

SIMATIC

Process Control System PCS 7 SMART PCS 7 SMART Getting Started - Part 2 (V9.0 with APL)

Getting Started

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CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

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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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Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines, and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

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For additional information on industrial security measures that may be implemented, please visit:

<https://www.siemens.com/industrialsecurity>

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under

<https://www.siemens.com/industrialsecurity>.

Preface

About this document

This document introduces the PCS 7 SMART functions that you can use for fast and effective configuration of your plant. These functions are especially convenient for configuring large and complex plants.

This Getting Started is aimed at the users who have completed *PCS 7 SMART Getting Started - Part 1 (V9.0 with APL)*.

This document is hereafter only referred to as *Getting Started - Part 2* and *PCS 7 SMART Getting Started - Part 1 (V9.0 with APL)* as *Getting Started - Part 1*.

Prerequisites

You must have knowledge in the following areas:

- Microsoft operating system Windows 7 Ultimate SP1 64 bit, Windows 7 Enterprise SP1 64 bit and Windows 10 Enterprise 2015 LTSC 64 bit
- Basic knowledge in the field of process automation
- Functions and configuration of SIMATIC S7 (S7-410, STEP 7)
- Functions and configuration of SIMATIC NET (network components, transmission media)

You must also be familiar with the basic functions of PCS 7 SMART. 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*.

Note

- SIMATIC PCS 7 SMART is based on PCS 7 Asia. PCS 7 SMART is specifically designed for smaller projects with up to 2400 Process Objects (PO) within the China and India markets. With PCS 7 SMART portfolio, we offer a custom-fit product for projects with up to eight PCS 7 SMART OS Single Stations. Specifically, the combination of SMART software and SMART hardware increases the functionality, and therefore, makes PCS 7 SMART a suitable software for such projects in China and India.
 - PCS 7 SMART does not come with a trial version. A USB hardlock needs to be plugged in permanently for configuration and runtime.
-

Accessing PCS 7 SMART documentation

You can find the PCS 7 SMART documentation at the following locations:

- On the *Process Control System; SIMATIC PCS 7 SMART* DVD
- On the computer, in the installation folder
- On the Internet:
 - Region India (<https://support.industry.siemens.com/cs/in/en/ps/21144>)
 - Region China (<https://support.industry.siemens.com/cs/cn/zh/ps/21144>)

In this entry you can also find the manual on PCS 7 SMART, which shows the differences between PCS 7 SMART and PCS 7.

Information about PCS 7 basic system on the Internet

All product and order information regarding PCS 7:

- Internet link (<https://www.siemens.com/PCS7>)

Overview of the most important technical information and solutions for PCS 7 in the Industry Online Support:

- Internet link (<https://support.industry.siemens.com/cs/document/63481413>)

All information on Support and Service in the Industry Online Support:

- Internet link (<https://support.industry.siemens.com>)

Note

Here, you can also subscribe to the newsletter, which keeps you constantly updated with current information about our products.

Contents of the PCS 7 Readme files

The PCS 7 V9.0 SMART Readme file is available in various versions:

1. PCS 7 SMART Readme (offline)
This is the version that is installed during the PCS 7 setup.
This file only contains general notes and links to documents on the internet.
2. PCS 7 SMART Readme (online)
This is the document which contains specific information on the installation and use of PCS 7 SMART.
This file is only available on the internet so that we can keep it up to date.
You can find the current version of this document for download under the entry ID 109744321 in the Industry Online Support:
 - Region India (<https://support.industry.siemens.com/cs/in/en/view/109744321>)
 - Region China (<https://support.industry.siemens.com/cs/cn/zh/view/109744321>)
3. PCS 7 Readme (online)
This is the document which contains general information on the installation and use of PCS 7.
You can find the current version of this document for download under the entry ID 109744312 in the Industry Online Support:
 - Internet link (<https://support.industry.siemens.com/cs/ww/en/view/109744312>)

Note

It is vital that you use the information from the most recent version of the SMART and PCS 7 Readme (online) before you begin the installation or use of PCS 7 V9.0 SMART version.

The information in the PCS 7 SMART Readme (online) supersedes the information in the PCS 7 Readme (online).

Each of the products comes with product-specific information in the form of readme files.

The information contained in these readme files also applies to using products in PCS 7 SMART.

Electronic manuals and help system for the basic system PCS 7

Pre-installed manuals

Once you have installed PCS 7 on your computer, the following PCS 7 documentation is immediately available.

- You can find this documentation in the section **SIEMENS Automation > SIMATIC > Documentation** or the product information in the "Start" menu of Windows:
 - PCS 7 - Catalog Overview (PDF)
 - PCS 7 - Operating Instructions - OS Process Control (PDF)
 - PCS 7 - Installation Manual - PC Configuration (PDF)
 - PCS 7 - Configuration Manual - Engineering System (PDF)
 - PCS 7 - Configuration Manual - Operator Station (PDF)

Complete documentation for PCS 7 on the internet and document updates

The complete PCS 7 documentation is available in multiple languages at the following Internet site:

- Internet link (<https://www.siemens.com/pcs7-documentation>)

You also have the option of updating the installed PCS 7 help system and post-installing the PCS 7 system documentation. The "PCS 7 Documentation Portal Setup" required for this is available for download under the entry ID 109744320 in the Industry Online Support:

- Download link (<https://support.industry.siemens.com/cs/ww/en/view/109744320>)

Note

Timeliness of online documents

Documents available online may be more up-to-date than the version of documents installed with PCS 7 Setup. The statements in documents available online should therefore be given priority over installed documents.

Information on modified documents

In order to keep yourself informed about changes to the PCS 7 readme and the other PCS 7 documentation, we recommend that you activate the relevant notification in the Industry Online Support:

- Internet link (<https://support.industry.siemens.com>)
-

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 and become familiar with the functions of rational engineering.

In the documentation, you will find the most important background information required to understand the individual topics. Detailed instructions guide you step-by-step through the configuration.

You can download the completed PCS 7 SMART project **color_gs** and the documentation *Getting Started - Part 1* and *Getting Started - Part 2* from the internet:

- Getting Started Part - 1 (<https://support.industry.siemens.com/cs/in/en/view/109751150>)
- Getting Started Part - 2 (<https://support.industry.siemens.com/cs/in/en/view/109751151>)
- To download the project, click on the following icon: 

Open the projects on the engineering station (ES) 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

- The preparatory tasks for *Getting Started - Part 2* are described in detail in *Getting Started - Part 1*. This *Getting Started - Part 2* only provides an overview of the preparatory work.
 - To test the **color_gs** project in process mode, the hardware configuration of the project must correspond to your actual hardware configuration. If necessary, replace the hardware components of the **color_gs** project with the actual hardware components present. For additional information on this, refer to *Getting Started - Part 1*.
-

Conventions

In this document, all the instructions are given using their full menu commands. You can also access virtually all of the functions through the shortcut menu or by double-clicking.

Note

In this documentation, the versions of profiles, libraries and modules are always displayed as Vxx.

Ensure that you use an appropriate version for your hardware or software.

Example:

- Profile: PCS7_Vxx
 - PCS 7 AP Library Vxx
 - IE General: SW Vxx
-

Note

The names of elements in the software interface are specified in 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 SMART, 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-and-drop" instead of "copy and paste"

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

PCS 7 SMART glossary

The PCS 7 SMART glossary containing the definitions of important technical terms used in the documentation are available within the PCS 7 SMART software through the Help menu in the SIMATIC Manager (**Help>Contents**).

Additional information

You can find detailed background information and general context in the following documentation, 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*

This documentation is available as an online help or in the PDF format.

- Online help
 - In the PCS 7 software in SIMATIC Manager via the menu command **Help > Topics**
- PDF file
 - In the "Start" menu, under the SIEMENS SIMATIC documentation folder, in the preferred language
 - on the *Process Control System; SIMATIC PCS 7 SMART* DVD in the folder _Manuals

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

Preparing for Getting Started - Part 2

3.1 Prerequisites

3.1.1 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	Intel® PRO/1000	Yes
Rack	UR2	Yes
Power supply	PS 407 4A	Yes
CPU	CPU 410 SMART Firmware as of V8.2	No
Crossover cable		No
USB hardlock	PCS 7 SMART V9.0	No (Hardlocks are version specific)

Note

- You need the SMART CPU (CPU 410 SMART) to implement the configuration as described in the Getting Started.
- You can find the detailed information on the hardware requirements in the *Getting Started - Part 1*.
- You can find the detailed information about setting up the PC station in the manual *Process Control System PCS 7; PCS 7 PC Configuration*.

Additional hardware components

In addition, you need at least the following components to actually run a simulation using I/O modules:

Hardware component	Version used in Getting Started	Other version possible
IM 650-8 SMART	6ES7 650-8PH00-xAA0	Yes
Digital input module	6ES7 650-8DK70-xAA0	Yes
Digital output module	6ES7 650-8EK70-xAA0	Yes

3.1 Prerequisites

Hardware component	Version used in Getting Started	Other version possible
Analog input module	6ES7 650-8AK60-xAA0	Yes
Analog output module	6ES7 650-8BK60-xAA0	Yes

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.

3.1.2 Software requirements for Getting Started - Part 2

Software requirements

- Information about installation and operation of the PCS 7 SMART software is available in the *Process Control System PCS 7; PCS 7 Readme file* (see "Preface (Page 9)").
- You will find information on the installation of the PCS 7 SMART software in the documentation *Process Control System PCS 7; PCS 7 PC Configuration*.

Note

Engineering system

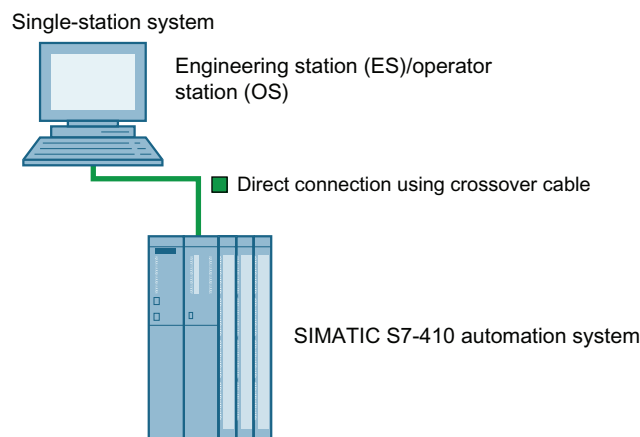
PC stations with a pre installed engineering system contain all the necessary software components. However, you must transfer the license keys to the PC station.

3.2 Introduction to the project for Getting Started

3.2.1 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.

3.2.2 Introduction to the overall project

Plant description

In this document, you will configure a fully automatic dye production plant. You have been 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.

3.2.3 Task definition

Task definition

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 be 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 will create structure 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 this document.

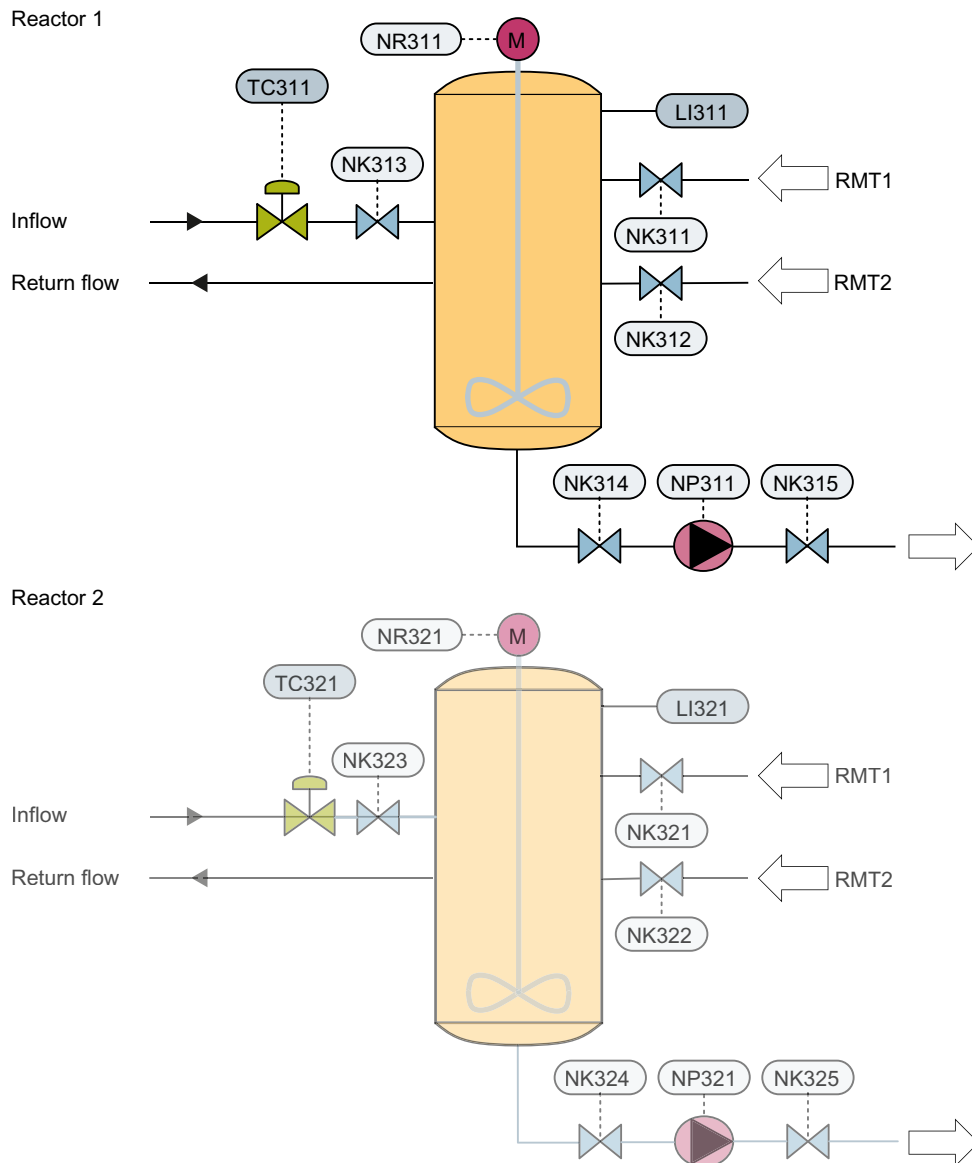
Note

This document gives a detailed description of how to configure the REAC1 part of the plant. You configure the REAC2 part of the plant on your own. In doing so, you use all of the functions that you have learnt in *Getting Started - Part 1* and *Getting Started - Part 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



3.2.4 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

3.3 Making the preparations

3.3.1 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** project from *Getting Started - Part 1*.

We recommend using the ready-to-use **color_gs** project.

You can download the completely configured PCS 7 SMART project **color_gs** from the Internet (<https://support.industry.siemens.com/cs/in/en/view/109478794>).

This ensures that all configuration steps have been performed and all folders, charts, and so on 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 color_gs project

If you use the supplied **color_gs** 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 22)
2	Retrieving the project from the archive (Page 23)
3	Adapting the hardware configuration of the AS (Page 24)
4	Renaming a PC station (Page 27)
5	Adapting the name of the OS (Page 28)
6	Adapting the configuration of the OS (Page 29)
7	Making settings in NetPro (Page 30)

3.3.2 Making settings in the Configuration Console

Introduction

This section provides information on how to configure a PC station.

Procedure

1. In the "Start" menu, under **Siemens Automation > SIMATIC > SIMATIC NET**, select "Communication Settings".
The configuration console opens.
2. Open the "Modules" folder in the tree view.
3. Select the network adapter by which communication between the automation system and the OS takes place.
4. Double-click the "General" entry in the detail view. The detail view for "General" opens.
5. In the detail view, select the "Configured mode" entry from the "Mode of the module" drop-down list.
6. Click "Apply". This button is only active if you have made changes. Your settings are now saved. The network card is now activated.
7. Open the "Access points" folder in the tree view.
8. Double-click the "S7ONLINE" access point in the detail view. The detail view for "Access point" opens.
9. In the "Assigned Interface Configuration" drop-down list box, select the entry "PC internal.local.1"
10. Click "OK". Your settings are saved now.
11. Specify "PG mode" as the module operating mode for all other network adapters.
12. Close the configuration console.

Result

The required communication settings are done using the configuration console.

3.3.3 Retrieving the project from the archive

Introduction

This section provides information on how to retrieve a project from the archive. This step is only necessary if you want to work with the **color_gs** project of the "color_gs.zip" file. You can extract the zip file using a SIMATIC Manager 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....**
2. Open the folder in which you have stored the "color_gs.zip" file.
3. Select "color_gs.zip"
4. Click "Open".
5. If you ...
 - want to accept the default folder, click "OK".
 - have created a separate folder for the **color_gs** project, navigate to this folder and then click "OK".Retrieval from the archive is then started. After the retrieval from the archive, the "Retrieve from Archive" message window opens.
6. Click "OK".
 - The message box "The multiproject color_gs_prj_MP" is retrieved from the archive.
 - The "Do you want to start it now?" dialog box appears.
7. Click "Yes".

Result

The **color_gs** project has been retrieved.

3.3.4 Adapting the AS hardware configuration

Note

The next section provides a short description of the configuration steps. You will find detailed descriptions in *Getting Started - Part 1*.

Requirements

- The **color_gs** is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\SIMATIC 400(1)" folder in the tree view.
2. Select the "Hardware" object in the detail view, and then select **Edit > Open Object**.
3. Select the module "PN/IO" in slot "3 / X5" and then select **Edit > Object Properties....**

4. Select the "Interface" tab and then click "Properties".
The "Properties - Ethernet Interface" dialog box opens.
5. In the "Properties - Ethernet interface" dialog box, enter a free IP address and the subnet mask in the address range of your computer in the "Parameter" tab.
6. Select the "Ethernet (1)" entry from the "Subnet" list.
7. Click "OK" in the "Properties - Ethernet interface" dialog box and then in the "Properties PN-IO(R0/S3.5)" dialog box.
The Ethernet interface is now adapted for *Getting Started - Part 2*.
8. Close "HW Config".
9. Click "Yes" to confirm the "Save changes in SIMATIC 400(1)?" prompt in the message box.

Result

The hardware configuration of the AS is adapted.

3.3.5 Adapting the blocks for the color_gs project

Introduction

This section provides information on how to adapt the block for the **color_gs** project.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The "PCS 7 AP Library V90" library is open and selected.

Procedure

1. Select the
"PCS 7 AP Library V90\Blocks+Templates\Blocks" entry in the tree view.
The detail view displays all blocks.
2. Select all blocks that are also contained in your library.
3. Drag-and-drop the blocks to the "color_gs_prj_MP\color_gs_prj_Lib\S7 Program(1)\Blocks" master data library.
The "Insert function block" dialog box opens.
4. Click "All".
This replaces all blocks in the master data library with the blocks from the current version of the PCS 7 library.
5. Select "color_gs_prj_MP\color_gs_prj_Lib\S7 program(1)\Charts" in the tree view.
6. Select the process tag type "ValveLean" (or Valve_Lean).

7. Select **Edit > Open Object**.
The process tag type opens in the CFC Editor.
8. Select **Options > Block Types....**
The "Block Types" dialog box opens.
9. Select all blocks in the "Chart Folder" group and click "New Version".
The "Set Format" dialog box opens.
10. Click "Yes" to implement the formats.
The "Import New Version" dialog box opens if the process tag types still contain blocks from an older version.
11. Select blocks and click "New Version" to update the blocks.
The "Import New Version" dialog box opens and displays all identical block types.
12. Click "OK".
The dialog box closes.
13. Click "Close".
14. Close the CFC Editor.
15. Select the entry "color_gs_prj_MP\color_gs_prj_Lib\S7 Program(1)\Blocks" in the tree view.
16. Select the menu command **Options > Charts > Update Block Types....**
The "Update Block Types" wizard opens.
 - Select the **color_gs** project in the "Select the S7 programs to be checked" step. The check boxes for all folders of all S7 programs are activated by default.
 - Click "Next".
 - All block types are activated by default in the "Select the block type to be updated" step.
 - Click "Finish".
The "Convert Format" dialog box opens.
 - Click "Yes" to implement the formats.
The log file opens when the update of the blocks and block instances is completed.
17. Click "Close" in the log.
18. Compile the AS after the block import.

Result

The blocks required are imported to the **color_gs** project.

3.3.6 Adapting the project data for the color_gs project

Introduction

This section provides information on how to adapt the project data for the **color_gs** project.

Requirements

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

Procedure

1. Select **Edit > Open Object**.
Click "Yes" if the "s7omwinx" dialog box opens.
The WinCC Explorer opens.
2. Select the entry "OS Project Editor".
3. Right-click and Select **Open**.
The OS project editor opens.
4. Adjust your screen resolution or accept the default settings and click "OK".
The OS project editor updates the project data.

Result

The project data is updated and adapted to the **color_gs** project.

3.3.7 Renaming the PC station

Introduction

This section provides information on how to rename the PC station.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select the object
"color_gs_prj_MP\color_gs_prj_Prj\SIMATIC PC-Station(1)" in the tree view.
2. Select **Edit > Rename**.
3. Enter the network name of the local computer and then confirm your entry.
The component view identifies the PC station icon with a yellow arrow.

Note

1. You will find the name of your local computer under "System Properties" in the Windows Control Panel.
 2. If the PC station is not identified by means of a yellow arrow after you renamed it, update the on-screen display by pressing the <F5> key.
 3. Check whether the name of the PC station in WinCC matches the name in the SIMATIC Manager.
-

Result

The PC station is renamed.

3.3.8 Adapting the name of the OS

Introduction

This section provides information on how to adapt the name of the OS.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select the object "color_gs_prj_MP\color_gs_prj_Prj\[name of the PC Station]\WinCC Appl. \ OS(1)" in the tree view.
2. Select **Edit > Open Object**.
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.
4. Click "Yes".
5. Select the "OS(1)\computer" entry in the tree view of WinCC Explorer.
6. Select the computer in the detail view, and then select **Edit > Properties**.
7. Click "Use Local Computer Name".

8. Click "OK". You will see the name change as soon as WinCC is closed and re-opened.

Note

The name of your local computer can be found in the "System" dialog of the Windows Control Panel.

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

Result

The name of the OS is adapted to your local computer.

3.3.9 Adapting the configuration of the OS

Introduction

This section provides information on how to adapt the OS configuration.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\[name of the PC station]" object in the tree view.
2. Select the "Configuration" entry in the detail view, and then select **Edit > Open Object**.
3. Select the network card you require from the hardware catalog if you are using a different one in your project. Drag it to the "IE General" slot.
This overwrites the existing network card.
4. Click "Yes" in the first and "OK" in the second message box.
5. Select the network card, followed by **Edit > Object Properties....**
The "Properties - IE General" dialog box opens.
6. Select the "General" tab and then click "Properties".
7. In the "IP address" input field, enter the same IP address that you entered in the configuration console (Adapting the AS hardware configuration (Page 24)).
8. Deactivate the "Set MAC address/Use ISO protocol" check box.
9. Select the "Ethernet (1)" entry from the "Subnet" list.

10. Click "OK" in the "Properties – Ethernet Interface IE General" dialog box.
11. Click "OK" in the "Properties – Ethernet Interface IE General" dialog box.
12. Select **Station > Save and Compile**.
13. Close "HW Config".

Result

The OS configuration is adapted.

3.3.10 Making settings in NetPro

Introduction

This section provides information on how to make settings in the NetPro.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select the object
"color_gs_prj_MP\color_gs_prj_Prj\[Name of the local computer]\WinCC Appl." in the tree view.
2. Select the "Connections" entry in the detail view, and then select **Edit > Open Object**. NetPro opens.
3. Select the "WinCC Appl." object for the SIMATIC PC station.
4. Select the S7 connection in the detail view at the bottom, followed by **Edit > Object Properties**.
The "Properties - S7 connection" dialog box opens.
5. Verify that the correct connection partners are selected:

Local	Partner
Interface "[Network card of the OS]", for example: IE General	Interface "[CPU internal interface of the AS]", For example: CPU 410 SMART, PN/IO ...

6. Click "OK".
7. Select the menu command **Network > Save and Compile....**
The "Delete system data completely from the automation system and replace with offline system data. "Are you sure?" dialog box opens.

8. Activate the "Compile and check everything" option button and then click "OK".
The "Outputs for consistency check" window opens once compilation has been successfully completed. Close this window.
9. Switch to SIMATIC Manager. Mark the PC station and select **PLC > Configure...** from the menu.
The "Configure" dialog box opens.
10. Select the target computer from the "Accessible computers" list. Click "Configure".
The dialog box "Configure: <Selected Station>" opens.
11. To perform remote configuration and apply the settings, 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 **PLC > Download** menu command. The message dialog "This action overwrites the configuration data that is already.... Continue?" opens.
13. Click "Yes".
The "Stop Target Modules" message box opens.
14. Click "OK".
The download stops.
15. Close NetPro.

Result

The NetPro settings are done.

Configuring the hardware

4.1 Principle of simulation with hardware components

4.1.1 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 can 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. However, runtime errors occur when these inputs are interconnected with the feedback signals from the valves, pumps, and drives. If you need to have another digital input module SM321 at your disposal, reconfigure the project so that a digital input is available for each feedback signal.

Bus systems

Due to the additional distributed I/O, you 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 34)
3	Assigning symbolic names (Page 37)

4.1.2 Changing the name of the plant bus

Introduction

This section provides information on how to change the name of the plant bus.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Component View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\SIMATIC 400(1)" folder in the tree view.
2. Select the "Hardware" object in the detail view, and then select **Edit > Open Object**.
The "HW Config - SIMATIC 400(1) (Configuration) -- <project_name>_Prj" window opens.
3. Select the "PN/IO-X5" module in slot "X5" and then select the menu command **Edit > Object Properties**.
The "Properties - PN-IO-X5 (R0/S2.5)" dialog box appears with the "General" tab being activated.
4. Click "Properties".
The "Properties - Ethernet interface PN-IO-X5 (R0/S2.5)" dialog box appears.
5. If you have not already done so, select the "Ethernet (1)" entry from the "Subnet" list and then click "Properties".
6. Enter the name "Plant bus" in the "Name" input field of the "Properties - Industrial Ethernet" dialog box, and click "OK".
7. Click "OK" in the "Properties - Ethernet interface" dialog box and in the "Properties - PN-IO-X5 (R0/S2.5)" dialog box.
You have successfully renamed the Ethernet bus.

Result

The name of the plant bus is changed to a required name.

4.1.3 Adding the distributed I/O

Introduction

This section provides information on how to add a distributed I/O.

Requirement

HW Config of the **color_gs** project is open.

Procedure

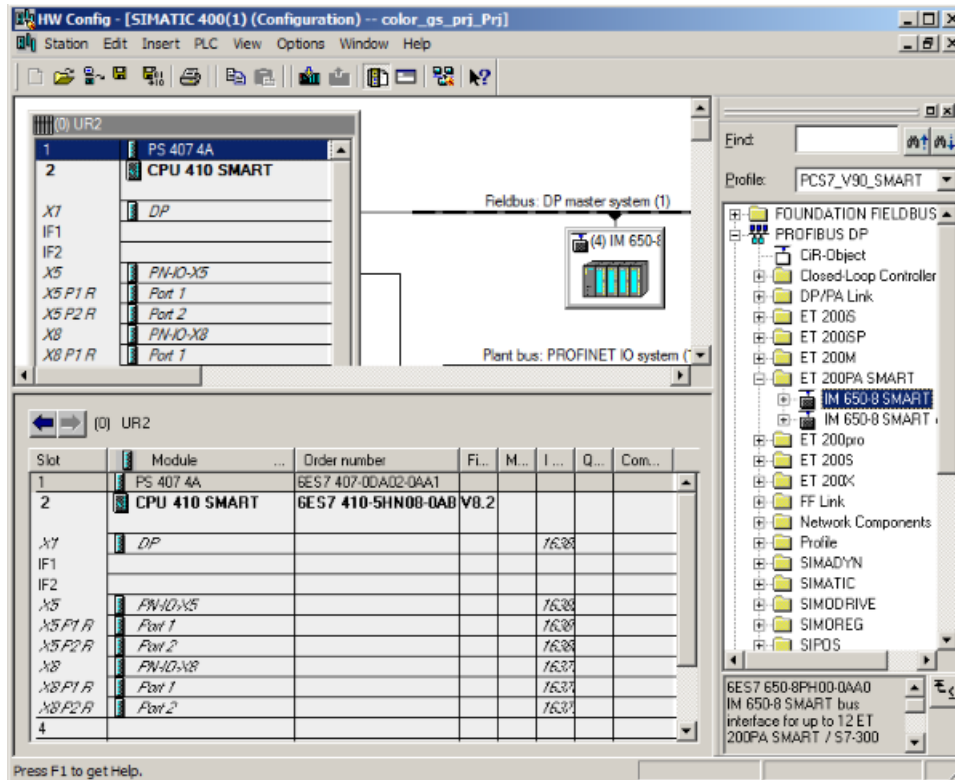
1. Select "PROFIBUS(1)".
PCS 7 SMART generated this bus automatically when you created the project.
2. Select **Edit > Object Properties**.
The "Properties – DP master system" dialog box opens.
3. Click "Properties".
The "Properties - PROFIBUS" dialog box opens with the "General" tab activated by default.
4. Enter "Fieldbus" in the "Name" input field.
5. Switch 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 subnet is now assigned the name "Fieldbus".
8. Open the hardware catalog and select the
"PROFIBUS-DP\ET 200PA SMART\IM 650-8 SMART" component with article number
6ES7 650-8PH00-xAA0 from **View > Catalog**. Drag-and-drop it to the "Fieldbus" DP master
system.
The "Properties - PROFIBUS Interface IM 650-8" dialog box opens.
9. Select the entry "4" from the drop-down list and then click "OK".
The dialog box closes and IM 650-8 SMART is inserted.
10. Select "IM 650-8 SMART".
11. Drag-and-drop the following I/O modules from the hardware catalog to the IM 650-8 SMART
slots:
The corresponding slots are displayed in the lower area of the window

Module type	Location in the hardware catalog	Article number	Slot
Analog output module	IM 650-8 SMART\AO8x12Bit	6ES7 650-8BK60-xAA0	4
Analog input module	IM 650-8 SMART\AI8x16Bit	6ES7 650-8AK60-xAA0	5
Digital output module	IM 650-8 SMART \DO16xDC24V/0.5A	6ES7 650-8EK70-xAA0	6
Digital input module	IM 650-8 SMART\DI16xDC24V	6ES7 650-8DK70-xAA0	7

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

Result

The distributed I/O are added as shown in the figure.



4.2 Function and use of symbolic names

4.2.1 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. These names are used 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")

4.2.2 Assigning symbolic names

Introduction

This section provides you information on how to assign the symbolic names.

Requirement

HW Config of the **color_gs** project is open.

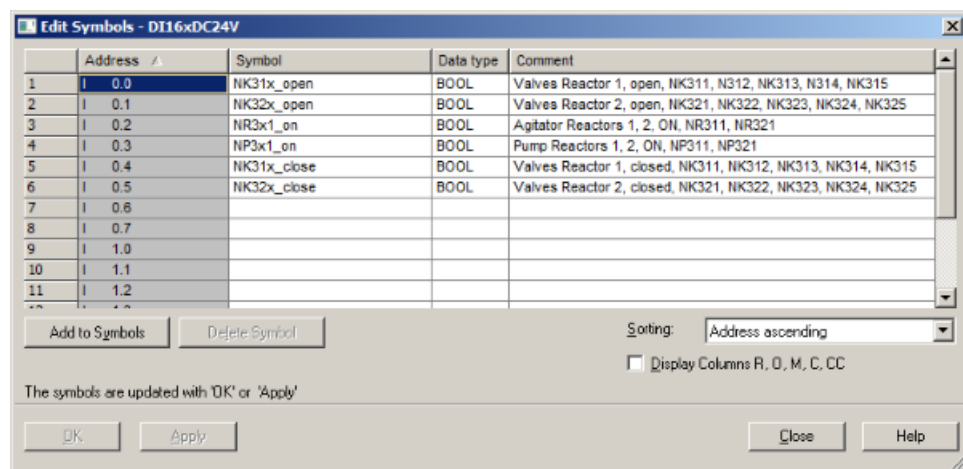
Procedure

1. Select the "IM 650-8 SMART" module in the workspace. The list view displays all I/O modules you inserted in the course of your hardware configuration.
2. Select the "DI16xDC24V" module from the list view.
3. Select the menu command **Edit > Symbols....**
The "Edit Symbols" dialog box opens. All absolute addresses of the inputs of this module are specified for you in a list.
4. Position the cursor next to address "I 0.0" in the "Symbol" column.
5. Enter the value "NK31x_open" and then press the <TAB> key.
The value entered is applied and the system automatically enters data type "BOOL".
6. Switch to the "Comment" column.
7. Enter the comment according to the following screenshot and then press the <TAB> key.
The cursor moves to the next row of the "Symbol" column.
8. Repeat steps 4 to 6 and enter the values according to the table under "Symbolic names for the digital input module (Page 41)".

Note

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

You can use the "Copy and Paste" Windows function to quickly edit the texts in the "Comment" column.



9. Save your entries by clicking the "Apply" button and then click the "Close" button.
The "Edit Symbols" dialog box closes.

10. Select the following modules in succession from the list view and assign symbolic names to them. To do so, perform steps 3 through 9. The symbols are listed in the corresponding tables:
 - AO8x12Bit - "Symbolic names for the analog output module (Page 39)"
 - AI8x16Bit - "Symbolic names for the analog input module (Page 39)"
 - DO16xDC24V/0.5A - "Symbolic names for the digital output module (Page 40)"
11. Once you have assigned all the symbolic names, select **Station > Save and Compile**. Your hardware configuration is saved.
12. Close HW Config.

Result

The symbolic names are assigned for various analog/digital I/O modules.

4.2.3 Symbolic names for the analog output module

Introduction

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

Address	Symbol	Data type	Comment
QW 512	LI311_c	WORD	Fill level Reactor 1 LI311
QW 514	LI321_c	WORD	Fill level Reactor 2 LI321
QW 516	TC311_c	WORD	Temperature Reactor 1 TC311
QW 518	TC321_c	WORD	Temperature Reactor 2 TC321

4.2.4 Symbolic names for the analog input module

Introduction

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

Address	Symbol	Data type	Comment
IW 512	LI311	WORD	Fill level measurement Reactor 1 LI311
IW 514	LI321	WORD	Fill level measurement Reactor 2 LI321
IW 516	LI311_V	WORD	Drainage rate Reactor 1 LI311
IW 518	LI321_V	WORD	Drainage rate Reactor 2 LI321
IW 520	TC311	WORD	Temperature control Reactor 1 TC311
IW 522	TC321	WORD	Temperature control Reactor 2 TC321

4.2.5 Symbolic names for the digital output module

Introduction

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

Address	symbol	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 NK313 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

4.2.6 Symbolic names for the digital input module

Introduction

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 NK311, NK312, NK313, NK314, NK315
I 0.1	NK32x_open	BOOL	Valves Reactor 2, open NK321, NK322, NK323, NK324, NK325
I 0.2	NR3x1_on	BOOL	Agitator Reactors 1, 2, ON NR311, NR321
I 0.3	NP3x1_on	BOOL	Pump Reactors 1, 2, ON NP311, NP321
I 0.4	NK31x_close	BOOL	Valves Reactor 1, closed NK311, NK312, NK313, NK314, NK315
I 0.5	NK32x_close	BOOL	Valves Reactor 2, closed NK321, NK322, NK323, NK324, NK325

Working in the plant hierarchy

5.1 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 <i>Getting Started - Part 2</i>
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.

5.2 Expanding the plant hierarchy

Introduction

This section provides information on how to expand the plant hierarchy.

Requirements

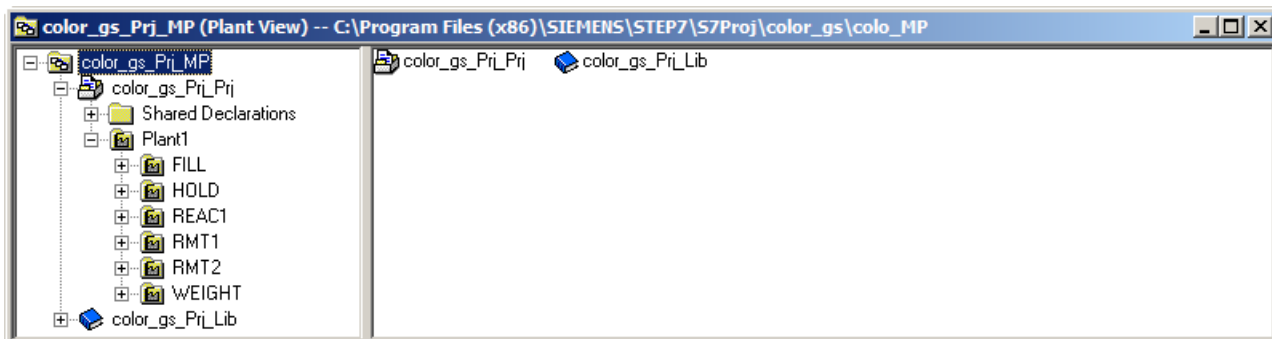
- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\Plant1" folder in the tree view.
2. Select the menu command **Insert > Technological Objects > 1 Hierarchy Folder**.
The new "Unit(3)" hierarchy folder is inserted.
3. Rename it as "WEIGHT".
4. Select the hierarchy folder in the detail view, followed by the menu command **Edit > Object Properties**.
The "Properties - Hierarchy folder" dialog box opens.
5. Check the following settings on the "Control and Monitoring 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 deactivated.
6. Click "OK".
This closes the dialog box and applies the settings.
7. Repeat steps 1 to 6 to create the following hierarchy folders:
 - REAC1
 - HOLD
 - FILL

Result

The plant hierarchy is expanded shown in the diagram:



5.3 Adding process pictures

Introduction

This section provides information on how to add the process pictures.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\Plant1\FILL" folder in the tree view.
2. Select the **Insert > Technological Objects > A Picture** menu command. The "Picture(8)" object 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

Result

The respective process pictures are added in the required folders.

Using textual interconnections

6.1 What are textual interconnections?

Textual interconnections

Textual interconnections are used if no interconnection partner is available. If an interconnection is made to the block input/output of a CFC chart that has not yet been created and configured, 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 a 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 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:
In the process tag type you enter a string which is not a random string. However, it should indicate the path reference that must be specified while creating individual process tags.

Textual interconnections in this getting started

In this document, the textual interconnections are encountered 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 SMART process tag types.
- When working with process tag types:
Here you learn how to use textual interconnections in import files.
- When working with SFC charts:
Here you learn how to use textual interconnections when entering the parameters for steps and transitions.

6.2 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. Click the block output of chart 1.
2. Switch to chart 2.
3. Click the corresponding block input of the interconnection partner.

Creating a cross-chart interconnection using a textual interconnection:

At the block input of chart 2, specify the path reference to the block output of the corresponding interconnection partner. 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.

Double-clicking on the interconnection in the sheet bar changes it to the corresponding I/O in the CFC chart as usual.

6.3 Textual interconnections in SFC charts

Textual interconnections as path references

Similar to CFC configuration, in SFC charts, 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 CFC chart.

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

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

- In SFC, the charts are highlighted in yellow
- In CFC, charts are indicated with a yellow triangle

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

7.1 Overview of the work in CFC

Configuration tasks

During the CFC configuration, perform the following configuration steps:

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

7.2 Expanding the master data library

7.2.1 Expanding the master data library

Introduction

After creating the **color_gs** project using *Getting Started - Part 1*, you are aware of the master data library where all the blocks required for the **color_gs** project are stored. For *Getting Started - Part 2*, a few more additional blocks are required. Therefore, 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
FC351	Add04	Calculates the sum of up to 4 values	Mathematical block	PCS 7 AP Library V90
FB1810	TimerP	Configure runtimes / delay times	Timer	PCS 7 AP Library V90

7.2.2 Storing additional blocks

Introduction

This section provides information on how to copy additional blocks from the "PCS 7 AP Library V90" library to the master data library.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select **File > Open....**
2. Select the "Libraries" tab
3. Select the following library:
"PCS 7 AP Library V90"
4. Click "OK".
The library is opened in the Component view.

5. Copy the following blocks from the "PCS 7 AP Library V90" to your master data library in the "color_gs_prj_MP\color_gs_prj_Lib\S7 Program(1)\Blocks" folder.

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 AP Library V90\Blocks + Templates\Blocks	• FB1810 • FB1828 • FC351

6. Close the libraries.

7.3 Simulation charts and chart-in-chart technique

7.3.1 Creating the "SIMREAC" simulation chart

Similar to the CFC chart for motor simulation, we provide brief instructions for the procedure along with tables containing the required values.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

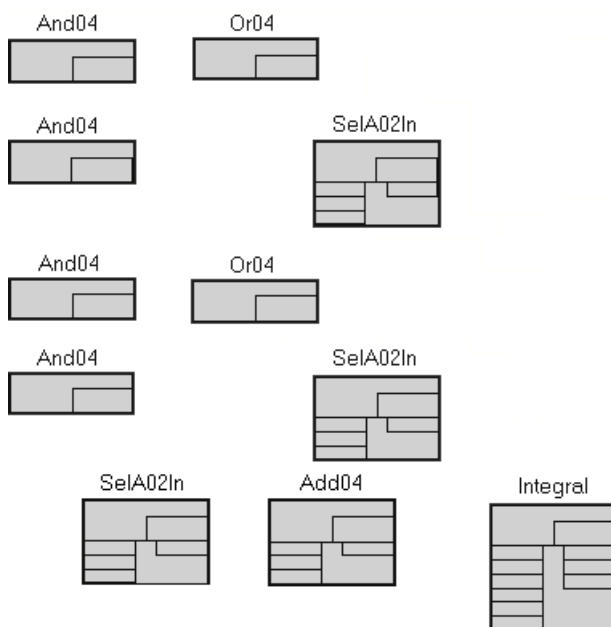
Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder in the tree view
2. In the detailed view, right-click and select **Insert New Object > CFC**, rename it to "SIMREAC".
3. Open the CFC chart "SIMREAC".

4. Use drag-and-drop to insert the following blocks:

Block	Storage in the catalog (Tab)	Storage in the catalog (Folder)	Function
And04 four times	Libraries	"PCS 7 AP Library V90\Blocks+Templates\Blocks\Logi-cDi"	Controls whether RMT1 or RMT2 performs dosing to REAC1 or REAC2.
Or04 twice	Libraries	"PCS 7 AP Library V90\Blocks+Templates\Blocks\Logi-cDi"	Controls whether RMT1 or RMT2 performs dosing to REAC1 or REAC2.
SelA02In three times	Libraries	"PCS 7 AP Library V90\Blocks+Templates\Blocks\Logi-cAn"	The fill level of the reactor is simulated based on which action has just taken place: - The dosing quantity for raw material dosing, derived from RMT1 or RMT2, is used as an input value for the integrator. - For drainage processes, a negative value is used as the input value for the integrator.
Integral	Libraries	"color_gs_prj_Lib \S7 Program(1)\Blocks \Math"	Generates a time integral for the respective input value.
Add04	Libraries	"color_gs_prj_Lib \S7 Program(1)\Blocks \Math"	Adder - generates the sum of the input values.

Arrange the blocks as shown in the diagram below



7.3 Simulation charts and chart-in-chart technique

5. Right-click on each block separately and select "Object Properties". In the "Name" box, enter the "Block description" as provided in the following table. Start with the top block on the left.

Block	Block description	I/O	Meaning	Value
And04 (1.)	RMT1_REAC1		If the pump from RMT1 is running and the valve to REAC1 is open, the fill level for REAC1 is simulated.	
And04 (2.)	RMT1_REAC2		If the pump from RMT1 is running and the valve to REAC2 is open, the fill level for REAC2 is simulated.	
And04 (3.)	RMT2_REAC1		If the pump from RMT2 is running and the valve to REAC1 is open, the fill level for REAC1 is simulated.	
And04 (4.)	RMT2_REAC2		If the pump from RMT2 is running and the valve to REAC2 is open, the fill level for REAC1 is simulated.	
Or04 (1.)	RMT1_RE- AC1_or_2		Depending on the AND operation, dosing takes place from RMT1 to REAC1 or to REAC2 .	
Or04 (2.)	RMT2_RE- AC1_or_2		Depending on the AND operation, dosing takes place from RMT2 to REAC1 or to REAC2 .	
Se- IA02In (1.)	RMT1	In1.Value	When no dosing is occurring in RMT1 , the value "0" from In1 is used as the input value for the adder.	0 *
Se- IA02In (2.)	RMT2	In1.Value	When no dosing is occurring in RMT2 , the value "0" from In1 is used as the input value for the adder.	0 *
Se- IA02In (3.)	BOUT	In1.Value	When no drainage process is occurring, the value "0" from In1 is used as the input value for the adder. When the drainage process is occurring, then the value from In2 is used. This value is negative because it has to represent the reduction of the fill level.	0 *
Add04	ADD		All outputs of the SEL_R blocks are connected to the adder.	
Integral	SIM_VOL	OutHiLim	The integrator defines the high limit based on the maximum value of the fill level.	1200
		Ti	Reset time	2.0
		InHyst	Hysteresis	1.0
* default				

6. Set up 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	Sel_In2
RMT1	Out	ADD	In1
RMT2_REAC1	Out	RMT2_REAC1_or_2	In1
RMT2_REAC2	Out	RMT2_REAC1_or_2	In2
RMT2_REAC1_or_2	Out	RMT2	Sel_In2
RMT2	Out	ADD	In2
BOUT	Out	ADD	In3
ADD	Out	SIM_VOL	In

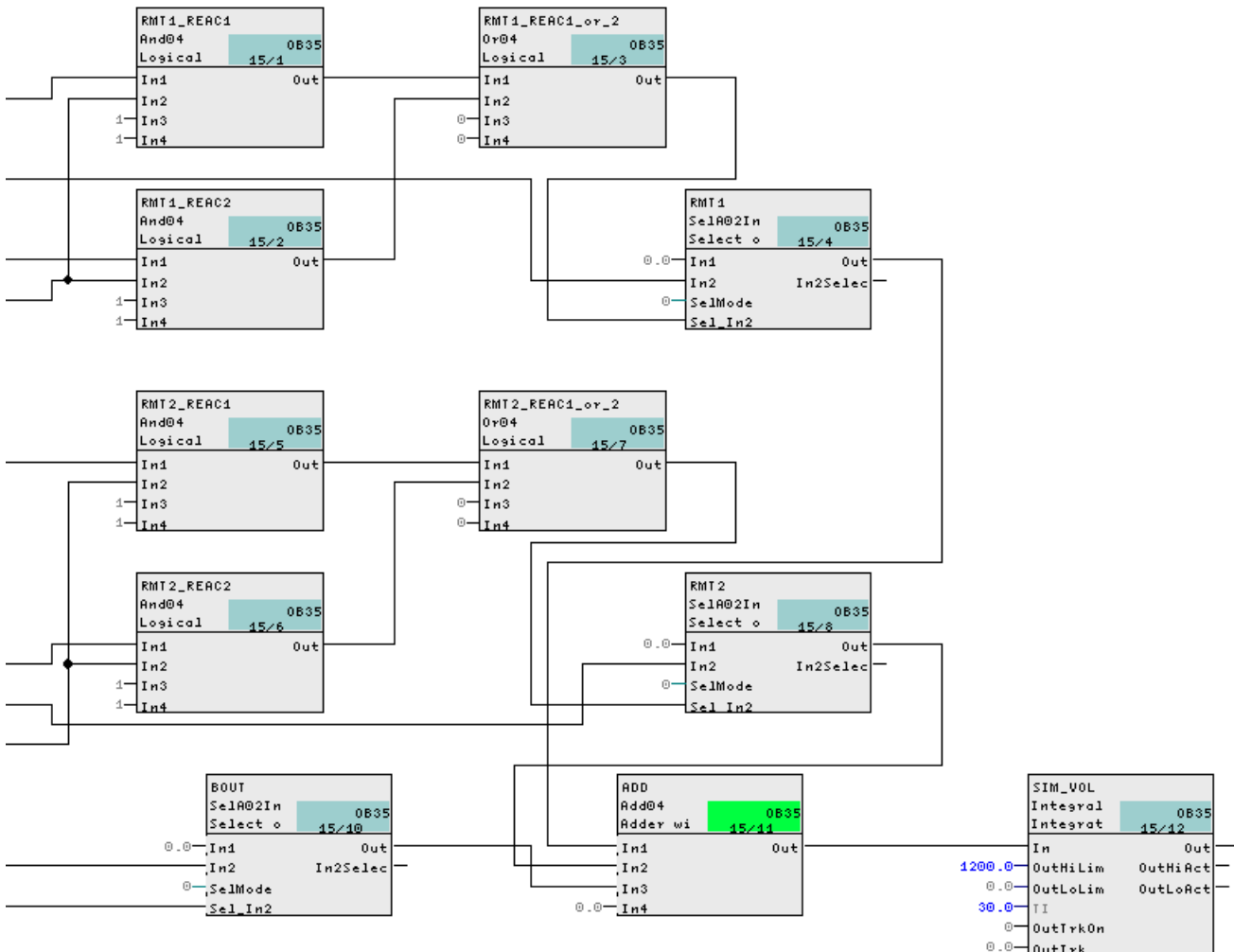
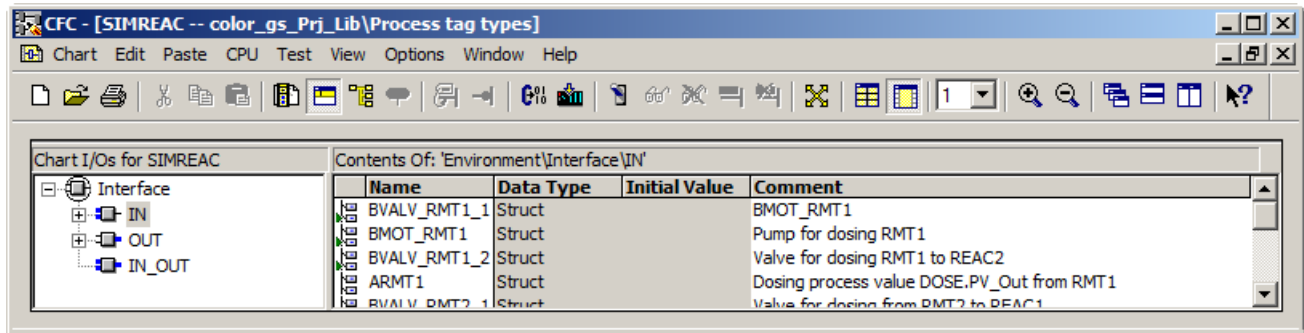
7. Select **View > Chart I/O**. Use drag-and-drop to specify the following chart I/Os and their corresponding parameters:

Interface	Block description	Block I/O	Naming of chart I/O	Comment for chart I/O
IN	RMT1_REAC1	In1	BVALV_RMT1_1	Valve for dosing from RMT1 to REAC1
		In2	BMOT_RMT1	Pump for dosing RMT1
	RMT1_REAC2	In1	BVALV_RMT1_2	Valve for dosing from RMT1 to REAC2
	RMT1	In2	ARMT1	Dosing process value DOSE.PV_Out from RMT1
	RMT2_REAC1	In1	BVALV_RMT2_1	Valve for dosing from RMT2 to REAC1
		In2	BMOT_RMT2	Pump for dosing RMT2
	RMT2_REAC2	In1	BVALV_RMT2_2	Valve for dosing from RMT2 to REAC2
	RMT2	In2	ARMT2	Dosing process value DOSE.PV_Out from RMT2
	BOUT	Sel_In2	BOUT	Pump drainage from REAC1
		In2	AOUT	Drain speed for REAC1 from CFC_LI311
OUT	SIM_VOL	Out	LEVEL_OUTPUT	Simulation value for fill level

7.3 Simulation charts and chart-in-chart technique

- Drag-and-drop the block I/Os to the names of the chart I/O to interconnect the following block I/Os with the chart I/Os you have already created:

Interface	Block description	Block I/O	Name of chart I/O
IN	RMT1_REAC2	In2	BMOT_RMT1
	RMT2_REAC2	In2	BMOT_RMT2



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"
-

9. Close the CFC chart.

Result

The "SIMREAC" simulation chart is created.

7.3.2 Implementing simulation with CFC charts

Simulation options

You simulate the states of process tags, for example: the fill level of the reactor or the state of the valve.

Two options are available:

- Through 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 can now configure these simulation charts.

You can choose between these two simulation types. For this purpose, a special "GENERAL" CFC is created that facilitates this selection on the OS in the process mode. You can use it to simulate selectively by using CFC charts or by using input/output modules when they are connected.

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

Chart-in-chart technique

When using the simulation charts, you will become acquainted with a function of rational engineering called the chart-in-chart technique.

This involves inserting one CFC chart into another CFC chart. The inserted chart then becomes the nested chart and the other, the top chart. This enables you to use a CFC chart repeatedly once it is created.

Example

- You create a simulation chart for a valve.
- You can insert this simulation chart as a nested chart in the top chart for the "valve" process tag.
- You can open and, if necessary, edit the nested chart from the top chart at any time.

Chart inputs/outputs

The following procedure simplifies the use of a nested 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 nested 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 "nested charts" in your master data library to ensure that you have a fast and easy access to them.

Note

If you make subsequent changes in the original simulation chart, the changes are **not** automatically applied to all the locations where the chart is used.

7.3.4 Function of the "General" CFC chart

"GENERAL" CFC chart

Apart from simulation charts, a special chart is required for the simulation:

The CFC chart "GENERAL"

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 by using input and output modules or by using simulation charts. You select the simulation mode through an operator control block. The output of this operator control block is interconnected to the "SimOn" 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. This occurs immediately after starting in the 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 to execute the SFC chart. This requires too much effort in this project. At CPU startup, the "GENERAL" chart sets the "RstLi" input for every valve temporarily to "1".

7.3.5 Inserting CFC charts for REAC1

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 **color_gs** project is open in the SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\Plant1\REAC1" folder in the tree view.
2. Select **Insert > Technological Objects > 2 CFC** to insert a new CFC chart named "GENERAL".
3. Select the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder in the tree view.
4. Select **Insert > Technological Objects > 2 CFC** to insert new CFC charts with the following names: SIMV, SIMMO.

Result

The CFC charts are inserted in "REAC1" and "Process tag types" folders.

7.3.6 Creating the "General" Chart

Requirements

- The **color_gs** project is open in the SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\Plant1\REAC1" folder in the tree view and open the CFC chart "GENERAL". This also opens the catalog.

Note

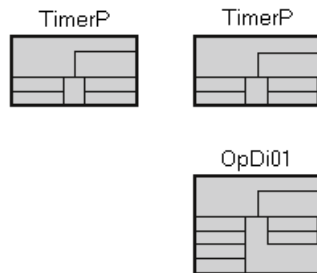
Select **View > Catalog** if the catalog is not opened by default. The catalog is now opened in the left pane of the window.

2. Select the "Libraries" tab and drag-and-drop the "OpDi01" block from the "color_gs_prj_Lib\S7 Program(1)\Blocks\Operate" library.
This is the operator control block for selecting the type of simulation.
3. Select the "OpDi01" block and then select **Edit > Object Properties**.
4. Enter the following parameters according to the table:
 - "General" tab, "Name" box: Block description
 - "I/Os" tab: Values of the I/Os

Block description	I/O	Value
ACT_SIM	SetLi.Value	1
	OosLi.Value	1

5. Click "OK" to save your entries.
You do not create any additional entries or interconnections at this point.
6. Open the "color_gs_prj_Lib\S7 Program(1)\Blocks\TIME" library in the catalog.

7. Use drag-and-drop to insert the "TimerP" object twice and arrange the objects according to the diagram below.



8. Enter the parameters according to the table below:

Block	Block description	I/O	Value
TimerP	RESET_TP	In.Value	1
		Ti	2
TimerP	RESET_TON	Ti	1

9. Set the following interconnections. You are already familiar with the procedure from *Getting Started - Part 1*:

Block description	I/O	Block description	I/O
RESET_TP	Out	RESET_TON	In
RESET_TP	Out	ACT_SIM	LiOp (inverted)

10. Close the CFC chart "GENERAL".

Result

The "GENERAL" CFC chart is created.

7.3.7 Creating the "SIMV" simulation chart

Overview

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

Step	Action
1	Insert blocks (Page 64)
2	Configure connections (Page 64)
3	Make Interconnections (Page 65)

7.3.8 Step 1 - Inserting blocks into "SIMV"

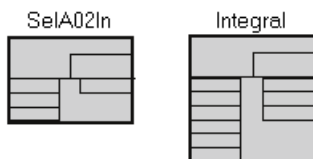
Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder in the tree view and then open the CFC chart "SIMV".
The chart is opened in the CFC Editor.
2. Use drag-and-drop to insert the blocks listed in the table in the specified order and arrange them in accordance with the diagram. 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	
SelA02In	Libraries	"PCS 7 AP Library V90\Blocks +Templates\Blocks\LogicAn"	Depending on the value at output VALVE.Ctrl of the top chart, one of the inputs is activated and interconnected to the input of the integrator
Integral	Libraries	"color_gs_prj_Lib\S7 Program(1)\Blocks\Math"	Generates a time integral for the input value



Result

The blocks are inserted in the "SIMV" CFC chart.

7.3.9 Step 2 - Assigning parameters for the inputs and outputs of "SIMV"

Requirements

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

Procedure

1. Select the required block, followed by the menu command **Edit > Object Properties....**
2. Enter the following parameters according to the following table and then click "OK".
 - "General" tab: Name of the block
 - "I/Os" tab: Values of the I/Os

Block	Name	I/O	Meaning	Value
SelA02In	SEL_OPEN_CLOSE	SelMode	This value activates step control mode (select with Sel_In2).	0 *
		In1.Value	This value is switched through to the Integral block when input "Sel_In2" =0.	-16.0
		In2.Value	This value is switched through to the Integral block when input "Sel_In2" =1.	16.0
Integral	SIM_DELAY	OutHiLim	High limit of the integrated output value.	100 *
* default				

Result

The required parameters are assigned for the inputs and outputs of "SIMV".

7.3.10 Step 3 - Interconnecting inputs and outputs of "SIMV"

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

Requirements

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

Procedure

1. Interconnect the I/Os as specified in the table:

Block description	Output connection	Block description	Input connection
SEL_OPEN_CLOSE	Out	SIM_DELAY	In

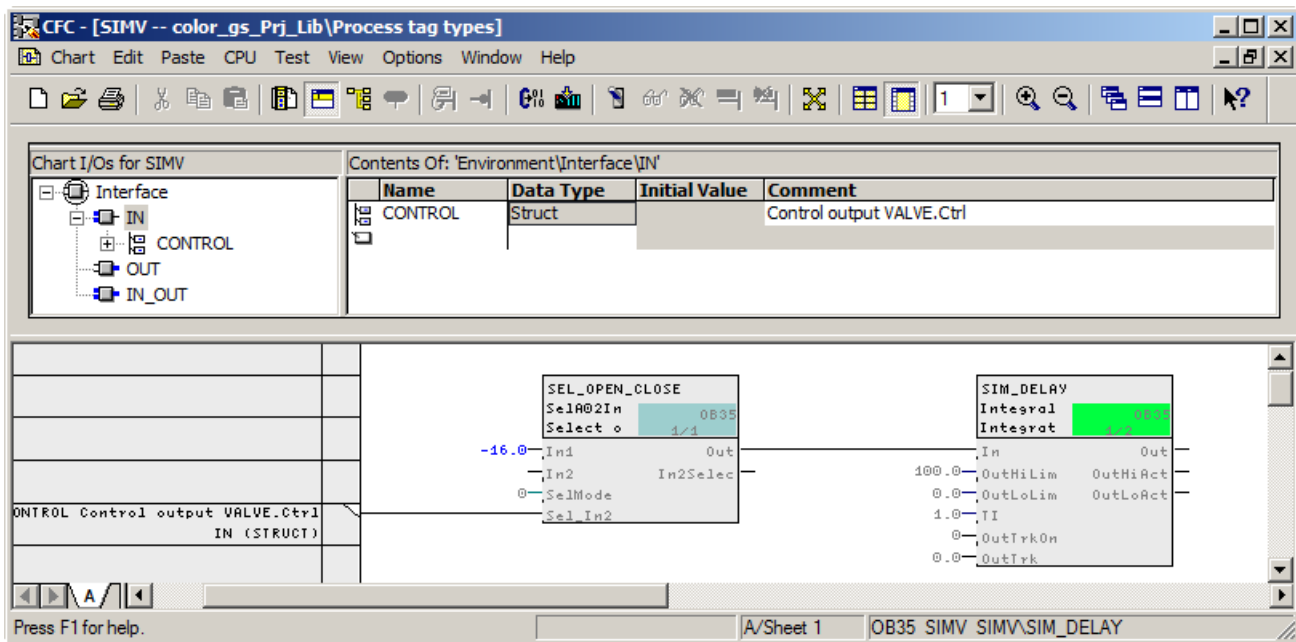
2. Select **View > Chart I/Os**.
The interface editor opens for editing the chart I/Os.
3. Select the "Interface\IN" entry in the tree view.
The detail view displays an empty input line.

7.3 Simulation charts and chart-in-chart technique

4. Drag-and-drop the "SEL_In2" block I/O from the "SEL_OPEN_CLOSE" block to the "Name" input box of the interface editor.
An interconnection is created 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.
5. Click the "Name" field and replace the default name with "CONTROL".
6. Define additional parameters in the command input line:
 - The "Data type" is set automatically to "STRUCT".
 - Click "Comment" and type in the text "Control output VALVE.Ctrl".

Note

Resize the column width so that the entire text fits into the input box.



7. Select "Interface\OUT" in the tree view of the interface editor.
8. Drag-and-drop the following block I/Os to the "Name" input box and specify the parameters in accordance with the table: (It is not required to enter a start value for the outputs.)

Block description	Block I/O	Name of chart I/O	Comment for chart I/O
SIM_DELAY	OutHiAct	FBOPEN	Feedback value VALVE.FbkOpen
SIM_DELAY	OutLoAct	FBCLOSE	Feedback value VALVE.FbkClose

9. Select **View > Chart I/Os** from the menu. The interface editor closes.
10. Close the CFC chart "SIMV".

Result

The inputs and outputs of "SIMV" are interconnected.

7.3.11 Creating the "SIMMO" simulation chart

To create the "SIMMO" simulation chart, you essentially use 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

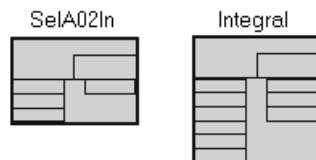
- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder in the tree view and open the CFC chart "SIMMO" using the detail view.
2. Use drag-and-drop to insert the following blocks :

Block	Storage in the catalog		Function
	Tab	Folder	
SelA02In	Libraries	"PCS 7 AP Library V90\Blocks +Templates\Blocks\LogicAn"	Depending on the value at output MOTOR.Start of the top chart, one of the inputs is activated and interconnected to the input of the integrator.
Integral	Libraries	"color_gs_prj_Lib\S7 Program(1)\Blocks\Math"	Generates a time integral for the input value.

Arrange the blocks as shown in the diagram below:



7.3 Simulation charts and chart-in-chart technique

3. Select each block separately. Select **Edit > Object Properties** and enter the following parameters:

Block	Block description	I/O	Meaning	Value
SelA02In	SEL_RUN_STOP	In1.Value	This value is switched through to the Integral block when the value of Start from the "MOTOR" block = "0".	-50.0
		In2.Value	This value is switched through to the Integral block when the value of Start from the "MOTOR" block = "1".	50.0
Integral	SIM_DELAY	OutHiLim	High limit of the integrated value	100 *
* default				

4. Set up the following output <-> input interconnection:

Block description	Output connection	Block description	Input connection
SEL_RUN_STOP	Out	SIM_DELAY	In

5. Select the **View > Chart I/Os** menu command. Use drag-and-drop to specify the following chart I/Os and their corresponding parameters:

Interface interface editor	Block description	Block I/O	Name of chart I/O	Comment for chart I/O
IN	SEL_RUN_STOP	SEL_In2	START	Control output MOTOR.Start
OUT	SIM_DELAY	OutHiAct	FBRUN	Feedback value MOTOR.FbkRun

6. Close the CFC chart.

Result

"SIMMO" simulation chart is created.

7.4 Working with process tag types

7.4.1 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 chart for each individual process tag if you use process tag types.

You first create a basic CFC chart with all general valid parameters.

Duplicate this chart using the import/export functions. This creates 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 SMART 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.

Note

You must not change the following for the created process tags:

- 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.
 - 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 SMART makes available for the motor and valves. In this part of the document, you create process tag types yourself.

Basic procedure for creating process tag types

To create process tag types, proceed as follows:

1. First, based on the concrete project, define all of the process tags of the same type that you can create from process tag types.
2. Then, create the CFC chart that will be used as the top chart for the process tag type.

3. Create a process tag type from this and define the block inputs/outputs to be individually assigned to the process tags created using the process tag type.
4. 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 **color_gs** project using process tag types:

- Motors: Agitators and drainage pumps
- Valves: All

7.4.2 Procedure for creating the 'MOTOR' process tag...

7.4.2.1 Creating "MOTOR" process tags using process tag types

Overview

Create the "MOTOR" process tag with process tag types in the following steps:

Step	What?
1	Creating the "TYPE_MOTOR" basic chart (Page 70)
2	Creating the "TYPE_MOTOR" process tag type (Page 72)
3	Creating the "MOTOR_REAC1" import file (Page 75)
4	Editing the "MOTOR_REAC1" import file (Page 76)
5	Generating "TYPE_MOTOR" process tags (Page 80)

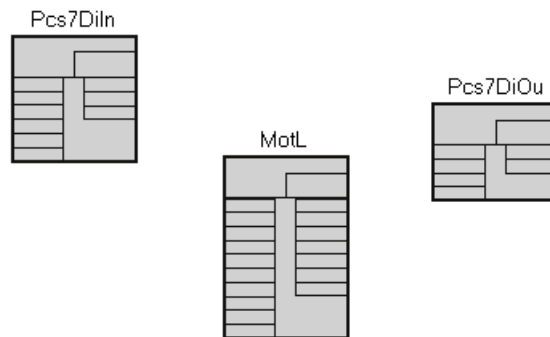
7.4.2.2 Step 1 - Creating the "TYPE_MOTOR" top chart

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder in the tree view.
2. Insert a CFC chart and name it "TYPE_MOTOR".
3. Open CFC chart "TYPE_MOTOR" in the CFC Editor.
4. Open the "color_gs_prj_Lib\S7 Program(1)\Blocks" library in the catalog.
5. Use drag-and-drop to insert the following objects:
 - Channel\Pcs7DiIn
 - Drives\MotL
 - Channel\Pcs7DiOu.
 Arrange them according to the diagram below



6. Enter the parameters according to the table below:

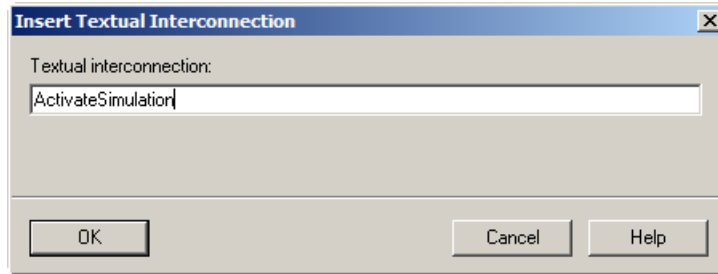
Block	Name in project
Pcs7DiIn	FBON
MotL	MOTOR
Pcs7DiOu	COU

7. Open the "color_gs_prj_Lib\S7 Program(1)\Charts" library in the catalog; use drag-and-drop to insert the "SIMMO" chart to the position below the "FBON" block. This is the chart you created specifically for 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. Set up the interconnections according to the following table:

Block description	Output	Block description	Input
FBON	PV_Out	MOTOR	FbkRun
MOTOR	Start	COU	PV_In
	Start	SIMMO	START
SIMMO	FBRUN	FBON	SimPV_In

9. Click "SimOn" input on the "FBON" block.
10. Select **Insert > Textual Interconnection...**
The "Insert Textual Interconnection" dialog box opens.

11. Enter the name "ActivateSimulation" in the "Textual interconnection" input box.



This way, you enter a character string as a placeholder. When you create the process tags, these placeholders are replaced with a concrete path reference.

The textual reference is displayed in the sheet bar and indicated by a yellow triangle.

12. Click the "StartAut" input of the "MOTOR" block and enter the 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 successfully created the top chart.

7.4.2.3 Step 2 - Creating the "TYPE_MOTOR" process tag type

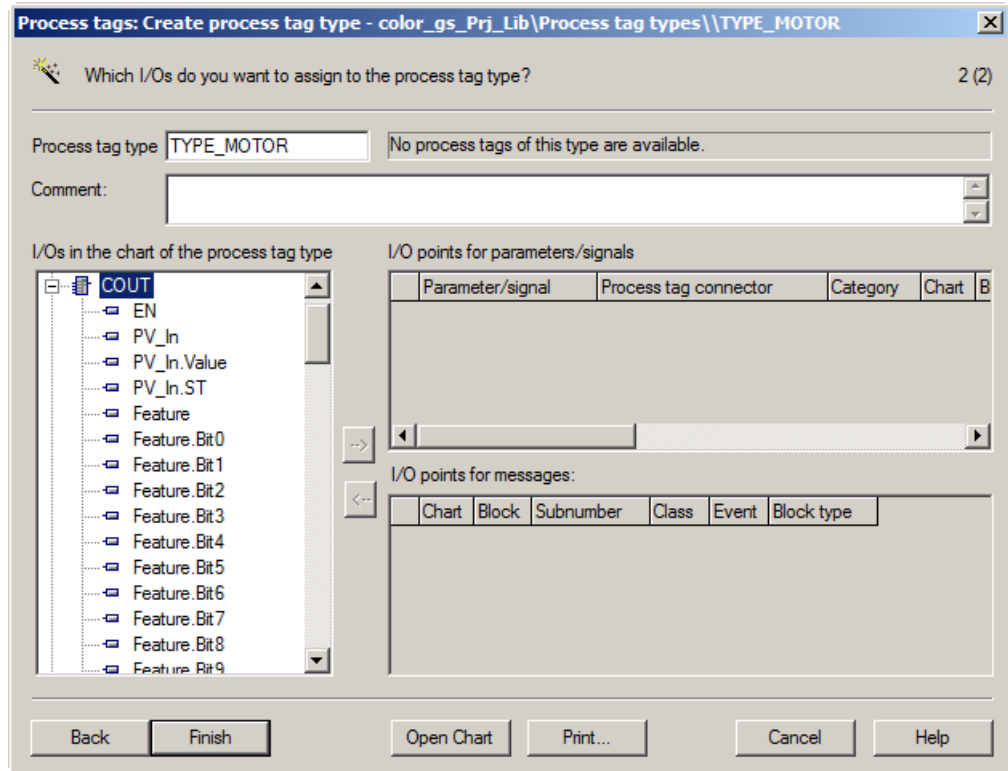
Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder in the tree view.
2. Select CFC chart "TYPE_MOTOR" in the detail view, followed by **Options > Process Tags > Create/Change Process Tag Type**.
The "Process tags: Create process tag type" wizard opens at the "Introduction" step.
3. Click "Next".
The step "Which I/Os do you want to assign to the process tag type?" opens. The "I/Os in the chart of the process tag type" list outputs all blocks you inserted in CFC chart "TYPE_MOTOR".

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

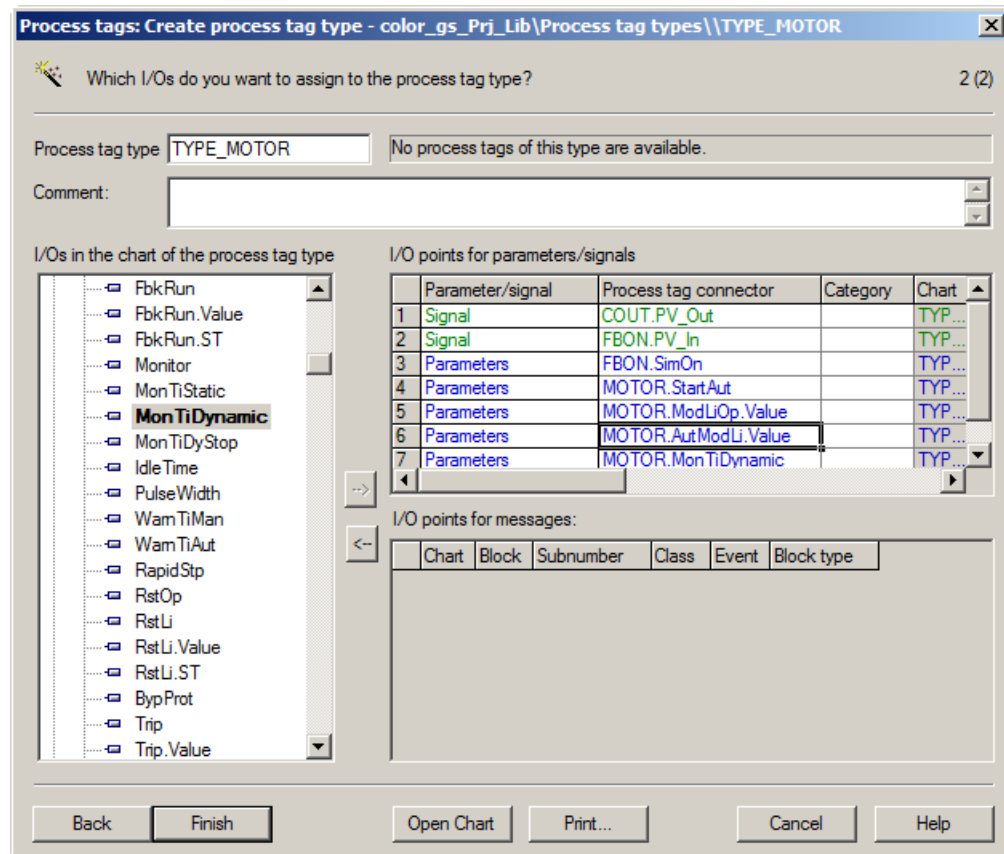


5. Double-click the "PV_Out" I/O.
The selected I/O is displayed in the "I/O points for parameters/signals" list.
6. In the "Parameter/signal" column, select the field corresponding to the "COUT.PV_Out" process tag connector.
A drop-down list opens.
7. Select the "Signal" item from the drop-down list.

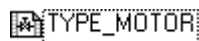


8. Follow exactly the same procedure to set the following I/Os in the "I/O points for parameters/signals" area and to define the values for the parameters/signals.

Block	I/O	Meaning	Parameter/signal
COUT	already done PV_Out	Input value of I/O module	Signal
FBON	PV_In	Input value of I/O module	Signal
	SimOn	Activates simulation	Parameters
MOTOR	StartAut	Automatic value ON/OFF	Parameters
	ModLiOp.Value	Changeover Manual/Auto mode	Parameters
	AutModLi.Value	Selection Man / Auto	Parameters
	MonTiDynamic	Monitoring time	Parameters



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



7.4.2.4 Step 3 - Creating the "MOTOR_REAC1" import file

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder in the tree view.
2. Select the "TYPE_MOTOR" process tag type in the detail view.
3. Select **Options > Process Tags > Assign/Create Import File**.
The "Process tags: Assign/Create Import File" wizard opens at the "Introduction" step.
4. Click "Next >".
The step "Which import file do you want to assign to the process tag type?" opens.
5. Click the input box of the "Column title" column and change the default name according to the table below. This column header is shown later in the import file.

Column title - default name	Column title - adapted name
COUT.PV_Out	Output value COUT.PV_Out
FBON.PV_In	Input value motor on FBON.PV_In
FBON.SimOn	Simulation motor FBON.SimOn
MOTOR.StartAut	Auto mode on/off MOTOR.StartAut
MOTOR.ModLiOp.Value	Man/auto changeover MOTOR.ModLiOp
MOTOR.AutModLi.Value	Selection man/auto MOTOR.AutModLi
MOTOR.MonTiDynamic	Monitoring time MOTOR.MonTiDynamic

6. Click "Create File Template".
You must generate a new import file because you started by generating the process tag type.
The "Create File Template" dialog box opens. The default directory in which PCS 7 SMART opens the import files is already open. PCS 7 SMART suggests an import file name that matches the name of the process tag type.
7. Change this default name to "MOTOR_REAC1.IEA" and then click "Save". The "Create File Template" dialog box opens with active "General" tab.

8. Enter the settings as shown in the table and then click "OK" in this "Create File Template" dialog box.

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

9. Click "Open File".
The import file opens in the IEA file editor. The entries in row 4 represent the configuration of the "TYPE_MOTOR" process tag type. This configuration will be used in the following step.

7.4.2.5 Step 4 - Editing the "MOTOR_REAC1" import file

This section 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 opened in the IEA file editor.

Procedure

Adjust the entries of columns in row 4, according to the following tables. This creates the import data for the CFC chart "CFC_NR311". Empty cells of the "change to" row remain unchanged.

Note

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

Line number	Column	Column	Column
1	Project	Hierarchy	AS
2			
3	Prj	H\	AS
4 (parameters)	color_gs_prj_Prj	Process tags\	S7 program(1)
4 (... change to:)		Plant1\REAC1	

Line number	Column	
1	ChName	ChComment
2	Chart	
3	C	
4 (parameters)	TYPE_MOTOR	
4 (... change to:)	CFC_NR311	

Line number	Column		
1	SymbolName	ConComment	BlockComment
2	output value COUT.PV_Out		
3	S		
4 (parameters)	---	Output value	Digital output driver
4 (... change to:)	NR311_con		

Line number	Column		
1	SymbolName	ConComment	BlockComment
2	input value motor on FBON.PV_In		
3	S		
4 (parameters)	---	Input value	Digital input driver
4 (... change to:)	NR3x1_on		

Note

The "Value" column is missing in the "simulation motor FBON.SimOn" (row 2 of the following table) area. To add a column, follow these steps:

1. Select the column header.
2. Select **Edit > Expand Parameter Column Group**. A dialog box opens. You can use the checkbox to insert sub-columns.
3. Select "Value".
4. Click "OK". The column is inserted.

Line number	Column		
1	TextRef	Value	ConComment
2	simulation motor FBON.SimOn		
3	P		
4 (parameters)	ActiveSimulation		1=Simulation active
4 (... change to:)	GENERAL\ACT_SIM.Out ¹	0	

¹ Textual interconnection from the top chart "TYPE_MOTOR". The placeholder "GENERAL \ACT_SIM.Out" indicates the path reference to the CFC chart "GENERAL" input "ACT_SIM.Out"

Line number	Column		
1	TextRef	ConComment	BlockComment
2	auto mode on/off MOTOR.StartAut		
3	P		
4 (parameters)	Level_Reac	1=Start: Start Command in Auto Mode	Motor - large
4 (... change to:)	"-CFC_LI311\TANK_LEV_MON.PV_WL_Act ¹	AUTO Mode 1=ON 0=OFF	

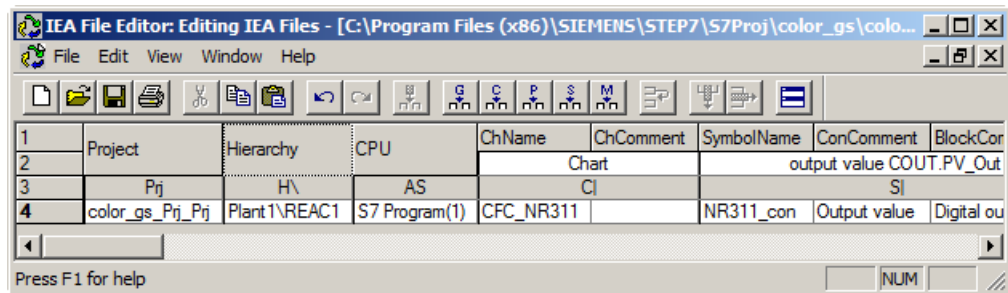
¹ Textual interconnection from the top chart "TYPE_MOTOR". The placeholder is indicated by the initial string "-". This means the input is negated.

Line number	Column		Column	
1	Value	ConComment	Value	ConComment
2	man/auto changeover MOTOR.ModLiOp		selection man/auto MOTOR.AutModLi	
3	P		P	
4 (parameters)	0	Value	0	Value
4 (... change to:)	1	Select: 1=Linking, 0=Operator Active	1	Linkable Input for MANUAL/AUTO Mode

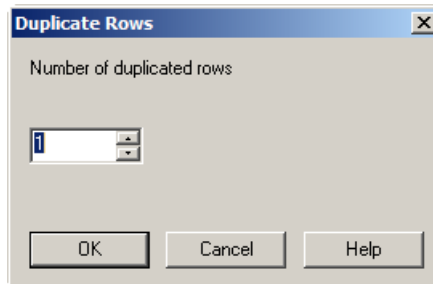
Line number	Column	
1	Value	ConComment
2	monitoring time MOTOR.MonTiDynamic	
3	P	
4 (parameters)	3.0	Monitoring Time of Feedback [s]
4 (... change to:)	10.0	

Create import data for additional CFC charts

1. Click line 4 to select it.



2. Select **Edit > Duplicate Row**.
The "Duplicate Rows" dialog box opens.



3. Enter the value "1" in the "Number of duplicated rows" field and then click "OK".
The row and all of its entries are applied.
4. Enter the deviating parameters in row 5 as shown in the following table. The "---" character string deletes a textual interconnection.

Column	Sub-column	Parameters
Chart	ChName	CFC_NP311
Output value COUT.PV_Out	SymbolName	NP311_con
Input value motor on FBON.PV_In	SymbolName	NP3x1_on
Auto mode on/off MOTOR.StartAut	TextRef	---
Man/auto changeover MOTOR.ModLiOp	Value	0
Selection man/auto MOTOR.AutModLi	Value	0

5. Select **File > Save**.

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6. Close the IEA file editor.
Return to the "Process tags: Assign/Create Import File" wizard.
7. Click "Finish". The wizard closes.

Note

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

1. Insert as many empty lines in the IEA file editor as needed to accommodate the number of existing process tags.
 2. Select the area in the IEA file editor to be edited in Excel.
 3. Copy and paste the data to Excel.
 4. Edit the data in Excel.
 5. Select the edited area in Excel and copy and paste it to the IEA file editor.
-

7.4.2.6 Step 5 - Creating "TYPE_MOTOR" process tags

Requirements

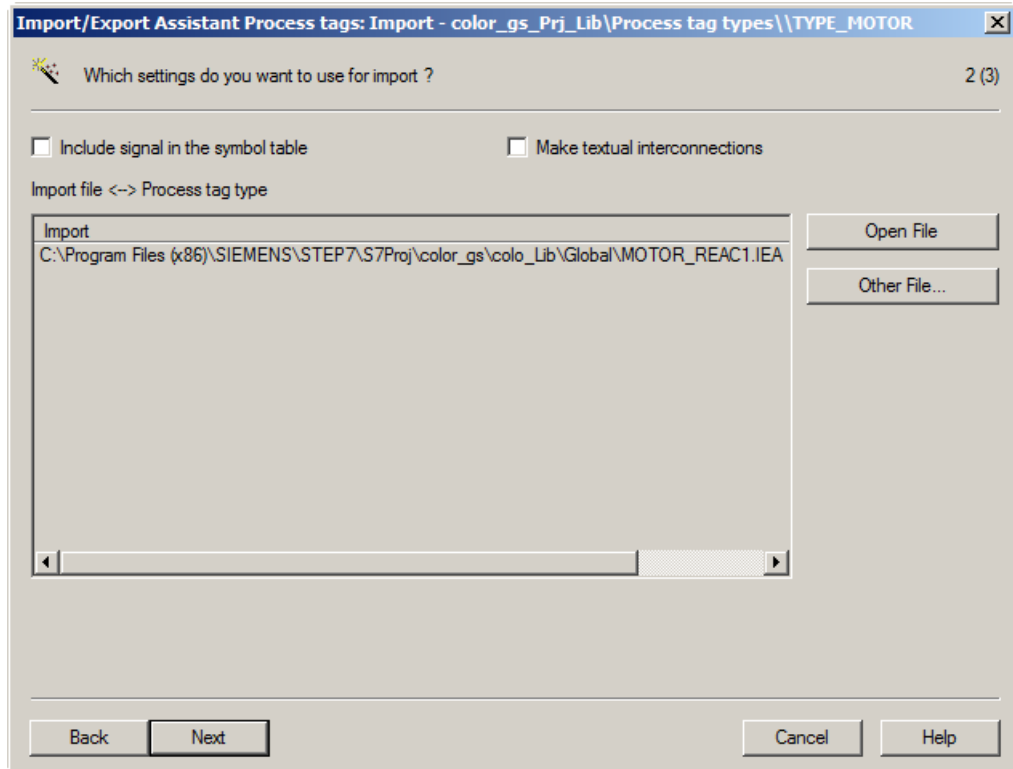
- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder in the tree view.
2. Select the "TYPE_MOTOR" process tag type in the detail view and then select **Options > Process Tags > Import**.
The "Import/Export Assistant Process tags: Import" opens at the "Introduction" step.

3. Click "Next".

The step "Which settings do you want to use for import?" opens. The list shows for the import file: "[storage path] MOTOR_REAC1" and for the process tag type: "TYPE_MOTOR".

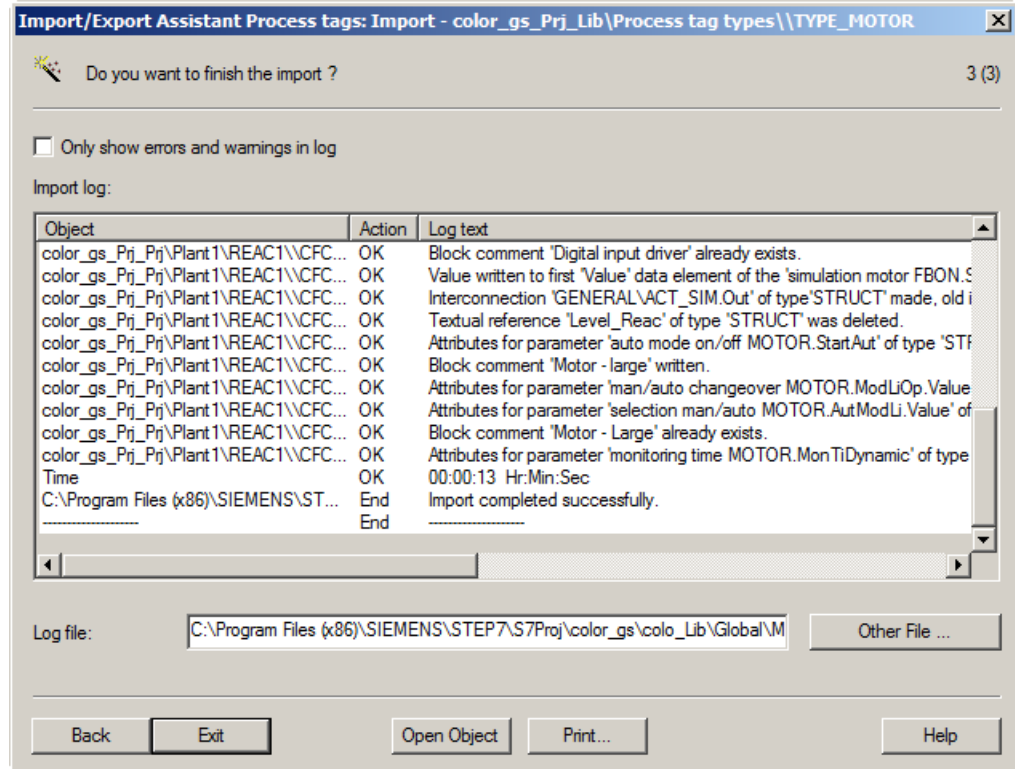


4. Click "Next".

The step "Do you want to finish the import?" opens.

5. Click "Finish".

The import starts and the 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.



You can change the location of the log text file and also print the log.

- Click "Other file" to change the installation path.
- Click "Print" to print the log or to save it as a PDF, and follow the on-screen instructions.

6. Click "Close" and close the IEA log window.

If you have saved the log as a PDF, it will remain open even after the IEA Wizard is closed.

7.4.2.7 The results...

Procedure

1. In the plant hierarchy, navigate to the "color_gs_prj_MP\color_gs_prj_Pj\Plant1\REAC1" folder. This folder contains two new CFC charts: "CFC_NP311" and "CFC_NR311". These are the process tags that you created through the import operation.
2. Open the new process tag "CFC_NR311" in the CFC Editor.
There you can see the results of the import and the correlation between the entries in the import file and the actual process tag:

"FBON" block, "SIM_On" input

At the "FBON" block, relocate the textual interconnection for the "SimOn" input. It is replaced by a concrete interconnection: "Plant1\REAC1\GENERAL(A,1)\ACT_SIM.Out"

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

In the import file, this was a parameter:

Column	Sub-column	Default entry	Parameters
Simulation motor FBON.SimOn	TextRef		GENERAL\ACT_SIM.Out

"FBON" block, "PV_In" input

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

In the import file, this was a parameter:

Column	Sub-column	Default entry	Parameters
Input value motor on FBON.PV_In	SymbolName	---	"NR3x1_on" I0.2 associated block comment

"COUT" block "PV_Out" output

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

In the import file, this was a parameter:

Column	Sub-column	Default entry	Parameters
Output value COUT.PV_Out	SymbolName	---	"NR311_con" Q1.2 associated block comment

"MOTOR" block, "MonTiDynamic" input

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

In the import file, this was a parameter:

Column	Sub-column	Default entry	Parameters
Monitoring time MO- TOR.MonTiDynamic	Value	3.0	10.0

"MOTOR" block, "StartAut" input

For the "MOTOR" block, the textual interconnection for the "StartAut" input can be found and it is replaced by a specific path reference:

"Plant1\REAC1\CFC_LI311 (A1)\TANK_LEV_MON.PV_WL_Act". This input is also negated.

In the import file, this was a parameter:

Column	Sub-column	Default entry	Parameters
Auto mode on/off MOTOR.StartAut	TextRef	Level_Reac	"-CFC_LI311\TANK_LEV_MON.PV_WL_Act"

Note

The information for creating the CFC chart LI311 is available in the following chapter: Creating the "CFC_LI311" CFC chart (Page 100)

7.4.3 Procedure for creating the 'VALVE' process tag...**7.4.3.1 Creating "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	Action
1	Creating the "TYPE_VALVE" top chart (Page 84)
2	Creating the "TYPE_VALVE" process tag type (Page 86)
3	Creating the "VALVE_REAC1" import file (Page 87)
4	Editing the "VALVE_REAC1" import file (Page 76)
5	Generating "TYPE_VALVE" process tags (Page 80)

7.4.3.2 Step 1 - Creating the "TYPE_VALVE" top chart

Follow the same basic procedure as for the "TYPE_MOTOR" process tag type. Brief instructions for the procedure, including the tables containing the required values, are provided below.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Insert the CFC chart "TYPE_VALVE" into the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder.
2. Open the CFC chart "TYPE_VALVE" in the CFC Editor.
3. Open the "color_gs_prj_Lib\S7 Program(1)\Blocks" or the "color_gs_prj_Lib\S7 Program(1)\Charts" library in the catalog.

4. Use drag-and-drop to insert the following objects:

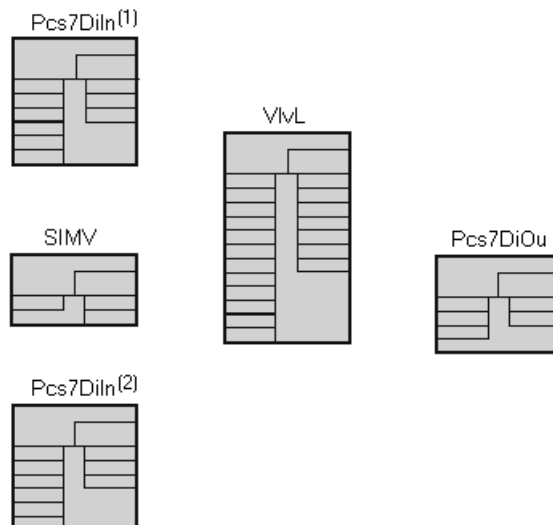
From "blocks":

- Channel\Pcs7DiIn - twice
- Drives\VlvL
- Channel\Pcs7DiOu

From "charts":

- SIMV

Arrange the blocks according to the diagram below.



5. Enter the parameters as indicated in the table below:

Block	Block name for the project	I/O	Parameters
Pcs7DiIn (1)	FBOP		
Pcs7DiIn (2)	FBCL		
VlvL	VALVE	Ctrl	Invisible: No
		MonSafePos	Value: 0
Pcs7DiOu	COU		
SIMV			

6. Set up the interconnections as shown in the table below:

Block diagram	Output connection	Block diagram	Input connection
FBOP	PV_Out	VALVE	FbkOpen
FBCL	PV_Out	VALVE	FbkClose
VALVE	Ctrl	COU	PV_In
	Ctrl	SIMV	CONTROL
SIMV	FBOPEN	FBOP	SimPV_In
	FBCLOSE	FBCL	SimPV_In

7. Insert the following textual interconnections as placeholders:

Block de- scription	I/O	Textual interconnection	Meaning
FBOP	SimOn	ActivateSimulation	Activates simulation in process mode
FBCL	SimOn	ActivateSimulation	Activates simulation in process mode
VALVE	RstLi	Reset	Resets monitoring errors

8. Close the CFC Editor.

7.4.3.3 Step 2 - Creating the "TYPE_VALVE" process tag type

The same procedure as that of "TYPE_MOTOR" process tag type must be followed. Brief instructions for the procedure, including the tables containing the required values, are provided below.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the CFC chart "TYPE_VALVE" in the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder, and then select **Options > Process Tags > Create/Change Process Tag Type**.
2. In the "Process tags: Create process tag type" dialog box, click "Next".
3. Assign the following I/Os to the process tag type in the "Which I/Os do you want to assign to the process tag type?" step:

Block	I/O	Meaning	Parameter/ signal
COUT	PV_Out	Input value of I/O module	Signal
FBCL	PV_In	Input value of I/O module	Signal
	SimOn	Activates simulation	Parameters
FBOP	PV_In	Input value of I/O module	Signal
	SimOn	Activates simulation	Parameters
VALVE	MonTiDynamic	Monitoring time	Parameters
	RstLi	Resets the valves	Parameters

4. Click "Finish".
You successfully completed the creation of the process tag type.

7.4.3.4 Step 3 - Creating the "VALVE_REAC1" import file

The same procedure as that of "TYPE_MOTOR" process tag type must be followed. Brief instructions for the procedure, including the tables containing the required values, are provided below.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the CFC chart "TYPE_VALVE" in the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder, and then select **Options > Process Tags > Assign/Create Import File**.
2. In the "Process tags: Assign/Create Import File" dialog box, click "Next".

3. Change the column headers as follows in the "Which import file do you want to assign to the process tag type?" step:

Column header default name	Column header adapted name
COUT.PV_Out	Output value COUT.PV_Out
FBCL.PV_In	Input value for closing FBCL.PV_In
FBCL.SimOn	Activate simulation for closing FBCL.SimOn
FBOP.PV_In	Input value for opening FBOP.PV_In
FBOP.SimOn	Activate simulation for opening FBOP.SimOn
VALVE.MonTiDynamic	Monitoring time VALVE.MonTiDynamic
VALVE.RstLi	Reset valve VALVE.RstLi

4. Click "Create File Template...".
5. Rename the import/export file "VALVE_REAC1.IEA".
6. In the "Create File Template" dialog box, assign the parameters according to the table below and then click "OK":

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

7. Click "Open file".

7.4.3.5 Step 4 - Editing the "VALVE_REAC1" import file

This section describes the procedure for editing the import file in the IEA file editor.

Requirement

The "VALVE_REAC1.IEA" import file is created and opened in the IEA file editor.

Procedure

1. The first row implicitly represents a process tag. Fill out the row in accordance with the following table:

Line number	Column	Column	Column
1	Project	Hierarchy	CPU
2			
3	Prj	H\	AS
4 (parameters)	color_gs_prj_Prj	Process tags\	S7 program(1)
4 (... change to:)		Plant1\REAC1	

Line number	Column		Column		
1	ChName	ChComment	SymbolName	ConComment	BlockComment
2	Chart		Output value COUT.PV_Out		
3	C		S		
4 (parameters)	TYPE_VAL VE		---	Output value	Digital output driver
4 (... change to:)	CFC_NK31 1		NK311_copen		

Line number	Column			Column	
1	Symbol- Name	ConCom- ment	BlockComment	TextRef ** (See note)	ConComment
2	Input value for closing FBCL.PV_In			Activate simulation for closing FBCL.SimOn	
3	S			P	
4 (parameters)	---	Input value	Digital input driver	ActivateSimula- tion	1=Simulation ac- tive
4 (... change to:)	NK31x_clo se			GENERAL VACT_SIM.Out	

Line number	Column		
1	SymbolName	ConComment	BlockComment
2	Input value for opening FBOP.PV_In		
3	S		
4 (parameters)	---	Input value	Digital input driver
4 (... change to:)	NK31x_open		

Line number	Column	
1	TextRef ** (See note)	ConComment
2	Activate simulation for opening FBOP.SimOn	
3	P	

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Line number	Column	
4 (parameters)	ActivateSimulation** (See note)	1=Simulation active
4 (... change to:)	GENERAL\ACT_SIM.Out	

Line number	Column			
1	Value	Con-Comment	Block-Comment	BlockIcon * (See note)
2	Monitoring time VALVE.MonTiDynamic			
3	P			
4 (parameters)	3.0	Monitoring Time of Feedback [s]	Valve - large	
4 (... change to:)	10.0			1

Line number	Column	
1	TextRef	ConComment
2	VALVE.RstLi	
3	P	
4 (parameters)	Reset	Linked reset signal
4 (... change to:)		

1. Select row 4 and duplicate it four times.
This produces a total of five process tags.
2. Adapt the parameters for the individual process tags in the "Chart/ChName" and "Output value output module COUT.PV_Out\SymbolName" columns as follows:

Row	Column "Chart/ChName"	Column "output value COUT.PV_Out\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. Enter a separate symbolic name for each interconnection with an I/O module.

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

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

7.4.3.6 Step 5 - Creating "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. In this document, you create the process tags for the "REAC1" part of the plant.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

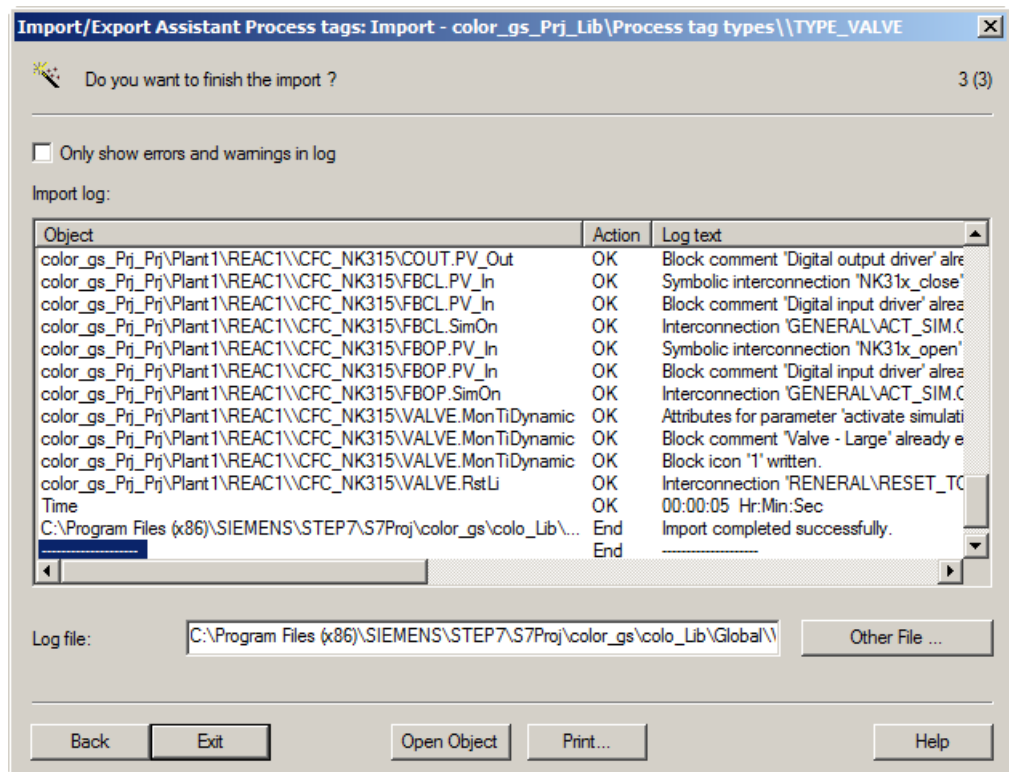
Procedure

1. Select the CFC chart "TYPE_VALVE" in the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder, and then select **Options > Process Tags > Import**.
2. In the "Import/Export Assistant Process tags" dialog box, click "Next".
3. In the "Which settings do you want to use for import ?" step, make sure that "[storage path] VALVE_REAC1" is shown for the import file and "TYPE_VALVE" for the process tag type, and then click "Next".
4. In the "Do you want to finish the import ?" step, click "Finish".

5. Complete the import.

The log file is displayed once you have completed the import. 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



6. Click "Exit".

7.4.4 Procedure for closing...

7.4.4.1 Closing 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 SMART function.

Requirements

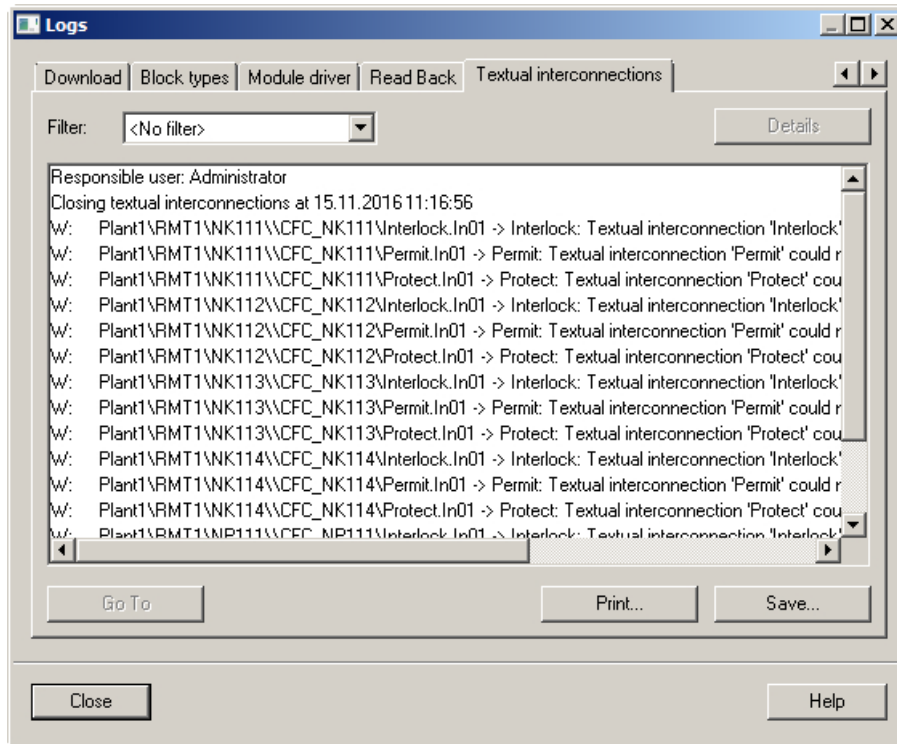
- The **color_gs** project is open in SIMATIC Manager.
- CFC chart "GENERAL" is open in the CFC Editor. The following interconnections are available:
 - Block output "RESET_TON.Out" to all "VALVE.RstLi" valve inputs
 - Block output "ACT_SIM.Out" to all "SimOn" valve inputs (FBON block) and motor process tags (FBOP, FBCL block)

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

Procedure

1. Select **Options > Close Textual Interconnections**.

This action closes all interconnections between the Out output and all valve blocks. The log file is displayed. You can ignore warnings about textual interconnections at the Permit, Interlock and Protect blocks.



2. Double-click any path name in the sheet bar of the CFC chart.
This will automatically take you to the CFC chart "CFC_NK31x". The interconnection flashes 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.

7.5 Modifications of process tag types

7.5.1 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 95): For example: you may want to display different block icons on the OS for the newly created process tags, and perform this assignment using the import file.
- Deleting all created process tags (Page 97): 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 97). If you require, for example, an additional block I/O, which you wish to configure with the import file.

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

7.5.2 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.

7.5.3 Adding 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

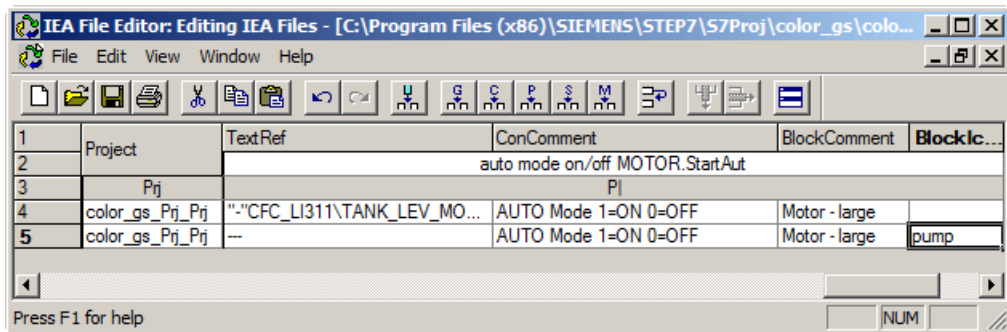
- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Lib\Shared Declarations" folder.
2. Select **Insert > Shared Declarations > 3 Enumeration**
Rename the listing to "TYPE_MOTOR".
3. Select the "TYPE_MOTOR" listing.
4. Select **Insert > Shared Declarations > 4 Value**
Rename the value to "pump".
5. Select the "color_gs_prj_MP\color_gs_prj_Lib\Shared Declarations" folder.
6. Select **Insert > Shared Declarations > 7 Equipment Properties**.
Assign the name "pump" to the new equipment property.
7. Select the "TYPE_MOTOR" process tag type in the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder, and then select **Options > Process Tags > Assign/Create Import File.....**
8. Click **"Next"** to go to the "Which import file do you want to assign to the process tag type?" step and check whether the correct import file "...MOTOR_REAC1.IEA" is displayed in the drop-down list.

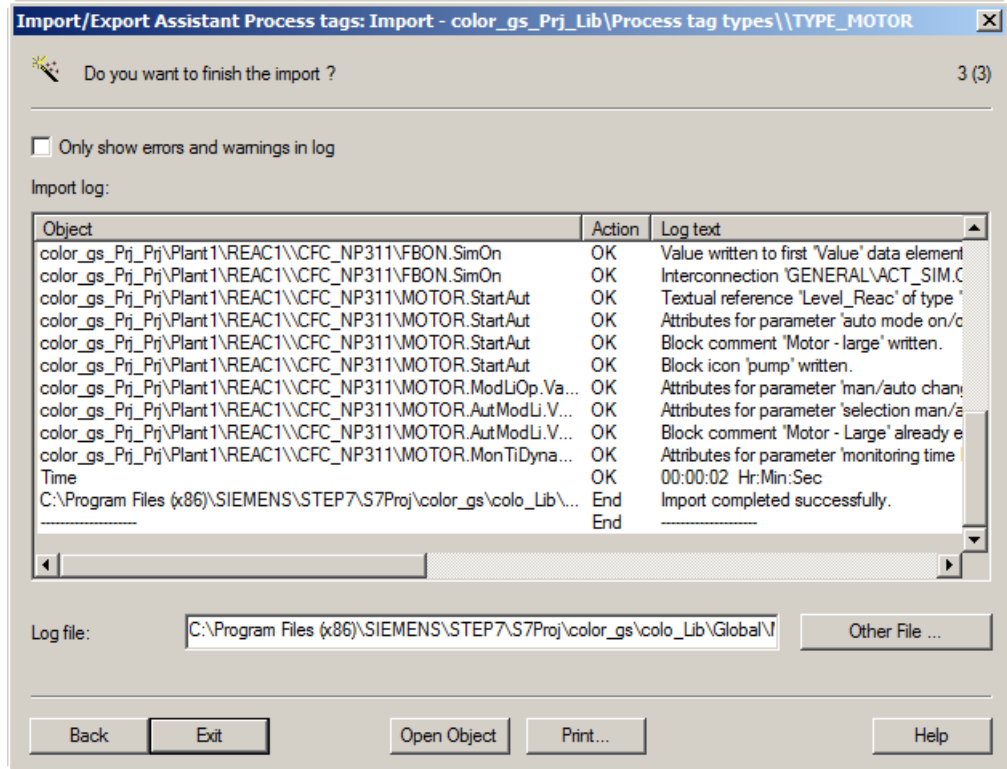
7.5 Modifications of process tag types

9. Click "Open file".
The file opens in the IEA file editor.
10. Select any field in the "auto mode on/off MOTOR.StartAut/BlockComment" column.
11. Select **Edit > Expand column group**.
12. Activate the "Block icon" check box in the "Expand Parameter Column Group" dialog box and click "OK".
The "BlockIcon" column is inserted.
13. 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 picture. Create this special block icon when configuring the OS.



14. Save the file.
15. Close the IEA file editor.
16. Click "Finish".

17. Select process tag type "TYPE_MOTOR", and then select **Options > Process Tags > Import...**
18. In the "Which settings do you want to use for import ?" step, verify that you have selected the correct import file "MOTOR.REAC1.IEA", and then start the import.
The existing process tags are modified according to the parameters set in the import/export file. You can see all of the modifications that have been performed in the log.



For this modification: The name "pump" is entered in the "Create block icon" input box in the "MOTOR" block properties of CFC chart "CFC_NP311". To verify this setting, open CFC chart "CFC_NP311" to view the "MOTOR" block properties.

7.5.4 Making corrections - basic procedure

Note

The following instructions are **not** part of the scope of the tasks in this document. 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.

Note

You can find the storage path for the IEA file as follows:

1. Select a process tag in the component view in SIMATIC Manager.
 2. Right-click and select "Process Tags > Assign/Create Import File...".
 3. Click "Next" in the dialog.
 4. You will now see the storage path next to "Import file:".
-

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. Generate 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 then select **Edit > Insert Column Group > General...**
4. Activate the "Import mode" check box in the "Insert General Column Groups" dialog box and then click "OK".
The "ImportMode" column is inserted as the first column.
5. Enter the "DELETE" command for all process tags that you want to delete and then save the file.
6. Close the IEA file editor.
7. Select process tag type "TYPE_MOTOR", and then select **Options > Process Tags > Import...**
8. Open the import file 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, then, select **Options > Process Tags > Create/Change Process Tag Type...**
2. Insert the additional I/O point and complete the change.
3. Open the corresponding import file and then select **Edit > Insert Column Group > Parameters or Signal**.
This command inserts an additional column.
4. Assign the new column a descriptive name and then save the import file.

5. Select the process tag type, and then select **Options > Process Tags > Assign/Create Import File....**
The additional column which you added to the import file is shown in the "Undefined I/O points in import file" list.
6. Drag-and-drop this column to the new I/O point in the "I/O points of the process tag type for parameters/signals:" list.
7. Complete the function.
8. Re-import the file.

7.6 Creating other CFC charts

7.6.1 Creating the "CFC_LI311" CFC chart

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

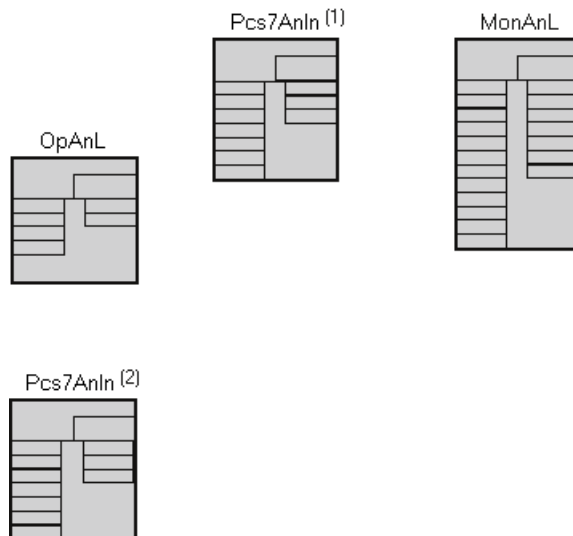
Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\Plant1\REAC1" folder in the tree view.
2. Insert CFC chart "CFC_LI311" and then open it in the CFC Editor.
3. In the tree view of the CFC editor, open the "color_gs_prj_Lib\S7 Program(1)\Blocks" library in the "Libraries" tab.
4. Use drag-and-drop to insert the following blocks:
 - Channel\Pcs7AnIn - twice
 - Monitor\MonAnL
5. Open the "PCS7 AP Library V90\Blocks+Templates\Blocks" library in the catalog
6. Use drag-and-drop to insert the following blocks :
 - Operate\OpAnL

Arrange the blocks according to the diagram below.



7. Enter the parameters as indicated in the table below:

Block	Name in project	I/O	Meaning	Value
Pcs7AnIn (1)	TANK_LEV	PV_InUnit	Unit of measure	1034
		PV_OutUnit	Unit of measure	1034
		Scale.High	High limit of the scale for the process value as a structure	1200
MonAnL	TANK_LEV_MON	PV_AH_Lim **	High alarm limit fill level	990
		PV_AL_Lim **	Low alarm limit fill level	20.0
		PV_Hyst **	Hysteresis	5
		PV_OpScale.High	Limit for scale in PV bar graph of faceplate	1200
		PV_Unit	Unit of measure	1034
		PV_WH_Lim **	High warning limit fill level	950
		PV_WL_Lim **	Low warning limit fill level	40.0
Pcs7AnIn (2)	OUTFLOW	Scale.High	High limit of the scale for the process value as a structure	0
		Scale.Low	Low limit of the scale for the process value as a structure	-100
		SimPV_In.Value	Simulation value for the flow during draining	-10
OpAnL	DRAIN_MIN_LEV	SP_HiLim	High limit minimum fill level	1200
		SP_Int **	Default minimum fill level	60
		SP_LoLim	Low limit minimum fill level	50
		PV_Unit	Unit of measure	1034

** Connection must be set as visible:

In the "Hidden" column you can decide whether interconnected or not interconnected I/Os are to be displayed or hidden:

- If the checkmark is present = hidden.
- If the checkmark is not present = visible.

If the I/O of an interconnection partner is not visible for an interconnection, the interconnection of the visible I/O is moved to the sidebar and the specification of the interconnection target is marked with the text "HIDDEN".

If both interconnection partners or the I/O with a symbolic or textual interconnection are set as hidden, this interconnection can only be identified in the "Interconnection" column and not in the chart. The same applies for interconnections to runtime groups.

8. In the tree view of the CFC editor, open the "color_gs_prj_Lib\S7 Program(1)\Charts" library.
9. Drag-and-drop the CFC chart "SIMREAC" to the position below the "TANK_LEV_MON" block.
This is the chart you created specifically for simulating fill levels.

10. Set up the interconnections according to the following table:

Block description	Output	Block description	Input
TANK_LEV	PV_Out	TANK_LEV_MON	PV
SIMREAC	LEVEL_OUTPUT	TANK_LEV	SimPV_In
OUTFLOW	PV_Out	SIMREAC	AOUT

11. Set the following textual interconnections with a specific path reference:

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

Note

1. The BVALV_RMT1_2 and BVALV_RMT2_2 inputs should not be interconnected for the REAC1 part of the plant.
2. Ensure that these inputs have the input value "0".
3. All textual interconnections are automatically closed because all interconnection partners are already available.

12. Select the block I/Os according to the table below, and then select **Insert > Interconnection to Address**.

The drop-down list containing the symbolic names of the block I/Os opens.

13. Double-click the required block I/O.

The shared address is activated and the interconnection PV_In is displayed in the sidebar.

Block description	I/O	Address
TANK_LEV	Input "PV_In"	LI311
OUTFLOW	Input "PV_In"	LI311_V

14. Close the CFC chart.

7.6.2 Creating the "CFC Chart TC 311" CFC chart

This chart regulates the temperature for REAC1.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\Plant1\REAC1" folder in the tree view.
2. Insert CFC chart "CFC_TC311" and then open it in the CFC Editor.

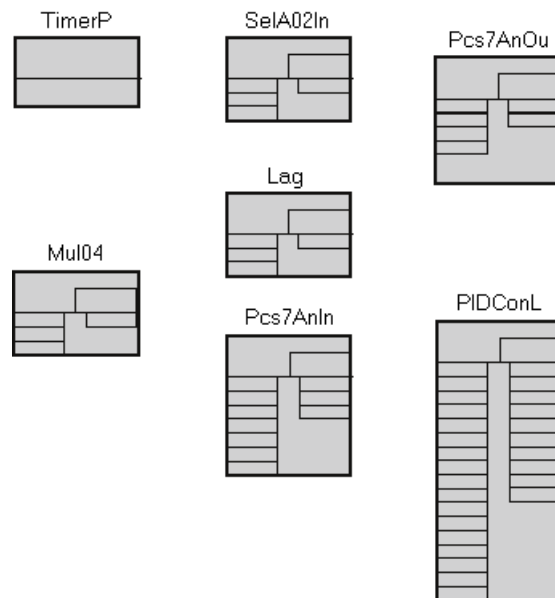
7.6 Creating other CFC charts

- Use drag-and-drop to insert the blocks listed in the table in the specified order and arrange them in accordance with the diagram. If a block has never been used, you have to drag-and-drop it from the "PCS 7 AP Library V90\Blocks+Templates\Blocks\...\\" to the graphic. The corresponding block is available in "color_gs_prj_Lib" the next time it is used.

Note

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

Block	Location	
	Tab	Folder
TimerP	Libraries	"color_gs_prj_Lib\S7 Program(1)\Blocks\TIME"
PIDConL	Libraries	"color_gs_prj_Lib\S7 Program(1)\Blocks\Control"
Mul04	Libraries	"color_gs_prj_Lib\S7 Program(1)\Blocks\Math"
SelA02In	Blocks	"color_gs_prj_Lib\S7 Program(1)\Blocks\LogicAn"
Lag	Libraries	"color_gs_prj_Lib\S7 Program(1)\Blocks\Math"
Pcs7AnIn	Libraries	"color_gs_prj_Lib\S7 Program(1)\Blocks\Channel"
Pcs7AnOu	Libraries	"color_gs_prj_Lib\S7 Program(1)\Blocks\Channel"



4. Enter the parameters according to the table below:

Block	Name in project	I/O	I/O attribute	Meaning	Value
TimerP	TOF	Ti		Maintains the temperature after the maximum value has been achieved	1
PIDConL	CTRL_TEM P	SP_Ext.Value		External setpoint	80
		Gain.Value		Proportional-action coefficient	1 *
		Ti.Value		Integral-action time [s]	8
		TD.Value		Derivative-action time [s]	0 *
		SP_LiOp.Value		Activates basic operator control	0 *
		MV_HiLim.Value		High alarm limit	100 *
		MV_LoLim.Value		Low alarm limit	0 *
		SP_ExHiLim.Value		High limit external setpoint	100 *
		SP_ExLoLim.Value		Low limit external setpoint	0 *
		PV_AH_Lim	Invisible	Process value: High alarm limit	140
		PV_WH_Lim	Invisible	Process value: High warning limit	130
		PV_AL_Lim	Invisible	Process value: Low alarm limit	20
		PV_WL_Lim	Invisible	Process value: Low warning limit	25
		NormPV.High	Invisible	High limit phys. meas. value range proc. value	150
		NormPV.Low	Invisible	Low limit phys. meas. value range proc. value	0 *
		PV_OpScale.High		High display limit	150
		PV_OpScale.Low		Low display limit	0 *
SelA02In	SEL_R	In1.Value		Minimum temperature of the reactor	30
Lag	PT1_P	LagTime		Time delay	60
Pcs7AnIn	INPUT	Scale.High		High limit process value	150
Mul04	MUL_R	In2.Value		Converts the valve position to temperature feedback	1 *
Pcs7AnOu	OUTPUT	Scale.High		High limit manipulated variable	100 *
* default					

7.6 Creating other CFC charts

5. Set the interconnections as indicated in the table below:

Block description	Output	Block description	Input
TOF	Out	SEL_R	Sel_In2
SEL_R	Out	PT1_P	In
PT1_P	Out	INPUT	SimPV_In
INPUT	PV_Out	CTRL_TEMP	PV
CTRL_TEMP	MV	MUL_R	In1
CTRL_TEMP	MV	CTRL_TEMP	Rbk
CTRL_TEMP	MV	OUTPUT	PV_In
MUL_R	Out	SEL_R	In2

6. Set the following textual interconnections:

Block description	Input	Textual interconnection	Meaning
INPUT	SimOn	GENERALVACT_SIM.Out	Activates simulation
TOF	In	CFC_NK313\VALVE.FbkOpenOut	Valve 313 open.

Note

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

7. Select the block I/Os indicated in the table below, followed by **Insert > Interconnection to Address**, and then set the interconnections:

Block description	I/O	Address
INPUT	Input "PV_In"	TC311
OUTPUT	Output "PV_Out"	TC311_c

8. Close the CFC chart and the CFC Editor.

7.7 Summary

7.7.1 Summary: "Rational engineering in the CFC configuration"

New functions

What have you learned from working with CFC charts?

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

- Chart-in-chart technique
- Process tag types

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

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

Chart-in-chart technique

In this document, 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 have inserted the "SIMV" simulation chart into all charts for valve process tags as a nested 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 nested chart are **not** automatically applied to all points of use. If you insert the modified nested chart into another top chart, you will have two different versions of the nested chart in your project. When the top chart opens, it is not immediately clear which version of the nested chart you have used. Make sure you always change the name of the chart when you make subsequent changes to a nested chart. Since the name is displayed when you use this chart in the top chart, you will immediately know which version of the nested chart you have used.

Process tag types

In this document, 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.

7.7 Summary

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 using 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 purposes of this configuration.

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. Select the "color_gs_prj_MP\color_gs_prj_Lib\Process tag types" folder in the plant view of SIMATIC Manager.
2. Select **Options > Process Tags > Import....** The Wizard displays all the import files you created in step 2(3).
3. Remove the import files of all process tag types for which you do not want to create process tags, and then complete the import.

Configuring SFC charts with the use of rational functions

8.1 Overview of configuration steps in the SFC

Configuration tasks

During SFC configuration, you 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.

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

8.2.1 Modifications in the RMT parts of the plant

Interfaces and valves

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

- The NK311 and NK312 valves belong to the "REAC1" part of the plant.
- The NK321 and NK322 valves 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 .

8.2.2 Modifying 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.

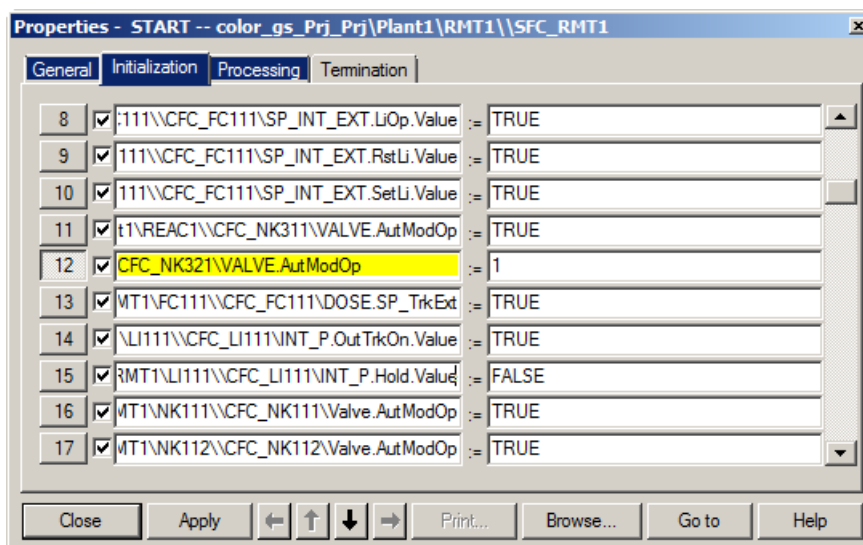
Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.

Procedure for the "RMT1" part of the plant

1. In the tree view, select the "color_gs_prj_MP\color_gs_prj_Prj\Plant1\RMT1" folder and open the SFC chart "SFC_RMT1" in the detail view.
The SFC Editor opens.
2. Select "START".
3. Select **Edit > Object Properties**.
The "START Properties" dialog box opens.
4. Select the "Initialization" tab.
5. Click the button labeled with row number 11.
6. Right click and select **Insert empty line**.
An empty row is inserted at the button with the number 11 .
7. Position the cursor in the input box for the left address in empty row 11 and then click "Browse...".
The "Browse" dialog box opens with the "Plant view" tab activated.

8. In the tree view, select the block:
"Plant1\REAC1\CFC_NK311\VALVE".
All I/Os of this block are displayed in the right pane.
9. Double-click the "AutModOp" input.
This returns you to the "Properties" dialog box and applies the value for the left address.
10. Set the right address to the value "1".
11. Click "Apply".
The value is applied.
12. Insert another empty row before row 12 .
13. Enter a textual interconnection in this row by writing the following:
 - Left address: "CFC_NK321\VALVE.AutModOp". This entry is displayed on a yellow background to identify it as textual interconnection.
 - Right address: "1".



14. Click "Apply".

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

Note

Proceed as follows with data type "STRUCT":

- Right click on the parameter and select "Open Structure".
The "Structure - <Connection name>" dialog opens.
- Double-click the line named "Value".

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.AutModOp	TRUE
Completed already: START	Textual interconnection	CFC_NK321\VALVE.AutModOp	1
INIT_LINE1	Direct interconnection	Plant1\REAC1\CFC_NK311\VALVE.OpenAut.Value	TRUE
INIT_LINE2	Textual interconnection	CFC_NK321\VALVE.OpenAut.Value	1
CLOSE_LINE	Direct interconnection	Plant1\REAC1\CFC_NK311\VALVE.OpenAut.Value	FALSE
	Textual interconnection	CFC_NK321\VALVE.OpenAut.Value	0
END	Direct interconnection	Plant1\REAC1\CFC_NK311\VALVE.OpenAut.Value	FALSE
	Textual interconnection	CFC_NK321\VALVE.OpenAut.Value	0

Procedure for the "RMT2" part of the plant

1. Copy the "SFC_RMT1" chart and paste it to the "color_gs_prj_MP\color_gs_prj_Prj\Plant1\RMT2" folder.
2. Delete the chart "SFC_RMT2", which is already in the "color_gs_prj_MP\color_gs_prj_Prj\Plant1\RMT2" folder.
3. Change the name of the newly copied chart "SFC_RMT1(1)" to "SFC_RMT2". Open the chart "SFC_RMT2".

4. Open the "Object Properties" dialog box. Enter the instructions as indicated in the table below:

Step	Comment	Left address	Right address
START	Direct interconnection	Plant1\REAC1\CFC_NK312\VALVE.AutModOp	TRUE
	Textual interconnection	CFC_NK322\VALVE.AutModOp	1
INIT_LINE1	Direct interconnection	Plant1\REAC1\CFC_NK312\VALVE.OpenAut.Value	TRUE
INIT_LINE2	Textual interconnection	CFC_NK322\VALVE.OpenAut.Value	1
CLOSE_LINE	Direct interconnection	Plant1\REAC1\CFC_NK312\VALVE.OpenAut.Value	FALSE
	Textual interconnection	CFC_NK322\VALVE.OpenAut.Value	0
END	Direct interconnection	Plant1\REAC1\CFC_NK312\VALVE.OpenAut.Value	FALSE
	Textual interconnection	CFC_NK322\VALVE.OpenAut.Value	0

5. Close the "Properties" dialog box and the SFC Editor.

Result

The SFC charts of the RMTx parts of the plant are modified as per the **color_gs** project requirements.

8.3 Working with SFC types

8.3.1 Overview of SFC types

Introduction

This section provides a theoretical overview of the SFC types. Of course, SFC types offers many more options which cannot be described in detail in this document.

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 process values or setpoints to the SFC type needed to be at a later point in time, they can be added to all other SFC instances automatically.

For more information on centralized modification, refer to the chapter: Summary of "Rational engineering in the SFC configuration" (Page 135)

Characteristics of an SFC type

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

- It possesses no runtime properties.
- It is managed in the Component view only and not in the plant hierarchy.
- It 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.

8.3.2 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 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 value "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 and 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 SMART automatically creates the required inputs/outputs in the SFC instance. You can also create the actual process interface for these inputs/outputs.

8.3.3 Planning for the "REAC" SFC type

Introduction

Create a "REAC" SFC type in the **color_gs** project. 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

8.3 Working with SFC types

- 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": This control strategy represents emptying the reactor.

Each control strategy is assigned to exactly one sequencer in the **color_gs** project. This results in the following sequencers:

- Reset (default name: Starting): This sequencer is automatically created and started when the SFC type is created as soon as the start command is executed for a sequential control. 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.
- 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 the 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 the 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. The setpoints and their limit values also apply to automatic mode, but we will not be using this variant in this document.

For the **color_gs** project, the setpoint "Heating" is defined for the temperature in the heating process. It is used in the "Heating" sequencer. 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 "fill level" process value is used in the "Drain" sequencer. 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 FbkRunOut 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

8.3.4 Creating an SFC type

Overview

You can create the SFC type in 11 steps:

Step	What?
1	Create an SFC type in SIMATIC Manager (Page 117)
2	Open an SFC type in the SFC Editor (Page 118)
3	Define control strategies (Page 119)
4	Create sequencers (Page 120)
5	Specify setpoints (Page 122)
6	Define process values (Page 124)
7	Define block contacts (Page 125)
8	Configure "RESET" sequence (Page 127)
9	Design "Heating" and "Drain" sequencers (Page 129)
10	Create an SFC instance (Page 132)
11	Store in master data library (Page 134)

8.3.5 Step 1 - Creating an SFC type

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\SIMATIC 400(1)\CPU 410 SMART \S7 Program(1)\Charts" folder in the tree view.
2. Select **Insert > S7 Software > SFC Type**.
The SFC 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 save the SFC type in the master data library in order to make it available for all the other engineers working in the multiproject.

Result

SFC types are created.

8.3.6 Step 2 - Opening the "REAC" SFC type

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\SIMATIC 400(1)\CPU 410 SMART \S7 Program(1)\Charts" folder in the tree view.
2. Select the "REAC" object in the detail window.
3. Select **Edit > Open Object**. The SFC Editor opens. As with an SFC chart, there is already a sequencer with the "START" and "END" steps and Transition 1 present.

Result

"REAC" SFC is opened.

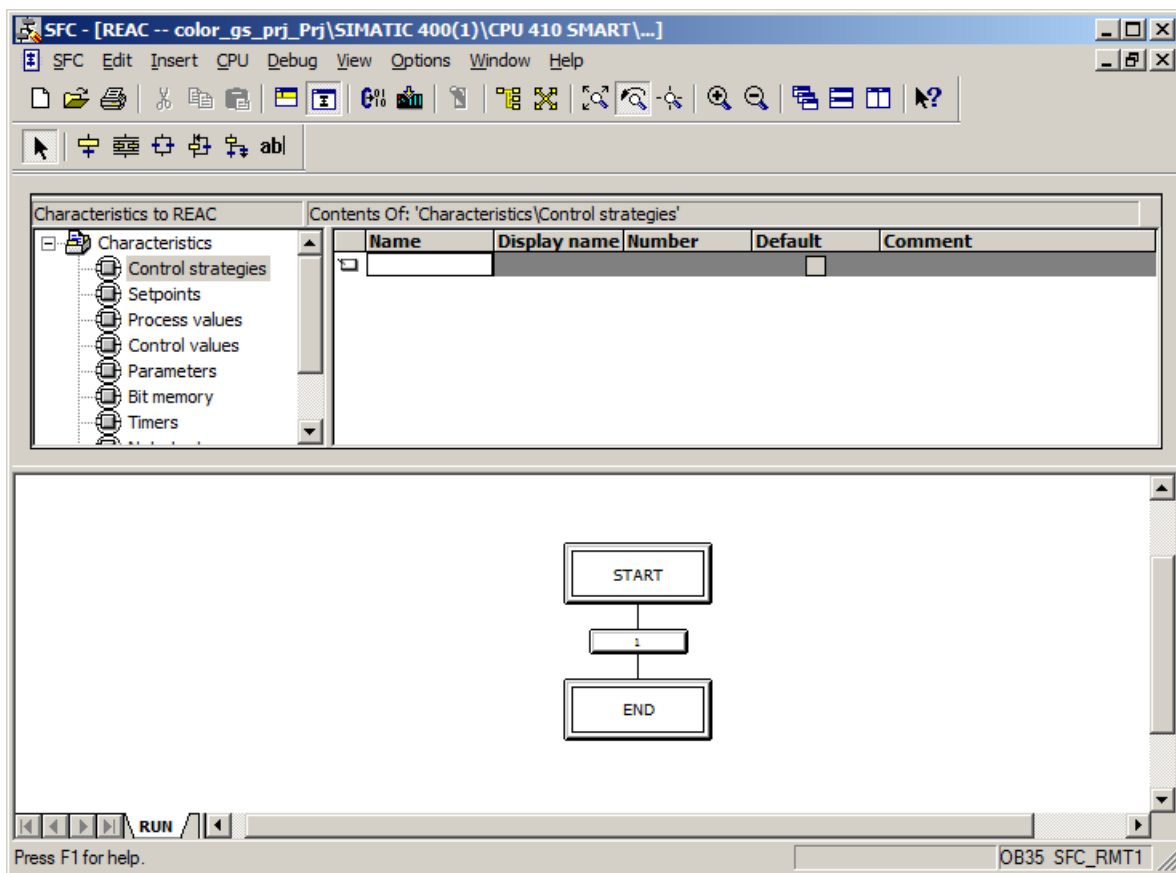
8.3.7 Step 3 - Defining the control strategies

Requirements

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

Procedure

1. Select **View > Characteristics**. The characteristics editor opens in the lower section of the SFC Editor.
2. Select the "Control strategies" entry in the tree view.
An empty input row is displayed in the detail view.



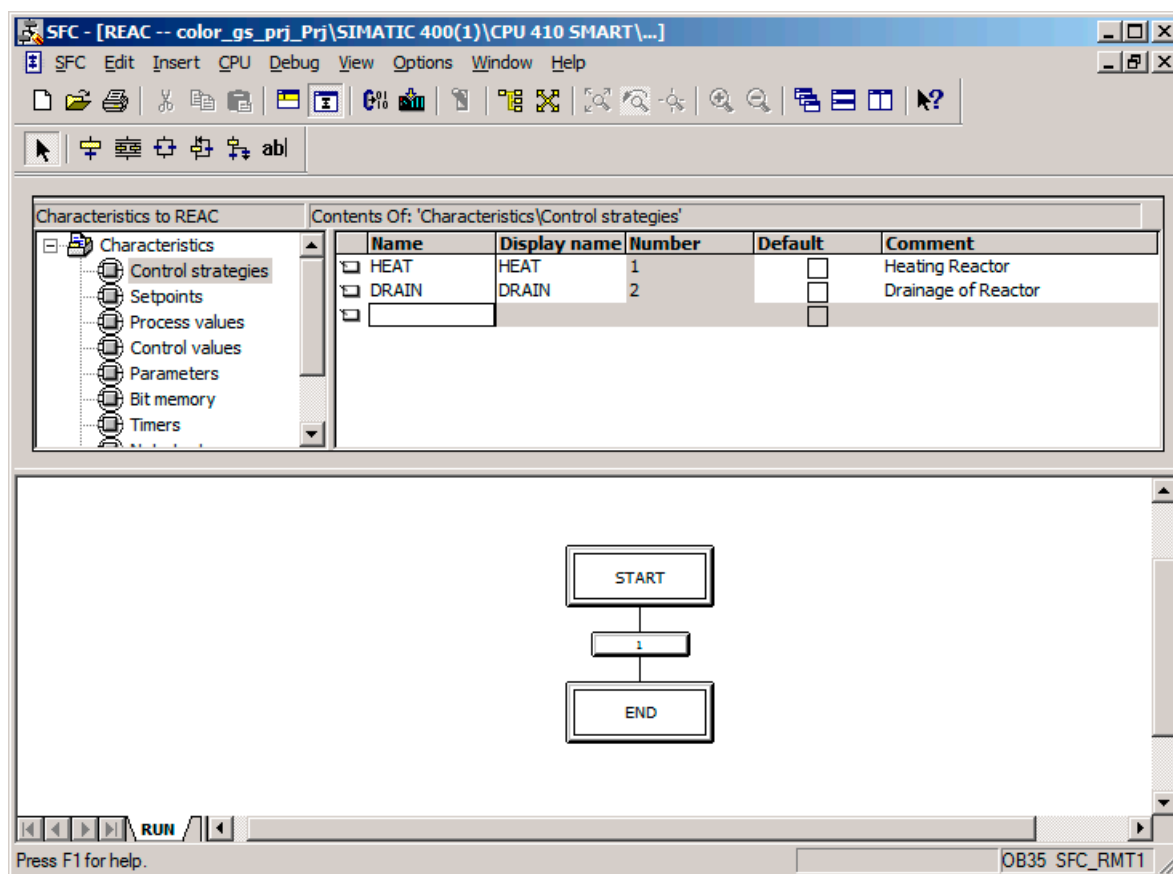
3. Position the cursor in the "Name" column of the input box and then type in the name "HEAT". Plant operators are shown with this name in process mode. For example: for selecting the control strategy. The system automatically assigns the number "1". You can use this number, for example, to logically combine the control strategy and the sequencer.

4. Type the text "Heating Reactor" in the "Comment" column.
5. In the same way, enter the following control strategy:

Name	Number automatically	Comment
DRAIN	2	Drainage of Reactor

Result

You have now defined all required control strategies.



8.3.8 Step 4 - Creating the sequencers

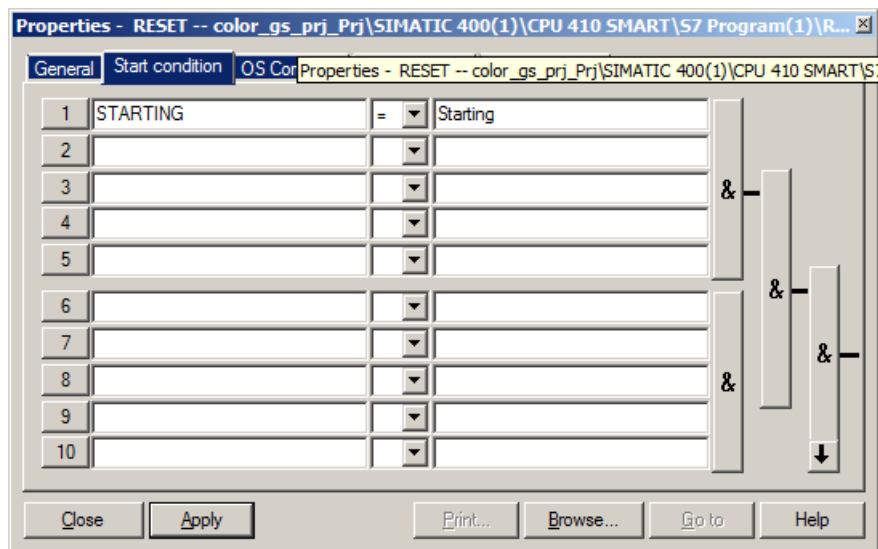
The "RUN" sequencer is automatically created when the SFC type is created. You rename this sequencer and create additional sequencers.

Requirements

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

Procedure

1. Select **Edit > Sequencer Properties....**
The "Properties-RUN" dialog box opens with the "General" tab activated.
2. Enter the name "RESET" in the "Name" field.
3. Click "Apply".
4. Select the "Start condition" tab.
5. Enter the start condition "STARTING" as address 1.
6. Click the input box corresponding to "STARTING" and select the "Starting" entry from the drop-down list.



7. Click "Apply" and then "Close".
The dialog box closes.
8. Select **Insert > Sequencer > At End**.
A new "SEQ1" sequencer is inserted and displayed in a separate tab. This tab is automatically activated.

9. Select **Edit > Sequencer Properties...** and enter the following parameters:

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

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

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

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

Result

The sequencers are created.

8.3.9 Step 5 - Specifying the setpoints

You need to specify a setpoint for the heating temperature.

Requirements

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

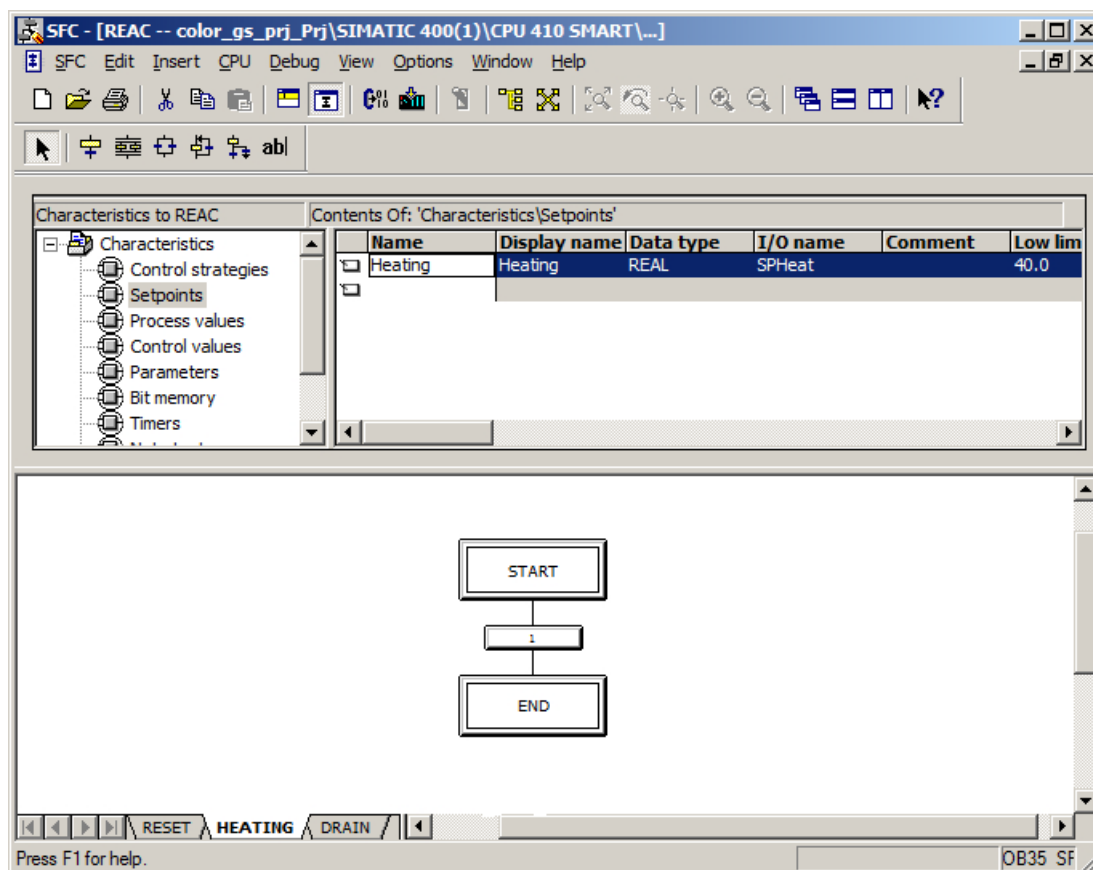
Procedure

1. Select the "Setpoints" entry in the tree view.
An empty input row is displayed in the detail view.
2. Position the cursor in the input box of the "Name" column and type in the name "Heating".
3. Press the <TAB> key. A drop-down list is displayed in the input box of the "Data type" column. The name you entered is activated automatically 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. Position the cursor in the corresponding 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	The minimum setpoint which plant operators can set in process mode	40
High limit	The maximum setpoint setpoint which plant operators can set in process mode	150

Result

The set points are specified as shown in the figure:



8.3.10 Step 6 - Creating process values

The process value will be set for the fill level.

Requirements

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

Procedure

1. Select the "Process values" entry in the overview.
An empty input row is displayed in the detail view.
2. Position the cursor in the input box of the "Name" column and type in the name "Level".

3. Position the cursor in the "Data type" column.
A list shows you all the available data types.
4. Select data type "REAL".
You have completed the definition of process value parameters. The I/O name is automatically taken from the "Name" field.
5. Create an additional process value with the following parameters:
 - Name: Level_min
 - Data type: REAL
 - I/O name: Levmin

Result

The process values are created.

8.3.11 Step 7 - Creating 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 **color_gs** project is open in SIMATIC Manager.
- The SFC type "REAC" is open in the SFC Editor.
- The characteristics editor is open.

Procedure

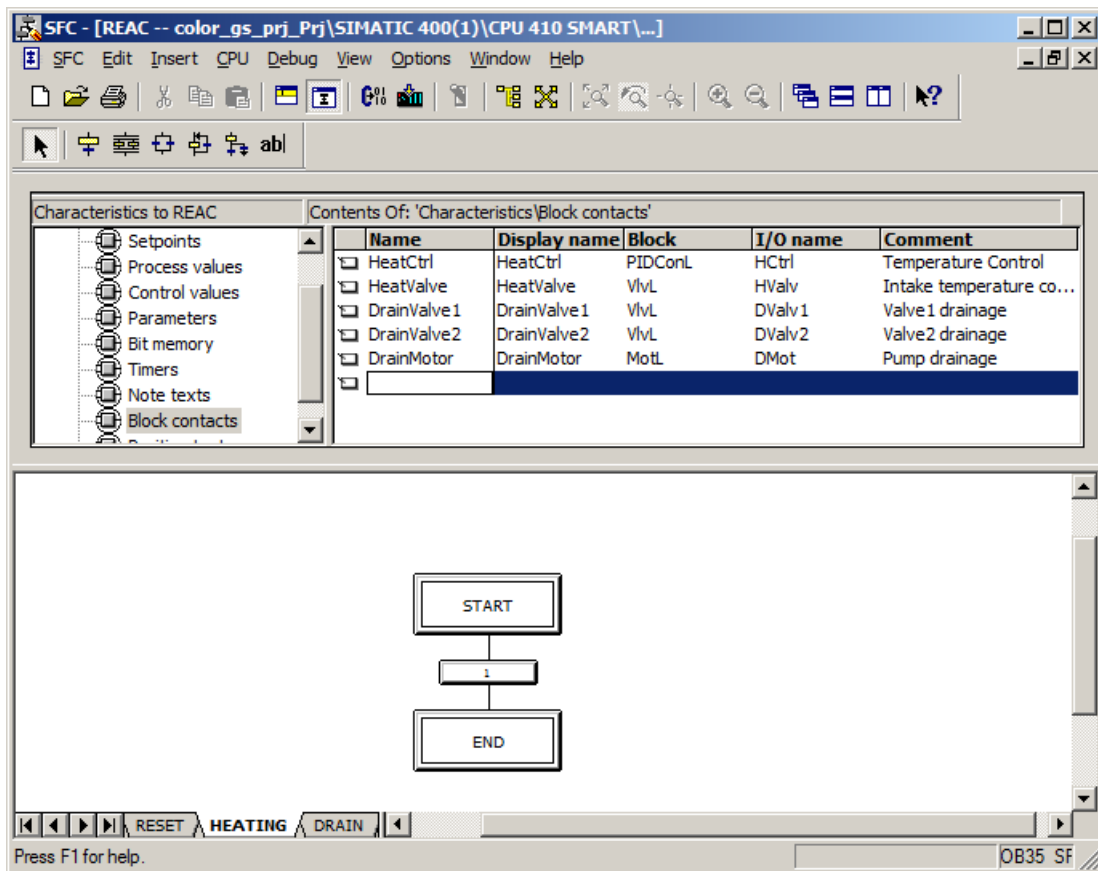
1. Select the "Block Contacts" entry in the tree view.
An empty input row is then displayed in the detail view.
2. Position the cursor in the input box of the "Name" column and type in the name "HeatCtrl".
3. Press the <TAB> key.
A drop-down list is displayed in the input box of the "Block" column. The name you entered is automatically applied in the "I/O name" column.
4. Select the "PIDConL" block from the drop-down list.
This drop-down list contains all the blocks you are currently using in your project. The chart inputs/outputs for the SFC instance are created based on the selected block.
5. Position the cursor in the "I/O name" column and overwrite the name which was automatically applied with the name "HCtrl".
Although the name is short and descriptive, it contains all the essential information, the name of the sequencer, and the name of the corresponding process tag.
6. Enter "Temperature control" in the "Comment" column as supplementary information.

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7. Enter the following information.

To do this, position the cursor in the corresponding column and enter the data as indicated in the table:

Name	Block	I/O name	Comment
Completed already: HeatCtrl	PIDConL	HCtrl	Temperature control
HeatValve	VlvL	HValv	Intake temperature control
DrainValve1	VlvL	DValv1	Valve1 drainage
DrainValve2	VlvL	DValv2	Valve2 drainage
DrainMotor	MotL	DMot	Pump drainage



8. Select **View > Characteristics**.

The characteristics editor is closed as you have already entered all the data required.

Result

The block contacts are created.

8.3.12 Step 8 - Configuring the "RESET" sequencer

Requirements

- The **color_gs** project is open in the SIMATIC Manager.
- The SFC type "REAC" is open in the SFC Editor.
- The tab with the "RESET" sequencer is activated.

Procedure for defining steps

1. Select **Insert > Step+Transition**.
2. Insert a new step 3 plus transition 2 below transition 1.
You have finished structuring the sequencer.
3. Select **Insert > Select**.
The cursor transforms into a selection cursor.
4. Select the "START" step, followed by the menu command **Edit > Object Properties....**
The "Properties" dialog box opens with the "General" tab activated.

8.3 Working with SFC types

- Change to the "Processing" tab and enter the following parameters according to the table below:

I/O type	Left address	Right address
OUT	HValv_ModLiOp.Value	TRUE
OUT	DValv1_ModLiOp.Value	TRUE
OUT	DValv2_ModLiOp.Value	TRUE
OUT	HValv_AutModLi.Value	TRUE
OUT	DValv1_AutModLi.Value	TRUE
OUT	DValv2_AutModLi.Value	TRUE

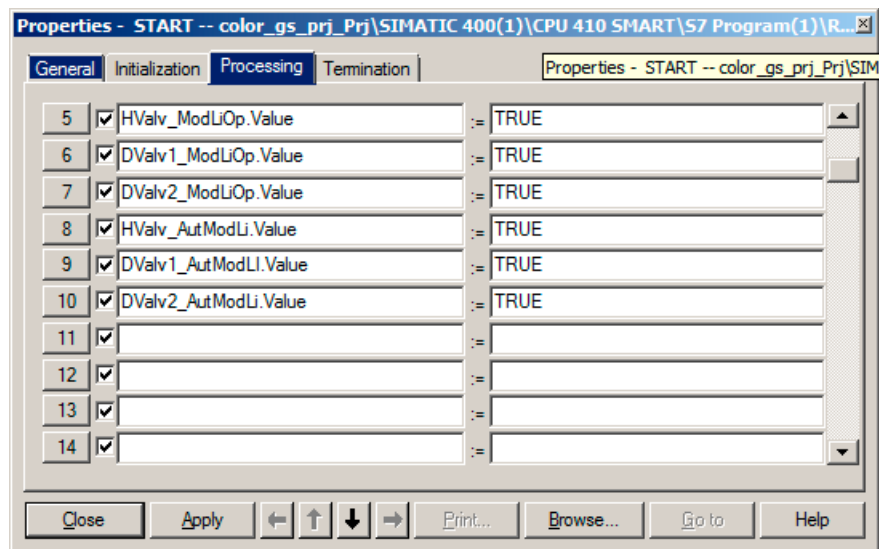
Note

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 to the input line.

The outputs of the CFC chart are the inputs of the SFC chart.



- Click "Apply".
- Go to step 3 using the arrow buttons.
- Enter the name "CLOSE_VALVE" in the "General" tab and then click "Apply".

9. Enter the following parameters in the "Processing" tab:

I/O type	Left address	Right address
OUT	HValv_OpenAut.Value	FALSE
OUT	DValv1_OpenAut.Value	FALSE
OUT	DValv2_OpenAut.Value	FALSE

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

Procedure for defining transitions

1. Select transition "2", followed by the menu command **Edit > Object Properties....**
The "Properties" dialog box opens with the "General" tab activated.
2. Enter the name "CLOSE_OK".
3. Click "Apply".
4. Switch to the "Condition" tab and enter the following parameters:

I/O type	Left address	Operator	Right address
IN	HValv_FbkCloseOut.Value	=	TRUE
IN	DValv1_FbkCloseOut.Value	=	TRUE
IN	DValv2_FbkCloseOut.Value	=	TRUE

5. Click on the link button to link the three addresses by means of "OR" logic.
The "&" symbol is replaced with the "≥1" symbol.
6. Click "Apply" and then "Close".
This saves all your entries and closes the "Properties" dialog box.

Result

"RESET" sequencer is configured.

8.3.13 Step 9 - Configuring the "Heating" and "Drain" Sequencers

Requirements

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

Procedure for configuring the "HEATING" sequencer

1. Open the "HEATING" tab.
2. Insert four additional steps with transitions below transition 1.
3. Select **Insert > Select**.
The cursor transforms into a selection cursor.

4. Enter the following step parameters:

Note

All parameters are available in the "OUT" I/Os.

"General" tab		"Processing" tab	
Step	Name	Left address	Right address
START	Unchanged	HCtrl_SP_LiOp.Value	TRUE
		HCtrl_SP_ExtLi.Value	TRUE
		HCtrl_ModLiOp.Value	TRUE
		HCtrl_AutModLi.Value	TRUE
3	VALVE_OPEN	HValv_OpenAut.Value	TRUE
		HValv_CloseAut.Value	FALSE
4	CONTROL	HCtrl_SP_Ext.Value	SPHeat_Q
5	SP_DOWN	HCtrl_SP_Ext.Value	30
6	VALVE_CLOSE	HValv_OpenAut.Value	FALSE
		HValv_CloseAut.Value	TRUE
END	Unchanged	HValv_ModLiOp.Value	FALSE
		HValv_OpenAut.Value	FALSE
		HCtrl_SP_LiOp.Value	FALSE
		HCtrl_ModLiOp.Value	FALSE

5. Enter the following transition parameters:

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

Procedure for configuring the "DRAIN" sequencer

1. Open the "DRAIN" tab.
2. Insert four additional steps with transitions below transition 1.

3. Enter the following step parameters:

Note

All parameters are available in the "OUT" I/Os.

"General" tab		"Processing" tab	
Step	Name	Left address	Right address
START	Unchanged	DMot_ModLiOp.Value	TRUE
		DMot_AutModLi.Value	TRUE
3	OPEN_VALVE	DValv1_OpenAut.Value	TRUE
		DValv1_CloseAut.Value	FALSE
		DValv2_OpenAut.Value	TRUE
		DValv2_CloseAut.Value	FALSE
4	PUMP_ON	DMot_StartAut.Value	TRUE
		DMot_StopAut.Value	FALSE
5	PUMP_OFF	DMot_StartAut.Value	FALSE
		DMot_StopAut.Value	TRUE
6	CLOSE_VALVE	DValv1_OpenAut.Value	FALSE
		DValv1_CloseAut.Value	TRUE
		DValv2_OpenAut.Value	FALSE
		DValv2_CloseAut.Value	TRUE
END	Unchanged	DValv1_ModLiOp.Value	FALSE
		DValv1_OpenAut.Value	FALSE
		DValv2_ModLiOp.Value	FALSE
		DValv2_OpenAut.Value	FALSE
		DMot_ModLiOp.Value	FALSE
		DMot_StartAut.Value	FALSE

4. Enter the following transition parameters:

Note

All parameters are available in the "IN" I/Os.

"General" tab		"Condition" tab		
Transition	Name	Left address	Operator	Right address
1	-	-	-	-
2	OPEN_OK	DValv1_FbkOpen-Out.Value	=	TRUE
		DValv2_FbkOpen-Out.Value	=	TRUE
3	ON_OK	DMot_FbkRunOut.Value	=	TRUE
		Level	<=	Levmin
4	OFF_OK	DMot_FbkRunOut.Value	=	FALSE
5	CLOSE_OK	DValv1_FbkClose-Out.Value	=	TRUE
		DValv2_FbkClose-Out.Value	=	TRUE

5. Close the SFC Editor.

Result

"Heating" and "Drain" sequencers are configured.

8.3.14 Step 10 - Creating an SFC instance

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The following CFC charts are open:
 - CFC_TC311
 - CFC_NP311
 - CFC_NK313
 - CFC_NK314
 - CFC_NK315
 - CFC_LI311
- The Plant View is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_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. Move the "REAC" block to the CFC chart using drag-and-drop.
This block represents the SFC instance that is based on the SFC type you created and configured. It contains all I/Os you defined in the block contacts. It also contains the setpoints and process values you defined in the characteristics editor.
6. Select **Edit > Object Properties**.
The "Properties" dialog box opens.
7. Enter the name "REAC" in the "Name" box.
8. Click "OK".
9. You now need to make the "HCtrl_SP_Ext" I/O visible for interconnection: Right-click on the block and select "Object properties".
Select the "I/Os" tab in the "Properties - Block" dialog.
In the "Invisible" column, clear the check box for the I/O "HCtrl_SP_Ext" and click OK.
Close the "Properties - Block" dialog box.
10. Now set the interconnections with 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 pointer slowly over the inputs/outputs to display the full name of the I/O as tooltip.
 - Switch to the "CFC_TC311" CFC chart
 - Click the "SP_Ext" input on the "CTRL_TEMP" block. This automatically closes all I/O interconnections with the control block.
11. Set up the following interconnections between the SFC instance and the CFC charts.

Output SFC_REAC	CFC chart	Block description	Input
HValv_OpenAut	CFC_NK313	VALVE	OpenAut
DValv1_OpenAut	CFC_NK314	VALVE	OpenAut
DValv2_OpenAut	CFC_NK315	VALVE	OpenAut
DMot_StartAut	CFC_NP311	MOTOR	StartAut

12. Set up the following interconnections between the CFC charts and the SFC instance:

CFC chart	Block description	Output CFC chart	Input SFC_REAC
CFC_TC311	INPUT	PV_Out	SPHeat_AI This displays the current control value on the OS of the controller.
CFC_LI311	DRAIN_MIN_LEV	SP_Out	Levmin Minimum fill level
	TANK_LEV	PV_Out	Level Current fill level

13. Select the menu command **Options > Optimize Run Sequence....**

8.3 Working with SFC types

14. Click "OK" in the "The run sequence of the blocks is changed and optimized according to the data flow....." message box.
All blocks are now automatically arranged in the correct run sequence.
15. Close the CFC Editor.

Result

SFC instance is created.

8.3.15 Step 11 - Storing the SFC type in the master data library

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\SIMATIC 400(1)\CPU 410 SMART\S7 Program(1)\Charts" folder in the tree view.
2. Copy SFC type "REAC".
3. Select the "color_gs_prj_MP\color_gs_prj_Lib\S7 Program(1)\Charts" folder in the tree view.
4. Insert the SFC type.

Result

SFC type is stored in the master data library.

8.4 Summary

8.4.1 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. This update only functions automatically if the changes were executed in the chart folder of the CPU. Otherwise, the "Update block types" command has to be executed in the SIMATIC Manager.

Note

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.

8.4 Summary

Compiling, downloading, and testing charts

9.1 Compiling, downloading and testing your project

Introduction

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

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

9.2 Compiling and downloading the project

Requirements

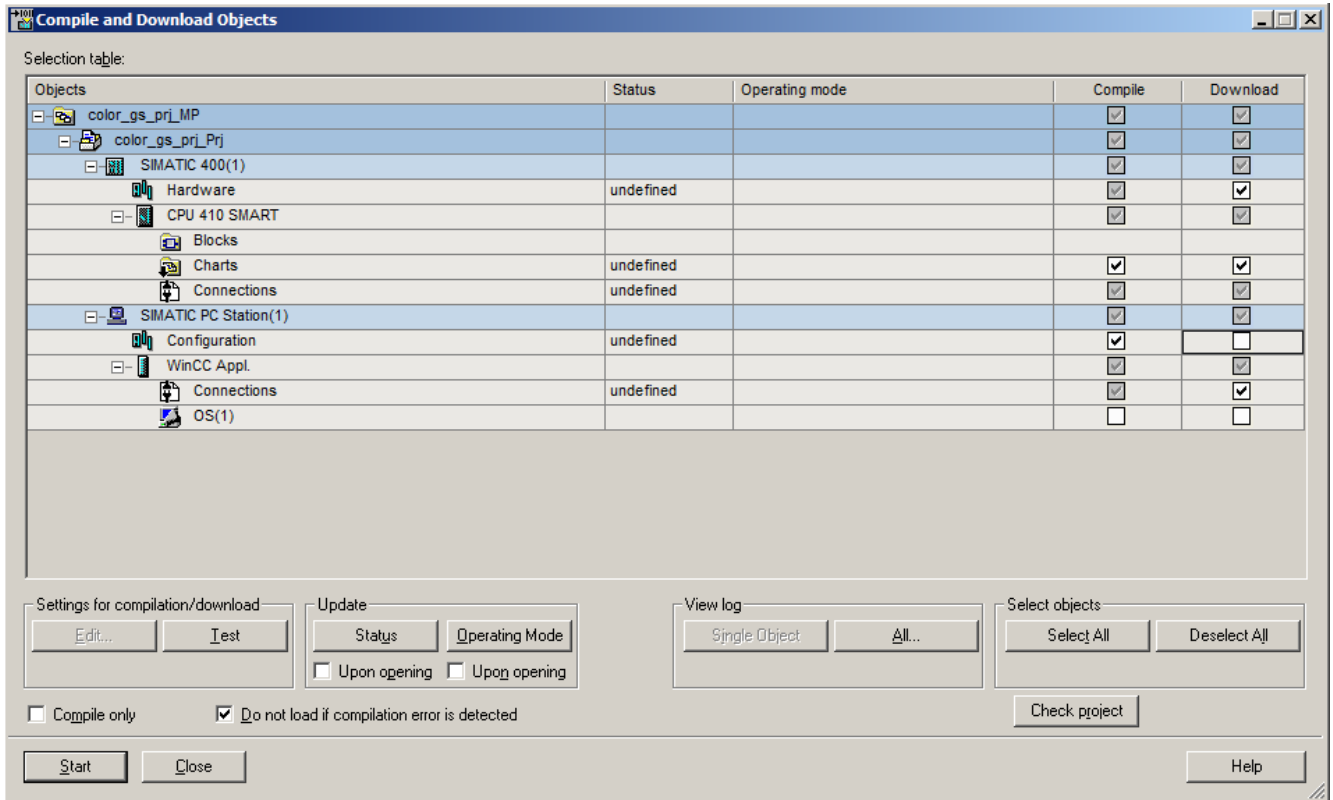
- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.
- The CPU is in STOP.
The first time you download, you need to download the entire program. It is only possible to download the entire program if the CPU is in STOP mode.

Procedure

1. Select the "color_gs_prj_MP" folder in the tree view.
2. Select **PLC > Compile and Download Objects**.
The "Compile and Download Objects" dialog box opens.
3. Expand the entire tree to display its full structure.

4. Make the interconnections as shown in the table below:

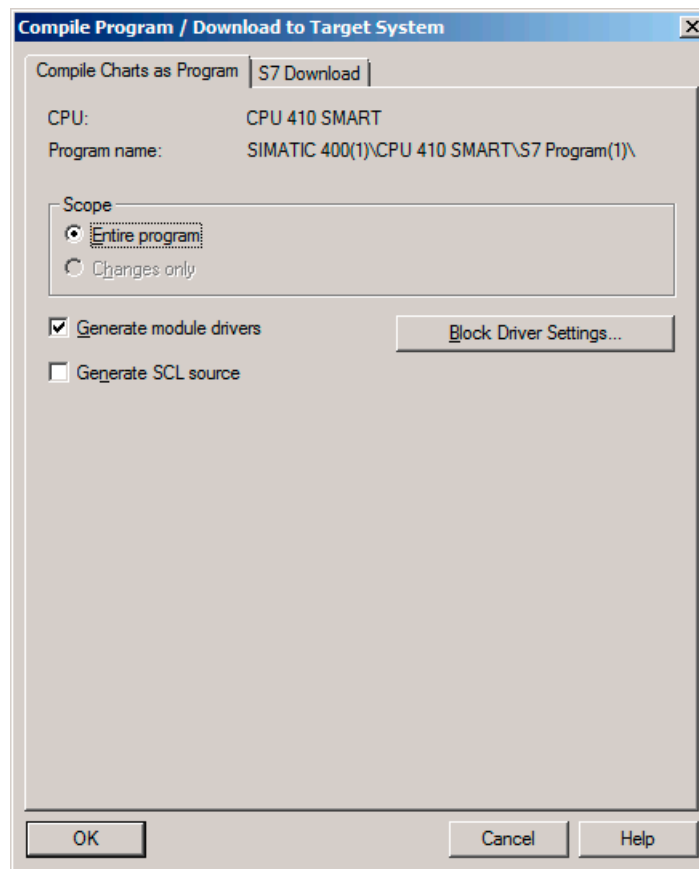
Object	Compile	Down- load
color_gs_prj_Prj\[name of your local PC station]\Configuration	X	-
color_gs_prj_Prj\[name of your local PC station]\WinCC Appl.\OS(1)	-	-
SIMATIC 400(1)\Hardware	X	X
SIMATIC 400(1)\CPU 410 SMART\Charts	X	X



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

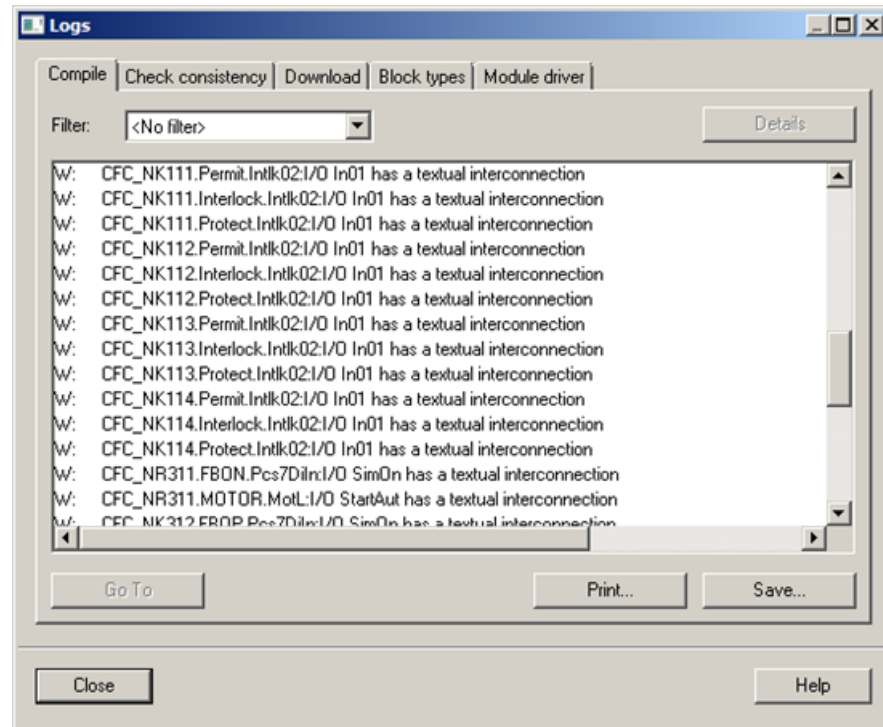


7. Click "OK".
8. Click "OK" in the message box "Note that the blocks in the CPU will be deleted if you download later (For example: in SIMATIC Manager using...), the blocks will be deleted in the CPU".
9. Click "Start".
10. Click "OK" in the first message box "Downloading program changes during operation 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".
The compilation and download procedures are now executed. You can view the log file in the text editor after the function is completed.
12. Close the text editor.

13. Select the "Charts" object in the tree view.

14. Click "Single object" in the "View 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.



15. Click "Close".

The "Logs" dialog box closes.

Return the CPU to the RUN state. Since you have configured an external I/O in HW Config but have not yet connected it, the following error LEDs light up on the CPU:

- EXTf - Continuous light
- BUS1F - Flashing

Result

Compiling and downloading the **color_gs** project is done successfully.

9.3 Testing 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

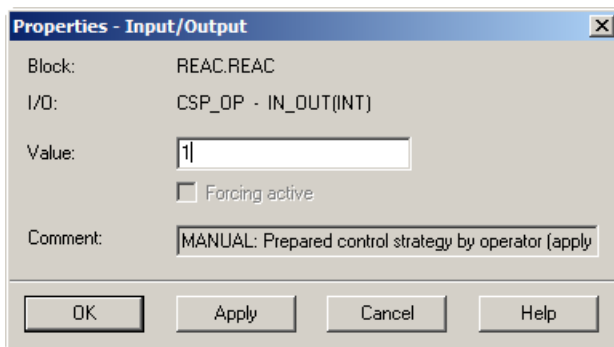
- The **color_gs** project is open in the SIMATIC Manager.
- The Plant View is activated.

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. Select the "color_gs_prj_MP\color_gs_prj_Prj\Plant1\REAC1" folder in the tree view.
2. Open the CFC chart "SFC_REAC" in the CFC Editor.
3. Select your SFC instance "REAC" and then select **Edit > Object Properties**.
4. Switch the "CSP_OP" I/O to visible and then click "OK".
This I/O is assigned the default value "0".
5. Compile and download the chart.
6. Select **Debug > Test Mode**.
This activates the test mode function you already know from *Getting Started - Part 1*.
7. Double-click the "CSP_OP" input.
The "Properties - Input/Output" dialog box opens.
8. Enter the value of the selected control strategy in the "Properties - Input/Output" dialog box and then click "OK".



Value	Control strategy
1	HEATING
2	DRAIN

9. Open Component View and select the SFC instance "REAC" and then select **Edit > Open**.
The SFC instance opens in the SFC Editor and the "RESET" tab is selected.
10. Select **Debug > Test Mode**.
This activates the test mode.
11. Click "Start".
The test starts with the "RESET" sequencer.
The control strategy you defined at input "CSP_OP" in the CFC Editor is automatically started in the next step.
12. Enter a different control strategy in the CFC chart and then restart the sequencer.

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.
-

13. Enter the value "0" again at input "CSP_OP".

Result

The program is tested successfully.

Configuring the PCS 7 SMART OS

10.1 Overview of work when configuring the OS

Introduction

When configuring the OS, you will access OS configuration settings data conveniently. This includes the following functions:

- Interconnecting the picture objects with the block inputs/outputs from the CFC charts when creating process pictures.
- Assigning block icons to the process tags in the CFC charts enabling you to create the block icons automatically.
- Defining the plant hierarchy in the SIMATIC Manager and configuring the settings for the OS area. This hierarchy is automatically represented on the OS in the process mode.

Work involved in OS configuration

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

- Creating and using your own icons
Creating 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 have become familiar with when creating the process pictures in *Getting Started - Part 1*.
- Creating the status display
Combining 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. The plant operator should easily recognize these two functions 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.

10.2 Creation of icons

10.2.1 Opening the picture file for your icons

This section provides information on how to open the picture files for the icons created and store all of the icons that you have created in this file.

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\[name of the PC station]\WinCC Appl.\OS(1)" folder in the tree view.
2. Select **Edit > Open Object**.
The WinCC Explorer opens.
3. Select the "Graphics Designer" object in the navigation window.
4. Right-click and select **Open**.
An empty file opens in the Graphics Designer.
5. Select **File > Save As...** and then save the file to the specified folder under the name "status_display.pdl".

10.2.2 Creating your own icons for process pictures

Custom icons for process tags

When you create plant-specific process pictures, it may be necessary to create your own special icons. For example: process tags.

You will create these icons once and then be able to use them repeatedly.

In this document, 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.

10.2.3 Creating the icons for the agitator

Requirement

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

Procedure

1. If the object palette is not displayed, select **View > Toolbars > Object Palette**.
2. Select the "Rectangle" object from the standard objects in the object palette and create a vertical rectangle.
3. If the object properties are not displayed, select **View > Toolbars > Object Properties**. The "Object Properties" dialog box opens.
4. Enter the following parameters; activate the default values for all other parameters:

Property	Attribute	Parameters - "Static" column
Rectangle	Object name	Axis
Rectangle > Geometry	Width	5
	Height	240
Rectangle > Colors	Background color	Black
Rectangle > Effects	Global color scheme	No

5. Create a second rectangle with the following parameters:

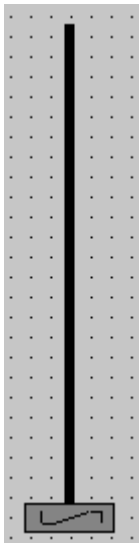
Property	Attribute	Parameters - "Static" column
Rectangle	Object name	Background
Rectangle > Geometry	Width	45
	Height	15
Rectangle > Colors	Background color	Dark gray
Rectangle > Effects	Global color scheme	No

6. Create an agitator icon using several lines:



7. Position the symbol in the small rectangle.

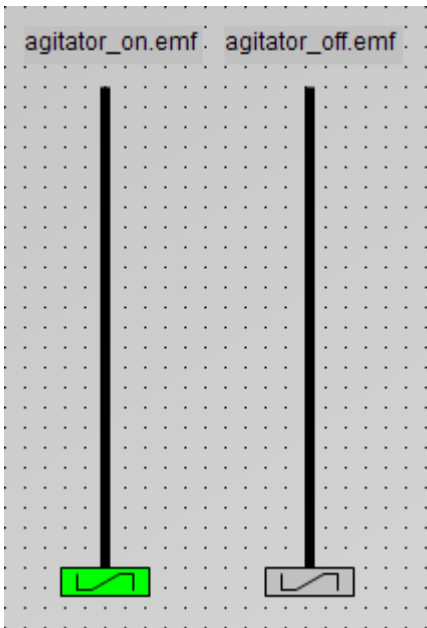
8. Join all elements to obtain a symbolic representation for an agitator.



9. Select the agitator using the mouse and then generate a copy.
10. Assign the "green" color to the small rectangle.
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. With the exception of the descriptive text fields, select all elements of the green agitator using the mouse, and then select **Edit > Group > Group**.
13. Following this, with the exception of the descriptive text fields, select all elements of the gray agitator using the mouse, and then select **Edit > Group > Group**.



14. Save the "status_display.pdl" file.
15. Select the green agitator icon, except for the explanatory test boxes, and then select **File > Export....**
The "Save as metafile" dialog box opens with the graphics folder for your project automatically selected.
16. Enter the file name "agitator_on.emf"
17. Click "Save".
18. Select the gray agitator icon and export the object the "agitator_off.emf" file.

Result

The icons for the agitator are created.

10.2.4 Creating 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 opened in the Graphics Designer.

Procedure

1. Select the "Circle" object from the standard objects in the object palette and create a circle.
2. Select **View > Toolbars > Object Properties**.
The "Object Properties" dialog box opens.
Enter the parameters indicated below:

Property	Attribute	Parameters - "Static" column
Circle	Object name	Circle
Circle > Geometry	Width	30
	Height	30
Circle > Colors	Background color	Green
Circle > Effects	Global color scheme	No

3. Select the "Polygon" object from the standard objects in the object palette and create a triangle.
4. Click once with the mouse for each corner and complete the polygon by double-clicking it.

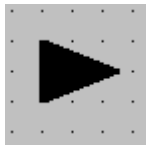
5. Select **View > Toolbars > Object Properties**.

The "Object Properties" dialog box opens.

Enter the parameters indicated below:

Property	Attribute	Parameters - "Static" column
Polygon	Object name	Pump
Polygon > Geometry	Width	25
	Height	20
Polygon > Colors	Background color	Black
Polygon > Effects	Global color scheme	No

6. If the triangle does not look like the one in the figure below, use the mouse to grab its corners and correct the shape.

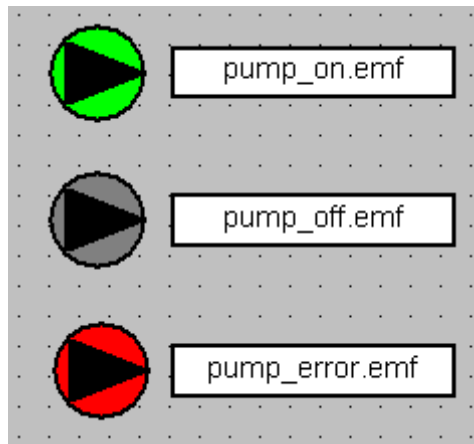


7. Insert the triangle into the circle.
8. Select all elements using the mouse and then generate a copy.
9. Select the circle and assign it the color "dark gray".
10. Generate a third copy and assign the color "red" to the circle.

11.Group the individual elements for each icon.

12.Create a descriptive text field for each icon:

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



- Save the "status_display.pdl" file.
- Export the new icons using the file names derived from your entries in the corresponding text fields.
- Close the "status_display.pdl" file.

Result

The icons for the pump are created.

10.3 Working with standard block icons

10.3.1 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 SMART. The standard block icons are stored in the "@PCS7TypicalsAPLV8.PDL" file that is included automatically when you install PCS 7 SMART.

However, you save your modified block icons to a new file instead of the original one. In *Getting Started - Part 2*, this file is given the name "@PCS7Typicals_APL_gs2.pdl".

Note

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. 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 "@PCS7TypicalsAPLV8.PDL" and "@PCS7Typicals_APL_gs2.pdl"

You may not rename the "@PCS7TypicalsAPLV8.PDL" file:

With this name, PCS 7 SMART automatically knows which file it must take the block icons from when executing the "Create/update block icons" function.

If you need 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 SMART to identify the files in which the additional block icons are stored. You assign the variable name component according to your project requirements.

10.3.2 Modification of the default block icons

Purpose

In this document, you modify the following default block icons:

- "MotL"
- "SFC- type"

"MotL" block icon

You are already familiar with the "MotL" 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" part of the plant, you should make these functions clearly recognizable to the plant operator at first glance. The agitator is represented by an empty 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 "VlvL" block icon in the process picture. 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. 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.

10.3.3 Creating 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 detail view.

3. Right-click and select **New Picture**.
A new picture with the file name "NewPdl0.Pdl" is inserted at the end of the list.
4. Select this new picture in the detail view.
5. Right-click and select **Rename Picture**.
6. Enter the name "@PCS7Typicals_APL_gs2.pdl" and confirm with "Enter".

Result

The template file is renamed.

10.3.4 Modifying 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 154)
2	Modify properties for the "MotL" block icon (Page 155)
3	Modify the representation of the pump (Page 156)
4	Modify the "SFC-TYP" block icon (Page 158)

10.3.5 Step 1 - Storing copies of the required block icon

Requirement

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

Procedure

1. Open the "@PCS7Typicals_APL_gs2.pdl" file.
Save your project-specific block icons to this file.
2. Open the "@PCS7TypicalsAPLV8.pdl" file in Graphics Designer.
This file contains the default block icons.
3. In the "@PCS7TypicalsAPLV8.pdl" file, select block icon "MotL" (MotL1) in the "MotL" line and then select **Edit > Copy**.
4. Now switch to the "@PCS7Typicals_APL_gs2.pdl" file and select **Edit > Paste**.
This inserts a copy of the "MotL" block icon (MotL1).

5. Position the block icon at the top of the drawing area.
6. Open the "@PCS7TypicalsBasisLibraryV8.pdl" file and select the "SFC-Type" block icon in the "SFC" row, including the "SFC_TYP" header.
7. Select **Edit > Copy**.
8. Now switch to the "@PCS7Typicals_APL_gs2.pdl" file and select the menu command **Edit > Paste**.
This inserts a copy of the "SFC-Type" block icon.
9. Position the "SFC-Type" block icon below the "MotL" block icon.
10. Save the "@PCS7Typicals_APL_gs2.pdl" file.
11. Close the "@PCS7TypicalsAPLV8.pdl" and "@PCS7TypicalsBasisLibraryV8.pdl" files.

Result

The copies of the required project specific block icons are stored in the "@PCS7Typicals_APL_gs2.pdl" file.

10.3.6 Step 2 - Changing the properties of the "MOTOR" block icon

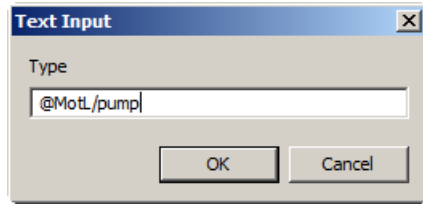
Requirement

- The "@PCS7Typicals_APL_gs2.pdl" file is opened in the Graphics Designer.

Procedure

1. Select the motor icon and then select **"View > Toolbars > Object Properties"**.
2. Select the "APL_BLOCK_ICON" in the Properties tab.
3. Enter the value "PUMP" at the "Object name" attribute.
4. Select the "System" property.
5. Double-click the "Type" attribute. The "Text input" dialog box opens.

6. Enter the following in the "Type" field: "@MotL/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.

Result

The properties of the "MOTOR" block icon is changed as per the requirement.

10.3.7 Step 3 - Adapting the representation of the pump

Requirement

- The "@PCS7Typicals_APL_gs2.pdl" file is opened in the Graphics Designer.

Procedure

1. Select the top block icon (motor).
2. Select **Edit > Customized Object > Edit...**
Use this command to split up the elements of the block icon you have implemented as a user object. You can edit these individually.

Note

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.
This graphic element has been implemented as a "status display (extended)".
-

Note

In the block icon, there are several objects on top of each other.

4. Select "Delete" in the shortcut menu.
The top object is removed.
5. Open the shortcut menu and select the **Configuration dialog....**
The "Extended Status Display Properties" dialog box opens.
6. Switch to the "Assign pictures" tab.
7. Select the first row, "Index 0".
The preview shows the pictures you have assigned.
8. Ensure that the "*.wmf,*.emf" option button is selected.
This function enables all pictures with file name extension "*.emf" and "*.wmf" to be displayed.
9. Double-click the "pump_off.emf" file in the list containing the pictures.
The preview and the list indicate that the original motor representation in the basic picture was replaced with the pump representation.
10. Double-click the "pump_on.emf" file in the list containing the pictures. The preview and the list indicate that the original motor representation in the flashing picture was replaced with the pump representation.
11. Select the next row, "Index 1".
12. Replace the other picture in the same way:

Row	Basic picture	New basic picture	Flashing picture	New flashing picture
Completed: Index 0	apl_fp_transparent.emf	pump_off.emf	-	pump_on.emf
Index 1	apl_bi_MotL_err.emf	pump_error.emf	-	-

13. Click "OK".
You can see that the pump representation has already changed in the "@PCS7Typicals_APL_gs2" file.
14. With the mouse button held down, draw a lasso around all the elements of the block icon (with the exception of the header) and select the menu command **Edit > Customized Object > Finish editing**.
15. Save the "@PCS7Typicals_APL_gs2" file.

Result

The representation of the pump is being adapted in the "@PCS7Typicals_APL_gs2" file.

10.3.8 Step 4 - Modifying the "SFC TYPE" block icon

Creating block icons for SFC instances

Note

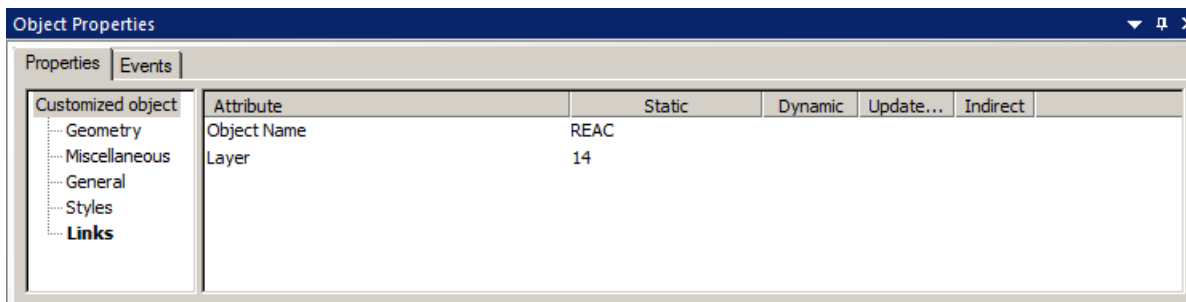
When you execute the "Create/Update Block Icons" function, a block icon is automatically placed in the appropriate picture and interconnected for all SFC instances that are enabled for operator control and monitoring.

Requirement

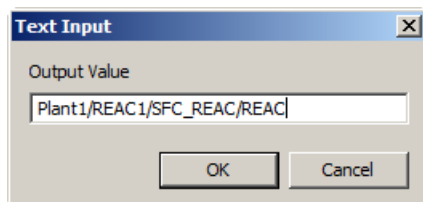
- The "@PCS7Typicals_APL_gs2.pdl" file is opened in the Graphics Designer.

Procedure

1. If the object properties are not shown, select the faceplate icon, followed by the menu command **View > Toolbars > Object Properties**.
The "Object Properties" dialog box opens.
2. Select the "@SFC_Typ/2" property in the "Object Properties" dialog box.
3. Double-click the "Object name" attribute and enter the name "REAC".

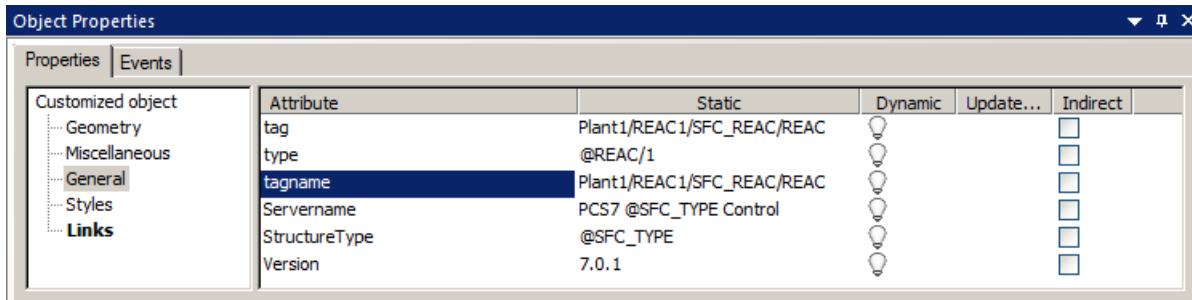


4. Select the "General" in the Properties tab.
5. Double-click the "Tag" attribute.
The "Text input" dialog box opens.
6. In the "Output value" box, enter the complete path to the SFC instance, including the name of the SFC instance in the CFC chart and click "OK". The path is: "Plant1/REAC1/SFC_REAC/REAC".



7. Enter the following values:

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



8. Close the "Object Properties" dialog box.
9. Save the "@PCS7Typicals_APL_gs2.pdl" file.
10. Close the Graphics Designer and WinCC Explorer.

Result

The "SFC type" block icon is modified as per the project requirements.

10.4 Creating block icons and compiling the OS

10.4.1 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.

10.4.2 Selecting the option for creating block icons

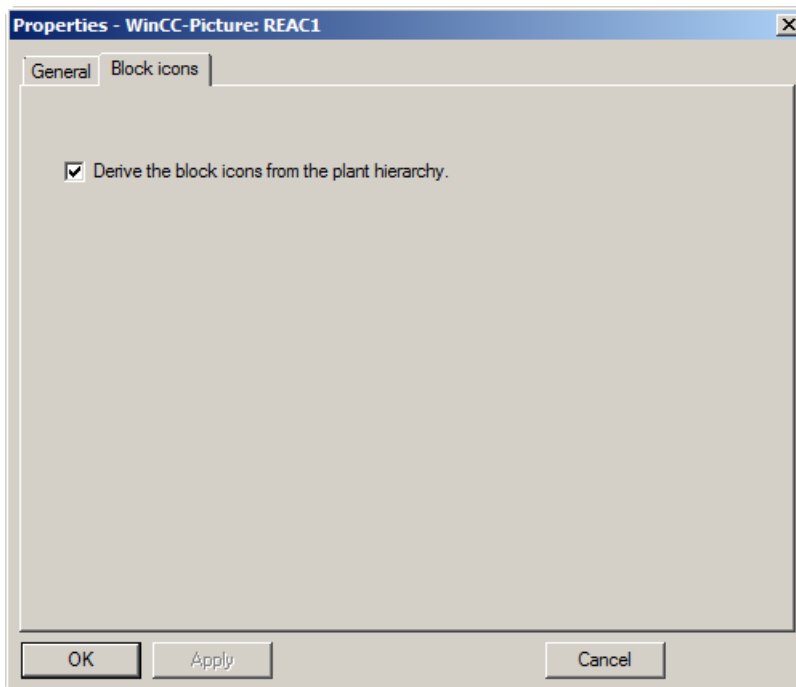
Requirements

- The **color_gs** project is open in the SIMATIC Manager.
- The Plant View is activated.
- WinCC Explorer closes.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\Plant1\REAC1" folder in the tree view.
2. Select the "REAC1" process picture in the detail view and open the object properties.

3. Check "Derive the block icons from the technological hierarchy" in the "Block icons" tab.



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

Result

An option for creating block icons is being selected.

10.4.3 Creating the block icons

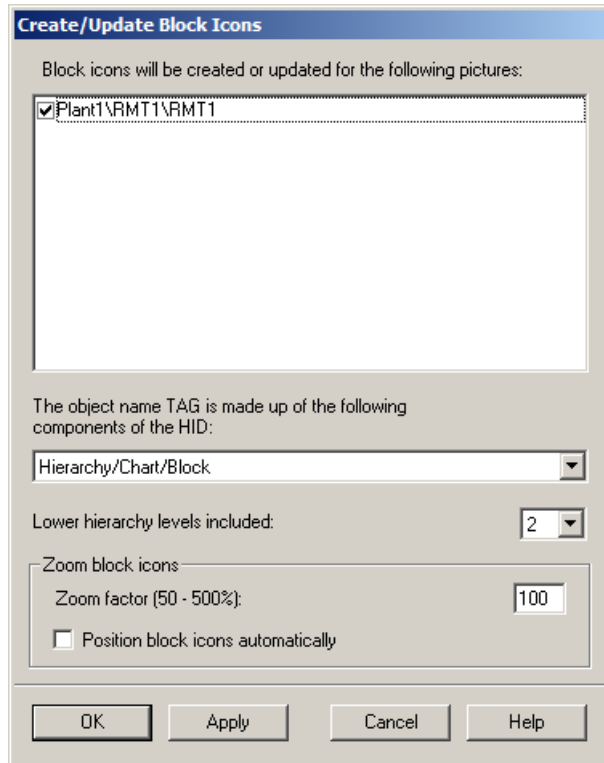
Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.
- The option for creating block icons is selected.

Procedure

1. Select the "color_gs_prj_MP\color_gs_prj_Prj\Plant1\REAC1" folder in the tree view.
2. Select **Options > Plant Hierarchy > Create/Update Block Icons....**

3. Check the following:
 - The correct picture has been selected.
 - "Lower hierarchy levels included:" is set to "1".



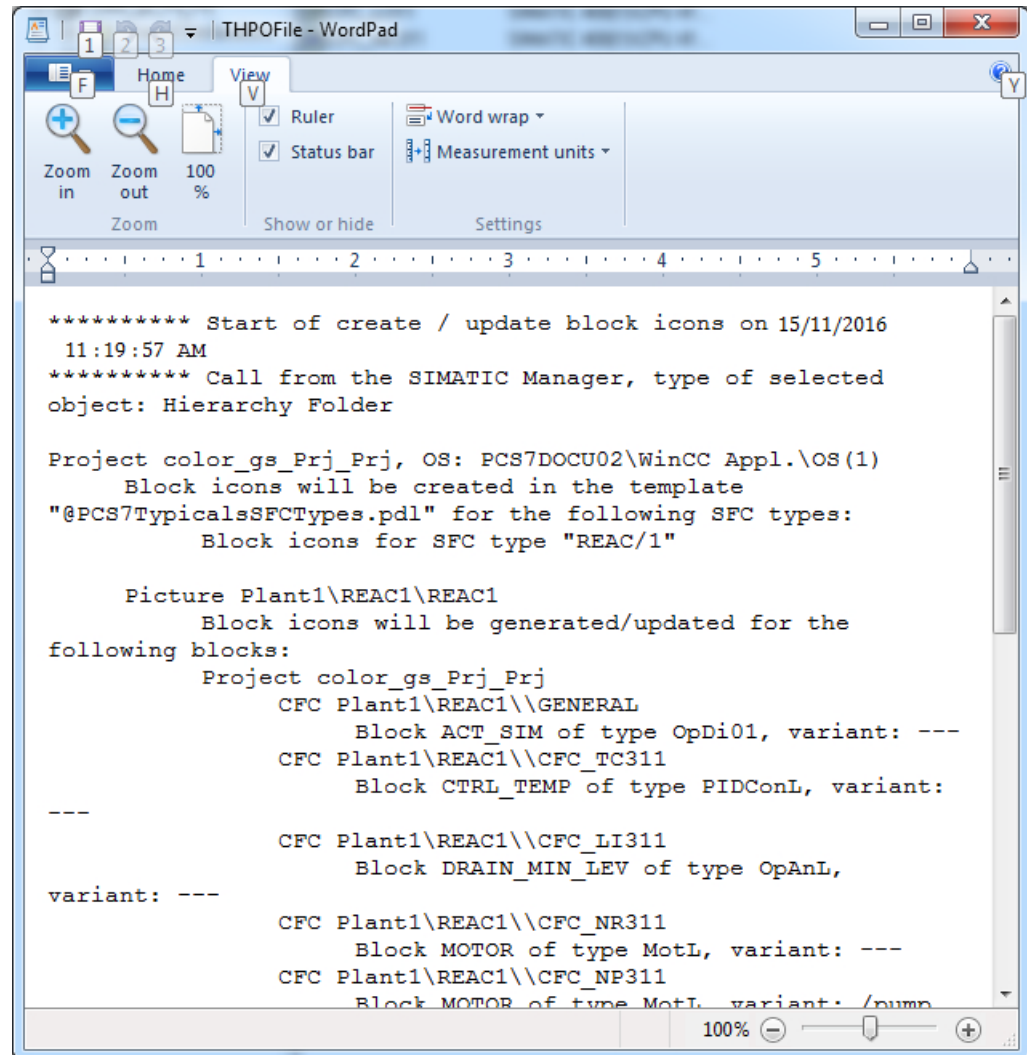
4. Click "OK". The block icons are created.

- Click "Yes" in the message dialog "To ensure possible automatic corrections to the WinCC picture interconnections,.... Do you want to view the function log now?".

The log opens 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 "1" 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.



- Close the text editor.

Note

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

Result

The block icons are created.

10.4.4 Compiling the OS

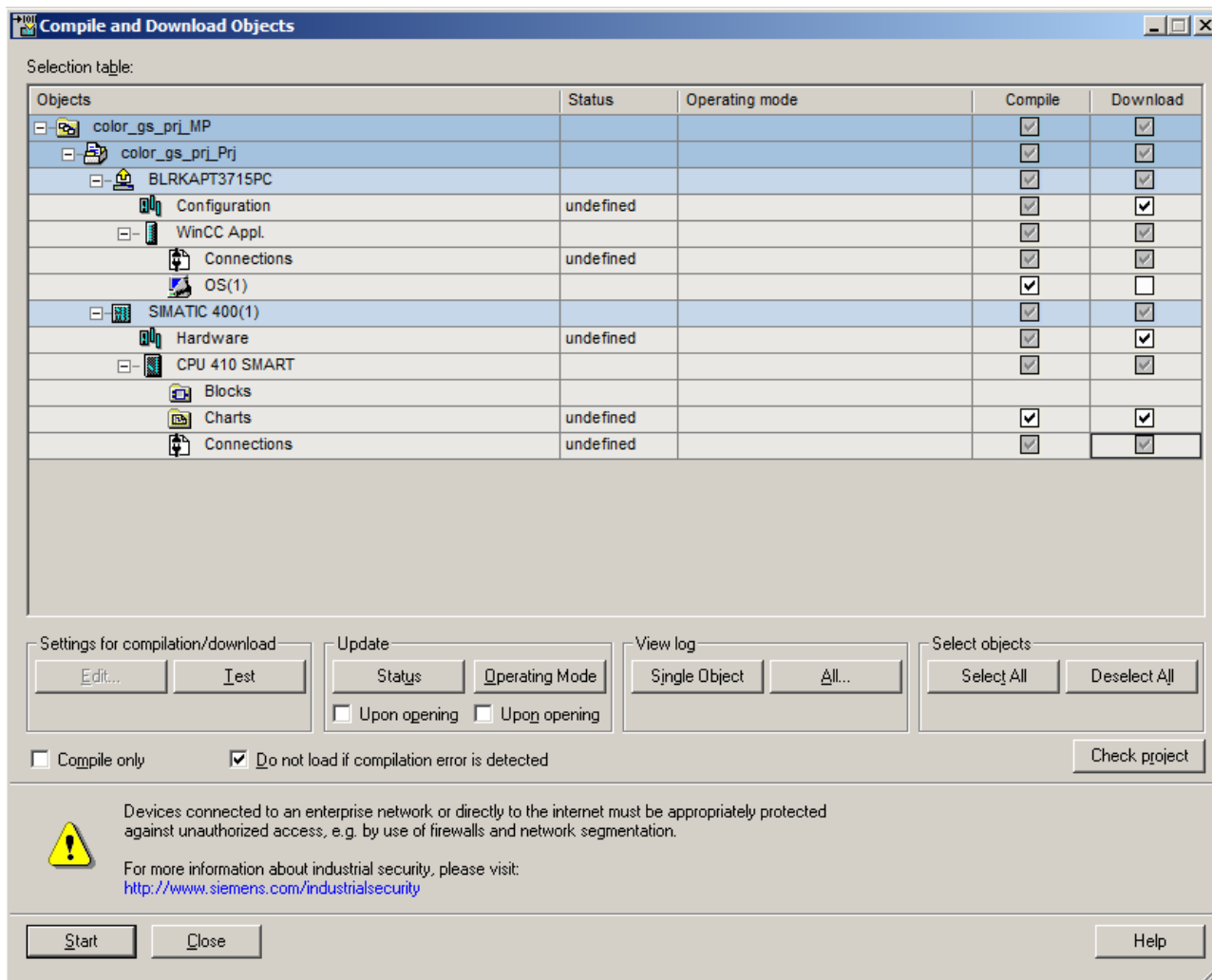
Requirements

- The SIMATIC Manager opens.
- The Plant View is activated.
- The block icons are created.

Procedure

1. Switch to the Component view.
2. Select the "color_gs_prj_MP" folder in the tree view.
3. Select **PLC > Compile and Download Objects**.
The "Compile and Download Objects" dialog box opens.
4. Expand the entire tree to display its full structure.

5. Activate the following check boxes:
 - "OS(1)" object: check box in the "Compile" column
 - "Charts" object: check box in the "Compile" column



6. Select the "OS(1)" object in the tree view and then click "Edit...".

7. In the "Settings: Compile OS" wizard, take the following steps:

Step	Actions
"Assignment of areas to operator stations"	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 with the "Named connections" entry in the "WinCC Unit" tab in the "Select network connection" dialog box. You created this connection beforehand in NetPro .
"Select the data you want to compile and the scope of the compilation".	Select the following check boxes or radio buttons: • Tags and messages • SFC Visualization: • Picture Tree • Entire OS, with memory reset

8. Click "Apply".
9. Click "Start".
10. Click "Yes" in the "If you want to download changes online, please make sure that ... Do you want to continue?" message box.
Compilation starts and the log file is displayed in the text editor on completion. Compilation of the charts ends with warnings as you cannot close the textual interconnections in this phase of the configuration.
11. Close the text editor.
12. Close the "Compile and Download Objects" dialog box.

Result

The OS is compiled successfully.

10.5 Creating a process picture

10.5.1 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

10.5.2 Creating the process picture

Requirement

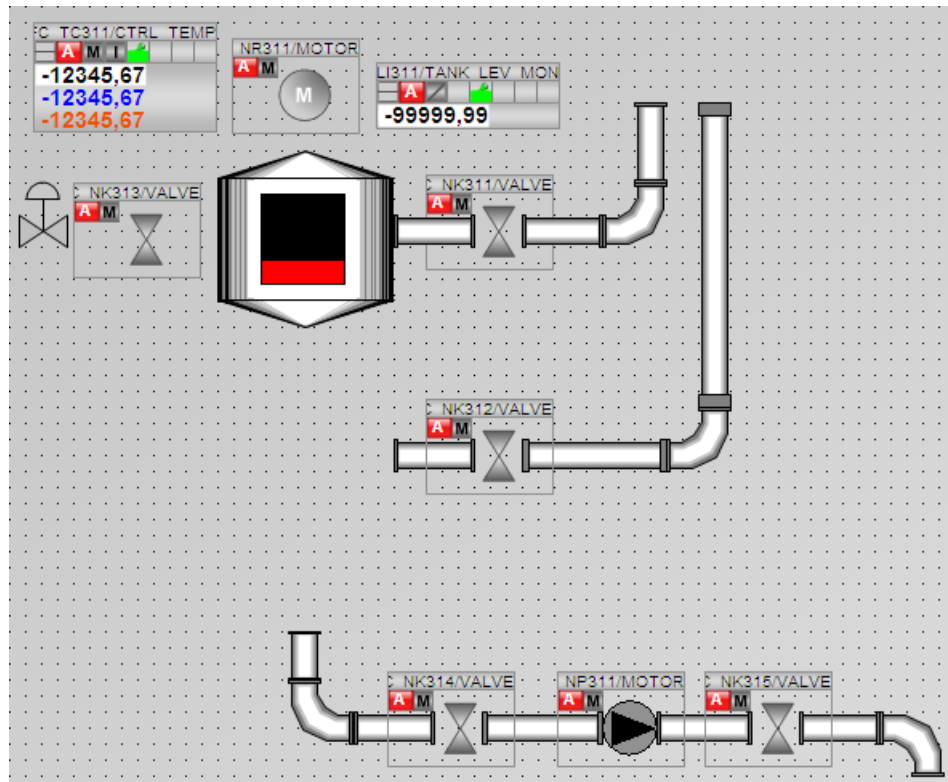
The operator station OS(1) in WinCC Explorer is open.

Procedure

1. Open the "REAC1" picture in the Graphics Designer. The picture already contains all block icons. Alternatively, you may select the "Pipe" object from the standard objects in the object palette and create your own pipe connections. To do this, follow the procedure outlined in the section Opening the picture file for your icons (Page 146).
2. Select **View > Toolbars > Symbol** and insert the following additional objects from the various folders:

Path in the library	Type	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/Symbols/Valves	31	1 x

3. Position the block icons and the new graphic objects as shown in the figure below, and resize the objects to roughly fit the picture:

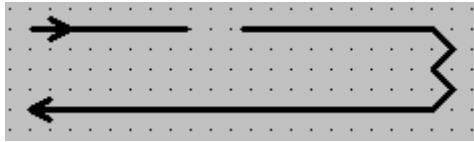


4. Select the reactor and then select **View > Toolbars > Object Properties**.
5. Enter the parameters as indicated in the table below and then close the "Object Properties" dialog box:

Property	Attribute	Parameters - "Static" column
Tank4	Object name	Reactor 1
Tank4/Geometry	Width	110
	Height	300
Tank4/Colors	background color	Dark gray
Tank4/Tag Assignment	Maximum value	1200

Property	Attribute	Parameters - "Dynamic" column
Tank4/Tag Assignment	Fill level	Tag interfacing using ES variables Plant1/REAC1/CFC_LI311/ TANK_LEV_MON.PV_out.Value

6. Create a symbolic representation for the heating using the "Line" and "Polygon" objects.



7. Create the graphic representation for the block icons.
To do this, use standard graphic objects such as rectangles and static text boxes with the required colors, and position the block icons:

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

8. Save the "REAC1.pdl" file.

Result

The process picture is being created for the **color_gs** project.

10.5.3 Inserting 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:

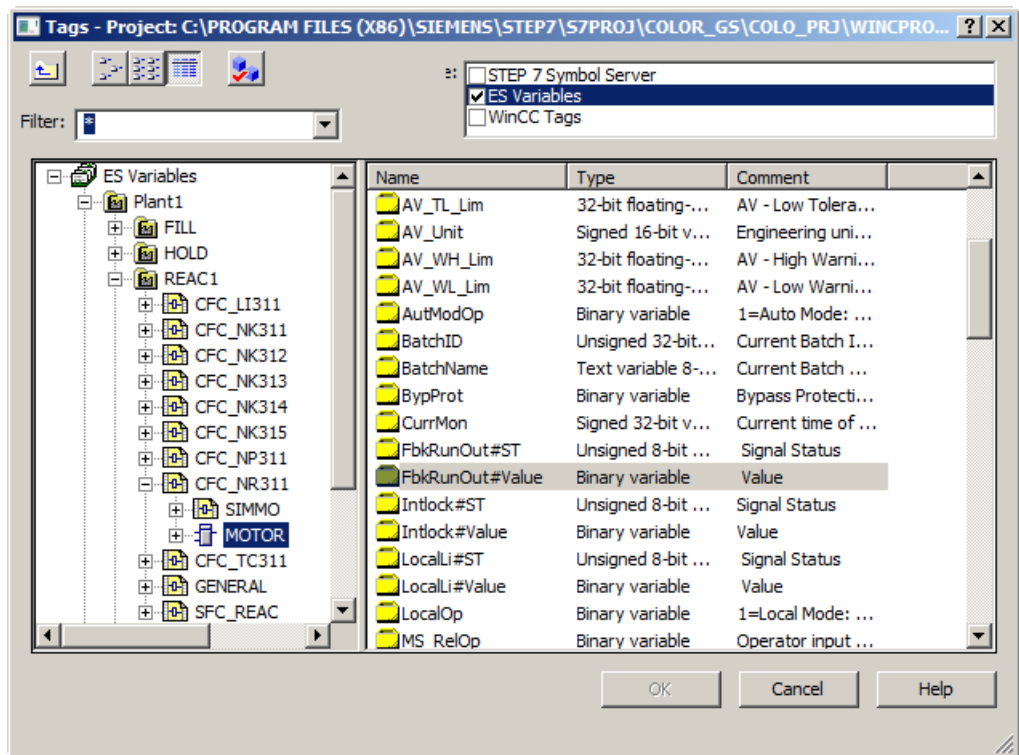
- Green: Agitator activated
- Gray: Agitator deactivated

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.

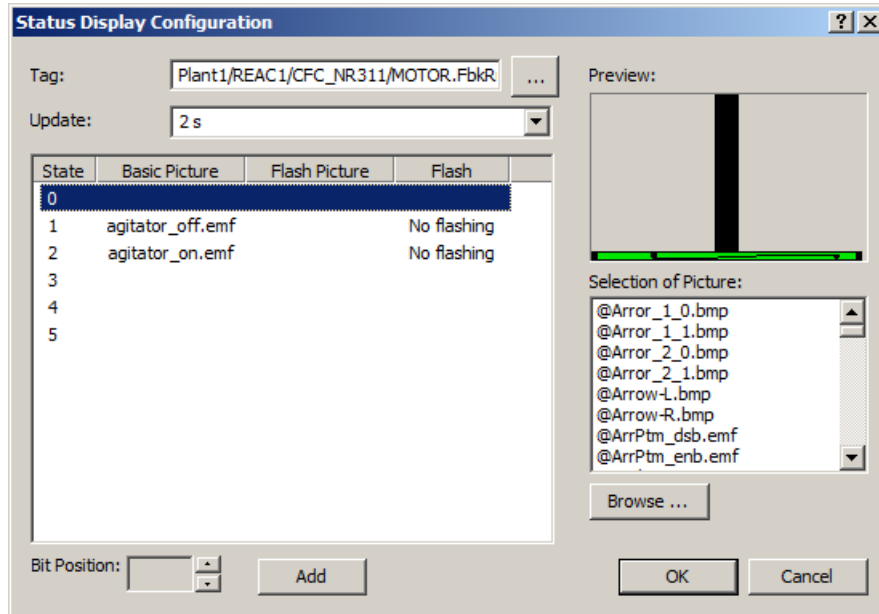
Procedure

1. Select the "Smart objects/status display" object in the object palette.
2. Switch to the drawing area.
The cursor transforms into a small status display symbol.
3. Draw a rectangle that is approximately the same size as the agitator.
The "Status display configuration" dialog box opens.
4. Click the "Tag" button.
The tag selection dialog opens.
5. Make sure that the "ES Variables" check box is set in the "Data source" area.
6. Select the "ES Variables/Plant1/REAC1/CFC_NR311/MOTOR" entry from the tree view, followed by the "FbkRunOut.Value" I/O in the detail view.



7. Click "OK".
This activates the variable.
8. Now select the "agitator_off.emf" file in the "Picture Selection" list and drag-and-drop it to the "Basic Picture" column.

9. Click "Add".
This adds an additional status to the status list: Status "1"
10. Drag-and-drop the "agitator_on.emf" picture from the picture selection to the basic picture of status "1".



11. Click "OK".
The process picture displays the agitator icon.
12. Position the agitator in the reactor on the agitator motor and adjust the size.
13. Save the "REAC1" picture.

Result

The status display is inserted.

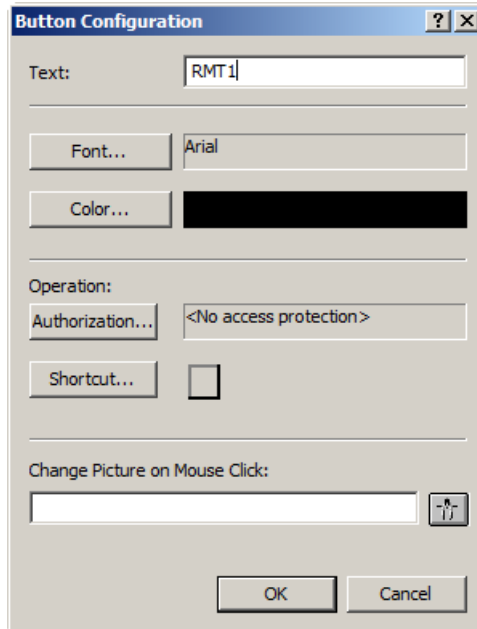
10.5.4 Inserting buttons for RMT1 and RMT2

Requirements

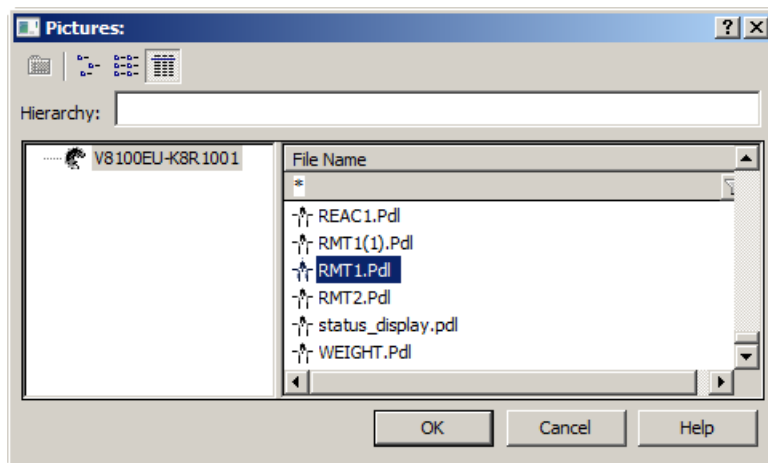
- The operator station OS (1) in WinCC Explorer is open.
- The "REAC1" process picture is open in the Graphics Designer.
- The object palette is open, and the "Standard" tab is active.

Procedure

1. Select the "Windows objects/Button" object in the object palette.
2. Drag-and -drop to the drawing area.
The cursor transforms into a small button.
3. Draw a rectangle for a button at the feed pipe of the NK311 inlet valve. This has to be large enough for the text "RMT1".
The "Button Configuration" dialog box opens.
4. Enter the name "RMT1" in the "Text" input box.

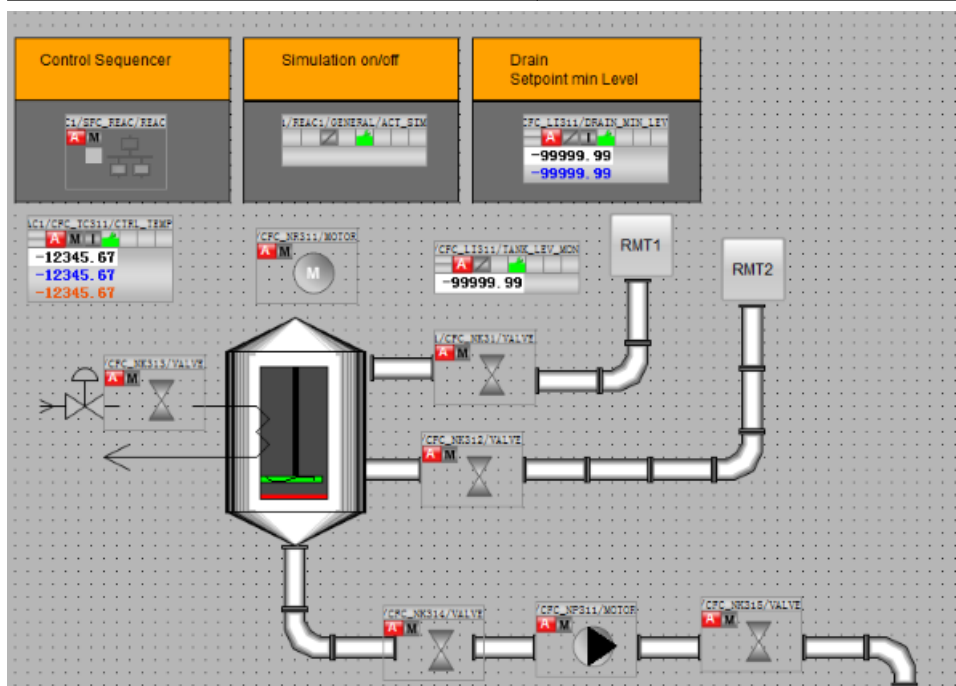


5. Click "Font...".
The "Font" dialog box opens.
6. Select the "Arial" font and click "OK".
7. Click the "Change Picture on Mouse Click" button next to the input box.
The "Pictures:" dialog box opens.



8. Select the "RMT1.PDL" picture and click "OK".
The picture name is applied in the input box.
9. Click "OK".
You have completed the button configuration.
10. Repeat steps 1 to 7 to insert buttons for changing to the picture for "RMT2" part of the plant.
Enter the parameters as indicated in the table below:

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



Note

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.

Result

Buttons for tanks RMT1 and RMT2 are inserted.

10.5.5 Modifying 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.pdl" process picture is open in the Graphics Designer.

Procedure

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

7. Select the object "Raw material tank" and open the "Object Properties" dialog with the **Properties** shortcut menu command.
8. Select the "Tag Assignment" property and enter the value "1000" for the "Maximum value" attribute in the "Static" column.
9. Close the "Object Properties" dialog box.
10. Save and close the "RMT1.pdl" picture.
11. Change the "RMT2.pdl" process picture accordingly.
12. Save and close the "RMT2.pdl" picture.

Note

Finally, you need to compile and download the OS, connections, and AS.

Result

RMT1 and RMT2 process pictures are modified as per **color_gs** project requirements.

10.6 Summary

10.6.1 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. Whenever you change a block icon in the ""@PCS7TypicalsAPLV8" file and call the function "Create/update block icons" again, all block icons are updated accordingly.

Note

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

11.1 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 document:

- Operating the SFC instance
- Switching the type of simulation

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.

11.2 Operating the SFC instance

Overview

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

You can perform the following operations here:

- Start SFC Instance (Page 179)
- Select control strategy (Page 180)
- Specify temperature setpoints (Page 181)

In addition you can switch the type of simulation (Page 182) in the process mode.

11.3 Starting the SFC instance

Requirements

- The **color_gs** project is in the process mode.
- The RMT1 /RMT2 unit has been run through once with dosing in Reactor 1.

Procedure

1. Click on the "...SFC-REAC/REAC" block icon in the "REAC1" part of the plant.
The associated faceplate opens.
2. Select the entry "Prepared values" from the drop-down list.
The "Start" button is activated.
3. Click "Start".
The "SFC Command" dialog box opens.
4. Click "OK".
This starts the control strategy displayed in the "Prepare control strategy" drop-down list.
5. Click "SFC section" from the drop-down list.
The sequential control system and the sequencer tabs are displayed. 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. Click "Reset" once the sequencers have been successfully executed.
Restart the SFC instance.

Result

The SFC instance is restarted.

11.4 Selecting the control strategy

Requirements

- The **color_gs** project is in the process mode.
- The "SFC_REAC" faceplate is open.

Procedure

1. Select the "Prepared values" option from the drop-down list.
This step activates the "Start" button and the "Prepare control strategy:" drop-down list.
2. Select the "DRAIN" option from the "Current control strategy" drop-down list.
The "SFC" dialog box opens.
3. Click "OK".
The drop-down list displays the control strategy you selected.
4. Click "Start".
The "SFC" dialog box opens.
5. Click "OK".
The sequential control system starts.
6. Click "Reset" once the sequencers are successfully executed.
You can now restart the SFC instance.

Result

The required control strategy is selected.

11.5 Changing the setpoint for the temperature

Requirements

- The **color_gs** project is in the process mode.
- The "SFC_REAC" faceplate is open.

Procedure

1. Click on the "...SFC-REAC/REAC" block icon.
The associated faceplate opens.
2. Select the entry "Prepared values" from the drop-down list.
The "Start" button and the "Current control strategy" drop-down list are activated.
3. Select the "HEAT" control strategy.
4. Click in the input box containing the specified setpoint.
In this case, the setpoint is "80". You defined this setpoint when creating the SFC type for the "Setpoints" characteristic. The high and low setpoint limits are displayed briefly in the form of a tooltip. You have already specified these values in the characteristics of the SFC type.
5. Enter a setpoint within specified limits and press Enter.
The "SFC Command" dialog box opens.
6. Click "OK".
This applies the setpoint you entered.
7. Restart the "HEAT" control strategy and monitor the values in the SFC and CFC charts.

Result

The setpoint for the temperature is changed to a required value.

11.6 Switching the type of simulation

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 the process mode.

Requirements

- The **color_gs** project is in the process mode.
- The I/O modules are connected.

Procedure

1. Click the block icon in the "Simulation on/off" box in the "REAC1" faceplate.
The faceplate opens.
2. Click "..." next to "Command".
The faceplate is expanded.
3. Click on the "Off" button to disable the simulation via the CFC charts.
This activates the simulation by way of I/O modules.
4. Click "OK".
The new value is applied and displayed in the faceplate.
5. Close the faceplate.

Result

The simulation can be switched between simulation using CFC charts and simulation using I/O modules.

11.7 Specifying 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 **color_gs** project is in the process mode.

Procedure

1. Click the block icon in the "Drain Setpoint min Level" field.
The faceplate opens.
2. Click in the text field to the right of "Setpoint."
The faceplate is expanded.
3. Enter the required fill level into the text box.
4. Click "OK".
You defined the precise minimum fill level which is to be retained in the reactor after the next drain operation.
5. Close the faceplate.

Result

The minimum fill level that must be maintained during the drain operation is specified.

Performing the additional task

12.1 Overview of the configuration of reactor 2

Duplication of parts of a plant

In this **color_gs** 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 SMART offers other possibilities for duplicating parts of the 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.

12.2 Configuring 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 **color_gs** project is open in SIMATIC Manager.
- The Process Object View is activated.
- The "General" tab is activated.

Procedure

1. Select hierarchy folder "REAC1" and copy it to hierarchy folder "Plant1". PCS 7 automatically assigns a new name, "REAC1(1)".
2. Rename the new folder "REAC2".
3. In the "Name" column of the "General" tab, change the names of the process tags in accordance with the plant overview (Page 17):
 - GENERAL(1) chart in GENERAL2
 - CFC_LI311(1) chart in CFC_LI321
 - SFC_REAC1(1) chart in SFC_REAC2
 - REAC1(1) picture in REAC2
 - Etc.
4. Switch to the "Signals" tab.
5. Adapt the symbolic names for the distributed inputs and outputs of reactor 2 in the "Signal" column:
Replace code number "1", which stands for reactor 1, with "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 **color_gs** project, these are the following names:

- NR3x1_on
 - NP3x1_on
-

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

Block	Input	Textual interconnection
SIMREAC	BVALV_RMT1_2	CFC_NK114\Valve.FbkOpenOut
	BMOT_RMT1	CFC_NP111\Motor.FbkRunOut
	ARMT1	CFC_FC111\INPUT_U.PV_Out
	BVALV_RMT2_2	CFC_NK118\Valve.FbkOpenOut
	BMOT_RMT2	CFC_NP112\Motor.FbkRunOut
	ARMT2	CFC_FC112\INPUT_U. PV_Out
	BOUT	CFC_NP321\MOTOR.FbkRunOut

Note

1. The BVALV_RMT1_1 and BVALV_RMT2_1 inputs should not be interconnected for the REAC2 part of the plant.
 2. The values of these inputs must be "0".
 3. 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...**
8. Click "OK" in the "The run sequence of the blocks will be changed and optimized according to the data flow....." message box.
All blocks are automatically arranged in the correct run sequence.
9. Close the CFC Editor.

Result

The "REAC2" part of the plant is configured.

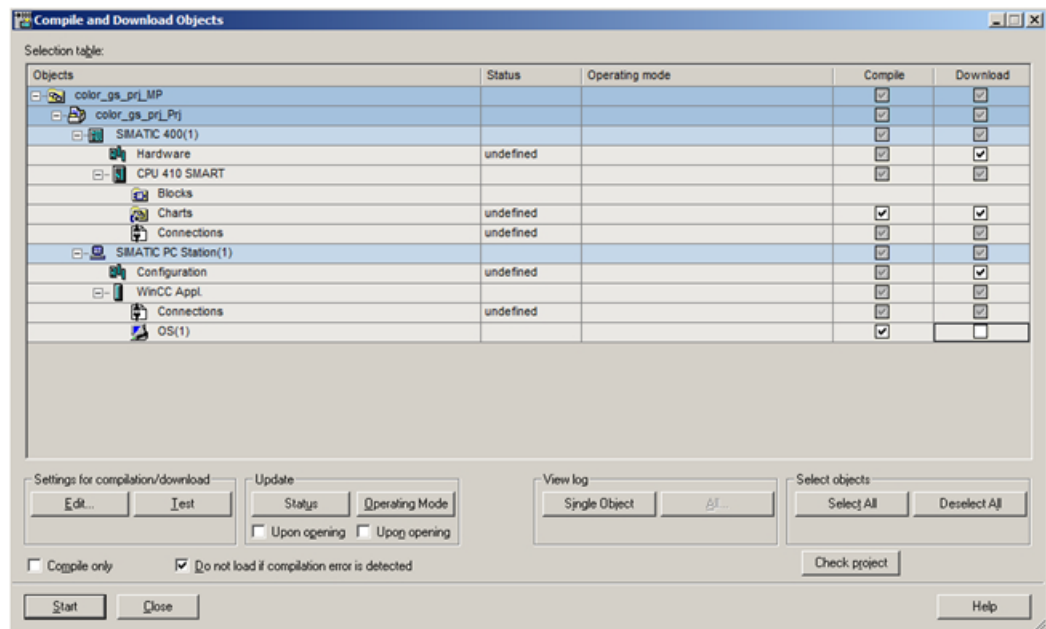
12.3 Compiling the changes

Requirements

- The **color_gs** project is open in SIMATIC Manager.
- The Plant View is activated.
- The CPU is in RUN mode.
- WinCC Explorer is closed.

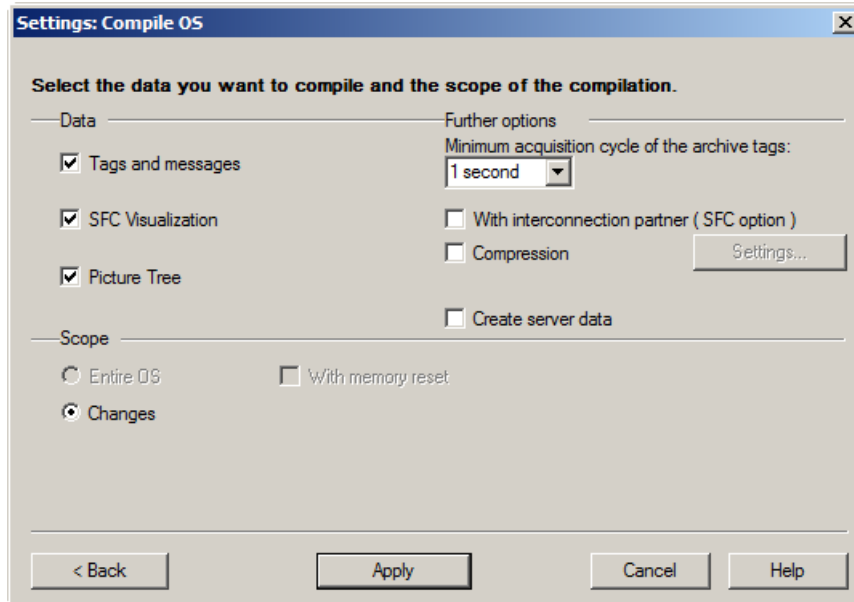
Procedure

1. Select the "color_gs_prj_MP" folder in the tree view, and then select **PLC > Compile and Download Objects**. Make the settings according to the following figure:

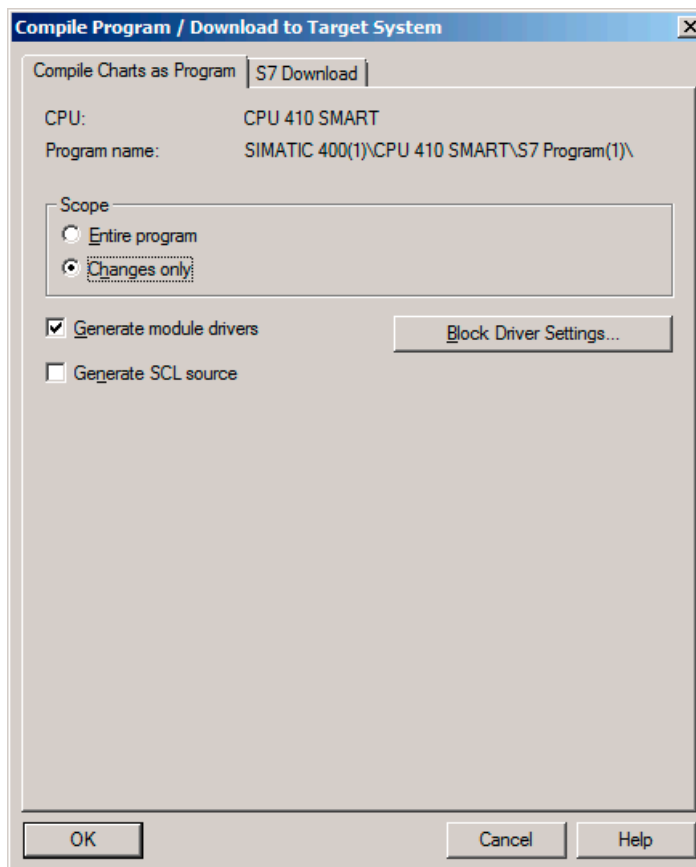


2. Select the "color_gs_prj_Pj\[name of your local PC Station]\WinCC Appl.\OS(1)" object in the tree view and then click "Edit".
The "Settings: Compile OS" dialog opens.
3. Click "Next>" until you reach the step "Select the data you want to compile and the scope of the compilation".

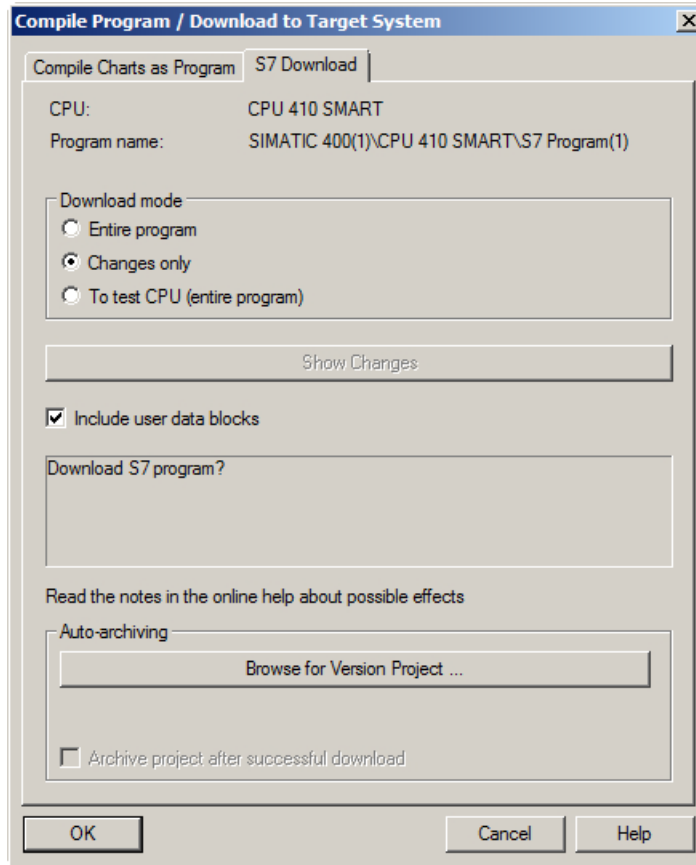
4. Select the "Changes" option button and click "Apply".



5. Select the "Charts" object in the tree view and then click "Edit...".
6. Activate the "Changes only" option button on the "Compile Charts as Program" tab and click "OK".



7. Switch to the "S7 Download" tab, activate the "Changes only" option button, and click "OK".



8. Click "Start" to execute the compilation and download.
Once the download is complete, the textual interconnections in the SFC charts are closed and all tag links are updated for reactor 2 in the process picture.

Result

The changes done during the OS configuration are compiled.

12.4 Follow-up work

Follow-up work

When commissioning your project, you may have found that the following modules were not configured during the planning stage:

- Driver blocks for the analog outputs LI311_c (AW512) and LI321_c (AW514), see also Symbolic names for the analog output module (Page 39) .
- Binary output signals NK31x_close (Valves Reactor 1 closed) and NK32x_close (Valves Reactor 2 closed); see also Symbolic names for the digital input module (Page 41).

Configure these modules if necessary and test the results.

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