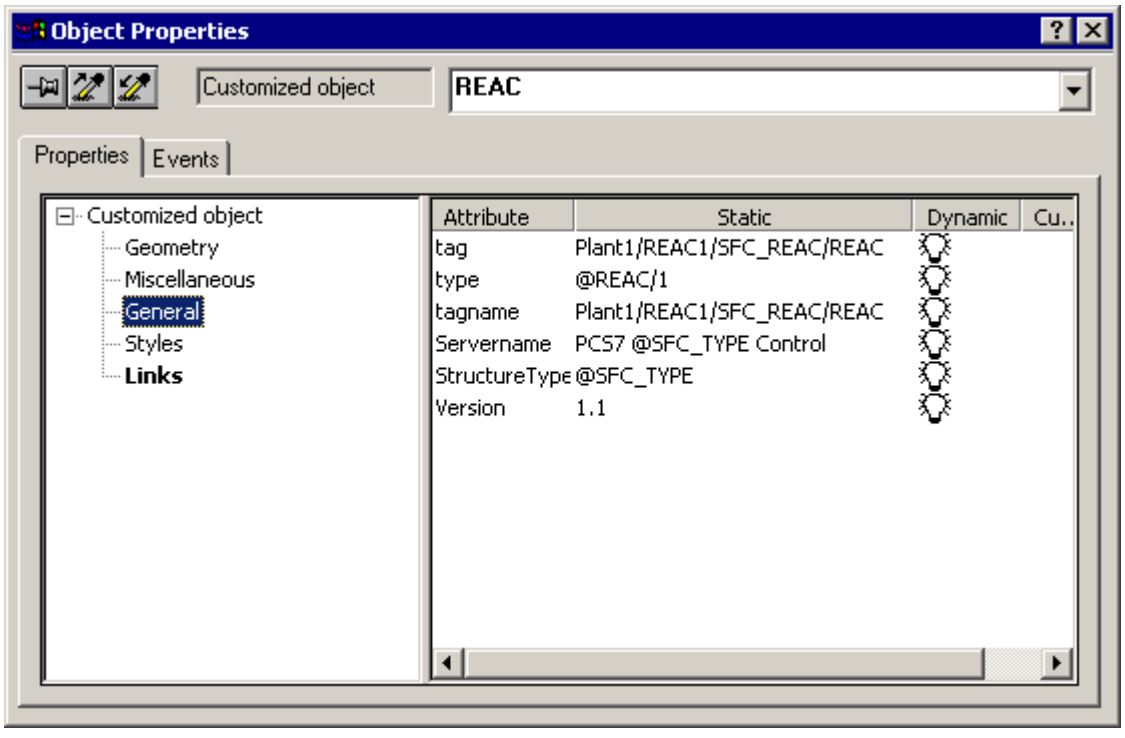

5. Select the "General" property.

6. Double-click on the "Tag" attribute.
   The "Text Input" dialog box opens.
7. In the "Output Value" box, enter the complete path to the SFC instance including the name of the SFC instance in the CFC chart:
   "Plant1/REAC1/SFC_REAC/REAC".




8. Enter the following values:

| Property | Attribute | Value |
|---|---|---|
| General | Type | @REAC/1 |
| General | Tag name | Plant1/REAC1/SFC_REAC/REAC |




9. Close the "Object Properties" dialog box.
10. Save the "@PCS7Typicals_gs2" file.
11. Close the Graphics Designer and close WinCC Explorer.

# 9.4 Creating block icons and compiling the OS

## 9.4.1 Creating block icons and compiling the OS

### Functions in the plant hierarchy

In order to generate block icons, you also need to run functions in the plant hierarchy – you are already familiar with this from *Getting Started - Part 1*. The steps involved are briefly outlined in the following sections.

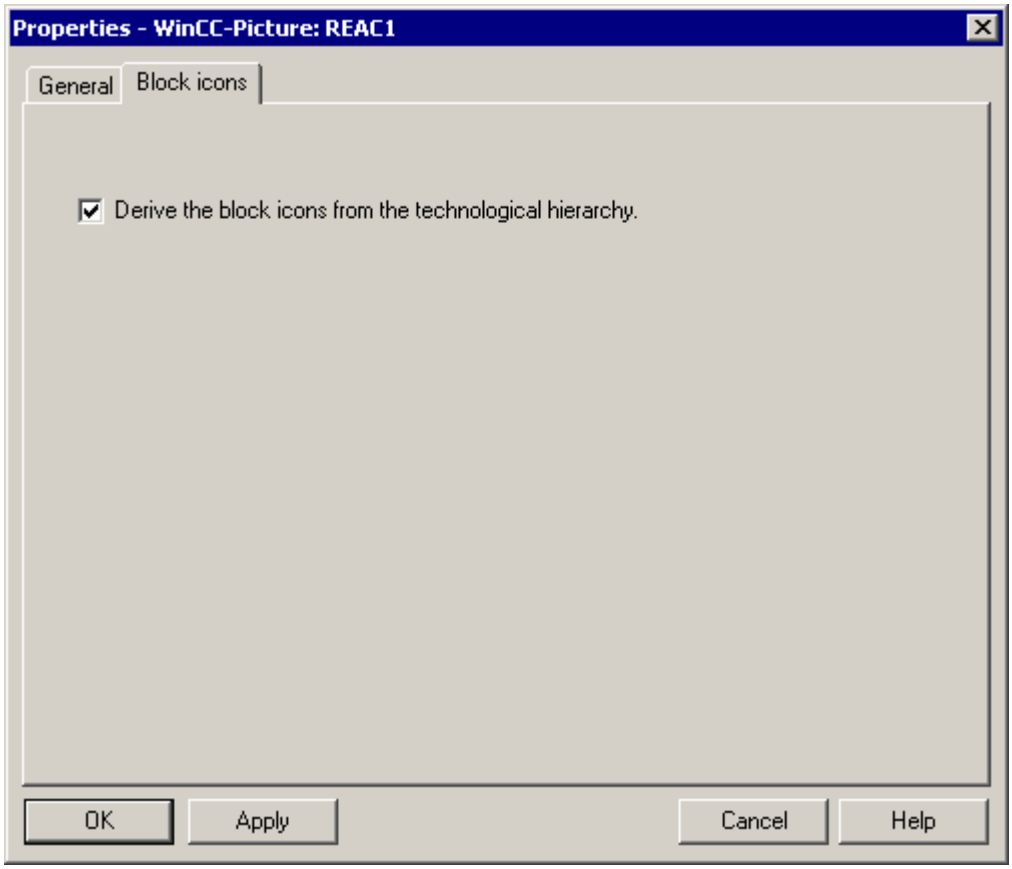
## 9.4.2 How to select the option for creating block icons

### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.
- WinCC Explorer is closed.

### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Prj/Plant1/REAC1".
2. Select the "REAC1" process picture in the detailed window and open the object properties.
3. In the "Block Icons" tab, select the "Derive the block icons from the technological hierarchy" check box.




4. Click "OK" and close the dialog box.

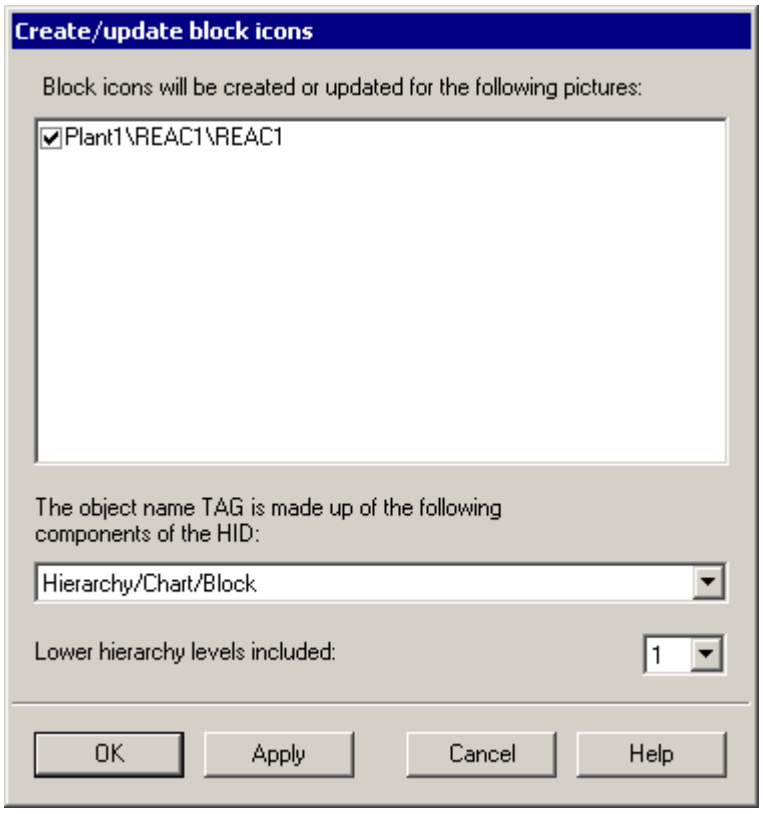
## 9.4.3 How to create the block icons

### Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.
- The option for creating block icons is selected.

### Procedure

1. Go to the tree view and select the folder "color_gs_MP/color_gs_Prj/Plant1/REAC1".
2. Select **Options > Plant Hierarchy > Create/Update Block Icons** from the menu.
3. Check the following:
   - The correct picture is selected.
   - The "Included lower level hierarchy levels" are set to "1".

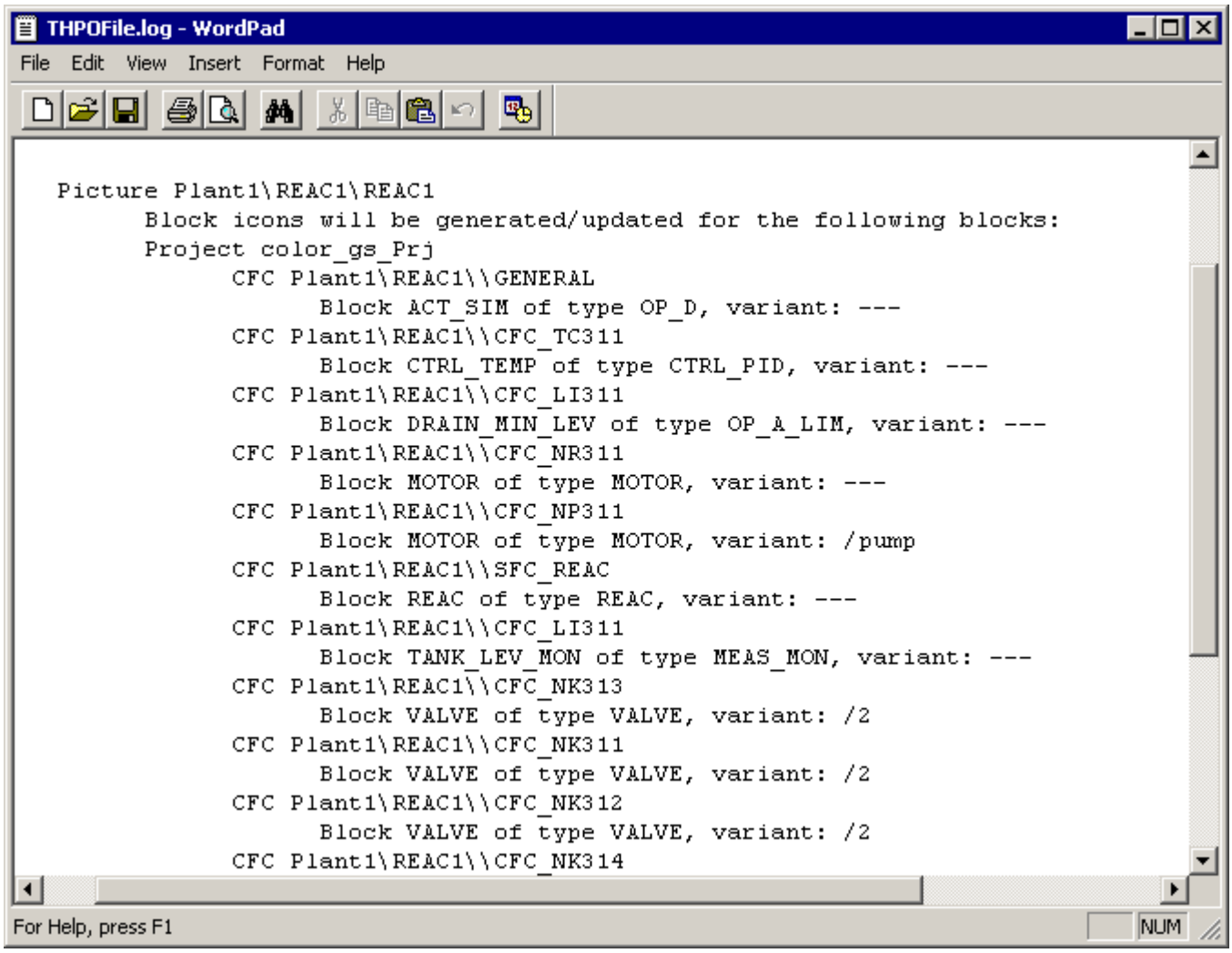



4. Click "OK".
   The block icons are generated.

5. In the "To ensure possible automatic corrections to the WinCC picture interconnections,…. Do you want to see the function log now?" message box, click "Yes". The log is opened in the text editor. There you will see the process tags for which block icons have been created. You can also see the variant.

   For the "Valve" process tag, for example, Variant "2" signifies the horizontal representation. For the "Motor" process tag, the "pump" variant signifies the representation of the motor as a pump.

   This is the name you entered in the import/export file and which has now been used when creating the block icons.




6. Close the text editor.

**Note**

If the log is not displayed, select **Options > Plant Hierarchy > Open Block Icons Log** from the menu.

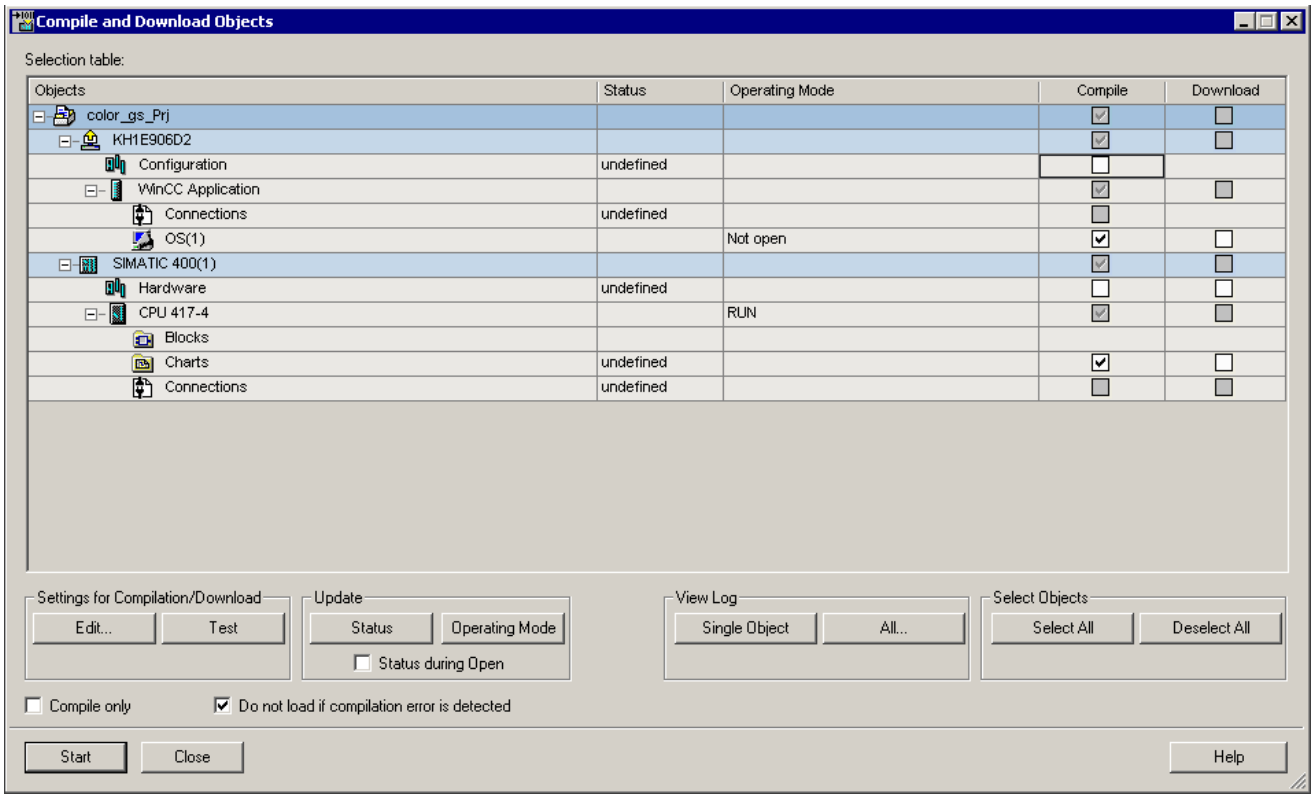
## 9.4.4 How to compile the OS

### Requirements

- SIMATIC Manager is open.
- The plant view is activated.
- The block icons have been created.

### Procedure

1. Switch to the component view.
2. Select the "color_gs_MP\color_gs_Prj" folder in the tree view.
3. Select **PLC > Compile and Download Objects** from the menu.
   The "Compile and Download Objects" dialog box opens.
4. Expand the entire tree so that all entries can be seen.
5. Select the following check boxes:
   - Object "OS(1)": check box in the "Compile" column
   - Object "Charts": check box in the "Compile" column



6. Select the "OS(1)" object in the tree view, and click the "Edit" button.
7. In the "Settings: Compile OS" wizard, take the following steps:

| Step | Actions |
|---|---|
| "Which areas do you want to assign to the operator station OS(1)?" | No additional settings are required here because OS(1) is already assigned for all areas by default and you will not use any other operator stations in your project. |
| "Select the network connections for the S7 programs associated with the areas" | Click the "Connection" button and select the S7 connection you have made in NetPro in the "Select network connection" dialog box. |
| "Select the data you want to compile and the scope of the compilation" | Select the following check boxes or radio buttons:<br>• Tags and messages<br>• SFC Visualization:<br>• Picture Tree<br>• Entire OS with memory reset |

8. Click "Apply".
9. Click the "Start" button.
10. Click "Yes" in the second message box "If you want to download changes online, please make sure that .... Do you want to continue?".
    The compilation starts and when it is completed, the log file is displayed in the text editor.
    The compilation is completed with warnings because the open textual interconnections cannot be made at this stage of the configuration.
11. Close the text editor.
12. Close the "Compile and Download Objects" dialog.

# 9.5 Creating a process picture

## 9.5.1 Creating a process picture

### Overview

You already know how to create a process picture from your work in *Getting Started - Part 1*. The steps involved in this work are briefly outlined in the following. Detailed instructions are provided for all tasks that were not covered in the first part of Getting Started. This includes the following configuration steps::

- Inserting and configuring the status display
- Inserting the buttons

## 9.5.2 How to create the process picture

### Requirement

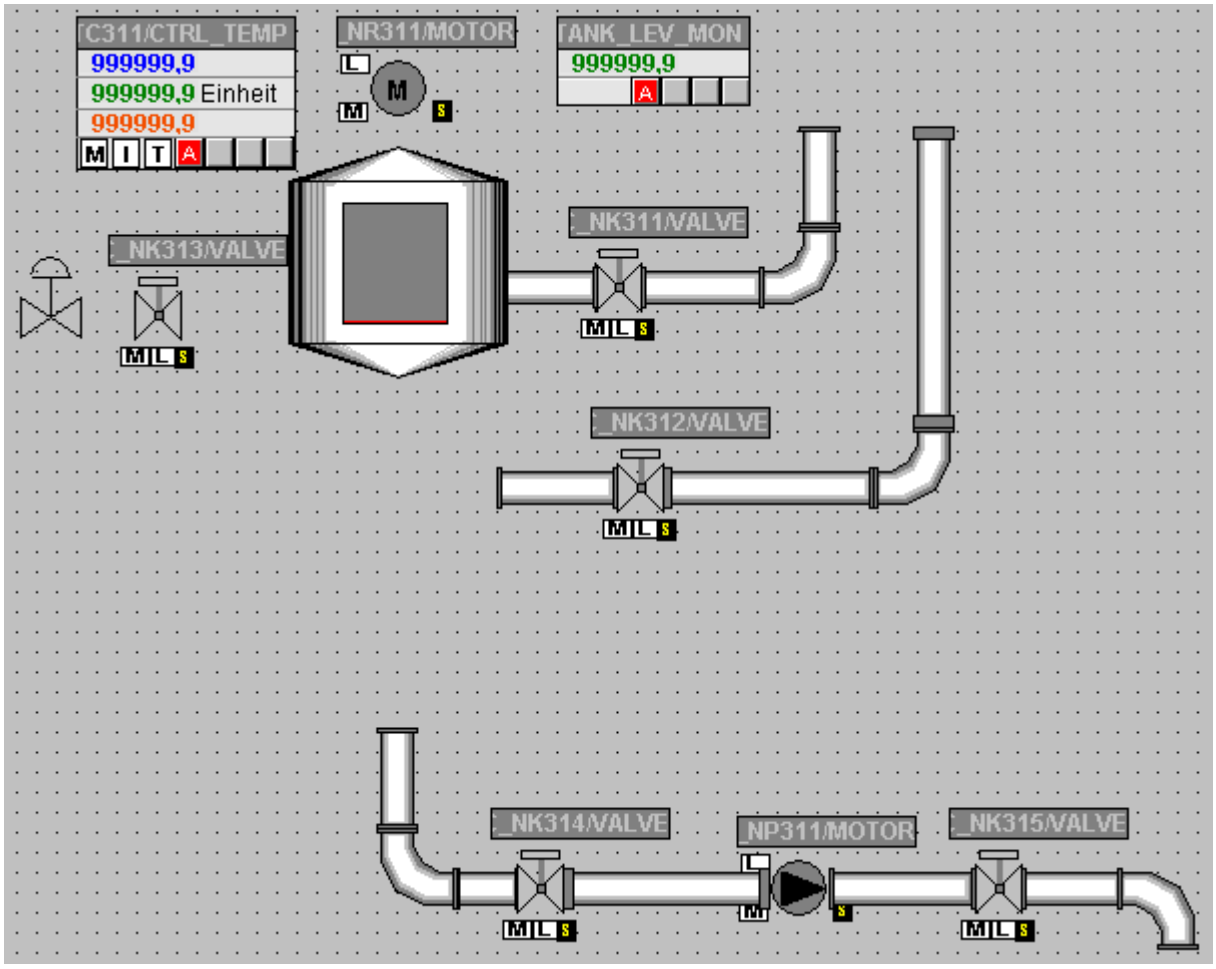
The operator station OS (1) in WinCC Explorer is open.

### Procedure

1. Open the "REAC1" picture in Graphics Designer.
   All the block icons have already been inserted here.
2. Select **View > Library** from the menu, and insert the following additional objects from the various folders.

| Path in the library | Name of object | Number |
|---|---|---|
| Global Library/PlantElements/Pipes - Smart Objects/3D Pipe Horizontal | Horizontal pipes | 8 x |
| Global Library/PlantElements/Pipes - Smart Objects/3D Pipe Vertical | Vertical pipes | 3 x |
| Global Library/PlantElements/Pipes - Smart Objects/3D Pipe Elbow 1 | Angle | 1 x |
| Global Library/PlantElements/Pipes - Smart Objects/3D Pipe Elbow 2 | Angle | 2 x |
| Global Library/PlantElements/Pipes - Smart Objects/3D Pipe Elbow 3 | Angle | 1 x |
| Global Library/PlantElements//Tanks/Tank4 | Reactor | 1 x |
| Global Library/Icons/Valves | 31 | 1 x |

3. Position the block icons and the new graphic objects as shown in the following illustration, and change the size of the objects to roughly match:



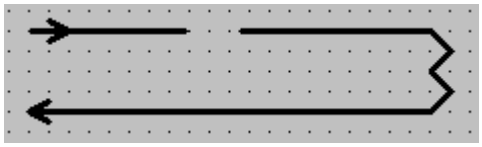

4. Select the reactor, and select **View > Properties** from the menu.

5. Enter the parameters in accordance with the following table and then close the "Object Properties" dialog box:

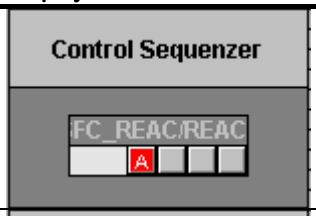
| Property | Attribute | Static" parameter column |
|---|---|---|
| Tank4 | Object name | Reactor 1 |
| Tank4/Geometry | Width | 110 |
| | Height | 300 |
| Tank4/Colors | Bar background color | Dark gray |
| Tank4/Link | Maximum value | 1200 |

| Property | Attribute | Dynamic" parameter column |
|---|---|---|
| Tank4/Link | Fill level | Tag interfacing using ES variables<br>Plant1/REAC1/CFC_LI311/TANK_LEV_MON.U |
| | Minimum value | Delete dynamic |

6. Create a symbolic representation for the heating using the "line" and "polygon" objects.



7. Create the graphic representation for the block icons.
   Use standard graphics objects such as rectangles and static text fields with the required colors and position the block symbols:

| Block icon | Display |
|---|---|
| SFC type |  |
| Operator control block for simulation |  |
| Operator control block for minimum fill level |  |

8. Save the "REAC1.pdl" file.

## 9.5.3 How to insert a status display

### Introduction

You create a special status display for the agitator. The icon for the agitator represents the current status of the agitator exactly like the motor:

- Green: Agitator activated
- Gray: Agitator deactivated

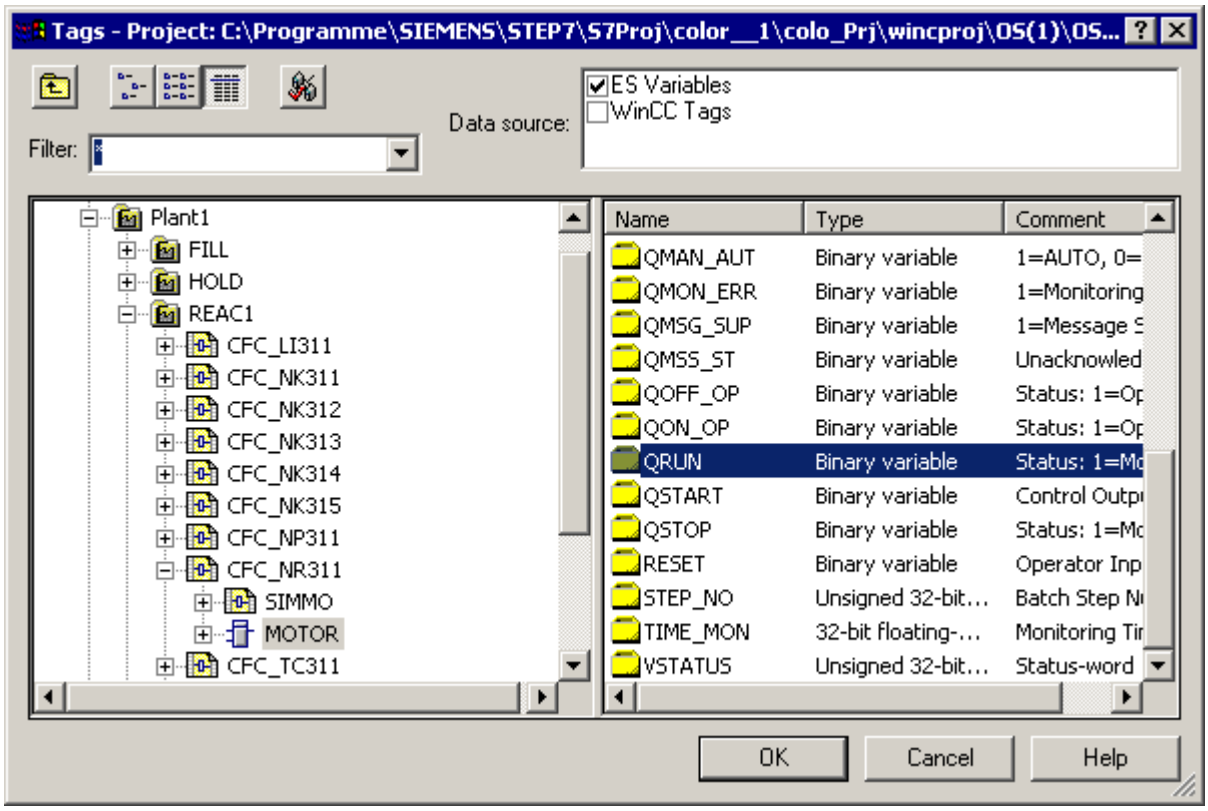
### Requirements

- The operator station OS (1) in WinCC Explorer is open.
- The "REAC1" process picture is open in the Graphics Designer.
- The object palette is open, and the "Default" tab is active.

### Procedure

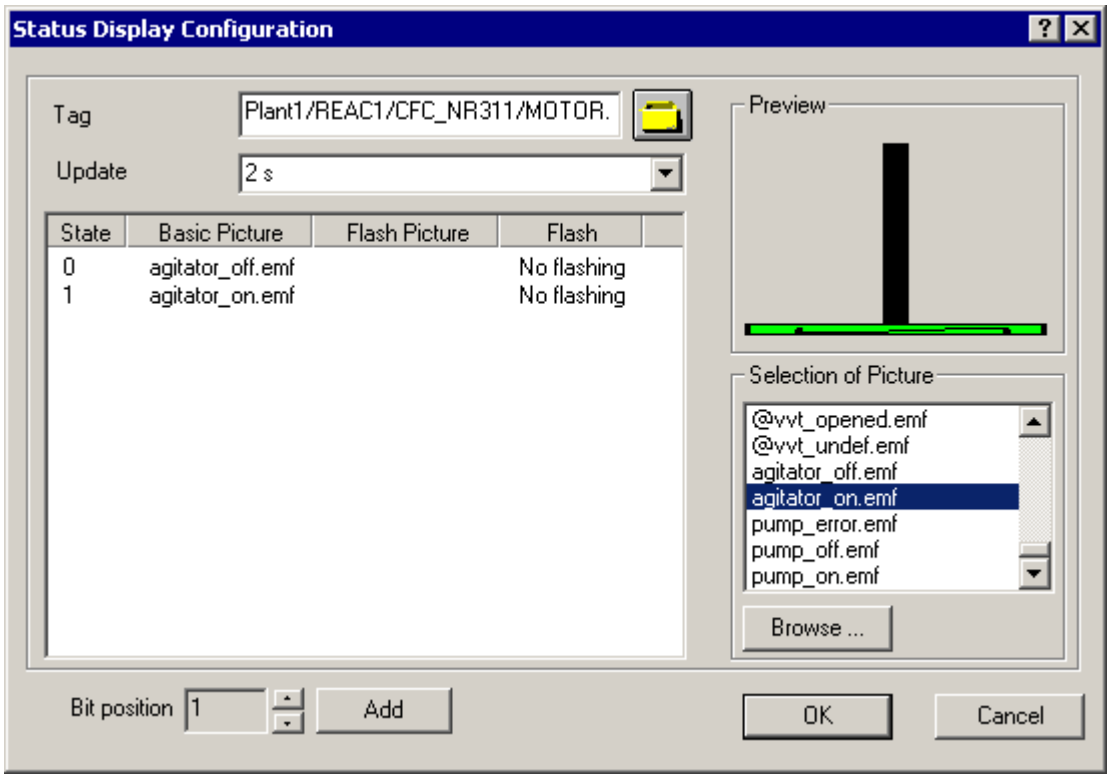
1. Select the "Smart Objects/Status Display" object in the object palette.
2. Go to the drawing area.
   The mouse pointer changes to a small status display symbol.
3. Open a rectangle about the size of the agitator.
   The "Status Display Configuration" dialog box opens.
4. Click the "Tag Selection" button.
   The tag selection dialog opens.
5. Make sure that the "ES Variables" check box is selected in the "Data source" area.

6. Go to the tree view and select the entry
   ES Variables/Plant1/REAC1/CFC_NR311/MOTOR" and then select the "QRUN" I/O in the detailed window.




7. Click "OK".
   The tag is entered.
8. Now select the "agitator_off.emf" file in the "Selection of Picture" list, and drag this picture into the "Basic picture" column.
9. Click the "Add" button.
   This adds a further status to the list of statuses: Status "1"

10. Now drag the "agitator_on.emf" picture from the picture selection to the basic picture of status "1".




11. Click "OK".
    The icon for the agitator is displayed in the process picture.
12. Now position the agitator in the reactor on the agitator motor and adapt the size.
13. Save the "REAC1" picture.

Video

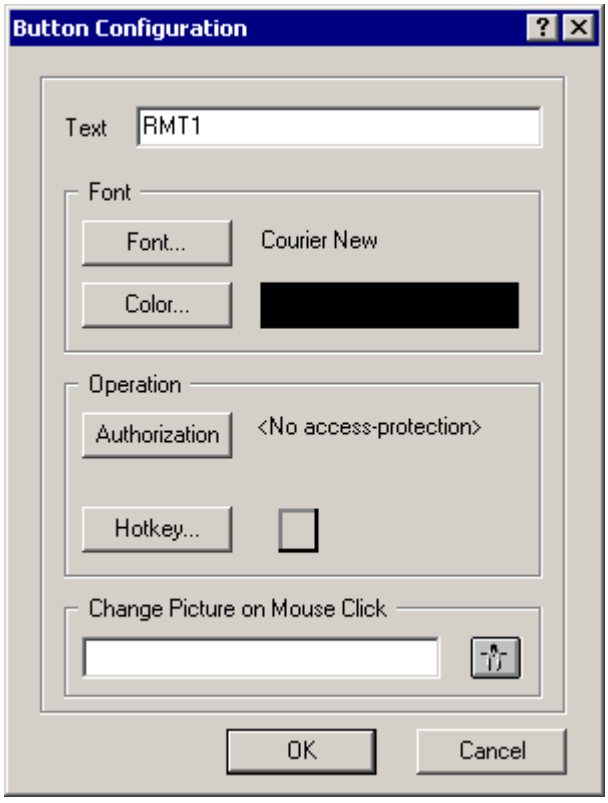
## 9.5.4 How to insert buttons for RMT1 and RMT2

### Requirements

- The operator station OS (1) in WinCC Explorer is open.
- The "REAC1" process picture is open in the Graphics Designer.
- The object palette is open, and the "Default" tab is active.

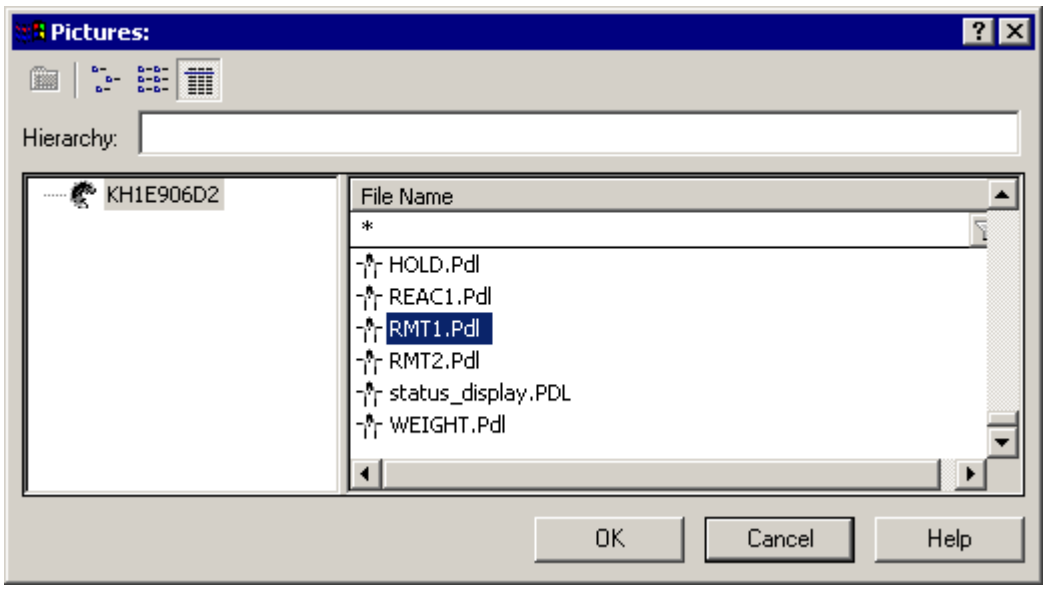
### Procedure

1. Select the "Windows Objects/Button" object in the object palette.
2. Go to the drawing area.
   The mouse pointer changes to a small button.
3. Drag a rectangle roughly the size of the button on the supply pipe of RMT1. RMT1 is the inlet valve NK311.
   The "Button Configuration" dialog box opens.
4. Enter the name "RMT1" in the "Text" box.




5. Click "Font".
   The "Font" dialog box opens.
6. Select "Arial" and click "OK".

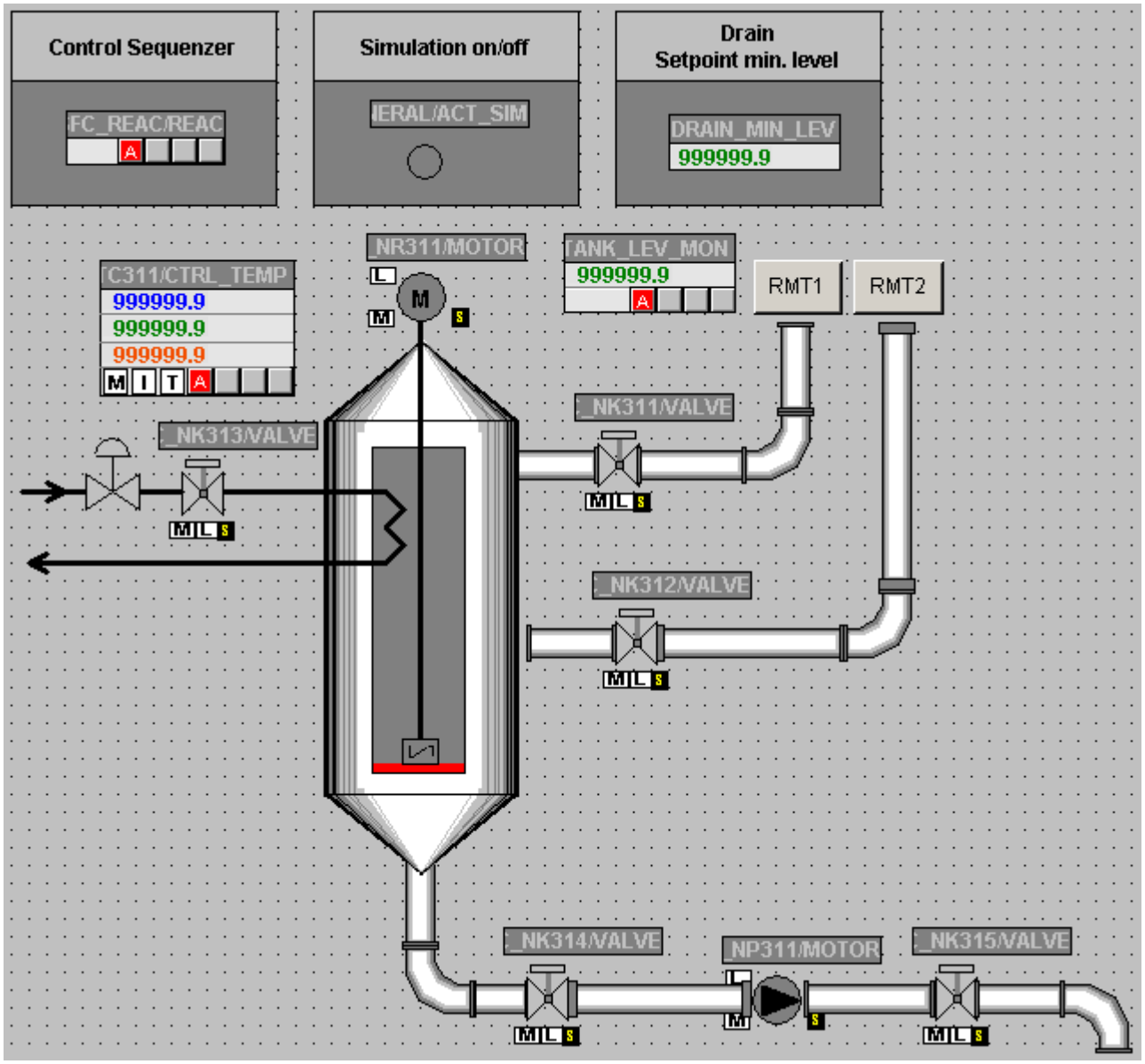
7. Click on the button next to the "Change Picture on Mouse Click" box.
   The "Pictures" dialog box opens.




8. Select the picture "RMT1.PDL" and click "OK".
   The picture name is entered in the input box.
9. Click "OK".
   The button is configured.

10. Repeat steps 1 to 7 to insert buttons for changing the picture to the "RMT2" part of the plant.
    Enter the parameters based on the following table:

| Parameter | Value |
|---|---|
| Position | Feed pipe on the "NK312" inlet valve |
| Button label | RMT2 |
| Link to picture | RMT2.PDL |



| NOTICE |
| --- |
| Note that the permission of the plant operator to change the picture using the button is **not** checked in process mode. When you use this function in actual operation, you must protect the authorization level with a C script. |

11.Save the "REAC1" picture.

## 9.5.5 How to modify the RMT1 and RMT2 process pictures

Since you are representing reactors 1 and 2 in the "REAC1" and "REAC2" process pictures, you do not require any other symbolic representation in the "RMT1" and "RMT2" pictures.

### Requirements

- The operator station OS (1) in WinCC Explorer is open.
- The "RMT1" and "RMT2" process pictures are open in the Graphics Designer.

### Procedure

1. Change to the "RMT1.pdl" process picture.
2. Delete Reactor 1 and its labeling.
3. Insert the Windows "Button" object from the object palette.
4. Enter the following parameters in the configuration dialog box:
   - "Text" input box: Enter "REAC1"
   - "Font" button: Select the "Arial" font
   - "Change Picture on Mouse Click" button: Select the "REAC1.pdl" picture
5. Delete Reactor 2 and its labeling.
6. Insert the Windows "Button" object from the object palette.
7. Enter the following parameters in the configuration dialog box:
   - "Text" input box: Enter "REAC2"
   - "Font" button: Select the "Arial" font
   - "Change Picture on Mouse Click" input field: Manually enter the picture name "REAC2.pdl"

   **Note**

   Since you have not yet configured the "REAC2" part of the plant, you have to enter the picture name manually.
8. Select the object "Raw Material Tank tank1" and open the "Object Properties" dialog box by opening the context menu and selecting **Properties** from the menu.
9. Select the "Links" property, and enter the value "1000" for the "Maximum value" attribute in the "Static" column.
10. Close the "Object Properties" dialog box.
11. Save and close the "RMT1.pdl" picture.
12. Change the "RMT2.pdl" process picture analogously.
13. Save and close the "RMT2.pdl" picture.

# 9.6 Summary

## 9.6.1 Summary of "Rational Engineering for the OS Configuration"

### New functions

What have you learned when configuring the OS?

- You have created custom icons for your process pictures that you can reuse as needed. In this case, there is no centralized editing feature. This is comparable to the chart-in-chart technique that you were introduced to when working with CFC charts.
- You have learned how to create new block icons by modifying default block icons. You have also become familiar with the relationship between the blocks and the block icons. Block icons offer the special advantage of centralized editing. When you change a block icon in the "@PCS7Typicals" file and call the function "Create/update block icons" again, all block icons are updated accordingly.

**Note**

Be aware of the following: If you have adapted the block icons in the process picture, any changes you have made will be overwritten when the block icons are updated.

# Operating and monitoring in process mode 10

## 10.1 Functions in process mode

### Overview

In *Getting Started - Part 1*, you already became familiar with the operator control and monitoring functions in process mode.

You will learn about two new functions in this part of Getting Started.

- Operating the SFC instance
- Switching the simulation method

Of course, you can still operate the "RMT1" and "RMT2" parts of the plant as usual.

**Note**

Be sure to run the "DRAIN" control strategy to empty the reactor before every new dosing with RMTx.

## 10.2 Operating the SFC instance

### Overview

You can operate the SFC instance by means of the block icon with the associated faceplate. You have created the block icon using the automatic functions in PCS 7. You open the faceplate by clicking the block icon.

You can perform the following operations here:

- Start SFC Instance (Page 198)
- Select control strategy (Page 199)
- Specify temperature setpoints (Page 200)

In addition you can switch the type of simulation (Page 201) in process mode.

## 10.3 How to start the SFC instance

### Requirements

- The example project is in process mode.
- The RMT1/RMT2 part of the plant has been run through once with dosing in Reactor 1.

### Procedure

1. Click the block icon "...SFC-REAC/REAC".
   The associated faceplate opens.
2. Select the entry "Prepared Values" from the drop-down list box.
   This activates the "Start" button.
3. Click "Start".
   The "SFC Operation" dialog box opens.
4. Click "OK".
   This starts the control strategy displayed in the "Prepare control strategy" list.
5. Click "Section".
   The sequencer is displayed with the tabs for the various sequencers. Here, you can closely monitor which step or which transition is being performed.
   You will also see that the "RESET" sequencer is always executed first at every start before the selected control strategy is started.
6. When the sequencer has run through successfully, click the "Reset" button.
   Then start the SFC instance again.

# 10.4 How to select the control strategy

## Requirements

- The example project is in process mode.
- The "SFC_REAC" faceplate is open.

## Procedure

1. Select the entry "Prepared Values" from the drop-down list box.
   This activates the "Start" button and the "Current control strategy" drop-down list box.
2. Select the entry "DRAIN" from the "Current control strategy" list.
   The "SFC Operation" dialog opens.
3. Click "OK".
   The selected control strategy is displayed in the list box.
4. Click "Start".
   The "SFC Operation" dialog box opens.
5. Click "OK".
   The sequencer starts.
6. When the sequencer has run through successfully, click the "Reset" button.
   You can then start the SFC instance again.

# 10.5 How to change the setpoint for the temperature

## Requirements

- The example project is in process mode.
- The "SFC_REAC" faceplate is open.

## Procedure

1. Click the block icon "...SFC-REAC/REAC".
   The associated faceplate opens.
2. Select the entry "Prepared Values" from the drop-down list box.
   This activates the "Start" button and the "Current control strategy" drop-down list box.
3. Select the control strategy "HEAT".
4. Click in the edit box with the specified setpoint. In this case the setpoint is "80".
   This is the setpoint you set for the "Setpoints" characteristic when creating the SFC type. The high and low limits are displayed automatically. You have already specified these values in the characteristics of the SFC type.
5. Enter a setpoint within the specified limits and press the ENTER key.
   The "SFC Operation" dialog opens.
6. Click "OK".
   The setpoint is applied.
7. Start the control strategy "HEAT" again and observe the values in the SFC and CFC charts.

# 10.6 How to switch the simulation method

## Simulation options

You have two different simulation options:

- Simulation using CFC charts
- Simulation using I/O modules

Simulation using CFC charts is set by default but can be easily changed in process mode.

## Requirements

- The example project is in process mode.
- The I/O modules are connected.

## Procedure

1. Click the "..../ACT_SIM" block icon.
   The faceplate opens.
2. Click the "COMMAND" list.
3. Select the "Off" option in the dialog box, and click "OK".
4. Close the faceplate
   This enables simulation using I/O modules. The circle in the block icon is now displayed as a gray circle.

## 10.7 How to specify the minimum fill level

You have inserted a faceplate in the CFC_LI311 CFC chart that you can use to specify the minimum fill level that must be maintained during the drain operation.

### Requirement

The example project is in process mode.

### Procedure

1. Click the "..../DRAIN_MIN_LEV" block icon.
   The faceplate opens.
2. Enter the required fill level.
3. Click "OK".
4. Close the faceplate.
   This defines the minimum fill level and this exact fill level will be maintained in the reactor at the next drain operation.

# Performing the additional task

# 11

## 11.1 Overview of the configuration of reactor 2

### Duplication of parts of a plant

In this sample project, the fastest way for you to configure the REAC2 part of the plant is to copy the entire REAC1 part of the plant and then conveniently modify the required parameters in the process object view.

PCS 7 offers other possibilities for duplicating parts of a plant:

- You quickly create new process tags from the created process tag types by editing the import/export file followed by an import procedure.
- You use the created SFC type on all comparable parts of a plant.

No extra work is required for the hardware configuration because both parts of the plant are controlled from the same CPU. Besides, no additional operator stations are required because you have a single-station system Also you have already assigned the symbolic names for the inputs and outputs during the hardware configuration.

# 11.2 How to configure the "REAC2" part of the plant

## Overview

The basic procedure for configuring the REAC2 part of the plant is described in the following:

- Copying the REAC1 part of the plant
- Adjusting the parameters

## Requirements

- The example project is open in SIMATIC Manager.
- The process object view is activated
- The "General" tab is activated.

## Procedure

1. Select the "REAC1" hierarchy folder and copy it to the "Plant1" hierarchy folder.
   PCS 7 automatically assigns a new name "REAC1(1)".
2. Rename the new folder to "REAC2".
3. Rename the process tags in "Name" column on the "General" tab according to the plant overview (Page 17):
   - Chart GENERAL(1) to GENERAL2
   - Chart CFC_LI311(1) to CFC_LI321
   - Chart SFC_REAC1(1) to SFC_REAC2
   - Picture REAC1(1) to REAC2
   - etc.
4. Change to the "Signals" tab.

5. Adapt the symbolic names for the inputs and outputs of the distributed I/O of reactor 2 in the "Signal" column:
   Replace the identifier "1" that stands for reactor 1 with the number "2", for example:
   – Change "NK311_copen" to "NK321_copen"
   – Change "TC311" to "TC321"
   – etc.
   As soon as you change a signal name, the relevant comment and absolute address are automatically updated.

**Note**

Make sure to leave the symbolic names of the signals that apply both to Reactor 1 and Reactor 2 unchanged. In the sample project, these are the following names:

- NR3x1_on
- NP3x1_on

6. Open the CFC_LI321 CFC chart and add the following textual interconnections for the "SIMREAC" chart:

| Block | Input | Textual interconnection |
|---|---|---|
| SIMREAC | BVALV_RMT1_2 | CFC_NK114\VALVE.QOPENED |
| | BMOT_RMT1 | CFC_NP111\MOTOR.QRUN |
| | ARMT1 | CFC_FC111\INPUT_U.V |
| | BVALV_RMT2_2 | CFC_NK118\VALVE.QOPENED |
| | BMOT_RMT2 | CFC_NP112\MOTOR.QRUN |
| | ARMT2 | CFC_FC112\INPUT_U.V |
| | BOUT | CFC_NP321\MOTOR.QRUN |

**Note**

The BVALV_RMT1_1 and BVALV_RMT2_1 inputs do not have to be interconnected to the REAC2 part of the plant.

The values of these inputs must be "0".

**Note**

Interconnections to charts that are stored outside the copied hierarchy folder are deleted. All interconnections within the copied hierarchy folder are retained and will be automatically updated in the process object view after the charts have been renamed.

7. Select **Options > Optimize Run Sequence...** from the menu.
8. In the "The run sequence of the blocks will be changed and optimized according to the data flow....." message box, click "OK".
   All blocks are then arranged automatically in the correct run sequence.
9. Close the CFC editor.

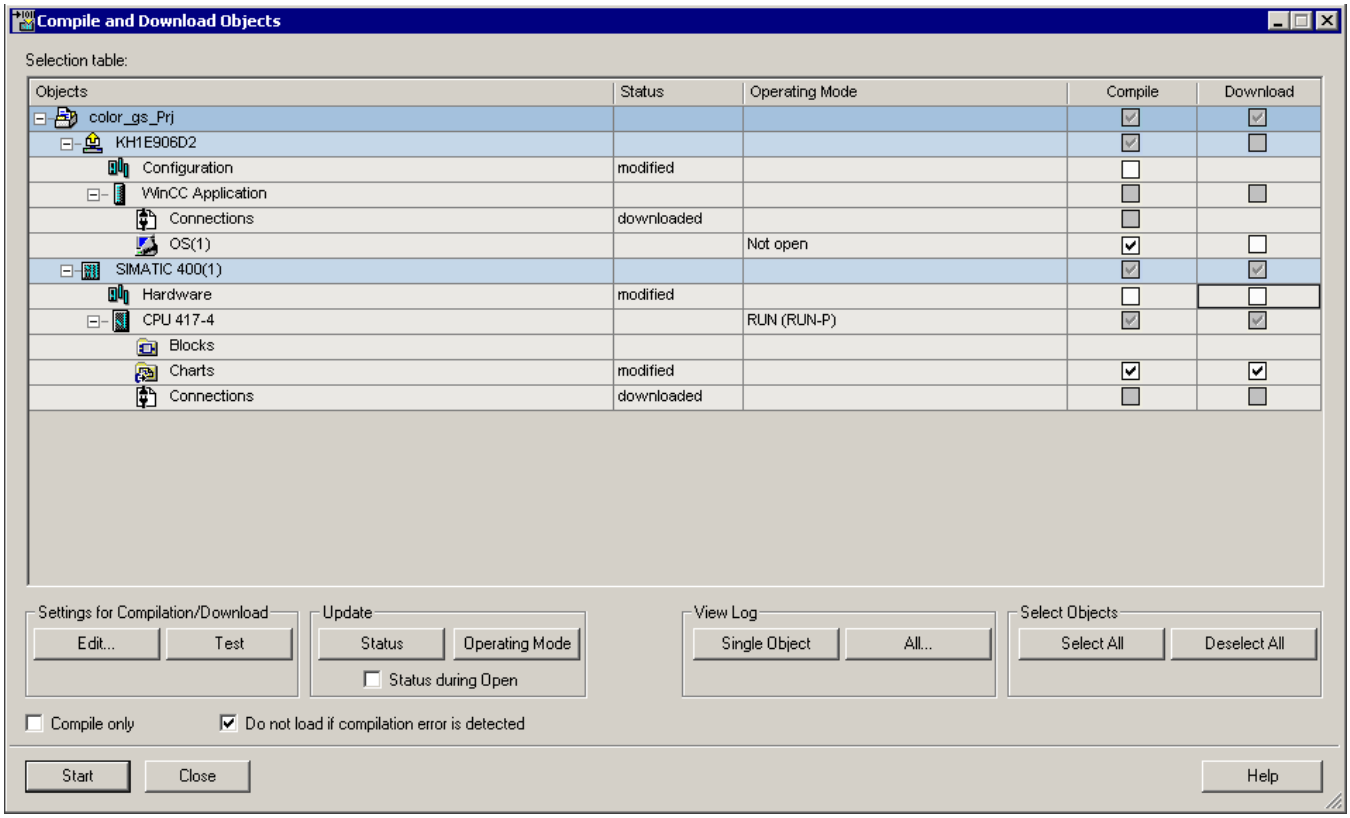
# 11.3 How to compile the changes

## Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.
- The CPU is in RUN_P.
  You can download changes without the CPU being in STOP.
- WinCC Explorer is closed.

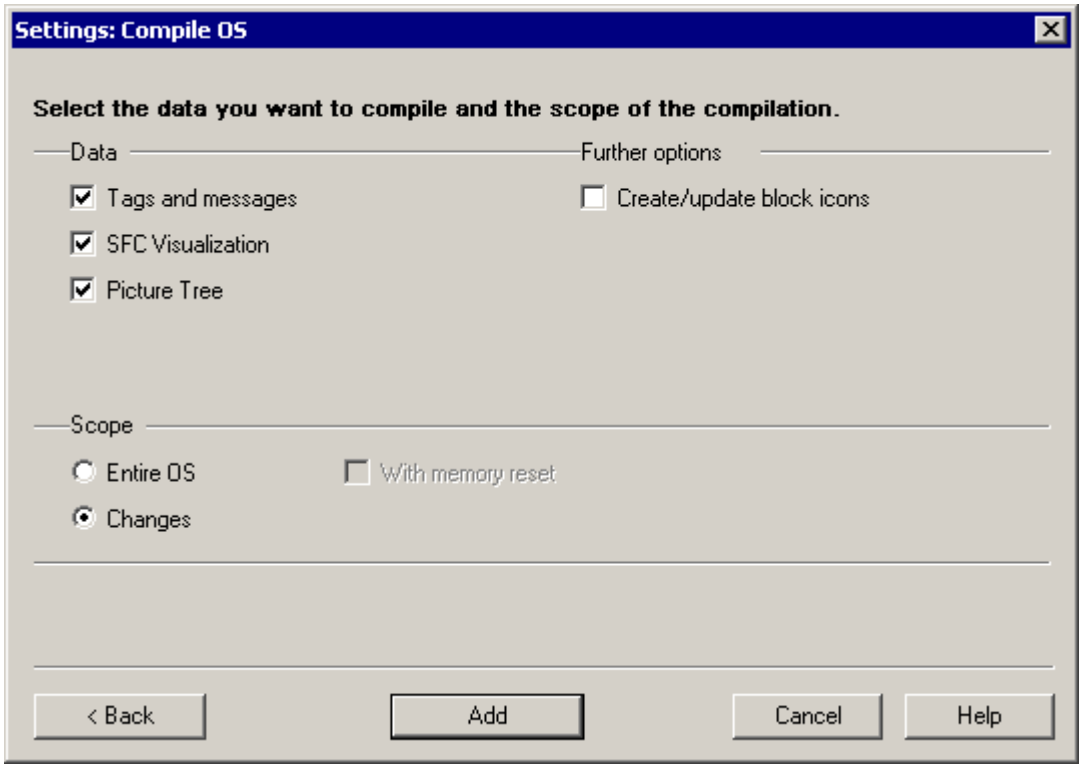
## Procedure

1. Select the "color_gs_MP\color_gs_Prj" folder in the tree view, and select **PLC > Compile and Download Objects** from the menu. Make the settings according to the following figure:



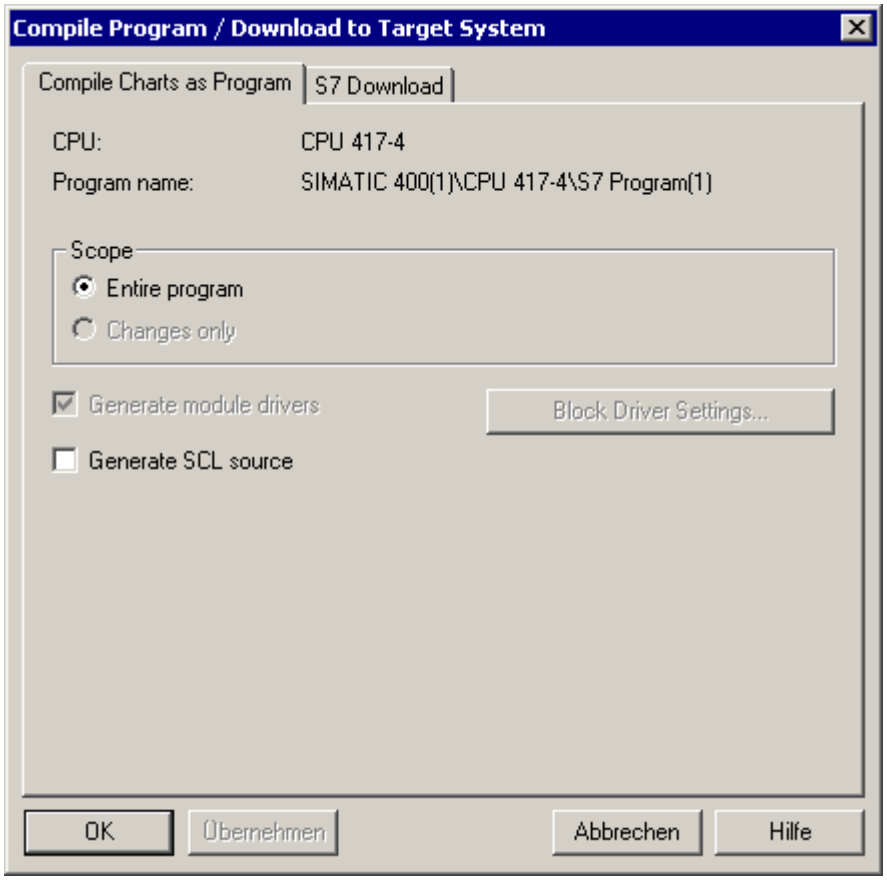

2. Select the "color_gs_Prj/[Name of your local PC station]/WinCC Application/OS(1)" object in the tree view and click "Edit".

3. In the "Select the data you want to compile and the scope of the compilation" step, select the "Changes" option.

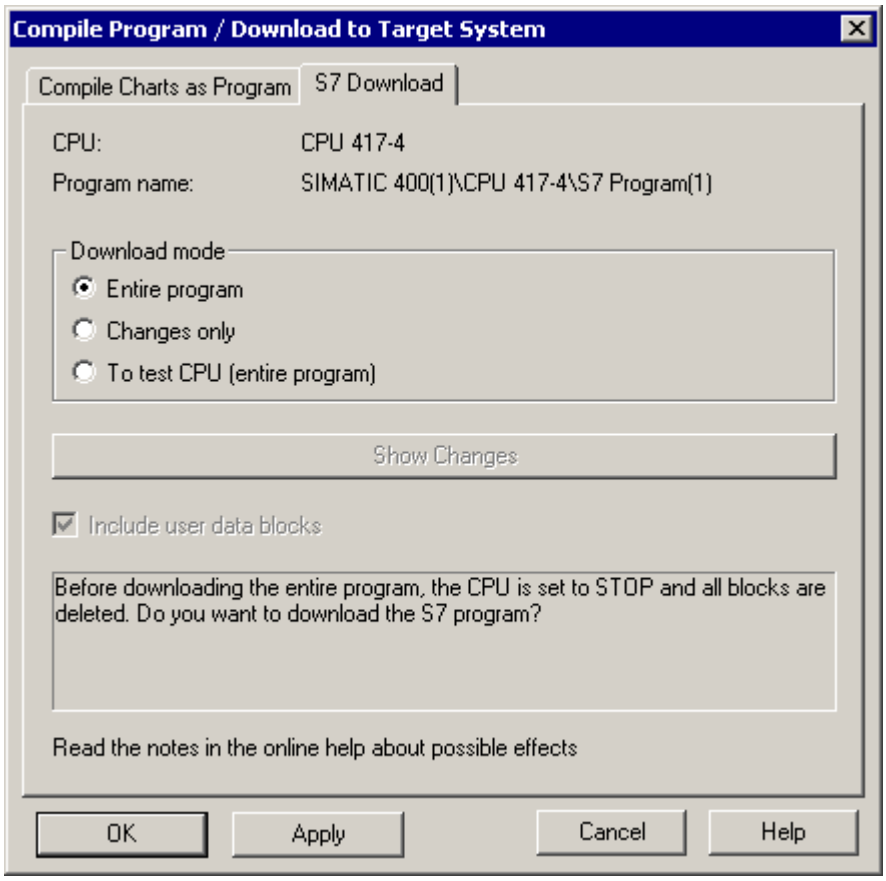



4. Select the "Charts" object in the tree view, and click the "Edit..." button.

5. In the "Compile Charts as Program" tab, select the "Changes only" option and click "Apply".



6. Change to the "S7 Download" tab, select the "Changes only" option and click "OK".




7. Click "Start" to start the compilation and download.
   Once the download is completed, the textual interconnections in the SFC charts are made and all tag links are updated for reactor 2 in the process picture.

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