SIEMENS

SIMATIC

Process Control System PCS 7 V7.0 SP1 PCS 7 - Getting Started - Part 1

Getting Started

09/2007
A5E00857261-02

Safety Guidelines

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

⚠DANGER

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

⚠WARNING

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

⚠CAUTION

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

CAUTION

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

NOTICE

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

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

Qualified Personnel

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

Prescribed Usage

Note the following:

⚠WARNING

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

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

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

Siemens AG
Automation and Drives
Postfach 48 48
90327 NÜRNBERG
GERMANY

Ordernumber: A5E00857261-02
℗ 09/2007

Table of contents

Preface

1

Purpose of this documentation

Getting Started - Part 1 gives you an initial overview of the PCS 7 process control system, enabling you to create a simple project yourself. You can configure the project on an existing SIMATIC PC station.

Getting Started - Part 1 is intended for newcomers to PCS 7 who work in the following areas:

- Configuration
- Commissioning and service

Required basic knowledge

You should already have knowledge in the following areas:

- Microsoft operating system Windows XP, Windows Server 2003
- Functions and configuration of SIMATIC S7 (S7-400, STEP 7)
- Functions and configuration of SIMATIC NET (network components, transmission media)

Validity of the documentation

This documentation is valid for the software package Process Control System; PCS 7 Toolset V7.0 SP1.

Guide

Getting Started - Part 1 explains the individual steps required to create the "color_gs" project. You will find the most important background information required to understand the steps in this Getting Started as well as detailed instructions on how to work through them.

Additionally, we provide you with the completed "color_gs" project as an example project. This is installed along with the system documentation of PCS 7. You open this project on an existing engineering station (ES) in order to view the configuration data and compare the data with your own configuration data. You activate the project on an operator station (OS) in order to control and monitor the process.

Note

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

You can find additional information about opening and adapting the example project under "Starting and adapting the example".

Conventions

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

Note

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

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

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

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

Video

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

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

PCS 7 glossary

A PCS 7 glossary which contains the definition of important technical terms used in the documentation is available on the DVD SIMATIC PCS 7; Manual Collection or in the SIMATIC Manager Online Help system within the PCS 7 software (menu command **Help > Topics > "Glossary" button)**.

Additional information

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

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

These manuals are stored as follows:

- As PDF files on the DVD "PCS 7 Engineering Toolset V7.0 SP1"
- In the PCS 7 software of the SIMATIC Manager.
  Select the menu command **Start > SIMATIC > Documentation > [required language]** to open these files.

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

Additional support

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

A list of Siemens representatives is available at:

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

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

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

Training center

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

By phone: +49 (911) 895–3200

Internet: http://www.sitrain.com

Technical Support

You can contact Technical Support for all A&D products

- using the Support Request Web form

  http://www.siemens.com/automation/support-request
- By telephone: + 49 (180) 5050-222
- By fax: + 49 (180) 5050-223

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

Service & Support on the Internet

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

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

There, you will find the following information:

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

Requirements for Getting Started 2

2.1 Requirements for Working through Getting Started - Part 1

Introduction

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

- Hardware
- Software

2.2 Required hardware for Getting Started

Hardware Components

The list below shows the hardware components you need to work through Getting Started and that we have used in the Getting Started example. For some hardware components you must use a specific version because it is not possible to work through Getting Started with a different (e.g., older) version.

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

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

Use of Other Hardware Components

If you are using other hardware components, you must enter the components you are actually using in the relevant places, for example, in HW Config. For the sake of clarity, we recommend using exactly the same components as those we have used in Getting Started.

Using S7-PCLSIM

If you do not have any hardware components available, you can use the S7-PLCSIM software that is included on the PCS 7 Toolset CD. You require a special license to use this software. If you use this software, you can use exactly the same hardware components as described in Getting Started.

2.3 Required software for Getting Started

Software components

The following software must be installed:

- Windows XP Professional or Windows Server 2003
- Internet Explorer 6.0 (supplied)
- Message Queuing Service
- SQL Server 2005
- PCS 7 software package *Engineering Toolset*
  If you have questions about installing the PCS 7 software, read the Readme file on the installation DVD or contact Customer Support.

PCS 7 in overview

3

3.1 Brief Overview of PCS 7

Description

PCS 7 is a process control system with many automatic functions to assist you during configuration. It enables you to create a project fast and conveniently. You will get to know some of these automatic functions in this Getting Started. At the same time, PCS 7 provides the advanced user many options for creating individual, project-specific solutions customized to the requirements at hand. These individual solutions are not part of this Getting Started - you can find additional information about these in the configuration manuals once you are familiar with the basic functionality.

What is a PCS 7 project?

Among other things, a PCS 7 project includes the following objects:

- Hardware Configuration
- Blocks
- CFC charts and SFC charts

These objects are always included - regardless of the number of operator stations, modules, and networking.

3.2 What Is Included in PCS 7?

PCS 7 Applications

You create the project on an engineering station (ES). Various applications are available on the ES. All applications provide you with a graphic user interface for simple operation and clear display of your configuration data. When you work through Getting Started, you will get to know the following applications:

- SIMATIC Manager is the central application and gateway to all other applications that you use to create a PCS 7 project. SIMATIC Manager is the starting point for creating your entire project.
- HW Config contains the configuration of the entire hardware of a system, for example, CPUs, power supply, communications processors.
- CFC editor and SFC editor are the editors you use for creating CFC charts and sequential control systems.
- PCS 7 OS with various editors is the tool you use for configuring the OS

3.3 What is SIMATIC Manager?

SIMATIC Manager

SIMATIC Manager represents the central application within the PCS 7 system and is used to access all the other applications you need to configure your PCS 7 project.

The SIMATIC Manager and all other applications are "linked": This is why you also see all blocks you have inserted into an CFC chart with the CFC editor in the SIMATIC Manager, for example.

Another great advantage of this link becomes clear when configuring the operator station: You have convenient access to all the data you have created in the SIMATIC Manager and the applications it includes. For example, you can visualize a process tag from a CFC chart quickly and easily when configuring the OS.

Due to the central function of SIMATIC Manager within PCS 7, it is worth taking time to become familiar with its structure and functions.

3.4 What is the Basic Structure of SIMATIC Manager?

Structure of SIMATIC Manager

SIMATIC Manager has a split window similar to Windows Explorer:

- In the left-hand window you will see a tree structure which displays different content depending on the View selected.
- In the right pane, the detailed window, you can see details of the object you have selected in the tree structure.

3.5 What Do the Views Signify in SIMATIC Manager?

Meaning of the Views

SIMATIC Manager provides you with three different views. An important feature of these views is that the objects they contain exist only once in reality but can be displayed and edited in the various views.

The structural principle of the views is the same:
The left pane displays the tree structure and the right pane displays the detail view. Each view offers advantages for performing certain tasks:

- Component view – this view represents the physical memory location of the individual objects, for example, of the charts and blocks. In the Component view, you can see immediately which blocks and charts belong to which AS.
- Plant view – this view shows the exact hierarchical structure of your plant. You can divide the plant into units and see which charts and which process pictures belong to which unit.
- Process object view – this view shows details of the individual objects from the plant view. This is particularly suitable when you want to assign the same parameter values to a large number of objects or if you want to add the same comments or make the same interconnections for these objects.

In the step-by-step instructions in Getting Started, you are always told which view you should be working in.

All the work that you perform in SIMATIC Manager is saved automatically by PCS 7.

3.6 Procedure

3.6.1 How to Open SIMATIC Manager

Procedure

You can start SIMATIC Manager in two ways:

Option	Procedure
1	Double-click the STEP 7 icon on your desktop. 
2	To start SIMATIC Manager, go to the Windows task bar and select the **Start > SIMATIC > SIMATIC Manager** command.

When you start SIMATIC Manager, the project you last opened is automatically opened again.

Initial work for the project

4

4.1 Planning the project

4.1.1 The "color_gs" Project

Introduction

After the initial theoretical introduction (Page 15) to PCS 7, you will now work 'hands-on' to create the "color_gs" project. Detailed step-by-step instructions are provided to assist you. To facilitate your understanding of the step-by-step instructions, some additional theoretical knowledge is necessary. Therefore, we will provide you with the most important background information for each topic.

Plant Description

We will only configure a small part of the entire plant for fully automatic dye production since configuring the entire plant would be beyond the scope of this Getting Started project. However, you should understand how this small part is integrated in the overall plant in order to better understand the total context. The following is a summary of the individual phases of the production process:

Phase I - Raw Materials

The liquid raw materials for the product are stored in two raw material tanks and are pumped from these tanks to the reactors. The solid raw materials are stored in three silos. Screw conveyors are used to measure out the solid raw materials from the silos to a weigh hopper for weighing. Another screw conveyor and a blower are used to blow the raw materials into one of the two mixing tanks in the correct mixing ratio.

Phase II – Production

The required quantities of liquid material are fed from the two raw material tanks to Reactor 1 or Reactor 2 by means of valves. The solid materials from the mixing containers are transported via screw conveyors to the reactors where they are blended using an agitator. The product is produced in the reactors by agitating, heating and cooling the raw materials together with the additives. Valves and actuators 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. Here, it is stirred slowly and kept at a constant temperature.

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

The reactors, piping, valves, actuators, holding tank, and filling tank can be cleaned by a cleaning-in-place (CIP) system. The resulting wastewater is collected in a separate effluent tank and disposed of.

4.1.2 Task list for Getting Started

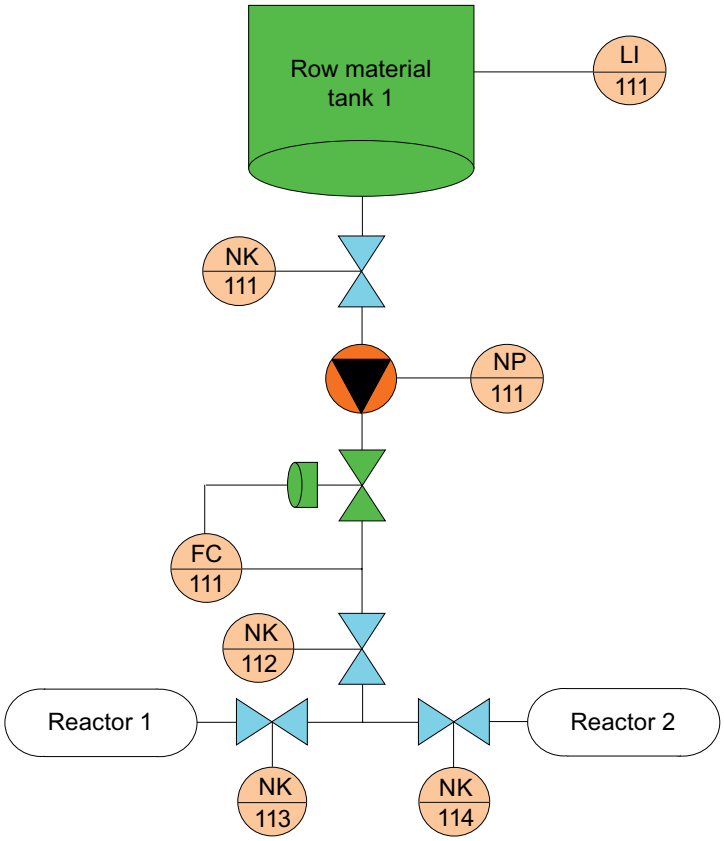
Specific Configuration Task

You will now configure part of "Phase I – Raw Materials":

Specifically, you will configure the storage of the liquid raw materials in two raw material tanks and the pump control used to pump these raw materials to the two reactors.

Piping and Instrumentation Diagram (P&ID)

The piping and instrumentation diagram illustrates the precise sequence of the configuration task and shows you all of the associated relevant process tags:



Explanation of the Piping and Instrumentation Diagram

The designations in the P&ID have the following meanings:

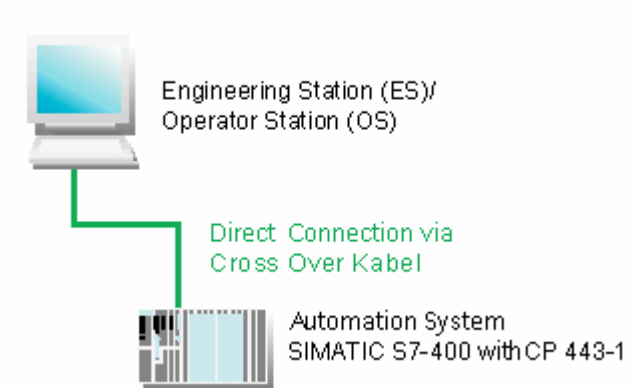
- LI111 (level indicator) – measurement of the current liquid level in the raw material tank
- NK111 and NK112 (customer-specific identifier for valves) – stop valves that must always be open when dosing raw materials.
- NP 111 (customer-specific identifier for motors) – pump that transports the raw material to the reactors
- NK 113 or NK 114 (customer-specific identifier for valves) – valves used to transport the raw material to either Reactor 1 or Reactor 2; only one of these valves can be open at a time
- FC111 (flow control) – actuator that is used to control the quantity of raw material

The states of valves NK111 to NK114 will be displayed on the operator station and can be monitored. You also have the opportunity to influence the dosing by means of FC111.

4.1.3 Configuration of the plant for the 'color_gs' project

Configuration

The "color_gs" project will be implemented on a minimum system consisting of a single automation system and a combined engineering station and operator station. The operator station is designed as a single station system. The following figure illustrates the system configuration.



Description

In Getting Started, you will build a control system containing the following components:

- Automatision system (AS)
  The individual components are described in the section "Requirements for performing the Getting Started".
- Program, which controls the "color_gs" plant.
  You create this program in the ES and download it to the CPU. The CPU executes the loaded program and shows process values to you. You load the program via the CP 443-1.
- Operator station (OS) on which the plant operator controls and monitors the plant during runtime. You yourself create the process picture seen by the plant operator on the OS. The AS is connected to the OS via the CP 443-1.

Note

Note that the plant configuration and hardware settings that result from it need to be espeically adaoted the the requirements of this Getting Started.

When configuring a real project, you will surely use more automation systems and also operate the engineering station and operator station(s) on several computers. The hardware settings will then be more complex, in any case, and will no longer correspond to the descriptions in the Getting Started.

4.1.4 Overview of Configuration Tasks

Configuration Sequence

You configure the system components in the following configuration steps:

- Setting the Parameters for the Network (Page 25)
- Creating the Project (Page 28)
- Configuring the Stations (Page 38)
- Working in the Plant Hierarchy (Page 51)
- Creating CFC Charts (Page 63)
- Creating SFC Charts (Page 115)
- Compiling, Downloading, and Testing Charts (Page 143)
- Configuring operator stations (Page 155)
- Creating the Process Pictures (Page 171)
- Working in Process Mode (Page 199)
- Performing the Additional Task (Page 213)

4.2 Preparational settings for the network

4.2.1 Settings for the Network and Interfaces

Settings

Before starting to configure the "color_gs" project, make the following settings:

- Network adapter settings on the configuration console
  PCS 7 automatically identifies the network adapters installed on your computer during startup of the station. You can use this information to program the interfaces on the configuration console.

Note

These settings are usually made immediately after PCS 7 is installed. If you did not install PCS 7 yourself, you should check the settings again and make any necessary modifications.

- Selecting the network adapter
  Select the network adapter the PC station requires to communicate with the PC station in this dialog.

4.2.2 Procedure

4.2.2.1 How to Make the Settings in the Configuration Console

Requirements

- All the necessary hardware components must be inserted on the rack and switched on.
- The crossover cable must be connected between the 3Com network adapter of your ES computer and the CP 443-1.

Procedure

1. Open the configuration console using the Windows command **Start > SIMATIC > SIMATIC NET > Configuration Console**.
2. Go to the "SIMATIC NET Configuration/ Modules/ [name of the network adapter]" entry in the tree view to select the network adapter to be used for AS-OS communication.
3. Select the "Address" entry.
   The address details of the selected network adapter are output to the detail view.
4. Make a note of the "Ethernet(MAC) address" because you will need this to subsequently configure the hardware.
5. Select the entry "Access points".
6. Double-click the "S7ONLINE" access point in the detailed window.
   The "Properties of S7 Online" dialog box opens.
7. In the "Assigned Interface Configuration" drop-down list, select the entry "PC internal (local)" and save your setting by clicking "OK".
8. Set all other network adapters in your PC to the "PG mode".
9. Close the configuration console.

4.2.2.2 How to select the network adapter in Simatic Shell

Introduction

Below, you will select the network adapter used to configure the PC stations.

Note

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

Procedure

1. Select the PC station (workstation) in the tree view of Windows Explorer.
2. Select the "Simatic Shell" folder.
3. Select the **Settings...** command from the shortcut menu.
   The "Select terminal bus" dialog box opens.
4. Select the network adapter you want to use to establish communication with the PC stations.
5. Click "OK".
6. Close the "Simatic Shell" folder.
   The communication module is reinitialized.

4.3 Creating the project

4.3.1 Use of the "New Project" Wizard

PCS 7 "New Project" Wizard

The PCS 7 "New Project" wizard is started automatically by means of default setting when you open SIMATIC Manager. You can enable or disable this option in the PCS 7 "New Project" wizard.

The "New Project" wizard supports you step-by-step in creating a new project and offers default settings. The PCS 7 wizard automatically creates various objects according to the default settings or the specific settings that you make.

Objects for "color_gs"

For the "color_gs" project, the following objects are important:

- Hardware objects: SIMATIC stations, for example a SIMATIC 400 station for the AS, a SIMATIC PC station for the OS
- Hierarchy folders representing the hierarchy levels of the plant structure. The number of hierarchy folders created corresponds to the setting you input in the PCS 7 wizard.
- A CFC chart
- An SFC chart
- One picture per plant hierarchy folder
- A master data library

4.3.2 Background knowledge for the PCS 7 wizards

What happens in the background when a new project is created?

The next two sections provide you with some theoretical background knowledge for the PCS 7 "New Project" wizard. They introduce two objects that are of great importance for working with PCS 7:

- Multiproject
- Master data library

How does a multiproject function?

When you create a new project with the PCS 7 wizard, a so-called multiproject is created automatically. A multiproject consists of a number of single projects.

In the context of the example project, the multiproject is structured as follows: The multiproject represents the entire plant and all of the single projects within this multiproject based on the individual phases of the process for producing paint. Since you are configuring only one phase of the overall plant in this Getting Started, your multiproject only contains one single project in this case.

Multiprojects have one major advantage: You can distribute the single projects to different configuration engineers who can then edit them. Once the configuration of the single projects is completed, these can be merged to form a complete project.

In Getting Started, although you will be working within a multiproject, you will not be using the wide range of functions provided by this multiproject engineering.

Detailed information is available in the *Process Control System PCS 7; Engineering System* Configuration Manual.

What is a master data library?

When you create a new project with the PCS 7 wizard, a master data library is created automatically. You store all the blocks required for the entire project in this library. Before you create a CFC chart, for example, you first store all the standard blocks you will insert in this CFC chart in your master data library.

A master data library provides the following advantage:

- When you archive a project, the master data library is automatically archived along with it.
- You can also adapt the blocks and then reuse these adapted blocks repeatedly in the project.

In the context of a "multiproject", the master data library is particularly important because it allows you to provide all the project engineers involved with blocks of a defined version so that you can be sure that only this version is used in the project.

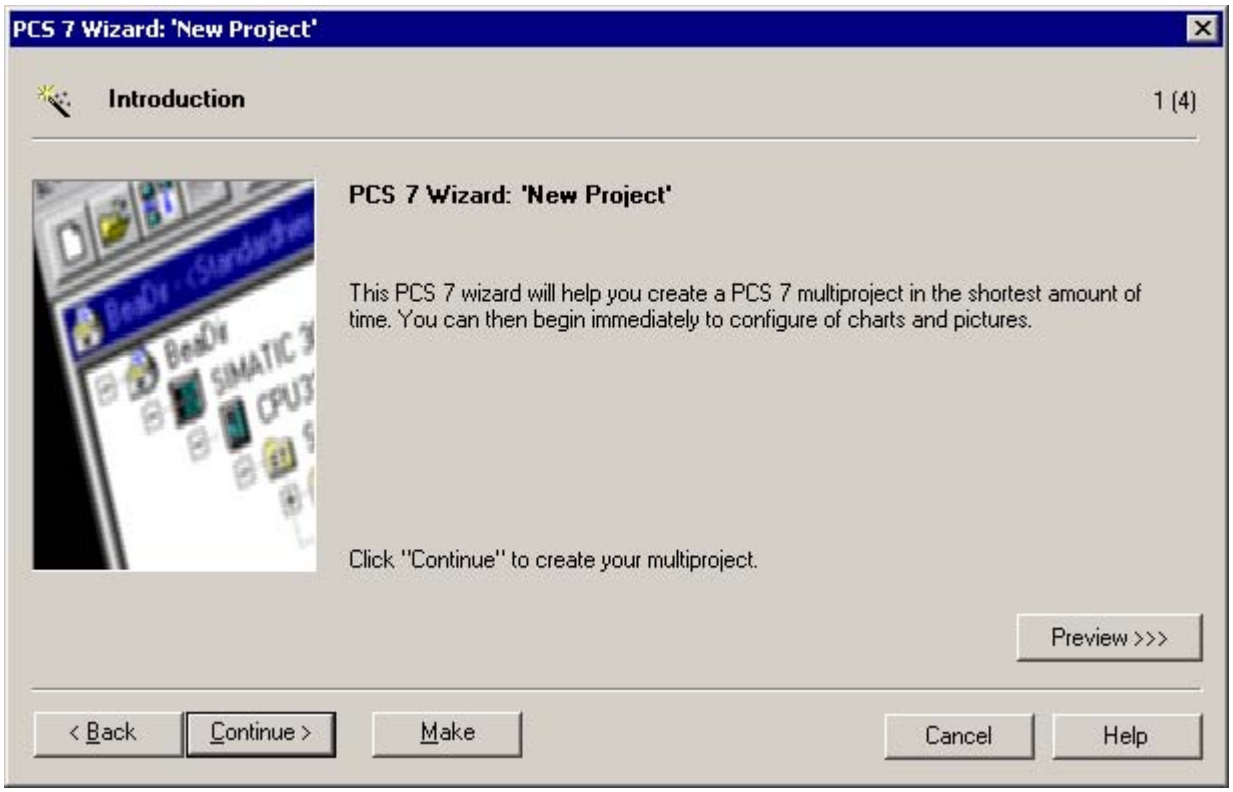
4.3.3 Procedure

4.3.3.1 How to Create the "color_gs" Project

Procedure

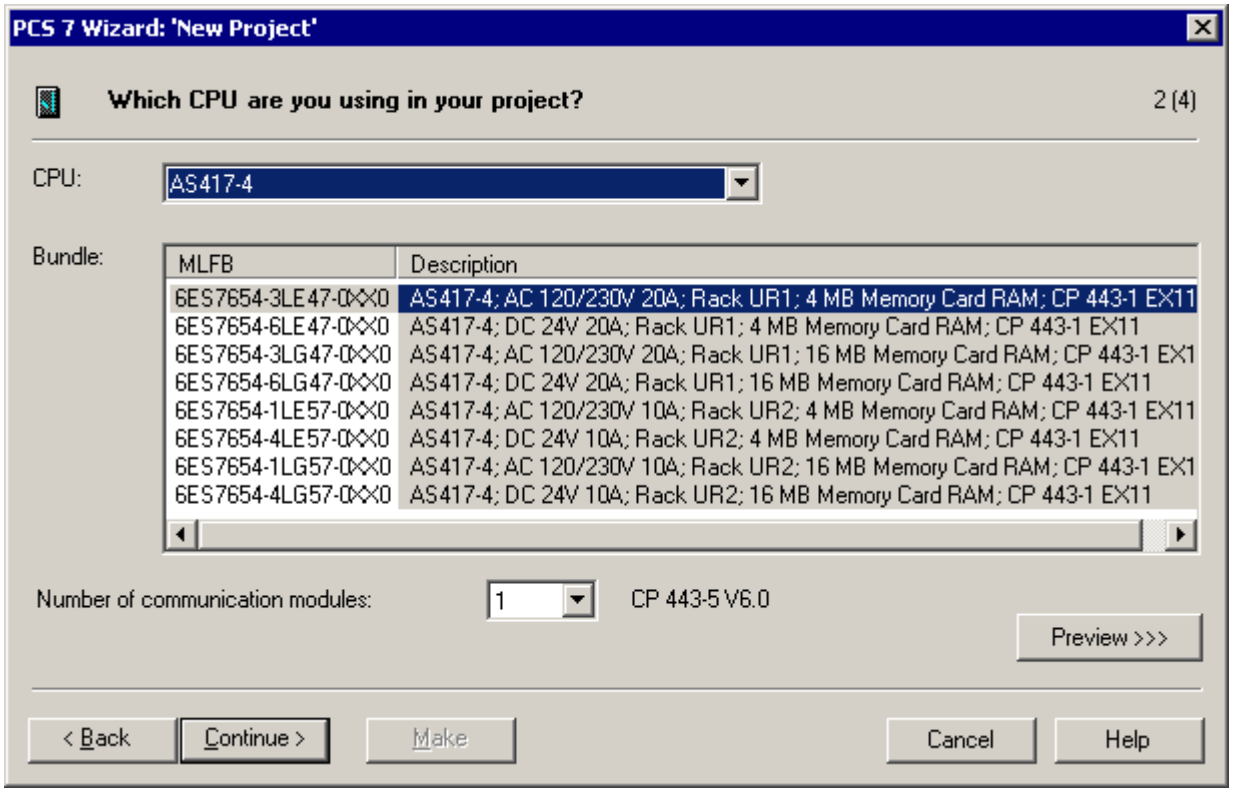
The PCS 7 wizard assists you in creating the "color_gs" project:

1. Open SIMATIC Manager.
2. Select the menu command **File > 'New Project' Wizard...**
   The "New Project" wizard of PCS 7 opens.



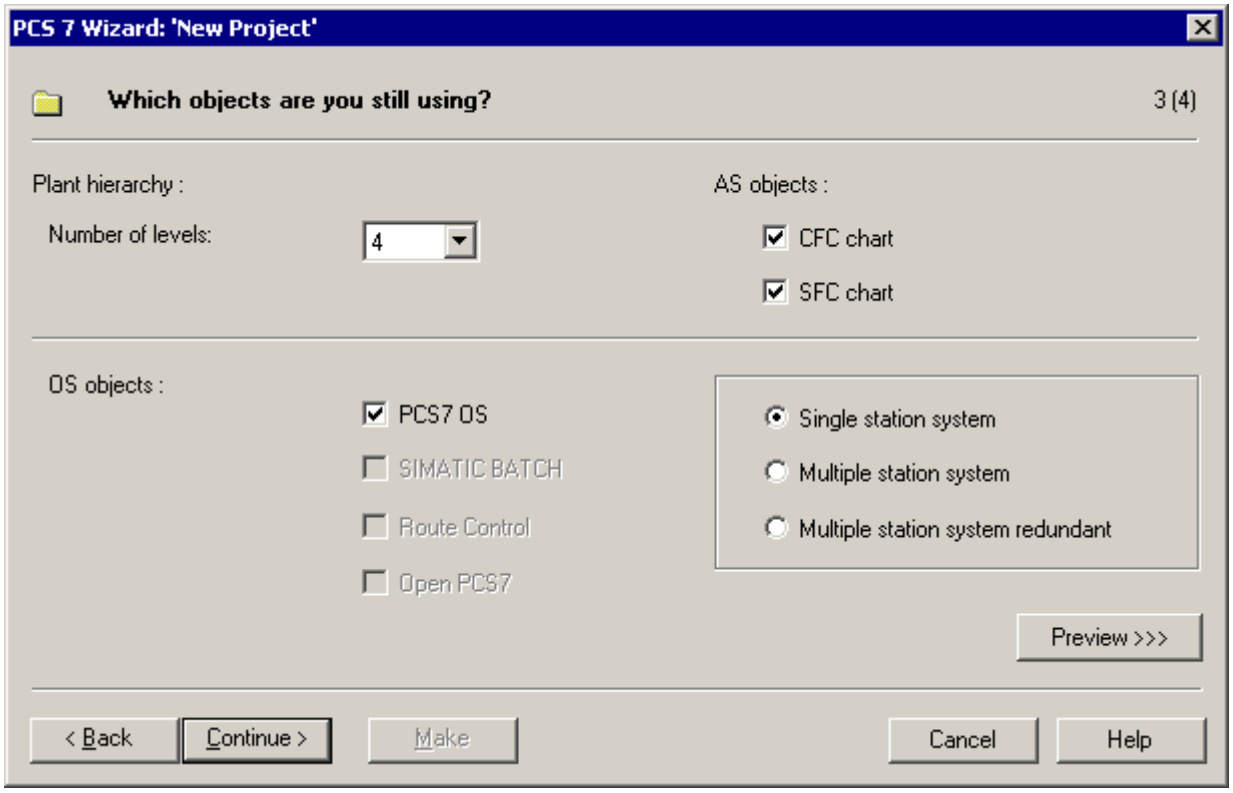
3. Click "Continue".

4. In Step 2(4) "Which CPU are you using in your project?", select the CPU bundle you are using in your project.
   Detailed information about the selected CPU bundle is displayed below the list.



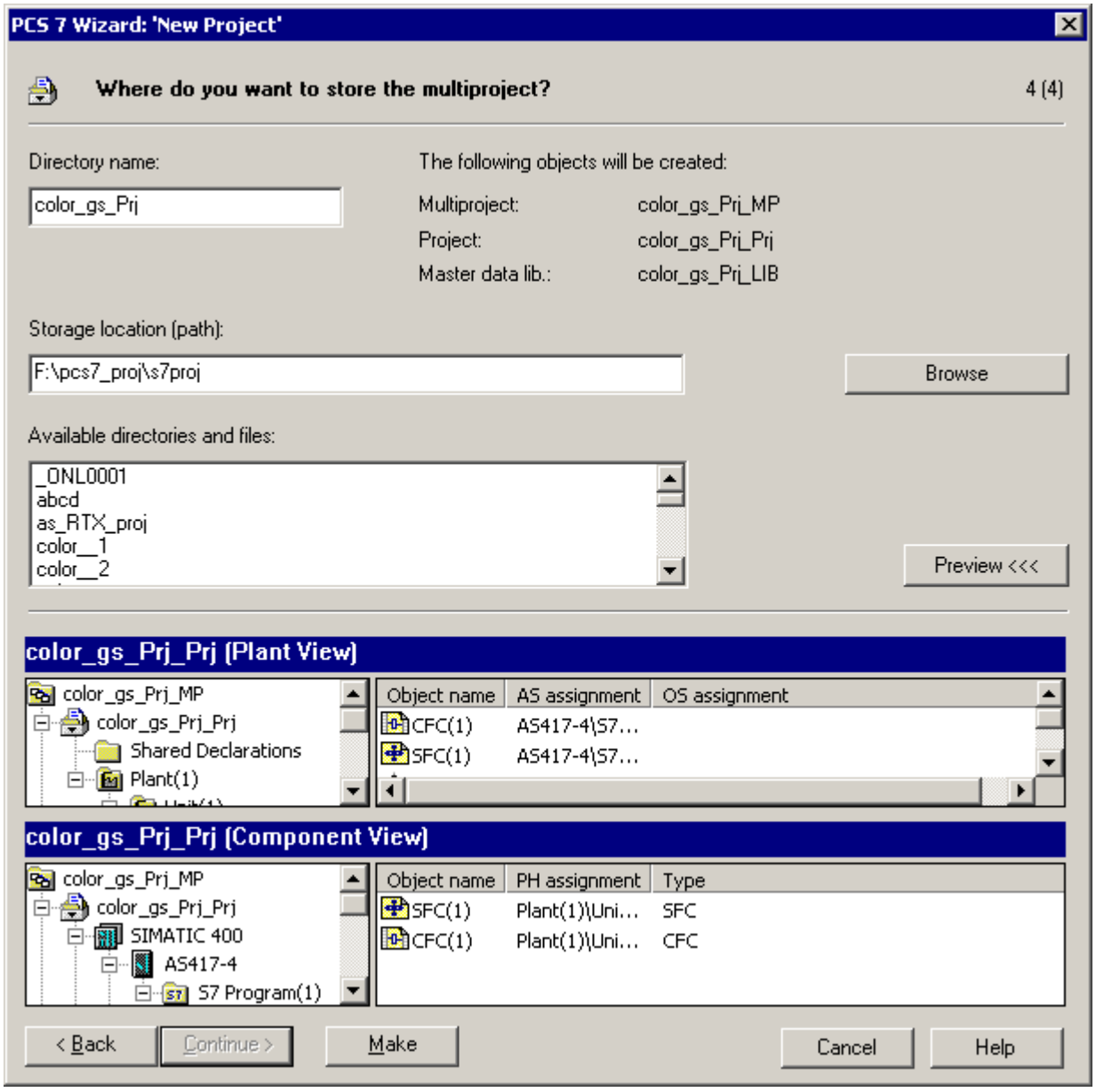
5. Click "Continue".

6. Make the following settings in Step 3(4) "Which objects are you still using?":
   - Select item "4" from the "Number of levels" drop-down list.
   - Under "AS Objects", check if the "CFC chart" and "SFC chart" check boxes are activated.
   - Activate the "PCS 7 OS" check box under "OS Objects".
     The "Single station system" option is activated automatically.

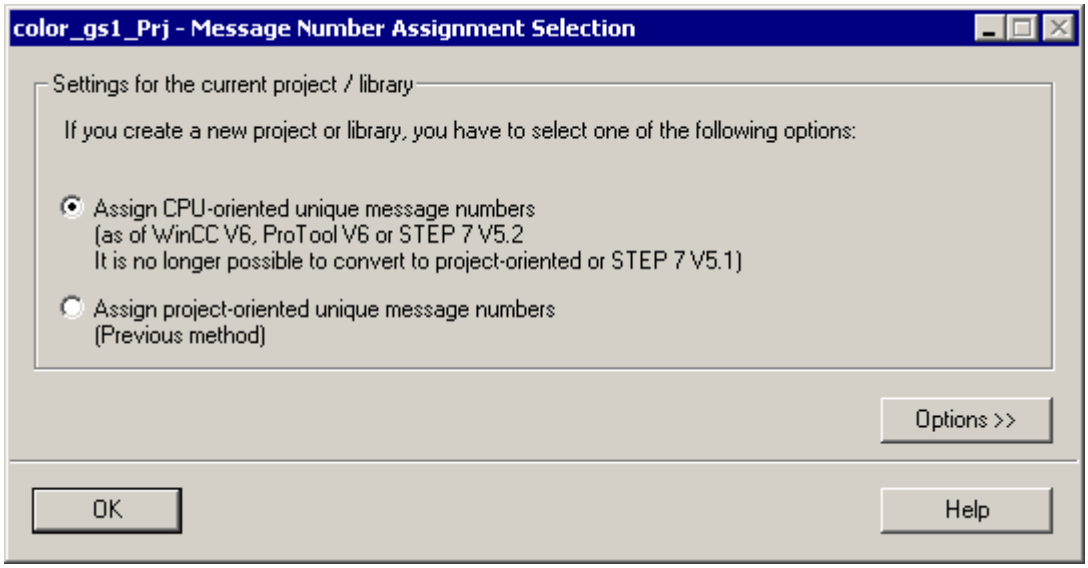


7. Click "Continue".

8. In Step 4(4), enter the name "color_gs" in the "Directory name" input field and accept the specified storage location.
9. Click "Preview >>" to see a preview of your current configuration status. This preview corresponds to the appearance of the project in the SIMATIC Manager.



10. Click "Finished".
    The "Message Number Assignment Selection" dialog box opens for creating the project and the "Assign CPU-oriented unique message numbers" check box is activated.



11. Click "OK" to apply the setting.
    The project is completed with these settings.

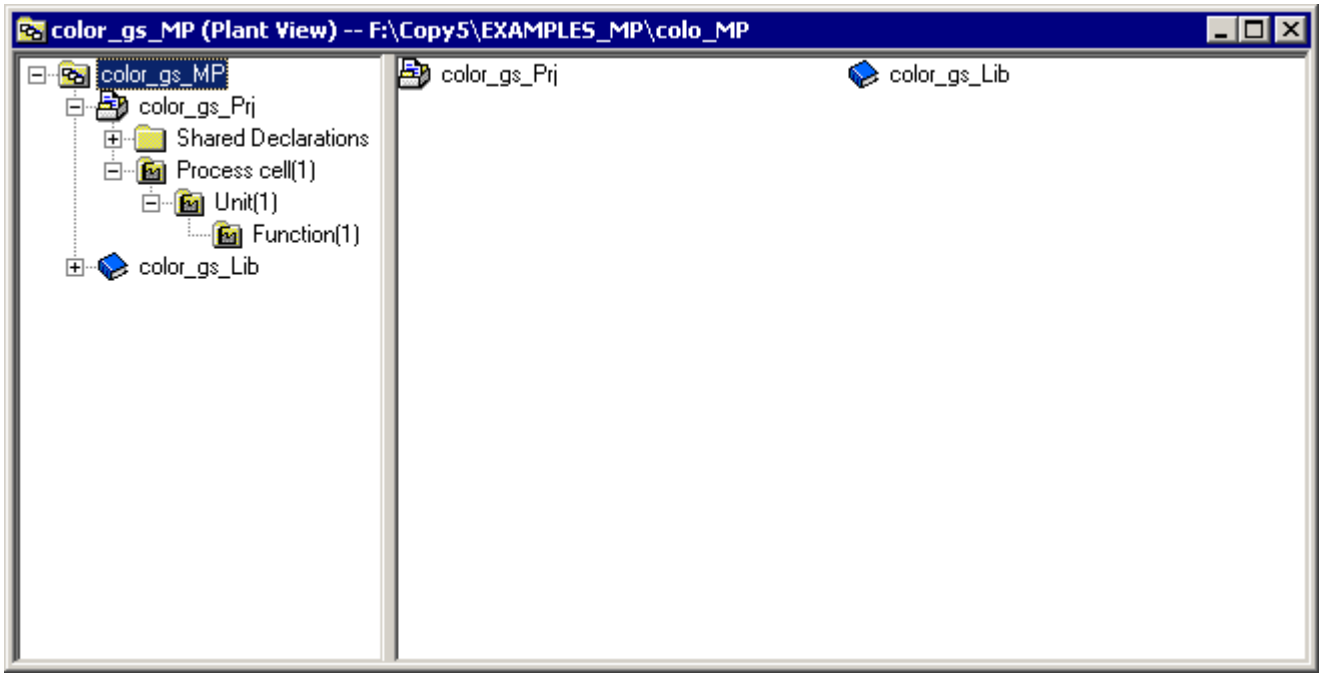
Note

Please note the following:

- If the project does not open automatically, follow the instructions provided in the section "How to close and opent the "color_gs" project (Page 36)".
- To activate different views, follow the instructions provided in the section "How to work with the various views (Page 37)".

Result

The project appears now in the plant view of the SIMATIC Manager as follows:



4.3.3.2 How to Close and Open the "color_gs" Project

Procedure for Closing a Project

1. If you have other projects open in SIMATIC Manager, close these projects for the sake of clarity.
2. Select the **Window > [Name of Project]** command and then select the project you want to close.
   SIMATIC Manager shows this project in the foreground.
3. Select the **File > Close** command.
   The program closes the project.

Procedure for Opening a Project

1. Open SIMATIC Manager.
2. Select the **File > Open** command if your "color_gs" project is not opened automatically.
   The "Open project" dialog box opens with active "User projects" tab.
3. Change to the "Multiprojects" tab and select the entry "color_gs_MP".
4. Click "OK".
   The program opens the project and the associated master data library.

Video

4.3.3.3 How to Work in the Various Views

Introduction

Once you have opened your project in SIMATIC Manager, you can display the project in various views and switch between these views.

Procedure

1. Select the **View > [Name of the desired view]** command in SIMATIC Manager:
   - Component view
   - Plant View
   - Process object view

or

1. Select the **Window > [Name of the project (name of the view)]** command if you already opened several projects.

4.4 Configuring the stations

4.4.1 Configuration overview

Overview

Configure the control system components which the PCS 7 "New Project" wizard has automatically inserted. This includes components such as the AS, the OS, and the associated connections.

For this purpose you must perform the following configuration steps:

Step	What?
1	Configure AS (Page **Fehler! Textmarke nicht definiert.**)
2	Rename PC station (Page 42)
3	Configure OS (Page 43)
4	Set connection in NetPro (Page 46)
5	Download hardware configuration (Page 50)

Local PC station

With PCS 7, you can configure the computer on which you perform the ES configuration as a local PC station. This allows you to conveniently test the functions of external operator stations using the menu command **Start OS Simulation**, without having to download the data to the real OS. Compiling the OS is enough.

The plant configuration for this Getting Started is a single station system; the ES and OS are on one computer. In this way, the local PC station you configure represents the ES and the OS at the same time. You configure a local PC station in a multiple station project in the same way.

4.4.2 Procedure

Requirements

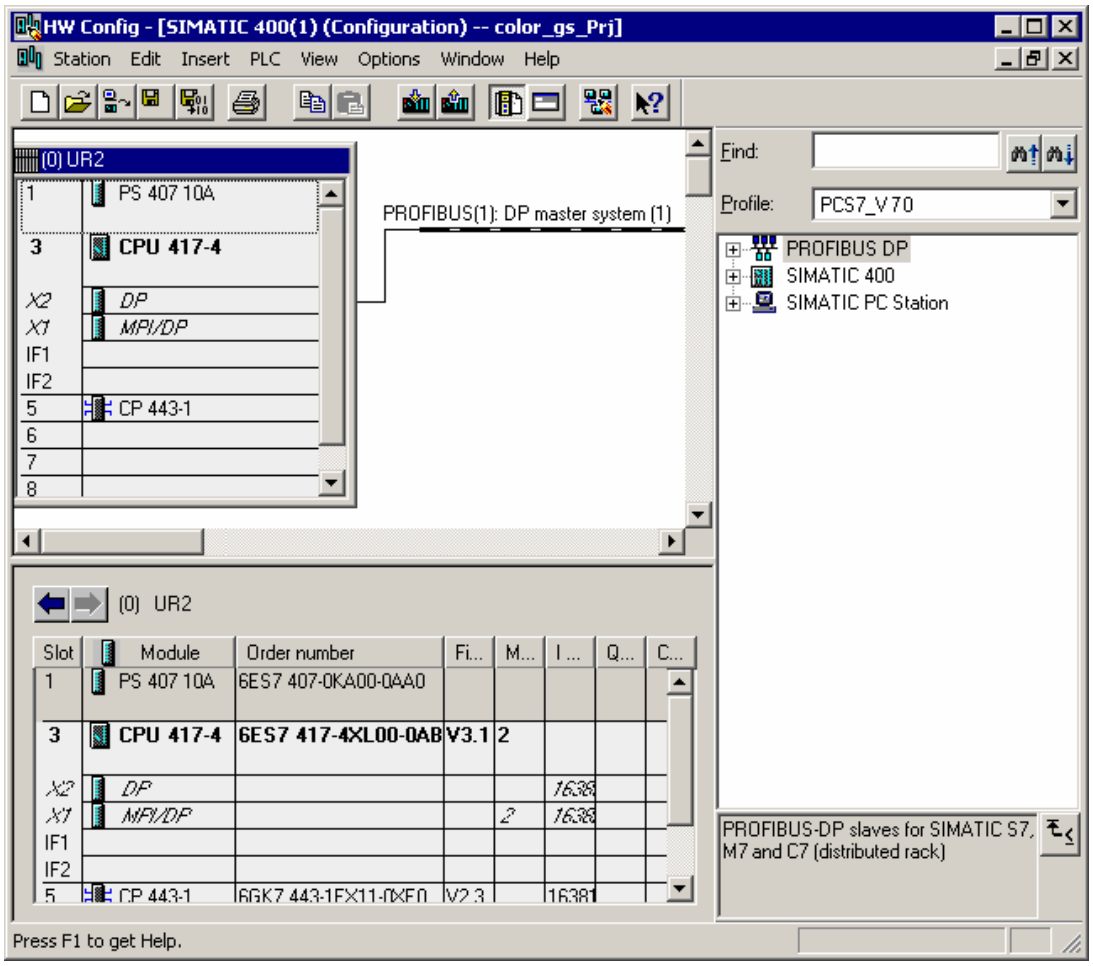
- The example project is open in SIMATIC Manager.
- The component view is activated.

Procedure

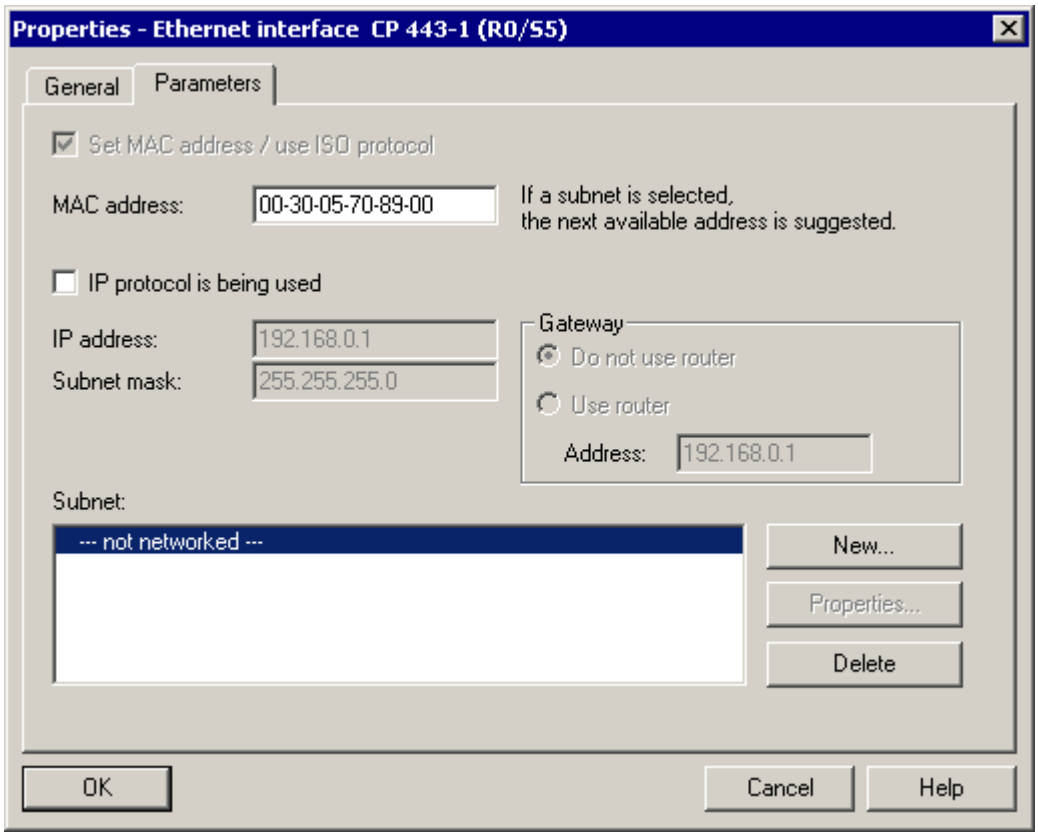
1. Select the
   "color_gs_MP/ color_gs_Prj/ SIMATIC 400(1)" folder from the tree view.
2. Select the "Hardware" object in the detail view and then select the menu command **Edit > Open Object**.
   HW Config opens and shows a view of the system hardware configuration.

Note

Select the menu command Vew > catalog if the hardware catalog is not displayed.
This opens the hardware catalog with active "PCS7_V70" profile.

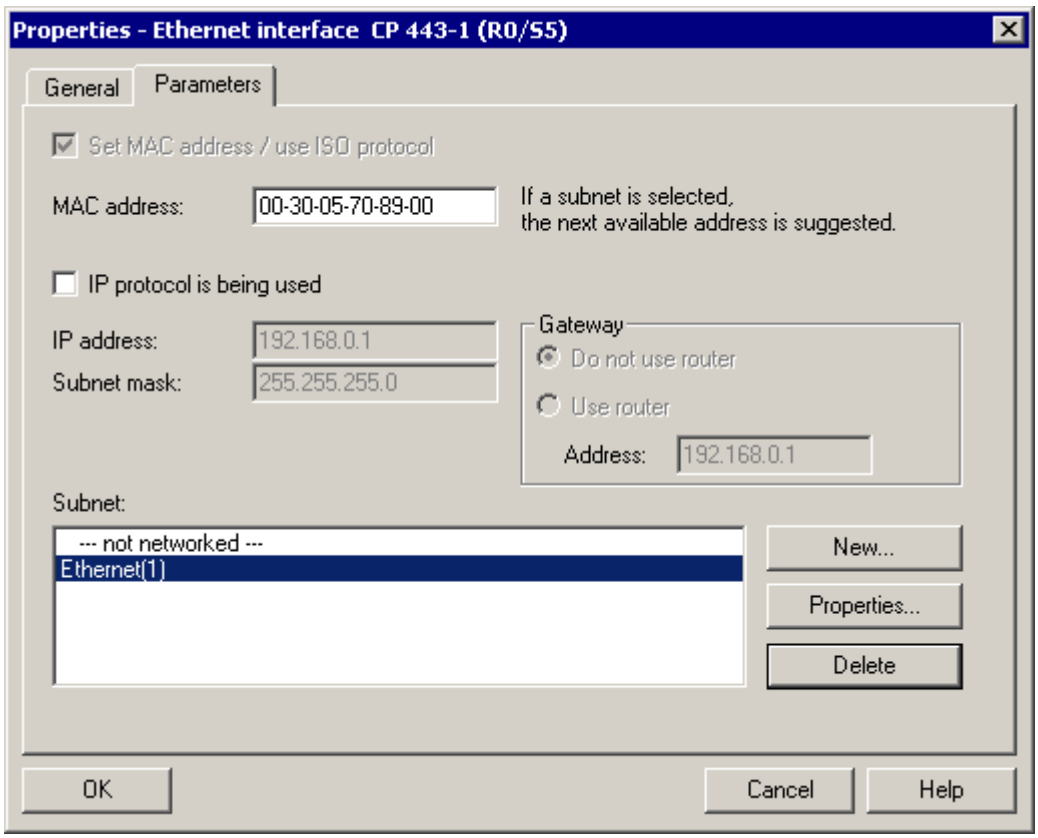


3. Select the CP 443-1 and then select the menu command Edit > Object Properties.
   The "CP 443-1 Properties" dialog box opens.
4. Click "Properties" in the "Interface" group.
   The "Ethernet Interface CP 443-1 (R0/S5) Properties" dialog box opens.
5. Enter the MAC address in the "MAC address" input box. The MAC address is labeled on the CP under the cover.
6. Deactivated the "IP protocol is being used" check box.
   This deactivates all associated input boxes.



7. Click "New" to create a new network connection. The CPU communicates with the ES via this network connection.
   The "Properties -- New Industrial Ethernet Subnet" dialog box opens.

8. Click "OK" to apply all the preparational settings.
   The "Ethernet(1)" entry is entered in the "Subnet" list and is already selected.



9. Click "OK".
   Your settings are applied.
   The "Properties - CP 443-1 (RO/S5)" dialog box opens.
10. Click "OK".
    Your settings are applied and the dialog box closes.
11. Select the menu command **Station > Save and Compile**.
12. Close HW Config.

Video

4.4.3 How to Rename the PC Station

Requirements

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

Procedure

1. Select the "color_gs_MP/color_gs_Prj/SIMATIC PC Station(1)" object from the tree view.
2. Select the menu command **Edit > Object Properties**.
3. Enter the name of the local computer "Name" input box as it appears in the network. You can find this name in the "Station" box of the Station Configuration Editor.
4. Activate the "Computer name identical to PC station name" check box in the "Computer name" area.
   The computer name is automatically entered in the lower box.
5. Click "OK".
   Your settings are applied and the dialog box closes.
   The component view identifies the PC station symbol with a yellow arrow.

Note

If the PC station is not labeled with a yellow arrow, refresh the screen display by pressing the <F5> key.

4.4.4 How to configure the PC station of the OS

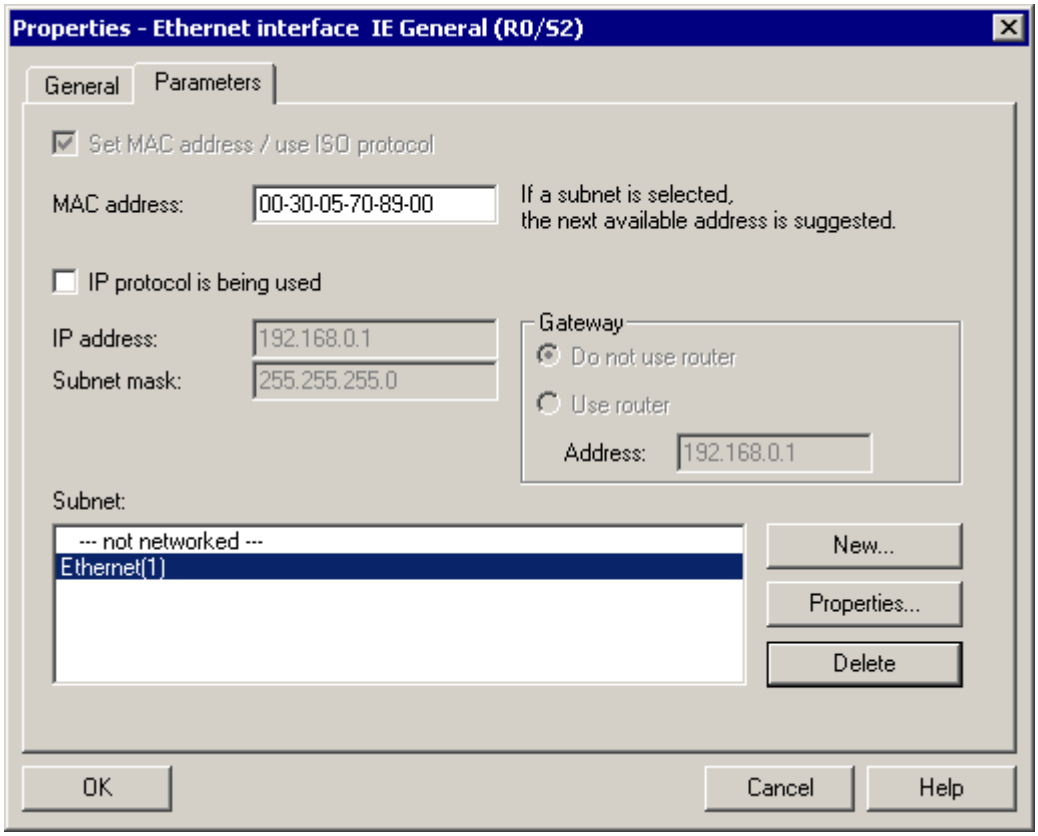
Requirements

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

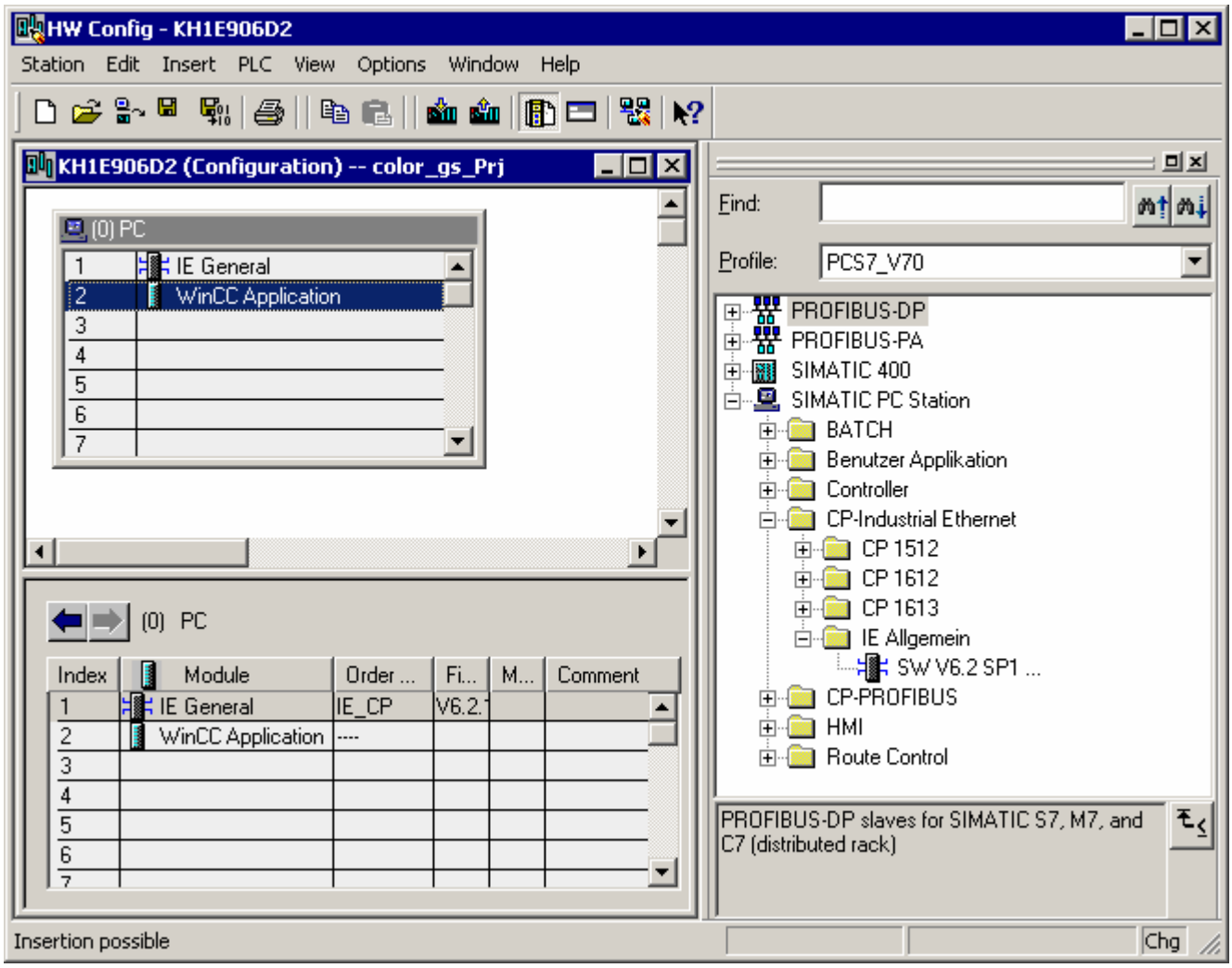
Procedure

1. Select the
   "color_gs_MP/ color_gs_Prj/ [name of the PC station]" folder from the tree view.
2. Select the "Configuration" object in the detail view and then select the **Edit > Open Object** command.
   HW Config opens and returns a view of the OS components. HW Config opens with the settings you made when configuring the AS:
   - The hardware catalog is open.
   - The "PCS7_V70" profile is active.
3. Select this CP from the hardware catalog:
   "SIMATIC PC-Station/CP-Industrial Ethernet/IE General/SW V6.2 SP1...".
   Drag-and-drop the CP to slot 1.
   The "Properties - Ethernet interface" dialog box opens.
4. Select the "Set MAC address/use ISO protocol" check box.
5. Enter the address that you noted from the configuration console in the "MAC address" box.
6. Clear the "IP protocol is used" check box.

7. Select the "Ethernet(1)" entry from the "Subnet" list box.
   This is the connection that you already configured for the CP..



8. Click "OK" to save your entries.
   The program closes the dialog box and returns you to HW Config.



9. Select the **Station > Save and Compile** command.
10. Close HW Config.

4.4.5 How to Make Settings in NetPro

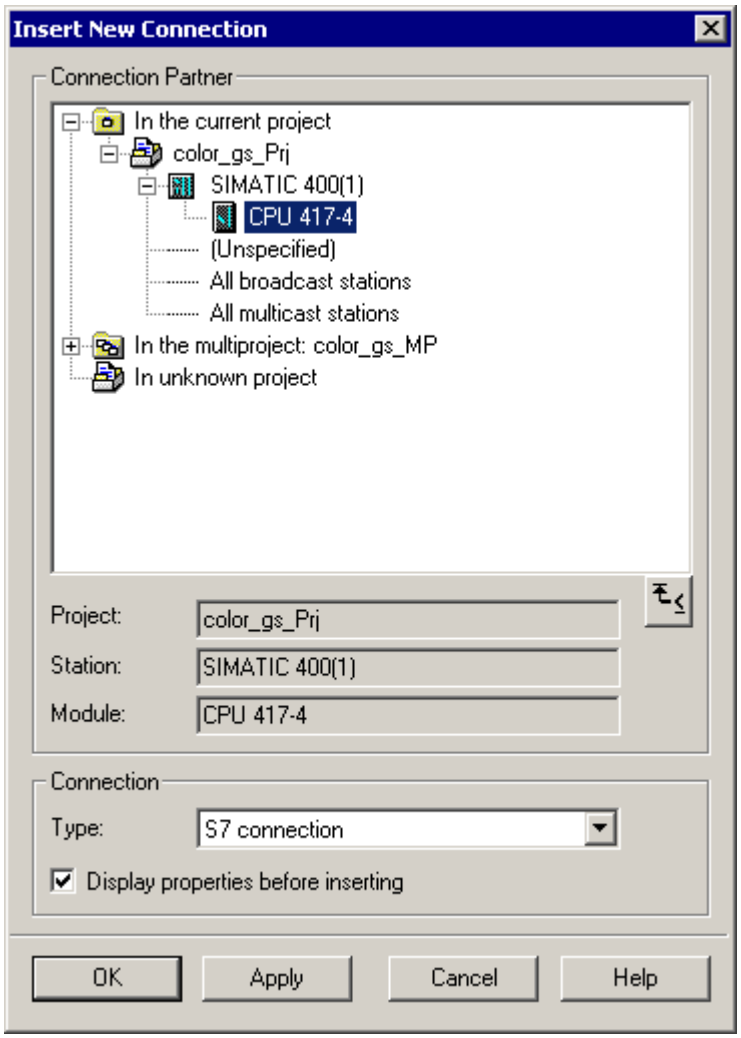
Requirements

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

Procedure

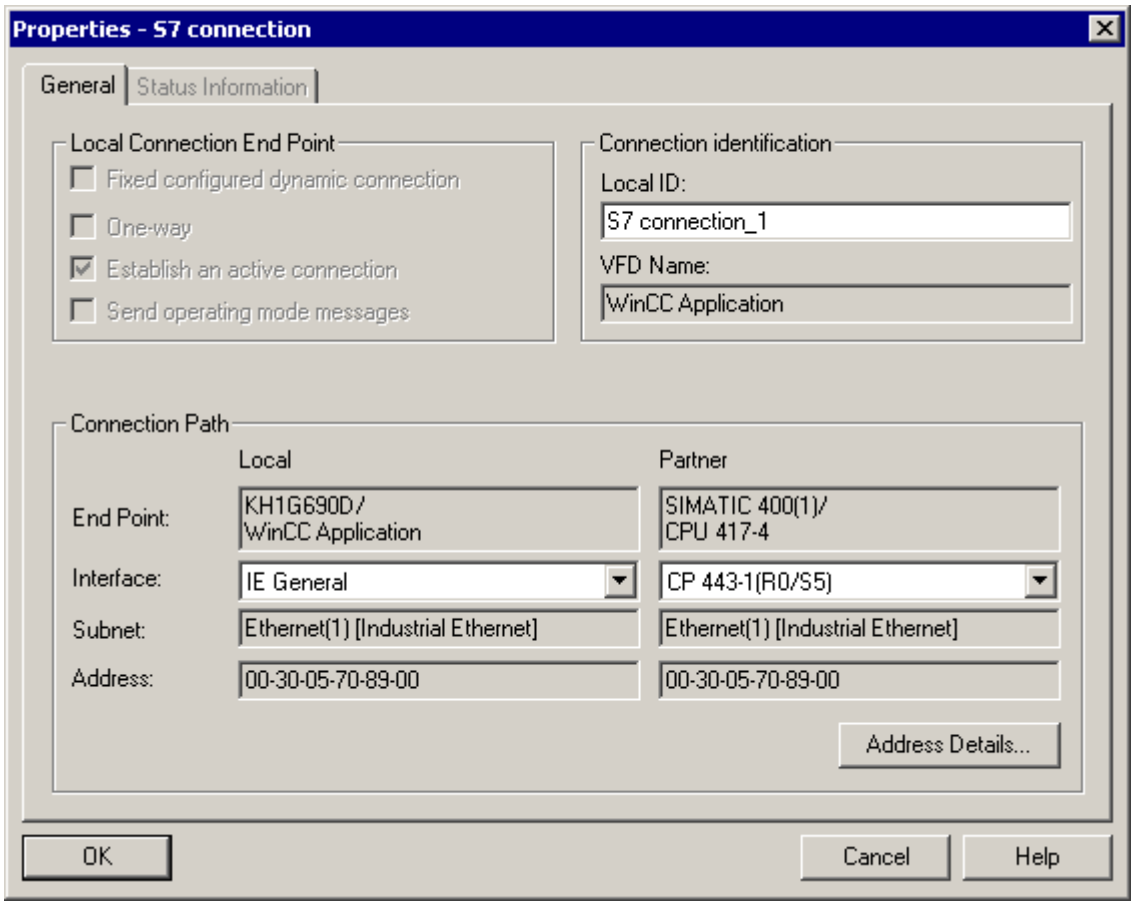
1. Select the
   "color_gs_MP/ color_gs_Prj/ [name of the local computer]" object from the tree view.
2. Select the "Connections" entry in the detail view and then select the menu command **Edit > Open Object**.
   Net Pro opens.
3. Select the "WinCC Applications" object at the SIMATIC PC station.
   Enter the required connection in the blank list shown in the lower detail view..
4. Select the first line in the lower detail view, and then select the menu command **Insert > New Connection...**.
   The "Insert New Connection" dialog box opens.
5. Select the CPU of your project from the tree view.
   This CPU is the communication partner of the OS, that is, it receives the data of this AS.

6. In the "Connection" group for the type, check if "S7 Connection" is set and the Display properties before inserting" check box is activated.



7. Click "OK".
   The "Properties - S7 Connection" dialog box opens and the "General" tab is selected.

8. Select the following connection partner for the connection between the CPU and OS:
   - Local: Interface "[Network adapter of the OS]", e.g., IE General
   - Partner: Interface "[CP of the AS]", e.g., CP 443-1



9. Click "OK".
   The new connection is shown in the list. This connection is also displayed if you select the CPU for the AS.
10. Select the menu command **Network > Save and Compile...**.
    The "Save and Compile" dialog box opens.
11. Select the "Compile and check everything" check box and click "OK".
    When the compilation operation is completed, the "Outputs for consistency check" window opens.
12. If the compilation was executed without errors, close the window.
    If any errors are displayed, correct them based on the information in the error messages and repeat the compilation operation.
13. Close NetPro.

4.4.6 How to configure and download the PC station of the OS

Procedure

1. Switch to the SIMATIC Manager. Select the PC station and select the menu command **PLC > Configure...**.
   The "Configure" dialog opens.
2. Click "Configure".
   The "Configure: <Selected Station>" dialog box opens.
3. To perform and apply the remote configuration, follow the instructions in the online help of the "Configure: <Selected Station>" dialog box.
4. Click "OK" and then acknowledge the subseqent information window that opens with "OK".
   The configuration data are transferred to the PC station.
5. When the "Transfer successfully completed" message appears, click "Close" in the configuration dialog.
   You must still download the network settings to this PC station in order to activate the network connections.
6. Select the PC station and select the menu command **PLC > Download**.
   The "Delete system data completely from the automation system and replace with offline system data. Are you sure?" message dialog opens.
7. Click "Yes".
   The "Stop Target Modules" message dialog opens.
8. Click "OK".
   The download finishes.

4.4.7 How to download the hardware configuration of the AS

Introduction

After you have configured and set the hardware, you must also make this information known to the CPU. Download the hardware configuration to the CPU.

Requirements

- The CPU is in "STOP" mode.
- The example project is open in SIMATIC Manager.
- The component view is activated.

Procedure

1. Select the "color_gs_MP/ color_gs_Prj/ SIMATIC 400(1)" folder from the tree view.
2. Select the menu command **PLC > Save and Compile Objects...**.
   The "Save and Compile Objects" dialog box opens.
3. Activate the check boxes in the "Compile" and "Download" columns of the "color_gs/[SIMATIC 400(1)/Hardware" object.
4. Click "Start".
   The message "Downloading program changes during operation can, in the case of malfunctions or program errors, cause serious damage to personnel and equipment! Make sure..." opens.
5. Click "OK".
   The compile and download operation is executed. The log file is opened in the text editor when the function is completed.
6. Close the text editor.
7. Click "Close" in the "Compile and Download Objects" dialog box.
   The dialog box closes.
8. Start the CPU.

4.5 Working in the PH

4.5.1 Settings in the Plant Hierarchy

Plant hierarchy

Once again, it is time for a little theory:

The plant hierarchy (PH) maps the hierarchical structure of your plant exactly, for example, the plant, unit or function. The PH provides you with a variety of possible settings, the most important of which are described here:

- Number of hierarchy levels:
  The nesting depth of these levels is determined by the plant structure. Rule: the more complex the plant structure the higher the number of hierarchy levels you require to reflect your plant structure. With the PCS 7 wizard, hierarchy folders with default names are created according to your specification.
- Determination of the hierarchy level(s) which influence the name of plant ID (HID):
  The PCS 7 project contains many instances of the HID: Messages generated in the active process and tag names contain this HID in order to allow operators to quickly recognize a specific plant unit associated with a message or tag. Rule: the more hierarchy levels you define and the longer each individual HID part is, the longer and less recognizable the entire HID becomes.
- Deriving the picture hierarchy from the PH:
  The process pictures are grouped in a specific hierarchy: This allows you to change from an overview picture to a lower level picture in process mode. The subordinate pictures represent a portion of the overview picture that is accurate in every detail. The hierarchy of the process pictures corresponds to how the process pictures are stored in the plant hierarchy.

4.5.2 How to Perform the Settings for the PH

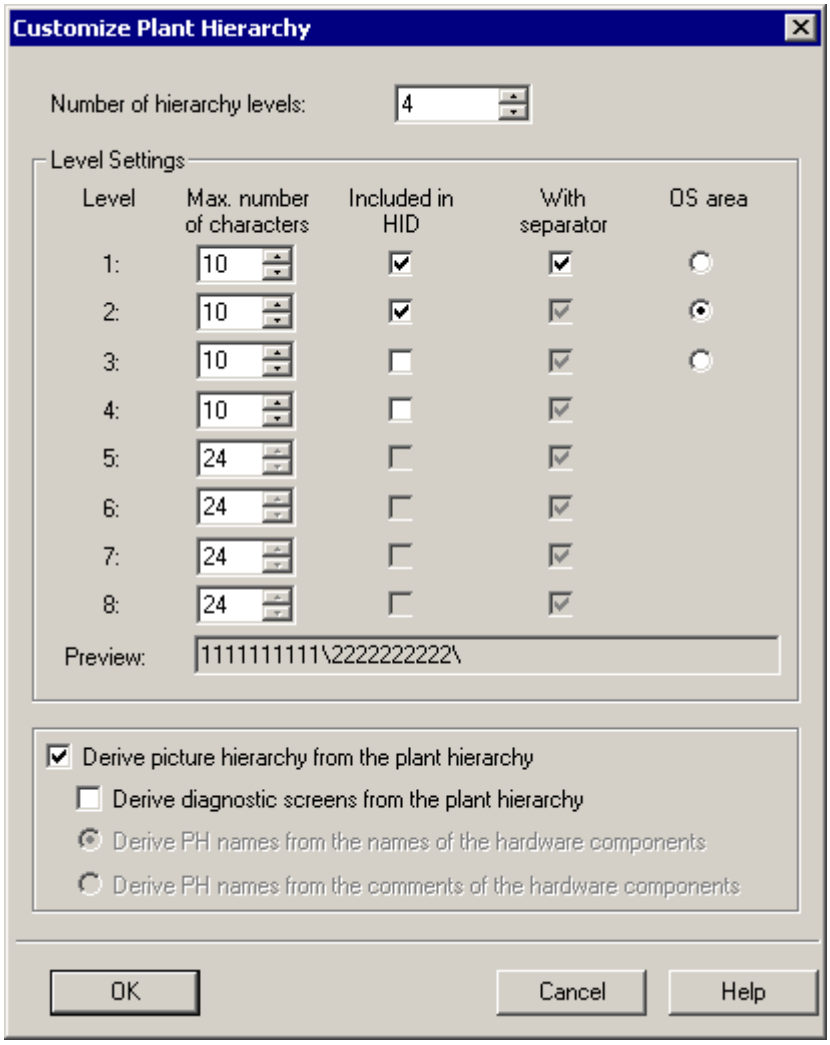
Requirements

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

Procedure

1. Select the "color_gs_MP/color_gs_Prj" hierarchy level in the tree view.
2. Select **Options > Plant Hierarchy > Settings...**.
   The "Customize Plant Hierarchy" dialog box opens for you to set the PH options.
3. Enter the value "4" in the "Number of hierarchy levels" box.
   This setting allows the definition of up to four hierarchy levels.
4. Enter the value "10" in the "Max. number of characters" input box for all four hierarchy levels.
   This setting limits the length of the HID string to 10 characters per hierarchy level.
5. Select the "Included in HID" check box for levels 1 and 2.
6. Select the "OS area" option for level 2.

7. Activate the "Derive picture hierarchy from the plant hierarchy" check box.
   Subsequent appearance of the dialog box:



8. Click "OK" to save your entries.
   The "You have changed the "Included in HID" property. Do you also want the changes to apply to existing hierarchy folders?" message is output.
9. Click "Yes" in the message box..
   The program saves all settings.

4.5.3 Structure in the Plant View

Plant hierarchy of the example project

You already specified four hierarchy levels with the PCS 7 "Create new project" wizard. As a result, you will find the following hierarchy folders in the tree view of your project:

- Process cell - level 1
- Unit - level 2
- Function - level 3
- Device - level 4

The names of the hierarchy folders are default names assigned automatically by PCS 7 when the project is created.

For your "color_gs_MP" project, you must, adapt this structure to the individual requirements of the "color_gs" project, change the default names, and insert new hierarchy folders. This provides you with a clear structure and makes it easier to navigate through your project. You can also treat all the objects as individual units.

In Getting Started we have specified the following hierarchy folder names for the various components of the plant:

Default name	Hierarchy folder	Technological assignment
Plant	Plant1	Complete plant
Unit	RMT1	Raw material tank 1
Function	FC111	Flow control (dosing)
Function	LI 111	Level indicator for raw material tank 1
Function	NP 111	Pump control
Function	NK 111	Valve control
Function	NK 112	Valve control
Function	NK 113	Valve control
Function	NK 114	Valve control
Device	ADDIT	Auxiliary chart for specifying setpoints

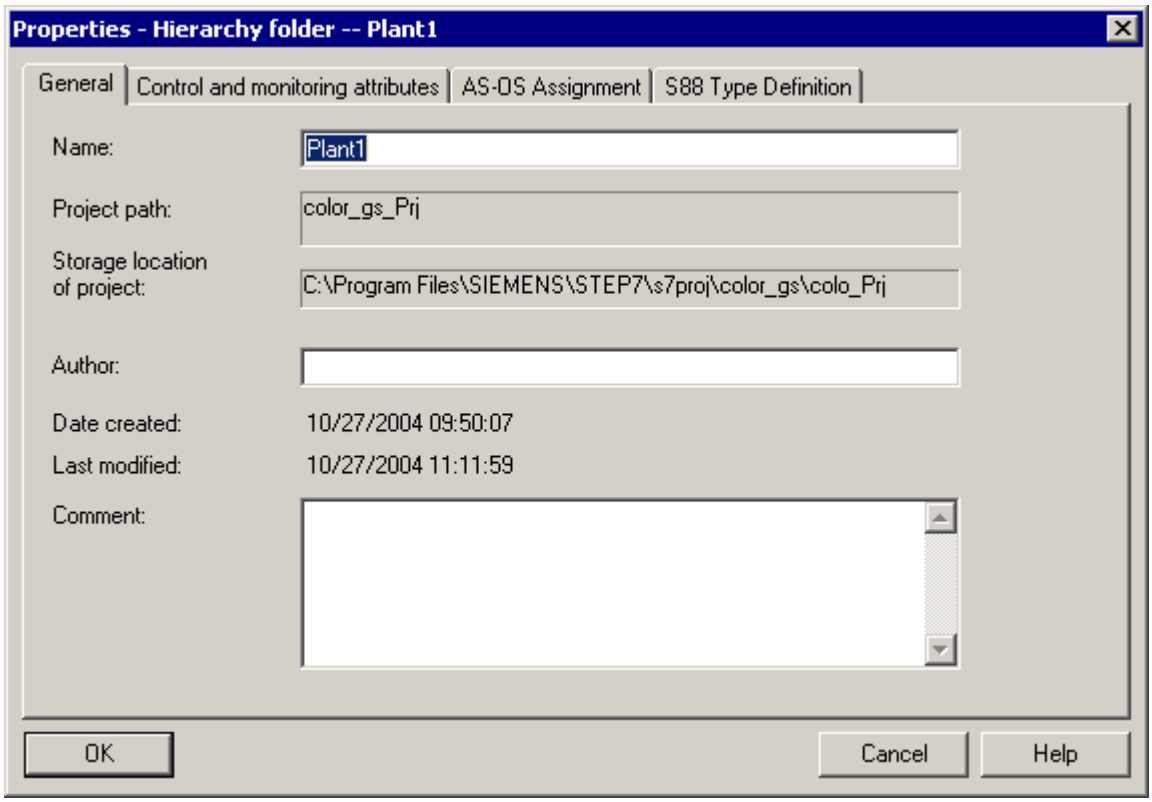
4.5.4 How to Adapt the Default Names

Requirements

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

Procedure for renaming the "Plant" folder

1. Select the hierarchy folder "color_gs_MP/color_gs_Prj/Process cell(1)".
2. Select the menu command **Edit > Object Properties...**.
   The "Properties - Hierarchy Folder" dialog box opens and the "General" tab is selected.
3. Enter the name "Plant1" in the "Name" box.

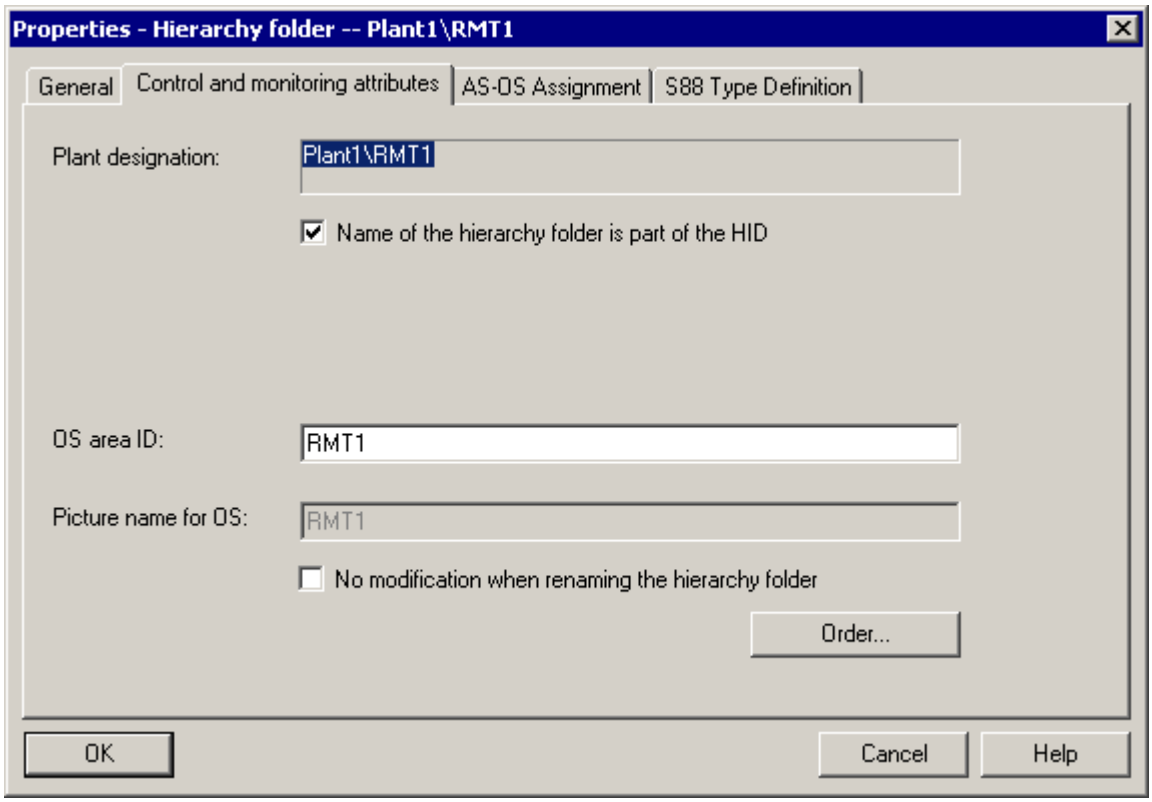


4. Click "OK" to apply your settings.
   The dialog box closes and the name of the hierarchy folder is changed to "Plant1".

Video

Procedure for renaming the "Unit" folder

1. Select the hierarchy folder "Unit (1)".
2. Select the menu command **Edit > Object Properties....**
   The "Properties - Hierarchy Folder" dialog box opens and the "General" tab is selected.
3. Enter the name "RMT1" in the "Name" box.
4. Switch to the "Control and Monitoring Attributes" tab.
   The "No modification when renaming the hierarchy folder" check box is deactivated by default. This ensures that the text for the OS area ID is always changed according to the name of the hierarchy folder.



5. Click "OK" to apply your settings.
   The dialog box closes and the name of the hierarchy folder is changed to "RMT1".

Procedure for renaming additional folders

1. Select the hierarchy folder "color_gs_MP/ color_gs_Prj/Plant1/RMT1/ Funktion(1)".
2. Select the menu command **Edit > Object Properties**.
   The "Properties – Hierarchy Folder" dialog box opens.
3. Enter the name "FC111" in the "Name" box.
4. Click "OK".
   Your settings are applied and the dialog box closes.
5. Select the folder "color_gs_MP/ color_gs_Prj/Plant1/RMT1/ FC111/ Device(1)".
6. Select the menu command **Edit > Object Properties**.
   The "Properties – Hierarchy Folder" dialog box opens.
7. Enter the name "ADDIT" in the "Name" box.
8. Click "OK".
   Your settings are applied and the dialog box closes.

4.5.5 How to Insert Additional Hierarchy Folders

Requirements

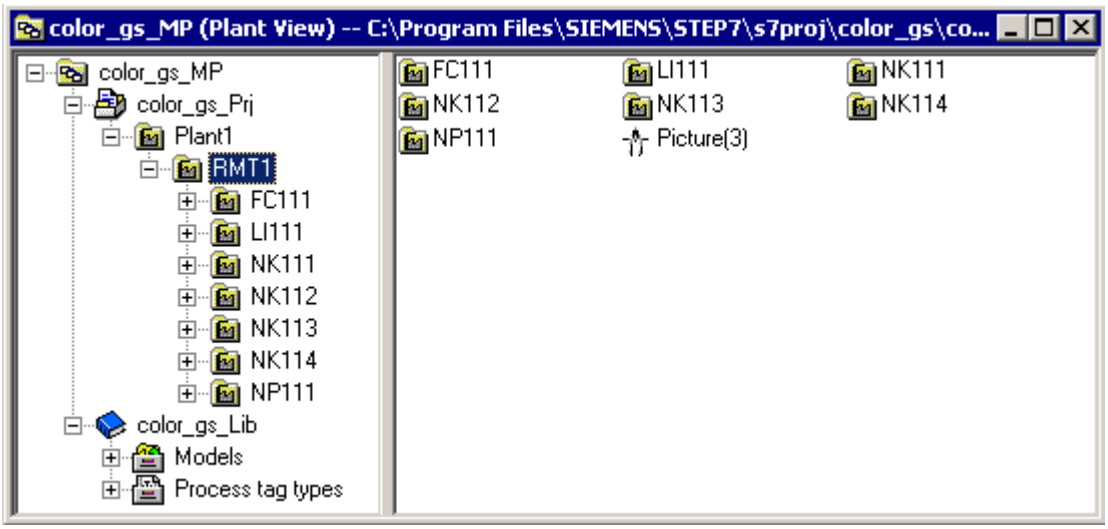
- The example project is open in SIMATIC Manager.
- The plant view is activated.

Procedure

1. Select the "RMT1" folder.
2. Select the **Insert > Plant Objects > Hierarchy Folder** command.
   The program generates new hierarchy folder named "Function [consecutive number]".
3. Change the name to "LI111".
4. Press the ENTER key
5. Repeat steps 1 to 4 to create additional hierarchy folders:
   - NP111 – motor control
   - NK111 – valve control
   - NK112 – valve control
   - NK113 – valve control
   - NK114 – valve control

Result

Your plant hierarchy should now look like this:



4.5.6 How to Check the Assignment of AS/OS to the PH

Assignment of the hierarchy folders

The individual components of the plant are assigned to specific automation systems and specific operator stations. Each hierarchy folder of the plant hierarchy is given exactly this information. This is only important if you have more than one automation system or operator station in your project.

In the "color_gs" project, you have only one automation system and one operator station. As a result, all the hierarchy folders are automatically assigned.

Procedure for checking the assignment

1. Select the "RMT1" hierarchy folder and then select the menu command **Edit > Object Properties**.
   The "Properties - Hierarchy folder" dialog box opens.
2. Select the "AS-OS Assignment" tab.
   Assignments in this tab:
   - In the "Assigned AS (chart folder)" list, you will see the automation system that processes the data.
   - In the "Assigned OS" list, you will see the operator station on which the data are displayed.
3. Close the dialog box.

4.5.7 The Current State of your Project

Completed Configuration Tasks

Up to now, you have made the following settings for your project:

- You have created the "color_gs" project in SIMATIC Manager.
- You have configured the hardware components in HW Config.
- You have downloaded the hardware configuration from HW Config to the CPU.
- You have entered settings in the plant hierarchy.
- You have mapped the plant structure of the "color_gs" project in the plant hierarchy.

Creating CFC charts

5

5.1 CFC Charts and the CFC Editor

The Theory -- What are CFC Charts and What is the CFC Editor?

The overall process of a plant is described by continuous sequences. For this purpose, you must create CFC charts in the CFC Editor of PCS 7.

You create CFC charts by inserting blocks from the *PCS 7 Library V7.0* into the charts. These include single blocks, for example, blocks for closed-loop control of a process or for monitoring measured values. The inputs and outputs of these blocks are then interconnected and assigned parameters directly in the CFC Editor. The user-friendly graphic user interface of the CFC Editor assists you in this task.

PCS 7 also provides process tag types in the standard library. They represent full CFC charts for various process tags such as motors and valves.

You retrieve the CFC charts in the plant hierarchy. To keep the structure of the project clear, the CFC charts are always stored in the hierarchy folders according to their relevance in the process.

Identification of CFC charts

CFC charts are identified by the following icon leading their name: 

5.2 Working with libraries

5.2.1 CFC Charts and the Master Data Library

A brief theoretical introduction to the master data library

When creating CFC charts, you are working with the master data library. DO NOT copy any blocks and process tag types directly from the PCS 7 standard library to the CFC charts of your project. Create the blocks and process tags as required in the master data library and copy these object from this library to the CFC charts.

What are the advantages of the master data library?

Use of the master data library ensures that the **the same** version of a block is used in a project and that there can be no confusion. This especially important if there is more than one project engineer working on a project with a multiproject.

The use of the master data library also provides you with another convenient PCS 7 function: the hiding of libraries. This function allows you to hide all libraries except for the master data library, for example, in order to prevent inconsistency and errors within the project.

One other advantage of using master data libraries is that they are archived automatically when you archive the multiproject.

5.2.2 How to Store Objects in the Master Data Library

Changes to blocks

You can change the properties of the block in the master data library. For example, you can adapt messages specifically to your project requirements. Each block instance that is created when you insert a block in a CFC chart automatically has the modified properties.

This means that you only have to modify the block once in the master data library and not repeatedly for each individual block instance.

Modifications to blocks that are intended for a specific CFC chart are made directly in the block instance in the CFC chart. This includes, for example, parameters for inputs and outputs, such as setpoints and limit values.

Master data library and process tag types

You can also store the process tag types provided by PCS 7 in your master data library. The following occurs in the background: all the blocks included in this process tag type, are automatically entered in the block folder of your master data library.

Basic procedure

Step	Action
1	Open library (Page 68)
2	Store all blocks in your master data library (Page 69) The PCS 7 wizard automatically generates the master data library when a project is created.
3	Store process tag types in the master data library (Page 72)

5.2.3 Working with the Master Data Library

Blocks in the master data library

Creating a master data library for a large project requires detailed planning before the CFC charts are actually created. In this Getting Started, we will provide you with all the blocks you require for the "color_gs" project. The blocks are listed in the table below. The table also contains:

- Object name
  This is an alphanumeric block code displayed in PCS 7
- Symbolic name
  Short descriptive name for the block
- Meaning
  Short description of the purpose of this block
- Type of block
  Defines the block category
- Associated CFC chart
  Returns all CFC charts where the block is installed

Object name	Symbolic name	Meaning	Type of block	Associated CFC chart
FB40	INT_P	Generates the time integral of an input value	Technological block	CFC_LI111 CFC_FC111
FB46	OP_A_LIM	Manipulates an analog value	Operator control block	CFC_FC111
FB48	OP_D	Manipulates a digital value	Operator control block	CFC_FC111
FB61	CTRL_PID	Continuous PID controller	Technological block	CFC_FC111
FB63	DOSE	Doses components	Technological block	CFC_FC111
FB65	MEAS_MON	Monitors an analog measured value	Technological block	CFC_LI111
FC63	MUL_R	Multiplies input values and outputs the result at the output	Function	CFC_FC111
FC275	CH_AI	Processes an analog input value signal	Driver block	CFC_LI111 CFC_FC111
FC276	CH_AO	Processes an analog output value signal	Driver block	CFC_FC111

Process tag types in the master data library

You enter the process tag types in your master data library in exactly the same way as the individual blocks. You need the following process tag types for the "color_gs" project:

Object name	Meaning	Associated CFC chart
MOTOR	CFC chart for a motor	CFC_NP111
VALVE	CFC chart for a valve	CFC_NK111

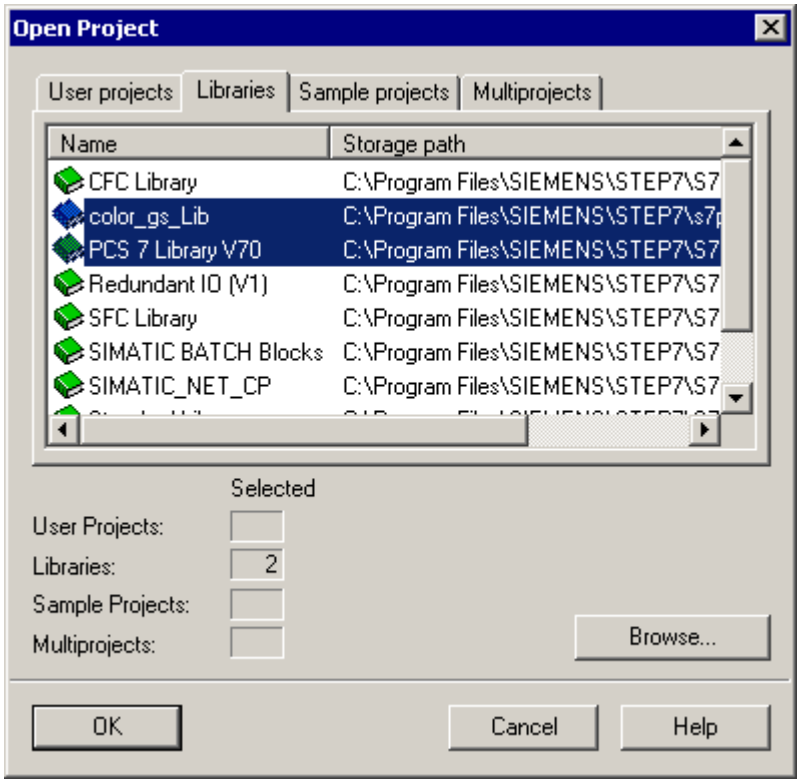
5.2.4 How to Open the Libraries

Requirement

SIMATIC Manager is open.

Procedure

1. Select the **File > Open....** command. The program opens the "Open Project" dialog box.
2. Select the "Libraries" tab.
3. Highlight the "PCS 7 Library V70" and "color_gs_Lib" libraries in the picklist.



4. Click "OK".
   The program opens both libraries in the component view.

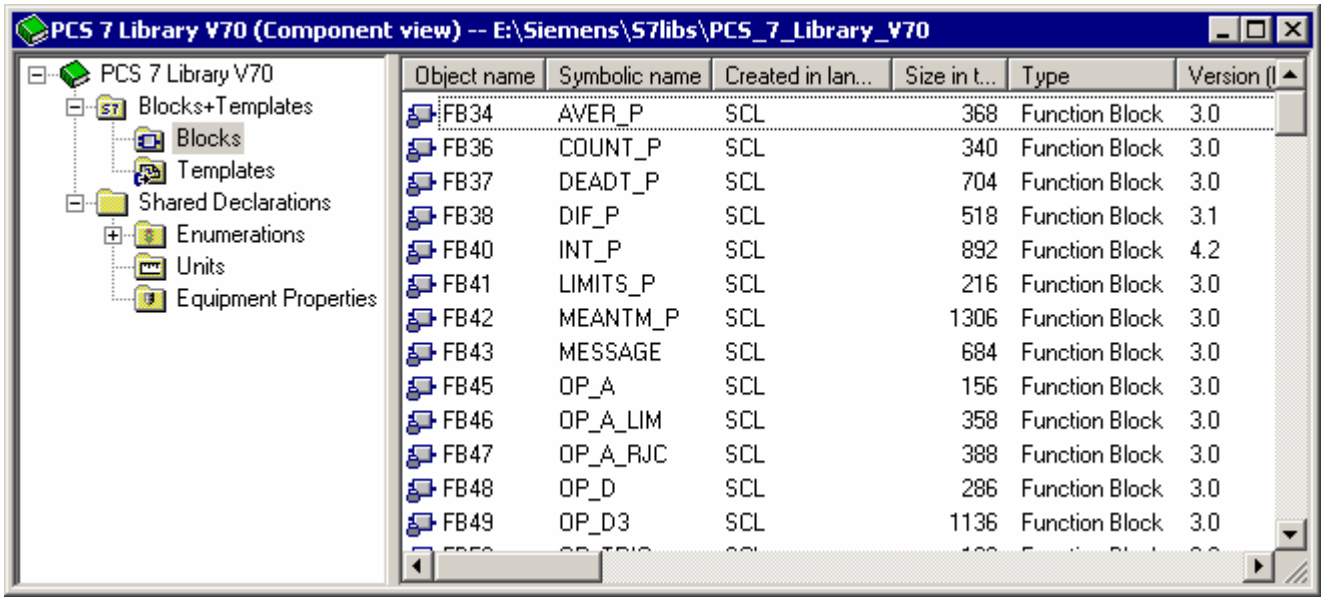
5.2.5 How to Store Blocks

Requirements

- SIMATIC Manager is open.
- PCS 7 Library V70" is opened and the component view is activated.
- The "color_gs_Lib" master data library is open and the component view is activated.

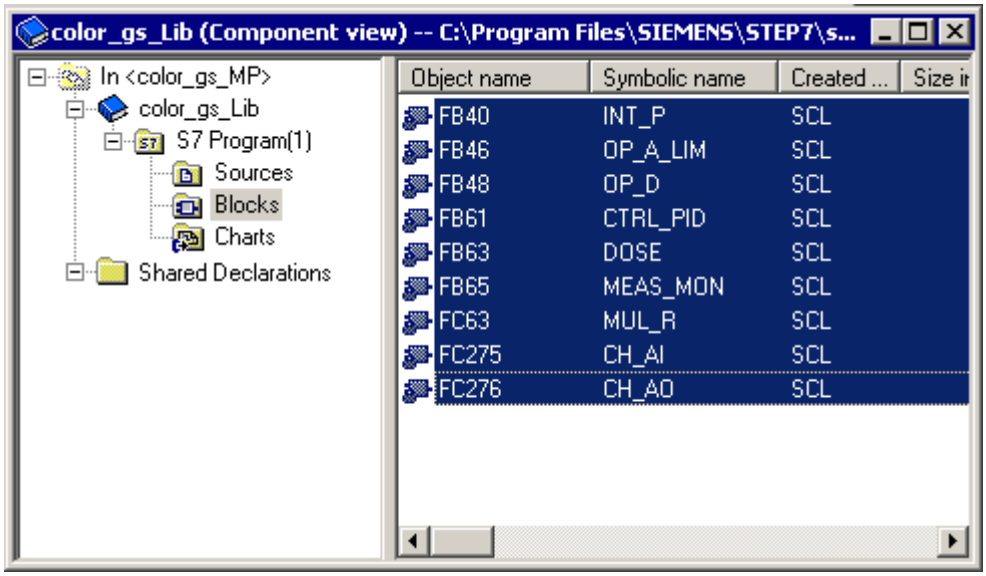
Procedure

1. Select the **Window > PCS 7 Library V70 (component view)** command
   The program opens the PCS 7 standard library.
2. Select the
   "PCS 7 Library V70/ Blocks + Templates/ Blocks" entry from the tree view.
   The detail view shows all blocks available in the PCS 7 standard library.
3. Select the **View > Details** command.
   The view returns the object names, that is, the short names, and the symbolic names of the blocks. This gives you more detailed information.
4. In the detailed window, select the required blocks according to the following list:
   - FB40 - INT_P
   - FB46 - OP_A_LIM
   - FB48 - OP_D
   - FB61 - CTRL_PID
   - FB63 - DOSE
   - FB65 - MEAS_MON
   - FC63 - MUL_R
   - FC275 - CH_AI
   - FC276 - CH_AO



5. Select the **Edit > Copy** command.
6. Select the **Window > color_gs_Lib (component view)** command.
   This opens the master data library.
7. Select the tree view entry
   "In <color_gs_MP>/ color_gs_Lib/ S7 program(1)/ Blocks".

8. Select the **Edit > Paste** command.
   The program inserts the selected blocks.



5.2.6 How to Store Process Tag Types

Introduction

In the following, you will store process tag types in the "Charts" directory of your master data library in the component view. You will then copy your master data library from the "Templates" directory to the "Process tag types" directory in the plant view.

Requirements

- SIMATIC Manager is open.
- PCS 7 Library V70" is opened and the component view is activated.
- The "color_gs_Lib" master data library is open and the component view is activated.

Procedure

1. Select the menu command **Window > PCS 7 Library V70 (Component View)**.
   This opens the component view of the PCS 7 standard library.
2. Select the PCS 7 Library V70/ Blocks + Templates/Templates" entry from the tree view.
   The detail view shows all charts templates available in PCS 7.
3. Select the following charts in the detailed window:
   - "MOTOR"
   - "VALVE"
4. Select the menu command **Edit > Copy**.
5. Select the menu command **Window > color_gs_Lib (component view)**.
   This opens the master data library.
6. Select the tree view entry
   "In <color_gs_MP>/ color_gs_Lib/ S7 program(1)/ Charts".
7. Select the menu command **Edit > Paste**.
   All the selected process tag types are inserted.
8. Close the "PCS 7 Library V70".
9. Open the plant view of "color_gs_lib".
10. Select the "In <color_gs_MP>/ color_gs_Lib/ Templates" folder from the tree view.
11. Select the following subfolders in the detailed window:
    - "MOTORS"
    - "VALVES"

12. Select the menu command **Edit > Cut**.
13. Select the folder
    "In <color_gs_MP>/ color_gs_Lib/ Process tag types" from the tree view.
14. Select the menu command **Edit > Paste**.
    The selected process tag types are inserted.
    The "Templates" directory is empty.

Note

As soon as a process tag type is stored in the master data library, all the individual blocks contained in this process tag type are automatically stored in the "Blocks" folder.
If you select "<color_gs_MP>/ color_gs_Lib/ S7 Program(1)/ Blocks" in the tree view, in the detailed window you will see all the blocks that you yourself have inserted or that were automatically created by copying the process tag types.

5.2.7 Showing and Hiding Libraries

Introduction

You can hide libraries you do not require. This makes working with the catalog in the CFC Editor clearer and less prone to errors. Since you have already stored all the necessary blocks and process tag types in your master data library, you work exclusively with this master data library when creating the "color_gs" project.

You can show libraries again quickly if you need them again.

5.2.8 How to Hide and Show Libraries

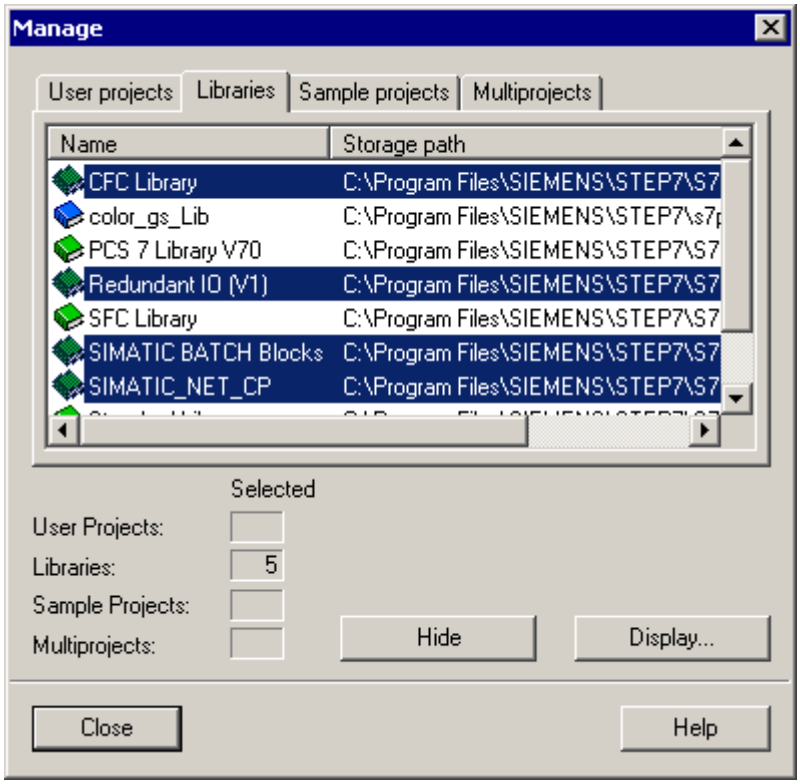
NOTICE
Make sure that you actually have all the required blocks and charts in your master data library.

Requirement

SIMATIC Manager is open.

Procedure for Hiding Libraries

1. Select the **File > Manage....** command. The program opens the "Manage" dialog box.
2. Select the "Libraries" tab.
3. Select all the libraries in the list except the following libraries:
   - Master data library "color_gs_Lib"
   - "PCS 7 Library V70"
   - SFC Library
   - Standard library



4. Click "Hide".
   All the libraries you selected are removed from the list.
5. Click "Close".
   You have hidden all libraries which you are not going to use. You can no longer see them in the CFC Editor catalog.

Procedure for Showing Libraries

1. Select the **File > Manage....**
   command. The program opens the "Manage" dialog box.
2. Select the "Libraries" tab.
3. Click "Display...".
   The program opens the "Browse" dialog box.
4. Select the ".../SIEMENS/ STEP7/ S7LIBS/ [name of library]" object from the tree view.
   The library is displayed in the pane on the right side.
5. Click "OK".
   The program closes the dialog box. The library you selected is displayed and marked in the libraries list of the "Manage" dialog box.
6. If you want to display additional libraries, repeat steps 3 through 5.
7. Click "Close".
   The program closes the dialog box.

5.3 CFC charts in the PH

5.3.1 Working with CFC Charts

Introduction

Once you have made the preparations for creating the CFC charts by filling your master data library, you can now start creating the CFC charts.

Basic procedure for creating CFC charts

Step	Action
1	Create empty CFC charts in the plant hierarchy
2	Insert individual blocks in an empty CFC chart
3	Interconnect the inputs and outputs of blocks and assign parameters to them

CFC Charts in the PH

The PCS 7 "New Project" wizard has already created a CFC chart in your plant hierarchy. This is stored in the "ADDIT" folder. This CFC chart does not yet contain any blocks. You have to insert them in the CFC Editor.

In addition, you require other charts for the "color_gs" project , which you insert in the plant hierarchy and then edit in the CFC Editor.

It is also important that you assign brief descriptive names for all CFC charts of the "color_gs" project to keep your project easy to understand.

5.3.2 Which Charts do you Need in the "color_gs" Project?

CFC Charts in the Example Project

The following CFC charts are needed for the "color_gs" project:

- CFC_SETP - for specification of setpoints
- CFC_FC111 – for closed-loop control of dosing amount and dosing speed
- CFC_LI111 – for control and simulation of the liquid level
- CFC_NP111 – for motor control
- CFC_NK111 to CFC_NK114 – for valve control

Each chart has a process-related meaning. To fully understand the part of the plant you are configuring in Getting Started, you should understand the process-related meaning of the individual CFC charts. We provide a brief description of each individual chart below.

Some Details about Creating CFC Charts

You will create the CFC_SETP, CFC_FC111 and CFC_LI111 charts yourself. PCS 7 makes the CFC_NP111 and CFC_NK11x available to you as a complete CFC chart in the form of a process tag type. This will illustrate the great advantage of using process tag types, which thus far you have only stored in your master data library.

Note

In the "color_gs" project, the names of the CFC charts are assigned according to the name of the associated hierarchy folder and, thus, also the name of the associated process tag. As a result, unique identification is always possible.

5.3.3 Process-Related Meaning of the "CFC_SETP" CFC Chart

CFC_SETP

The CFC_SETP is used for dosing from the OS. The blocks mean the following in this case:

- The PARADOS_RM1_QTY block specifies the dosing speed.
- The PARA_DOS_RM1_VOL block specifies the dosing volume.
- The PARA_DOS_RM1_SEL block specifies the target reactor.

5.3.4 Process-Related Meaning of the "CFC_FC111" CFC Chart

CFC_FC111

The CFC_FC111 is used for closed-loop control of the dosing volume and dosing speed. The blocks mean the following in this case:

- The "CH_AI" block provides the currently dosed volume at the "V" output and transfers this measured value to the "PV_IN" (process value) input of the "DOSE" block.
- The interposed "INT_P" block is used for simulating the dosed volume.
- The "CTRL_PID" block controls the speed of the dosing by means of a flow controller.
- The"CTRL_PID" block receives the setpoint specifications via the step control in conjunction with the "PARA_DOS_RM1_VOL" block.
- The manipulated variable for the valve is output at the "LMN" output and is fed directly to the "CTRL_PID" block at input "LMNR_IN" in the absence of manipulated variable feedback from the process.
- The "CH_AO" block outputs the manipulated variable to the valve.

5.3.5 Process-Related Meaning of the "CFC_LI111" CFC Chart

CFC_LI111

The CFC_LI111 is used for controlling and simulating the fill level. The blocks mean the following in this case:

- The "CH_AI" block reads in the fill level of the raw material tank and outputs the current value at output "V".
- By default, this output is interconnected with the "U" input of the "MEAS_MON" block.
- The "INT_P" block is used to simulate the fill level.

5.3.6 Process-Related Meaning of the "CFC_NP111" CFC Chart

CFC_NP111

The CFC_NP111 is used for pump control. The blocks mean the following in this case:

- The "CH_DI" block supplies the current state of the pump (on or off) at output "Q".
- This value is interconnected to the "FB_ON" input (feedback ON) of the MOTOR block where it is evaluated.
- The plant operator or a higher level controller controls the "MOTOR" block.
- The "CH_DO" block takes the control command from the "QSTART" output of the "MOTOR" block and outputs this to the pump in the process.

5.3.7 Process-Related Meaning of the "CFC_NK11x" CFC Chart

CFC_NK11x

The CFC_NK11x is used for valve control. The blocks mean the following in this case:

- The "CH_DI" block returns feedback on the status of the valve (open or closed) to the "VALVE" block.
- The "VALVE" block switches the valve according to the setting made by an external controller or by an operator: The control command is passed on from the "QCONTROL" output via the "CH_DO" output driver to the valve.
- The "VALVE" block can forward fault messages to the operator station.

5.3.7.1 How to Rename CFC Charts in the PH

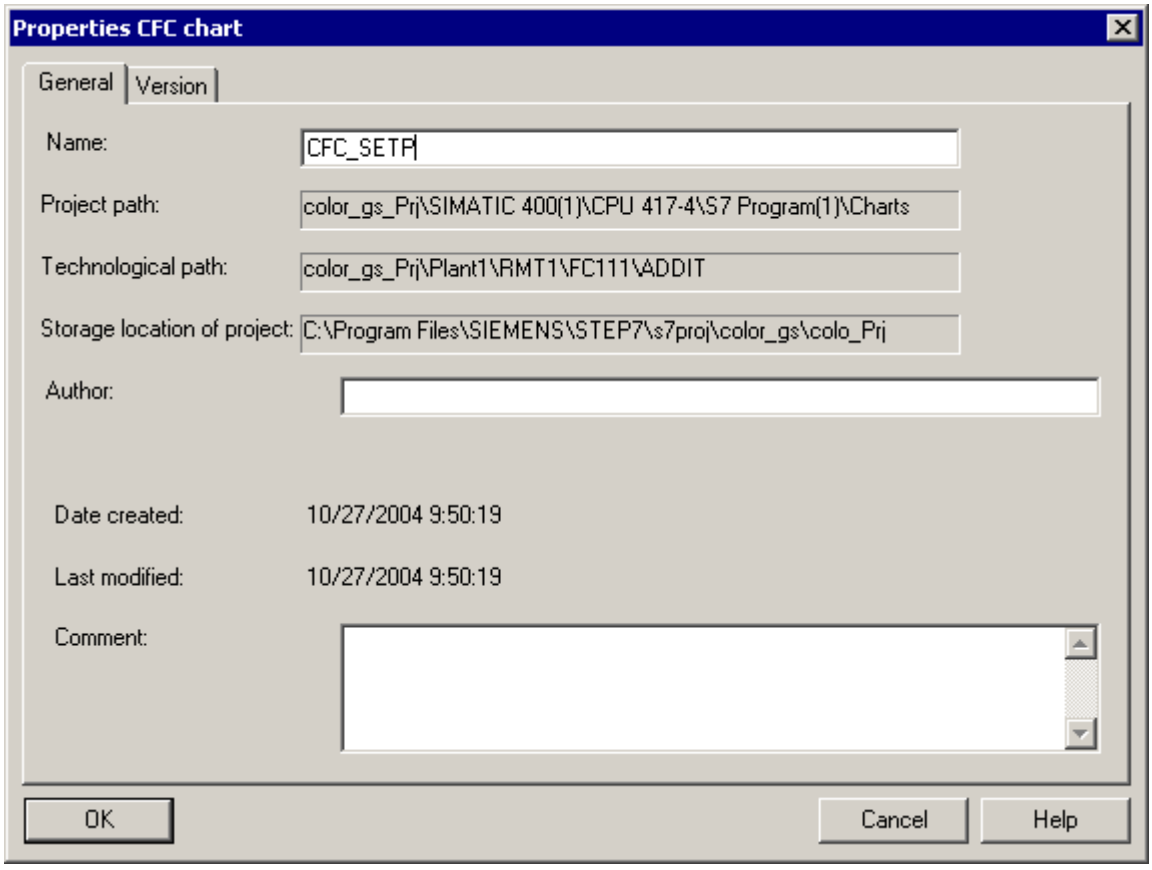
Requirements

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

Procedure

A CFC chart you created is already in the ADDIT folder. All you need to do now is rename it.

1. Select the"color_gs_MP/color_gs_Prj/Plant1/RMT1/FC111/ADDIT" folder in the tree view.
2. Select the "CFC(1)" object in the detailed window.
3. Select **Edit > Object Properties**.
   The "Properties CFC Chart" dialog box opens and the "General" tab is selected.
4. Type the name "CFC_SETP" into the input box.
   The name of the chart real projects usually relates to a user-specific system for the identification of process tags.



5. Click "OK" to save your entries.

Video

5.3.7.2 How to Insert New CFC Charts in the PH

CFC charts to be inserted

You must insert the following CFC charts in the form of new, empty CFC charts:

- "CFC_FC111"
- "CFC_LI111"

Requirements

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

Procedure

1. Select the "color_gs_MP/color_gs_Prj/Plant1/RMT1/FC111" folder from the tree view.
2. Select the menu command **Insert > Plant Objects > 2 CFC**.
   The CFC chart "CFC(1)" is inserted. When you insert new charts, PCS 7 first assigns the default name "CFC" followed by a consecutive number and activates the input mode for a new name.
3. Enter the name "CFC_FC111" and press the Enter key.
4. Select the "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1/ LI111" folder from the tree view.
5. Select the menu command **Insert > Plant Objects > 2 CFC**.
   The CFC chart "CFC(1)" is inserted.
6. Enter the name "CFC_LI111" and press the Enter key.

5.3.7.3 How to Insert the "MOTOR" Process Tag Type

Introduction

You have already stored the "MOTOR" process tag type in your master data library. You now only need to insert this process tag type into the plant hierarchy in your "color_gs" project.

Requirements

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

Procedure

1. Select the tree view entry "color_gs_MP/ color_gs_Lib/Process tag types/MOTORS". The detail view displays the process tag types you inserted into the master data library.
2. Select the "MOTOR" CFC chart and then select the menu command **Edit > Copy**.
3. Select the "color_gs_MP/ color_gs_Prj/Plant1/RMT1/NP111" folder from the tree view and then select the menu command **Edit > Paste**. The "MOTOR" CFC chart is inserted into the hierarchy folder and selected.
4. Select the menu command **Edit > Object Properties**. The "Properties CFC Chart" dialog box opens.
5. Change the default name "MOTOR" to "CFC_NP111" in the "Name" box.
6. Click "OK" to save your entries.

Video

5.3.8 Current Status of Your Project

Completed Configuration Tasks

In preparation for the actual creation of CFC charts, you have now completed the following configuration tasks:

- You have stored all the necessary blocks and process tag types in the master data library.
- You have hidden libraries that you do not require for the "color_gs" project so that only the "color_gs_Lib" master data library is still visible.
- You have renamed and inserted new CFC charts in the plant hierarchy.
- You have inserted the "MOTOR" process tag type in the plant hierarchy.

5.4 Working with the CFC Editor

5.4.1 Introduction to the CFC Editor

CFC Editor

The CFC charts are actually edited, e.g., blocks are inserted and their parameters assigned, in the CFC Editor. As soon as you open a CFC chart, the CFC Editor opens. The editor always opens in the view in which it was closed the last time you worked with it.

With its normal settings, the CFC Editor is divided up as follows:

- On the left side of the editor you see the CFC chart displayed. If you have opened an empty CFC chart, you will simply see an empty space here. This is where you insert blocks as required to describe continuous processes. Afterwards, you assign parameters and interconnect the blocks.
- On the right side of the editor you see the catalog containing the blocks, libraries, and CFC charts.

All the work that you do with the CFC Editor is saved automatically by PCS 7.

Additional information

Detailed information about the CFC Editor is available in the corresponding CFC Online Help and in the *SIMATIC,CFC for S7, Continuous Function Chart* Manual.

5.4.2 CFC Chart in the CFC Editor

CFC chart

Each CFC chart can consist of up to 26 chart partitions. A new CFC chart consists of only one chart partition. Only one chart partition is necessary for the "color_gs" project. Each chart partition, in turn, consists of six sheets.

You can select between two different views using buttons in the toolbar:

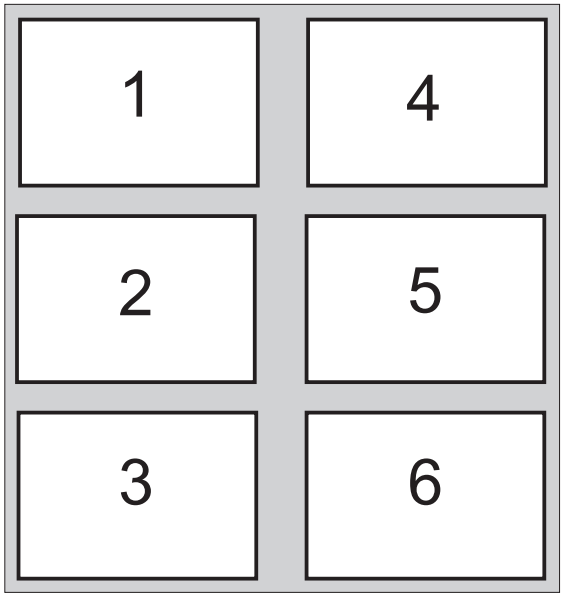
- A single sheet: 
- Overview with six sheets: 

The status bar shows which sheet of which chart partition is currently being displayed.

Switching from the Overview to a Single Sheet

You can switch from the overview to the single sheet view by double-clicking on the required sheet.

The individual sheets in the overview are arranged in the order shown below:



Additional information

Detailed information is available in the corresponding online help of the CFC and in the *SIMATIC, CFC for S7, Continuous Function Chart* Manual.

5.4.3 Catalog in the CFC Editor

Opening the Catalog

If it is not already open, open the catalog using the menu command View> Catalog menu.

Organization of the catalog

In the catalog you will see four tabs:

- Blocks - here you will find the blocks sorted according to block families. You will not work in this tab in the "color_gs" project.
- Charts - here you will find all the charts you created in the plant hierarchy, for example, CFC _FC111, CFC_LI111. The CFC chart that is currently open and displayed in the CFC editor is labeled by a small open folder.
- Libraries - These contain all PCS 7 standard libraries and your master data library. You have already executed the "hide" function to hide all libraries in the "color_gs" project which you do not require to configure the system. This means that you can only see the "color_gs_Lib" library.
- Unplaced blocks - here you will find blocks that are not displayed in a CFC chart. Within the "color_gs" project, this tab is not displayed since there are no "unplaced blocks" in your project.

Additional information

Detailed information is available in the corresponding CFC Online Help and in the *SIMATIC, CFC for S7, Continuous Function Chart* Manual.

5.4.4 Overview of the Configuration Steps for CFC Charts

Overview

To create CFC charts, always follow the steps below in the order given:

Step	What?
1	Open chart (Page 89)
2	Insert blocks Options: • Insert blocks in "CFC_SETP" • Insert blocks in "CFC_FC111" • Insert blocks in "CFC_LI111"
3	Assign parameters to blocks • Rename blocks • Specify input/output values
4	Interconnect blocks (Page 100)

The "Insert blocks" step is skipped for process tag types. You now only have to configure and interconnect the process tag types.

Information from the online help for the block

Note

If you need additional information on the blocks, for example, the functions of the individual block inputs, select a block in the library or directly in the CFC chart and press the <F1> key. The online help for this block opens immediately.

5.4.5 How to Open the "CFC_SETP" CFC Chart

Introduction

To be able to place blocks in your CFC charts, you must now open the CFC chart.

Requirements

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

Procedure

1. Select the "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1/ FC111/ ADDIT" folder from the tree view.
2. Select the "CFC_SETP" object in the detail view, and then select the **Edit > Open Object** command.
   The CFC editor opens.

You can now edit the open chart.

5.4.6 Assignment of Block Parameters in CFC Charts

Assignment of Block Parameters

Each block has a number of different I/Os that are displayed in a table of the properties dialog box. Click the column heading of the table to quickly find the inputs/outputs in this dialog box. The column is then sorted in ascending or descending order.

The I/Os of a block can be both visible or invisible: You can only see invisible parameters in the properties of the block but not in the representation in the CFC chart. In the properties of the block, you can specify which I/Os in the CFC chart will be visible and which will be invisible. In the "Not Displayed" column, you need to deactivate the check box of the relevant I/O to make the I/O visible in the CFC chart. This function helps to make a CFC chart easier to read. In the "color_gs" project, you will accept the default settings.

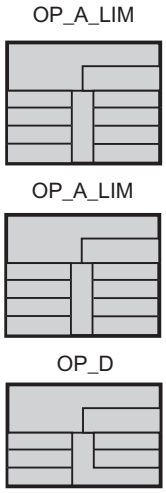
5.4.7 How to Insert the Blocks into the "CFC_SETP"

Requirements

- The "CFC_SETP" CFC chart is open in the CFC editor - Storage location: "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ FC111/ ADDIT".
- The catalog is open.

Procedure

1. Switch to the "Libraries" tab in the catalog. The tab shows a view of the "color_gs_Lib" library.
2. Open the "color_gs_Lib/S7 Program(1)\Blocks/ OPERATE" folder in the tree view.
3. Drag-and-drop the "OP_A_LIM - FB46" block from the catalog to the CFC chart. This block is used to define the dosing volume.
4. Insert further blocks into the CFC chart. Proceed as described for the "OP_A_LIM - FB46" block.
   - OP_A_LIM - FB 46: Dosing speed setting
   - OP_D - FB48: Specifying the reactor to which the raw material will be pumped
5. Arrange the blocks in the CFC chart as shown below:



6. Close the chart.

Note

If a block is shown in blue or light gray after you have inserted it and if no block I/Os are displayed, it is covering an underlying block or extends beyond the edge of the sheet.

In this case, you must move the block with the mouse so that it does not cover any other block and is within the limits of the sheet.

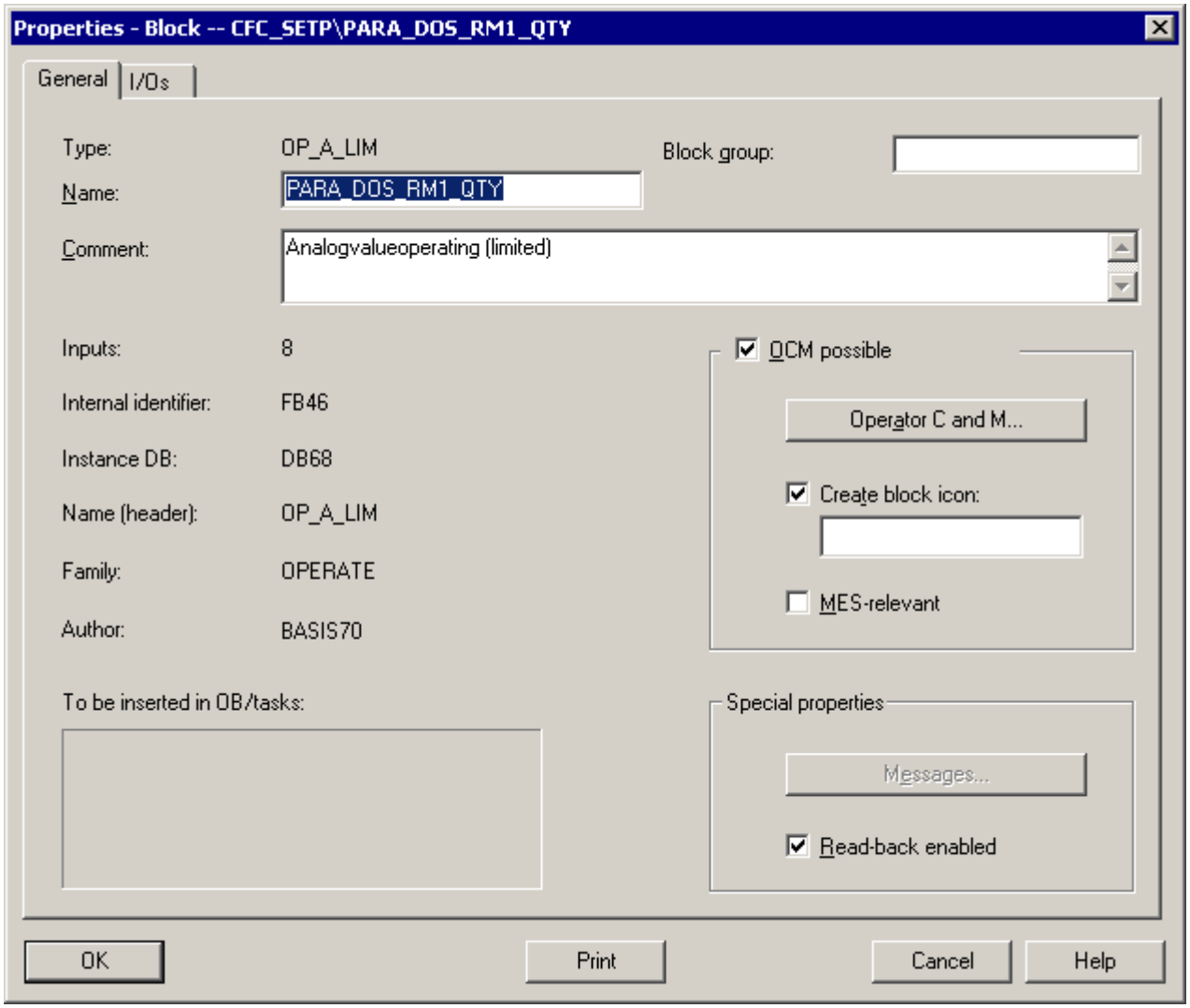
5.4.8 How to Assign Parameters for the Blocks in "CFC_SETP"

Requirements

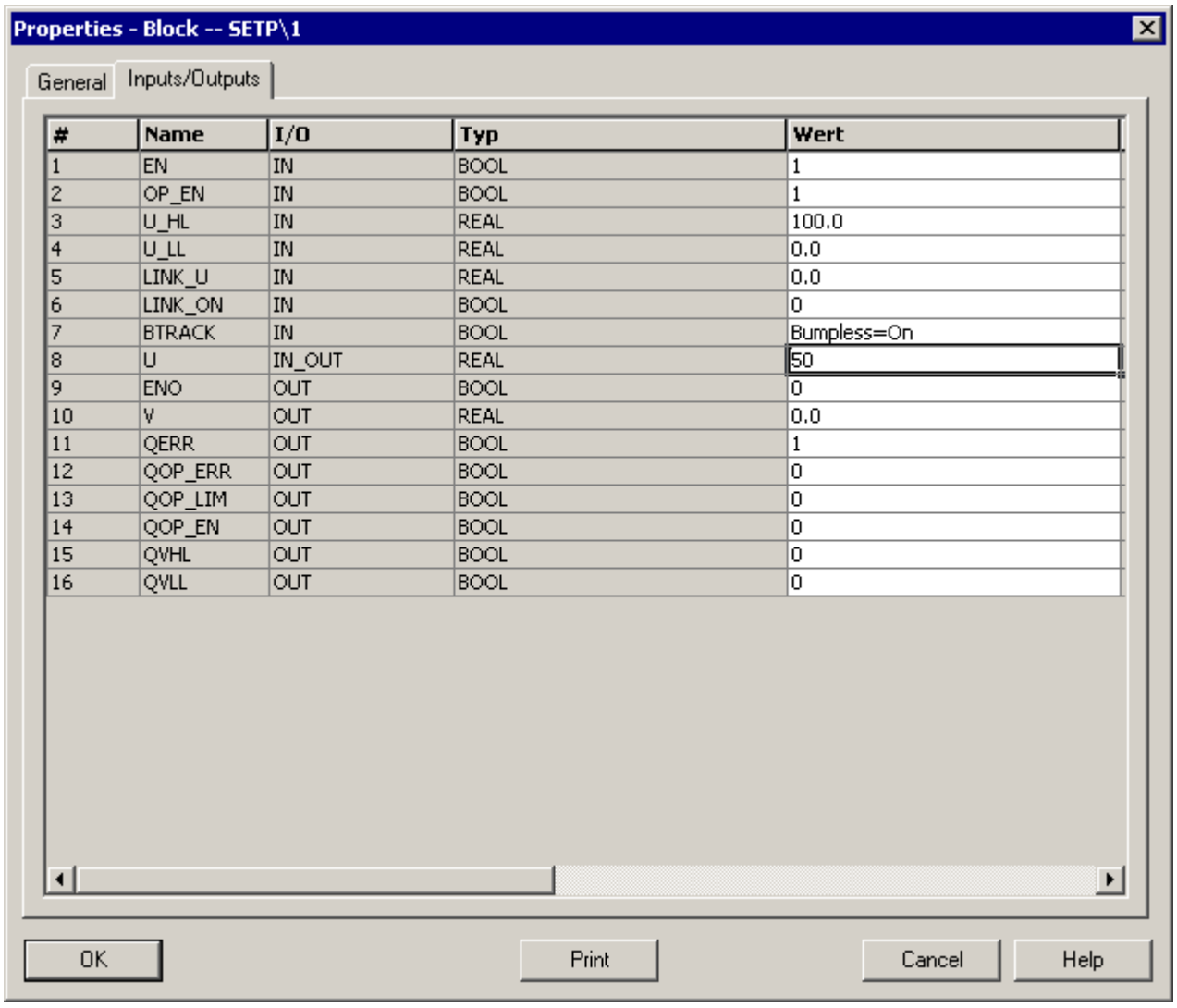
- The "CFC_SETP" CFC chart is open in the CFC editor -
  Storage location: "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ FC111/ ADDIT".
- All blocks are inserted.

Procedure

1. Select the "1 OP_A_LIM" block and then select **Edit > Object Properties....**
   The "Properties - Block" dialog box opens and the "General" tab is selected.
2. Enter the name "PARA_DOS_RM1_QTY" in the "Name" input box.
   The "Enable operating and monitoring" check box is activated by default.



3. Switch to the "Inputs/Outputs" tab.
   Here you can configure the I/Os of a block. You will find the names of all inputs and outputs in the "Name" column.
4. Position the cursor in the "Value" column of the "U" connection and overwrite the default value with the value "50".



#	Name	I/O	Typ	Wert
1	EN	IN	BOOL	1
2	OP_EN	IN	BOOL	1
3	U_HL	IN	REAL	100.0
4	U_LL	IN	REAL	0.0
5	LINK_U	IN	REAL	0.0
6	LINK_ON	IN	BOOL	0
7	BTRACK	IN	BOOL	Bumpless=On
8	U	IN_OUT	REAL	50
9	ENO	OUT	BOOL	0
10	V	OUT	REAL	0.0
11	QERR	OUT	BOOL	1
12	QOP_ERR	OUT	BOOL	0
13	QOP_LIM	OUT	BOOL	0
14	QOP_EN	OUT	BOOL	0
15	QVHL	OUT	BOOL	0
16	QVLL	OUT	BOOL	0

5. Position the cursor in the "Unit" column of the "U" connection.
   A drop-down list is displayed.
6. Select the "m3/min" unit from the drop-down list.

7. Click "OK" to apply your settings.
   The name "PARA_DOS_RM1_QTY" is displayed in the header of the block in the CFC chart.
   When you create the process pictures, you will interconnect the I/Os of the blocks from the CFC charts with objects in the process pictures. The tag name is formed from the plant hierarchy, the CFC chart name, and the block name. You can find the name "PARA_DOS_RM1_QTY" as part of the tag name.
   The values of the I/Os are applied.
8. Now change the names and parameter settings for the other blocks as shown in the table below. To do this, follow the procedure described in Steps 1 to 5.
   Some of the I/Os are not visible in the CFC chart.
9. Close the chart.

Block	Name in project	I/O	Meaning	Value	Unit
2 OP_A_LIM	PARA_DOS_RM1_VOL	U*	Setpoint for dosing	500	m3
		U_HL	Limit for entering the U parameter	500	
OP_D	PARA_DOS_RM1_SEL	IO*	The dosing is performed in reactor 1.	OFF	

* Invisible in CFC.

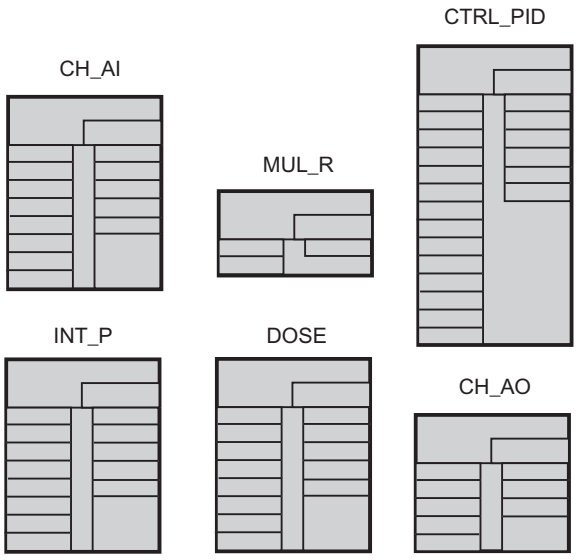
5.4.9 How to Insert the Blocks into the "CFC_FC111"

Requirements

- The "CFC_FC111" CFC chart is open in the CFC editor - Storage location: "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ FC111".
- The catalog is open, and the "Libraries" tab is visible.
- The "color_gs_Lib/S7 Programs(1)\ Blocks" folder is open in the tree view.

Procedure

1. Use a drag-and-drop operation to Insert the following blocks:
   - Folder "DRIVER": CH_AI - FC275: Signal processing of an analog input value
   - Folder "CONTROL": INT_P - FB40: Simulation of the dosing quantity
   - Folder "CONTROL": DOSE - FB63: Dosing of raw material
   - Folder "MATH_FP": MUL_R - FC63: Multiplies input values and returns the result at the output
   - Folder "CONTROL": CTRL_PID - FB61: Fill level monitoring and visualization of the level in the process mode
   - Folder "DRIVER": CH_AO - FC276: Processes an analog output value signal
2. Arrange the blocks in the CFC chart as shown below:



3. Close the chart.

5.4.10 How to Assign Parameters for the Blocks in the "CFC_FC111"

Requirements

- The "CFC_FC111" CFC chart is open in the CFC editor - Storage location: "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ FC111".
- All blocks are inserted.

Procedure

1. Open the "General" tab and "Inputs/Outputs" tab in the "Object Properties" dialog box for each block.
2. Enter parameters for all blocks according to the table below.
3. When you have entered the parameters for all block I/Os, click "OK" each time. Your settings are applied.
4. Close the chart.

Block	Name in project	I/O	Meaning	Value
CH_AI	INPUT_U	SIM_ON*	Simulation activated	1
		MODE	Measuring range 4 to 20 mA	16#0203
		VHRANGE	High measuring range	100 **
		SUBS_ON	Enables a substitute value	1
INT_P	INT_P	V_HL	High limit volume summation 1000 Liters	1000
		TI	Integration time	2
DOSE	DOSE	SP_HLM*	High limit of the setpoint for the dosing volume	1000
		MO_PVHR*	High display limit of the process value for the dosing volume	1000
		MO_PVLR	Low display limit of the process value for the dosing volume	0
		SPEXON_L	Interconnection for the internal/external switchover active	1
		SPEXT_ON	Default for the internal/external switchover	1
MUL_R	MUL_R	IN2	Parameters for optional adaptation of the actual flow rate value	1 **
CTRL_PID	CTRL_PID	LIOP_MAN_SEL	Interconnection automatic/manual active	1
		LIOP_INT_SEL	Interconnection for the internal/external switchover active	1
		SPEXON_L	Switch controller to external setpoint	1
		GAIN	Set the gain of the controller to 0.5	0.5
CH_AO	OUTPUT_LMN	Not applicable		

* Invisible in CFC.
** Default value

Note

Use a period as the decimal separator.
For some input boxes, PCS 7 provides predetermined values that you can select from a drop-down list. This drop-down list is activated automatically when you position the cursor in the input box.

Note

You assign the "MODE" I/O for the CH_AI block. You assign this parameter only because you have not configured any external I/O modules in this Getting Started.

5.4.11 How to Insert the Blocks in the "CFC_LI111"

Introduction

Now you have to create the "CFC_LI111" chart. The procedure is exactly the same as for the "CFC_FC111" chart.

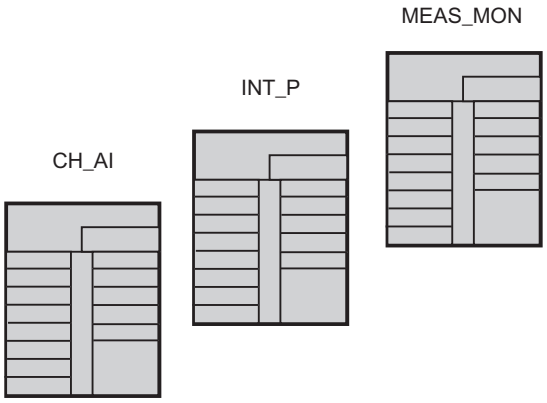
Requirements

- The "CFC_LI111" CFC chart is open in the CFC editor -
  Storage location: "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ LI111".
- The catalog is open.
- The "color_gs_Lib/S7 Programs(1)\ Blocks" folder is open in the tree view.

Procedure

Drag-and-drop the following blocks to insert themm arrange them as shown in the figure and then close the chart:

- Folder "DRIVER": CH_AI - FC275: This block reads the process value of an input module and makes the value read in available in CFC for further processing.
- Folder "CONTROL": INT_P - FB40: This block is used to simulate the level of the raw material tank 1.
- Folder "CONTROL": MEAS_MON - FB65: Fill level monitoring and visualization of the level in the process mode



5.4.12 How to Assign Parameters for the Blocks in the "CFC_LI111"

Requirements

- The CFC chart "CFC_LI111" is open in the CFC Editor - stored in the "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ LI111" folder.
- All blocks are inserted.

Procedure

1. Open the "General" tab and "Inputs/Outputs" tab in the "Object Properties" dialog box for each block.
2. Enter parameters for all blocks according to the table below.
3. When you have entered the parameters for all block I/Os, click "OK" each time. Your settings are applied.
4. Close the chart.

Block	Name in project	I/O	Meaning	Value	Unit
CH_AI	INPUT_U	MODE	Measuring range 4 to 20 mA	16#0203	
		VHRANGE	High measuring range	500	
		SIM_ON	Simulation value active	1	
		SIM_V	Raw material tank level	500	
		SUBS_ON	Enables a substitute value	1	
		SUBS_V	Substitute value for SIM_V	500	
INT_P	INT_P	U	Simulation of the raw material tank level	-10	
		V_HL	High limit of the output value	500	
		TI	Integration time	1.0**	
MEAS_MON	LIA	U_WH	High warning limit = 450 m^3	450	m3
		U_WL	Low warning limit = 7 m^3	7	m3
		U_AH	High alarm limit = 490 m^3	490	m3
		U_AL	Low alarm limit = 5 m^3	5	m3
		MO_PVHR*	High display limit of the process value in the container	500	m3
		MO_PVLR*	Low display limit of the process value in the container	0	m3
		HYS	Hysteresis	1	
* Invisible in CFC. ** Default value					

Note

You assign the "MODE" I/O for the CH_AI block. You assign this parameter only because you have not configured any external I/O modules in this Getting Started.

5.4.13 How to Assign Parameters for Blocks in the "CFC_NP111"

Introduction

You have already inserted the CFC_NP111 chart as a process tag type. For this chart, you still need to adapt the default parameter values to your "color_gs" project.

Note

You do not have to adapt the names of the individual blocks when using process tag types.

Requirement

The "CFC_NP111" CFC chart is open in the CFC Editor - stored in the "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ NP111" folder.

Procedure

1. Open the "General" tab and "Inputs/Outputs" tab in the "Object Properties" dialog box for each block.
2. Enter parameters for all blocks according to the table below.
3. Click "OK".
   Your settings are applied.
4. Close the chart.

Block	Name in project	I/O	Meaning	Value
CH_DI	FB_RUN	SIM_ON	Switch simulation active	1
		SUBS_ON	Enables a substitute value	1
MOTOR	MOTOR	MONITOR	Deactivate monitoring	Monitoring = Off
		AUT_ON_OP*	Activate automatic mode	Mode = AUTO
* Invisible in CFC.				

5.4.14 Interconnection of Blocks in the CFC Charts

Interconnection of Blocks

Now, you will interconnect the inputs and outputs in the charts. You can interconnect the blocks conveniently by clicking on the graphic user interface of the CFC editor. To do so, click first on the output of a block and then on the input you want to interconnect the output with. After clicking on the input, the interconnection is displayed as a line. The CFC Editor automatically draws lines in the best position. The position of the lines has no impact on the function of the interconnection.

Note

If you draw a connection incorrectly:

Click on the line of the incorrect interconnection and select the **Edit > Delete** command.

A Special Feature of the "CFC_SETP" and "CFC_NP111" Charts

The CFC_SETP charts do not require any interconnection because this chart is used only for specifying setpoints and for storing operator commands.

The CFC_NP111 chart does not require any interconnections since you used a process tag type for this chart so that all the interconnections are already made.

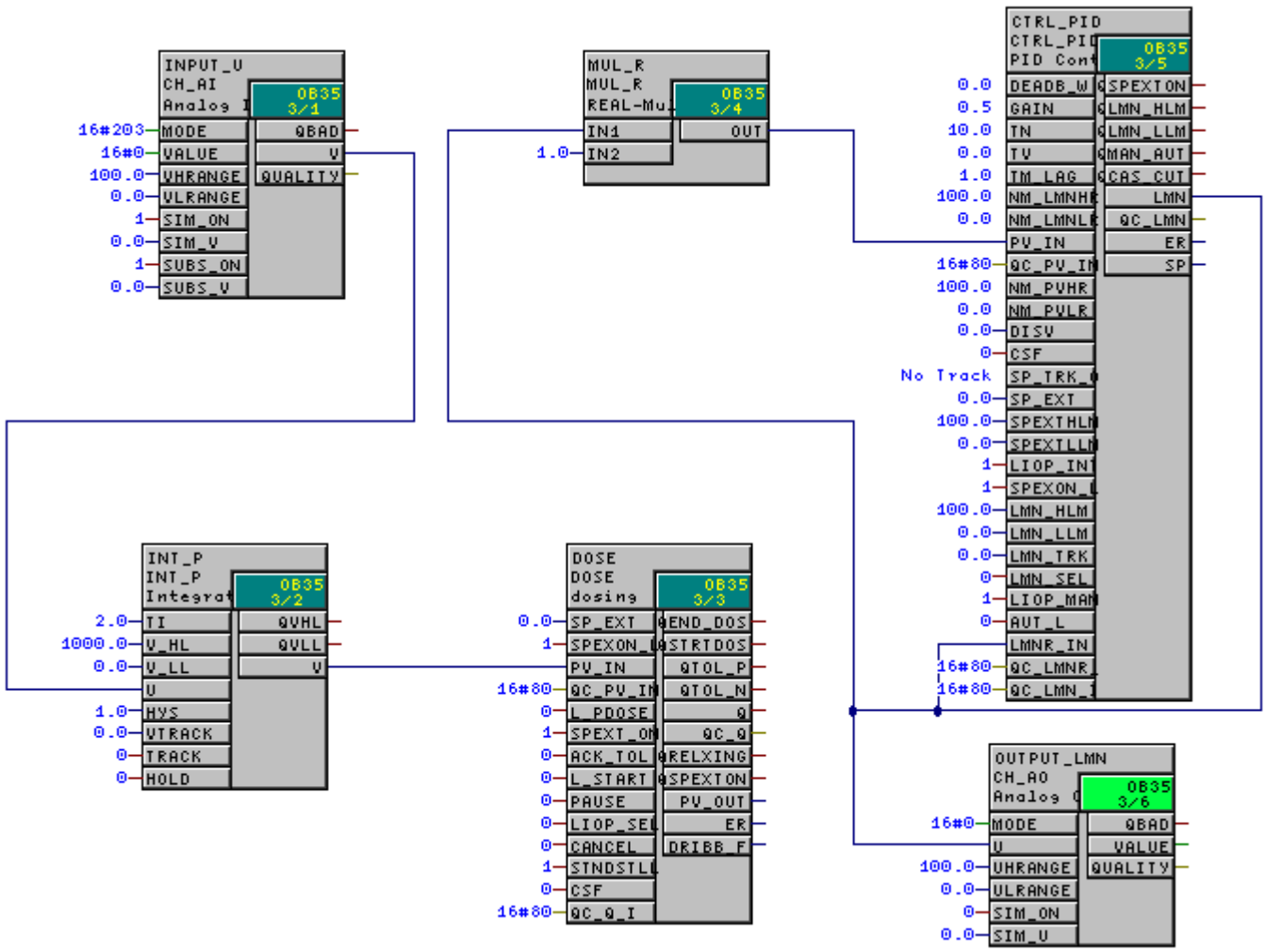
5.4.15 How to Interconnect Blocks in the "CFC_FC111"

Requirements

- The "CFC_FC111" CFC chart is open in the CFC Editor.
- All blocks are inserted, renamed and configured.

Procedure

1. Click output "V" on the "INPUT_U" block.
2. Click on input "U" of the "INT_P" block.
   The CFC editor automatically generates an interconnection line.
3. Following the same procedure, interconnect additional blocks according to the table below.
   The CFC chart then appears as follows:



4. Close the chart.

Block	Output	Block	Input
INPUT_U	V	INT_P	U
INT_P	V	DOSE	PV_IN
MUL_R	OUT	CTRL_PID	PV_IN
CTRL_PID	LMN	OUTPUT_LMN	U
CTRL_PID	LMN	MUL_R	IN1
CTRL_PID	LMN	CTRL_PID	LMNR_IN

Video

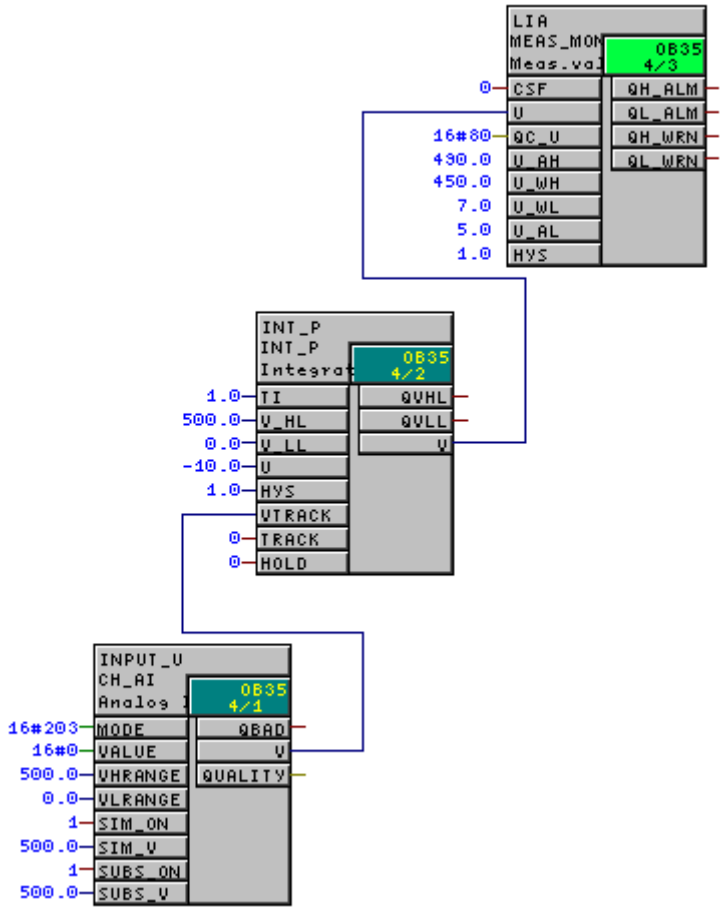
5.4.16 How to Interconnect Blocks in the "CFC_LI111"

Requirements

- The "CFC_LI111" CFC chart is open in the CFC Editor.
- All blocks are inserted, renamed and configured.

Procedure

1. Interconnect additional blocks according to the table below.
   The CFC chart then appears as follows:



2. Close the chart.

Block	Output	Block	Input
INPUT_U	V	INT_P	VTRACK
INT_P	V	LIA	U

5.5 CFC charts in the process object view

5.5.1 Use of the Process Object View for Valve Control

Introduction

Now work on the charts CFC_NK111 to CFC_NK114. Until now you have inserted the "VALVE" process tag type in your master data library and created the four hierarchy folders in the plant hierarchy.

Working with the process object view

To handle almost identical charts, you will now become familiar with an extremely convenient function in PCS 7: the process object view. This means that you do not need to open each individual chart in the CFC Editor and assign parameter; rather, you can modify values quickly in a table within the process object view.

The following preparations are necessary for this:

- Define the I/O in the process tag type for the process object view (Page **Fehler! Textmarke nicht definiert.**)
  As the process object view does not visualize all I/Os for reasons of clarity you must define the I/Os to be shown. You define this once in the process tag type in the master data library.
- Rename process tag types and their insertion into the hierarchy folder (Page 107)
  You are going to copy the process tag type from the master data library to all the hierarchy folders in which you require the valve control..
- Edit parameter values in the process object view (Page 108)
  The next sections are going to demonstrate the benefits of a process object view: you can edit values quickly and easily in a table.

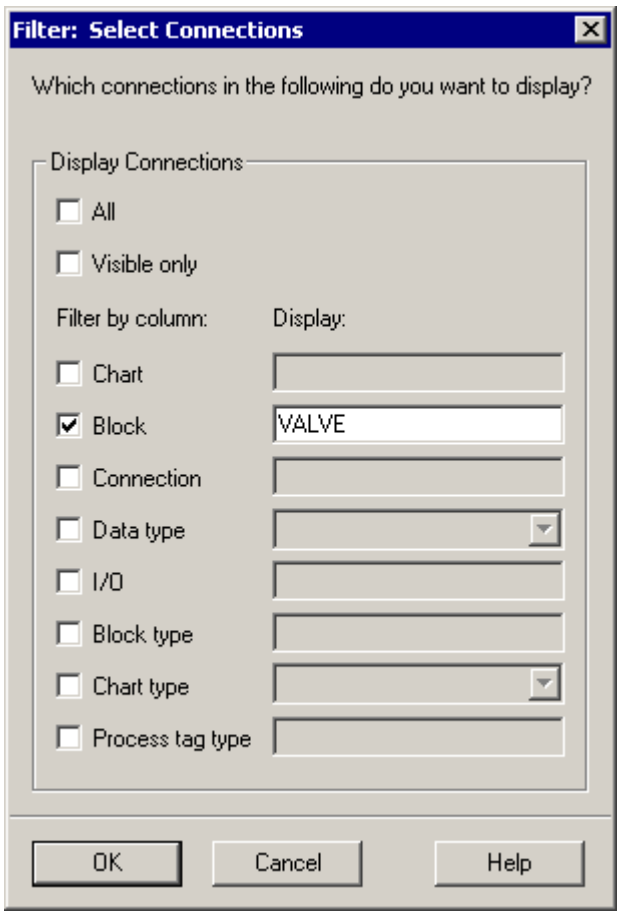
5.5.2 Procedure

Requirements

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

Procedure

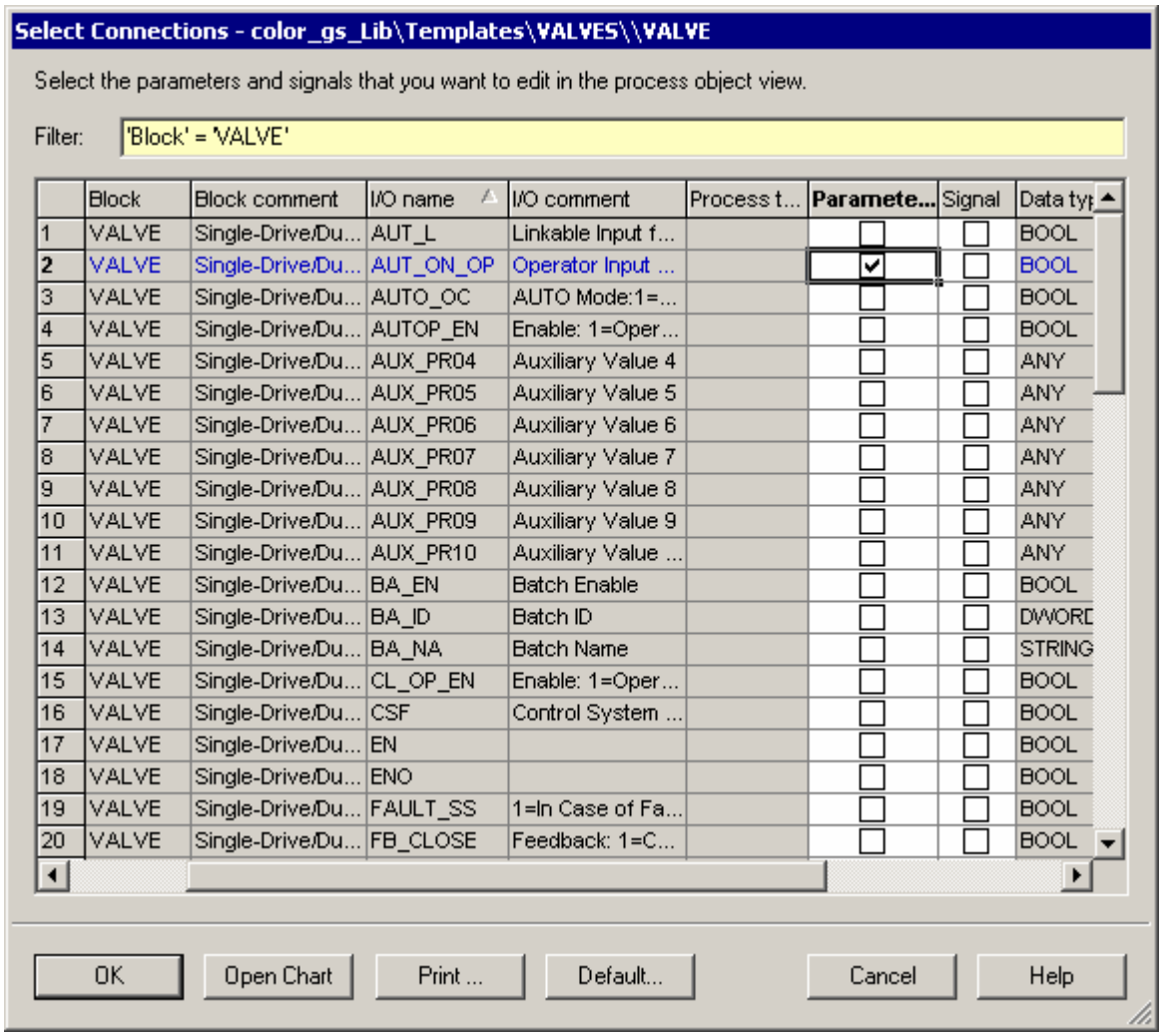
1. Select the "color_gs_Lib/Process tag types/Valves/VALVE" object from the tree view.
2. Select the menu command **Options > Process Objects > Select I/Os...**. The "Filter: Select Connections" dialog box opens.
3. Activate the "Block" check box and enter the value "VALVE" in the input box. This setting only allows the display of "VALVE" block connections.



4. Click "OK".
   The "Select I/Os" dialog box opens.
5. Click on the title of the "Parameters" column.
   This will display all I/Os in the upper rows that are activated in the "Parameters" column.
6. Deactivate the check boxes of these I/Os.
7. Activate the check boxes in the "Parameters" column for the following I/Os:
   – AUT_ON_OP
   – MONITOR
   – START_SS

Note

If you click on the title of the "I/O" column, the I/Os are sorted in ascending or descending order. This makes it easier to find what you are looking for.



	Block	Block comment	I/O name	I/O comment	Process t...	Paramete...	Signal	Data typ
1	VALVE	Single-Drive/Du...	AUT_L	Linkable Input f...		☐	☐	BOOL
2	VALVE	Single-Drive/Du...	AUT_ON_OP	Operator Input ...		☑	☐	BOOL
3	VALVE	Single-Drive/Du...	AUTO_OC	AUTO Mode:1=...		☐	☐	BOOL
4	VALVE	Single-Drive/Du...	AUTOP_EN	Enable: 1=Oper...		☐	☐	BOOL
5	VALVE	Single-Drive/Du...	AUX_PR04	Auxiliary Value 4		☐	☐	ANY
6	VALVE	Single-Drive/Du...	AUX_PR05	Auxiliary Value 5		☐	☐	ANY
7	VALVE	Single-Drive/Du...	AUX_PR06	Auxiliary Value 6		☐	☐	ANY
8	VALVE	Single-Drive/Du...	AUX_PR07	Auxiliary Value 7		☐	☐	ANY
9	VALVE	Single-Drive/Du...	AUX_PR08	Auxiliary Value 8		☐	☐	ANY
10	VALVE	Single-Drive/Du...	AUX_PR09	Auxiliary Value 9		☐	☐	ANY
11	VALVE	Single-Drive/Du...	AUX_PR10	Auxiliary Value ...		☐	☐	ANY
12	VALVE	Single-Drive/Du...	BA_EN	Batch Enable		☐	☐	BOOL
13	VALVE	Single-Drive/Du...	BA_ID	Batch ID		☐	☐	DWORD
14	VALVE	Single-Drive/Du...	BA_NA	Batch Name		☐	☐	STRING
15	VALVE	Single-Drive/Du...	CL_OP_EN	Enable: 1=Oper...		☐	☐	BOOL
16	VALVE	Single-Drive/Du...	CSF	Control System ...		☐	☐	BOOL
17	VALVE	Single-Drive/Du...	EN			☐	☐	BOOL
18	VALVE	Single-Drive/Du...	ENO			☐	☐	BOOL
19	VALVE	Single-Drive/Du...	FAULT_SS	1=In Case of Fa...		☐	☐	BOOL
20	VALVE	Single-Drive/Du...	FB_CLOSE	Feedback: 1=C...		☐	☐	BOOL

8. Click "OK".
   The "Select I/Os" dialog box closes.
9. Close the process object view.

5.5.2.1 How to Insert the "VALVE" Process Tag Type

Requirements

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

Procedure

Follow exactly the same procedure as for the "MOTOR" process tag type:

1. Select the "VALVE" process tag type in the detail window of the "color_gs_MP/ color_gs_Lib/ Process tag types/VALVES" folder.
2. Insert the "VALVE" process tag type in the following folders using the **Edit > Copy** and **Edit > Paste** menu commands:
   - color_gs_MP/color_gs_Prj/Plant1/RMT1/NK111
   - color_gs_MP/color_gs_Prj/Plant1/RMT1/NK112
   - color_gs_MP/color_gs_Prj/Plant1/RMT1/NK113
   - color_gs_MP/color_gs_Prj/Plant1/RMT1/NK114
3. Rename the inserted process tag types according to the table below.
4. Close the plant view.

Hierarchy folder	Rename to:
../RMT1/NK111	CFC_NK111
../RMT1/NK112	CFC_NK112
../RMT1/NK113	CFC_NK113
../RMT1/NK114	CFC_NK114

A detailed description is available in the section
"How to insert the "MOTOR" process tag type" (Page 83).

5.5.2.2 How to Adapt the Parameters for "CFC_NK11x"

Requirements

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

Procedure

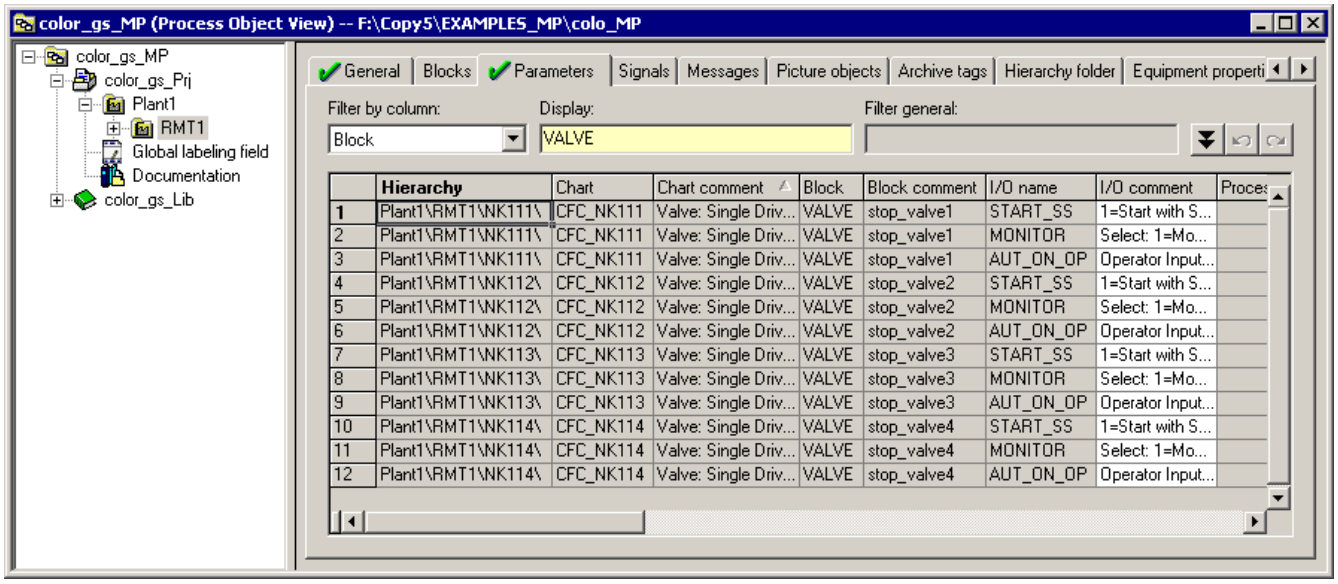
1. Select the
   "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1" folder from the tree view.
2. Select the "Blocks" tab.
   The data are updated.
3. Select the "Block" entry from the "Filter by column" drop-down list.
   This activates the "Display" box.
4. Enter the name of the block in the "Display" input box: "VALVE".
   The table is updated and shows you the "Valve" block for all four CFC charts.

   Note

   If the name of the CFC chart is not fully displayed in the column, position the cursor between the "Chart" column and "Chart Comment" column and double-click. This adapts the column width automatically to the width of the entries.

5. Enter the name "stop_valve1" in the "Block Comment" column for the "CFC_NK111" chart, and press the ENTER key.
   This updates the block comment at all connections of this chart.
6. Change the block comment for the other CFC charts in the way shown in the table below.
7. Select the "Parameters" tab.
   The data is updated.
8. Select the "Block" entry from the "Filter by column" drop-down list.
   The "Display" input box is active.

9. Enter the name of the block in the "Display" input box: "VALVE".
   The table is updated.
   You see exactly three I/Os for each chart.



	Hierarchy	Chart	Chart comment	Block	Block comment	I/O name	I/O comment	Proces
1	Plant1\RMT1\NK111\	CFC_NK111	Valve: Single Driv...	VALVE	stop_valve1	START_SS	1=Start with S...	
2	Plant1\RMT1\NK111\	CFC_NK111	Valve: Single Driv...	VALVE	stop_valve1	MONITOR	Select: 1=Mo...	
3	Plant1\RMT1\NK111\	CFC_NK111	Valve: Single Driv...	VALVE	stop_valve1	AUT_ON_OP	Operator Input...	
4	Plant1\RMT1\NK112\	CFC_NK112	Valve: Single Driv...	VALVE	stop_valve2	START_SS	1=Start with S...	
5	Plant1\RMT1\NK112\	CFC_NK112	Valve: Single Driv...	VALVE	stop_valve2	MONITOR	Select: 1=Mo...	
6	Plant1\RMT1\NK112\	CFC_NK112	Valve: Single Driv...	VALVE	stop_valve2	AUT_ON_OP	Operator Input...	
7	Plant1\RMT1\NK113\	CFC_NK113	Valve: Single Driv...	VALVE	stop_valve3	START_SS	1=Start with S...	
8	Plant1\RMT1\NK113\	CFC_NK113	Valve: Single Driv...	VALVE	stop_valve3	MONITOR	Select: 1=Mo...	
9	Plant1\RMT1\NK113\	CFC_NK113	Valve: Single Driv...	VALVE	stop_valve3	AUT_ON_OP	Operator Input...	
10	Plant1\RMT1\NK114\	CFC_NK114	Valve: Single Driv...	VALVE	stop_valve4	START_SS	1=Start with S...	
11	Plant1\RMT1\NK114\	CFC_NK114	Valve: Single Driv...	VALVE	stop_valve4	MONITOR	Select: 1=Mo...	
12	Plant1\RMT1\NK114\	CFC_NK114	Valve: Single Driv...	VALVE	stop_valve4	AUT_ON_OP	Operator Input...	

10. Go to the "Value" column and enter the values as listed in the table below. The following applies to the the "Value" column:
    - Place the cursor in the appropriate field..
      This changes the field to a drop-down box.
    - Select the desired item in the drop-down list.

CFC chart	Block comment
CFC_NK112	stop_valve2
CFC_NK113	stop_valve3
CFC_NK114	stop_valve4

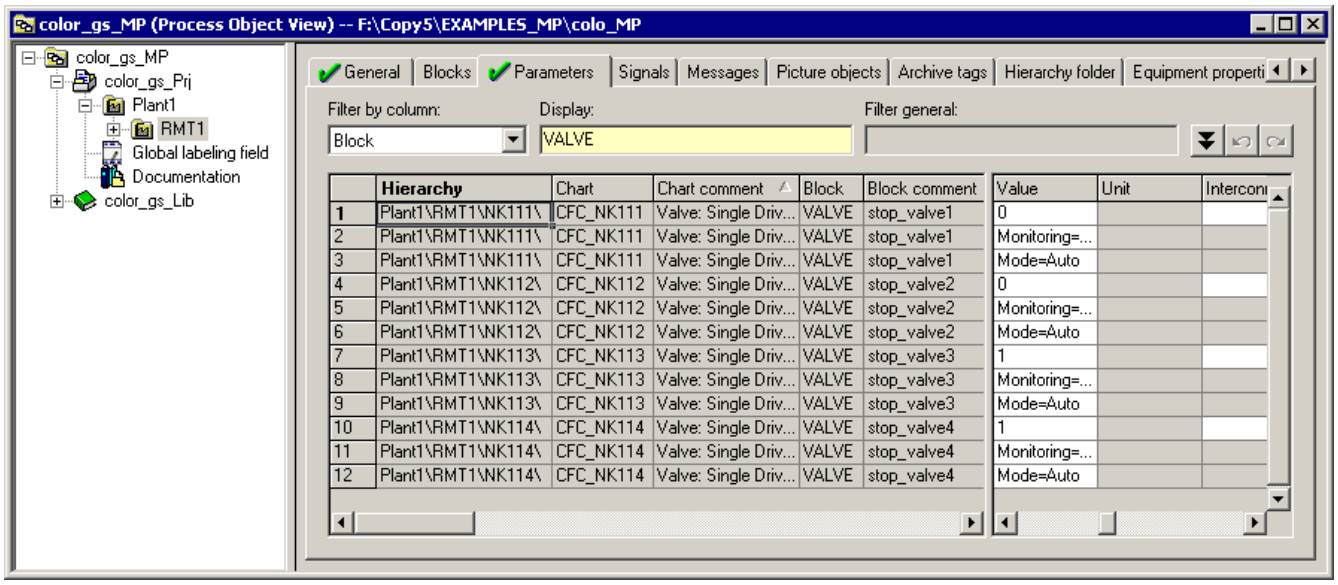
Note

Depending on the size of your monitor, you may not be able to see the "Chart" column any more and, as a result, the assignment of the individual I/Os to a chart becomes difficult.

The process object view offers you the following options:

1. Position the cursor on the small box on the left next to the horizontal scroll bar and click.
   This makes a vertical marker visible in the table.
1. Hold down the mouse button and drag this vertical marker behind the "I/O" column.
2. Release the mouse button.
   This splits the table window and you can navigate in the right side with the horizontal scroll bar in the table while the chart names are displayed on the left side.

CFC chart	I/O	Meaning	Value
CFC_NK111	START_SS	Specify the initial valve state (open/closed)	0
	MONITOR	Disable monitoring of feedback from the process for the example	Monitoring=off
	AUT_ON_OP	Switch the valve to automatic mode	Mode=Auto
CFC_NK112	START_SS	See above	0
	MONITOR	See above	Monitoring=off
	AUT_ON_OP	See above	Mode=Auto
CFC_NK113	START_SS	See above	1
	MONITOR	See above	Monitoring=off
	AUT_ON_OP	See above	Mode=Auto
CFC_NK114	START_SS	See above	1
	MONITOR	See above	Monitoring=off
	AUT_ON_OP	See above	Mode=Auto



5.5.2.3 How to Specify the Type of Block Icon

Introduction

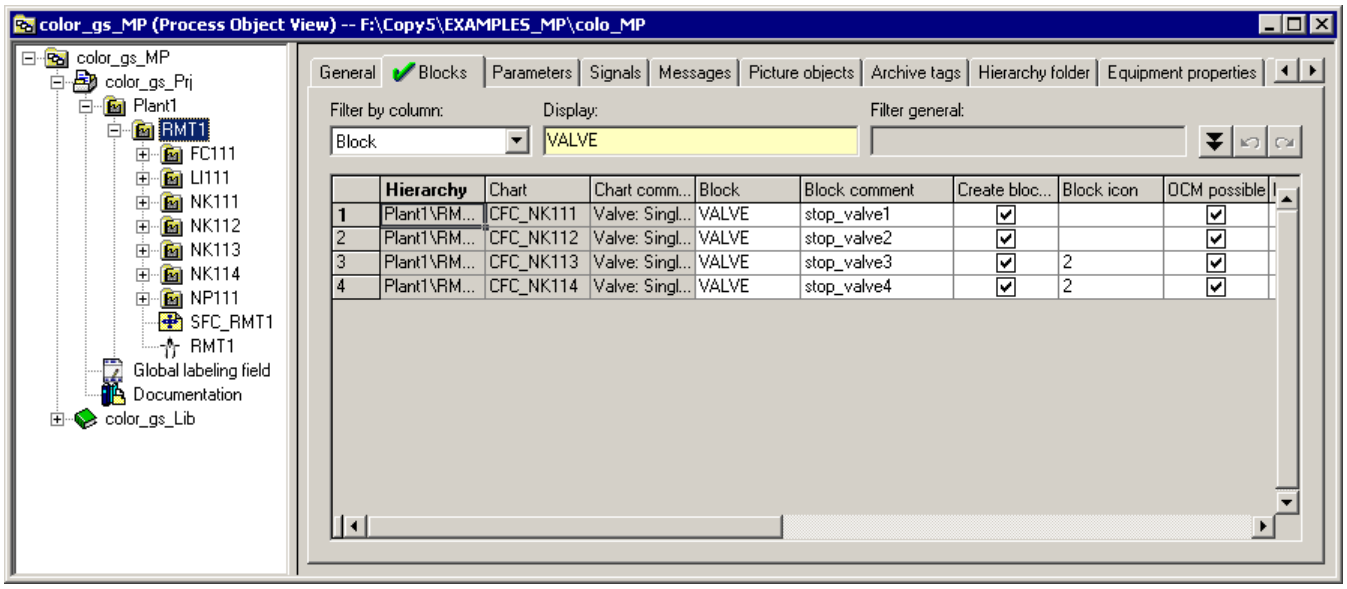
At this point you must start preparing for creation of process pictures. Since there are a few automatic functions for this, you can already make settings at this point.

Requirements

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

Procedure

1. Select the "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1" folder from the tree view.
2. Select the "Blocks" tab.
   The program updates the data.
3. Select the "Block" entry from the "Filter by column" drop-down list box.
   The program activates the "Display" input box.
4. Enter the name of the block in the "Display" input box: "VALVE".
   The program updates the table and shows you the "Valve" block for all four CFC charts.
5. Enter "2" in the "Block Icon" column for the following charts:
   - "CFC_NK113"
   - "CFC_NK114"
6. Press ENTER.
   This sets horizontal alignment of the valve block icon in the process picture.



7. Close the process object view.

5.5.2.4 How to Delete Interconnections to Addresses

Introduction

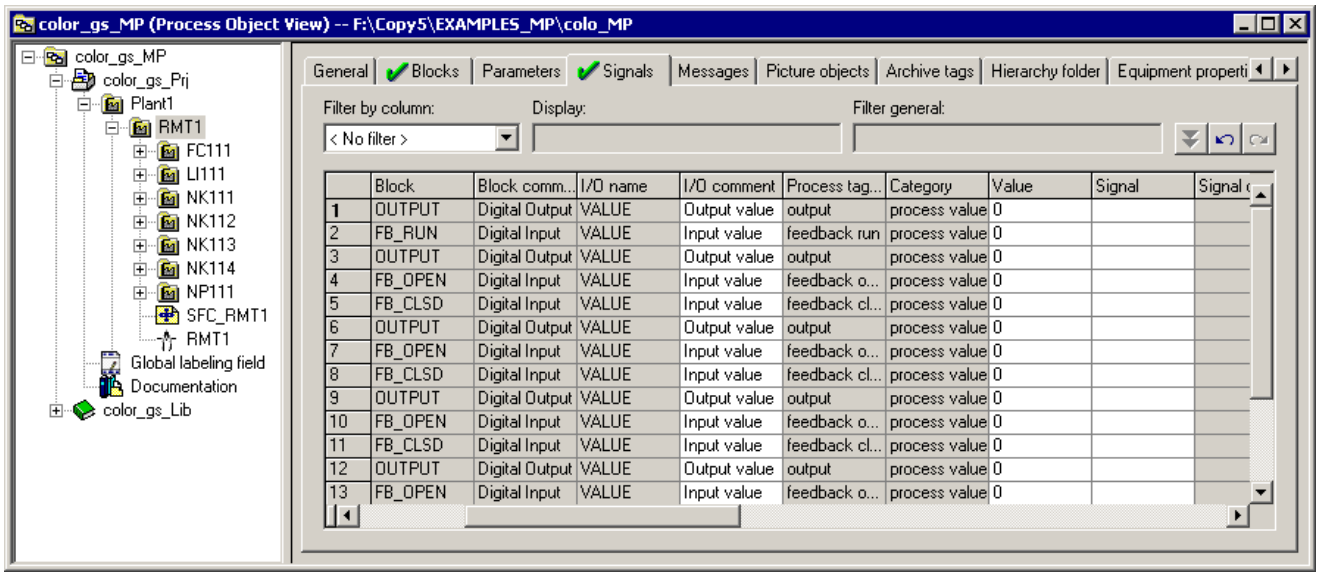
You use process tag types from the PCS 7 Library in your project for the NK111 to NK114 valve controls and the NP111 motor control. These process tag types have default interconnections to input/output modules. Because you are working without real input/output modules in this Getting Started, a warning message appears during compilation. You have to delete these interconnections to avoid the warnings.

Requirement

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

Procedure

1. Select the "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1" folder from the tree view.
2. Select the "Signals" tab.
   The program updates the data.
3. Click in the column heading for the "Signal" column to sort the entries in the column.
4. Select all entries and press the <DEL> key.
   - "digital output"
   - "feedback run"
   - "feedback open"
   - "feedback closed"



5. Close the process object view.

5.5.3 Current Status of Your Project

Completed Configuration Tasks

You have completed the following tasks during CFC configuration:

- You have inserted blocks in the CFC Editor, assigned parameters for the blocks and interconnected them.
- You have used the process object view to assign parameters to the same process tag types.

Creating SFC charts

6

6.1 Overview of SFC Charts

The Theory -- What is SFC?

Sequential function chart (SFC) is a sequential control system with a step-by-step sequence. Depending on the conditions, control passes from one state to the next. With a sequential control system, functions such as CFC charts are controlled and selectively processed by means of operating mode and state changes. You create SFC charts in the SFC Editor.

When you created the "color_gs" project with the PCS 7 wizard, PCS 7 automatically created an SFC chart. This chart is still empty. You will now use the SFC Editor to edit the SFC chart for the "color_gs" project.

6.2 Working with the SFC Editor

6.2.1 Introduction to the SFC Editor

SFC Editor

As soon as you open an SFC chart, the SFC Editor opens. The SFC Editor is always opened in the view in which it was closed the last time you worked with it.

Like the CFC Editor, the SFC Editor provides you with a graphic user interface that allows the convenient creation of sequential control systems.

A sequential control system essentially consists of two basic elements:

- Transition:
  A condition which controls the execution of a step. Transitions are represented by small rectangles in the SFC chart.
- Step:
  The step consists of actions that are performed in three phases.
  - Initialization
  - Execution
  - Completion

Initialization is performed once as soon as the step becomes active. It is executed until the follow-up transition is satisfied. When this is the case, the completion phase of the step is performed once. When the completion phase is finished, the step becomes inactive and the follow-up step becomes active.

Steps are represented by large rectangles in the SFC chart.

New SFC chart in the SFC Editor

When you open a new SFC chart in the SFC Editor, you will first see two steps and one transition:

- START" step
- Transition 1
- END" step

6.2.2 Important Functions in the SFC Editor

Important Functions in the SFC Editor

In the following section, we introduce you to the main functions of the SFC Editor that you will require for configuring the SFC charts for your "color_gs" project.

You use the element bar of the SFC Editor to build up your sequential control system. The buttons have the following meaning:

Button	Meaning
 Enable selection" button	When this button is enabled, you can select individual objects of the SFC chart, for example, the steps and transitions. A selected step or a selected transition is displayed in blue.
 Insert step + transition" button	When this button is enabled, the cursor changes to a small cross and a circle with a bar across. When you move the cross to a position in the chart where insertion of a step or a transition is possible, the circle turns into the icon for "Step with Transition". At the same time, a green line indicates where the "Step with Transition" will be inserted.
 Insert alternative branch" button"	When this button is active, you can insert an alternative branch. This means that depending on the defined transition either one or the other sequence is processed.

None of the other buttons are used in the "color_gs" project.

Additional information

Detailed information about the SFC editor is available in its Online Help system and in the *SIMATIC SFC for S7; Sequential Function Chart* Manual.

6.2.3 Properties of Steps and Transitions

Introduction

In order to edit the names and values of the steps and transitions, you will work in the "Properties" dialog box. You do not need to reopen the dialog box every time for each step and transition. Instead, you can move directly to the next transition or the next step and to transitions and steps of an alternative branch in this dialog box.

Navigation Buttons

The following navigation buttons are available to you:

Button	Meaning
 Arrow down" button"	Use this to switch to the subsequent transition/step
 Arrow up" button"	Use this to switch to the previous transition/step
 Right arrow" button and  Left arrow" button	Use this to switch to the adjacent transition/step

"Properties" Dialog Box

The dialog box has four different tabs. These tabs will be introduced briefly below.

Tabs in the "Properties" Dialog Box for a Step:

- General – here, you make the general settings, such as changing the name for the step.
- Initialization – the action you define here is only processed once when the step is activated.
- Processing – the action you define here is processed cyclically until the next transition is satisfied.
- Termination – the action you define here is only processed once when the step is terminated.

Tabs in the "Properties" Dialog Box for a Transition:

- General – here, you make the general settings, such as changing the name for the transition.
- Condition – in this tab, you specify the condition that decides when the next step in the sequential control system will be enabled.

6.2.4 Overview of the Configuration Steps for SFC Charts

Overview

To create SFC charts, you perform the steps listed below:

Step	What?
1	Move SFC Chart (Page 119)
2	Rename SFC Chart (Page 120)
3	Open SFC Chart (Page 121)
4	Define Technological Structure of the Sequential Control System (Page 122)
5	Rename Steps (Page 125)
6	Rename Transitions (Page 128)
7	Configure Steps (Page 130)
8	Configure Transitions (Page 137)
9	Optimize the Run Sequence (Page 140)

6.2.5 How to Move an SFC Chart

Introduction

The SFC chart "SFC(1)" created by the PCS 7 "New Project" wizard when you created the "color_gs" project is stored in the "ADDIT" hierarchy folder. Since the charts are stored in the plant hierarchy according to their relevance, you will need to move the SFC chart created automatically by the PCS 7 Wizard to the relevant hierarchy folder.

Requirements

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

Procedure

1. Select the "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1/ FC111/ ADDIT" folder from the tree view.
2. Select the "SFC(1)" object in the detailed window.
3. Select the **Edit > Cut** command.
4. Select the "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1" folder from the tree view.
5. Select the **Edit > Paste** command.
   The program inserts the selected process tag types.

6.2.6 How to Rename the SFC Chart

Introduction

To keep the naming consistent and clear within your project, you will need to change the default names.

Requirements

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

Procedure

1. Select the "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1" folder from the tree view.
2. Select the "SFC(1)" object in the detailed window.
3. Select the **Edit > Object Properties** command.
   The "Properties CFC Chart" dialog box opens with active "General" tab.
4. Change the default name "SFC(1)" to "SFC_RMT1" in the "Name" box.
5. Click "OK" to save your entries.

6.2.7 How to Open the "SFC_RMT1" SFC Chart

Requirements

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

Procedure

1. Select the
   "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1" folder from the tree view.
2. Select the "CFC_RMT1" object in the detail view, and then select the **Edit > Open Object** command.
   The SFC editor opens. The "Start" and "End" steps and transition 1 already exist.

6.2.8 Technological Structure of the Sequential Control System

Technological Sequence

The following section provides you with an overview of the technological sequence of the individual steps and transitions in the sequential control system for the "color_gs" project.

Name of the Step	Function
START	Defaults: Changing the dosing controller to manual mode Switching the dosing controller to external Setting the units to automatic mode Stopping dosing
DOSE_REA1 DOSE_REA2	Query: Should Reactor 1 or Reactor 2 be used for dosing?
INIT_LINE1 INIT_LINE2	Controllers: Open valves of the respective branch Turn on the pump Switch the dosing controller to an external setpoint
INIT_1_OK INIT_2_OK	Query: Is the pump turned on? Is the controller set to "External Setpoint"?
INIT_DOSE	Controllers: Set the setpoint for the dosing speed Set the dosing controller to automatic mode Set the setpoint for dosing volume Start dosing
INIT_OK	Query: Dosing started ? Dosing volume (setpoint actual value) < 500 liters?
SLOW_DOWN	Controller: Reduce the dosing speed shortly before reaching the required dosing volume
END_DOSE	Query: Dosing ended?
CLOSE_LINE	Controllers: Close all valves Turn off the pump Switch the dosing controller to manual mode Set dosing speed to 0 Stop dosing
CLOSE_OK	Query: Is the pump turned off?
END	Reset: Switch the dosing controller to internal Close valves Turn off motor

The plant operator can start, control, and monitor this chart on the operator station.

6.2.9 How to Create the Sequential Control System in the SFC Chart

Introduction

When you insert steps and transitions, the SFC Editor assigns continuous numbers. You then replace these numbers with descriptive, plant-specific names.

Requirements

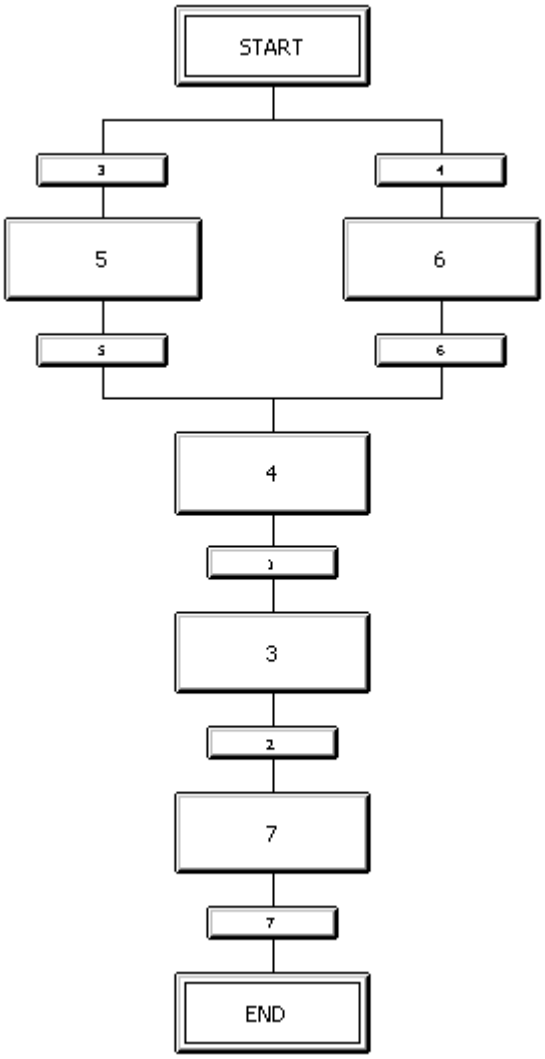
- The "SFC_RMT1" SFC chart is open in the SFC Editor.
- The"START" and "END" steps and "Transition 1" already exist.

Procedure

1. Select the **View > Toolbar** command if the toolbar buttons for inserting steps and transitions are hidden.
   This opens the toolbar
2. Click the "Insert Step + Transition" button.
   
   The cursor transforms into a small cross and a circle with a bar.
3. Position the cursor below Transition 1 until a green line is displayed and insert the object by clicking it.
   The program inserts step "3" and transition "2" into the SFC chart.
4. Click the "Insert alternative branch" button.
   
5. Position the cursor below the "START" step until a green line is displayed and insert the object by clicking it.
   The program inserts an alternative branch directly below the "START" step: The transitions "3" and "4" are inserted parallel to each other and step "4" below them.
6. Click the "Insert Step + Transition" button.
   
7. Position the cursor at the following positions and insert a step + transition:
   - Below transition 3 – step 5 and transition 5 are inserted
   - Below transition 4 – step 6 and transition 6 are inserted
   - Below transition 2 – step 7 and transition 7 are inserted

Result

Your SFC chart should now appear as follows:



6.2.10 How to Rename Steps

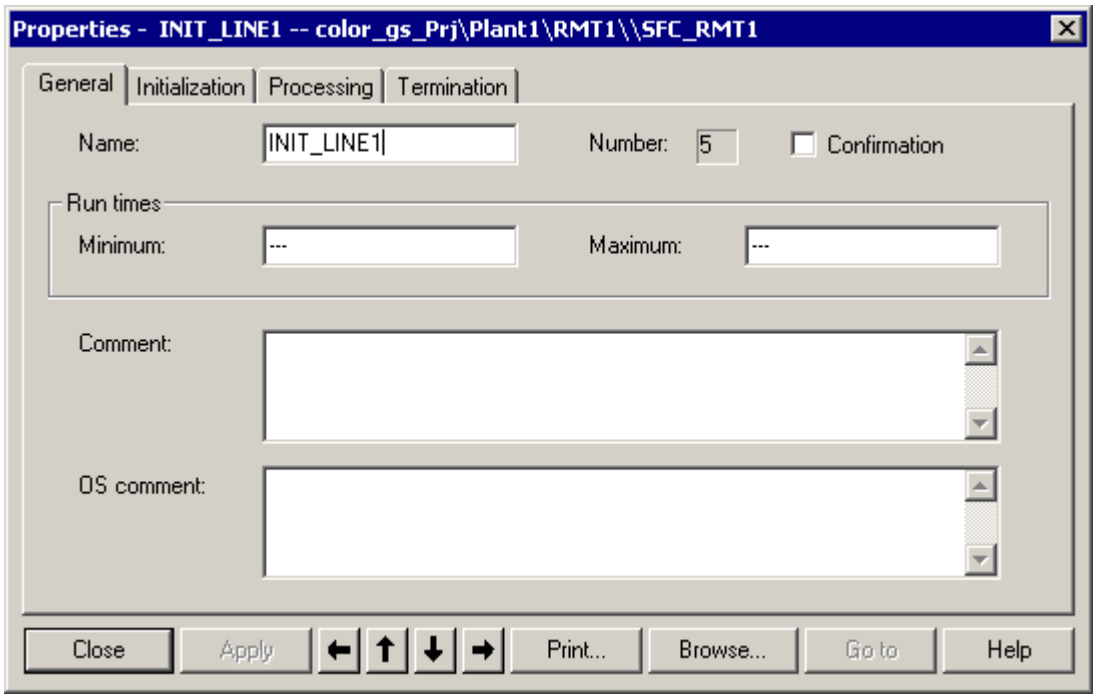
Requirements

- The "SFC_RMT1" SFC chart is open in the SFC Editor.
- All steps and transitions have been inserted

Procedure

1. Click the "Select" button.

2. Select step "5".
3. Select the menu command **Edit > Object Properties**.
The "Properties" dialog box opens and the "General" tab is selected.
The default entry "5" is already selected in the "Name" box.
4. Change the "5" in the "Name" box to "INIT_LINE1".



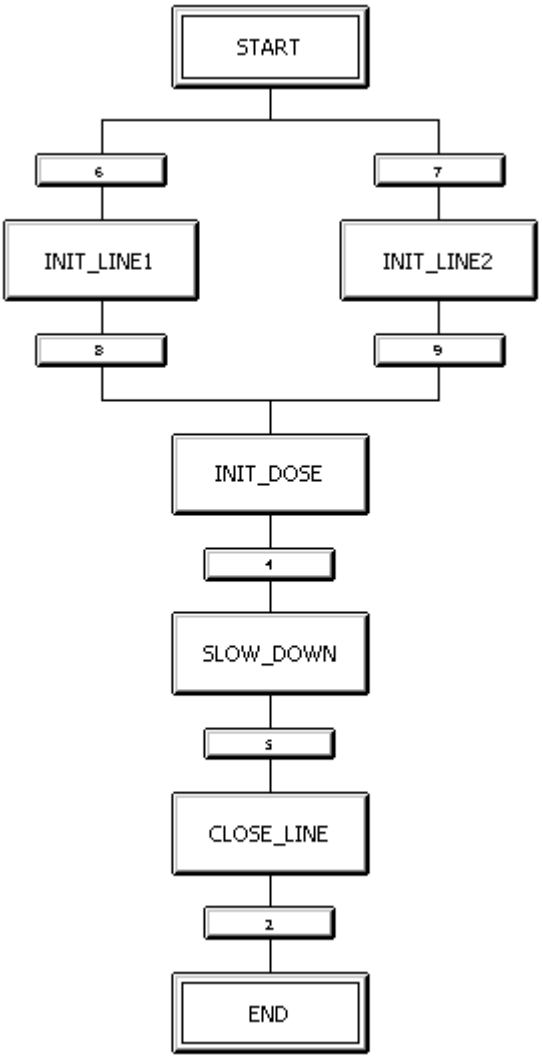
5. Click "Apply".
The new name is saved.
6. Click the "Down arrow".
This brings you to step "4".
7. Change the "4" in the "Name" box to "INIT_DOSE" and click "Apply".

8. Navigate to the other steps with the arrow buttons and change the names according to the table below.
   Each time you enter a new name, click "Apply".
9. Click "Close".
   This saves your settings and closes the "Object Properties" dialog box.

Default name	New name
5	INIT_LINE1 - finished
4	INIT_DOSE - finished
3	SLOW_DOWN
7	CLOSE_LINE
6	INIT_LINE2

Result

The changed names of the individual steps are displayed in the SFC chart.



6.2.11 How to Rename Transitions

Introduction

Just as you renamed the steps, you must also replace the default names of all transitions with descriptive, plant-specific names. Use the same procedure as you did for changing the names of the steps.

Requirement

The "SFC_RMT1" SFC chart is open in the SFC Editor.

Procedure

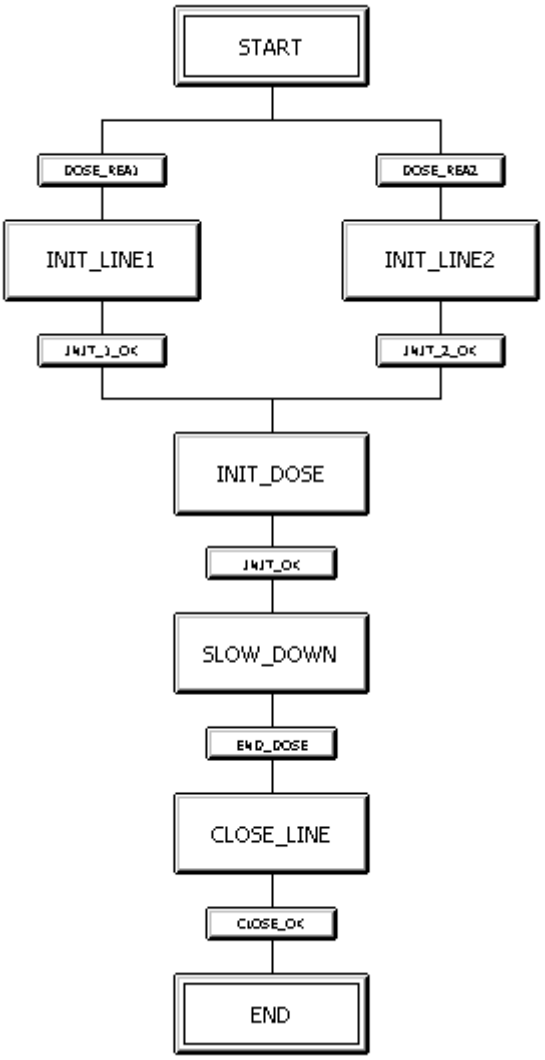
1. Select transition "3" and then select the menu command **Edit > Object Properties**.
   The "Object Properties" dialog box opens and the "General" tab is selected.
2. Replace the default name in the "Name" box with a plant-specific name.
   The plant-specific names are listed in the following table.
3. Each time you enter a name, complete the change by clicking the "Apply" button.
4. Use the arrow buttons to move from one transition to the next.
5. Click "Close".
   Your settings are saved and the "Object Properties" dialog box closes.

Default name	New name
3	DOSE_REA1
5	INIT_1_OK
1	INIT_OK
2	END_DOSE
7	CLOSE_OK
4	DOSE_REA2
6	INIT_2_OK

Result

The changed names of the transitions are displayed in the SFC chart.

Your SFC chart should now appear as follows:



6.3 Setting parameters

6.3.1 How to Assign Parameters to the Steps of the SFC Chart

Introduction

From SFC, you assign values to the block inputs of the CFC charts. The initial settings for the sequence of the dosing process are made with the first "START" step.

Each step for which you have defined an action is displayed in dark gray. This means that you can see at a glance whether or not a step has already had parameters assigned.

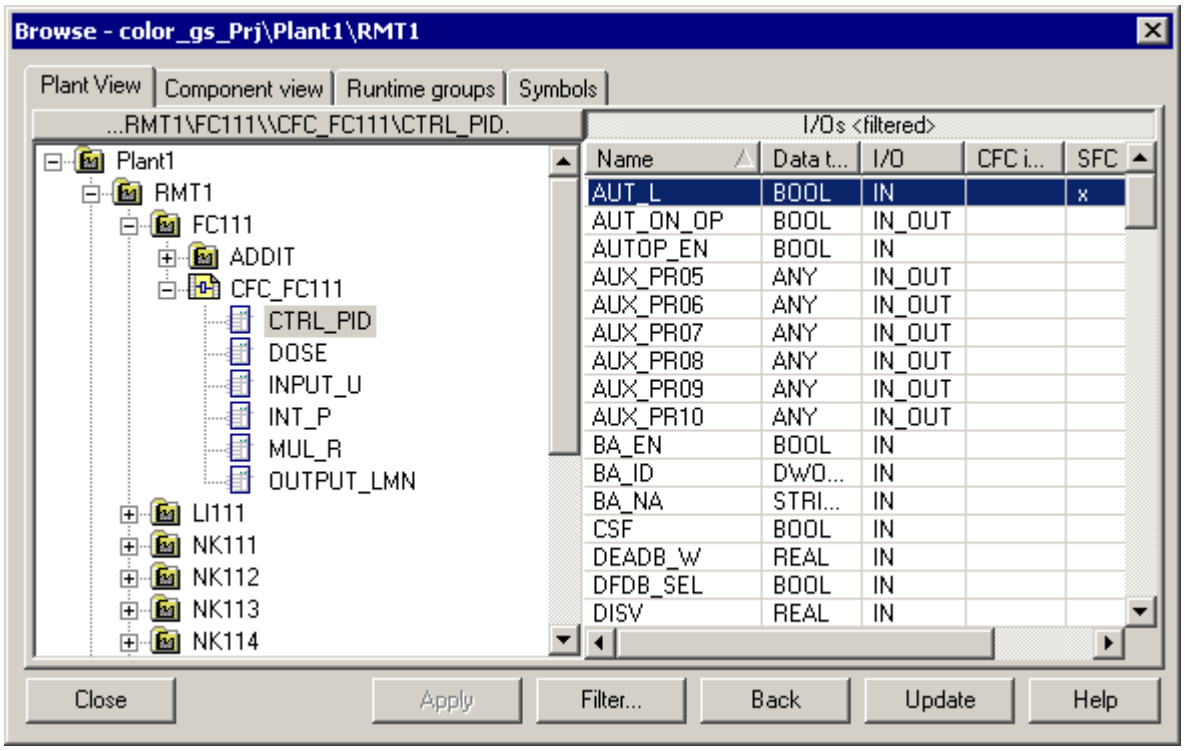
Requirements

- The "SFC_RMT1" SFC chart is open in the SFC Editor.
- The names of the steps and transitions have been adapted.

Procedure

1. Click "START".
   The "Properties" dialog box opens and the "General" tab is selected.
2. Switch to the "Initialization" tab.
   This tab displays an empty list with statement lines and the cursor is positioned in the left column of the first row.
3. Click "Browse".
   The "Browse" dialog box opens with active "Plant view" tab.
   In this dialog, the plant hierarchy is displayed in the left section and the I/Os of the block you have selected in the plant hierarchy are shown in the right section.

4. Select the "Plant1/ RMT1/ FC111/ CFC_FC111/ CTRL_PID" block from tree view.
   The section on the right side shows all corresponding block connections.



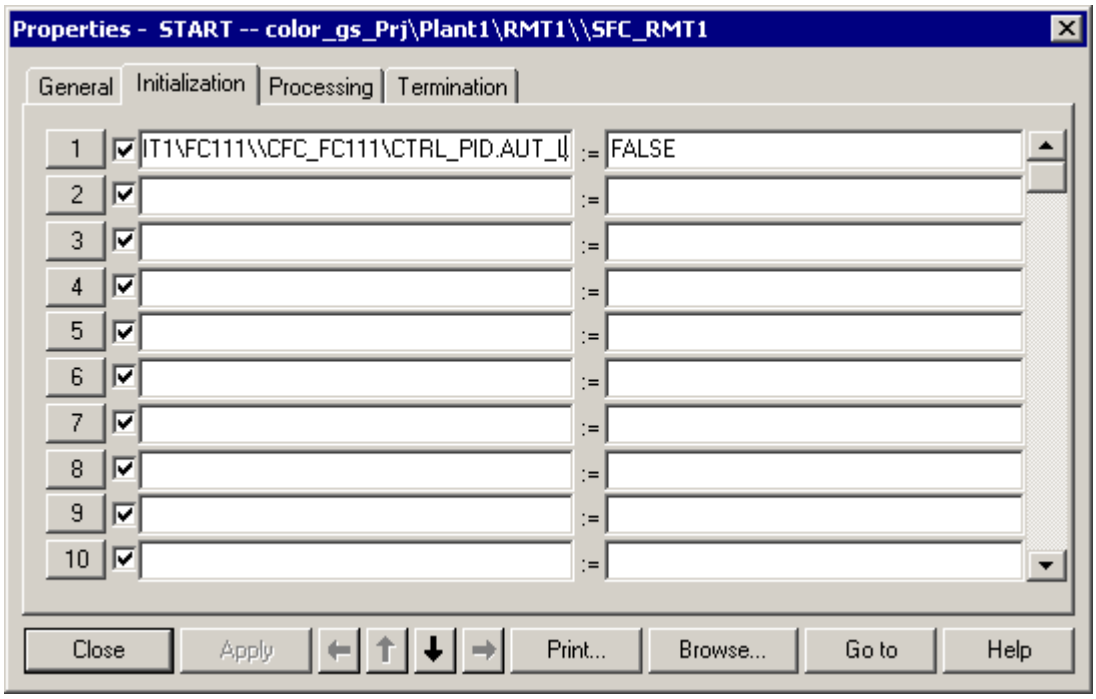
5. Double-click on the "AUT_L" input.
   The "Browse" dialog box goes to the background and the selected block I/O along with its full path is entered as the first address in line 1.
   The cursor is automatically positioned in the right column of line 1.

Note

If you cannot read the name of the block I/Os, increase the width of the column.

6. Enter the value "0" in this input box.
7. Click "Apply".
   The value "0" is automatically replaced by "FALSE". The first assignment in the "Start" step is now complete.

The dialog box now appears as follows:



8. Click the button with the number "2". This button is arranged directly in front of the statement line.
   This positions the cursor in the left column of the second line.
9. Repeat steps 3 through 9 to define the remaining addresses for the "START" step. You will find the information you require in the table below.
10. Click "Apply".
11. Click the arrow button to navigate to the other steps and enter the addresses according to the tables below.

Note

The addresses in the table are specified in the following format:

[chart folder\chart name\block I/O]

The"Plant1\RMT1" component is omitted because it is identical for all objects. This keeps the table easy to understand. As soon as you insert an additional plant or unit in the "color_gs" project, you must, of course, also pay attention to the assignment of the chart to the plant hierarchy.

No.	Address 1	Address 2	Meaning
1	Completed already: FC111\CFC_FC111\ CTRL_PID.AUT_L	FALSE	Controller manual
2	FC111\CFC_FC111\CTRL_PID.SP_EXT	FC111\ADDIT\CFC_SETP\PARA_DOS_RM1_QTY.V	Setpoint for flow control
3	FC111\CFC_FC111\CTRL_PID.LMN_SEL	FALSE	No tracking
4	FC111\CFC_FC111\DOSE.L_START	FALSE	Dosing stopped
5	FC111\CFC_FC111\INT_P.TRACK	TRUE	Track integrator
6	LI111\CFC_LI111\INT_P.TRACK	TRUE	Track integrator
7	NK111\CFC_NK111\VALVE.AUT_ON_OP	Auto	Valve in automatic mode
8	NK112\CFC_NK112\VALVE.AUT_ON_OP	Auto	Valve in automatic mode
9	NK113\CFC_NK113\VALVE.AUT_ON_OP	Auto	Valve in automatic mode
10	NK114\CFC_NK114\VALVE.AUT_ON_OP	Auto	Valve in automatic mode
11	NP111\CFC_NP111\MOTOR.AUT_ON_OP	Auto	Motor in automatic mode
12	LI111\CFC_LI111\INT_P.HOLD	FALSE	Hold output value

Note

When entering the addresses, verify that you have selected the required step based on the title bar of the "Properties" dialog box.

If you have inadvertently closed the "Properties" dialog box, double-click on the step you are currently editing to reopen the dialog box.

6.3.2 Parameters for the Steps

Parameters for the "INIT_LINE1" Step

The following table shows the parameters for the "INIT_LINE1" step:

No.	Address 1	Address 2	Meaning
1	NK111\CFC_NK111\VALVE.AUTO_OC	TRUE	Open valve
2	NK112\CFC_NK112\ VALVE.AUTO_OC	TRUE	Open valve
3	NK113\CFC_NK113\ VALVE.AUTO_OC	TRUE	Open valve
4	NP111\CFC_NP111\MOTOR.AUTO_ON	TRUE	Turn on motor

Parameters for the "INIT_LINE2" step

The following table shows the parameters for the "INIT_LINE2" step:

No.	Address 1	Address 2	Meaning
1	NK111\CFC_NK111\VALVE.AUTO_OC	TRUE	Open valve
2	NK112\CFC_NK112\ VALVE.AUTO_OC	TRUE	Open valve
3	NK114\CFC_NK114\VALVE.AUTO_OC	TRUE	Open valve
4	NP111\CFC_NP111\MOTOR.AUTO_ON	TRUE	Turn on motor

Parameters for the "INIT_DOSE" Step

The following table shows the parameters for the "INIT_DOSE" step:

No.	Address 1	Address 2	Meaning
1	FC111\CFC_FC111\CTRL_PID.SP_EXT	FC111\ADDIT\CFC_SETP\PARA_DOS_RM1_QTY.V	Active setpoint for flow control
2	FC111\CFC_FC111\CTRL_PID.AUT_L	TRUE	Controller automatic mode
3	FC111\CFC_FC111\DOSE.SP_EXT	FC111\ADDIT\CFC_SETP\ PARA_DOS_RM1_VOL.V	Active setpoint for dosing volume
4	FC111\CFC_FC111\DOSE.L_START	TRUE	Start dosing
5	FC111\CFC_FC111\INT_P.TRACK	FALSE	Integrator after setpoint correction
6	FC111\CFC_FC111\INPUT_U.SIM_V	50.0	Simulation: 50 liters/min flow simulated
7	FC111\CFC_FC111\INPUT_U.SUBS_V	50.0	Substitute value for the simulation value SIM_V
8	LI111\CFC_LI111\INT_P.TRACK	FALSE	No correction for integrator
9	LI111\CFC_LI111\INPUT_U.SIM_V	FC111\ADDIT\CFC_SETP\ PARA_DOS_RM1_VOL.V	Simulation value for the dosing quantity
10	LI111\CFC_LI111\INPUT_U.SUBS_V	FC111\ADDIT\CFC_SETP\ PARA_DOS_RM1_VOL.V	Substitute value for the simulation value SIM_V

Specify run time - "INIT_DOSE" Step

1. Change to the "General" tab.
2. Enter the value "8s" in the "Minimum" box in the "Run times" group.
3. Click "Apply"
   PCS 7 automatically changes the value to "T#8s".

Parameters for the "SLOW_DOWN" Step

The following table shows the parameters for the "SLOW_DOWN" step:

No.	Address 1	Address 2	Meaning
1	FC111\CFC_FC111\CTRL_PID.SP_EXT	10.0	Reduction of the flow setpoint
2	FC111\CFC_FC111\INPUT_U.SIM_V	10.0	Simulation: 10 liters/min flow simulated
3	FC111\CFC_FC111\INPUT_U.SUBS_V	10.0	Substitute value for the simulation value SIM_V

Parameters for the "CLOSE_LINE" Step

The following table shows the parameters for the "CLOSE_LINE" step:

No.	Address 1	Address 2	Meaning
1	NK111\CFC_NK111\VALVE.AUTO_OC	FALSE	Close valve
2	NK112\CFC_NK112\ VALVE.AUTO_OC	FALSE	Close valve
3	NK113\CFC_NK113\ VALVE.AUTO_OC	FALSE	Close valve
4	NK114\CFC_NK114\VALVE.AUTO_OC	FALSE	Close valve
5	NP111\CFC_NP111\MOTOR.AUTO_ON	FALSE	Turn off motor
6	FC111\CFC_FC111\CTRL_PID.LMN_SEL	TRUE	Correction of the manipulated variable to 0 value (close valve)
7	FC111\CFC_FC111\CTRL_PID.SP_EXT	0.0	Active setpoint for flow control
8	FC111\CFC_FC111\CTRL_PID.AUT_L	FALSE	Controller manual mode
9	FC111\CFC_FC111\DOSE.L_START	FALSE	Dosing stopped
10	FC111\CFC_FC111\INPUT_U.SIM_V	0.0	Simulation: Flow volume 0 liters/minute simulated
11	FC111\CFC_FC111\INPUT_U.SUBS_V	0.0	Substitute value for the simulation value SIM_V
12	LI111\CFC_LI111\INT_P.HOLD	TRUE	Track integrator

Parameters for the "END" Step

The following table shows the parameters for the "END" step:

No.	Address 1	Address 2	Meaning
1	FC111\CFC_FC111\CTRL_PID.AUT_L	FALSE	Reset input
2	FC111\CFC_FC111\CTRL_PID.LMN_SEL	FALSE	No correction of manipulated variable
3	NK111\CFC_NK111\VALVE.AUTO_OC	FALSE	Close valve
4	NK112\CFC_NK112\ VALVE.AUTO_OC	FALSE	Close valve
5	NK113\CFC_NK113\ VALVE.AUTO_OC	FALSE	Close valve
6	NK114\CFC_NK114\VALVE.AUTO_OC	FALSE	Close valve
7	NP111\CFC_NP111\MOTOR.AUTO_ON	FALSE	Turn off motor

6.3.3 How to Assign Parameters to the Transitions of the SFC Chart

Introduction

A transition contains the conditions according to which a sequential control system passes control from one step to the next. In principle, you assign parameters for the transitions in the same way as for the steps.

Requirements

- The "SFC_RMT1" SFC chart is open in the SFC Editor.
- The default names of the steps and transitions have been adapted.

Procedure

1. Click the "DOSE_REA1" transition.
   The "Properties" dialog box opens with active "General" tab.
2. Change to the "Condition".
   This tab returns a blank list, that is, the statement lines. The cursor is positioned in the left column of the first line. The layout of the dialog box is the same as you saw when the assigning parameters for the steps.
3. Assign the parameters for the "DOSE_REA1" transition. You will find the entries required in the following table. Below you can see an overview of the steps as a reminder:
   - For address 1, click the "Browse" button to open the "Browse" dialog box and select the relevant I/O
   - Enter address 2
   - Apply your settings
   - Select a new line
   - etc.
4. Select the new transition and enter the addresses.

Note

When entering the addresses, verify that you have selected the required transition based on the title bar of the "Properties" dialog box.

Just as with the parameters for steps, the addresses in the table are specified in the following format:

[chart folder\chart name\block I/O].

The plant hierarchy is omitted.

6.3.4 Parameters for the Transitions

Parameters for the "DOSE_REA1" transition

The following table shows the parameters for the "DOSE_REA1" transition:

No.	Address 1	Operator	Address 2	Meaning
1	FC111\ADDIT\CFC_SETP\ PARA_DOS_RM1_SEL.Q0	=	FALSE	Dosing in reactor 1?
2	FC111\ADDIT\CFC_SETP\ PARA_DOS_RM1_VOL.V	>	0.0	Dosing volume greater than 0?

Parameters for the "INIT_1_OK" transition

The following table shows the parameters for the "INIT_1_OK" transition

No.	Address 1	Operator	Address 2	Meaning
1	NP111\CFC_NP111\MOTOR.QRUN	=	TRUE	Motor on?
2	FC111\CFC_FC111\ CTRL_PID.QSPEXTON	=	TRUE	Controller set to external setpoint?

Parameters for the "INIT_OK" transition

The following table shows the parameters for the "INIT_OK" transition

No.	Address 1	Operator	Address 2	Meaning
1	FC111\CFC_FC111\DOSE.QSTRTDOS	=	TRUE	Dosing started ?
2	FC111\CFC_FC111\DOSE.ER	<	200.0	Dosing quantity: Setpoint – actual value < 200 liters?
3	FC111\CFC_FC111\DOSE.ER	>	0.0	Dosing quantity: Setpoint – actual value 0 > liters?

Parameters for the "END_DOSE" transition

The following table shows the parameters for the "END_DOSE" transition:

No.	Address 1	Operator	Address 2	Meaning
1	FC111\CFC_FC111\DOSE.QEND_DOS	=	TRUE	Dosing ended?

Parameters for the "CLOSE_OK" transition

The following table shows the parameters for the "CLOSE_OK" transition:

No.	Address 1	Operator	Address 2	Meaning
1	NP111\CFC_NP111\MOTOR.QRUN	=	FALSE	Motor off?

Parameters for the "INIT_2_OK" transition

The following table shows the parameters for the "INIT_2_OK" transition:

No.	Address 1	Operator	Address 2	Meaning
1	NP111\CFC_NP111\MOTOR.QRUN	=	TRUE	Motor on?
2	FC111\CFC_FC111\ CTRL_PID.QSPEXTON	=	TRUE	Controller set to external setpoint?

Parameters for the "DOSE_REA2" transition

The following table shows the parameters for the "DOSE_REA2" transition:

No.	Address 1	Operator	Address 2	Meaning
1	FC111\ADDIT\CFC_SETP\ PARA_DOS_RM1_SEL.Q0	=	TRUE	Dosing in reactor 2?
2	FC111\ADDIT\CFC_SETP\ PARA_DOS_RM1_VOL.V	>	0.0	Dosing volume greater than 0?

Close the SFC chart.

6.3.5 How to Optimize the Run Sequence

Introduction

PCS 7 provides you with a function for optimizing the run sequence based on the data flow. You use this function when you have completed the configuration of the CFC and SFC charts.

Requirements

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

Procedure

1. In the tree view, select any folder in which you have saved a CFC chart.
2. Select a CFC chart from the detail view, and then select the menu command **Edit > Open Object**.
   The chart opens in the CFC editor.
3. Select **Options > Optimize run sequence....**
   The message dialog "The run sequence of the blocks will be changed ...." opens.
4. Click "OK".
   The run sequence is optimized.
5. Close the CFC chart.

6.3.6 Current Status of Your Project

Completed configuration tasks

What have you learned during the SFC configuration?

- You have worked with standard functions such as renaming and opening.
- You have created a sequential control system with graphic support.
- You have renamed and assigned parameters to the steps and transitions of the sequential control system.
- You have optimized the run sequence.

Compiling, downloading and testing the charts

7

7.1 Overview of Compiling, Downloading, and Testing

Overview

This tutorial will explain the following to you:

- How to compile the program you have created with CFC and SFC.
- How to download your program to the CPU.
- How to run your program in test mode.

This allows you to check the correct functionality of the charts. You already been introduced to the "Download" function when you downloaded the hardware configuration.

You perform two steps in conjunction with creating the chart:

- First, you compile and download the blocks and charts – for this task, you use the "Compile and Download Objects" function.
- Then, you test the program – you can test both in the SFC Editor and in the CFC Editor.

7.2 How to Compile and Download CFC and SFC Charts

Introduction

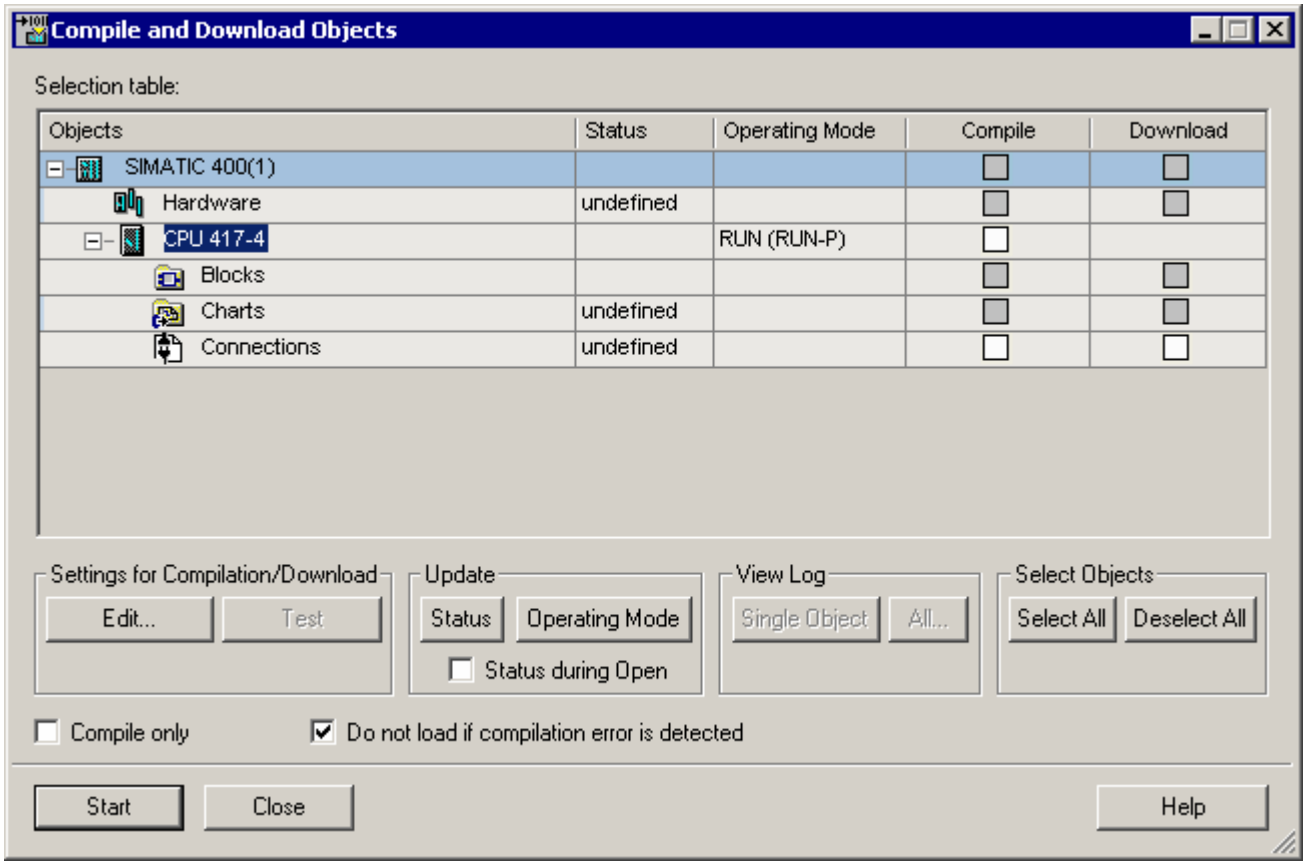
You have created the CFC and SFC charts for your "color_gs" project. These charts must be compiled and loaded in a CPU for the automation functions to be executed by the AS. The compile and download operation are started in a common dialog box and run one after the other.

Requirements

- The green "RUN" LED on the CP is active.
- The CPU is in "STOP" mode.
- The example project is open in SIMATIC Manager.
- The component view is activated.

Procedure

1. Select the "color_gs_MP/ color_gs_Prj/ SIMATIC 400(1)" folder from the tree view.
2. Select the menu command **PLC > Save and Compile Objects...**.
   The "Save and Compile Objects" dialog box opens.
3. Click "+" to expand the tree view.
   The view shows a structure of the "color_gs" project which is basically similar to the component view of SIMATIC Manager.
   The view shows status or operating state information for each object:



4. Select the "Compile" and "Download" check boxes for the "Charts" object.

5. Select the "Charts" entry and click "Edit..." in the "Settings for Compilation/Download" area.
   The "Compile Program / Download to Target System" dialog box opens and the "Compile Charts as Program" tab is selected. The "Entire program" option is automatically selected since you are starting the compile and download operation for the first time.

Note

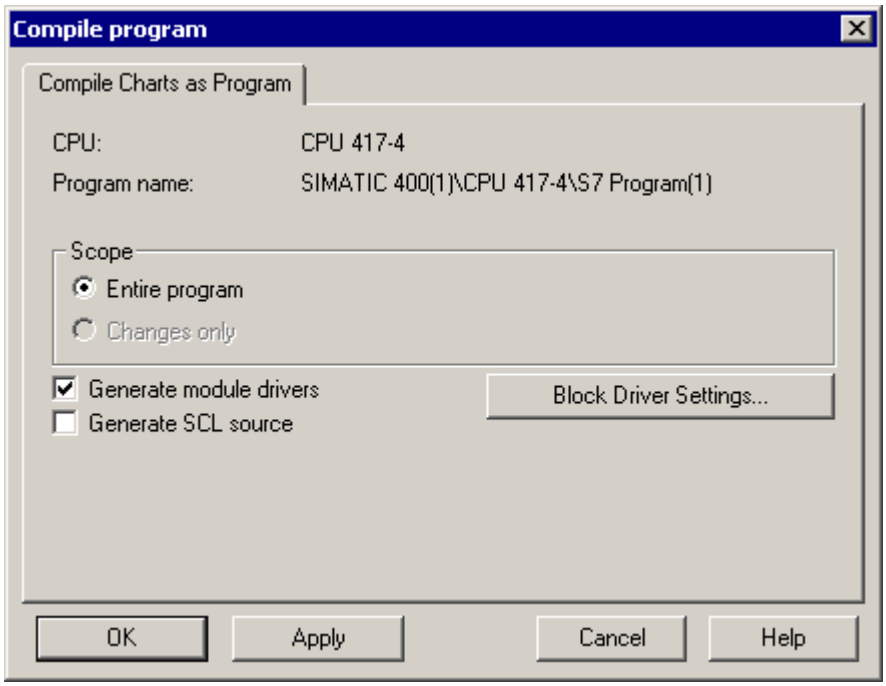
If you have discovered errors in your program during testing, you must correct your CFC and SFC charts to eliminate the errors. When you restart the compiling and downloading thereafter, make sure that you select the "Changes only" option.

This will save you a considerable amount of time when compiling and downloading.

6. Activate the "Generate module drivers" check box.
   This option generates the module drivers for the signal-processing blocks.

Note

You can remove empty runtime groups by selecting the menu command **Edit > Delete Empty Runtime Groups**.



7. Click "OK" to apply your settings.
   The dialog closes and the message "Remember that if you download later (...), the blocks will be deleted on the CPU" opens.
8. Click "OK".
9. Check the settings of the following check boxes in the lower area of the "Compile and Download Objects" dialog box:
   - Compile only: deactivated
   - Do not load if compilation error is detected activated

10. Click the "Start" button to start the compile and download operation.
    The message "Downloading program changes during operation can, in the case of malfunctions or program errors, cause serious damage to personnel and equipment! Make sure..." opens.
11. Click "OK".
    The message dialog "If you want to download changes online, please make sure that ... Do you want to continue?" opens.
12. Click "Yes".
    The compile and download operation starts.

Note

The progress display indicates which step PCS 7 is currently performing, for example:

- "Compiling and downloading object"
- "Compiling charts as program"

When the operation is finished, the log file opens in a text editor.

13. Ignore the message:
    " ...-> Object compilation was executed (with warnings).
    The message is generated because you have not yet integrated I/O modules in your project.
14. Close text editor.
    The status in the "Charts" line is now "downloaded".

Note

If warnings or errors are shown in the log file following compilation, select the "Charts" object in the tree view and click "Single Object". This opens the "Logs" dialog box. There you can view the detailed warnings and error messages.

15. Click "Close" in the "Compile and Download Objects" dialog box.
    The dialog box closes.
16. Start the CPU.

7.3 Testing the Program

Introduction

You can test your program both in the SFC Editor and in the CFC Editor. In test mode, you can watch how the values change during the course of the process. Using test mode, you can make sure that your configured sequential control system runs free of errors.

Test mode in SFC

The test is made in the SFC Editor that you already got to know when you created the SFC chart: The "Properties" dialog box plays a central role in test mode.

If you double-click on a step or a transition in the SFC chart, the "Properties" dialog box opens. Just as during creation of the SFC chart, you can use the arrow buttons to change from one step or transition to the next. In test mode, the dialog boxes also provide additional information:

- In the properties dialog of a step, you see the actual values on the left beside address 1 and the setpoints on the right beside address 2.
- In the properties dialog of a transition, you see the respective current values to the left of address 1 and to the right of address 2.

NOTICE
You can modify all values in the white fields. Remember, however, that these values are written directly into your configuration data and therefore change the parameters of your SFC chart. While working through the Getting Started, you will not change any values; rather, you will use the "Properties" dialog boxes only for the purpose of monitoring.

Test mode in CFC

You start the test mode in CFC in the CFC Editor. You will be able to have the process values displayed at the individual block I/Os and to monitor the changes.

7.4 How to Test the Program in the SFC Editor

Introduction

After you have compiled and downloaded the program you can run it in test mode. This way you can check if the sequential control system is working and the program is running correctly.

Requirements

- The example project is open in SIMATIC Manager.
- The "SFC_RMT1" SFC chart is open in the SFC Editor.
- The CPU is in "RUN" mode.

Working in test mode

1. Select the menu command **Test > Test mode**.
   The program enables test mode.
   - In the title bar of the SFC Editor, the name "SFC_RMT1 – color_gs_Prj\Plant1\RMT1 ONLINE" is shown on a colored background.
   - In the lower part of the SFC editor, you can see the status of the program, the operating mode, and the step control mode. The operating mode is set to "MANUAL" by default. The current step control mode is displayed in the drop-down list and is set to "T" by default.
   - In the lower part of the SFC Editor, there are also buttons for controlling the SFC chart, for example, for starting, holding, resuming.
2. Select the menu command **Test > Step Control Mode > T or M**.
   This mode activates an additional "O" command button next to the transition while the SFC chart is running.
   The run sequence reacts as described by the table below.
3. Click the "Start" button to run the program.
   The SFC chart starts.
   - Each step that is currently being executed is displayed in light green and with a small arrow pointing right.
   - Steps that have already been worked through are displayed in dark green and with a small check mark.
   - Transitions that are active but not yet satisfied are shown on a brown background.
   - If you performed your configuration correctly, the entire SFC chart will be worked through to the end and all the steps will turn dark green and have a check mark beside them. Otherwise, you can click the "C" button to manually enable the next step although the transition is not satisfied.
4. Select the menu command **Test > Test mode**.
   Test mode closes.

Characteristics of the sequential control system

If the chart…	… the sequential control system will do the following:
is free of errors	the sequential control system is executed step-by-step according to the configured parameters. You do not need the button.
contains errors	the sequential control system stops if the transition is not satisfied. You can click the "C" button to pass control to the next step regardless of whether the transition is satisfied.

7.5 How to Test the Program in the CFC Editor

Introduction

You can test CFC charts in the CFC Editor in the same way as SFC charts.

Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.
- The "SFC_RMT1" SFC chart is open in the SFC Editor.
- The "CFC_FC111" CFC chart is open in the CFC Editor.

Procedure

1. Select the menu command **Test > Test mode**.
   Test mode is activated.
2. Press the "CTRL" key and select the following blocks:
   – CTRL_PID
   – INPUT_U
   – DOSE
3. Select the menu command **Test > Monitoring On**.
   All block connections which are enabled for debugging in the block properties are displayed.
4. Switch to the "SFC_RMT1" SFC chart.
5. Click the "Start" toolbar button.
   This starts the program.
6. Switch to the "CFC_FC111" chart.
   You can monitor all changes to values in this chart: for example, the current value of the dosed volume is displayed at the "PV_OUT" output of the "DOSE" block.

Note

Arrange the windows one beside the other to be able to watch the CFC and the SFC chart at the same time in test mode.

7. Select the menu command **Test > Test mode**.
   This closes test mode.
8. Close the SFC Editor and the CFC Editor.

7.6 Current Status of Your Project

Completed Configuration Tasks

By this time, you have completed almost all of the configuration steps in SIMATIC Manager and in the CFC Editor and SFC Editor. You have compiled and downloaded this configuration, and you have observed the project execute in the SFC and CFC Editors.

This enabled you to make sure that your configuration is thus far error-free. If you find that your project has errors when it runs in the test mode, it is much easier to located the error at this stage than after the entire project is completed.

Configuring the operator station

8

8.1 Operator Station in Process Mode

Purpose of the Operator Station

The plant operator can operate and monitor the process on the operator station (OS) in process mode. So-called process pictures are displayed to the operator for this purpose. The automation system (AS) controls the process (open-loop and closed-loop control) and the OS reads the process values from the AS and displays the values graphically in the process pictures. Warnings and alarms are also displayed in the process pictures as soon as process values reach or exceed certain specified limits. This allows the operator to identify the location in the plant at which a problem occurs.

You will create one process picture for your "color_gs" project that will allow you to observe the fill level of the raw material container, the status of the valves etc.

8.2 Configuring the Operator Station

The operator station in the project

At the time you created a project with the PCS 7 "New Project" wizard, PCS 7 automatically created an operator station. You have already configured this operator station in HW Config. You have not, however, created a network connection for this OS as you did for the communication between the automation system and the engineering station to enable you to download data from the ES to the AS. This is not necessary for the "color_gs" project because the engineering station and the operator station are on the same computer and the operator station uses the same connection to the AS as the ES.

Process pictures in the project

The PCS 7 wizard also creates pictures automatically in the plant hierarchy, which you then configure in the OS. Larger projects have multiple process pictures for the various components of the plant. For the "color_gs" project, you only have to configure a single picture. During configuration you will nevertheless become familiar with all the basic functions of the OS.
Pictures are labeled with the following icon: 

8.3 Working in the SIMATIC Manager

8.3.1 Preparations in SIMATIC Manager

Overview

Before you start to configure in the OS, there are a few preliminary steps to be performed in SIMATIC Manager:

Step	What?
1	Adapt picture names and activate the function for creating block icons (Page 158)
2	Delete unnecessary pictures (Page 160)
3	Create block icons (Page 161)
4	Compile OS (Page 164)

Editing the picture properties

Since the PCS 7 "New Project" wizard has already created pictures, these pictures have default names, just like the CFC chart. You first have to adapt these default names to suit your project requirements by assigning short descriptive names to them.

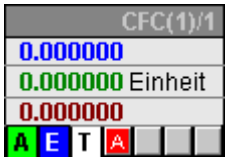
You also need to activate the function for creating block icons.

Deleting unnecessary pictures

When you create a project with the PCS 7 wizard, pictures are automatically inserted in every hierarchy folder of the plant hierarchy. Since you only require one picture in your "color_gs" project, you must remove the unnecessary pictures from the PH.

Creating block icons

PCS 7 provides you with the "Create block icons" function. Block icons are inserted in process pictures and provide the operator with the most important information on a process tag at a glance. For example, in the block icon for a controller, the operator sees the process value (PV), the setpoint (SP) and the manipulated value (OUT). The block icon for a controller is displayed in a process picture as shown below:



Compiling the OS

You must execute the "Compiles OS" function after you finish configuring all of the data in SIMATIC Manager and before you start configuring the OS data of the OS. All the data from SIMATIC Manager, such as variables, messages, texts, plus the hardware and connection configurations must be "made known" to the OS.

Starting the OS

You have to start the OS to continue configuring it. You then perform other steps in WinCC Explorer.

8.3.2 How to Edit Picture Properties

Introduction

You make the following settings for editing the picture properties:

- Change the name of the picture
- Select the option for creating block icons

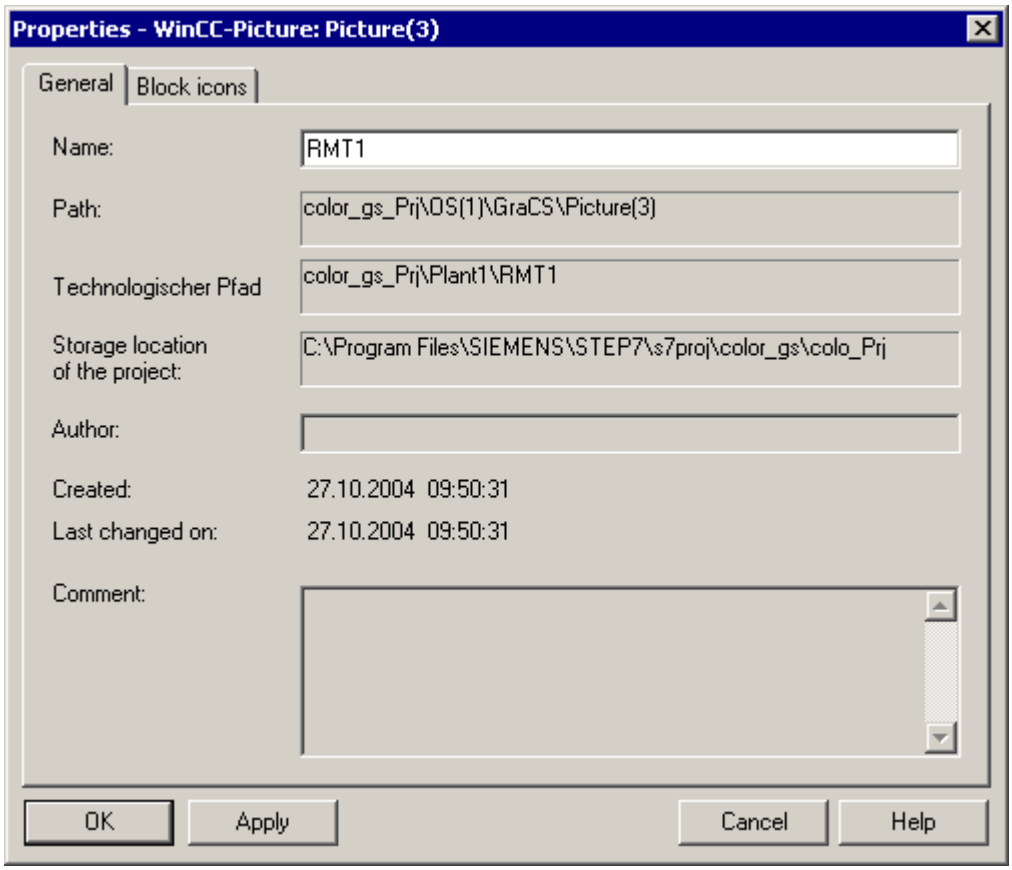
Requirements

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

Procedure for Changing the Picture Name

1. Select the "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1" folder from the tree view.
2. Select the picture "Picture(3)" in the detailed window.
3. Select the **Edit > Object Properties** command.
   The "Properties - WinCC Picture: Picture(3)" dialog box opens with active "General" tab.

4. Change the default name "Picture(3)" to "RMT1" in the "Name" box.



5. Click "Apply" to enter your settings.

Procedure for Creating Block Icons

1. Change to the "Block icons" tab.
2. Select the "Derive block icons from the plant hierarchy" check box.
3. Click "OK" to save your entries.
   The program closes the dialog box and displays the new picture name in the plant hierarchy.

Video

8.3.3 How to Delete Unnecessary Pictures

Introduction

The PCS 7 "New Project" wizard creates a picture in every hierarchy folder by default. In the "color_gs" project, you require only one picture since all the required data can be represented clearly in one picture.

Requirements

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

Procedure

1. Select the "Plant1" folder in the tree view.
2. Select the picture "Picture(2)" in the detailed window.
3. Press <DEL>.
   The "Delete" dialog box opens.
4. Click "Yes".
   The program deletes the picture.
5. Repeat steps 1 through 4 for the following folders in the plant hierarchy:

Name of the Folder	Name of the Picture
FC111	Picture(4)
ADDIT	Picture(5)

8.3.4 How to Create Block Icons

Requirements

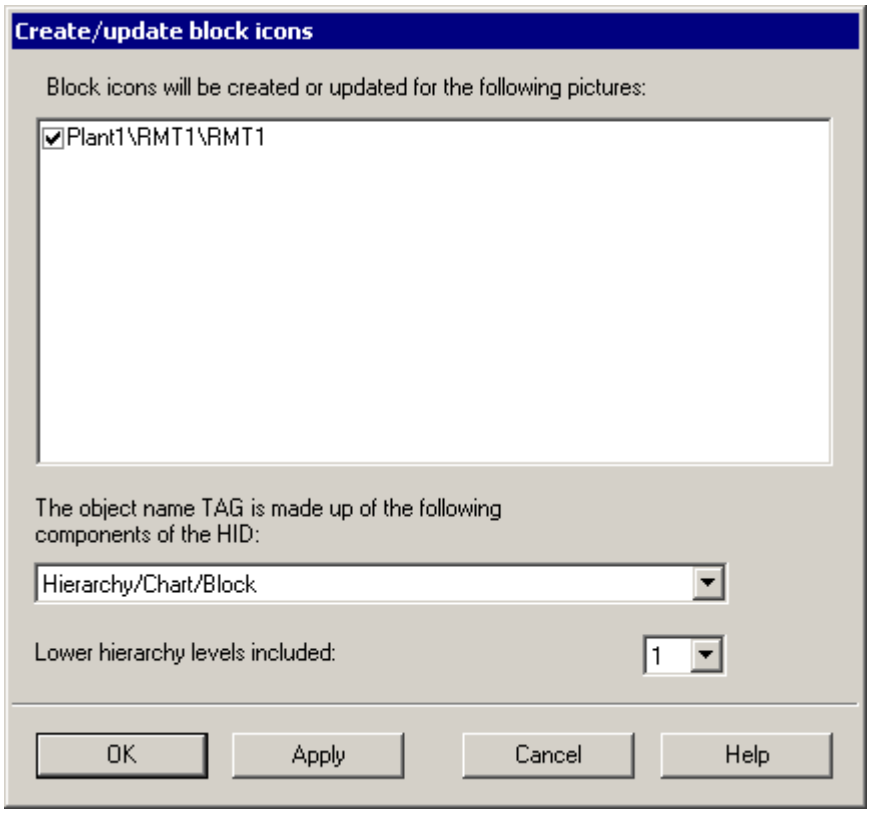
- The example project is open in SIMATIC Manager.
- The plant view is activated.
- The option for creating block icons is selected.

You can information about these settings in the section "How to Work with Picture Properties (Page 158)".

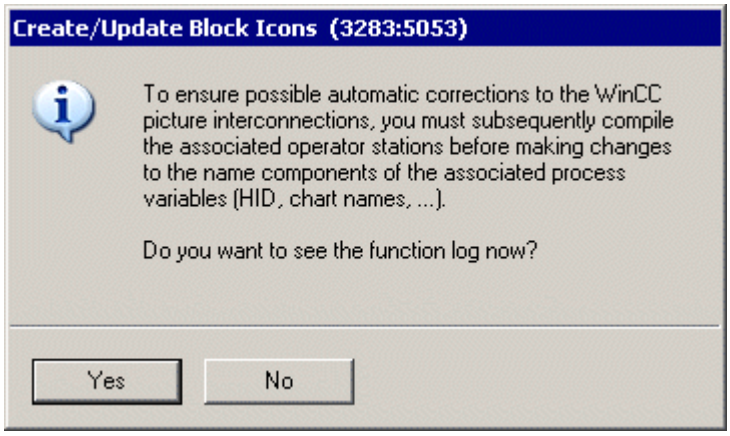
Procedure

1. Select the "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1" folder from the tree view.
2. Select the **Options > Plant Hierarchy > Create/Update Block Icons...** command. The "Create/Update Block Icons" dialog box opens. The list contains the pictures for which block icons have been created. In this Getting Started, the picture is called "Plant1\RMT1\RMT1".

3. Check the following settings:
   - Check box in front of the "Plant1\RMT1\RMT1" picture is selected.
   - The value "1" is entered in the "Lower hierarchy levels included" box.



4. Click "OK".
   The program starts generation of the block icons.
   The message dialog "For any later... you must subsequently compile the participating operator stations... Do you want to view the function log now?".



5. Click "No".
   The program completes generation of the block icons and closes the dialog box.

For the moment, you cannot see any visible results of this function. Only when you open the process picture for the "color_gs" project do the block icons that were created become visible.

8.3.5 How to Compile the OS

Introduction

Before configuring the data in the OS, you have to compile the OS. With this function, all the data from SIMATIC Manager, such as variables, messages, texts, plus the hardware and connection configurations are "made known" to the OS. Do not confuse compiling with downloading: When you compile, the data remains on the engineering system computer – it is simply made known to the OS so that you can access this data during configuration.

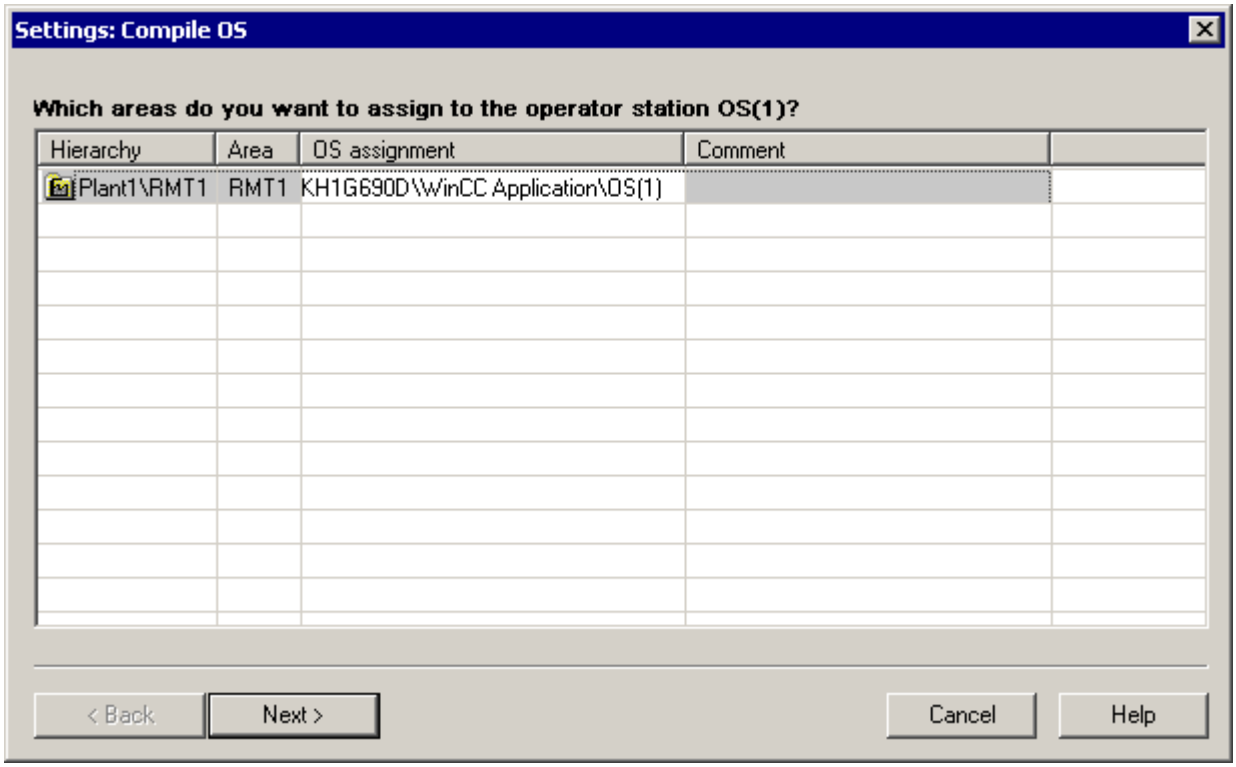
Requirements

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

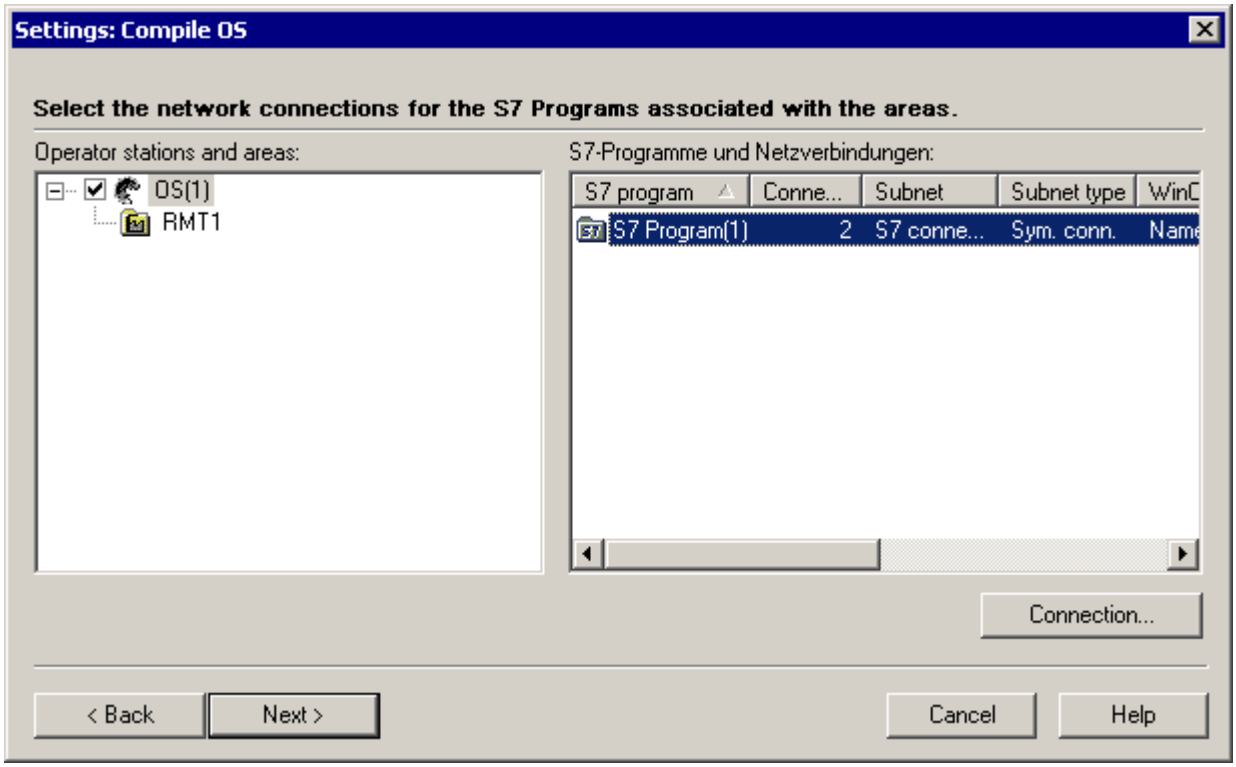
Procedure

1. Select the "color_gs_MP/ color_gs_Prj/ [name of the SIMATIC PC station]" entry from the tree view.
2. Select the menu command **PLC > Save and Compile Objects...**.
   The "Save and Compile Objects" dialog box opens.
3. Open the tree view and select the "Compile" check box for the "OS(1)" object.

4. Select the "OS(1)" object and click "Edit".
   The "Which areas do you want to assign to operator station OS(1)?" dialog box opens.
   You can ignore this setting as you have not yet created more than one area / one OS in this project.



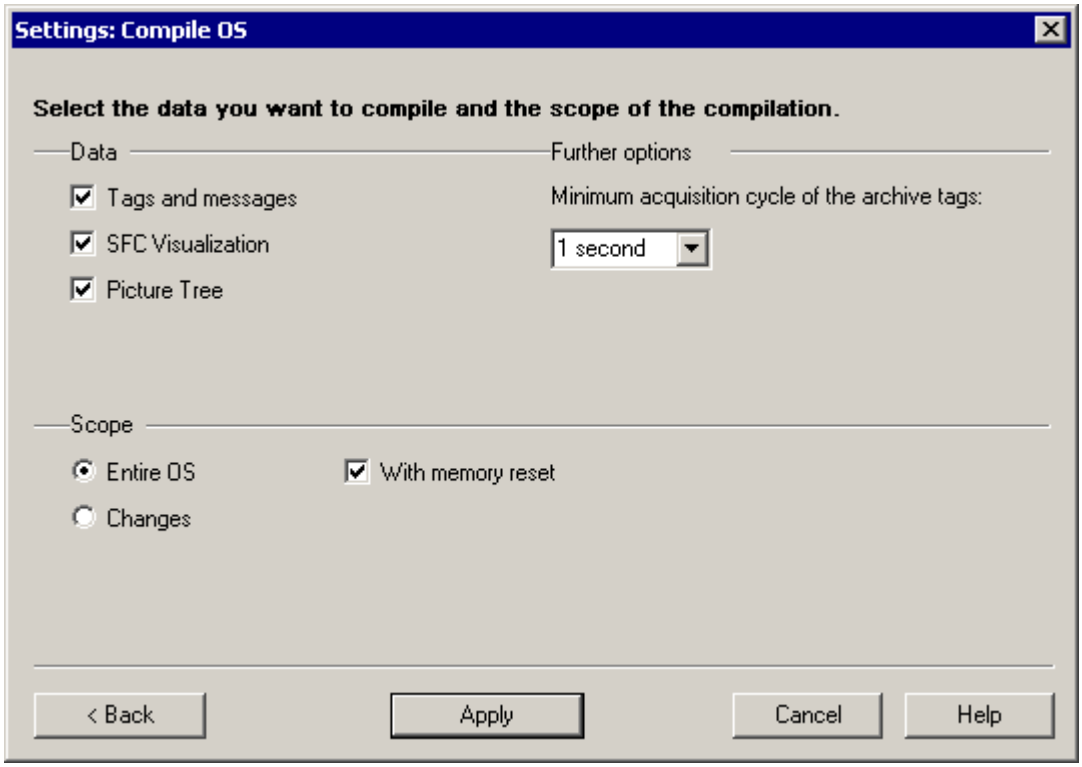
5. Click "Next >".
   The "Select the network connections for the S7 programs associated with the areas" dialog box opens.
   In the "S7 programs and network connections" group, you will find the entry "S7 connection" and the subnet "Sym. conn.": This is the connection that the automation system and operator station use for communication and that you already created in NetPro.



6. If no connection is displayed here, click "Connection...".
   Select the S7 connection you have made in NetPro from the "Select network connection" dialog box and then click "OK".
   The selected connection is entered.
7. Click "Next".
   The "Select the data you want to compile and the scope of the compilation" step opens.

8. Select the following check boxes and options:

Area	Check box / option
"Data"	"Tags and messages" "SFC visualization" "Picture tree"
"Scope"	"Entire OS with memory reset"



1. Click "Apply".
2. The dialog box "Settings: Download OS" opens.
   The message dialog "If you want to download changes online... Do you want to continue?" opens.
3. Click "Yes".
   Compilation is started and a progress bar is displayed.
   When compilation is completed, the log file opens in a text editor to show you whether or not the compilation was executed without error.
4. Close the text editor.
5. Click "Close" in the "Compile and Download Objects" dialog box.

8.3.6 How to Start the OS

Introduction

You have now completed all the preparation steps for configuring the OS in SIMATIC Manager, and you can now start to configure the OS. To do so, first open the OS.

Requirements

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

Procedure

1. Select the "color_gs_MP/ color_gs_Prj/ SIMATIC PC-Station/ WinCC Application/ OS(1)" object from the tree view.
2. Select the **Edit > Open Object** command.
   the PCS 7 OS - WinCC Explorer opens.

8.4 Working on the OS

8.4.1 Structure of the OS - WinCC Explorer

Introduction

WinCC Explorer provides you with a series of editors that you can use to configure an OS. But for configuring the OS you will only use a few of these editors.

What is the basic structure of WinCC Explorer ?

In principle, the structure of WinCC Explorer is very similar to Windows Explorer::

- In the left pane, there is a navigation window. Here, you will find all the editors for configuring the PCS 7 OS.
- In the right pane, there is a detailed window in which detailed information on the entry selected in the navigation window is displayed.

You only work with Graphics Designer in the "color_gs" project. This is the tool you use to create process pictures. You do not require any other editors to configure the OS.

8.4.2 Function of process pictures

Process Pictures

Process pictures represent the process-related equipment to the operator. The process is operated here and system statuses are displayed.

The process picture you will create for the "color_gs" project already exists in the plant hierarchy in SIMATIC Manager.

You edit the process picture in the "Graphics Designer" editor. You insert the desired static and dynamic objects and interconnect them.

8.5 Working in general with the Graphics Designer

8.5.1 Introduction to the Graphics Designer

User Interface

The Graphics Designer is one of the editors of the OS. The user interface of the Graphics Designer is structured as follows:

- On the left side, you will see a color palette that you can use to assign certain colors to the objects.
- In the middle is the drawing board on which you insert the objects for the process picture.
- In the right section, you will see the object palette. This is the library containing the various standard objects provided by the Graphics Designer. You will also see a style palette on the right side that you use to format the objects.

Libraries

The libraries of the Graphics Designer contain a wide selection of ready-to-use graphic elements, such as piping and valves. You can modify these elements or add to them and store them in your own project libraries so that they are available to you at any time.

Objects

The Graphics Designer distinguishes between two different types of objects:

- Static objects – these objects are purely drawing objects as you would find in a drawing program, for example lines, circles, polygons or static text.
- Dynamic objects -- these objects are made dynamic via a connection to a block I/O (tag). In process mode these objects always display the current values of a process tag of the process cell. In the "color_gs" project, you will get to know various dynamic objects.

8.5.2 How to Open a Process Picture

Introduction

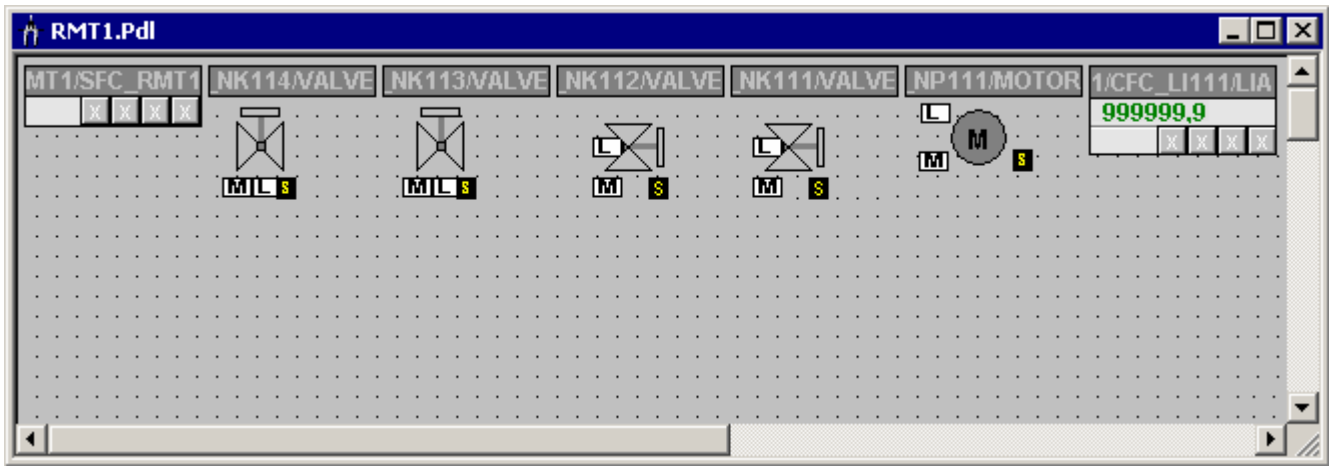
You edit the process picture in the OS. You use the "Graphics Designer" editor for this.

Requirement

The example project is open in WinCC Explorer.

Procedure

1. Select the "Graphics Designer" entry on the navigation window.
   The detail view shows all pictures belonging to the project. All the default pictures and template pictures provided by PCS 7 are, of course, also displayed. These can be identified by the "@" character in front of the name.
2. Double-click the "RMT1.pdl" picture file in the detail view.
   The process picture opens in Graphics Designer.
   The view shows that this process picture already contains objects although you have not yet inserted any. These are the block icons that you created in the process picture with the "Create block icons" function in SIMATIC Manager. You can also see that the block icon for the valve has been inserted both in the horizontal alignment and vertical alignment variants. These two variants are influenced by the setting in the process object view in the "Picture Objects" tab that you made when assigning parameters for the CFC charts.



Note

The sequence of the block icons in your process picture may differ from the sequence in the diagram above

8.5.3 How to Open the Various Toolbars

Introduction

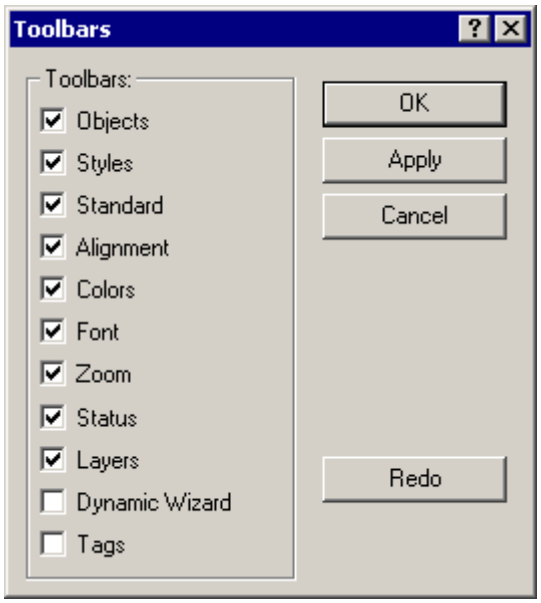
The most important toolbars and palettes are open by default. If you inadvertently close toolbars or palettes, you should know how to make them visible again.

Requirement

The process picture is open in the Graphics Designer.

Procedure

1. Select the menu command **View > Toolbars**.
   The "Toolbars" dialog box opens. Here, you see all the toolbars provided by the Graphics Designer.
2. Make the same settings for the toolbars as shown in the screenshot of the dialog box:



3. Click "OK" to apply your settings.
   This displays the selected toolbars in the object palettes.

The object palette contains two tabs:

- "Standard" tab
- "Controls" tab

In Getting Started, you will only use the "Standard" tab.

8.5.4 Objects in the Graphics Designer

Objects in the Graphics Designer

Before you get started on the actual configuration in the Graphics Designer, it is time for some theory relating to the various objects that you will use to create the "RMT1.pdl" process picture. These objects include the following:

- Static Objects
- Text Fields
- I/O fields

You also receive some background information on interconnecting tags – this is the way you create the relationship between the process picture and the process tag.

8.5.5 What Are Static Objects?

Static Objects

To visualize equipment, such as a pipe or a tank, you require static objects. These objects do not change while in process mode; in other words, they are not influenced by a status or by a value of a process tag.

8.5.6 What Are Text Fields?

Text Fields

In a text field, you can enter any information that you want the plant operator to see in the process picture. You can, for example, insert a text field to allow you to label objects and to simplify the assignment of the picture objects to the process for the operator. You can enter any text in these text fields and can position the text fields anywhere in the process picture.

For the "color_gs" project, you will insert text fields with appropriate labels for all the process tags.

8.5.7 What Are I/O Fields?

I/O fields

I/O fields are used for inputting and outputting values. There are different types of I/O fields:

- Output field
- Input field
- Combined input and output field

I/O fields can process different data formats, such as binary, decimal, string, hexadecimal.

Just as for all other objects, you can also select different formats and make different settings for I/O fields.

In the "color_gs" project, you will use an I/O field to selectively control dosing to either reactor 1 or 2.

8.5.8 How Does Tag Interconnection Work?

Tag interconnection

Tag interconnection is a central function when you create process pictures: Objects are entered in the process picture that represent the process values of a process tag in the process mode. With the tag interconnection, you create the connection between the object in the process picture and the actual process tag. This enables the OS to receive data from the AS, to display the data in the process picture and to update the data.

8.6 Creating the process picture

8.6.1 How to Insert Pipes and a Tank into the Process Picture

Requirements

- The "RMT1" process picture is open in the Graphics Designer.
- The block icons are available.
  Do not yet start editing these icons. You must first create a picture of the equipment with the static objects before you can move the icons to the positions where they require information.

Procedure

1. Select the menu command **View > Library**.
   This opens the OS libraries.
2. Select the "Global Library/PlantBlocks/Tanks/Tank4" and move it to the drawing board using a drag-and-drop operation.

   Note

   Click on the "Eyeglasses" button in the toolbar to obtain a preview of the graphic objects.

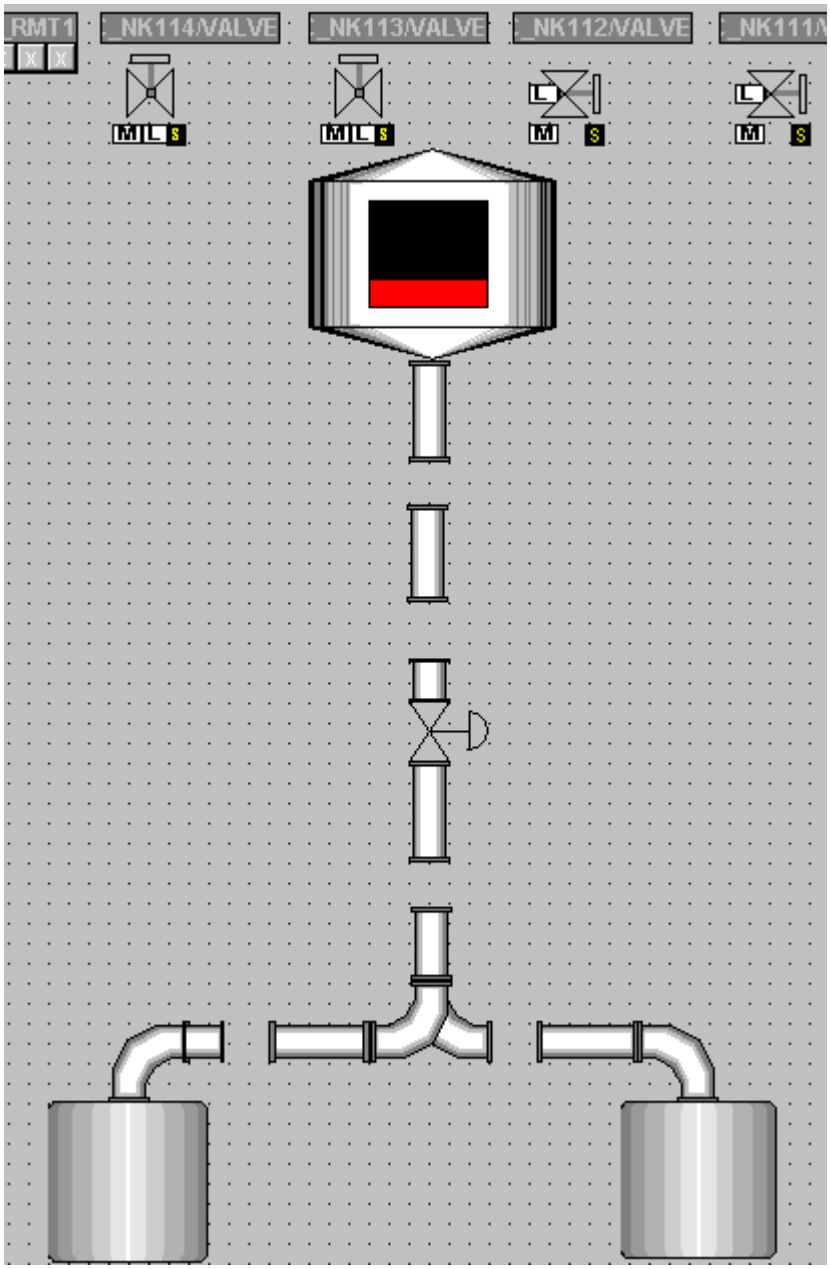
   Video

3. Drag additional objects to the drawing board as shown in the table below.
4. Close the library.

5. Select an object and adapt its size and position to match the following picture:
   - You can move the object by positioning the mouse pointer on the object, holding down the mouse button and dragging the object to the required location.
   - You can increase or decrease the size of the object by positioning the mouse pointer on the corner handles of the object, holding down the mouse button, and dragging to make the object larger or smaller.

Name of the object	Number	Path in the library
Horizontal pipes	3 x	Global Library/PlantElements/Pipes - Smart Objects/3D Pipe Horizontal
Vertical pipes	5 x	Global Library/PlantElements/Pipes - Smart Objects/3D Pipe Vertical
Angle	1 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	1 x	Global Library/PlantElements/Pipes - Smart Objects/3D Pipe Elbow 3
Angle	1 x	Global Library/PlantElements/Pipes - Smart Objects/3D Pipe Elbow 4
Control valve	1 x	Global Library/Symbols/Valves/30
Tanks representing reactors	2 x	Global Library/Siemens HMI Icon Library/Tanks/Tank1


RMT1
_NK114/VALVE
_NK113/VALVE
_NK112/VALVE
M L S
M L S
M S
M S

8.6.2 Labeling the Parts of the Plant

Overview

The parts of the plant are labeled in three separate steps:

Step	What?
1	Insert and Format Text Field (Page 179)
2	Set Text Field (Page 180)
3	Duplicate Text Field (Page 181)

8.6.3 Step 1 - How to Insert a Text Field

Requirements

- The "RMT1.pdl" process picture is open in the Graphics Designer.
- The static objects have been inserted.

Procedure

1. Select "Standard Objects/Static Text" in the object palette.
2. Use the mouse to navigate to the drawing area.
   The mouse pointer transforms into a small text input symbol.
3. Draw a text field next to the reactor.
   A rectangle is inserted and the text within it is already selected.
4. Change this text to "Reactor 1".
5. Press the Enter key to apply the text.
6. Now format the text field using the Style Palette:
   - Select the text field and click on the "Line weight/invisible" entry.
     This hides the frame of the text field.
   - Select the text field and click on the "Fill pattern/transparent" entry.
     This makes the color of the text field transparent.

Video

8.6.4 Step 2 - How to Set the Text Field

Requirements

- The "RMT1.pdl" process picture is open in the Graphics Designer.
- The text field is inserted and selected.

Procedure

1. Select the menu command **View > Properties**.
   The "Object Properties" dialog box opens with active "Properties" tab.
2. Select the "Static text" entry from the tree view.
   The detail view shows the name of the text field and the level.
3. Switch to the detail view and then double-click the "Static Text 1" input box in the "Static" column.
   You can now edit text in this input box.
4. Type in the name "Reactor 1" and then press ENTER.
   This saves this name and displays it in the top row. If you are working on the drawing board, this name will be displayed as a tooltip whenever you move the mouse over the object.
5. Select the "Static Text/Font" entry in the tree view.
6. Switch to the detail view. Double-click the value "no" in the box next to the "bold" attribute.
   The values changes from "no" to "yes" and the text is assigned the "bold" attribute.
7. Close the "Object Properties" dialog box.
   All changes are shown.

Video

8.6.5 Step 3 - How to Duplicate the Text Field

Requirements

- The "RMT1.pdl" process picture is open in the Graphics Designer.
- The text field is inserted.
- The settings for text fields have been made.

Procedure

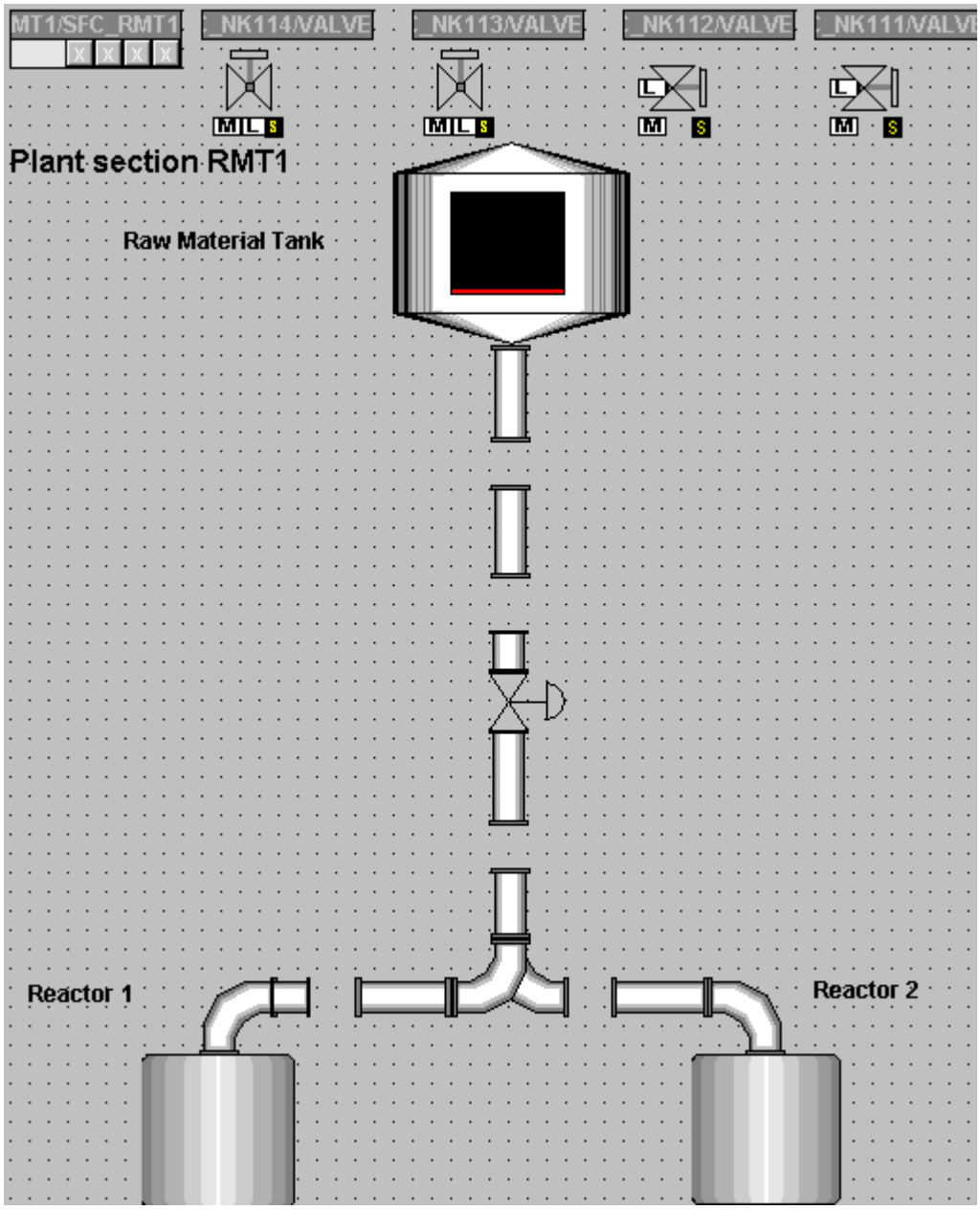
To avoid having to repeat all the settings you made for the first text field, you duplicate the existing text field and simply overwrite the existing text.

1. Select the text box if it is no longer marked and then select the **Edit > Duplicate** command.
   The program duplicates the text box.
2. Double-click in the text box and change the text to "Reactor 2".
   The duplication functions automatically sets all other formats.
3. Select the **View > Properties** command.
4. Change the object name to "Reactor 2" in the detailed window.
5. Position the text field next to the object.
6. Repeat steps 1 to 5 to create the following text fields:
   - Raw material tank
   - RMT 1 part of the plant
7. Open the properties for the text field "Unit RMT 1" and the entry "Static Text/Font in the tree view.
8. Switch to the detailed window and enter the value "16" for the "Font Size" attribute.
9. Close the "Object Properties" dialog box.
10. Position the text fields as follows:
    - Raw material tank – left next to the raw material tank
    - RMT 1 part of the plant – in the upper left corner of the process picture
11. Select the **File > Save** command.
    The program saves the process picture.

8.6.6 Current status of the process picture...

Result

Now that you have inserted the tank, the pipes, and the labeling, your process picture should look like the one below:



8.6.7 How to Connect the Raw Material Tank with the Process Value

Introduction

The tank you inserted in your process picture represents the raw material tank. In order to display the current fill level of the raw material tank in process mode, you now connect this tank with the relevant block.

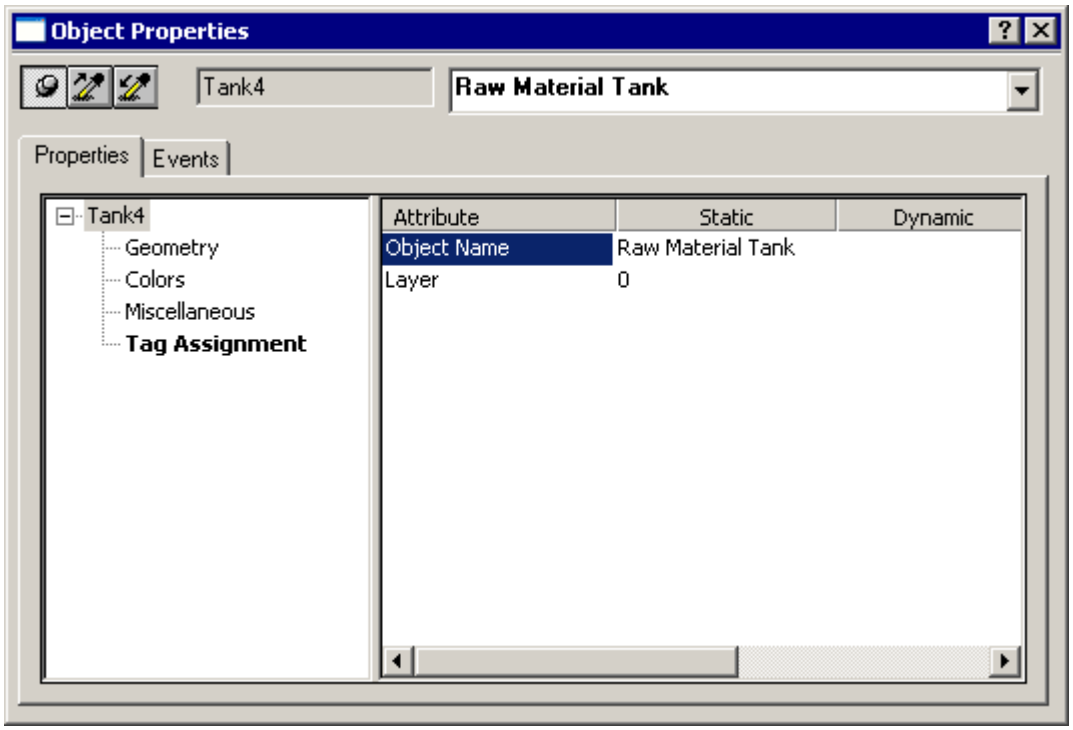
Requirements

- The "RMT1.pdl" process picture is open in the Graphics Designer.
- The static objects have been inserted.

Procedure

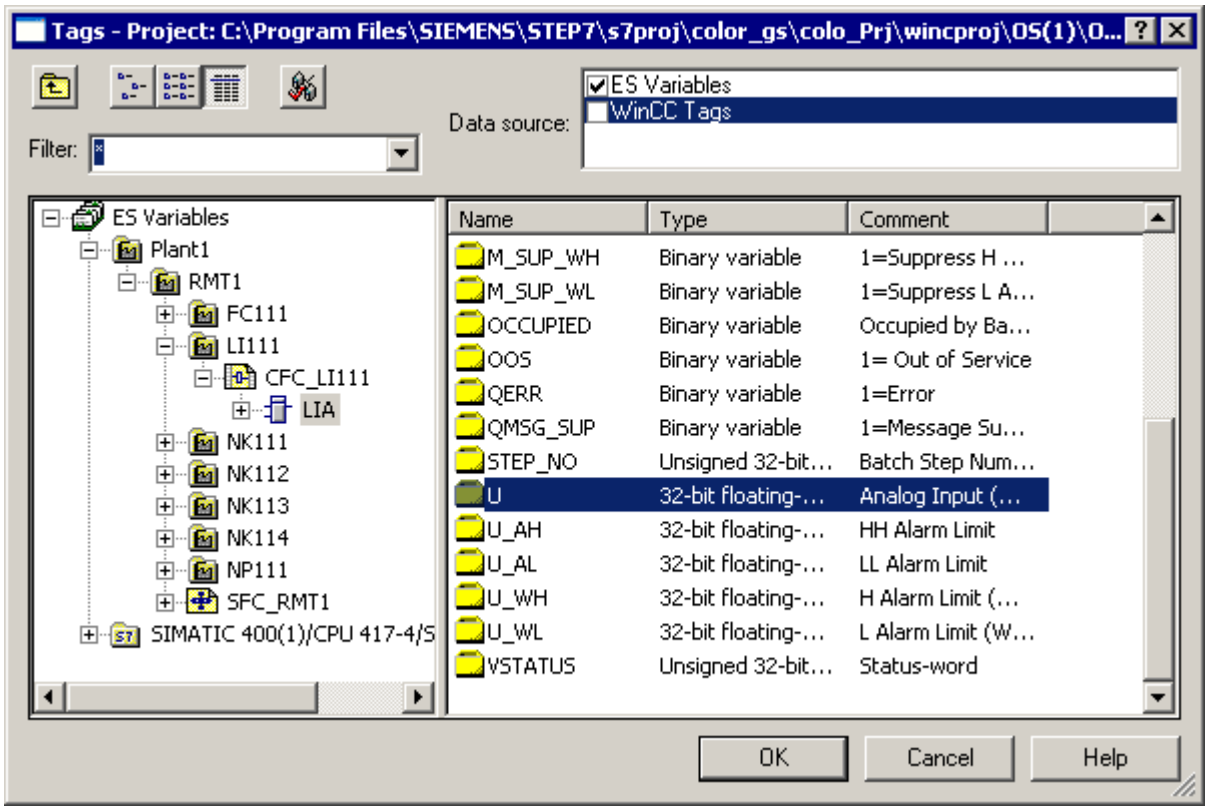
1. Select the "Tank4" object which represent the raw materials tank.
   The name of the object is shown in the tooltip that appears when you place the cursor on the object.
2. Select the **View > Properties** command.
   The "Object Properties" dialog box opens with active "Properties" tab. Tank4" is selected in the tree view and the "Object name" and "Layer" attributes are displayed in the detailed window.
3. Change to the detail view and then double-click the "Tank4" input box in the "Static" column.
   You can now edit text in this input box.

4. Enter the name "Raw material tank1" and press the "Enter" key.

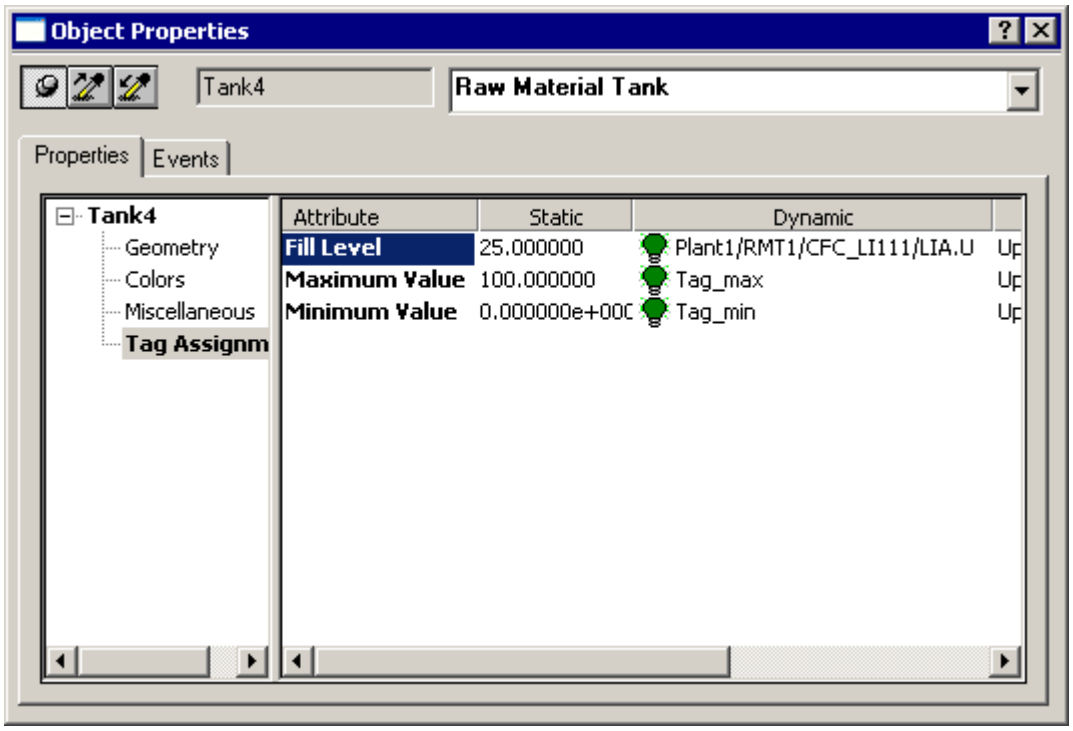


5. Select the "Tank4/Tag Assignment" entry in the tree view.
6. Change to the detailed window. Position the cursor on the "light bulb" icon for the "Fill Level" attribute, and open the context menu.
7. Select **Tag...**
   The tag selection dialog box opens.
8. Select the "ES tags" check box from the "Data source" group and deactivate the "WinCC tags" check box.
   The tree view displays the ES tags.
9. Select the
   "ES tags/ Plant1/ RMT1/ LI111/ CFC_LI111/ LIA" entry from the tree view.
   The detail view displays all ES tags.

10. Select the "U" variable in the detailed window:



11. Click "OK".
    The program writes the tag and its full path to the "Dynamic" column.



12. Double-click the value "100" at the "Maximum value" attribute in the "Static" column.
    The "Value input" dialog box opens.
13. Enter the value "600" in the "Maximum value" input box and click "OK".
    The program saves this value.
14. Accept the parameters for the minimum value.
15. Close the "Object Properties" dialog box.
16. Select the **File > Save** command.
    The program saves the process picture.

8.6.8 How to Position the Block Icons

Introduction

Your process picture already contains block icons that you inserted in SIMATIC Manager using the "Create/Update Block Icons" function. PCS 7 has automatically inserted these block icons sequentially in the upper section of the process picture. If you take a look at the block icons, you will see that PCS 7 has automatically created block icons in the horizontal and vertical directions based on the settings for the block in the CFC chart.

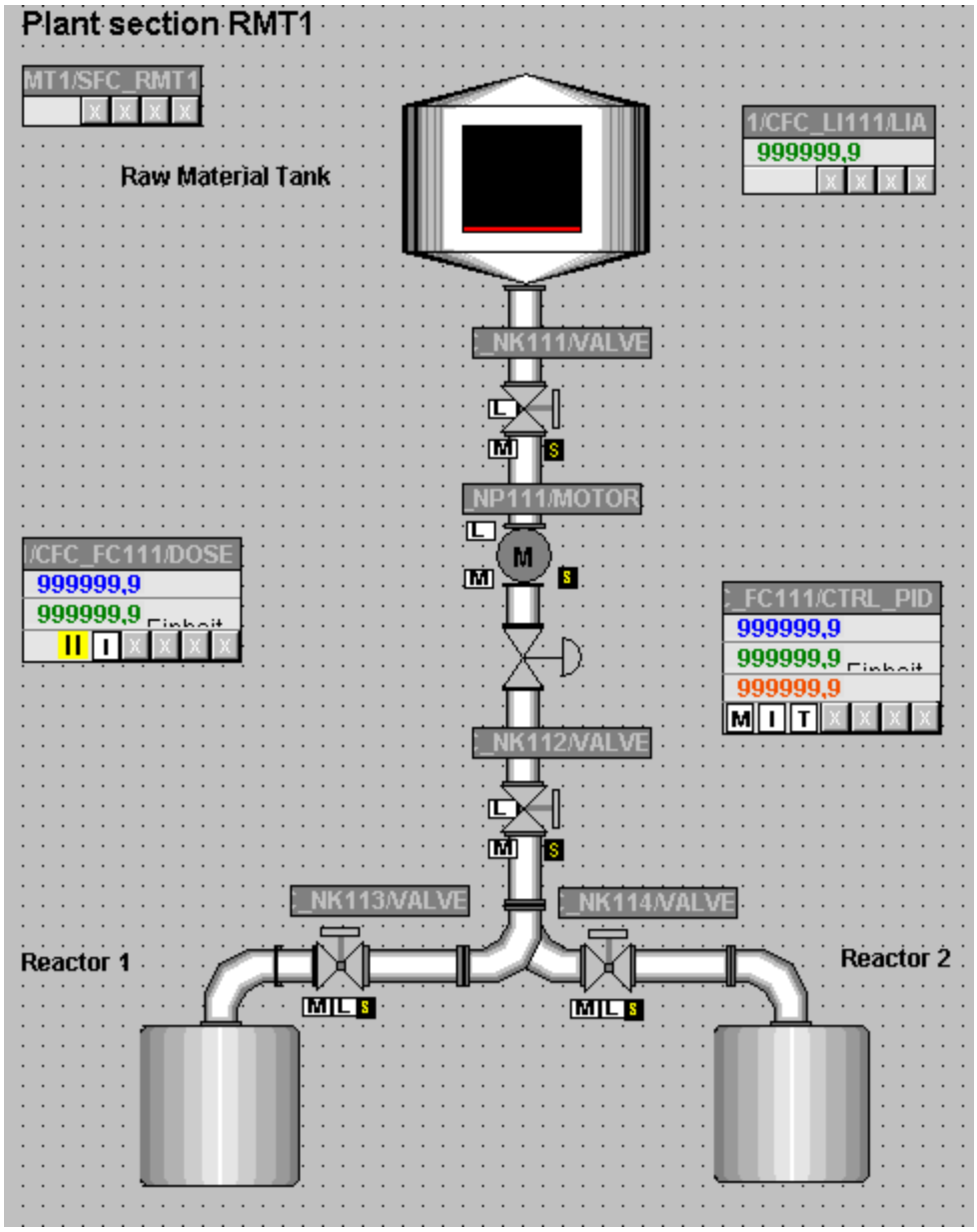
You must position these block icons in accordance with the plant structure.

Requirements

- The "RMT1.pdl" process picture is open in the Graphics Designer.
- The block icons are available.

Procedure

1. Select the "..._NK111/VALVE" block icon and drag it to the required position so that the valve display in the block icon is positioned exactly between the pipes.
2. Follow the same procedure for all other block icons and position them in accordance with the following graphic:



3. Select the **File > Save** command.
   The program saves the process picture.

8.6.9 Inserting I/O Fields for Operator Control

Overview

You will provide two opportunities for operator control in your process picture:

- Reactor selection
- External/internal setpoint output

You start by configuring the reactor selection – this involves three steps. Afterwards, you basically follow the same procedure to configure the setpoint output:

Step	What?
1	Insert I/O field (Page 189)
2	Format I/O field (Page 192)
3	Insert Explanatory Text (Page 193)
4	Configure Default Setpoint Value (Page 194)

8.6.10 Step 1 - How to Insert the I/O Field

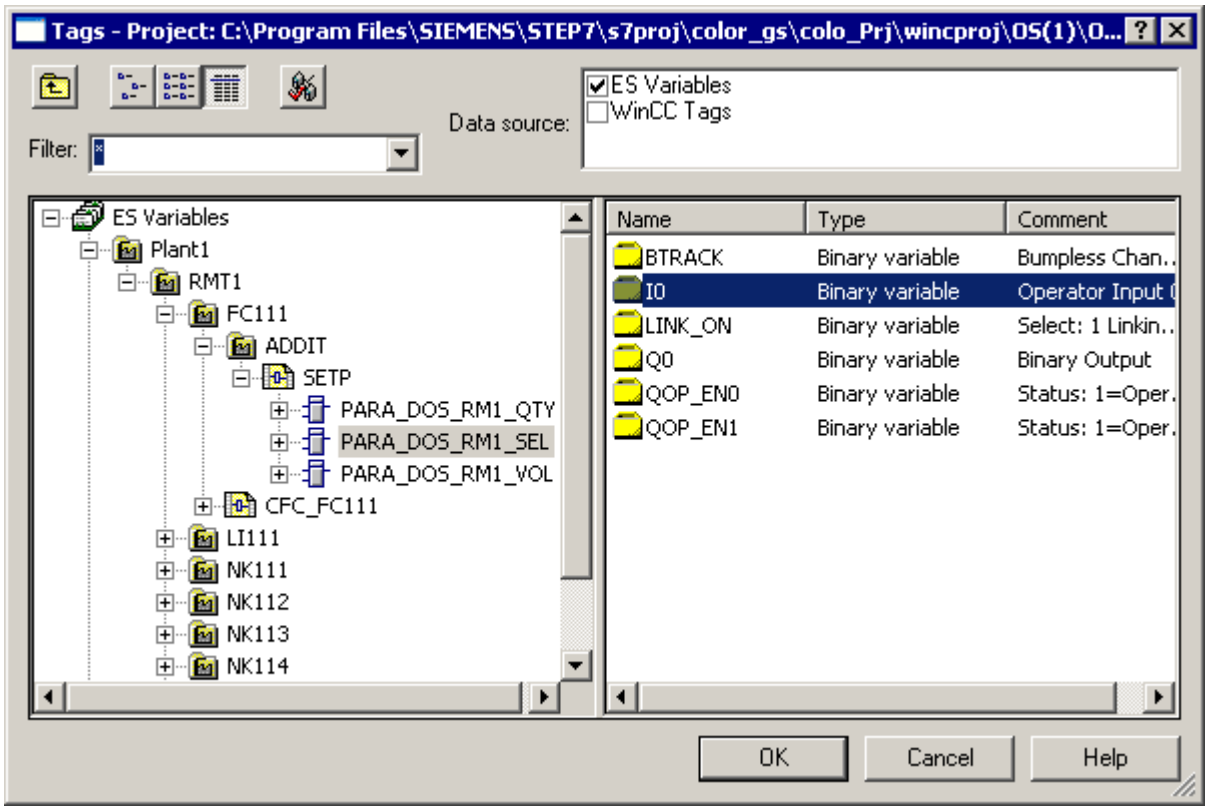
Requirements

- The "RMT1.pdl" process picture is open in the Graphics Designer.
- The object palette is visible.
- The style palette is visible.

Procedure

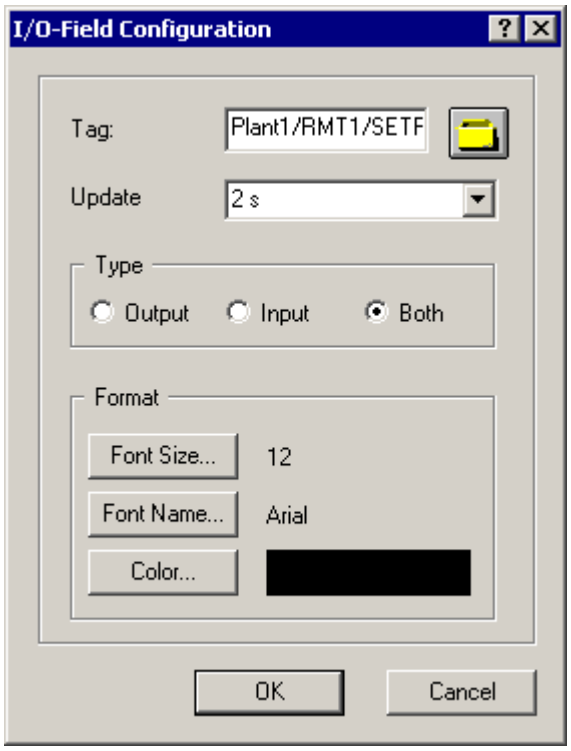
1. Select the "Smart Objects/I/O Field" entry in the object palette.
2. Use the mouse to change to the drawing area.
   The mouse pointer transforms into a small I/O box icon.
3. Draw a rectangle between the reactors by holding down the mouse button. The size of the rectangle should correspond with the size of your I/O box.
   The "I/O field configuration" dialog box opens.
4. Click the "Tag selection dialog" button next to the "Tag" box.
   The "Tags - Project" dialog box opens.
5. Select the "ES tags" check box from the "Data source" group.
   The tree view displays the ES tags.
6. Select the entry "ES Tags/Plant1/RMT1/FC111/ADDIT/CFC_SETP/PARA_DOS_RM1_SEL" from the tree view.
   The detail view displays all tags.

7. Select the variable "I0" in the detailed window.



8. Click "OK" to save your entries.
   The program enters the tag into the "Tag" input box.

9. Make sure that the "Both" option is selected.



10. Click "OK" to save your entries.

8.6.11 Step 2 - How to Format the I/O Field

Requirements

- The "RMT1.pdl" process picture is open in the Graphics Designer.
- The I/O field has been inserted.

Procedure

Format the I/O field in the same way as you formatted the text fields.

1. Select I/O field 1.
2. Format using the style palette:
   – Click on the "Line Weight/Invisible" entry.
   This hides the text field frame.
   – Click on the "Fill pattern/transparent" entry.
   The text field color is now transparent.
3. Select the menu command **View > Properties**.
   The "Object Properties" dialog box opens with active "Properties" tab.
4. Select the "I/O field" entry from the tree view which contains the properties of the input box.
   The detail view shows the name of the text box and the level.
5. Switch to the detail view and then double-click the "IOField1" input box in the "Static" column.
   You can now edit text in this input box.
6. Type in the name "SEL_REAK" and then press ENTER.
   This saves this name and displays it in the top row.
7. Select the "I/O Field/Font" entry in the tree view and change the value of the "Bold" attribute to "Yes" in the detailed window.
8. Select the "I/O Field/Output/Input" entry in the tree view and change the value of the "Data Format" attribute to "Binary" in the detailed window.
9. Close the "Object Properties" dialog box.
   All changes are shown.

8.6.12 Step 3 - How to Add Explanatory Text

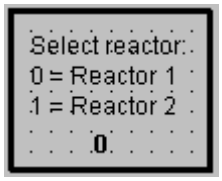
Requirements

- The "RMT1.pdl" process picture is open in the Graphics Designer.
- The I/O field has been inserted and formatted.

Procedure

The plant operator also has to know what can be set with this I/O field. You use a text field in order to provide this explanation. You have already used text fields when labeling the plant.

1. Insert a text field – use the "Standard Objects/ Static Text" object to do this.
2. Enter the following text: "Select reactor: 0 = Reactor 1, 1 = Reactor 2".
   Press <Shift + Return> to create a line break.
3. Format the text fields using the style palette:
   - Frame invisible – "Line Weight/Invisible" setting
   - Fill transparent – "Fill Pattern/Transparent" setting
4. Drag a frame around the I/O field and the explanatory text – use the "Standard Objects/Rectangle" " object for this purpose.
5. Format the text fields using the style palette:
   - Thickness of the frame – "Line Weight/3 Pixel" setting
   - Fill transparent – "Fill Pattern/Transparent" setting
6. Position the objects as shown in the figure below:



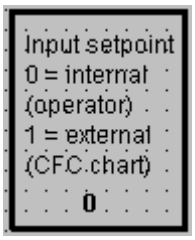
7. Lasso all the objects with the mouse.
8. Select the menu command **Edit > Group > Group**.
   This groups all the objects into a single object and makes it easier to move them.
9. Position the objects between the reactors.

8.6.13 Step 4 - How to Insert the Setpoint Output

Procedure

Proceed as with the selection between reactor 1 and 2; the section below provides an overview of the steps:

1. insert an I/O field using the tag "Plant1/RMT1/FC111/CFC_FC111/DOSE/SPEXT_ON".
2. Specify the properties for the I/O field in the style palette:
   - Frame: invisible – style palette setting "Line Weight/Invisible"
   - Fill: transparent – style palette setting "Fill Pattern/Transparent"
3. Specify the properties for the I/O field in the "Properties" dialog box:
   - I/O Field" property – "Object Name" attribute: "SEL_SP"
   - Font" property – "Bold" attribute: "Yes"
   - Output/Input" property – "Data Format" attribute: "Binary"
4. Insert explanatory text field: "Input setpoint, 0 = internal (operator), 1 = external (CFC chart)"
5. Format the text field via the style palette:
   - Frame: invisible – "Line Weight/Invisible" setting
   - Fill: transparent – "Fill Pattern/Transparent" setting
6. Insert a whole frame – object palette, "Standard Objects/ Rectangle" object
7. Format the whole frame via the style palette:
   - Line weight of frame -- "Line Weight/3 Pixel" setting
   - Fill: transparent – "Fill Pattern/Transparent" setting



8. Group the objects by calling the **Edit > Group objects > Group** command.
9. Position grouped objects in the lower section on the left.

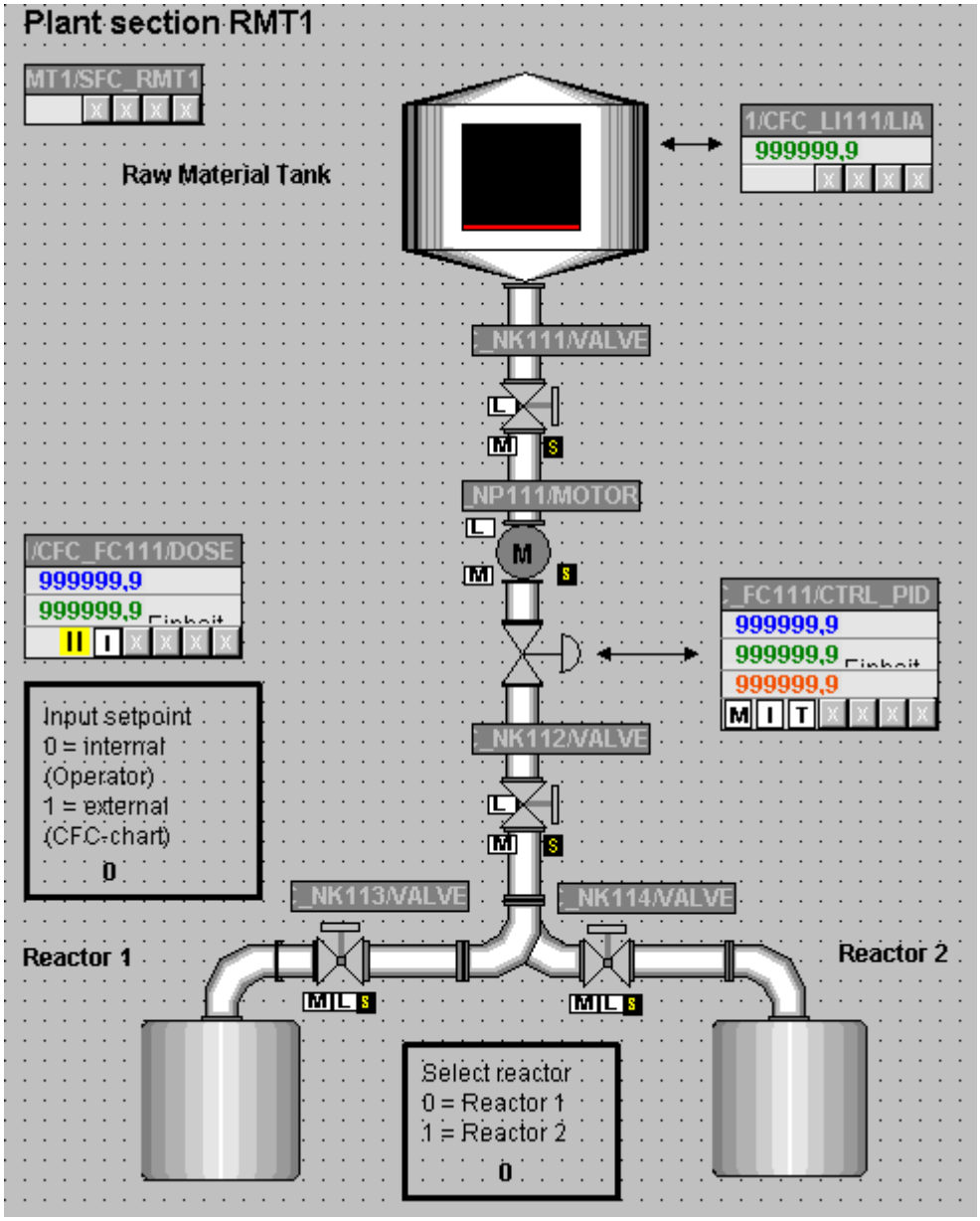
8.6.14 How to Complete the Work

Procedure

1. Insert an arrow between the actuator and the "..._FC111/CTRL_PID" block icon to indicate the relationship between the process tag and the block icon.
2. Insert an arrow between the raw material tank and the block icon ".../CFC_LI111/LIA" to indicate the relationship between the process tag and the block icon.
3. Position the setpoint selection above the block icon ".../CFC_FC111/DOSE".
4. Then position all other objects.

Result

Your process picture should now appear as shown below:



1. Select the **File > Save** command.
   The program saves the process picture, including all changes and additions.
2. Close the Graphics Designer.

8.6.15 Current Status of Your Project

Completed Configuration Tasks

At this point, your project is complete, thus enabling you to activate process mode. You have become acquainted with the following functions during the OS configuration:

- Setting the picture properties in SIMATIC Manager
- Creating block icons
- Compiling the operator station
- Creating a process picture in the Graphics Designer with a variety of objects, for example, static and dynamic objects

Working in runtime

9

9.1 Planning the user interface

9.1.1 Operator Station in Process Mode

Operator control and monitoring options in process mode

In process mode, the "color_gs" project provides various opportunities for operator control and monitoring of the process.

With the block icons, you have the following options:

- Observe the state of the valve: valve open or closed
- Observe the state of the pump: pump active or inactive
- Changing from a block icon to the associated faceplate

With I/O fields, you have the following options:

- Selecting the reactor
- Selecting whether the setpoint is read from the CFC chart or whether the plant operator can specify the setpoint externally
- Assigning the setpoint for the dosing volume in the faceplate

You can also monitor the CFC and SFC charts. You were already introduced to this function when testing the charts.

9.1.2 User Interface in Process Mode

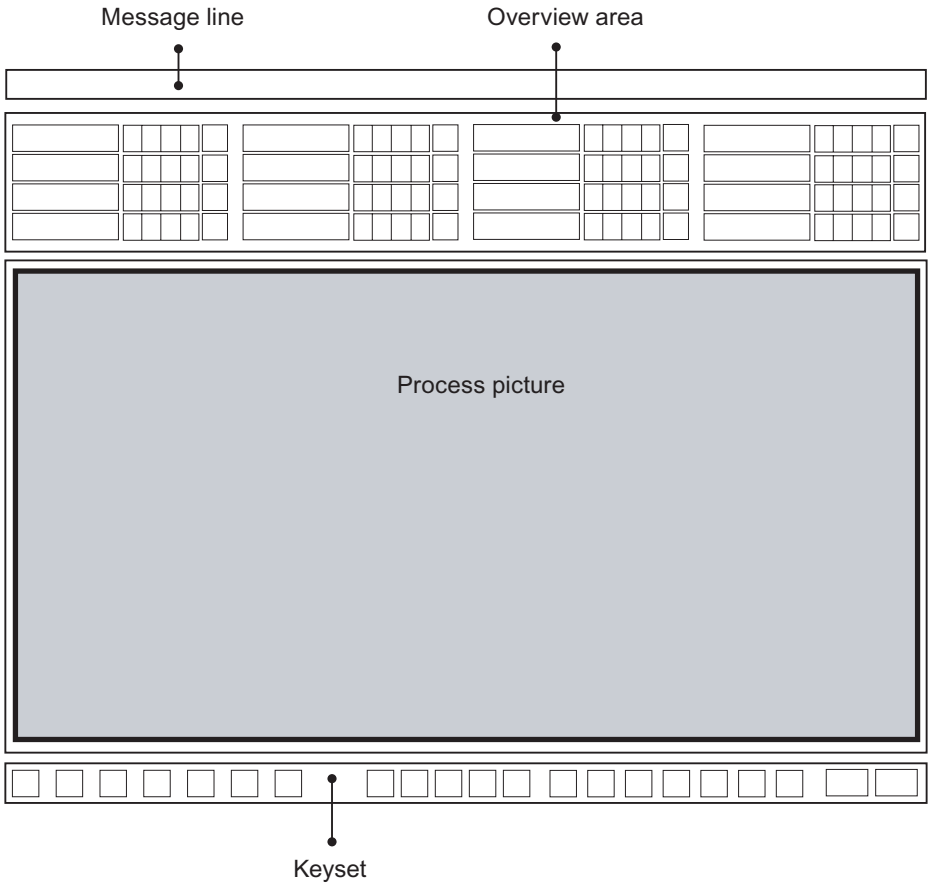
Structure

To allow you to monitor and operate the process yourself, here is a brief explanation of the user interface of PCS 7 in process mode.

The user interface in process mode is divided into four areas:

- Message line
  Displays the most recent message with the highest priority.
- Overview area
  Lets you select the areas of a plant and view these by means of the various command buttons In your "color_gs" project, you have only one button, namely "RMT1" because your plant consists of only one part.
  Next to each button there are four other small buttons which you can use to view alarms and warnings from the sublevel hierarchy. If you click in this area, you automatically change to the process picture in which the alarm or warning originated.
  The arrow key on the extreme right opens a tree view in which you can select a sublevel of the hierarchy.
- Process picture
  Returns the associated process picture, depending on the area you selected in the overview. In your "color_gs" project, the plant picture you created in the Graphics Designer is displayed.

- Button set
  Can be used to call various functions which you can select in process mode. In the "color_gs" project, you will only get to know the buttons that are important for this project.



9.2 Operator control and monitoring in process mode

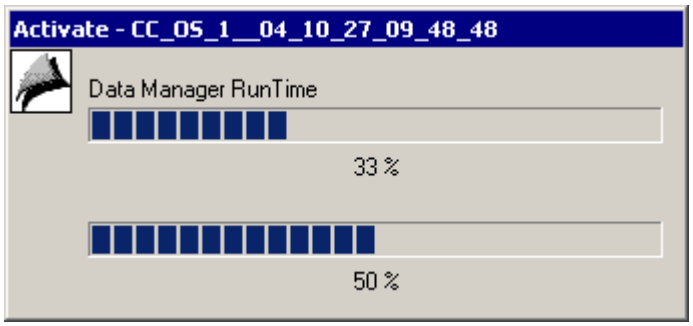
9.2.1 How to Activate Process Mode

Requirements

- WinCC Explorer is open.
- The example project is open.

Procedure for Activating Process Mode

1. Select the **File > Activate** command.
   The progress bar and start screen open.



2. Click on "RMT1" in the overview area.
   This displays the process picture which you created in Graphics Designer.

9.2.2 How to Start the Process

Introduction

To enable operator control and monitoring of all functions that you have configured, you now just have to start the dosing process.

Dosing is started using the SFC chart. You start the SFC directly in process mode without having to change back to SIMATIC Manager.

There are two ways to start the process:

- Using the block icon ".../RMT1/SFC_RMT1"
- Using a button in the button set

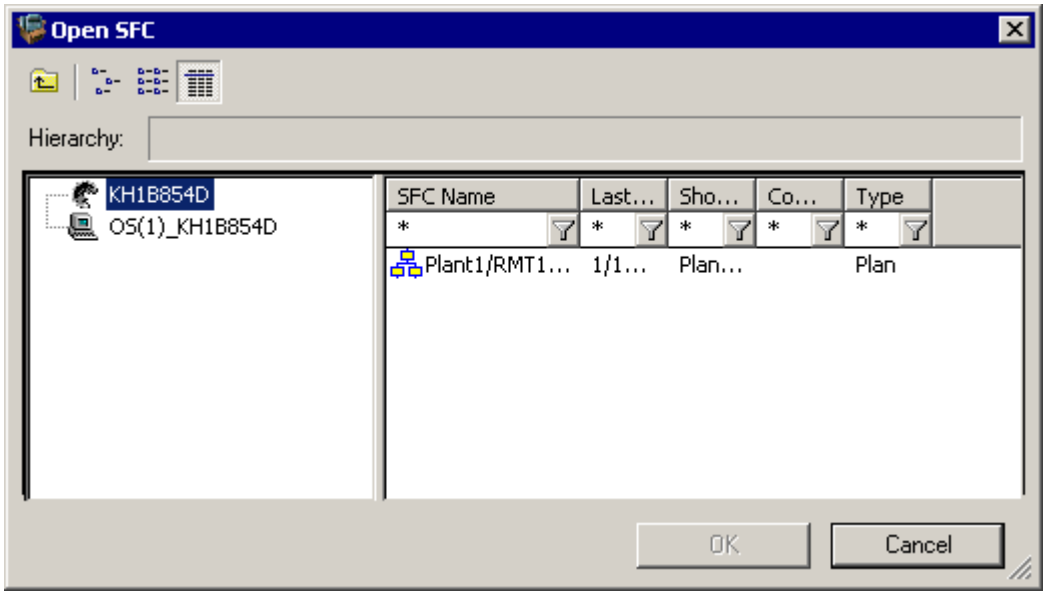
Starting using the block icon

1. Click on the ".../RMT1/SFC_RMT1" block icon.
   The associated faceplate opens.

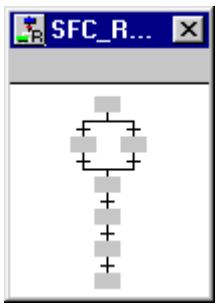
2. Click the "Start" button.
   The "SFC Operation" dialog box opens.
3. Click "OK".
   The sequential control system starts and you can follow the process in your process picture.
4. Click "Section".
   This opens the detailed display of the SFC chart. This display corresponds to the display of the SFC chart in the SFC Editor.
5. Double-click on a step in the SFC chart to view additional details about the current status of the SFC chart.

Starting using the button set

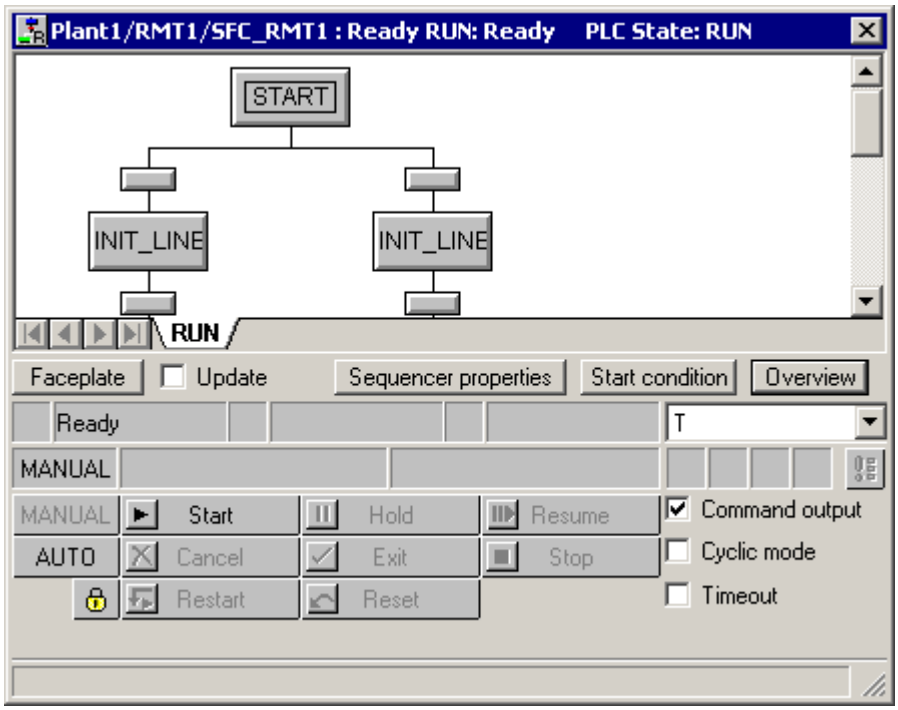
1. Click "Change Button Set": 
   The second button set is displayed.
2. Click "SFC Visualization". 
   The "Open SFC" dialog box opens. Since you only have one OS and one SFC chart in your project, only this OS is displayed in the tree view and only the SFC chart in the detail window.



3. Select the "RMT1/FC111/SFC_RMT1" chart in the detailed window and click "OK".
   A greatly reduced overview of the SFC chart opens.



4. Click on this overview.
   The detailed display of the SFC chart appears. This detailed display is comparable to the display that you worked with when testing the SFC chart in the SFC Editor.



5. Position this detailed display so that you can see your entire process picture.
6. Click "Start".
   The "SFC Operation" dialog box opens.
7. Click "OK".
   The sequence control system starts: You can monitor the process both in your process picture and in the detailed display of the SFC chart. The representation in the SFC chart is no different from the representation you know from the test mode.

9.2.3 How to Stop the Process

Procedure

If you do not want the process to run right through to the end, you can stop it manually:

1. Click "Stop" in the detail view of the SFC chart.
   The "SFC operation" dialog box opens.
2. Click "OK".
   This pauses the process.
3. Now click "Reset" and then "OK" in the "SFC Operation" dialog box.
   This resets all values to the input values.

9.2.4 How to Control the Process by Means of the Process Picture

Operator process control

There are several ways of influencing the process in the process mode using the process picture:

- Select Reactor (Page 207)
- Open Faceplate (Page 207)
- Define Setpoint Value (Page 208)

9.2.5 How to Specify the Reactor

Procedure

1. Position the mouse pointer on the I/O field in the "Select reactor" area.
   The mouse pointer is transformed into a text selection symbol.
2. Click on the I/O field.
   The I/O field is shown on a gray background.
3. Enter the required number to select the reactor:
   - If you want to dose in reactor 1: 0
   - If you want to dose in reactor 2: 1
4. Press ENTER.
   The new value is saved after a brief delay and the displayed in this area.

   Video

5. Restart the process and review the results.

9.2.6 How to Open the Faceplates

Procedure

1. Start the process
2. Click the block icon "..._FC111/CTRL_PID".
   The corresponding faceplate opens with active "Standard" tab.
3. Select other tabs using the drop-down list box. For your "color_gs" project, the following views are of interest:
   - Standard – here, you can see, for example, the setpoint and actual value of the controller displayed as specific values and in graphic form.
   - Parameters – here, you can, for example, modify certain values. Using the "Bar HL" and "Bar LL" boxes you can modify the graphic display for the "Standard" tab.
   - Limits – here, you can see, for example, the alarm limits that you defined in the CFC chart for this block.
4. Close the faceplate.

9.2.7 How to Change the Setpoint

Introduction

The setpoint is changed in two steps:

- First, you define whether the process uses the external or internal setpoint.
- Then, you enter the specific setpoint.

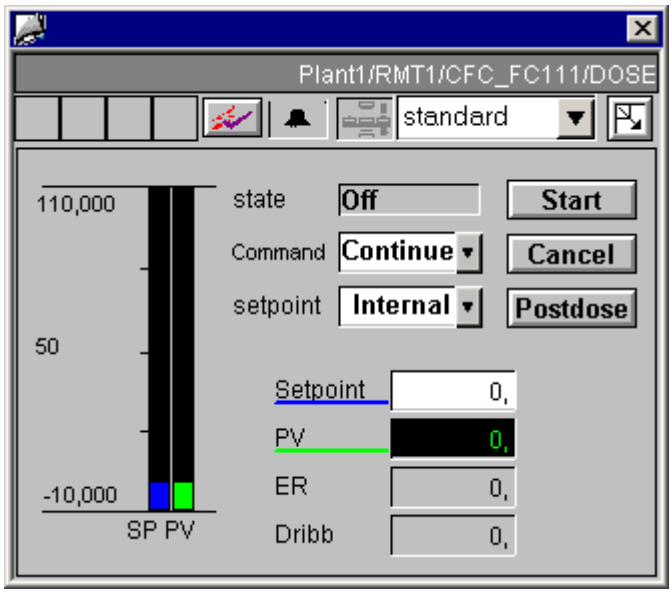
Step 1: Specify setpoint output

1. Position the cursor on the I/O field in the "Input setpoint" area. You already created this area in the process picture.
   The mouse pointer is transformed into a text selection symbol.
2. Click on the I/O field and enter the required number of the method for the setpoint output as shown in the table below.
3. Press ENTER.
   The new value is saved after a brief delay and the displayed in this area.

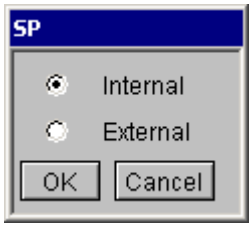
If the setpoint …	… enter the following number:
will be read from the CFC chart	1
will be entered manually by the operator	0

Step 2: Enter the setpoint

1. Click the block icon ".../CFC_FC111/DOSE.
   The corresponding faceplate opens with active "Standard" tab.

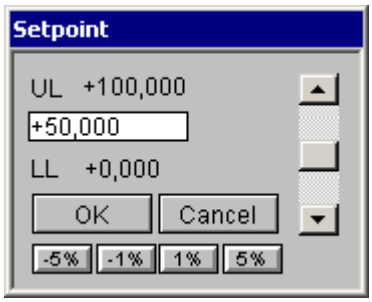


2. Open the "Setpoint" drop-down list.
   The "SP" dialog box opens.
3. Activate "Internal" check box.



4. Click "Run".
   The "Setpoint" input box is activated.
5. Click on the "Setpoint" input box.
   The "Setpoint" dialog box opens.

6. Click in the input box and enter the required value.



7. Click "Run".
   The value is entered in the input box.
8. Close the faceplate.
   The modified value is displayed in the block icon.
9. Restart the process and review the results.

9.2.8 How to Work with Messages

Introduction

Messages are displayed to you as follows:

- In the message line
- In a separate message list

Message line

While the process is running, warnings and alarms with messages are displayed in the message line of your screen. The message line contains the latest message with the highest priority.

Click the button to the right of the message line to acknowledge the messages.

Message list

You can also view all the messages and alarms in a list.

1. Click the "Change Button Set" button:
   
2. Click "Message System":
   
   The message list is displayed.
3. Acknowledge the messages as shown in the table below.
4. Click on the buttons in the button area to navigate to the various message and alarm lists.
5. Click the "Previous Graphic" button in the button area:
   
   This returns you to the "RMT1" process picture.

If you …	… then
want to acknowledge a single message	click "Acknowledge single messages".  This acknowledges the message that is labeled at the start of the line with a triangle.
want to acknowledge all messages	click "Acknowledge all visible messages". 

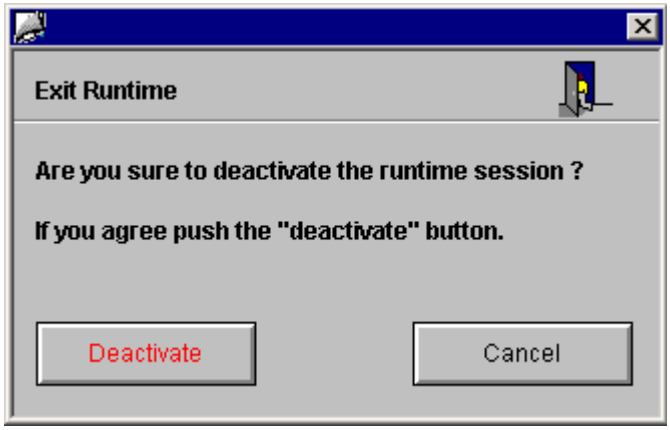
9.2.9 How to Exit Process Mode

Procedure

1. Click the "Change Button Set" button in the button area.

2. Click the "Exit Runtime" button:

   The "Exit Runtime" dialog box opens.



3. Click "Deactivate".
   This exits process mode.
4. Close WinCC Explorer.

Performing additional tasks

10

10.1 Introduction to the Additional Task

Additional Task

In the "color_gs" project, two identically configured raw material tanks are required. The additional task is to configure the second raw material tank "RMT2". But do not worry: You do not need to work through all steps again but will use the automatic functions of PCS 7. You will find that the copying function of PCS 7 will save you many steps by performing these steps for you automatically in the background.

When you create the second raw material tank, you will work largely on your own. You have already become familiar with many of the required dialog boxes during configuration of the first raw material tank. Therefore, in this section, we will not prescribe detailed step-by-step instructions but will simply specify the order in which you must make the configuration, giving you a general guideline on how to proceed.

10.2 How to Copy the Existing 'RMT1' Part of the Plant

Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.
- Configuration of the RMT1 plant component is complete and free of errors.

Procedure

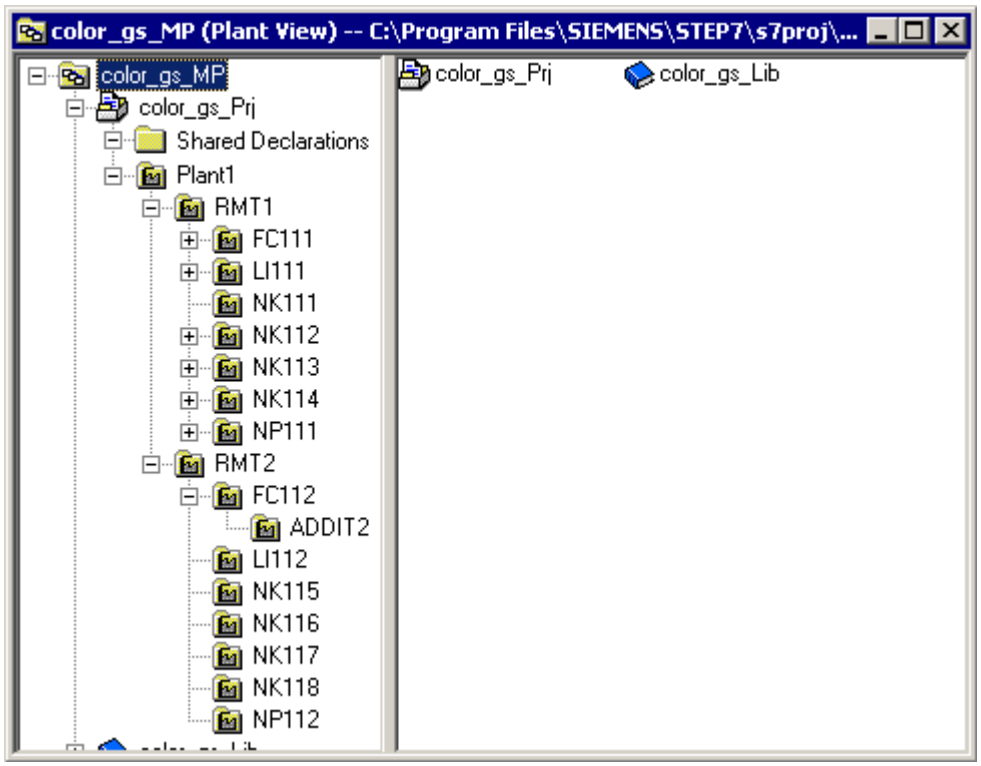
1. Select the "Copy / Paste" function in Windows to copy the "RMT1" hierarchy folder to the "Plant1" hierarchy folder.
   SIMATIC Manager generates a copy of the "RMT1" hierarchy folder, names it "RMT1(1)" and saves it to the "Plant1" hierarchy folder. The names of the objects, for example, CFC/SFC charts are appended a consecutive number.
   In the destination hierarchy folder, the cross-references to CFC blocks which are defined in the dynamic objects of the OS pictures are automatically updated when you copy / move hierarchy folders which contain CFC charts and process pictures.

NOTICE
If you copy or move charts and pictures individually, in other words, you copy or move them not within the hierarchy folder, the references of the dynamic objects are lost and they must be linked to the blocks again in the pictures.

2. Change the names of the hierarchy folder and the objects in the individual hierarchy folders according to the table below:

Hierarchy folder	New name	Object contained – old name	New name
RMT1(1)	RMT2	RMT1(1)" process picture	RMT2
		SFC_RMT1(1)	SFC_RMT2
FC111	FC112	CFC_FC111(1)	CFC_FC112
ADDIT	ADDIT2	CFC_SETP(1)	CFC_SETP2
LI111	LI112	CFC_LI111(1)	CFC_LI112
NK 111	NK115	CFC_NK111(1)	CFC_NK115
NK112	NK116	CFC_NK112(1)	CFC_NK116
NK113	NK117	CFC_NK113(1)	CFC_NK117
NK114	NK118	CFC_NK114(1)	CFC_NK118
NP111	NP112	CFC_NP111(1)	CFC_NP112

Your plant hierarchy should now appear as follows:



10.3 Preparation for Process Mode

Preparation

New charts and a new process picture were created when plant component RMT1 was copied to create RMT2. This new information must now be downloaded to the automation system and "made known" to the OS.

You use the central "Compile and Download Objects" function for this purpose. In this situation, PCS 7 provides you with the option of compiling and downloading only the changed information. This reduces the time required for the compile and download operation. In your "color_gs" project, this is not yet a problem since the project is small. When configuring large plants, this option gains in significance.

Once the compile and download operation is complete, you need to adapt the RMT2 process picture.

Then you can activate process mode and test the functions.

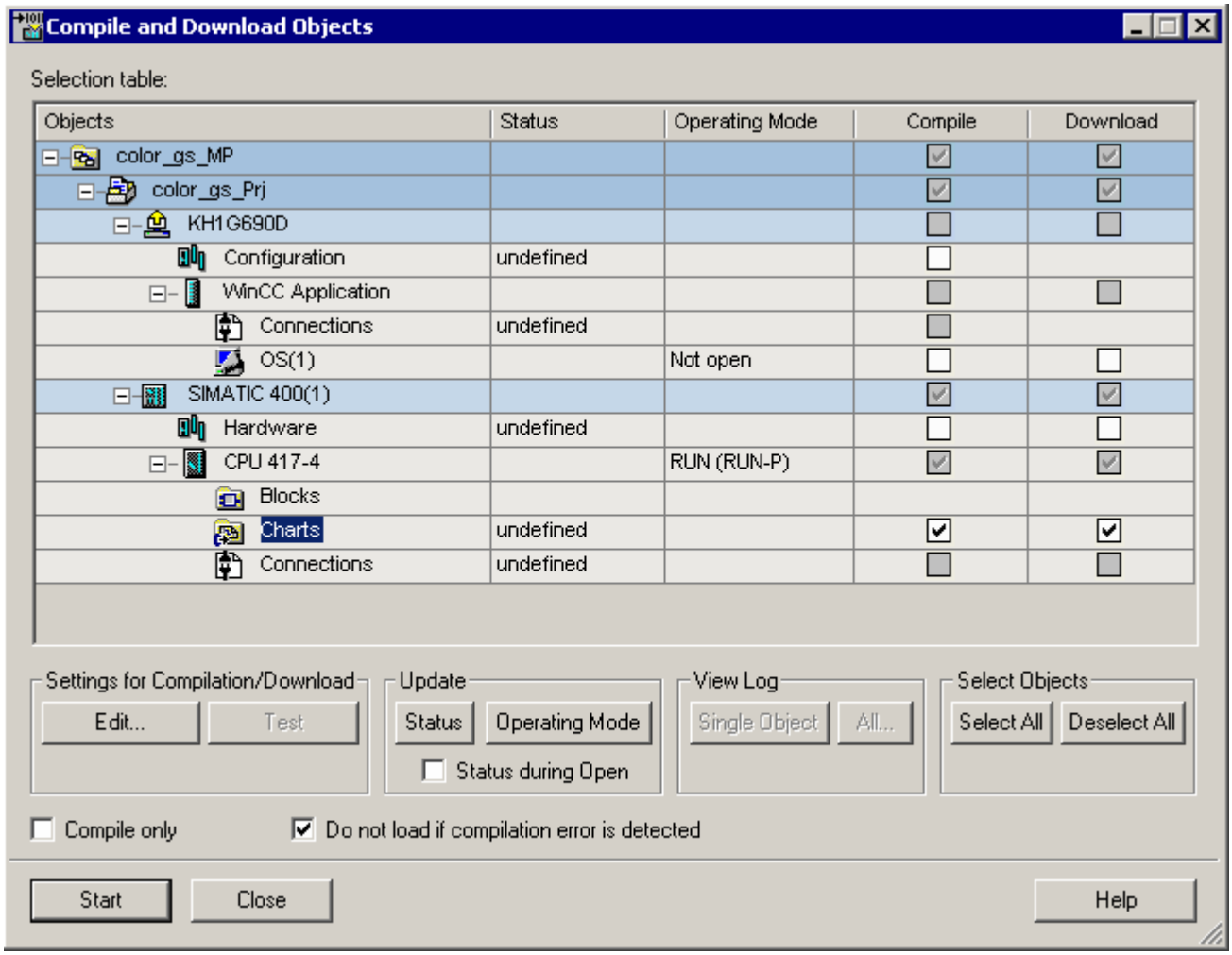
10.4 How to Compile and Download the Changes

Requirements

- The example project is open in SIMATIC Manager.
- The plant view is activated.
- The CPU is in "RUN-P" mode.

Procedure

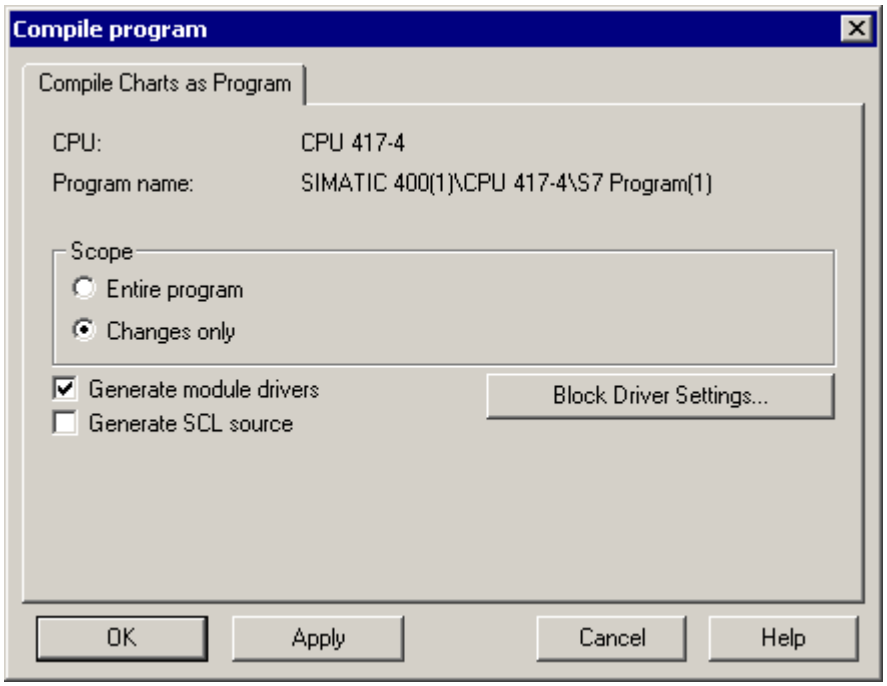
1. Select the "color_gs_Prj" project in the tree view.
2. Select the menu command **PLC > Save and Compile Objects...**.
   The "Charts" object status is changed.
3. Activate the check boxes as follows:



Note

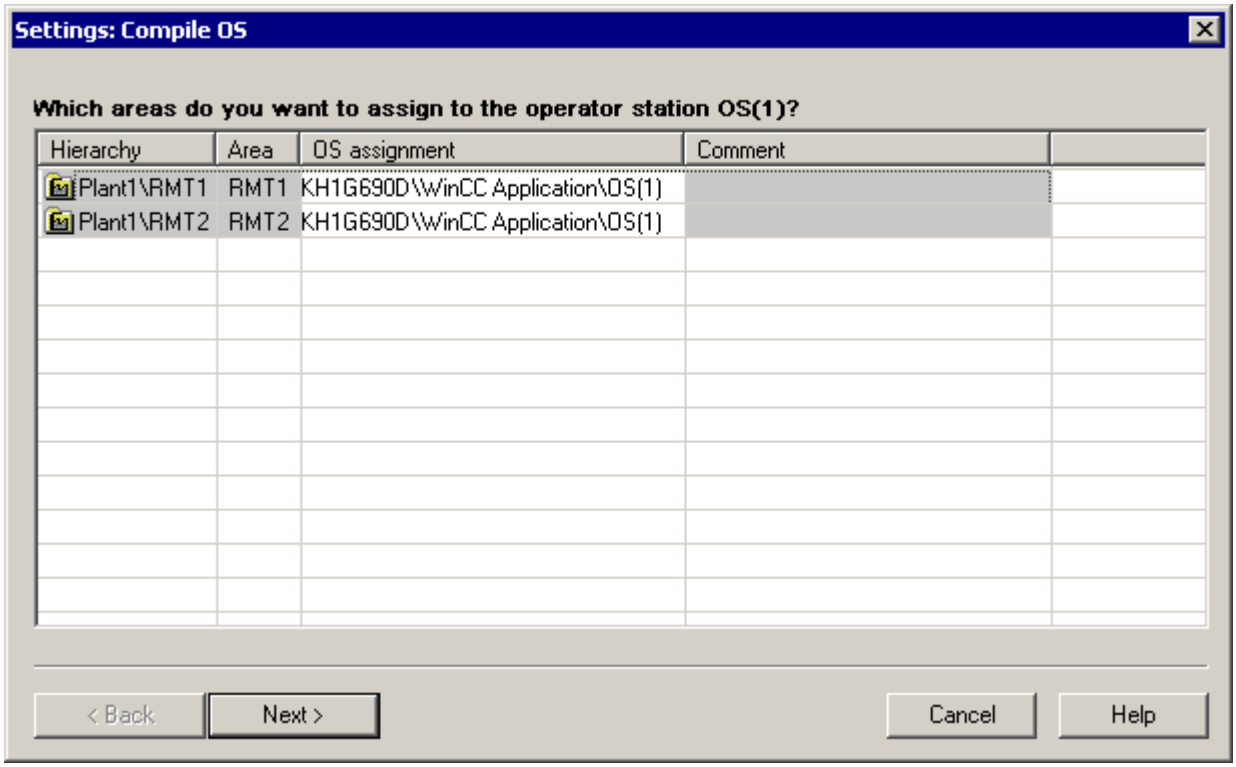
If you see the status "undefined" for all objects in the "Compile and Download Objects" dialog box, click "Status" in the "Update" area.
This updates the status.

4. Select the "Charts" object and click the "Edit" button.
   The "Compile Program / Download to Target System" dialog box opens.
5. Set the following:
   - Activate the "Changes only" check box in the "Scope" group.
     The CPU only remains in process mode if you activate this option.
   - Activate the "Generate module drivers" check box.

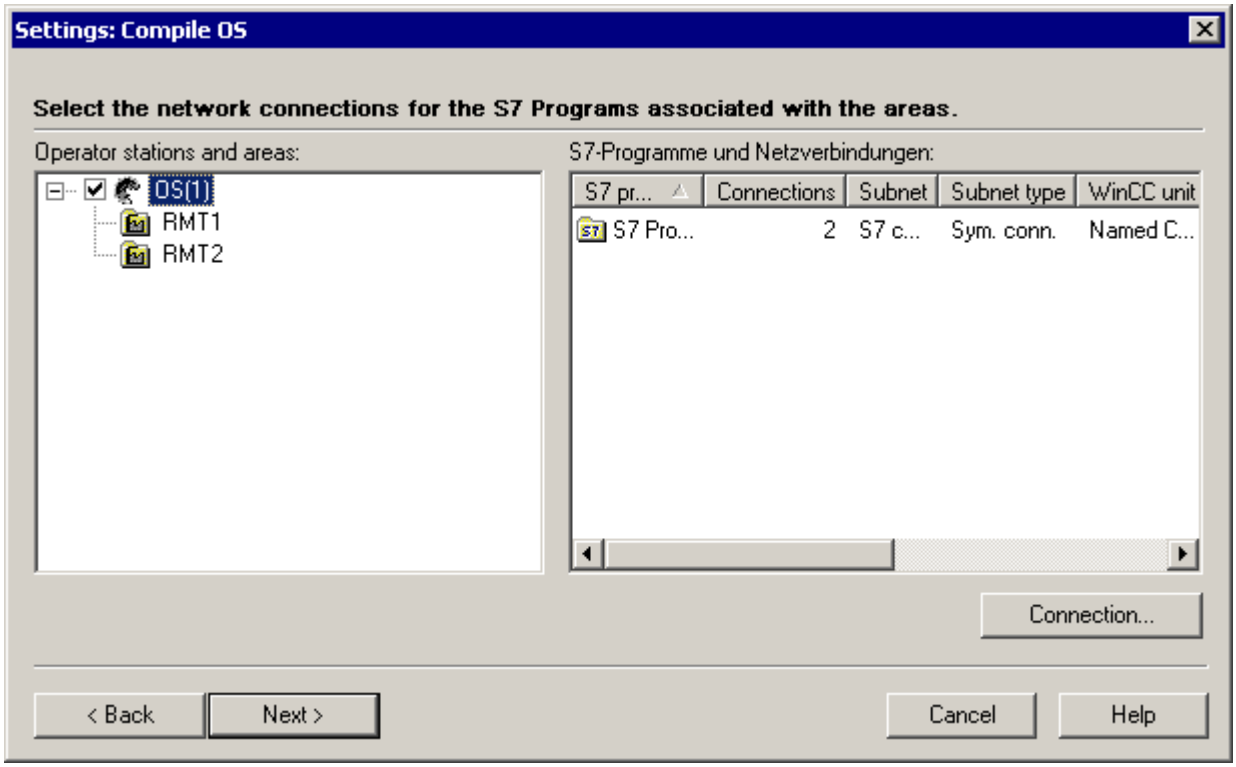


6. Click "OK".
   The settings are applied and the "Download S7" tab is displayed.
7. Select the "Changes" option and click "OK".
   The settings are now applied.

8. Select the "OS(1)" object and click "Edit".
   The "Which areas do you want to assign to operator station OS(1)?" dialog box opens and the existing "RMT1" plant component and the new "RMT2" plant component are displayed in the list. Both are automatically assigned to the OS (1).



9. Click "Next >".
   The "Select the network connections for the S7 programs associated with the areas" dialog box opens. Both OS areas are shown in the left pane and the network connection that you have created in NetPro is shown in the right pane.



10. Click "Next >".
    The "Select the data you want to compile and the scope of the compilation" dialog box opens.
11. Activate the following check boxes and options:
    - "Data" group: "Tags and messages"
    - "Data" group: "SFC visualization"
    - "Data" group: "Picture tree"
    - "Scope" group: "Changes"

12. Click "Apply".
    The dialog box closes.
13. Click "Start".
    The compile and download operation is started, and the message dialog "Downloading program changes during operation...." opens.
14. Click "OK".
    The message dialog "If you want to download changes online, please make sure that.... Do you want to continue?" opens.
15. Click "Yes".
    The compile and download operation starts and the log file is opened in the text editor.
16. Close the text editor.
17. Click "Close" in the "Compile and Download Objects" dialog box.

10.5 How to Adapt the OS Configuration

Requirement

The example project is open in WinCC Explorer.

Procedure

1. Open the "RMT2" process picture in the Graphics Designer.
2. Change the header text to "RMT2 part of the plant".
3. Save the process picture.
4. Close the Graphics Designer.

Additional changes are not necessary because all the block icons in the process picture along with their associated interconnections were updated by the copy operation and the subsequent compilation operation.

10.6 How to Start Process Mode

Requirements

- The OS is compiled.
- The example project is open in WinCC Explorer.
- The follow-up work has been performed in the "RMT2" process picture.

Procedure

1. Select **File > Activate** in WinCC Explorer.
   This function changes to operation in process mode.
   The overview area displays a button named "RMT2". You monitor the units separately by toggling the views using the "RMT1" and "RMT2" buttons.
   The button of the unit which is currently visualized is marked with a color.
2. Click the "RMT2" button in the overview area.
3. Change the button set and then click "SFC Visualization".
   The program opens the "Open SFC" dialog box.
   The detail view shows two SFC charts: the SFC chart from "RMT1" and the SFC chart from "RMT2".
4. Select the "../RMT2" SFC chart and start the sequential control system.

Note

You can find detailed information about this under "Working in Process Mode – Operator Control and Monitoring in Process Mode".

5. Perform the following steps in process mode:
   - Change between the parts of the plant
   - Change the setpoint output.
   - Specify the reactor selection.
   - …

Additional information

You can find detailed information about this in the section "Working in Process Mode".

Starting and adapting the example

11

11.1 Example Project "color_gs"

Example project "color_gs"

With Getting Started, you also receive the PCS 7 project "color_gs" that has already been fully configured. You can open and start this project on your computer. Since we assumed a specific hardware configuration when creating the project, you will need to adapt the hardware configuration if you use different hardware components.

The overview shows you how to open and adapt the example project:

- Open the example project (Page 224)
- Adapt the hardware of the example project (Page 225)
- Adapt the blocks for the example project (Page 226)
- Adapt the project data for the example project (Page 228)
- Compile and download the example project (Page 229)

11.2 Procedure

11.2.1 How to Open the Example Project

Requirement

SIMATIC Manager is open.

Note

The example project comes in the form of a ZIP file that you extract using a PCS 7 function.

Procedure

1. Select the menu command **File > Retrieve....**.
   The "Retrieve - Select Archive" dialog box opens.
2. Open the folder "SIEMENS/ STEP7/ Examples_MP".
3. Select the "color_gs.zip" file, and click "Open".
   The "Select Destination Directory" dialog box opens, and the "S7proj" folder is selected - this is the default storage location for all PCS 7 projects.
4. If you …
   – want to accept the default folder, click "OK".
   – have created a separate folder for the example project, navigate to this folder and then click "OK".

   Retrieval from the archive is then started.
   After retrieval from the archive, the "Retrieve from Archive" message window opens.
5. Click "OK".
   Another message dialog opens:
   "Multiproject 'color_gs' has been retrieved from the archive. Do you want to open it now?".
6. Click "Yes".
   The example project opens.

11.3 How to Adapt the Hardware for the Example Project

Requirements

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

Procedure

1. Activate the required network adapter in the configuration console.

   You can detailed information about this in the section:
   "How to make the settings in the Configuration Console" (Page 26).

2. Select the network adapter (communications processor) you want to use for communication with the engineering station.

   You can information about this in the section:
   "How to select the network adapter in Simatic Shell" (Page 27).

3. Configure the AS:

   – Select your component from the hardware catalog and drag it to the slot in which our component is inserted. This overwrites component that we used with your component.

   – Make the settings for the CP and the network connections.

   You can detailed information about this in the section:
   "How to configure the AS" (Page **Fehler! Textmarke nicht definiert.**).

4. Rename the PC station.

   You can detailed information about this in the section:
   "How to rename the PC Station" (Page 42).

5. Configure the OS:

   – Set the network adapter and network connections.

   You can detailed information about this in the section:
   "How to configure the PC Station of the OS" (Page 43).

6. Configure the network connection in NetPro and download the PC station.

   You can detailed information about this in the section:
   "How to make the settings in NetPro" (Page 46).

11.4 How to Adapt the Blocks for the Example Project

Requirements

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

Procedure

1. Go to the tree view and select the entry
   "PCS 7 Library V7.0/Blocks+Templates/Blocks"
   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_MP/color_gs_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_MP/color_gs_Lib/S7 Program(1)/Charts" in the tree view.
6. Select the process tag type "VALVE".
7. Select the menu command **Edit > Open Object**.
   the process tag type opens in the CFC editor.
8. Select the menu command **View > 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. Click "Yes" to update the blocks.
    The "Import New Version" dialog box opens and display all identical block types.
12. Click "Yes".
    The dialog box closes.
13. Click "Close".
14. Close the CFC editor.
15. Select "color_gs_MP/color_gs_Lib/S7 Program(1)/Blocks" in the tree view.

16. Select the menu command **Options > Charts > Update block types**.
    The "Update Block Types" wizard opens.
    - In the "Select the S7 programs to be checked" step, select all the files of the the "color_gs" project. The check boxes for all folders of all S7 programs are activated by default.
    - Click "Continue".
    - All block types are activated by default in the step "Select the block type to be updated".
    - Click "Finish".
      The "Set 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.

11.5 How to adapt the project data for the example project

Requirements

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

Procedure

1. Select the menu command **Edit > Object Properties**.
   The "s7omwinx" dialog box opens.
2. Click "Yes" to open the project on a local computer which operates in server mode
   WinCC Explorer opens.
3. Select the OS(1)/Computer entry in the navigation window.
4. Double-click on the computer symbol in the detailed window.
5. Enter the name of the computer on which you open the project in the "Computer name" input field.
   You can find this name in the Station Configuration Editor.
6. Click "OK".
7. Acknowledge the "Change computer name" message with "OK".
   The computer symbol is not crossed out red in the dialog box.
8. Close the WinCC Explorer and open it again.
   The computer name has now been applied.
9. Select the entry "OS Project Editor".
10. Select the **Open** command from the shortcut menu.
    The OS project editor opens.
11. Accept the default settings and click "OK".
    The OS project editor configures the project.
12. Close the WinCC Explorer.

11.6 How to Compile and Download the Example Project

Requirements

- The example project is open in SIMATIC Manager.
- The CPU is in "STOP" mode.
- The hardware is adapted.
- The blocks and project data are adapted.

Procedure

1. Select the "color_gs_Prj" project in the tree view.
2. Select the menu command **PLC > Save and Compile Objects...**.
   The "Save and Compile Objects" dialog box opens.
3. Select the following check boxes:
   – color_gs_Prj/[name of the PC station]/Configuration: "Compile"
   – color_gs_Prj/[name of the PC station]/WinCC Application/OS(1): "Compile"
   – color_gs_Prj/SIMATIC 400(1)/Hardware: "Compile" and "Download"
   – color_gs_Prj/SIMATIC 400(1)/[Name of the CPU]/Charts: "Compile" and "Download"
4. Select the "Charts" object and click the "Edit" button.
   The "Compile Program / Download to Target System" dialog box opens.
5. Activate the following check boxes and options:
   – "Scope" group: "Entire program"
   – Additional settings: "Generate module drivers"
6. Click "OK".
7. Select the "OS(1)" object and click "Edit".
8. In the "Which areas do you want to assign to the operator station OS(1)?" dialog box, assign the "RMT1" and "RMT2" plant components to OS (1).
9. Select the S7 connection in the "Select the network connections for the S7 programs associated with the areas" dialog box.
10. In the "Select the data you want to compile and the scope of the compilation" dialog box, select the following check boxes:
    – "Data" group: "Tags and messages"
    – "Data" group: "SFC visualization"
    – "Data" group: "Picture tree"
    – "Scope" group: "Entire OS with memory reset"

11. Click "Apply".
12. Click "Start".
    The compile and download operation starts.
    The message "Downloading program changes during operation can, in the case of malfunctions or program errors, cause serious damage to personnel and equipment! Make sure..." opens.
13. Click "OK".
    The message dialog "If you want to download changes online, please make sure that ... Do you want to continue?" opens.
14. Click "Yes".
    The log file opens in the text editor to show you whether or not compilation and the download were successfully completed.
15. Close the text editor.
16. Start the CPU of the AS.

Working in the OS

1. Switch to the component view of SIMATIC Manager.
2. Open the OS.

   You can detailed information about this in the section:
   "How to start the PCS 7 OS (Page 168)".
3. Activate process mode.

Additional information

You can detailed information about this in the section:
"The operator station in process mode (Page 199)".

Index

D

E

F

G

H

I

L

M

N

O

P

R

S

T

U

V

W

Y