

SIEMENS

SIMATIC

Process Control System PCS 7 Getting Started - Part 1

Manual

Preface, Contents	
Requirements for Getting Started	1
Overview of PCS 7	2
First Steps in the Project	3
Creating CFC Charts	4
Creating SFC Charts	5
Compiling, Downloading, and Testing the Charts	6
Configuring the Operator Station	7
Working in the Process Mode	8
The Additional Task	9
Starting and Adapting the Sample Project	10
Index	

Safety Guidelines

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



Danger

indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.



Warning

indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.



Caution

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

Caution

indicates that property damage can result if proper precautions are not taken.

Notice

draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:



Warning

This device and its components 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.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

Trademarks

SIMATIC®, SIMATIC HMI® and SIMATIC NET® are registered trademarks of SIEMENS AG.

Third parties using for their own purposes any other names in this document which refer to trademarks might infringe upon the rights of the trademark owners.

Copyright © Siemens AG 2003 All rights reserved

The reproduction, transmission or use of this document or its contents is not permitted without express written authority. Offenders will be liable for damages. All rights, including rights created by patent grant or registration of a utility model or design, are reserved.

Disclaimer of Liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

Preface

Purpose of the Manual

PCS 7 Getting Started provides you with an initial overview of the process control system PCS 7 and helps you to create a simple project yourself. You can configure the project on an existing SIMATIC Station.

Getting Started – Part 1 is intended for newcomers to PCS 7 active in the following areas:

- Configuration
- Commissioning and service

Required Experience

You should already have experience in the following areas:

- Microsoft operating system Windows 2000
- Functions and configuration of SIMATIC S7 (S7-400, STEP 7)
- Functions and configuration of SIMATIC NET (network components, transmission media)

Scope of the Manual

Getting Started applies to the "PCS 7 Engineering Toolset V 6.0".

Guide to the Manual

Getting Started 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 Getting and detailed instructions on how to work through the steps.

You also receive the finished "color_gs" project as a sample project in the form of a file. This is installed along with the system documentation of PCS 7. You can open this project on an existing engineering system (ES) to view the configuration data and compare the data with your own configuration data. You can activate the project on an operator station (OS) to control and monitor the process.

Note

To test the sample project in the process mode, you may need to adapt the hardware configuration of the project to the hardware that is actually installed; in other words, you must replace the hardware components of the sample project with the actual existing hardware components.

For more detailed information on opening the sample project, refer to "Starting and Adapting the Sample".

Notes on Getting Started

In Getting Started, all the instructions are explained based on the full menu commands. You can also activate the majority of functions with the context-sensitive menu or by double-clicking.

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

- Multiple selection with the "CTRL" and "Shift" keys
- Sorting columns in tables by clicking on the column header
- Using Drag & Drop instead of Copy and Paste

If you open the HTML version of Getting Started, you can open video sequences. These video sequences show the exact steps that you can follow on screen before performing them yourself. Video sequences are indicated by the following icon:



Video

Click on the word "Video" to start a video sequence. You can freeze, stop and restart video sequences. You have buttons available similar to those of the Windows Media Player.

One tutorial in Getting Started leads on to the next and you will create a complete PCS 7 project yourself step by step. This makes it essential to work through the tutorials in the correct order.

Further Information

You will find more detailed information and wider-ranging topics in the configuration manuals "Process Control System PCS 7, Engineering System" and "Process Control System PCS 7, Operator Station" and these will be useful to you as a source of reference.

These manuals are located

- on the CD "SIMATIC Process Control System PCS 7 V 6.0, Electronic Manuals[0]".
- in the PCS 7 Software in the SIMATIC Manager[0]. You can open the documents with the menu command "Start > SIMATIC > Documentation > [required language]".

Here, you will also find other manuals on specific topics, for example on SFC, CFC.

Further Support

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

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

Training Centers

Siemens offers a number of training courses to familiarize you with BATCH *flexible* and the Process Control System PCS 7. Please contact your regional training center or our central training center in D 90327 Nuremberg, Germany for details:

Telephone: +49 (911) 895-3200.

Internet: <http://www.sitrain.com>

A&D Technical Support

Worldwide, available 24 hours a day:



<p>Worldwide (Nuernberg) Technical Support</p> <p>24 hours a day, 365 days a year Phone: +49 (0) 180 5050-222 Fax: +49 (0) 180 5050-223 E-Mail: adsupport@siemens.com GMT: +1:00</p>		
<p>Europe / Africa (Nuernberg) Authorization</p> <p>Local time: Mon.-Fri. 8:00 to 17:00 Phone: +49 (0) 180 5050-222 Fax: +49 (0) 180 5050-223 E-Mail: adautorisierung@siemens.com GMT: +1:00</p>	<p>United States (Johnson City) Technical Support and Authorization</p> <p>Local time: Mon.-Fri. 8:00 to 17:00 Phone: +1 (0) 423 262 2522 Fax: +1 (0) 423 262 2289 E-Mail: simatic.hotline@sea.siemens.com GMT: -5:00</p>	<p>Asia / Australia (Beijing) Technical Support and Authorization</p> <p>Local time: Mon.-Fri. 8:30 to 17:30 Phone: +86 10 64 75 75 75 Fax: +86 10 64 74 74 74 E-Mail: adsupport.asia@siemens.com GMT: +8:00</p>
<p>The languages of the SIMATIC Hotlines and the authorization hotline are generally German and English.</p>		

Service & Support on the Internet

In addition to our documentation, we offer our Know-how online on the internet at:

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

where you will find the following:

- The newsletter, which constantly provides you with up-to-date information on your products.
- The right documents via our Search function in Service & Support.
- A forum, where users and experts from all over the world exchange their experiences.
- Your local representative for Automation & Drives via our representatives database.
- Information on field service, repairs, spare parts and more under "Services".

Contents

1	Requirements for Getting Started	1-1
1.1	Requirements for Working through Getting Started.....	1-1
1.1.1	Hardware Required for Getting Started	1-1
1.1.2	Software Required for Getting Started.....	1-2
2	Overview of PCS 7	2-1
2.1	Brief Overview of PCS 7	2-1
2.2	What Belongs to PCS 7?	2-1
2.3	Introduction to the SIMATIC Manager	2-2
2.4	What is the Basic Structure of the SIMATIC Manager?.....	2-2
2.5	What Does View Mean in the SIMATIC Manager?.....	2-3
2.5.1	How to Open the SIMATIC Manager	2-3
3	First Steps in the Project	3-1
3.1	Introducing the Project	3-1
3.1.1	The 'color_gs' Project.....	3-1
3.1.2	The Task for Getting Started.....	3-2
3.1.3	Structure of the Plant for the 'color_gs' Project.....	3-3
3.1.4	Overview of the Steps in Configuration.....	3-4
3.2	Hardware Settings.....	3-5
3.2.1	Hardware Settings outside the SIMATIC Manager	3-5
3.2.1.1	How to Check the Hardware Settings	3-5
3.2.1.2	How to Set the PG/PC Interface.....	3-8
3.3	Creating the Project	3-11
3.3.1	Using the 'New Project' Wizard.....	3-11
3.3.2	Background Information on the PCS 7 Wizard	3-11
3.3.2.1	How to Create the 'color_gs' Project	3-12
3.3.2.2	How to Open and Close the 'color_gs' Project	3-18
3.3.2.3	How to Work in the Various Views	3-18
3.4	Configuring the Hardware	3-19
3.4.1	Configuring the Hardware	3-19
3.4.1.1	How to Configure the Hardware - PLC.....	3-20
3.4.1.2	How to Download the Hardware Configuration	3-23
3.4.1.3	How to Configure the Hardware - OS.....	3-26
3.5	Working in the PH	3-29
3.5.1	Settings in the Plant Hierarchy.....	3-29
3.5.1.1	How to Make the Settings for the PH	3-30
3.5.2	Structuring in the Plant View	3-32
3.5.2.1	How to Adapt the Default Names	3-33
3.5.2.2	How to Insert Further Hierarchy Folders	3-35
3.5.3	Exchange of Information between PLC and OS	3-36
3.6	The Current Status of Your Project.....	3-37

4	Creating CFC Charts	4-1
4.1	Overview of CFC Charts and the CFC Editor	4-1
4.2	Working with Libraries	4-2
4.2.1	CFC Charts and the Master Data Library.....	4-2
4.2.2	Storage of Objects in the Master Data Library.....	4-3
4.2.3	Working with the Master Data Library.....	4-4
4.2.3.1	How to Open Libraries	4-5
4.2.3.2	How to Insert Blocks in Your Library.....	4-6
4.2.3.3	How to Insert Process Tag Types in a Library	4-8
4.2.4	Showing and Hiding Libraries	4-10
4.2.4.1	How to Hide and Show Libraries.....	4-10
4.3	CFC Charts in the PH	4-12
4.3.1	Working with CFC Charts.....	4-12
4.3.2	Which Charts do You Require in the 'color_gs' Project?	4-12
4.3.3	Technological Significance of the 'CFC_SETP' Chart	4-13
4.3.4	Technological Significance of the 'CFC_FC111' Chart.....	4-13
4.3.5	Technological Significance of the 'CFC_LI111' Chart.....	4-14
4.3.6	Technological Significance of the 'CFC_NP111' Chart.....	4-14
4.3.7	Technological Significance of the 'CFC_NK11x' Chart.....	4-14
4.3.7.1	How to Rename CFC Charts in the PH	4-14
4.3.7.2	How to Insert New CFC Charts in the PH.....	4-16
4.3.7.3	How to Insert the 'MOTOR' Process Tag Type.....	4-17
4.4	The Current Status of Your Project.....	4-18
4.5	Working with the CFC Editor.....	4-18
4.5.1	Introduction to the CFC Editor.....	4-18
4.5.2	The Chart in the CFC Editor.....	4-19
4.5.3	The Catalog in the CFC Editor	4-20
4.5.4	Overview of the Configuration Steps for CFC Charts	4-20
4.5.4.1	How to Open the 'CFC_SETP' CFC Chart.....	4-21
4.5.5	Assigning Parameter Values to the Blocks in CFC Charts	4-22
4.5.5.1	How to Insert the Blocks in 'CFC_SETP'	4-22
4.5.5.2	How to Assign Parameter Values for the Blocks in 'CFC_SETP'	4-24
4.5.5.3	How to Insert the Blocks in 'CFC_FC111'	4-26
4.5.5.4	How to Assign Parameter Values for the Blocks in 'CFC_FC111'	4-27
4.5.5.5	How to Insert the Blocks in 'CFC_LI111'.....	4-29
4.5.5.6	How to Assign Parameter Values for the Blocks in 'CFC_LI111'	4-30
4.5.5.7	How to Assign Parameter Values for Blocks in 'CFC_NP111'	4-31
4.5.6	Interconnecting the Blocks in the CFC Charts	4-31
4.5.6.1	How to Interconnect Blocks in 'CFC_FC111'	4-32
4.5.6.2	How to Interconnect Blocks in 'CFC_LI111'.....	4-34
4.6	CFC Charts in the Process Object View	4-35
4.6.1	Using the Process Object View for Controlling Valves	4-35
4.6.1.1	How to Define I/Os for the Process Object View.....	4-35
4.6.1.2	How to Insert the 'VALVE' Process Tag Type.....	4-37
4.6.1.3	How to Adapt the Parameters for 'CFC_NK11x'	4-38
4.6.1.4	How to Specify the Type of Block Icon	4-40
4.7	The Current Status of Your Project.....	4-42

5	Creating SFC Charts	5-1
5.1	Overview of SFC Charts	5-1
5.2	Working with the SFC Editor	5-1
5.2.1	Introduction to the SFC Editor	5-1
5.2.2	The Main Functions of the SFC Editor	5-2
5.2.3	Properties of Steps and Transitions	5-2
5.2.4	Overview of the Configuration Steps for SFC Charts	5-3
5.2.4.1	How to Move an SFC Chart	5-4
5.2.4.2	How to Rename the SFC Chart	5-4
5.2.4.3	How to Open the 'SFC_RMT1' SFC Chart	5-5
5.2.5	Technological Structure of the Sequential Control System	5-5
5.2.5.1	How to Create the Sequential Control System in the SFC Chart	5-7
5.2.5.2	How to Rename Steps	5-9
5.2.5.3	How to Rename Transitions	5-11
5.3	Setting the Parameters	5-13
5.3.1	How to Assign Parameter Values to the Steps of the SFC Chart	5-13
5.3.1.1	Parameters for the 'INIT_LINE1' Step	5-17
5.3.1.2	Parameters for the 'INIT_LINE2' Step	5-17
5.3.1.3	Parameters for the 'INIT_DOSE' Step	5-17
5.3.1.4	Parameters for the 'SLOW_DOWN' Step	5-18
5.3.1.5	Parameters for the 'CLOSE_LINE' Step	5-18
5.3.1.6	Parameters for the 'END' Step	5-18
5.3.2	How to Assign Parameter Values to the Transitions of the SFC Chart	5-19
5.4	The Current Status of Your Project	5-21
6	Compiling, Downloading, and Testing the Charts	6-1
6.1	Overview of Compiling, Downloading, and Testing	6-1
6.1.1	How to Compile and Download CFC and SFC Charts	6-1
6.2	Testing the Program	6-5
6.2.1	How to Test the Program in the SFC Editor	6-6
6.2.2	How to Test the Program in the CFC Editor	6-7
6.3	Current Status of the Project	6-8
7	Configuring the Operator Station	7-1
7.1	The Operator Station in the Process Mode	7-1
7.2	Configuring the Operator Station	7-1
7.3	Working in the SIMATIC Manager	7-2
7.3.1	Preparations in the SIMATIC Manager	7-2
7.3.1.1	How to Edit Picture Properties	7-3
7.3.1.2	How to Delete Unnecessary Pictures	7-5
7.3.1.3	How to Create Block Icons	7-6
7.3.1.4	How to Compile the OS	7-7
7.3.1.5	How to Start the PCS 7 OS	7-11
7.4	Working on the PCS 7 OS	7-12
7.4.1	Structure of the PCS 7 OS - WinCC Explorer	7-12
7.4.2	The Function of Process Pictures	7-12
7.5	General Aspects of Working with the Graphics Designer	7-13
7.5.1	Introduction to the Graphics Designer	7-13
7.5.1.1	How to Open a Process Picture	7-14
7.5.1.2	How to Open the Various Toolbars	7-15
7.5.2	The Objects in the Graphics Designer	7-16
7.5.3	What Are Static Objects?	7-16
7.5.4	What Are Text Fields?	7-16
7.5.5	What Are I/O Fields?	7-16
7.5.6	How Does Tag Interconnection Work?	7-17

7.6	Creating the Process Picture	7-17
7.6.1	How to Insert Pipes and a Tank for the Process Picture	7-17
7.6.2	Labeling the Various Pieces of Equipment	7-20
7.6.2.1	Step 1 - How to Insert a Text Field	7-20
7.6.2.2	Step 2 - How to Set the Text Field	7-21
7.6.2.3	Step 3 - How to Duplicate the Text Field	7-22
7.6.3	Current Status of the Process Picture.....	7-23
7.6.3.1	How to Connect the Raw Material Tank with the Process Value	7-24
7.6.3.2	How to Adapt the Block Icons	7-26
7.6.4	Inserting Input/Output Fields for Operator Control.....	7-29
7.6.4.1	Step 1 - How to Insert the I/O Field.....	7-29
7.6.4.2	Step 2 - How to Format the I/O Field	7-31
7.6.4.3	Step 3 - How to Add Explanatory Text.....	7-32
7.6.4.4	Step 4 - How to Insert Setpoint Assignment	7-33
7.6.4.5	Finishing Touches.....	7-34
7.7	The Current Status of Your Project.....	7-36
8	Working in the Process Mode	8-1
8.1	Introduction to the User Interface.....	8-1
8.1.1	The Operator Station in the Process Mode.....	8-1
8.1.2	User Interface in the Process Mode.....	8-1
8.2	How to Control and Monitor in the Process Mode	8-3
8.2.1	How to Activate the Process Mode	8-3
8.2.2	How to Start the Process	8-4
8.2.3	How to Stop the Process.....	8-6
8.2.4	How to Control the Process from the Process Picture.....	8-6
8.2.5	How to Select the Reactor	8-6
8.2.6	How to Open Faceplates.....	8-7
8.2.7	How to Change the Setpoint	8-7
8.2.8	How to Work with Messages.....	8-9
8.2.9	How to Exit the Process Mode	8-10
9	The Additional Task.....	9-1
9.1	Introducing the Additional Task.....	9-1
9.1.1	How to Copy the Existing 'RMT1' Plant Section	9-1
9.2	Preparing for the Process Mode	9-3
9.2.1	How to Download the New Charts	9-4
9.2.2	How to Compile the OS after Changes.....	9-6
9.2.3	How to Start the Process Mode	9-7
10	Starting and Adapting the Sample Project	10-1
10.1	The Supplied Sample Project 'color_gs'	10-1
10.1.1	How to Open the Sample Project.....	10-1
10.1.2	How to Adapt the Hardware for the Sample Project	10-3
10.1.3	How to Compile and Download the Sample Project	10-4

Index

1 Requirements for Getting Started

1.1 Requirements for Working through Getting Started

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

- Hardware
- Software

1.1.1 Hardware Required for Getting Started

The list below shows the hardware components you require to work through Getting Started and that we have used in the Getting Started example. In some cases, you require a specific version of a hardware component since it is not possible to work through Getting Started with an older or different version.

Hardware Component	Version Used in Getting Started	Other Version Possible
PG or PC with a standard network adapter	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 2.0 or higher with a fixed MAC address	no
Memory card		
Crossover cable		no

Caution

The CPU and the CP are absolutely necessary to be able to create the configuration as described in Getting Started.

If you use a different hardware component, you must remember to enter the actual component you are using at certain points during the configuration, for example in HW Config. If it is at all possible, we recommend that you use exactly the same components as we used in Getting Started.

If you do not have any hardware components available, you can also use the software PLC Sim that is also 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.

1.1.2 Software Required for Getting Started

The following software must be installed:

- Windows 2000 Professional
- Internet Explorer 6.0
- Message queuing service
- SQL Server
- Software package from PCS 7: "PCS 7 Engineering"

These packages are all available on the "PCS 7 Toolset V 6.0" CD. If you have questions relating to the installation of the PCS 7 Toolset, please read the readme file on the installation CD or contact customer support.

2 Overview of PCS 7

2.1 Brief Overview of PCS 7

PCS 7 is a process control system that supports you during configuration with numerous automatic functions so that you can create a project quickly and conveniently. You will get to know some of these automatic functions when you work through this Getting Started. When you have become an advanced user, you will also find that PCS 7 provides a variety of options with which you can create individual and project-specific solutions tailored to your specific requirements. These individual solutions are, of course, not part of this Getting Started – for more information in this direction, you can refer to 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 and SFC charts

These objects always exist regardless of the number of operator stations, modules, and networking.

2.2 What Belongs to PCS 7?

The project is created with the Engineering System, generally abbreviated to ES. The ES consists of various applications. All applications provide you with a graphic user interface for simple control and clear display of your configuration data. When you work through Getting Started, you will get to know the following applications:

- SIMATIC Manager – the central application providing you with access to all other applications that you use to create a PCS 7 project. The SIMATIC Manager is the starting point for creating your entire project.
- HW Config – configuration of the entire hardware of a system, for example CPUs, power supply, communications processors.
- CFC and SFC Editor – for creating CFC charts and sequential controls
- PCS 7 OS with various editors – for creating the OS configuration

2.3 Introduction to the SIMATIC Manager

What is the SIMATIC Manager?

The SIMATIC Manager is the central application and in some ways the "core" of PCS 7. This is your starting point from which you can open all other applications in which you make the settings for your PCS 7 project. The SIMATIC Manager and all other applications are linked to each other. When you open the SIMATIC Manager, you can for example also see all the blocks you inserted in a CFC chart with the CFC editor. Another great advantage of this linking becomes clear when you configure the operator station. You can access all data you created in the SIMATIC Manager and the other applications, for example you can visualize a process tag from a CFC chart quickly and simply during configuration of the OS.

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

2.4 What is the Basic Structure of the SIMATIC Manager?

The SIMATIC Manager has a window made up of two panes – comparable with the Windows Explorer:

- The left pane contains a tree structure whose contents depend on the selected view.
- The right-hand window, the detailed window contains details of the object you select in the tree structure.

2.5 What Does View Mean in the SIMATIC Manager?

The SIMATIC Manager provides you with three different views. One important feature of these views is that the objects they contain exist only once in reality but can be displayed and manipulated in the various views. Each view has basically the same structure: In the left-hand pane you see the tree structure and in the right-hand pane the detailed window. Each view has its own particular advantages depending on the task in hand.

- Component view – this 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 PLC.
- Plant view – this shows the hierarchical structure of your plant. You can divide the plant into sections or units and can see which charts and which process pictures belong to which plant section.
- Process object view – this shows details of the individual objects of the plant view. This is particularly suitable when you want to assign similar parameter values to a large number of objects, add comments to them or interconnect them.


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

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

2.5.1 How to Open the SIMATIC Manager

Open the SIMATIC Manager

There are two ways in which you can start the SIMATIC Manager:

Option	Procedure
1	Double-click on the STEP 7 icon on your desktop. 
2	Start the SIMATIC Manager from the Windows taskbar with the following menu command: Start > SIMATIC > SIMATIC Manager.

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

3 First Steps in the Project

3.1 Introducing the Project

3.1.1 The 'color_gs' Project

After this initial theoretical introduction to PCS 7, we will now turn to more practical matters and create the "color_gs" project. You will, of course, be supported by detailed step-by-step instructions. To better understand the step-by-step instructions, a certain amount of theory is of course necessary – and we will provide you with the most important background information on all topics.

We will only configure a small part of the entire plant for fully automatic paint production since configuring the entire plant would be beyond the scope of this Getting Started project. You should, nevertheless, know how this small part is integrated in the entire plant so that you have a more complete picture. With this in mind, the individual phases of the entire process are explained briefly below.

Phase I – Raw Materials

The liquid raw materials required for the product are stored in two tanks and are pumped from these tanks to the reactors. The solid raw materials are stored in three silos. Three feed screws leading from the silos transport the solid raw materials to a weighing hopper where they are weighed. Once the correct mixture has been obtained, a further feed screw and a blower transport the raw materials to one of the two mixing containers.

Phase II – Creating the Product

The required quantities of liquid material are fed to either reactor 1 or reactor 2 via valves. The solid materials from the mixing containers are transported to the reactors by feed screws and mixed by an agitator. The product is produced in the reactors by agitating, heating and cooling the raw materials along with the additives. The temperature in the reactors is controlled by valves and actuators. When necessary, water can be let in to the reactors flow-controlled from a filtering unit.

Phase III – Holding Phase

The finished product is then pumped to a holding tank. Here, it is stirred slowly and kept at a constant temperature.

Phase IV – Filling

Following the holding phase, the product is briefly stored in a filling tank from which it can then be filled into tankers or small drums.

Phase V – Cleaning

The reactors, piping, valves, actuators, holding tank, and filling tank can then be cleaned by a cleaning system (CIP). The resulting effluent is then collected in a separate effluent tank for disposal.

3.1.2 The Task for Getting Started

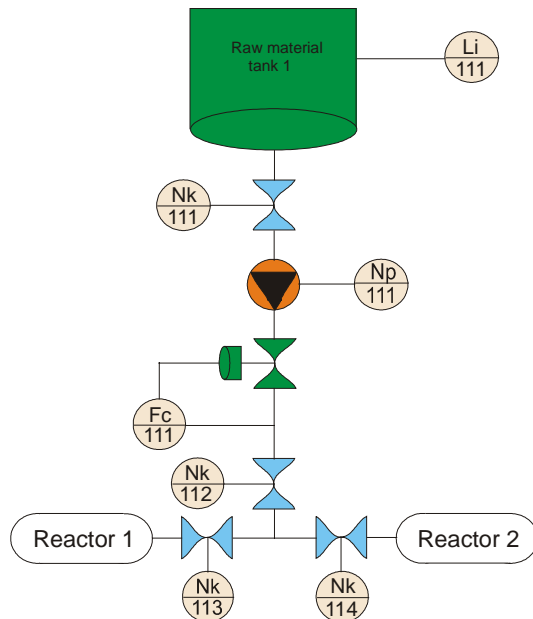
Your Configuration Task...

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

The storage of the liquid raw materials in two tanks and control of the pumps to pump these raw materials to the two reactors.

Piping and Instrumentation Flow Diagram

The piping and instrumentation flow diagram illustrates the precise sequence of the configuration tasks and shows you all the relevant measuring points (tags):



Explanation of the Piping and Instrumentation Flow Diagram

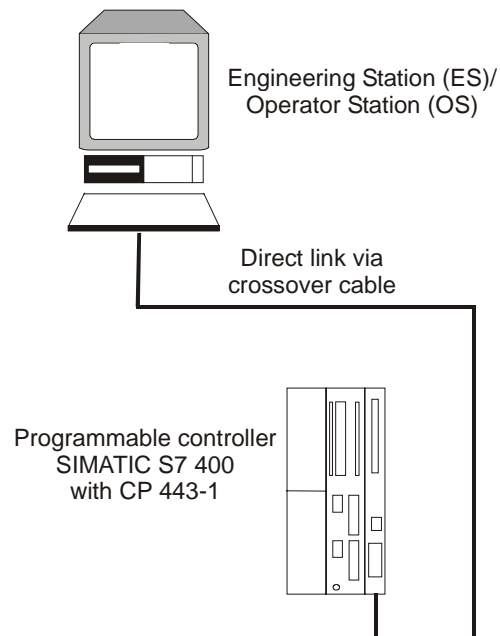
- LI111 (Level Indicate) – measurement of the current level of the raw material tank
- NK111 and NK112 (customer-specific identifier for valves) – stop valves that must always be open when dosing raw materials.
- NP111 (customer-specific identifier for motors) – pump that transports the raw material to the reactors
- NK113 or NK114 (customer-specific identifier for valves) – valves of which only one can ever be open at any one time used to transport the raw material to either Reactor 1 or Reactor 2
- FC111 (Flow Control) – actuator with which the amount of raw material is controlled

The states of valves NK111 to NK114 will be displayed on the operator station and can be monitored. It will also be possible to influence the dosing with FC111.

3.1.3 Structure of the Plant for the 'color_gs' Project

The "color_gs" project is implemented in a small unit of plant with one programmable controller and a combined engineering system and operator station. The operator station is designed as a single workstation system. The following figure illustrates the structure of the plant.

Single workstation system



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

- Programmable controller, abbreviated to PLC
The individual components are described in *Requirements for Implementing Getting Started*.
- Program that handles the control of the "color_gs" plant. You will create this program in the engineering system, abbreviated to ES and download it to the CPU. The CPU processes the loaded program and returns process values to you. You download the program via the CP 443-1.
- Operator station, abbreviated to OS, on which the plant operator can control and monitor the plant in the process mode. You will create the process picture that the operator sees on the OS yourself. The connection between the PLC and the OS is via the CP.

Note

Please remember that the plant setup and the hardware settings resulting from it are designed specially for the requirements of this Getting Started. When you configure a real project, you will certainly use more programmable controllers and run the engineering system and the operator station(s) on different computers. As a result, the hardware settings will be far more complex and will certainly no longer match the descriptions in Getting Started.

3.1.4 Overview of the Steps in Configuration

To configure this plant section, you will need to perform the following steps:

- Make hardware settings
- Start the SIMATIC Manager and set up a PCS 7 project
- Create CFC charts
- Create SFC charts
- Download and test the project
- Configure and compile the PCS 7 OS
- Create process pictures
- Change to the process mode with the simulated process values

3.2 Hardware Settings

3.2.1 Hardware Settings outside the SIMATIC Manager

Before you even start to configure the "color_gs" project, you should check the hardware settings, set the PG/PC interface, and test the connection between your ES computer and the PLC. This makes sure that you will be able to download the configuration data without problems and that you can change your project to the process mode once you have completed the configuration data.

Note

These settings are generally made immediately after installing PCS 7 using the Commissioning Wizard. Since you probably did not install PCS 7 yourself, you should check the settings again and make any necessary adaptations.

3.2.1.1 How to Check the Hardware Settings

Requirement

Make sure of the following:

- That all required hardware components are inserted in the rack and turned on
- That there is a crossover cable between the 3Com network adapter of your ES computer and the CP 443-1

Follow the steps outlined below...

1. Open the Configuration Console using the Windows command **Start > Simatic > SIMATIC NET > Settings > Configuration Console**.
The configuration console opens and all the hardware components belonging to your PC are displayed under the "Modules" entry in the tree structure.

Caution

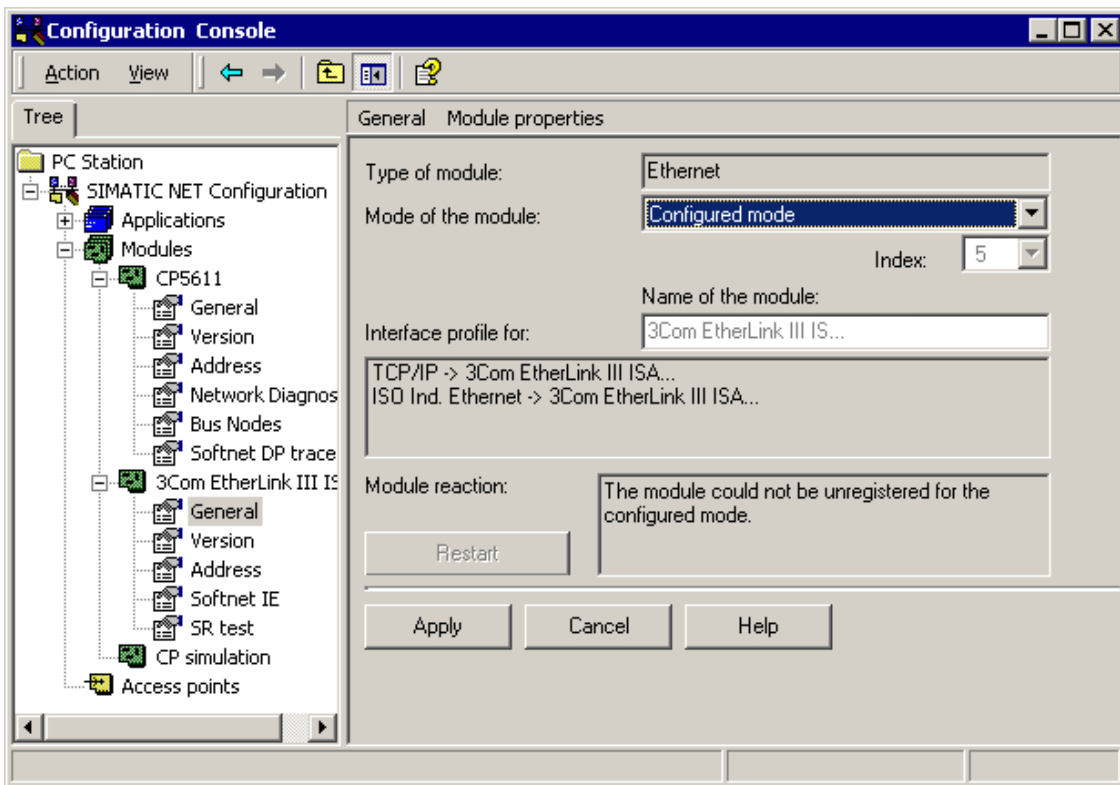
If the configuration console is not opened directly but rather the Commissioning Wizard is started, click on the "Cancel" button.
This closes the Commissioning Wizard and the Configuration Console is opened.

2. In the tree structure, select the entry "SIMATIC NET Configuration/Modules/[name of the network adapter, for example: "3Com EtherLink III IS..."]/General". The general information on this module is then displayed in the detailed window.

Note

If you are using a different network adapter in your PC, the name of your network adapter will of course be displayed here. In this case, you must select this network adapter.

3. In the detailed window you will see a drop-down list box "Mode of the module" where you select the entry "Configured mode". This activates this network adapter.



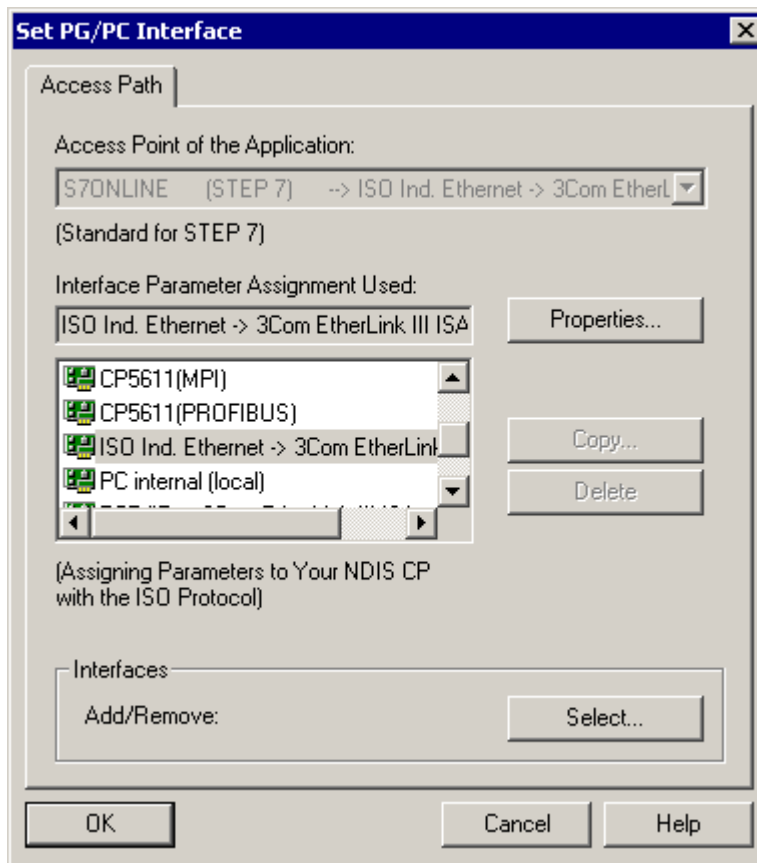
4. Click the "Apply" button. This enters your settings.

5. If you have other network adapters, for example the CP 5611 MPI adapter or another 3Com adapter in your PC, you must deactivate it since it will not be required for getting started.
Follow the steps below:
 - Select the required entry in the tree structure, for example "SIMATIC NET Configuration/ Modules/[Name of the adapter, for example "CP5611"]/ General".
The general information on this module is then displayed in the detailed window.
 - In the detailed window you will see a drop-down list box "Mode of the module" where you select the entry "Not yet specified".
 - Click the "Apply" button.
This enters your settings.
6. Repeat Step 5 for all other network adapters in your PC that you do not require for communication between the ES/OS computer and the CPU.
7. Close the Configuration Console.



3.2.1.2 How to Set the PG/PC Interface

1. Select the following menu command via the Windows taskbar **Start > Simatic > STEP 7 > NCM S7 Industrial Ethernet > Diagnostics**.
NCM S7 diagnostics is opened.
2. Select the menu command **Diagnostics > Open Online Connection...**
The "NCM S7 Diagnostics: Online Path" dialog box is opened.
3. Click on the "Set PG/PC Interface" button.
The "PG/PC Interface" dialog box opens.



4. Select the entry "ISO Ind. Ethernet -> 3Com EtherLink III ISA..."
5. Click the "OK" button to enter your settings.
6. In the "Destination Station" area, select the entry "Industrial Ethernet" in the "Destination station attachment" drop-down list box.
7. Enter the MAC address printed on your CP in the "Node address" box.

8. In the "Rack/slot" drop-down list box, select the entry "0/5".
The CP is in the rack in Slot 5 if you have inserted a power supply and CPU in the rack.

NCM S7 Diagnostics: Online Path

Which module do you want to access?

Gateway

Gateway attachment:

Node address (gateway):

S7 subnet ID of destination network: -

Destination Station

Destination station attachment

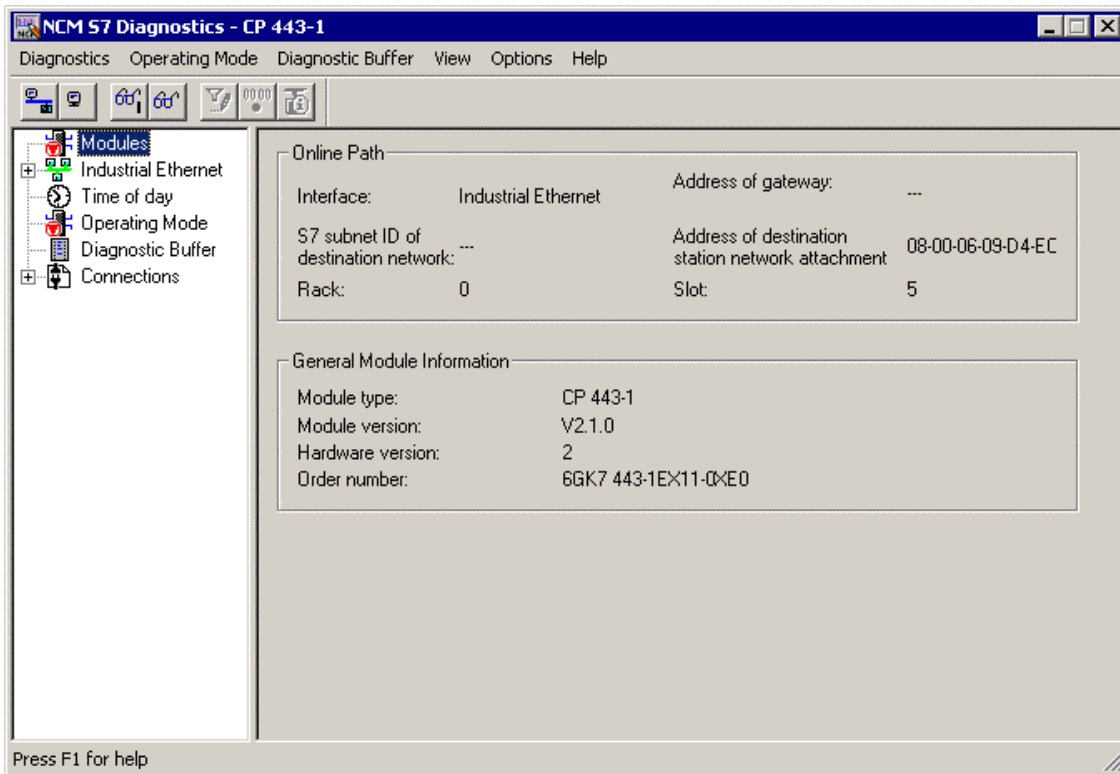
Node address:

Rack / slot: /

Set PG/PC Interface

OK Cancel Help

9. Click the "OK" button to enter your settings.
If your connection is functioning correctly, the data of the CP will be displayed.



10. Close NCM S7 diagnostics.



3.3 Creating the Project

3.3.1 Using the 'New Project' Wizard

When you start the SIMATIC Manager, the default setting automatically starts the PCS 7 wizard "New Project". You can activate or deactivate this option in the "New Project" wizard.

The "New Project" wizard supports you step-by-step when you create a new project and supports you with default settings. Depending on the default settings you leave and any settings you make extra, the wizard automatically creates various objects.

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

- Hardware objects: SIMATIC stations, for example a SIMATIC 400 for the PLC, 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 made in the wizard.
- one CFC chart
- one SFC chart
- one picture per plant hierarchy folder
- one master data library

3.3.2 Background Information on the PCS 7 Wizard

What happens in the background when you create a new project?

The next two sections provide you with a little theoretical background on the PCS 7 "New Project" wizard. These sections also introduce you to two new terms whose significance you should understand:

- Multiproject
- Master data library

How does a multiproject function?

When you create a new project with the PCS 7 wizard, a multiproject is automatically created. This requires a little explanation. A multiproject consists of several single projects. Taken in the context of a concrete project, a multiproject could be implemented as follows: The multiproject represents the entire plant and all of the single projects within this multiproject could, for example, represent the individual phases of the process for making paint. Since you are only configuring a small section of the entire plant, your multiproject naturally only contains one single project.

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 complete, these can be merged back to form the full project.

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

For more detailed information on this topic, refer to the Configuration Manual *Process Control System PCS 7, Engineering System*.

What is a master data library?

When you create a new project with the PCS 7 wizard, a master data library is automatically created. You store all the blocks required for the entire project in this library. Before you create, for example a CFC chart, you deposit all the standard blocks you want to insert in this CFC chart in your master data library. A master data library has the following advantage: When you archive a project, the master data library is automatically archived along with the project. You can also make changes to the blocks and then continue to use these adapted blocks repeatedly.

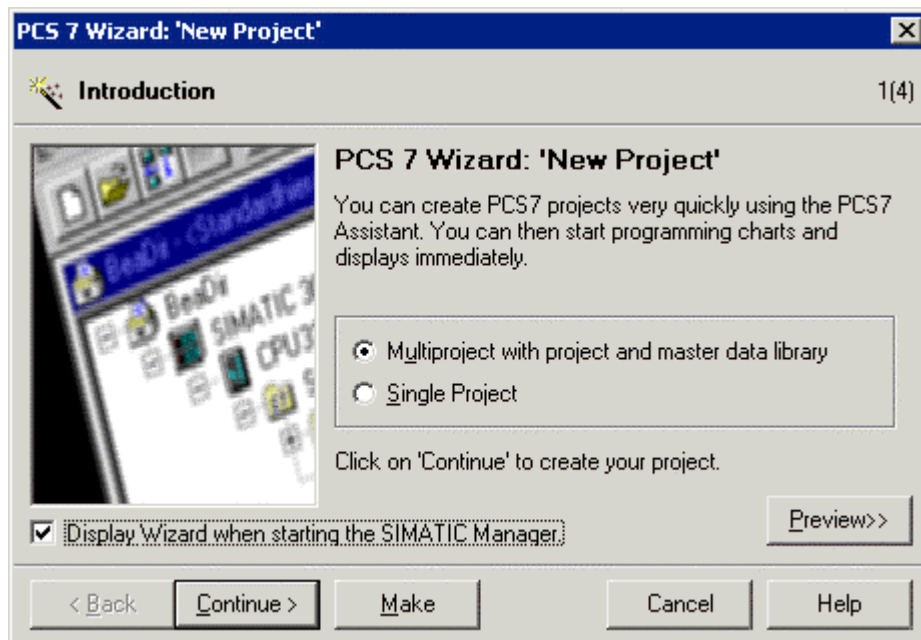
In the context of a multiproject, the master data library is, of course, particularly important because it allows you to provide all the configuration engineers involved with a defined set of block versions so that you can be sure that only this version is used in the project.

3.3.2.1 How to Create the 'color_gs' Project

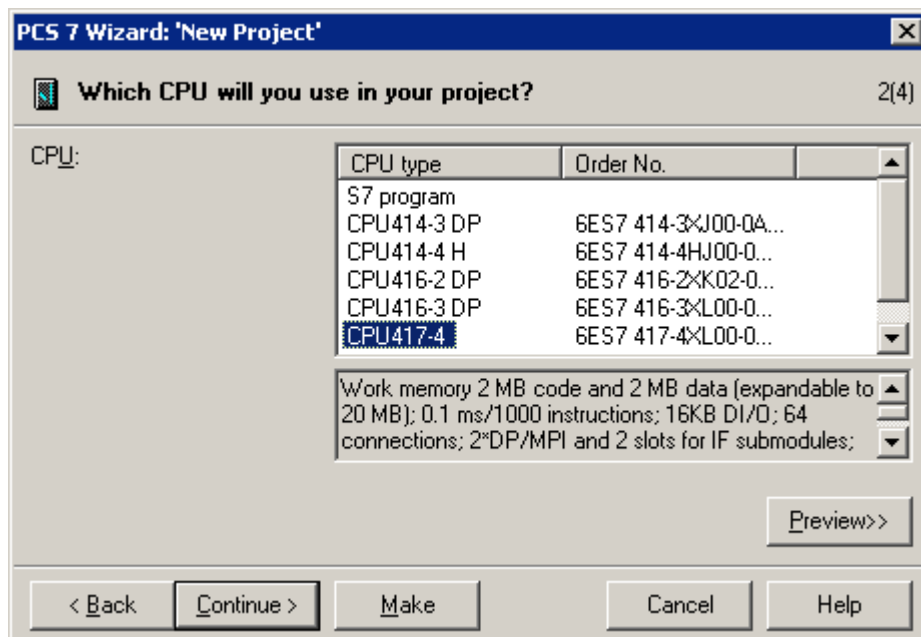
When you create the "color_gs" project, you are supported by the wizard. Follow the steps outlined below:

1. Open the SIMATIC Manager
2. If the wizard does not start automatically, select the menu command **File > 'New Project' Wizard....**
The PCS 7 "New Project" wizard opens.

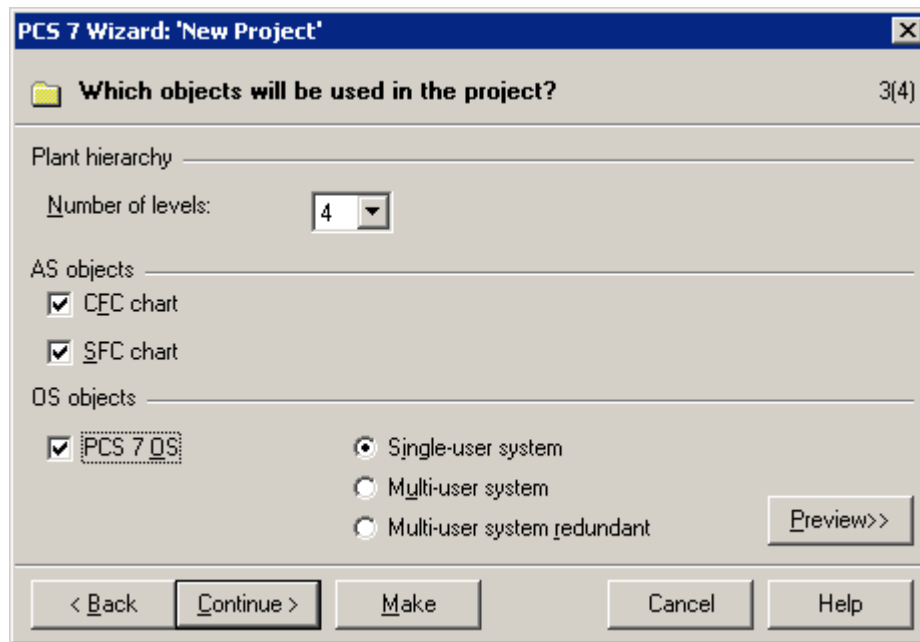
- In step 1(4) "Introduction", activate the option "Multiproject with project and master data library" – this option is activated as the default setting.



- Click the "Next" button.
- In Step 2(4) "Which PLC will you use in your project?", select the CPU type you are using in your project, for example a CPU 417-4. Below the list, you will see detailed information on the selected CPU. When you make your selection here, you should compare the type number and order number printed on the front panel of your CPU with the type number and order number displayed in the list.

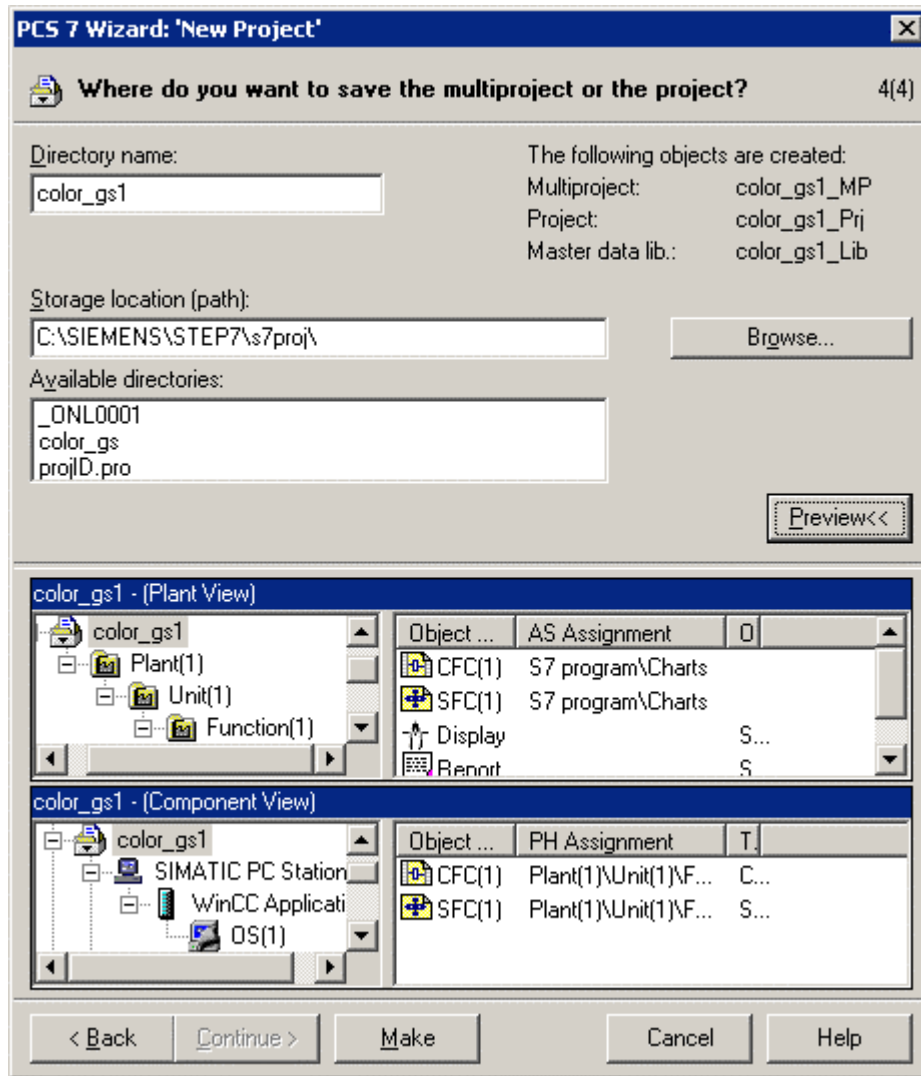


6. Click the "Continue" button.
7. In step 3(4) "Which objects will be used in the project ?", make the following settings:
 - In the list box "Number of levels", select the entry "4".
 - Under OS objects, activate the "PCS 7 OS" check box.
The "Single-user system" option is automatically activated.



8. Click the "Next" button.
9. In step 4(4), enter the name "color_gs" in the "Directory name" box and confirm the storage location.

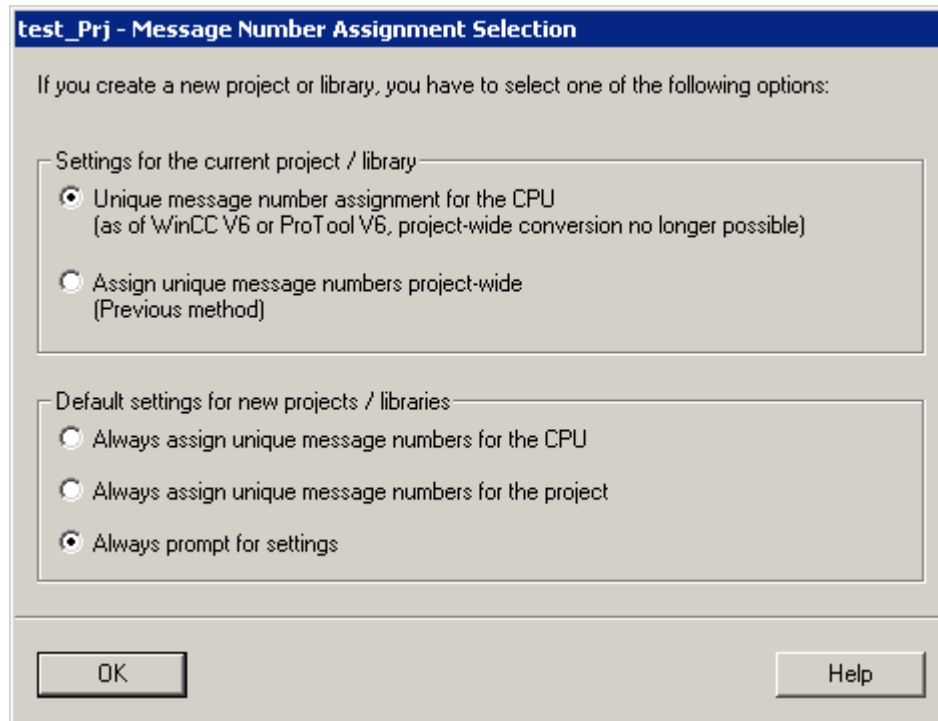
- Click on the "Preview >>" button to display a preview of your current stage of configuration. This preview corresponds to the appearance of the project in the SIMATIC Manager.



- Click on the "Finish" button. The "Message Number Assignment Selection" dialog box is opened twice when the project is being created.

12. Accept the default settings:

- "Unique message number assignment for the CPU" activated
- "Always prompt for settings" activated



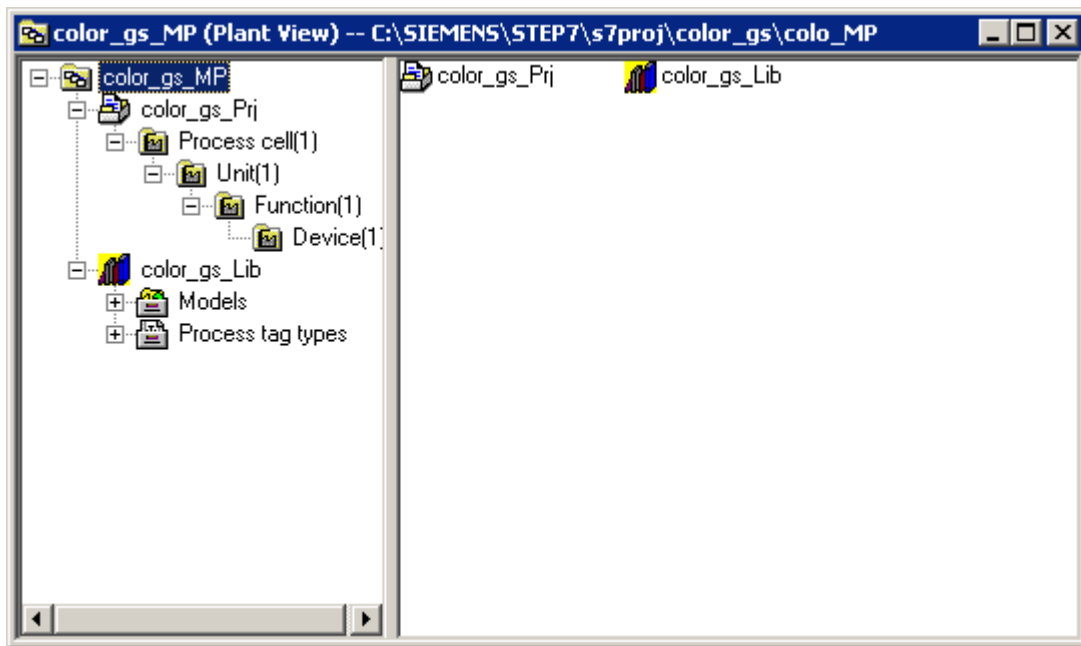
13. Click the "OK" button.

The project is now created with these settings.

Note

- If the project does not open automatically, follow the same steps as in "First Steps in the Project – Creating the Project – How to Open and Close the "color_gs" Project".
 - To activate the various views, follow the steps as described in "First Steps in the Project – Creating the Project – How to Work in the Various Views".
-

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



3.3.2.2 How to Open and Close the 'color_gs' Project

Closing a project

1. If you have other projects open in the SIMATIC Manager, close these projects to keep the display simpler.
Select the menu command **Window > [Name of the Project]** and select the project you want to close.
The project is then shown in the foreground in the SIMATIC Manager.
2. Select the menu command **File > Close**.
The project closes.

Opening the project

1. Open the SIMATIC Manager.
2. If your "color_gs" project does not open automatically, select the menu command **File > Open**.
The "Open Project" dialog box opens and the "User Projects" tab is active.
3. Change to the "Multiprojects" tab and select the "color_gs_MP" entry.
4. Click the "OK" button.
The project along with its master data library opens.



3.3.2.3 How to Work in the Various Views

Once you have opened your project in the SIMATIC Manager, you can activate various views:

- Select the menu command **View > [Name of the required view]** in the SIMATIC Manager:
 - Component view
 - Plant view
 - Process object view
- If you have already opened several projects, select the menu command **Window > [Name of the project (name of the view)]**.

3.4 Configuring the Hardware

3.4.1 Configuring the Hardware

The individual components of the control system such as the CPU, the operator station, the engineering system must be able to communicate with each other. To make this possible, you must insert and configure hardware components. When you run the wizard, some hardware components such as the rack, the CPU and the connection are automatically inserted. You must also insert the CPs you require and set the required connections.

Which hardware components do you need to configure for the "color_gs" project?

- Configuring the programmable controller and configuring the connection – the CPU communicates with the ES over this connection.
- Downloading the configuration to the CPU
- Configuring the OS and configuring the connection – the OS communicates with the PLC via this connection.

3.4.1.1 How to Configure the Hardware - PLC

Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- The component view is activated

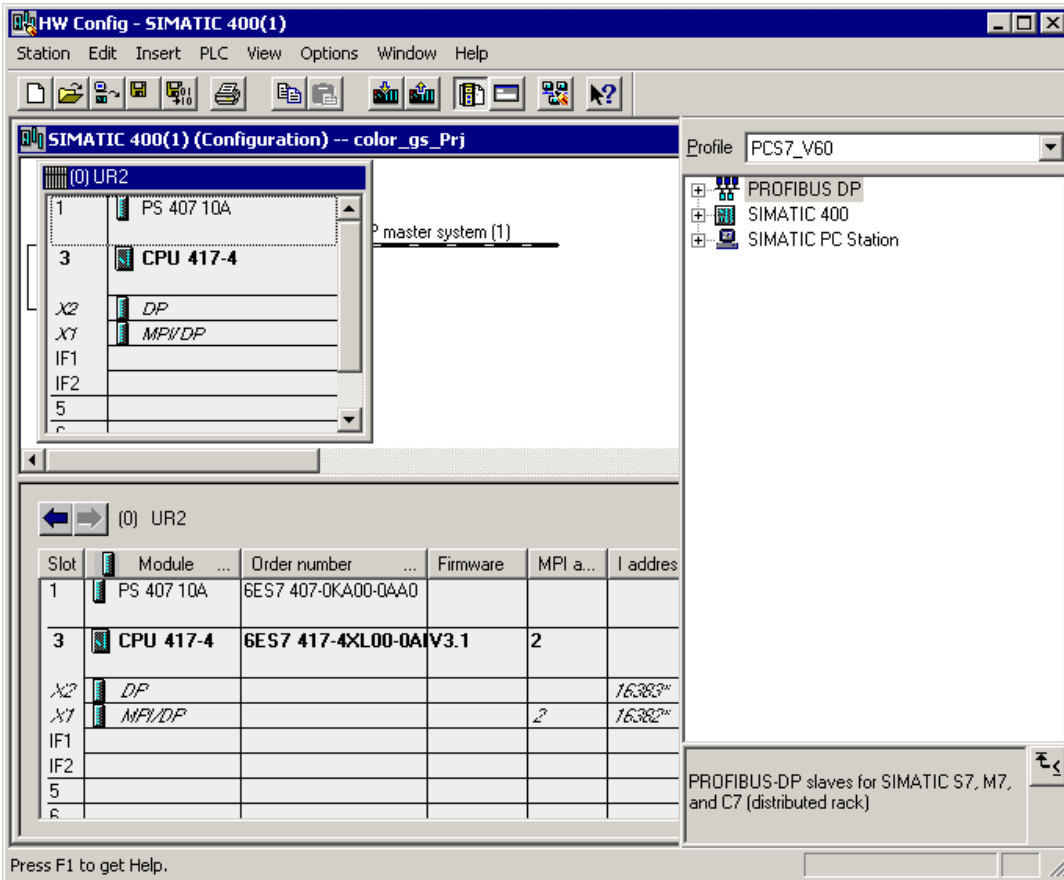
Follow the steps outlined below...

1. Go to the tree structure and select the folder "color_gs_MP/ color_gs_Prj/ SIMATIC 400(1)".
2. Select the "Hardware" object in the detailed window and then select the menu command **Edit > Open Object**.
HW Config is opened and the hardware structure of your system is displayed.

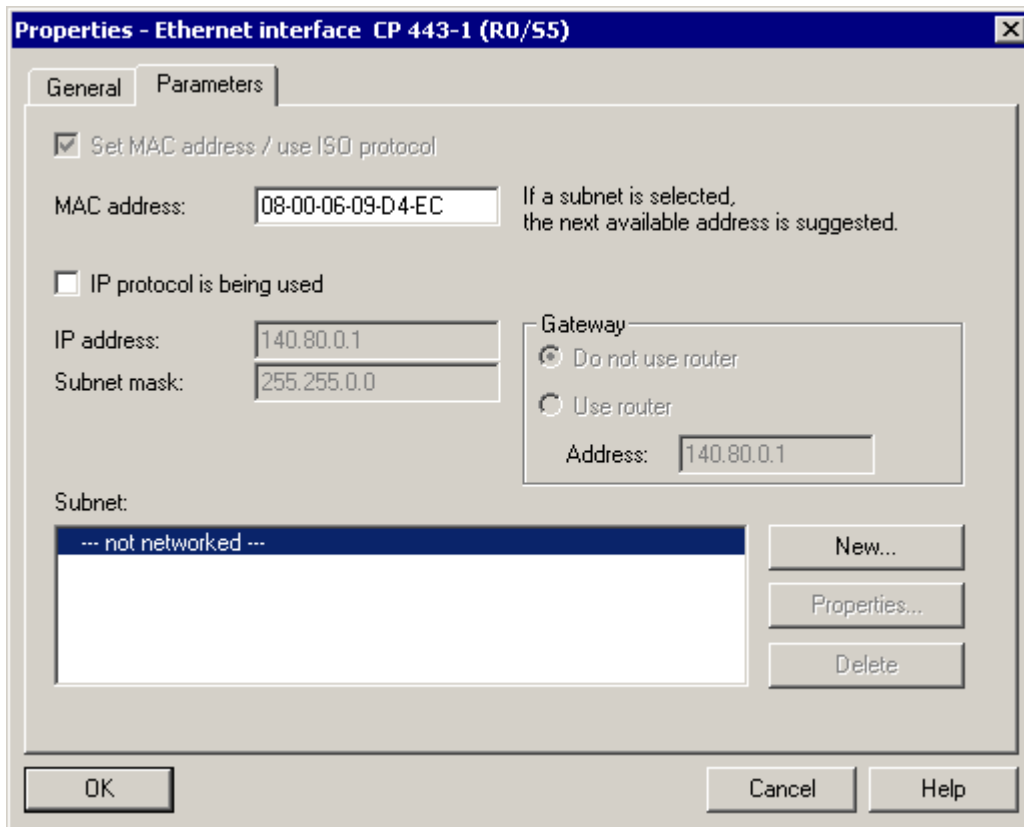
Note

If the hardware catalog is not displayed, select the menu command **View > Catalog**.

The hardware catalog opens and the "PCS7_V60" profile is active.

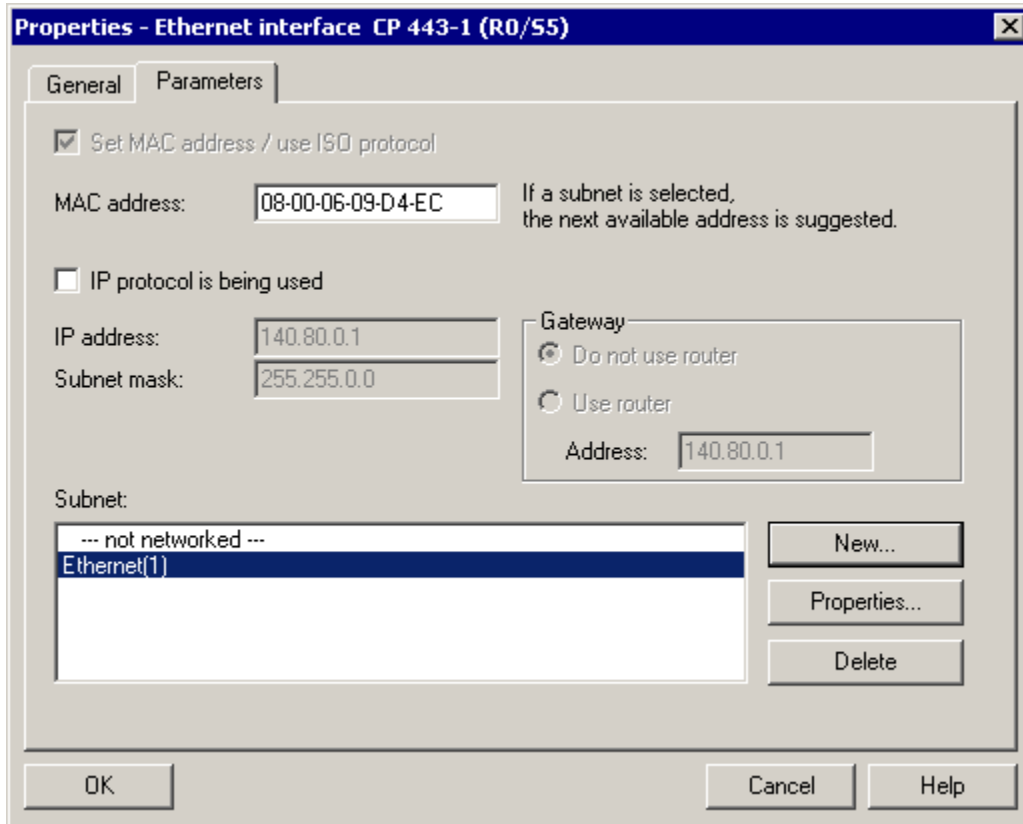


3. Select the following CP from the catalog:
 "SIMATIC 400/ CP-400/Industrial Ethernet/ CP 443-1/ 6GK7 443-1EX11-0XE0/
 V2.0".
 And drag it to slot 5 of the rack.
 The "Properties - Ethernet Interface" dialog box opens.
4. Activate the "Set MAC address/use ISO protocol" option.
5. In the "MAC address" box, enter the MAC address printed on the front of the CP.
6. Deactivate the "IP protocol is used" option.
 This activates all the associated input boxes.



7. Click on the "New" button.
 The "Properties - new subnet Industrial Ethernet" dialog box opens.

8. Apply all your selections and click the "OK" button.
The "Ethernet(1)" entry is entered in the "Subnet" list box and is already selected.



9. Click the "OK" button to enter your settings.
The dialog is closed.
10. Select the menu command **Station > Save and Compile**.



3.4.1.2 How to Download the Hardware Configuration

Once you have created the hardware configuration for the CPU, you must also inform the CPU of this configuration. You do this by downloading the hardware configuration.

Requirement

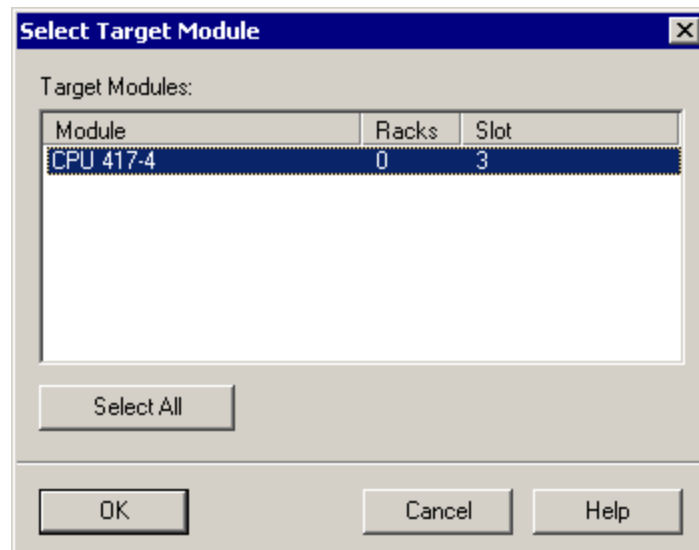
Set your CPU to RUN-P with the mode selector. This allows the CPU to be stopped automatically and restarted again in HW Config.

Ready to Start?

- HW Config is open for the "color_gs" project

Follow the steps outlined below...

1. Select the menu command **PLC > Download to Module**.
The "Select Target Module" dialog box opens and the CPU 417-4 is displayed and automatically selected in the list. This is the CPU you have installed in your project.



2. Click the "OK" button.
The "Select Node Address" dialog box opens.

- Click the "Display" button.
In the list of "Accessible Nodes", you can see the CP with the MAC address you entered when configuring the hardware.

Over which station address is the programming device connected to the module CPU 417-4?

Rack:

Slot:

Target Station: Local
 Can be reached by means of gateway

Enter connection to target station:				
MAC address	Module type	Station name	CPU name	Plant designation
08.00.06.09.D4.EC	CP 443-1			

Accessible Nodes

08.00.06.09.D4.EC	CP 443-1			

Update

OK Cancel Help

- Select the "CP 443-1" in the list of "Accessible Nodes" and click the "OK" button.
The progress bar is displayed. Finally the "Stop Target Modules" message window opens.
- Click on the "OK" button to stop the CPU.
The message window closes and the download is continued. On completion of the download, the "Download to Module" message window opens.

6. Click on the "Yes" button to restart the CPU.
The following LEDs are then lit green and the download has been completed successfully.
 - On the CPU: "RUN"
 - On the CP: "LINK" and "RUN"



3.4.1.3 How to Configure the Hardware - OS

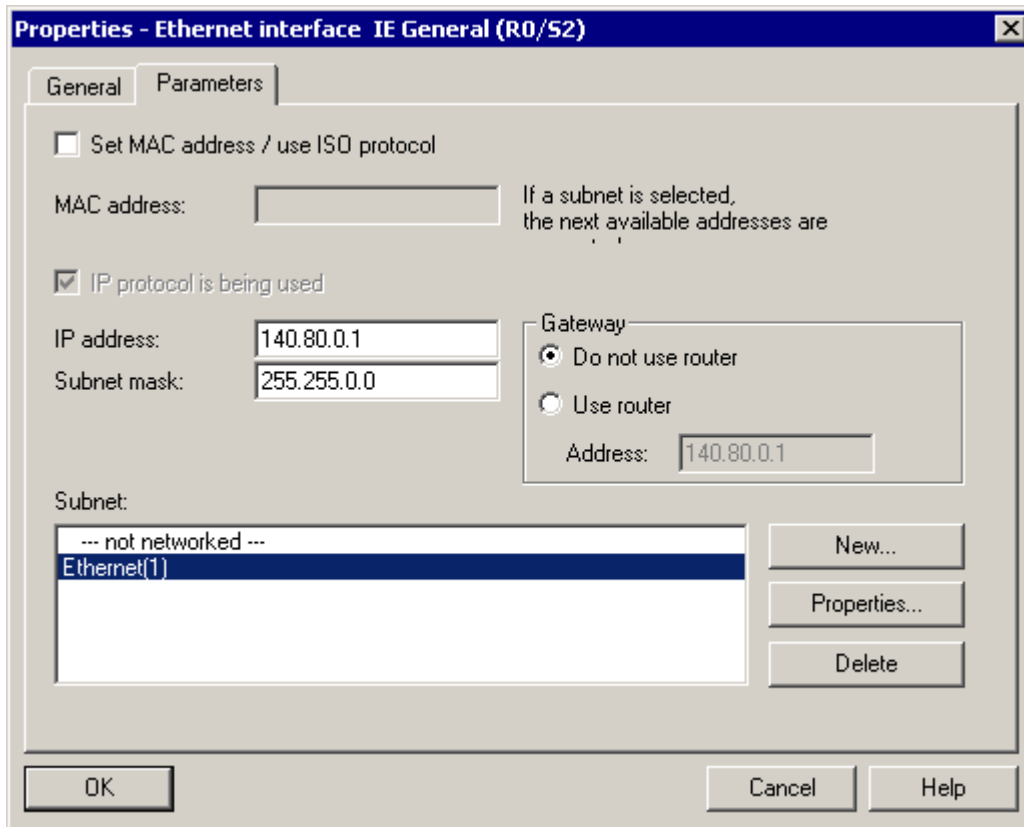
Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- The component view is activated

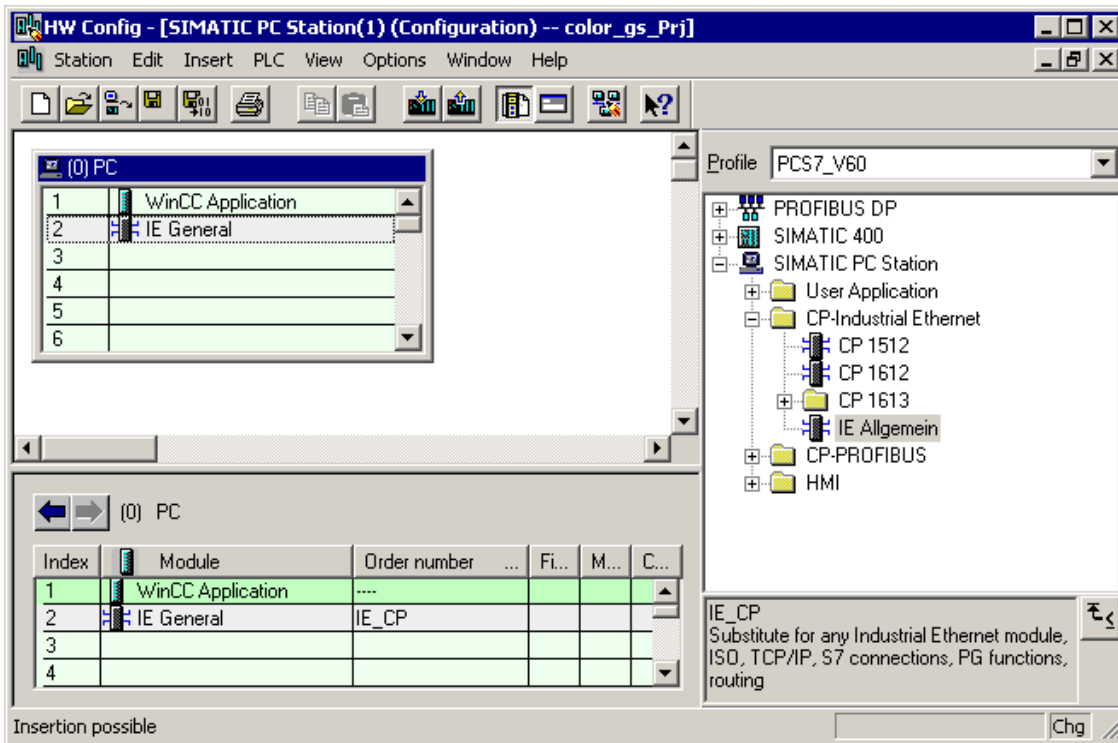
Follow the steps outlined below...

1. Go to the tree structure and select the folder "color_gs_MP/ color_gs_Proj/ SIMATIC PC-Station(1)".
2. Select the "Configuration" object in the detailed window and then select the menu command **Edit > Open Object**.
HW Config opens and the components of the OS are displayed. HW Config is opened with the settings you made during configuration of the PLC:
 - The hardware catalog is open.
 - The "PCS7_V60" profile is active.
3. Select the following CP from the catalog:
"SIMATIC PC-Station/CP-Industrial Ethernet/IE General"
and drag it to Slot 2.
The "Properties - Ethernet Interface" dialog box opens.

4. Open the "Ethernet" entry in the "Subnet" list box.
This is the connection that you already configured for the CP.



5. Click the "OK" button to enter your settings.
The dialog box closes and you return to HW Config.



6. Select the menu command **Station > Save and Compile**.
7. Close HW Config.



3.5 Working in the PH

3.5.1 Settings in the Plant Hierarchy

Once again, it is time for a little theory:

The plant hierarchy that normally abbreviates to PH, mirrors the hierarchical structure of your plant: Plant, unit, function etc. The PH allows you to make a lot of different settings and the most important of these are described below.

- **Number of hierarchy levels:**
Your plant structure influences the number of hierarchy levels. As a rule of thumb, the more complex the plant structure the higher the number of hierarchy levels you require to reflect your plant structure. Hierarchy folders with the default names are created when you work with the wizard.
- **Selecting the hierarchy level(s) that contribute to the name of the plant designation (also known as higher level designation):**
The higher level designation abbreviated to HID is used at many points in the PCS 7 project for example messages occurring during the process mode and tags contain this HID. This makes it easy to recognize the plant section to which a message or tag belongs. As a rule of thumb, the more hierarchy levels used to specify the HID and the longer each individual part is, the longer and less easily recognizable the entire HID becomes.
- **Basing the picture hierarchy on the PH:**
The process pictures are arranged in a certain hierarchy: This allows you to change from an overview picture to a lower level picture showing only part of the overview picture but with far greater detail. You can base the hierarchy of process pictures on the plant hierarchy so that it corresponds to the plant hierarchy.

3.5.1.1 How to Make the Settings for the PH

Ready to Start?

- The "color_gs_MP" project is open in the SIMATIC Manager
- The plant view is activated

Follow the steps outlined below...

1. Select the "color_gs_MP/color_gs_Prj" hierarchy level in the tree structure.
2. Select the menu command **Options > Plant hierarchy > Customize**.
The "Customize Plant Hierarchy" dialog box opens where you can set all the options for the Plant Hierarchy.
3. Enter the value "4" in the "Number of hierarchy levels" box.
This means that a maximum of 4 hierarchy levels are permitted.
4. Enter the value "10" in the "Max. number of characters" box.
This limits the plant designation to 10 characters per hierarchy level.
5. Activate the "Include in designation" check box for the levels 1 and 2.
6. Activate the "OS area" option button for level 2.
7. Select the "Base picture hierarchy on the plant hierarchy" check box.

When you have made the settings, the dialog box appears as shown below:

Level	Max. number of characters	Included in HID	With separator	OS area
1:	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>
2:	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="radio"/>
3:	10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>
4:	10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>
5:	24	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>

Preview: 1111111111\2222222222\

Derive picture hierarchy from the plant hierarchy
 Derive SIMATIC BATCH configuration from the plant hierarchy

OK Cancel Help

8. Click the "OK" button to enter your settings.
The message "You have changed the include in designation property. Do you also want the changes to apply to existing hierarchy folders?" is displayed.
Click on the "Yes" button in the dialog.
This enters all your settings.

3.5.2 Structuring in the Plant View

You already specified four hierarchy levels in the "New Project" wizard. As a result, you will find the following hierarchy folders in the tree structure of your project:

- Plant – 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 you create the project.

In your "color_gs_MP" project, you must, of course, adapt these to the individual requirements of the "color_gs" project, in other words, 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 handle all the objects and individual units.

For the various plant sections, we decided on the following names for the hierarchy folders:

Default Name	Hierarchy Folder	Technological assignment
Plant	Plant1	Complete plant
Unit	RMT1	Raw material Tank 1
Function	FC111	Flow control (dosing)
Function	LI111	Level indicator raw material tank 1
Function	NP111	Pump control
Function	NK111	Valve
Function	NK112	Valve
Function	NK113	Valve
Function	NK114	Valve
Device	ADDIT	Auxiliary chart for selecting setpoints

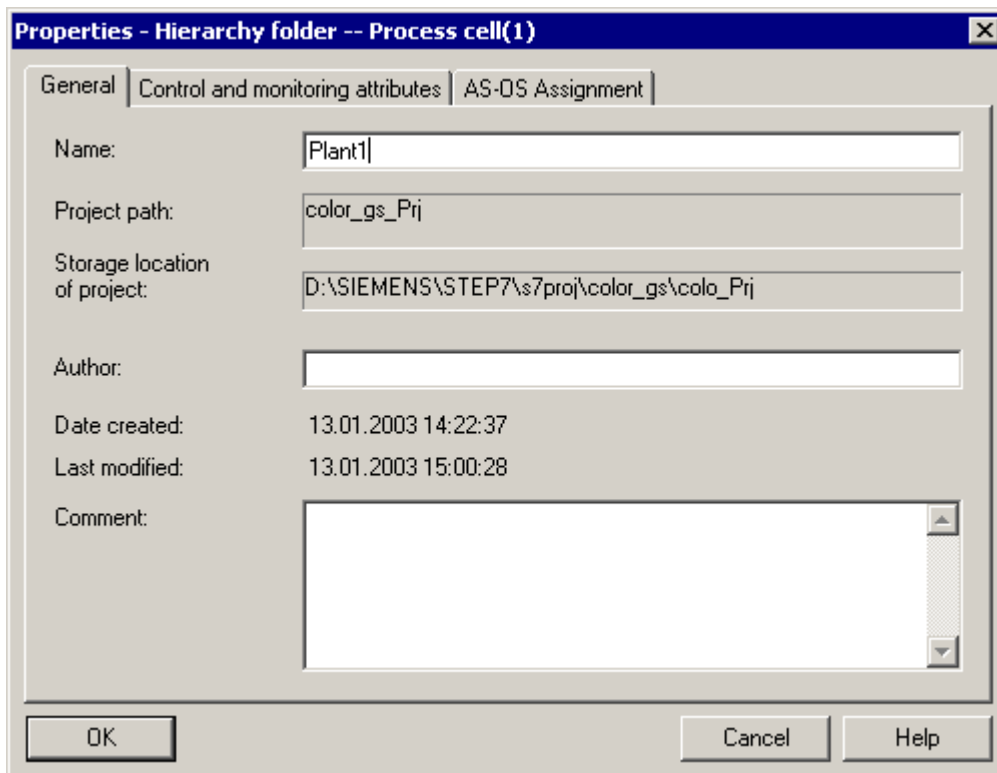
3.5.2.1 How to Adapt the Default Names

Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- The plant view is activated

Renaming the "Plant" Folder

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

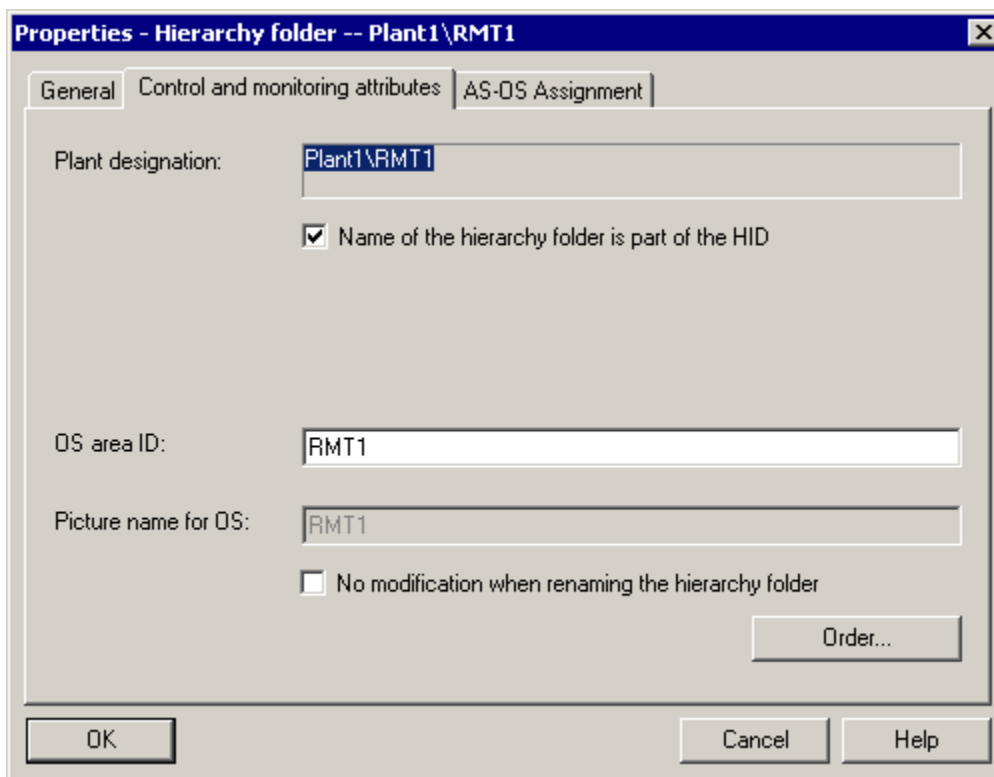


4. Click the "OK" button to enter your settings.
The dialog box is closed and the name of the hierarchy folder is changed to "Plant1".



Object Properties and Renaming the "Unit" Folder

1. Select the "Unit(1)" hierarchy folder.
2. Select the menu command **Edit > Object Properties**.
The "Properties – Hierarchy Folder" dialog box opens and the "General" tab is active.
3. Enter the name "RMT1" in the "Name" input box.
4. Change to the "Control and Monitoring Attributes" tab.
5. Make sure that the check box "No modification when renaming the hierarchy folder" is deactivated.
This makes sure that the text for the OS area identifier is modified according to the name of the hierarchy folder.



6. Click the "OK" button to enter your settings.
The dialog box is closed and the name of the hierarchy folder is changed to "RMT1".

Renaming the Other Folders

1. Select the "color_gs_MP/ color_gs_Prj/Plant1/RMT1/ Function(1)" hierarchy folder and make the following settings:
 - Change the name "Function(1)" to "FC111".
 - Deactivate the check box "No modification when renaming the hierarchy folder"

Note

Follow the same procedure as for renaming the "Plant" folder.

2. Select the " color_gs_MP/ color_gs_Prj/Plant1/RMT1/ Function(1)/ Device(1)" folder and make the following settings:
 - Change the name "Device(1)" to "ADDIT"
 - Deactivate the check box "No modification when renaming the hierarchy folder"

Note

Follow the same procedure as for renaming the "Plant" folder.

3.5.2.2 How to Insert Further Hierarchy Folders

Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- The plant view is activated

Follow the steps outlined below...

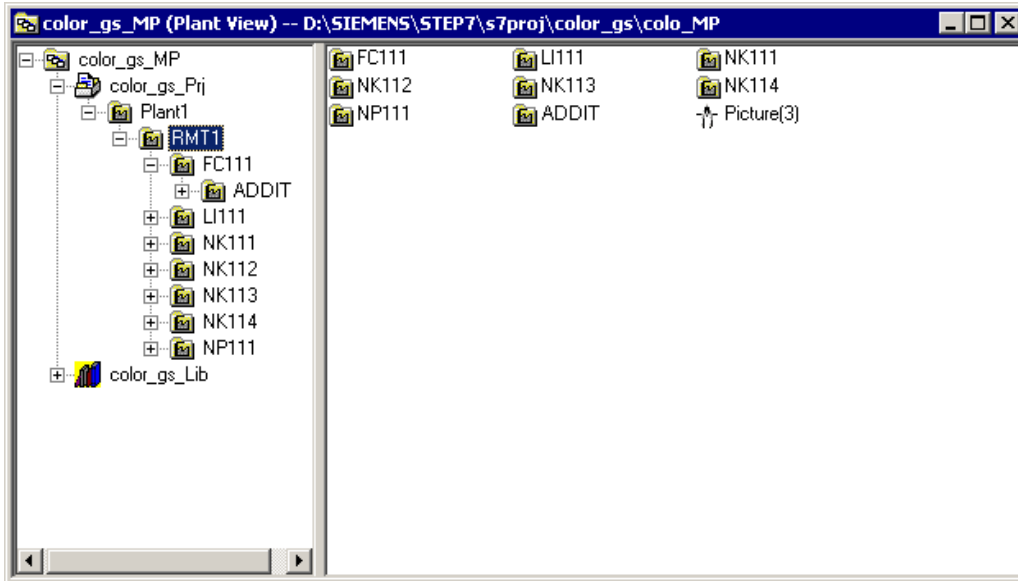
1. Select the "RMT1" folder.
2. Select the menu command **Insert > Technological Objects > Hierarchy Folder**.
A new hierarchy folder "Function [consecutive number]" is created
3. Change the name to "LI111" and make sure that the check box "No modification when renaming the hierarchy folder" is deactivated in the "Control and Monitoring Attributes" tab of the "Properties – hierarchy folder" dialog box.
4. Press Enter.



5. Repeat steps 1 to 4 to create the following hierarchy folders:

- NP111 – motor control
- NK111 – valve control
- NK112 – valve control
- NK113 – valve control
- NK114 – valve control

Your plant hierarchy should now appear as follows:



3.5.3 Exchange of Information between PLC and OS

The individual parts of the plant are assigned to specific programmable controllers or specific operator stations. Each hierarchy folder includes this information. This is, of course, only important when you have more than one programmable controller or operator station in your system. In the "color_gs" project, you have only one programmable controller and one operator station. As a result, all the hierarchy folders are automatically assigned. You can check the assignment as follows:

1. Select the hierarchy folder "Plant1" and select the menu command **Edit > Object Properties**.
The "Object Properties" dialog box opens.
2. Change to the "PLC and OS Assignment" tab.
Here, you will see the following assignment:
 - In the "Assigned PLC (chart folder)", you will see the programmable controller that processes the data.
 - In the "Assigned OS" list box, you will see the operator station on which the data is displayed.
3. Close the dialog box.

3.6 The Current Status of Your Project...

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

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

4 Creating CFC Charts

4.1 Overview of CFC Charts and the CFC Editor

The Theory – What are CFC Charts, What is the CFC Editor?

The entire operation of a plant is described by continuous processes. This is achieved by creating CFC charts in the CFC Editor of PCS 7. To create CFC charts, you insert blocks located in the "PCS 7 Library V6.0" in the CFC charts. These include single blocks such as blocks for controlling a process or for monitoring measured values. The inputs and outputs of these blocks are then interconnected directly in the CFC Editor and are given parameter values. While doing this, you are supported by the user-friendly graphic user interface of the CFC Editor.

In the standard library, PCS 7 also provides process tag types that are based on full CFC charts for various process tags such as motors and valves.

You will also find the CFC charts in the plant hierarchy. To keep the structure of the project clear, the CFC charts are always in the hierarchy folders in which they are of technological significance.

Identifying CFC Charts

CFC charts can be identified by the following symbol in front of their names: 

4.2 Working with Libraries

4.2.1 CFC Charts and the Master Data Library

Brief Theoretical Introduction to the Master Data Library...

When you create the CFC charts, you will work with the master data libraries. You have already got to know the master data library in the theoretical section dealing with the multiproject and when creating your project. All the blocks and process tag types required in the CFC charts in your project are never taken directly from the standard library of PCS 7. You first store the required blocks and process tag types in the master data library and insert them in the CFC charts from there.

What are the Advantages of the Master Data Library?

At first, working with the master data library appears to be somewhat "long winded": You first store the blocks in this library and then take them from the master data library again to insert them in the CFC charts. Why take the trouble? Using the master data library makes sure that the same version of a block is **always** used in a project and that there can be no mix ups. This is particularly important when there is more than one configuring engineer working in a project which is almost always the case in larger projects working within the framework of a multiproject. The use of the master data library also provides you with another convenient PCS 7 function: Namely the hiding of libraries. This allows you to hide all the libraries except for the master data library to avoid inconsistencies and errors within the project. Inconsistencies and errors in a configuration can cause considerable unnecessary extra work. One other advantage of using master data libraries is that they are archived automatically when you archive the multiproject.

4.2.2 Storage of Objects in the Master Data Library

Changes to Blocks

At this point, we will make another brief excursion. This work does not of course belong to the scope of Getting Started but will provide you with a good insight into the options made available to you by PCS 7:

In the master data library, you can change the properties of the block, for example adapt the messages to your particular project. Each block instance created when you insert a block in a CFC chart automatically has the modified properties. This means that you only need to make the changes once to the block in the master data library, you no longer have to make individual modifications to the block instances over and over again. Changes to a block that is specific to a CFC chart can then be made directly in the block instance in the CFC chart itself. This includes, for example, parameters for inputs and outputs such as setpoints and limit values.

Master Data Library and Process Tag Types

You can, of course, also store the process tag types provided by PCS 7 in your master data library. 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

- Open a library
- Put all the blocks in your master data library – the master data library was created automatically by the PCS 7 wizard when you created the project
- Enter the process tag types in your master data library

4.2.3 Working with the Master Data Library

Blocks in the Master Data Library

Creating a master data library for a large project does, of course, involve a lot of precise planning before the CFC charts are created. In Getting Started, we will of course provide you with all the blocks you require for the "color_gs" project. The blocks are shown in the following list. We have added a certain amount of additional information:

- Object name – this is an alphanumeric short identifier for the block that is displayed in PCS 7
- Symbolic name – this is a short self-explanatory name for the block
- Meaning – here, you will find a brief explanation of how the block can be used
- Type of block – here you will see the category to which the block belongs
- Relevant CFC chart – here you will find all the CFC charts in which the block is used

Object name	Symb. name	Meaning	Type of block	Relevant CFC chart
FB40	INT_P	Forms the time integral of an input value	Technological block	CFC_LI111 CFC_FC111
FB46	OP_A_LIM	Controls and analog value	Operator control block	CFC_FC111
FB48	OP_D	Controls 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 product at the output	Function	CFC_FC111
FC275	CH_AI	Signal processing of an analog input value	Driver block	CFC_LI111 CFC_FC111
FC276	CH_AO	Signal processing of an analog output value	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 blocks. You require the following process tag types for the "color_gs" project:

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

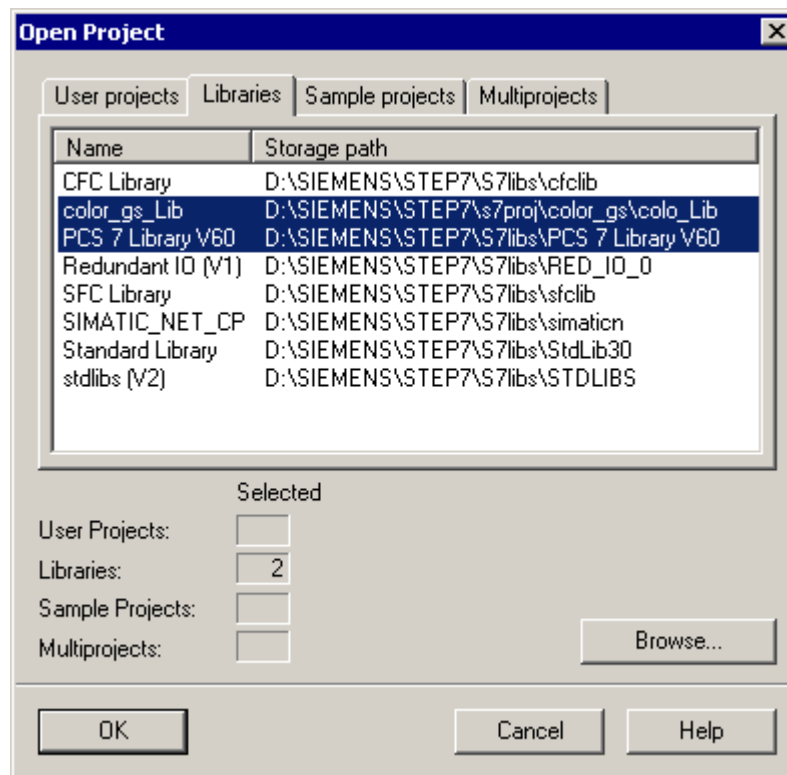
4.2.3.1 How to Open Libraries

Ready to Start?

SIMATIC Manager is open

Opening Libraries

1. Select the menu command **File > Open**.
The "Open Project" dialog box opens.
2. Select the "Libraries" tab.
3. Select the libraries "PCS 7 Library V60" and "color_gs_Lib" in the selection list.



4. Click the "OK" button.
Both libraries are opened in the component view.

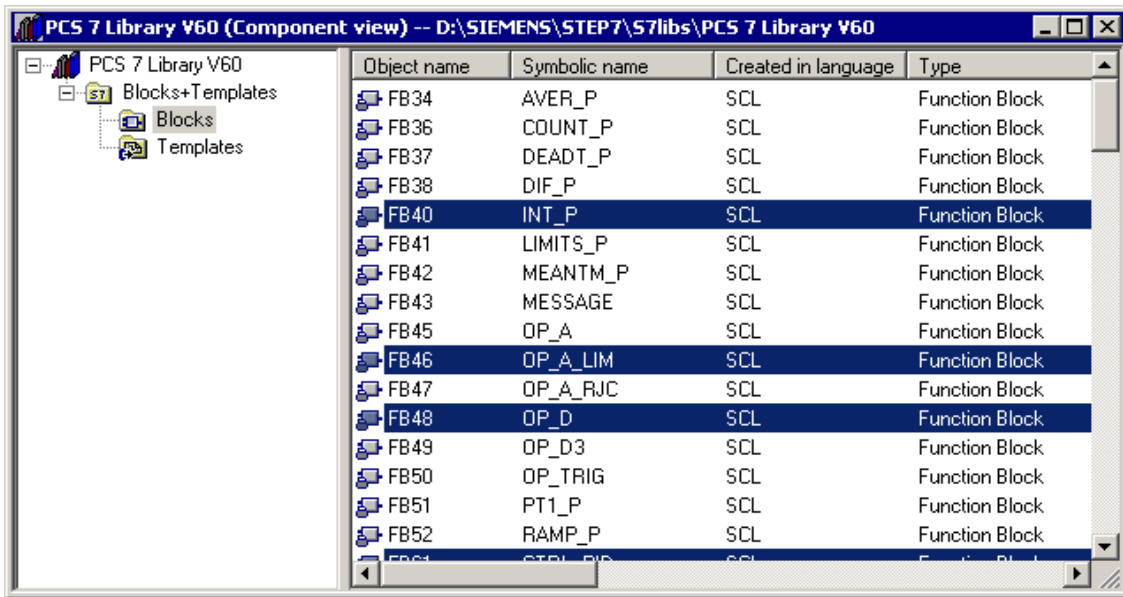
4.2.3.2 How to Insert Blocks in Your Library

Ready to Start?

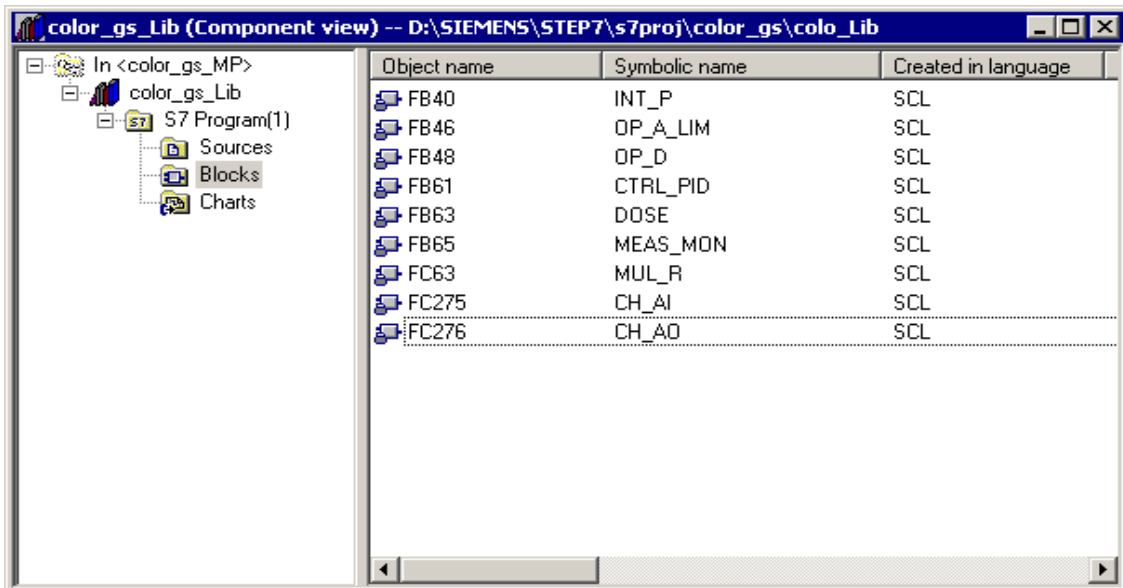
- SIMATIC Manager is open
- "PCS 7 Library V60" is open and the component view is activated.
- Master data library "color_gs_Lib" is open and the component view activated

Inserting Blocks in the Master Data Library

1. Select the menu command **Window > PCS 7 Library V60 (component view)**. This brings you to the PCS 7 standard library.
2. Select the following entry in the tree structure "PCS 7 Library V60/ Blocks + Templates/ Blocks". All the blocks provided by PCS 7 as default are displayed in the detailed window.
3. Select the menu command **View > Details**. The object names, in other words the brief identifiers of the blocks and the symbolic names are now displayed providing you with 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 menu command **Edit > Copy**.
6. Select the menu command **Window > color_gs_Lib (component view)**.
This brings you to the master data library.
7. Select the following entry in the tree structure
"In <color_gs_MP>/ color_gs_Lib/ S7-Program(1)/ Blocks".
8. Select the menu command **Edit > Paste**.
All selected blocks are inserted.



4.2.3.3 How to Insert Process Tag Types in a Library

Ready to Start?

- SIMATIC Manager is open
- "PCS 7 Library V60" is open and the component view is activated.
- Master data library "color_gs" is open and the component view activated

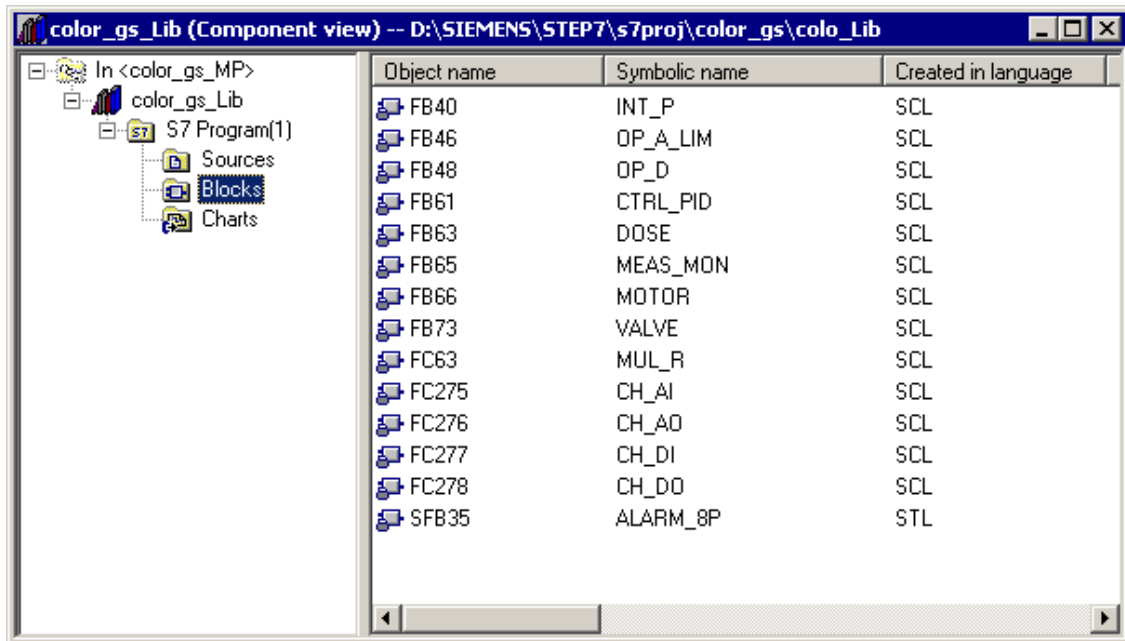
Inserting a Process Tag Type in the Master Data Library

1. Select the menu command **Window > PCS 7 Library V60 (component view)**.
You change to the component view of the PCS 7 standard library.
2. Select the following entry in the tree structure "PCS 7 Library V60/ Blocks + Templates/Templates".
All the charts provided by PCS 7 as default are displayed as templates in the detailed window.
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 brings you to the master data library.
6. Select the following entry in the tree structure
"In <color_gs_MP>/ color_gs_Lib/ S7-Program(1)/ Charts".
7. Select the menu command **Edit > Paste**.
All selected process tag types are inserted.

Note

Once you have inserted a process tag type in the master data library, all the individual blocks contained in this process tag type are entered automatically in the "Blocks" folder.

If you select the entry "In <color_gs_MP>/ color_gs_Lib/ S7-Program(1)/ Blocks", all the blocks are displayed in the detailed window: The blocks you have inserted yourself along with the blocks that were inserted automatically as a result of copying the process tag types.



8. Now close the "PCS 7 Library V60" and "color_gs_lib" libraries.

4.2.4 Showing and Hiding Libraries

You have the option of hiding all the libraries that you do not require. This makes working with the catalog in the CFC Editor clearer and less liable to errors. Since you have already inserted all the required blocks and process tag types in your master data library, you will only need to work with the master data library to create the "color_gs" project.

You can, of course, display libraries again when you require them.

4.2.4.1 How to Hide and Show Libraries

Caution

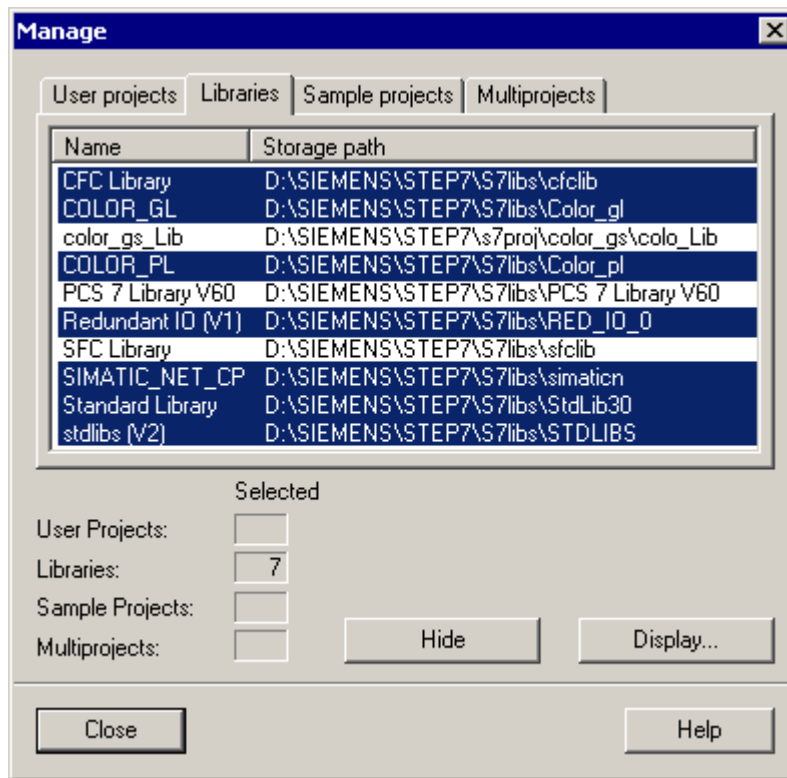
Make sure that you actually have all the required blocks and charts in your master data library.

Ready to Start?

- SIMATIC Manager is open

Hiding Libraries

1. Select the menu command **File > Manage**.
The "Manage" dialog box opens.
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 V60
 - SFC Library



- Click the "Hide" button.
All the libraries you selected are removed from the list.
- Click the "Close" button.
You have now made all the libraries you do not want to use invisible. As a result, they will not longer be displayed in the catalog of the CFC Editor.

Showing Libraries Again

- Select the menu command **File > Manage**.
The "Manage" dialog box opens.
- Click the "Display" button.
The "Browse" dialog is opened.
- Select the folder ".../SIEMENS/ STEP7/ S7LIBS in the tree structure.
- Select the required library.
This is displayed in the adjacent "Libraries" tab.
- Click the "OK" button.
The dialog box closes and the required library is displayed and selected in the list of libraries in the "Manage" dialog.
- If you want to display further libraries, repeat steps 2 through 5.
- Click the "Close" button.
The dialog box is closed.

4.3 CFC Charts in the PH

4.3.1 Working with CFC Charts

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

What are the Basic Steps in Creating CFC Charts?

In principle, there are three basic steps:

- Creating empty CFC charts in the plant hierarchy
- Inserting individual blocks in an empty CFC chart
- Interconnecting the inputs and outputs of blocks and assigning parameter values to them

CFC Charts in the PH

The "New Project" wizard has already created a CFC chart in your plant hierarchy. This is stored in the "ADDIT" folder. This chart does not yet contain any blocks – you will insert these in the CFC Editor.

For the "color_gs" project you require other charts that you insert in the plant hierarchy and then edit in the CFC Editor.

It is important that you assign self-explanatory short names to all the charts of the "color_gs" project to keep the project clear to understand.

4.3.2 Which Charts do You Require in the 'color_gs' Project?

The following charts are required for the "color_gs" project:

- CFC_SETP – Assigning setpoints
- CFC_FC111 – controlling the dosing amount and speed
- CFC_LI111 – controlling and simulating the level
- CFC_NP111 – motor control
- CFC_NK111 to CFC_NK114 – valve control

Each chart has a technological significance. To fully understand each part of the plant that you configure in Getting Started, you should also understand the technological significance of the individual charts and we therefore provide you with a brief explanation of each chart.

A Few Details on Creating CFC Charts

You will create the charts CFC_SETP, CFC_FC111 and CFC_LI111 yourself. PCS 7 provides you with the charts CFC_NP111 and CFC_NK11x in the form of a process tag type. This will illustrate the great advantage of using process tag types that you have simply inserted in your master data library up to now.

Note

In the "color_gs" project, the names of the charts are assigned according to the naming of the corresponding hierarchy folder and therefore at the same time according to the naming of the corresponding process tag. As a result, unique identification is always possible.

4.3.3 Technological Significance of the 'CFC_SETP' Chart

The operator must be able to control the dosing from the OS. The following settings are necessary:

- The PARA_DOS_RM1_QTY block specifies the dosing speed.
- The PARA_DOS_RM1_VOL block specifies the dosing volume.
- The target reactor is specified with the PARA_DOS_RM1_SEL block.

4.3.4 Technological Significance of the 'CFC_FC111' Chart

This chart is used to control the dosing amount and speed:

- 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 "INT_P" block is used for simulation of the dosed volume.
- The speed of the dosing is controlled by a flow control with the "CTRL_PID" block.
- The "CTRL_PID" block receives the setpoints 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 feedback from the process.
- The "CH_AO" block outputs the manipulated variable to the valve.

4.3.5 Technological Significance of the 'CFC_LI111' Chart

This chart is used to control and simulate the level:

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

4.3.6 Technological Significance of the 'CFC_NP111' Chart

The "CFC_NP111" chart is used for pump control:

- The "CH_DI" block supplies the current state of the pump (on or off) at output "Q".
- This value is connected to the "FB_ON" input (feedback ON) of the MOTOR block where it is evaluated.
- The 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.

4.3.7 Technological Significance of the 'CFC_NK11x' Chart

This chart is used to control the valves:

- 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.

4.3.7.1 How to Rename CFC Charts in the PH

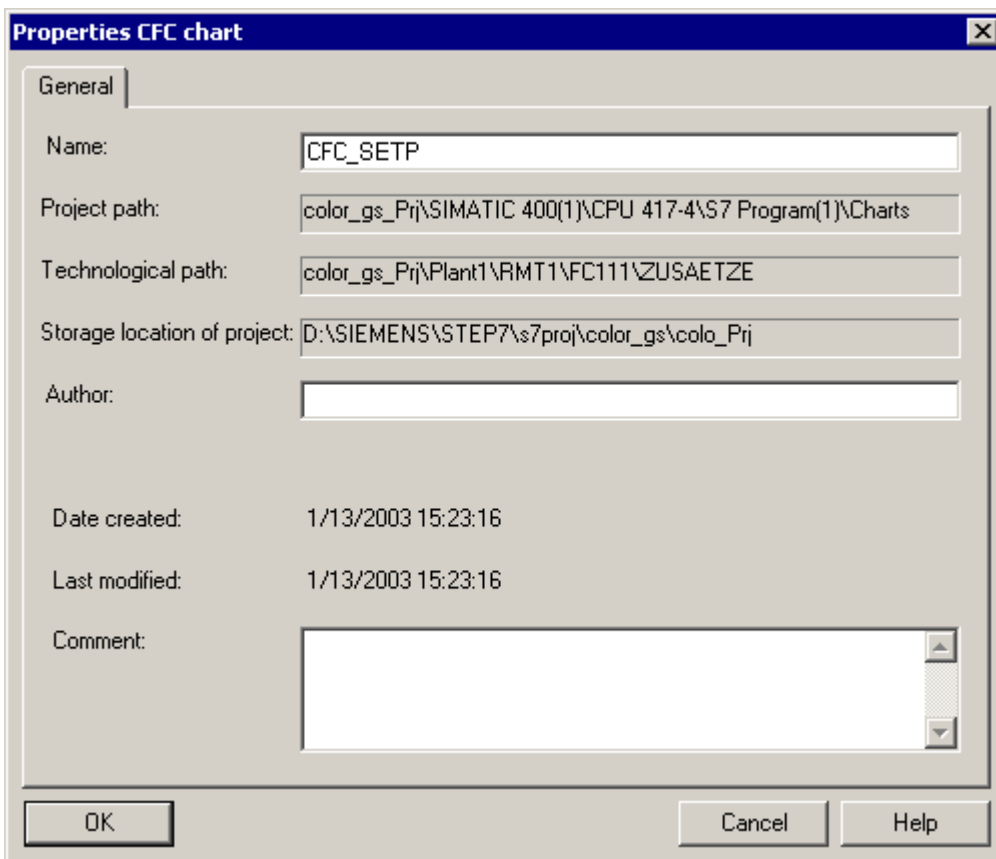
Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- Plant view activated

Follow the steps outlined below...

The ADDIT folder already contains a CFC chart created automatically by the wizard. This chart needs to be renamed.

1. Select the following folder in the tree structure
"color_gs_MP/color_gs_Prj/Plant1/RMT1/FC111/ADDIT".
2. Select the "CFC(1)" object in the detailed window.
3. Select the menu command **Edit > Object Properties**.
The "Properties CFC Chart" dialog box opens.
4. Enter the name "CFC_SETP" in the "Name" input box.
In real projects, the name of the chart already relates to an identification system as required by the customer for the process tags.



The screenshot shows a dialog box titled "Properties CFC chart" with a "General" tab. The "Name" field contains "CFC_SETP". The "Project path" is "color_gs_Prj\SIMATIC 400(1)\CPU 417-4\S7 Program(1)\Charts". The "Technological path" is "color_gs_Prj\Plant1\RMT1\FC111\ZUSAETZE". The "Storage location of project" is "D:\SIEMENS\STEP7\s7proj\color_gs\colo_Prj". The "Author" field is empty. The "Date created" and "Last modified" are both "1/13/2003 15:23:16". The "Comment" field is empty. The "OK", "Cancel", and "Help" buttons are visible at the bottom.

5. Click the "OK" button to enter your settings.



4.3.7.2 How to Insert New CFC Charts in the PH

You will need to insert the following charts yourself as new empty CFC charts:

- "CFC_FC111"
- "CFC_LI111"

Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- Plant view activated

Follow the steps outlined below...

1. Select the following folder in the tree structure
"color_gs_MP/color_gs_Prj/Plant1/RMT1/FC111".
2. Select the menu command **Insert > Technological Objects > 2 CFC**.
The "CFC(1)" CFC chart is inserted. When you insert new charts, PCS 7 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".



4. Select the following folder in the tree structure
"color_gs_MP/ color_gs_Prj/ Plant1/ RMT1/ LI111".
5. Select the menu command **Insert > Technological Objects > 2 CFC**.
The "CFC(1)" CFC chart is inserted.
6. Enter the name "CFC_LI111".

4.3.7.3 How to Insert the 'MOTOR' Process Tag Type

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

Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- Plant view activated

Follow the steps outlined below...

1. Select the following entry in the tree structure
"color_gs_MP/ color_gs_Lib/Templates/MOTORS".
The detailed window displays the process tag types you inserted in your master data library.
2. Select the "MOTOR" chart and then the menu command **Edit > Copy**.
3. Select the following folder in the tree structure
"color_gs_MP/ color_gs_Prj/Plant1/RMT1/NP111" and select the menu command **Edit > Paste**.
The "MOTOR" chart is inserted in the hierarchy folder and is 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 the "OK" button to enter your settings.



4.4 The Current Status of Your Project...

As preparation for the actual creation of CFC charts, you have now performed the following tasks:

- Inserted all the required blocks and process tag types in the master data library
- Hidden libraries that you do not require for the "color_gs" project so that only the "color_gs_Lib" master data library is visible.
- Renamed and inserted new CFC charts in the plant hierarchy
- Inserted the "MOTOR" process tag type in the plant hierarchy

4.5 Working with the CFC Editor

4.5.1 Introduction to the CFC Editor

The actual editing of the CFC charts such as inserting blocks and assigning parameter values to them is done in the CFC Editor. As soon as you open a CFC chart, the CFC Editor opens. The editor is always opened 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-hand side of the editor you see the chart displayed. If you have opened an empty CFC chart, here you will simply see an empty space. This is where you insert blocks as required to describe continuous processes. The final job is to assign parameter values and interconnect the blocks.
- On the right-hand side of the editor you will see the catalog with blocks, libraries, and charts.



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

For more detailed information on the CFC Editor refer to the online help *Help on CFC* and the manual *SIMATIC CFC for S7, Continuous Function Chart*.

4.5.2 The Chart in the CFC Editor

Each CFC chart can contain up to 26 chart partitions. When a chart is created the first time, it consists of only one chart partition. Only one chart partition is necessary for the "color_gs" project. Each chart partition itself consists of six sheets.

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

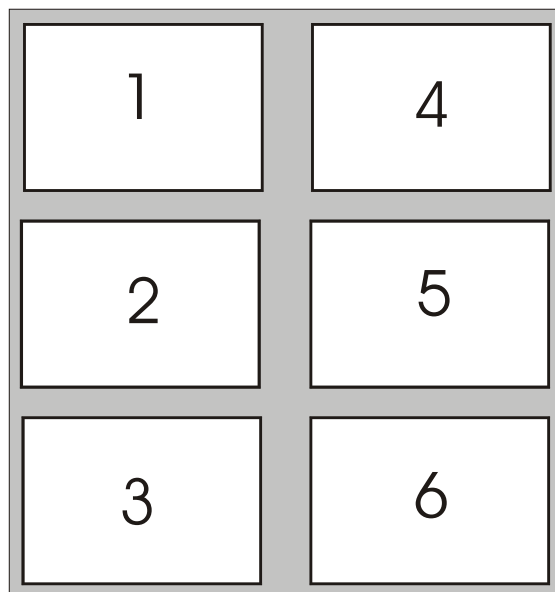
-  A single sheet
-  Overview with six sheets

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

Changing from the Overview to a Single Sheet

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

The arrangement of the individual sheets at the overview level is in the order shown below:



You will find more detailed information in the online help *Help on CFC* and in the manual *SIMATIC, CFC for S7, Continuous Function Chart*.

4.5.3 The Catalog in the CFC Editor

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

In the catalog you will see four tabs:

- Blocks – here you will find blocks sorted according to block families. In the "color_gs" project you will not work in this tab.
- Charts – here you will find all the charts you created in the plant hierarchy, for example CFC_FC111, CFC_LI111. The chart that is currently open in the CFC Editor and displayed is indicated by a small open folder.
- Libraries – normally, you would find all the libraries provided by PCS 7 along with your master data library.
In the "color_gs" project, you have already made the libraries you do not require invisible using the "Hide" function. This means that you will 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.

You will find more detailed information in the online help *Help on CFC* and in the manual *SIMATIC, CFC for S7, Continuous Function Chart*.

4.5.4 Overview of the Configuration Steps for CFC Charts

When you create CFC charts, follow the steps below in exactly the order shown:

- Open chart
- Insert blocks in the required run sequence

Caution

The order in which you insert blocks in the CFC chart is exactly the same order in which the blocks will be executed in the process mode. In this Getting Started, we, of course, tell you the correct order. In a real configuration, you must find out the exact run sequence based on the process and keep to this when inserting blocks in the CFC chart.

- Set block parameters
 - Rename blocks
 - Set input/output values
- Interconnect blocks

Note

If you require further information about the blocks, for example, which inputs of the block have which function, select the corresponding block in the library and then press the F1 key. This opens the online help for this block.

The step "Insert Blocks" is, of course, omitted for process tag types. With these, you only need to assign parameter values and interconnect them.

4.5.4.1 How to Open the 'CFC_SETP' CFC Chart

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

Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- Plant view activated

Follow the steps outlined below...

1. Select the following folder in the tree structure
"color_gs_MP/color_gs_Prj/Plant1/RMT1/FC111/ADDIT".
2. Select the "CFC_SETP" object in the detailed window and then select the menu command **Edit > Open Object**.
The CFC editor is opened.

You can now edit the open chart.

4.5.5 Assigning Parameter Values to the Blocks in CFC Charts

Each block has a number of different I/Os, which are displayed in a table in the Properties dialog. To find the I/Os quickly in this dialog box, you can click in the column head of the table and sort the column in an ascending or a 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. You can specify which I/Os in the CFC chart will be visible and which will be invisible. You specify this in the properties of the block in the "Not Displayed" column by unchecking 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, we will use the default settings.

Follow the steps outlined here...

4.5.5.1 How to Insert the Blocks in 'CFC_SETP'

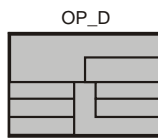
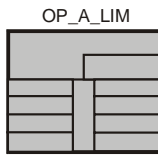
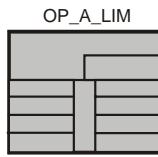
Ready to Start?

- CFC chart "CFC_SETP" is open in the CFC Editor – stored in folder "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ FC111/ ADDIT"
- The catalog is open

Follow the steps outlined below...

1. Change to the "Libraries" tab in the catalog.
Here you will see the "color_gs_Lib" library.
2. Open the following folder in the tree structure "color_gs_Lib/S7 Program(1)\Blocks".
3. Drag the "OP_A_LIM – FB46" block from the catalog to your CFC chart.
This block is used to set the dosing volume.
4. Insert further blocks into the CFC chart.
Use the same procedure as described for the "OP_A_LIM – FB46" block.
 - OP_A_LIM – FB46: Setting the dosing speed
 - 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:



Note

If a block is shown in blue or light gray after you have inserted it and if no block I/Os are displayed, this 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.



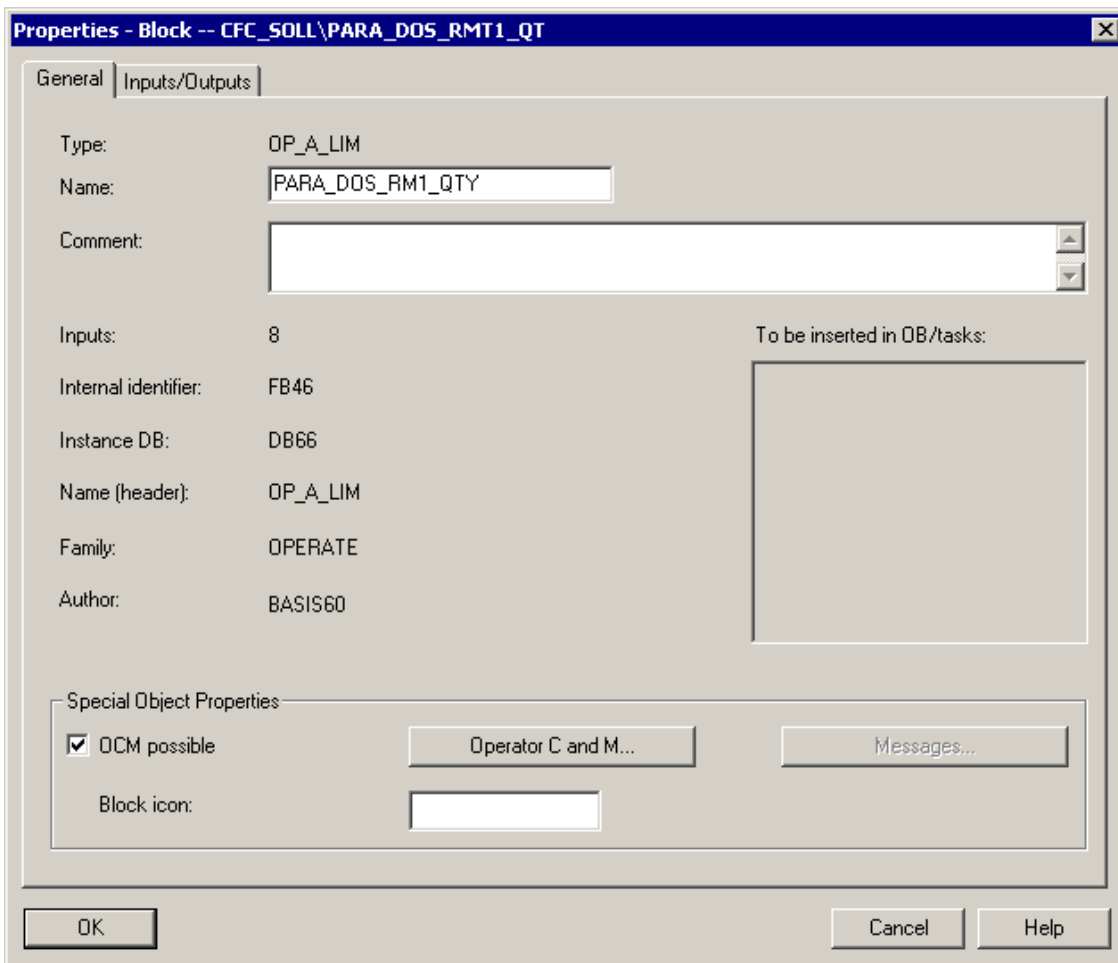
4.5.5.2 How to Assign Parameter Values for the Blocks in 'CFC_SETP'

Ready to Start?

- CFC chart "CFC_SETP" is open in the CFC Editor – stored in folder "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ FC111/ ADDIT"
- All blocks are inserted

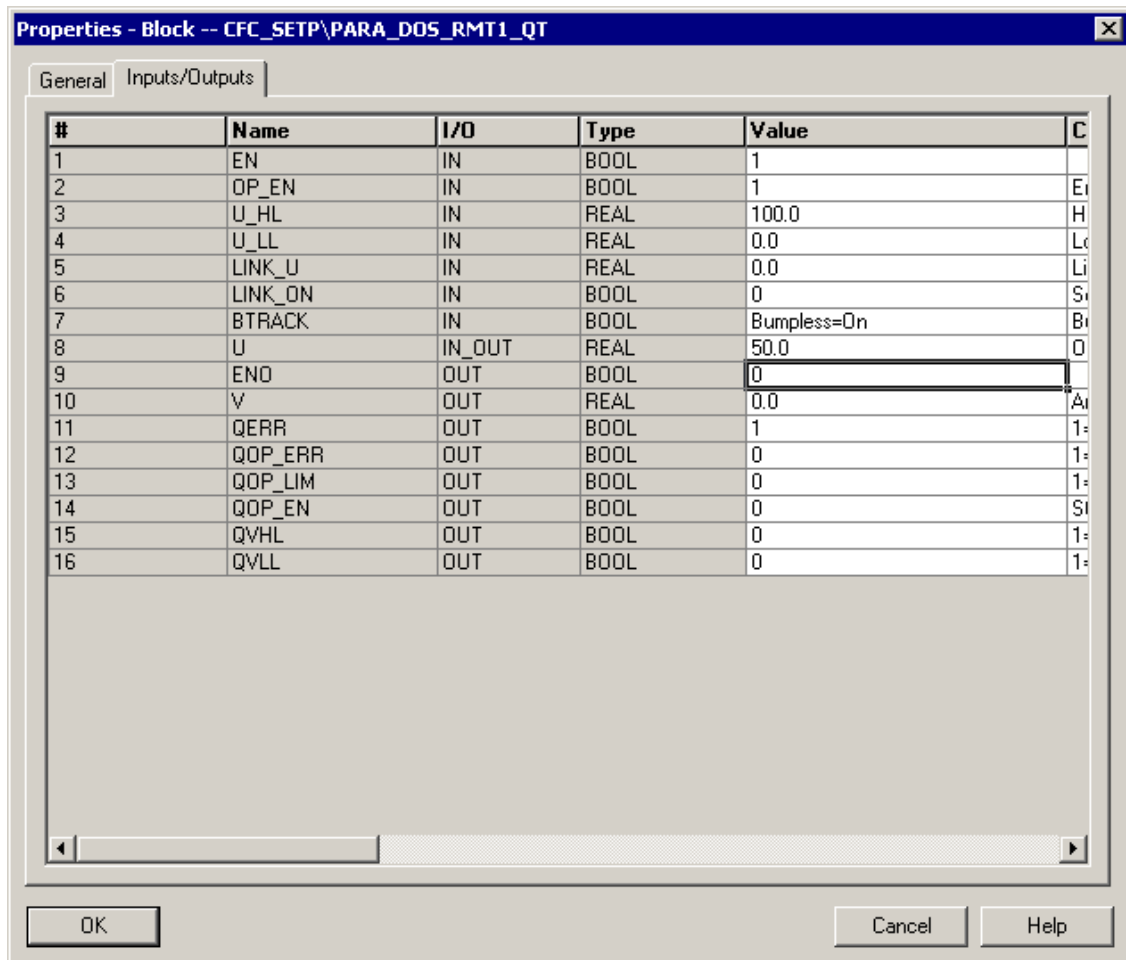
Follow the steps outlined below...

1. Select the "OP_A_LIM" block and select the menu command **Edit > Object Properties**.
The "Properties – Block" dialog box opens and the "General" tab is active.
2. Enter the name "PARA_DOS_RM1_QTY" in the "Name" box.
The "Operator C and M possible" check box is activated as default.



3. Select the "Inputs/Outputs" tab.
Here, you can assign parameter values for all the I/Os of a block. The "Name" column lists the names of all inputs and outputs.

- Position the mouse pointer in the "Value" column of the "U" field and overwrite the default value with the value "50".



- Click the "OK" button to enter 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 name of tags is formed from the plant hierarchy, the CFC chart name, and the block name. You will find the name "PARA_DOS_RM1_QTY" as part of the tag name.
The values of the I/Os are entered.



6. Now change the names and parameter settings for the other blocks as shown in the following table. Follow the procedure as explained in Steps 1 to 5. Some of the I/Os are not visible in the CFC chart.

Block	Name in Project	I/O	Meaning	Value
OP_A_LIM	PARA_DOS_RM1_VOL	U*	Setpoint for dosing 1000 liters	1000
		U_HL	Limit value of the entry for the U parameter	10000
OP_D	PARA_DOS_RM1_SEL	IO*	The material is fed to reactor 1	OFF

* invisible in CFC.

4.5.5.3 How to Insert the Blocks in 'CFC_FC111'

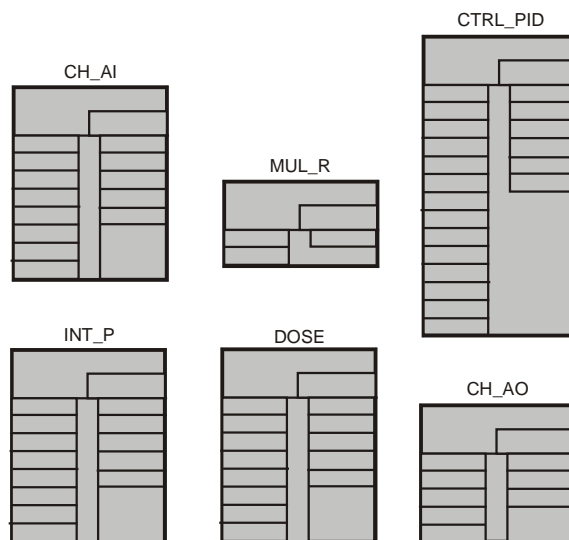
Ready to Start?

- CFC chart "CFC_FC111" is open in the CFC Editor – stored in folder "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ FC111"
- The catalog is open, the Libraries tab is visible

Follow the steps outlined below...

1. Insert the following blocks by dragging with the mouse:
 - CH_AI – FC275: Signal processing of an analog input value
 - INT_P – FB40: Simulation of the dosing volume
 - DOSE – FB63: Dosing the raw material
 - MUL_R – FC63: Multiplication of the input values and output of the product at the output
 - CTRL_PID – FB61: Fill level monitoring and visualization of the level in the process mode
 - CH_AO – FC276: Signal processing of an analog output value

2. Arrange the blocks in the CFC chart as shown below:



4.5.5.4 How to Assign Parameter Values for the Blocks in 'CFC_FC111'

Ready to Start?

- CFC chart "CFC_FC111" is open in the CFC Editor – stored in folder "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ FC111"
- All blocks are inserted

Follow the steps outlined below...

1. Open the "Object Properties" dialog box, "Inputs/Outputs" tab for each block.
2. Enter the parameters for all blocks according to the following list:

Note

Make sure that you use a period as the decimal separator.

In some fields, PCS 7 displays default values in a drop-down list box that you can select. This drop-down list box is activated automatically when you position the mouse pointer in the input field.

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	Upper measuring range	100 **
		SUBS_ON	Enabling of a substitute value	1
INT_P	INT_P	V_HL	Upper limit quantity summation 10000 Liters	10000
DOSE	DOSE	SP_HLM*	Upper limit of the setpoint for the dosing volume	10000
		MO_PVHR*	Upper limit of the process value for the dosing volume	10000
		SPEXON_L	Interconnection for the internal/external switchover active	1
		SPEXT_ON	Default for the internal/external switching	1
MUL_R	MUL_R	IN2	Parameters for optional adaptation of the 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	omitted	—	—

* invisible in CFC.

** default value

- When you have entered the parameters for all the I/Os, click on the "OK" button to enter your settings.

4.5.5.5 How to Insert the Blocks in 'CFC_LI111'

You now have to complete the "CFC_LI111" chart. The procedure is exactly the same as for the "CFC_FC111" chart.

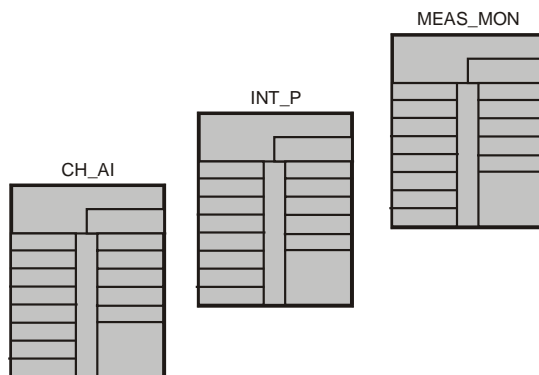
Ready to Start?

- CFC chart "CFC_LI111" is open in the CFC Editor – stored in folder "color_gs_MP/ color_gs_prj/ Plant1/ RMT1/ LI111"
- The catalog is open

Follow the steps outlined below...

Drag the blocks with the mouse pointer and arrange them as shown in the figure:

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



4.5.5.6 How to Assign Parameter Values for the Blocks in 'CFC_LI111'

Ready to Start?

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

Follow the steps outlined below...

1. Open the "Object Properties" dialog box, "Inputs/Outputs" tab for each block.
2. Enter the parameters for all blocks according to the following list:

Block	Name in Project	I/O	Meaning	Value
CH_AI	INPUT_U	MODE	Measuring range 4 to 20 mA	16#0203
		VHRANGE	Upper measuring range	100 **
		SIM_ON	Simulation value active	1
		SIM_V	Raw material tank level 78%	78
		SUBS_ON	Enabling of a substitute value	1
		SUBS_V	Substitute value for SIM_V	78
INT_P	INT_P	U	Simulation of the raw material tank level	-0.4
MEAS_MON	LIA	U_WH	Warning high = 90 m ³	90
		U_WL	Warning low = 7 m ³	7
		U_AH	Alarm high = 98 m ³	98
		U_AL	Alarm low = 5 m ³	5
		MO_PVHR*	Upper limit of the process value in the container = 100 m ³	100

* invisible in CFC.

** default value

3. When you have entered the parameters for all the I/Os, click on the "OK" button to enter your settings.

4.5.5.7 How to Assign Parameter Values for Blocks in 'CFC_NP111'

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

Note

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

1. Open the "Object Properties" dialog box, "Inputs/Outputs" tab for each block.
2. Enter the parameters for all blocks according to the following list:

Block	Name in Project	I/O	Meaning	Value
CH_DI	FB_RUN	SIM_ON	Switch simulation active	1
		SUBS_ON	Enabling of a substitute value	1
MOTOR	MOTOR	MONITOR	Deactivate monitoring	Monitoring =Off
		AUT_ON_OP*	Activate the automatic mode	Mode = AUTO

* invisible in CFC.

3. Click the "OK" button to enter your settings.

4.5.6 Interconnecting the Blocks in the CFC Charts

Now make the required interconnections in the charts between outputs and inputs. You can create the interconnections of blocks conveniently by clicking on the graphic user interface of the CFC editor with the mouse. Click first the output of a block and then the input you want to connect to it. After clicking on the input, the interconnection is displayed as a line. The CFC Editor draws the lines automatically taking the most suitable path. The position of the lines has no effect whatsoever on the function of the interconnection.

Caution

Always connect the output of a block to the input of another block – and not vice-versa.

Note

If you make an incorrect interconnection:

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

Special Feature of the Charts "CFC_SETP", "CFC_NP111" and "CFC_NK11x"

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

In the CFC_NP111 and CFC_NK11x charts, you do not need to make interconnections since you used the process tag types for these charts and all the interconnections are already made.

4.5.6.1 How to Interconnect Blocks in 'CFC_FC111'

Ready to Start?

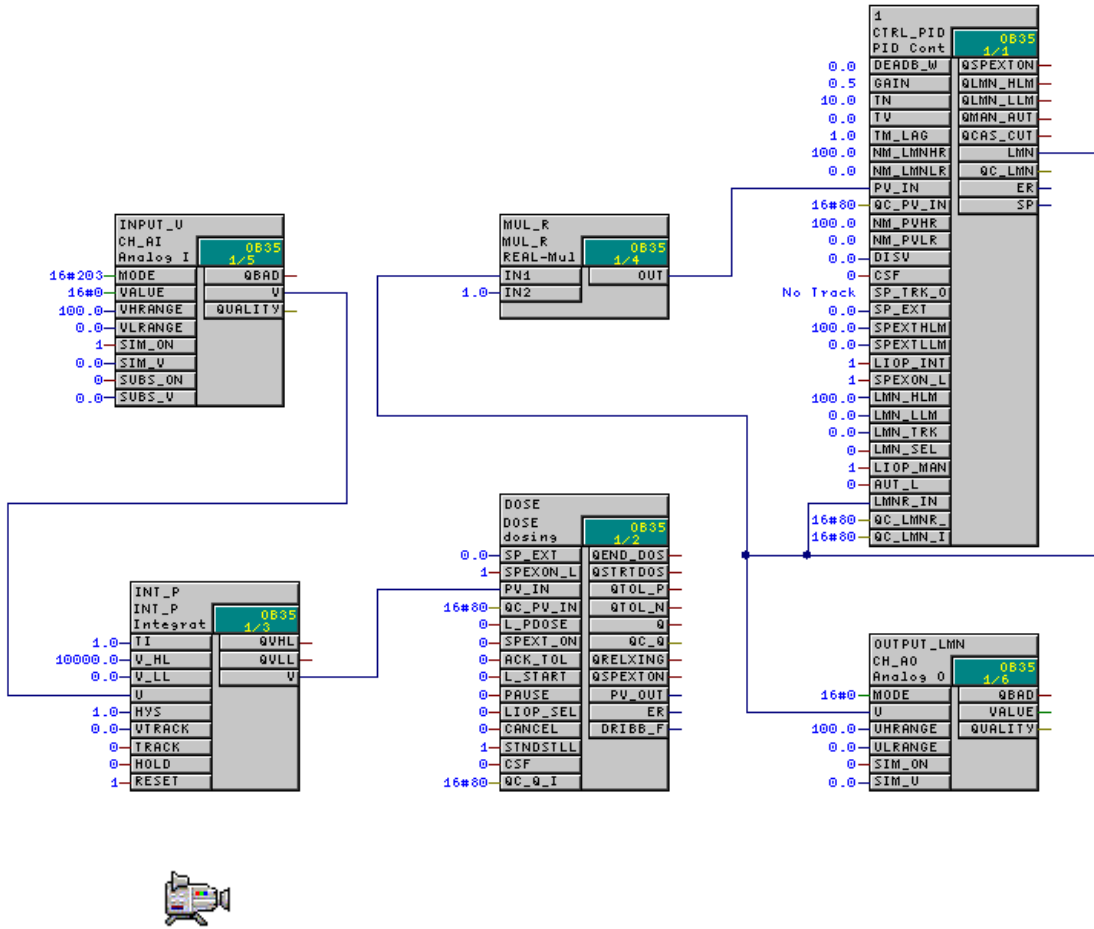
- The "CFC_FC111" chart is open in the CFC Editor
- All blocks are inserted

Now make the interconnections...

1. Click on output "V" of the "INPUT_U" block.
2. Now click on the input "U" of the "INT_P" block.
The CFC Editor automatically creates a line indicating the interconnection.
3. Following the same procedure, make the remaining interconnections according to the list below:

Block	Output	Block	Input:
erl.: 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

The chart then appears as shown below:



4.5.6.2 How to Interconnect Blocks in 'CFC_LI111'

Ready to Start?

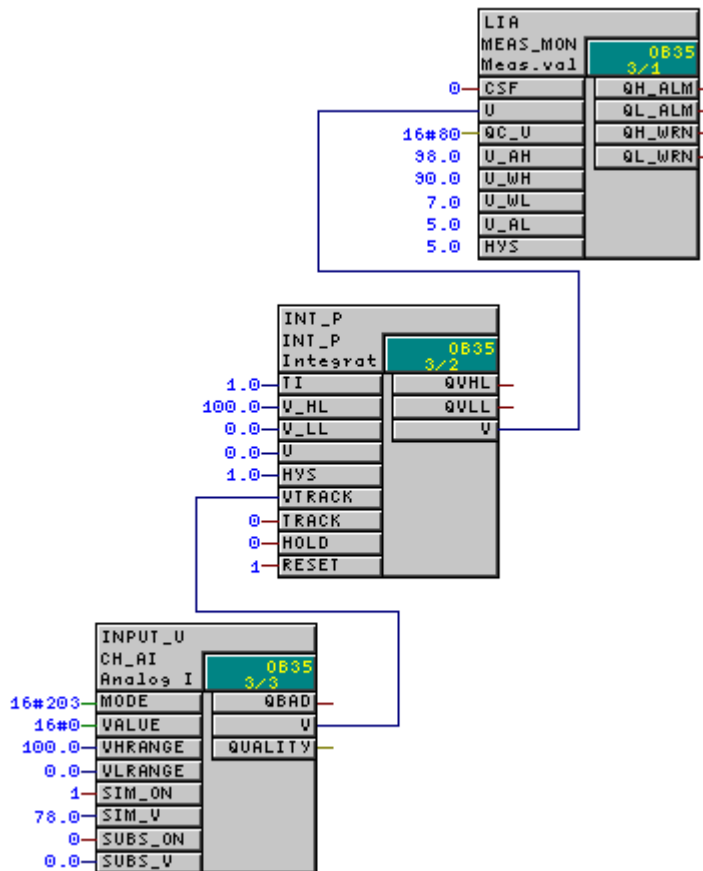
- The "CFC_LI111" chart is open in the CFC Editor
- All blocks are inserted

Now make the interconnections...

Make the interconnections according to the following list:

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

The chart appears as shown below:



Close the CFC editor.

4.6 CFC Charts in the Process Object View

4.6.1 Using the Process Object View for Controlling Valves

You may be asking yourself why we have done nothing up to now with the charts CFC_NK111 to CFC_NK114. You have simply inserted the "VALVE" process tag type in your master data library and created the four hierarchy folders in the plant hierarchy.

To handle almost identical charts, we will now introduce you to 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 values but can simply change values quickly in a table.

The following preparations are necessary:

- Specify I/Os in the process tag type for the process object view – since some I/Os are not displayed in the process object view to improve clarity, you must first define the I/Os you want to be visible. You define this once in the process tag type in the master data library.
- Insert the process tag type in the individual hierarchy folders and rename them – you will copy the process tag type from the master data library to all hierarchy folders in which you require valve control.
- Adapt the values of the parameters in the process object view – you will now get to know the great advantage of the process object view: You can edit values quickly and conveniently in a table.

4.6.1.1 How to Define I/Os for the Process Object View

Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- Plant view activated

Follow the steps outlined below...

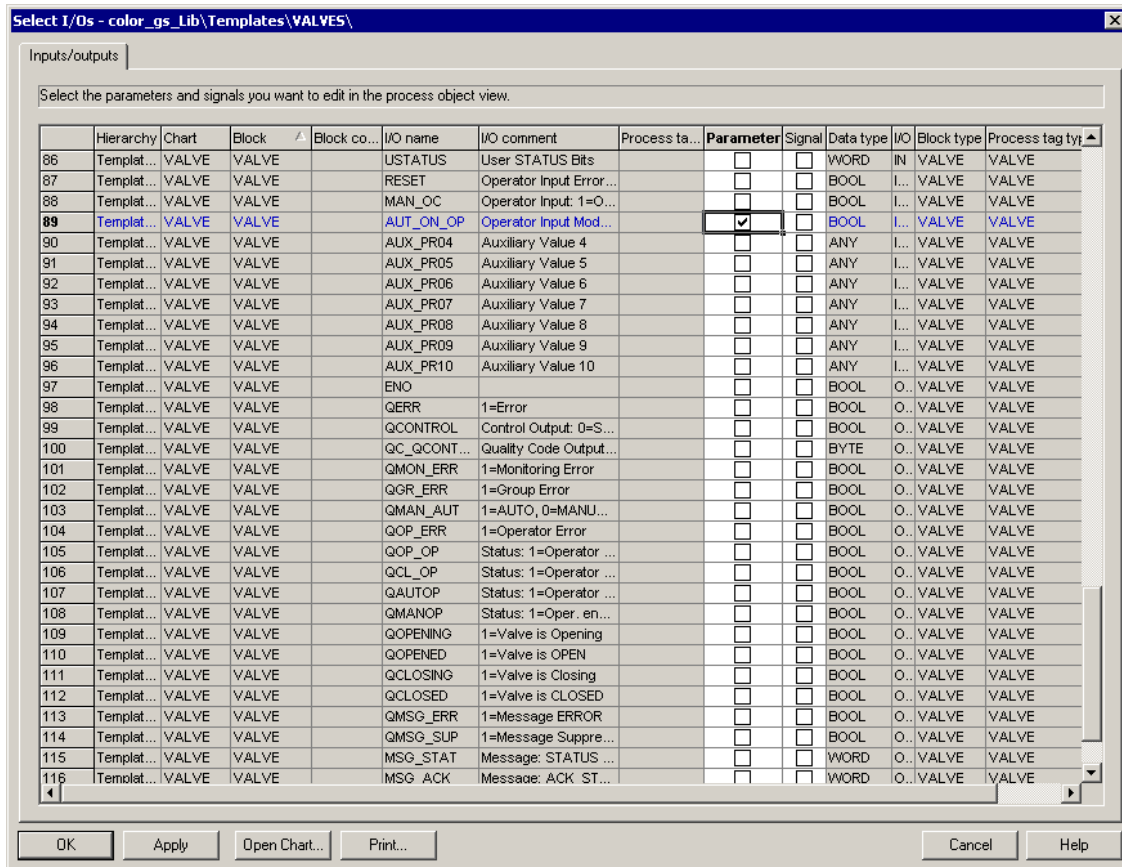
1. Select the following folder in the tree structure "color_gs_Lib/Templates/Valves".
2. Select the "VALVE" CFC chart in the detailed window.
3. Select the menu command **Options > Process Objects > Select I/Os**. The "Select I/Os" dialog box opens.
4. Click on the column header of the "Parameter" column. All the I/Os are then displayed in the upper lines that are activated in the "Parameter" column.
5. Deactivate the check boxes of these I/Os.

6. Activate the check boxes in the "Parameter" column for the following I/Os:

Block	I/O
VALVE	START_SS
VALVE	MONITOR
VALVE	AUT_ON_OP

Note

Click in the column header of the "Input/Output" column to sort the I/Os in ascending or descending order and make them easier to find.



7. Click the "Apply" button to enter your settings.

8. Click the "OK" button.
The "Select I/Os" dialog box is closed.

4.6.1.2 How to Insert the 'VALVE' Process Tag Type

Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- Plant view activated

Follow the steps outlined below...

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

1. Select the "VALVE" process tag type in the folder "color_gs_MP/color_gs_Lib/Templates/VALVES".
2. Insert the "VALVE" process tag type in the following folders using the function "Edit > Copy" and "Edit > Paste":
 - 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. In the message dialog "The object 'valve' already exists. Do you want to overwrite it?", click on the "No" button.
4. In the message box "The object 'Valve' exists already. Do you want to overwrite it?", click on the "No" button.
5. Rename the inserted process tag types according to the following table:

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

You will find a detailed description in "Creating CFC Charts – CFC Charts in the PH – How to Insert the "MOTOR" Process Tag Type.

4.6.1.3 How to Adapt the Parameters for 'CFC_NK11x'

Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- The process object view is activated

Follow the steps outlined below...

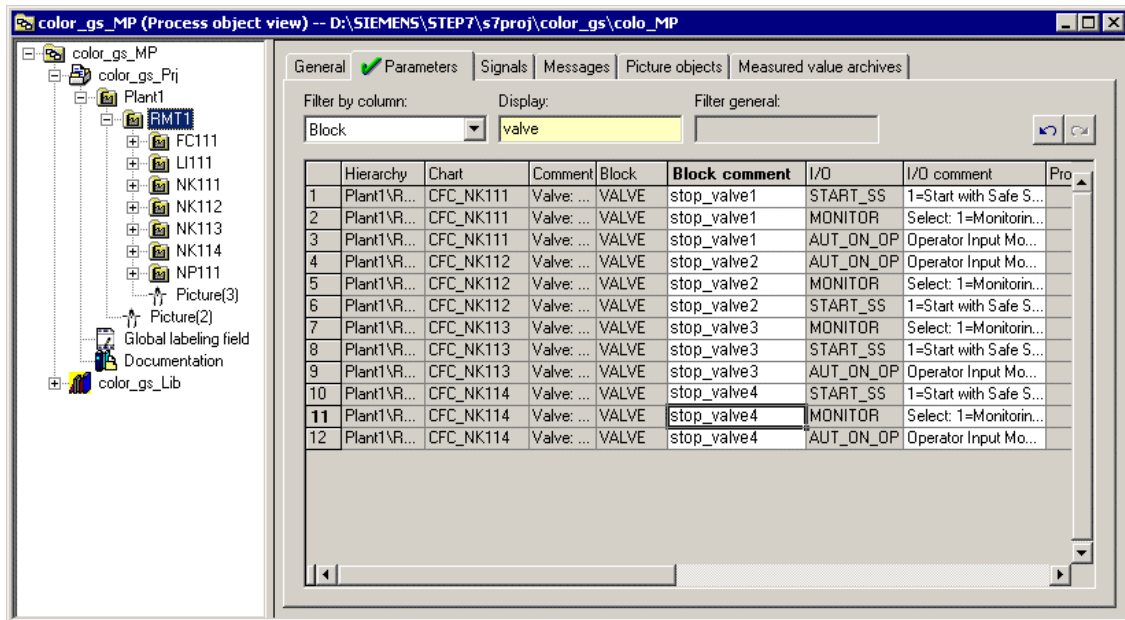
1. Select the following folder in the tree structure
"color_gs_MP/ color_gs_Prij/ Plant1/RMT1".
2. Select the "Parameter" tab.
The data is updated.
3. Select the "Block" entry from the "Filter by column" drop-down list box.
This activates the "Display" box.
4. Enter the name of the block in the "Display" box: "VALVE".
The table is updated and shows you the "Valve" block for all four CFC charts.
For each chart you can see three I/Os that have been made visible especially for the process object view.

Note

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

5. In the "Block Comment" column for the "CFC_NK111" chart, enter the name "Stop_valve1" and press the Enter key.
The block comment is then updated for all I/Os of this chart.
6. Do the same for the block comment in the other CFC charts:

CFC Chart	Block comment
CFC_NK112	stop_valve2
CFC_NK113	stop_valve3
CFC_NK114	stop_valve4



- Change to the "Value" column and make the entries according to the table shown below:

Note

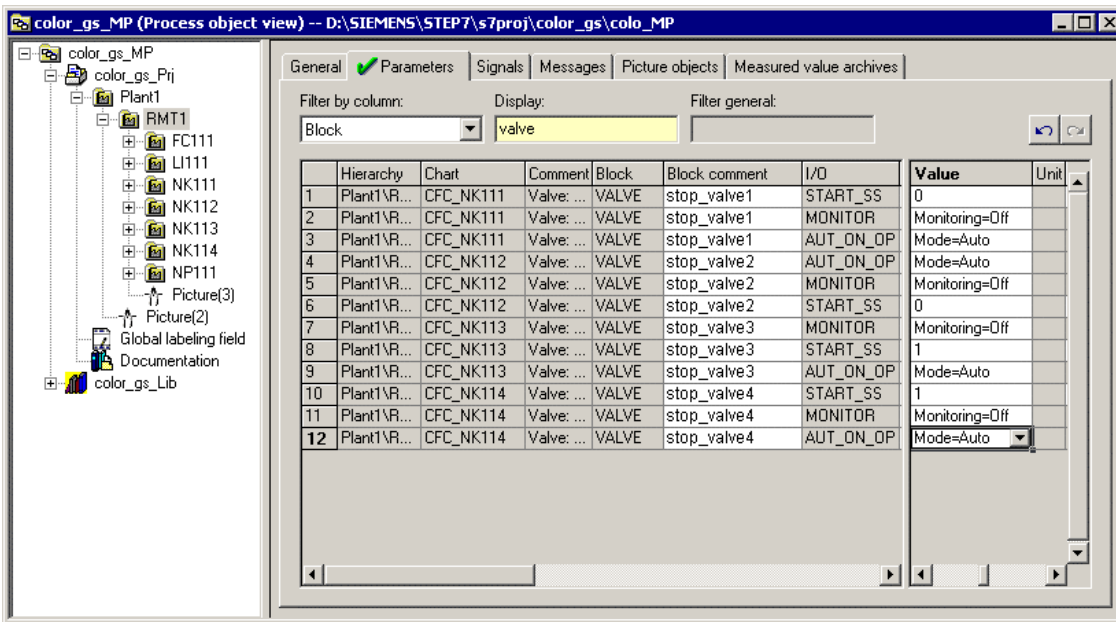
Depending on the size of your monitor, you may not be able to see the "Chart" column any more and this makes the assignment of the individual I/Os to a chart unclear.

In the process object view, you have the following option:

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

- Position the mouse pointer in the relevant field
This converts the field to a drop-down list box.
- Select the required entry from this drop-down list box.

CFC Chart	I/O	Meaning	Value
CFC_NK111	START_SS	Select the valve default state (open/closed)	0
	MONITOR	Disable monitoring of feedback from the process for the example.	Monitoring=off
	AUT_ON_OP	Switch the valve to the 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



4.6.1.4 How to Specify the Type of Block Icon

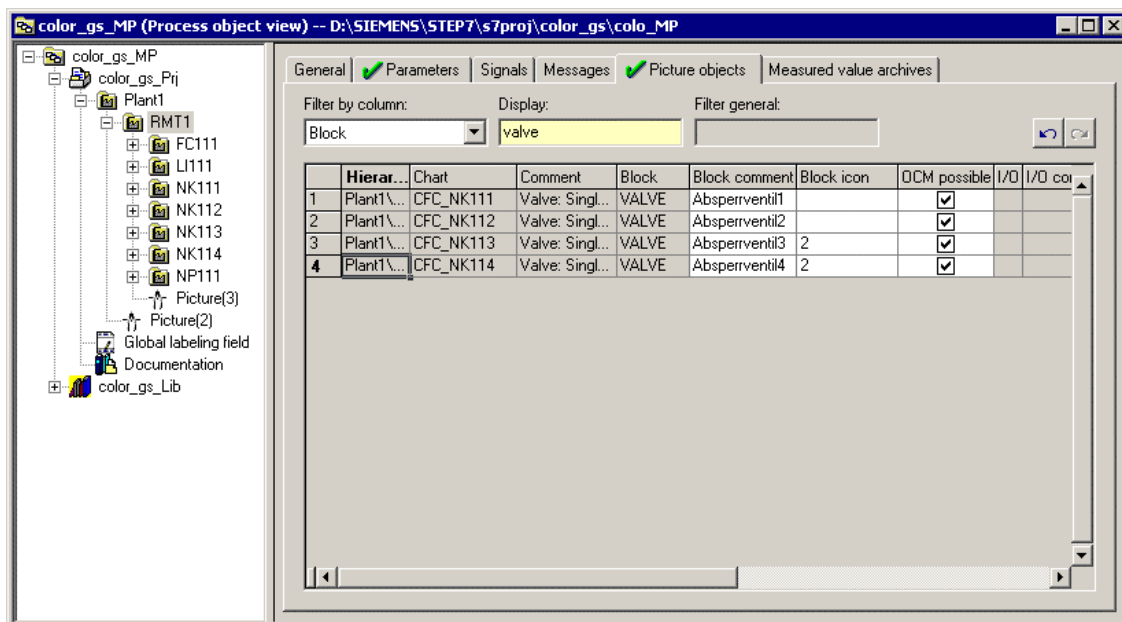
At this stage, you must make preparations for creating the process pictures. Since there are certain automatic functions, you can already make settings here.

Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- The process object view is activated

Follow the steps outlined below...

1. Select the following folder in the tree structure
"color_gs_MP/ color_gs_Prj/ Plant1/RMT1".
2. Select the "Picture Objects" tab.
The data is updated. The first time, this updating can take several minutes.
3. Select the "Block" entry from the "Filter by column" drop-down list box.
This activates the "Display" box.
4. Enter the name of the block in the "Display" box: "VALVE".
The table is updated and shows you the "Valve" block for all four CFC charts.
5. Enter the value "2" in the "Block Icon" column for the following charts:
 - "CFC_NK113"
 - "CFC_NK114"
6. Press the enter key
This specifies that a block icon aligned horizontally will be used in the process picture.



7. Close the process object view.



4.7 The Current Status of Your Project...

During CFC configuration, you have performed the following tasks:

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

5 Creating SFC Charts

5.1 Overview of SFC Charts

What is SFC?

SFC (Sequential Function Chart) is a sequential control system partitioned to ensure step-by-step execution with control passing from one state to the next state dependent on conditions. With a sequential control system, basic automation functions, for example CFC charts are controlled based on state changes and can be selectively processed. You create SFC charts in the SFC Editor.

When you created the "color_gs" project with the wizard, PCS 7 automatically created an SFC chart. This chart is, of course, still empty and you must edit the chart with the SFC Editor for the "color_gs" project.

5.2 Working with the SFC Editor

5.2.1 Introduction to the SFC Editor

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

The SFC Editor – just like the CFC Editor – provides you with a graphic user interface that allows the convenient creation of sequential control systems.

A sequential control system consists primarily of two basic elements: Steps and transitions.

- The transition is a condition that controls the execution of a step. Transitions are represented by small rectangles in the SFC chart.
- The step is the control instance for processing the assigned actions on the programmable controller. It is executed until the following transition is satisfied. Steps are represented by large rectangles in the SFC chart.

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




- Step "START"
- Transition 1
- Step "END"

A sequential control system will run with the values you assigned to the blocks in a CFC chart.

5.2.2 The Main Functions of the SFC Editor

Here, we will 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 will use the element bar of the SFC Editor to build up your sequential control system. The buttons have the following significance:

-  "Activate Selection" button – when this button is active, 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 active, the mouse pointer changes to a small cross and a circle with a bar across. Once you move the cross to a position in the chart at which you can insert a step or a transition, the circle becomes the icon for "Step with Transition". At the same time, a green line indicates where the "Step with Transition" will be inserted.
-  "Insert Alternative Sequence" button – when this button is active, you can insert an alternative sequence. 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.

For more detailed information on the SFC Editor refer to the online help *Help on SFC* and the manual *SIMATIC SFC for S7, Sequential Function Chart*.

5.2.3 Properties of Steps and Transitions

To be able to edit the names and values of the steps and transitions, you will work in the "Properties" dialog box. You do not need to open the dialog box extra for each step and each transition but can move directly to the next transition or next step and to transitions and steps of an alternative sequence in this dialog box.

To allow this, the following buttons are available:

-  "Arrow Down" button – with this button you change to the next transition/step
-  "Arrow Up" button – with this button you change to the previous transition/step
-  "Arrow Right" button and  "Arrow Left" button – with these buttons you change to the adjacent transition/step

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 of the step.
- Initialization – the action you define here is processed once only 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 processed once only 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 of the transition.
- Condition – in this tab, you specify the condition that decides when control will be passed to the next step in the sequential control system.

5.2.4 Overview of the Configuration Steps for SFC Charts

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

- Move the SFC Chart
- Rename the SFC Chart
- Open the SFC Chart
- Specify the Technological Structure of the Sequential Control System
- Name the Steps
- Name the Transitions
- Assign Parameter Values for the Steps
- Assign Parameter Values for the Transitions

5.2.4.1 How to Move an SFC Chart

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

Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- Plant view activated

Follow the steps outlined below...

1. Select the following folder in the tree structure
"color_gs_MP/color_gs_Prj/Plant1/RMT1/FC111/ADDIT".
2. Select the "SFC(1)" object in the detailed window.
3. Select the menu command **Edit > Cut**.
4. Select the following folder in the tree structure
"color_gs_MP/color_gs_Prj/Plant1/RMT1".
5. Select the menu command **Edit > Paste**.
The SFC chart is inserted in the selected folder.

5.2.4.2 How to Rename the SFC Chart

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

Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- Plant view activated

Follow the steps outlined below...

1. Select the following folder in the tree structure
"color_gs_MP/ color_gs_Prj/ Plant1/ RMT1".
2. Select the "SFC(1)" object in the detailed window.
3. Select the menu command **Edit > Object Properties**.
The "Properties SFC Chart" dialog box opens.
4. Overwrite the default name "SFC(1)" with "SFC_RMT1" in the "Name" box.
5. Click the "OK" button to enter your settings.

5.2.4.3 How to Open the 'SFC_RMT1' SFC Chart

Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- Plant view activated

Follow the steps outlined below...

1. Select the following folder in the tree structure
"color_gs_MP/ color_gs_Prj/ Plant1/ RMT1".
2. Select the "SFC_RMT1" object in the detailed window and then select the menu command **Edit > Open Object**.
The SFC editor is opened. The "Start" and "End" steps and transition 1 already exist.

5.2.5 Technological Structure of the Sequential Control System

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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • Will Reactor 1 or Reactor 2 be used for dosing?
INIT_LINE1 INIT_LINE2	Controllers: <ul style="list-style-type: none"> • Open valves of the relevant branch • Turn on the pump • Switch the dosing controller to an external setpoint
INIT_1_OK INIT_2_OK	Query: <ul style="list-style-type: none"> • Is the pump turned on? • Is the controller set to "External Setpoint"?

Name of the Step	Function
INIT_DOSE	Controllers: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • Dosing started ? • Dosing volume (setpoint actual value) < 500 liters?
SLOW_DOWN	Controller: <ul style="list-style-type: none"> • Reduction of the dosing rate shortly before reaching the required dosing volume
END_DOSE	Query: <ul style="list-style-type: none"> • Dosing ended ?
CLOSE_LINE	Controllers: <ul style="list-style-type: none"> • Close all valves • Turn off the pump • Switch the dosing controller to manual • Set dosing speed to 0 • Stop dosing
CLOSE_OK	Query: <ul style="list-style-type: none"> • Is the pump turned off?
END	Reset <ul style="list-style-type: none"> • 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.




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

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

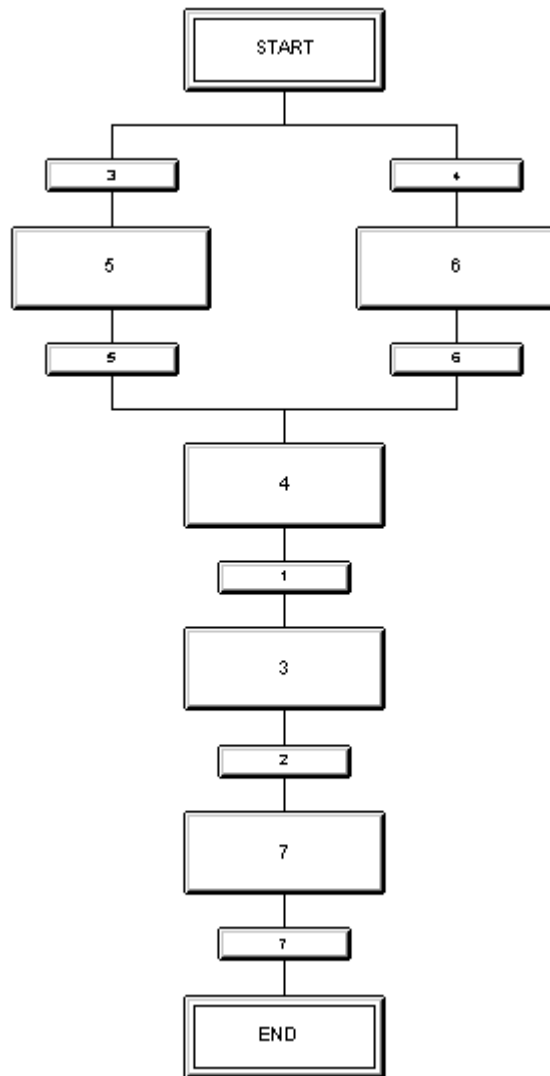
Ready to Start?

- The "SFC_RMT1" SFC chart is open in the SFC Editor
- The steps "START" and "END" and transition 1 are visible

Follow the steps outlined below...

1. If the element bar with the buttons for inserting steps and transitions is not displayed, Select the menu command **View > Element Bar**.
This opens the element bar.
2. Click the "Insert Step + Transition" button.
The mouse pointer changes to a small cross and a circle with a bar.
3. Position the mouse pointer below Transition 1 until a green line is displayed and insert the object by clicking.
Step "3" and transition "2" are inserted in the chart.
4. Click the "Insert Alternative Sequence" button.

5. Position the mouse pointer below the "START" step until a green line is displayed and insert the object by clicking.
An alternative sequence is inserted 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 mouse pointer 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

Your SFC chart should now appear as follows:



5.2.5.2 How to Rename Steps

Ready to Start?

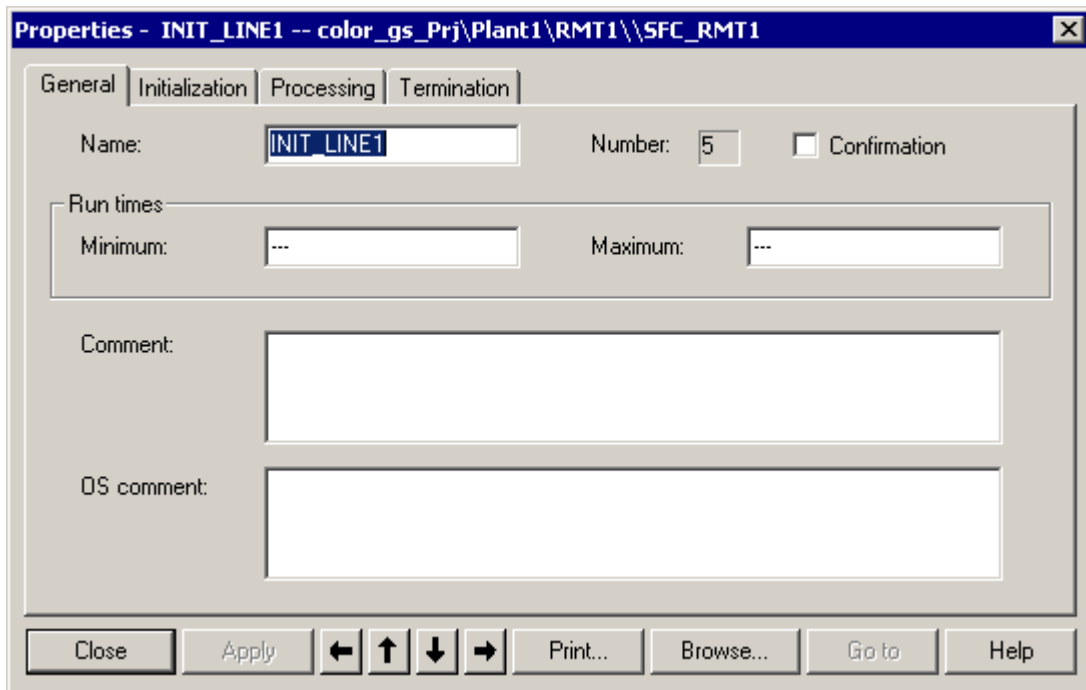
- The "SFC_RMT1" SFC chart is open in the SFC Editor
- All steps and transitions are inserted

Follow the steps outlined below...

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 active.
The default entry "5" in the "Name" box is already selected.
4. Change the name "5" in the "Name" box to "INIT_LINE1".

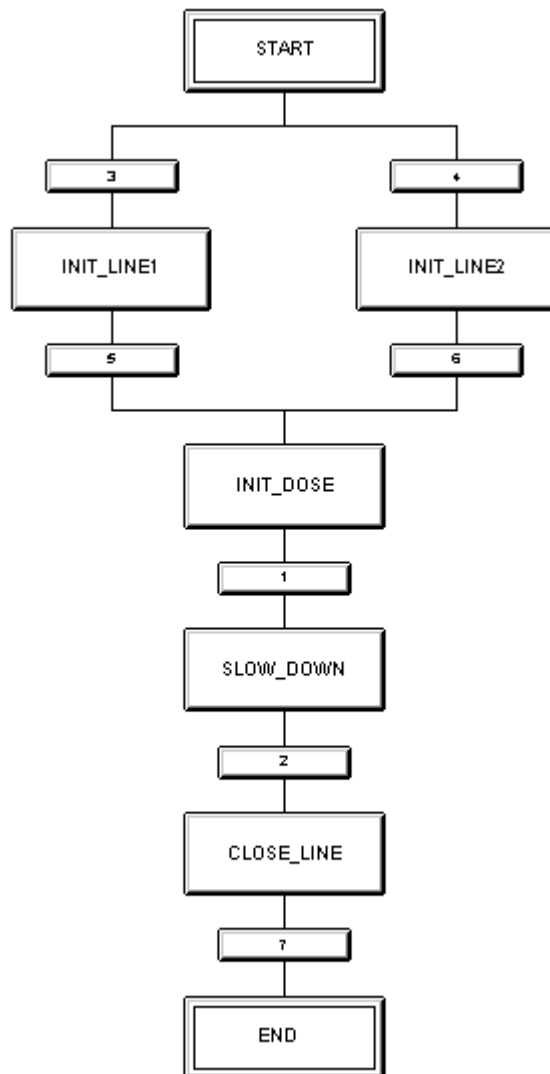


5. Click the "Apply" button.
The new name is stored.
6. Click the "arrow down" button.
You change to step "4".
7. Change the default name "4" in the "Name" box to "INIT_DOSE" and click the "Apply" button.

- Change to the other steps with the arrow buttons and change the names according to the table below. Each time you enter a name, complete the change by clicking the "Apply" button.

Default Name	New Name
5	INIT_LINE1 – done
4	INIT_DOSE – done
3	SLOW_DOWN
7	CLOSE_LINE
6	INIT_LINE2

- Click the "Close" button.
This saves your settings and the "Object Properties" dialog box is closed. The changed names of the steps are displayed in the SFC chart.



5.2.5.3 How to Rename Transitions

In just the same way as you renamed the steps, you must also replace the default names of all transitions with self-explanatory, plant-specific names. The procedure is exactly the same as for changing the names of the steps.

Ready to Start?

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

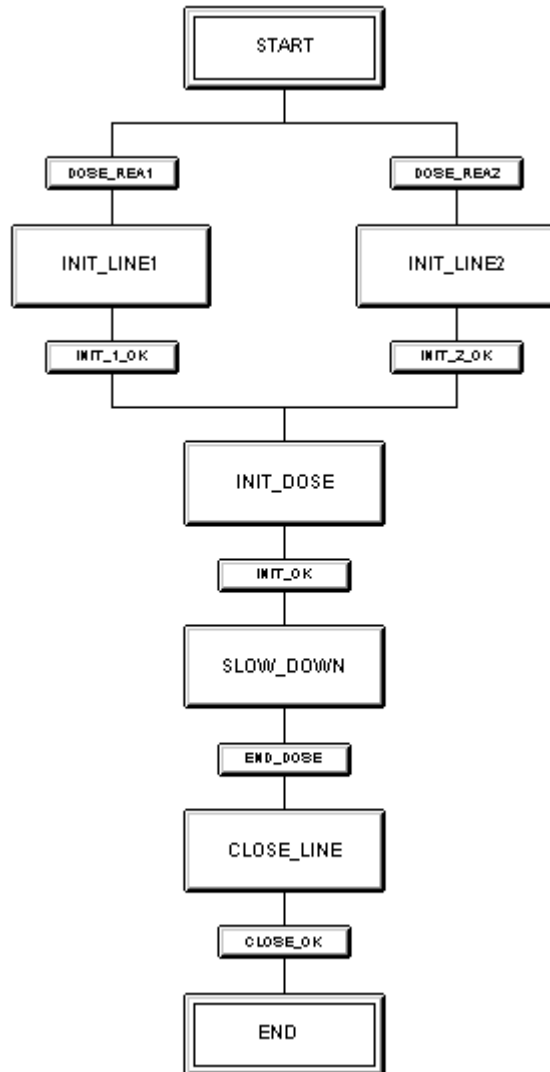
Follow the steps outlined below...

1. Double-click on transition "3".
The "Object Properties" dialog box opens and the "General" tab is active.
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.

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

5. Click the "Close" button.
This saves your settings and the "Object Properties" dialog box is closed. The changed names of the transitions are displayed in the SFC chart.

Your SFC chart should now appear as follows:



5.3 Setting the Parameters

5.3.1 How to Assign Parameter Values to the Steps of the SFC Chart

Starting in SFC, you assign values to the block inputs of the CFC charts. With the first step "START", you make the settings for the sequence of the dosing process.

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 had parameter values assigned to it.

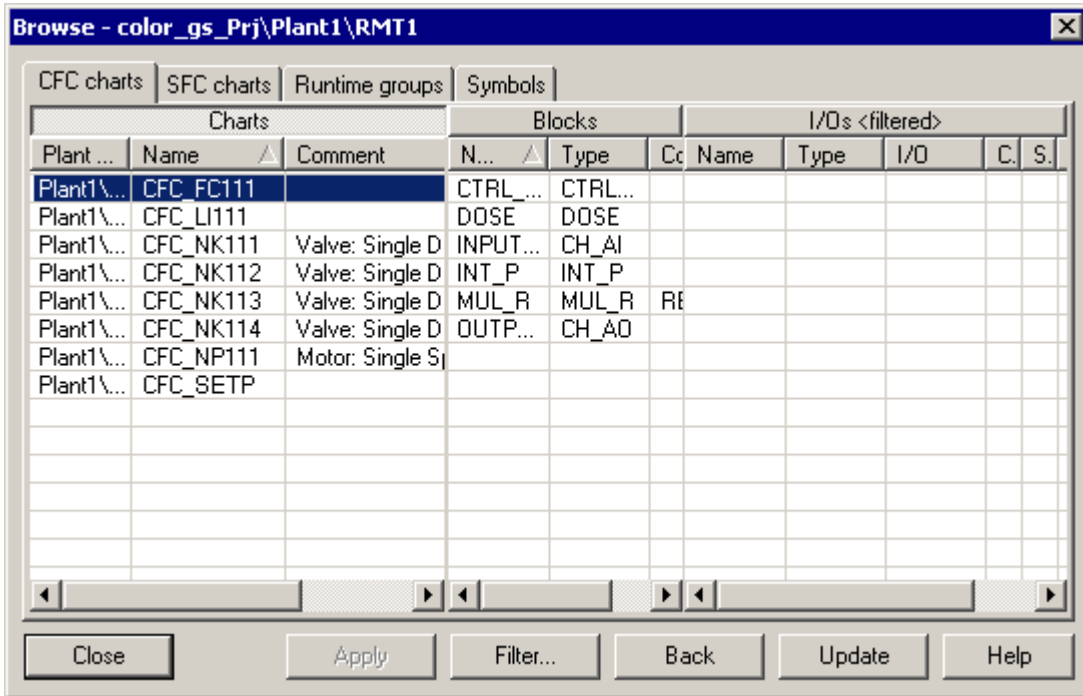
Ready to Start?

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

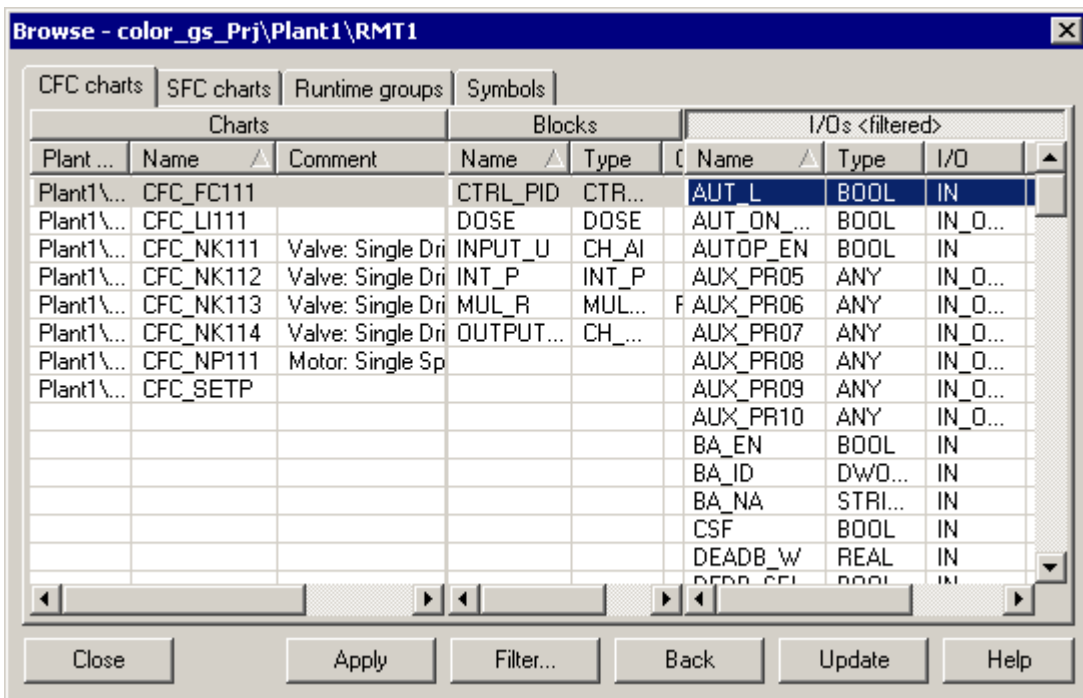
Follow the steps outlined below...

1. Double-click on the "START" step.
The "Properties" dialog box opens and the "General" tab is active.
2. Select the "Initialization" tab.
This tab displays an empty list with statement rows and the mouse pointer is positioned in the left column of the first row.
3. Click the "Browse" button.
The "Browse" dialog box opens and the "CFC Charts" tab is active.
In this dialog box, you can see the CFC charts of the "color_gs" project with the PH assignment, the chart name, and the comment in the first three columns. In the next three columns, you can see all the blocks belonging to the chart selected in the first columns. As soon as you select a block, the last column displays all the relevant I/Os.

- Select the "CFC_FC111" CFC chart.
In the adjacent columns, you now see all the blocks of the "CFC_FC111" CFC chart.



- Select the "CTRL_PID" block.
In the right-hand columns, you will see all the relevant I/Os of this block.



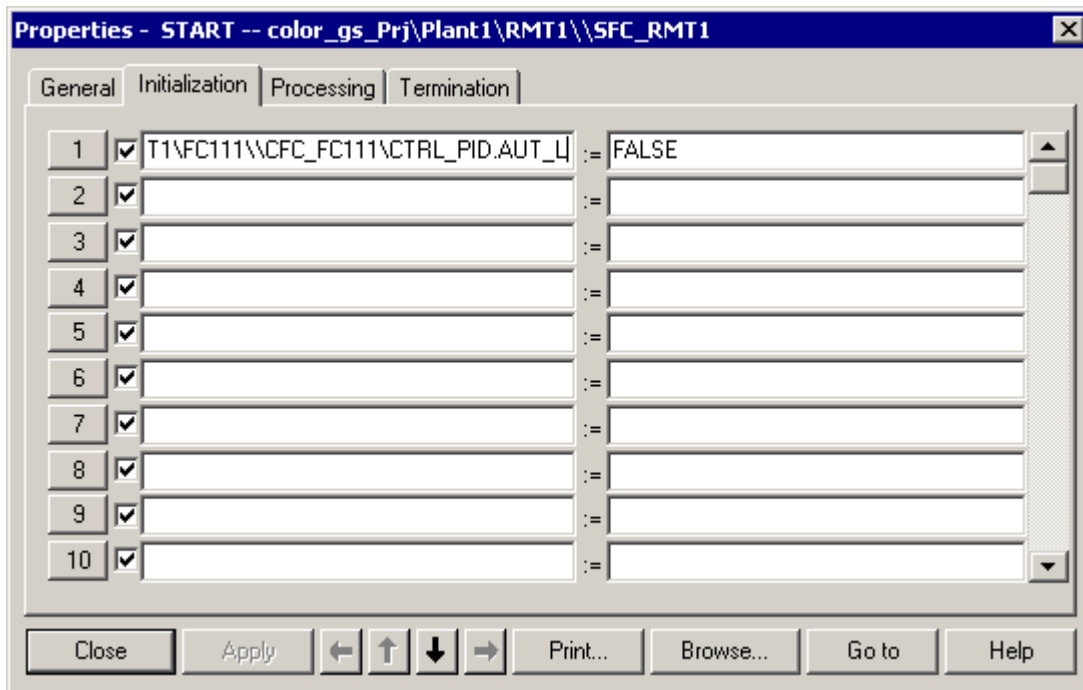
6. Double-click on the "AUT_L" input.
The "Browse" dialog box goes to the background and the selected block I/O along with its full path is entered as the first address in row 1.
The mouse pointer is automatically positioned in the right column of row 1.

Note

If you cannot read the names of the block I/Os, position the mouse pointer over the relevant field – the full name is then displayed in a tooltip.

7. Enter the value "0" in this field.
8. Click the "Apply" button.
The value "0" is automatically replaced by "FALSE". The first assignment in the "Start" step is now complete.

The dialog box now appears as shown below:



9. Click on the button with the continuous number "2". This button is arranged directly in front of the statement row.
This positions the mouse pointer in the left column of the second row.
10. Repeat steps 3 through 9 to define the remaining addresses for the "START" step. You will find the information you require in the following table.



Note

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

[chartname\block\I/O].

The plant hierarchy is omitted to make the table clearer. As soon as you insert a further plant or unit in the "color_gs" project, you must, of course, include the assignment of the chart to the plant hierarchy.

Cont. No.	Address 1	Address 2	Meaning
1	already done: CFC_FC111\CTRL_PID\AUT_L	FALSE	Controller manual mode
2	CFC_FC111\CTRL_PID.SP_EXT	CFC_SETP\PARAM_DOS_RM1_QTY.V	Setpoint for flow control
3	CFC_FC111\CTRL_PID.LMN_SEL	FALSE	No setpoint correction
4	CFC_FC111\DOSE.L_START	FALSE	Dosing stopped
5	CFC_FC111\INT_P.TRACK	TRUE	Track integrator
6	CFC_LI111\INT_P.TRACK	TRUE	Track integrator
7	CFC_NK111\VALVE.AUT_ON_OP	Auto	Valve in automatic mode
8	CFC_NK112\VALVE.AUT_ON_OP	Auto	Valve in automatic mode
9	CFC_NK113\VALVE.AUT_ON_OP	Auto	Valve in automatic mode
10	CFC_NK114\VALVE.AUT_ON_OP	Auto	Valve in automatic mode
11	CFC_NP111\MOTOR.AUT_ON_OP	Auto	Motor in automatic mode
12	CFC_LI111\INT_P.HOLD	FALSE	Hold output value

11. Click the "Apply" button.

12. Click on the arrow button to change to the other steps and enter the addresses according to the tables.

Note

When entering the addresses (operands), check whether you have selected the required step based on the title bar of the "Properties" dialog box.

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

- INIT_LINE1
- INIT_LINE2
- INIT_DOSE
- SLOW_DOWN
- CLOSE_LINE
- END

5.3.1.1 Parameters for the 'INIT_LINE1' Step

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

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

5.3.1.2 Parameters for the 'INIT_LINE2' Step

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

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

5.3.1.3 Parameters for the 'INIT_DOSE' Step

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

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

Setting the Run Time

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

5.3.1.4 Parameters for the 'SLOW_DOWN' Step

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

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

5.3.1.5 Parameters for the 'CLOSE_LINE' Step

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

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

5.3.1.6 Parameters for the 'END' Step

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

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

5.3.2 How to Assign Parameter Values to the Transitions of the SFC Chart

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

Ready to Start?

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

Follow the steps outlined below...

1. Double-click on the "DOSE_REA1" transition.
The "Properties" dialog box opens and the "General" tab is active.
2. Select the "Condition" tab.
This tab displays an empty list with statement rows and the mouse pointer is positioned in the left column of the first row. The layout of the dialog box is the same as you saw when the assigning parameter values for the steps.
3. Set all the parameter values for the "DOSE_REA1" transition. You will find the information you require in the following table. Below you can see an overview of the steps as a reminder:
 - For address 1, open the "Browse" dialog box by clicking the "Browse" button and selecting the relevant I/O
 - Enter address 2
 - Apply your settings
 - Select a new line
 - etc.
4. Select a new transition and enter the addresses.

Notes

When entering the addresses (operands), check whether you have selected the required transition based on the title bar of the "Properties" dialog box.

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

[chartname\block\I/O].

The plant hierarchy is omitted.

Parameters for the "DOSE_REA1" Transition

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

Parameters for the "INIT_1_OK" Transition

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

Parameters for the "INIT_OK" Transition

Cont. No.	Address 1	Operator	Address 2	Meaning
1	CFC_FC111\DOSE.QSTRTDOS	=	TRUE	Dosing started ?
2	CFC_FC111\DOSE.ER	<	500.0	Dosing volume: setpoint – actual value < 500 liters?

Parameters for the "END_DOSE" Transition

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

Parameters for the "CLOSE_OK" Transition

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

Parameters for the "INIT_2_OK" Transition

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

Parameters for the "DOSE_REA2" Transition

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

5.4 The Current Status of Your Project...

What have you learnt during configuration in SFC?

- 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 parameter values to the steps and transitions of the sequential control system.

6 Compiling, Downloading, and Testing the Charts

6.1 Overview of Compiling, Downloading, and Testing

This tutorial explains how you compile the program you have created with CFC and SFC, download it to the CPU and run it in the test mode. This gives you the opportunity of checking the correct functionality of the charts. You already got to know the "Download" function when you downloaded the hardware configuration.

You now have two steps to perform with the charts:

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

6.1.1 How to Compile and Download CFC and SFC Charts

You have already created the CFC and SFC charts for your "color_gs" project. These charts must be compiled into a language so that they can execute on a CPU. Obviously they must also be downloaded to the CPU so that the CPU can run the program. The compilation and download are started in a common dialog box and run one after the other.

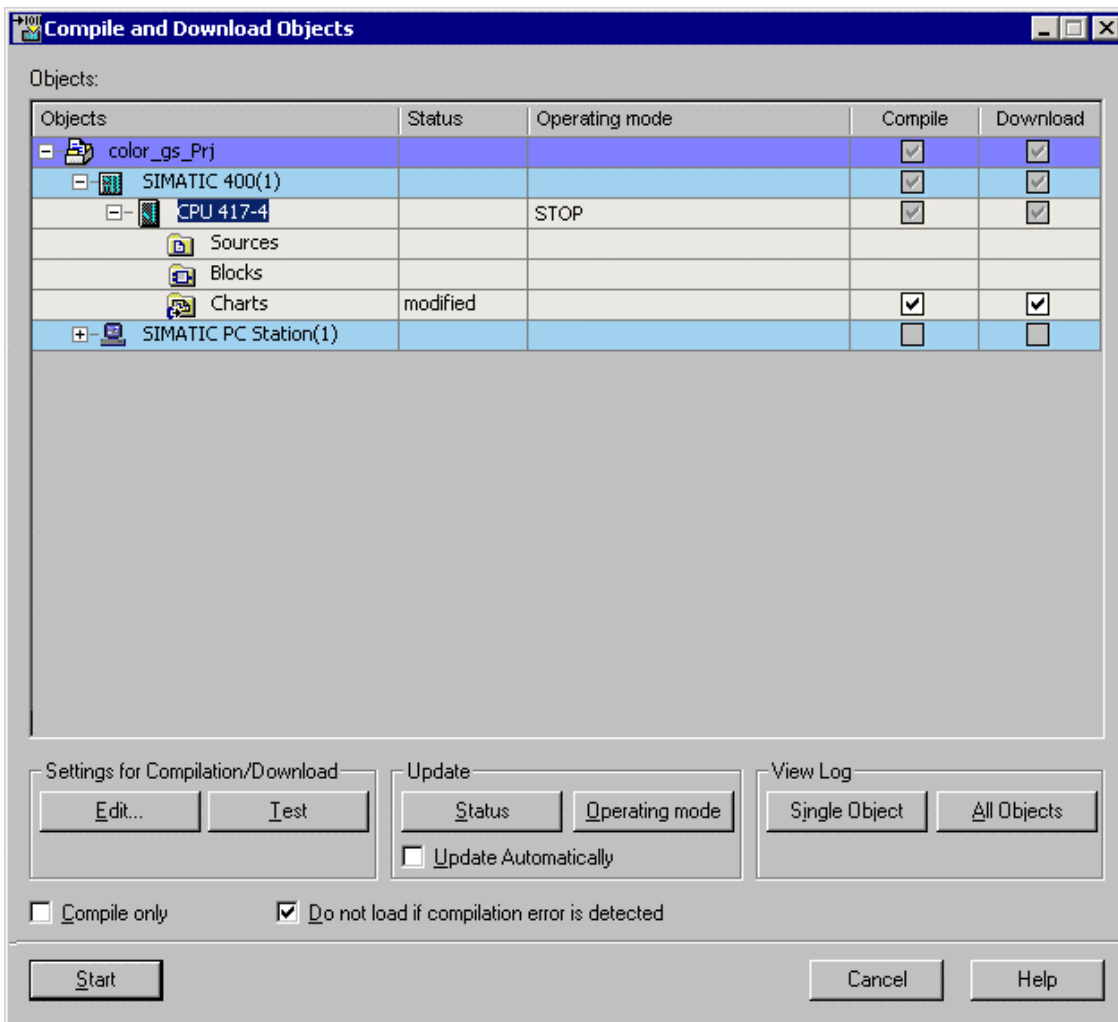
Ready to Start?

- Green "RUN" LED on the CP is lit
- CPU is in STOP
- The "color_gs" project is open in the SIMATIC Manager
- The component view is activated

Follow the steps outlined below...

1. Select the following folder in the tree structure "color_gs_MP/ color_gs_Prj/ SIMATIC 400".
2. Select the menu command **PLC > Compile and Download Objects**. The "Compile and Download Objects" dialog box opens.
3. Click on "+" to expand the tree structure. The "color_gs" project is displayed with a structure basically the same as in the component view of the SIMATIC Manager. You will see the individual objects and relevant information on the status or operating state:

Object	Status	Operating state
CPU 417-4	–	STOP
Sources	–	–
Blocks	–	–
Charts	modified	–

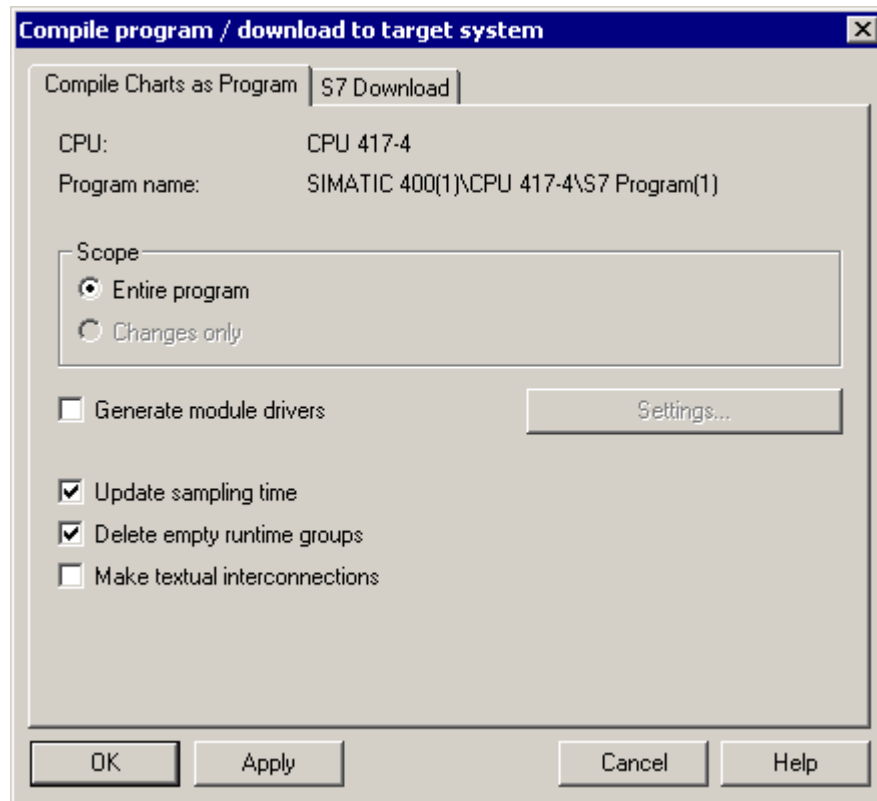


4. For the "Charts" object, check the "Compile" and "Download" check boxes.
5. Select the "Charts" entry and click on the "Edit..." button under "Settings for Compilation/Download".
The "Compile program / download to target system" dialog box opens and the "Compile Charts as Program" tab is active. The "Entire program" check box is automatically activated since you are starting the compilation and download for the first time.

Note

If you find errors in your program when you test it, you will have to make changes to your CFC or SFC charts to eliminate the problem. When you restart compilation and downloading afterwards, make sure that you activate the "Changes only" check box. This will save you a considerable amount of time when compiling and downloading. Selecting this option also means that you can download the changes without needing to stop the CPU.

6. Make sure that the following check boxes are activated:
 - Update sampling time – With this option, prior to compiling, the system checks to find out the OB in which the relevant block is installed and makes the appropriate entry at the "SAMPLE_T" input. "SAMPLE_T" corresponds to the sampling time of the block in seconds.
 - Delete empty run-time groups – This option deletes or empty run-time groups that might exist in the S7 program.



7. Click the "OK" button to enter your settings.
The dialog closes and the message box "Remember that if you download later (...), the blocks in the CPU will be deleted " opens.
8. Click the "OK" button.
9. Check the settings in the following check boxes:

Check box	Setting
Compile only	deactivated
Do not load if compilation error is detected	activated

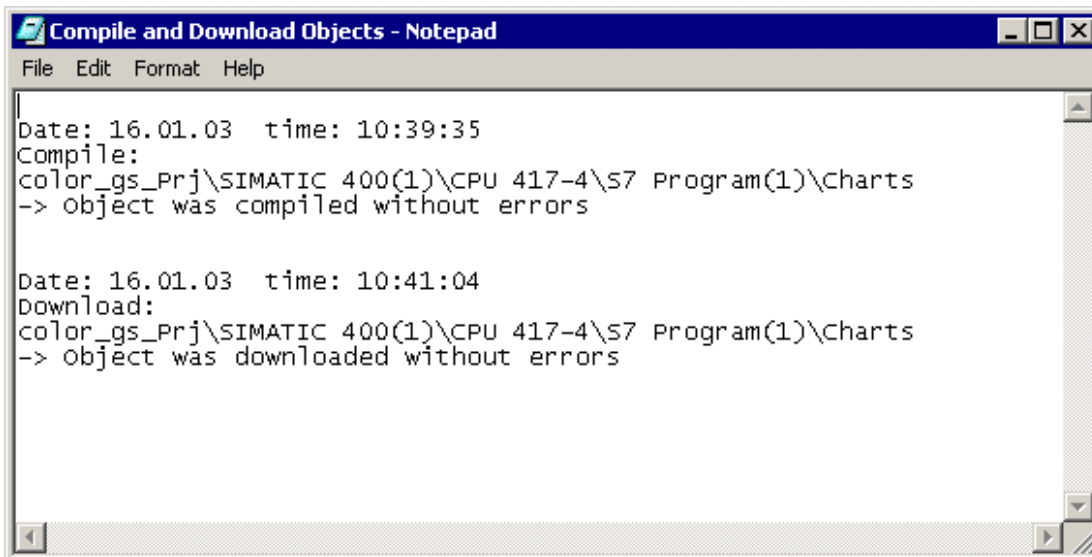
10. Click on the "Start" button to start the compilation and download.
The message box "Please make sure the settings for downloading changes are correctly selected for all the objects to be downloaded ... Do you want to continue?" opens.
11. Click the "yes" button.

Note

The progress display indicates exactly what PCS 7 is currently doing, for example:

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

When this is completed, the log file opens to show you whether or not the compilation and download was error-free.



The status in the "Charts" row is now "downloaded".

12. Click the "Cancel" button.
The dialog box is closed.
13. Start the CPU.

6.2 Testing the Program

You can test both in the SFC Editor and in the CFC Editor. In the test mode, you can watch how the values change during the course of the process. Using the 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 that you have already seen also plays a central role in the test mode.

If you double-click on a step or a transition in the SFC chart, the "Properties" dialog box opens – this is familiar territory. Just as during creation of the SFC charts, you can use the arrow buttons to change from one step or transition to the next. In the 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 to the right beside address 2.
- In the properties dialog of a transition the current values are displayed to the left of address 1 and to the right of address 2.

Caution

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 Getting Started, you will not change any values here and will simply use the "Properties" dialog boxes to monitor the values.

Test Mode in CFC

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

6.2.1 How to Test the Program in the SFC Editor

After you have compiled and downloaded the program, you can run the program in the test mode to check whether the sequential control system works properly and whether the program runs correctly.

Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- The "SFC_RMT1" SFC chart is open in the SFC Editor

Working in the Test Mode

1. Select the menu command **Debug > Test Mode**.
The Test mode is activated.
 - 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 will see the status of the program, the mode, and the step control mode. As default, the mode is set to "MANUAL". The current step control mode is displayed in the drop-down list box and as default is set to "T".
 - In the lower part of the SFC Editor, there are also buttons for controlling the SFC chart, for example start, hold, resume.
2. Select the menu command **Debug > Step Control Mode > T or C**.
In this step control mode, an additional button "C" is displayed beside the transition while the SFC chart is running:

If the chart...	... the sequential control system will do the following:
is free of errors	The sequential control system will be executed according to the configured parameters. You do not need the button.
contains errors	The sequential control system stops when 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.

3. Click on the "Start" button to start the program.
The SFC chart is started.
 - Each step that is currently being executed is light green with a small arrow pointing down next to the step.
 - Steps that have already been processed are displayed in dark green and have a small check mark beside them.
 - Transitions that are active but not yet satisfied are shown on a brown background.

If you created your configuration correctly, the entire SFC chart will execute to the end and all steps will turn dark green and have a check mark beside them. Otherwise, you can click the "C" button to pass control to the next step manually although the transition is not satisfied.

4. Select the menu command **Debug > Test Mode**.
This stops the Test mode.

6.2.2 How to Test the Program in the CFC Editor

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

Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- The "SFC_RMT1" SFC chart is open in the SFC Editor and the Test mode is active
- The "CFC_FC111" CFC chart is open in the CFC Editor

Follow the steps outlined below...

1. Select the menu command **Debug > Test Mode**.
The Test mode is activated.
2. Press the "CTRL" key and select the following blocks:
 - CTRL_PID
 - INPUT_U
 - DOSE
3. Select the menu command **Debug > Watch On**.
All the block I/Os activated for the test mode in the properties of the block are then shown on a yellow background.
4. Change to the "SFC_RMT1" SFC chart.
5. Click on the "Start" button in the toolbar.
This starts the program.
6. Change to the "CFC_FC111" CFC chart.
You can then watch the values change: 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 the Test mode.

7. Select the menu command **Debug > Test Mode**.
This stops the Test mode.

6.3 Current Status of the Project...

In the meantime, you have completed almost the entire configuration work in the SIMATIC Manager and in the CFC and SFC Editors. After compiling and downloading this configuration, you have been able to watch the project execute in the SFC and CFC Editors.

This allowed you to make sure that your configuration is free of errors up to now. If you find that your project has errors when it runs in the test mode, it is much easier to correct at this stage than after the entire project has been completed.

7 Configuring the Operator Station

7.1 The Operator Station in the Process Mode

The plant operator can control and monitor the process on the operator station in the process mode. The operator station displays process pictures. The PLC controls the process and the OS reads the process values from the PLC and represents the values graphically in the process pictures. Warnings and alarms are also displayed in the process pictures as soon as certain specified limits are reached or exceeded. This allows the operator to identify the point at which a problem occurs in the plant.

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

7.2 Configuring the Operator Station

The Operator Station in the Project

When you create a project with the "Create New Project" wizard, PCS 7 automatically creates 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 communication between the programmable controller and the engineering system so that you could download the data of the ES to the PLC. This is not necessary for the "color_gs" project because the engineering system and the operator station are on the same computer and the operator station uses the same connection to the PLC as the ES.

The Process Pictures in the Project

The wizard also creates the pictures automatically in the plant hierarchy and you then configure them in the PCS 7 OS. Larger projects do, of course, have several process pictures for the various plant sections. For the "color_gs" project, you only need to configure a single picture. You will nevertheless become familiar with all the basic functions involved in configuration of the PCS 7 OS. Pictures are identified by the following icon:



7.3 Working in the SIMATIC Manager

7.3.1 Preparations in the SIMATIC Manager

Before you can start to configure in the PCS 7 OS, there are a few preliminary jobs to be done in the SIMATIC Manager:

- Adapting picture names and activating the function for creating block icons
- Deleting unnecessary pictures
- Creating block icons
- Compiling the OS

Editing the Picture Properties

Since the "Create New Project" wizard has already created pictures, these pictures, just like the CFC chart, have default names. You must first adapt these default names to suit your project by assigning self-explanatory short names to them.

You must also activate the function for creating block icons.

Deleting Unnecessary Pictures

When you create a project with the 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 an excellent function: "Create block icons": 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 run the "Compile OS" function once you have completed configuration of all data in the SIMATIC Manager and before you start to configure the OS data of the PCS 7 OS. All the data from the SIMATIC Manager, such as variables, messages, texts and the hardware and connection configuration must be "made known" to the OS.

Starting the OS

To continue configuration of the PCS 7 OS, you must start the OS so that you can continue working in the WinCC Explorer.

7.3.1.1 How to Edit Picture Properties

When you edit the picture properties, you make two settings:

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

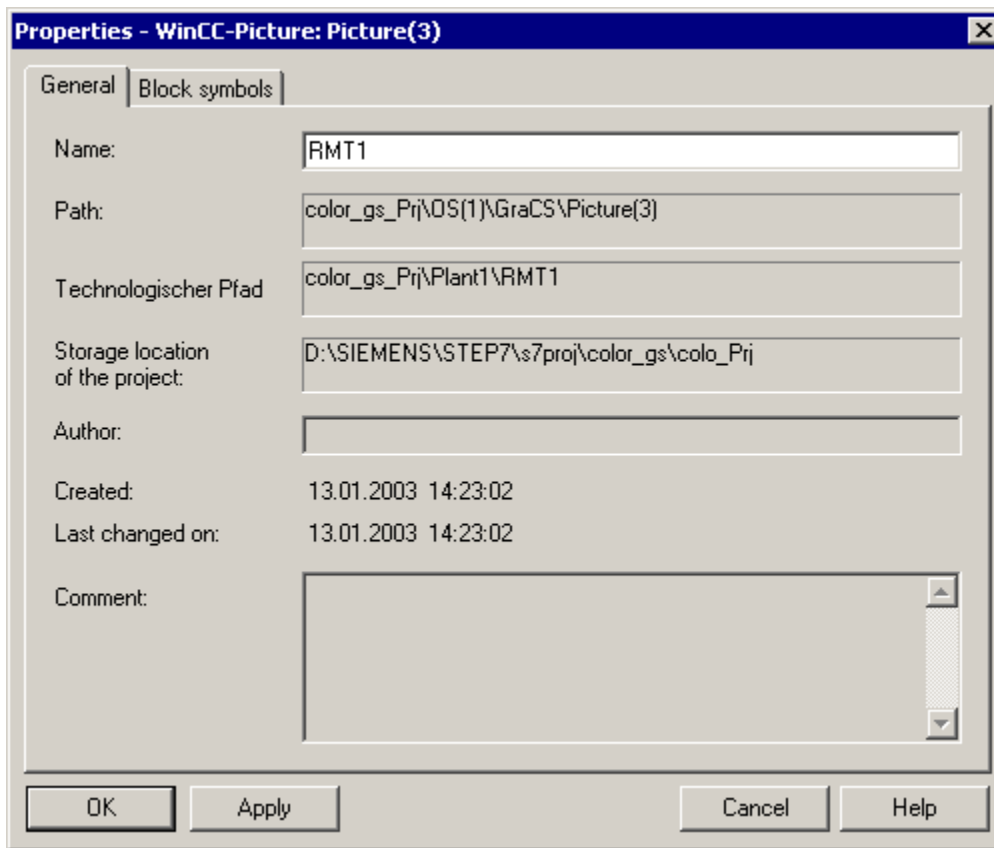
Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- The plant view is activated

Change the name of the picture

1. Select the following folder in the tree structure
"color_gs_MP/ color_gs_Prj/ Plant1/ RMT1".
2. Select the picture "Picture(3)" in the detailed window.
3. Select the menu command **Edit > Object Properties**.
The "Properties – WinCC Picture(3)" dialog box opens and the "General" tab is active.

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



5. Click the "Apply" button to enter your settings.

Activate the option for creating block icons

1. Change to the "Block Icons" tab.
2. Select the "Base block icons on the plant hierarchy" check box.
3. Click the "OK" button to enter your settings.
The dialog box is closed and the new name of the picture is displayed in the plant hierarchy.



7.3.1.2 How to Delete Unnecessary Pictures

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

Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- The plant view is activated

Follow the steps outlined below...

1. Select the "Plant1" folder in the tree structure.
2. Select the picture "Picture(2)" in the detailed window.
3. Press the "Del" key.
The "Delete" dialog box opens.
4. Click the "yes" button.
The picture is deleted.
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)

7.3.1.3 How to Create Block Icons

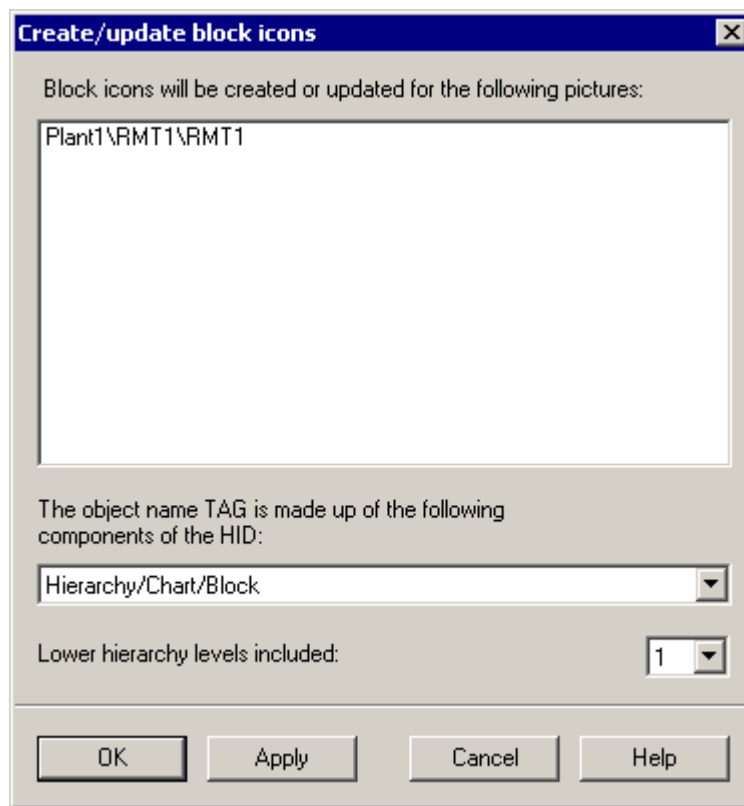
Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- The plant view is activated
- The option for creating block icons is activated

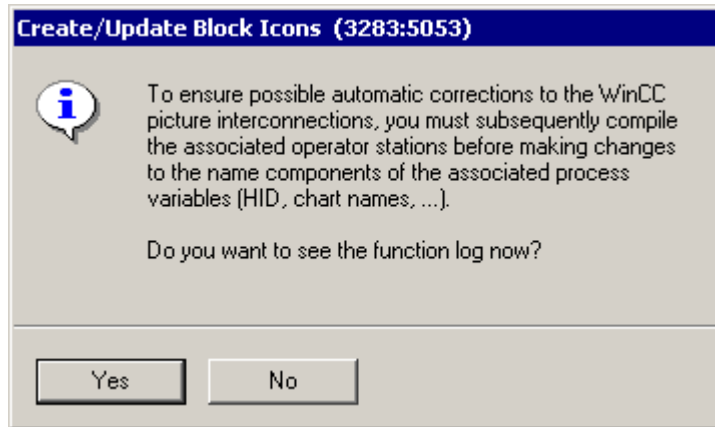
For more detailed information on these settings, refer to "Configuring the Operator Station – Working in the SIMATIC Manager – How to Edit Picture Properties" in section "Activate the option for creating block icons".

Follow the steps outlined below...

1. Select the following folder in the tree structure
"color_gs_MP/ color_gs_Prij/ Plant1/ RMT1".
2. Select the menu command **Options > Plant Hierarchy > Create/Update Block Icons...**
The "Create/Update Block Icons" dialog box opens. The picture for which the block icons will be created "Plant1\RMT1\RMT1" is displayed in the list.
The value "1" is entered in the "Lower hierarchy levels included" drop-down list box.



3. Click the "OK" button.
This starts creation of the block icons.
A message window opens informing you that you will need to compile the operator stations involved. "Do you want to see the log of the function?"



4. Click the "No" button.
The message window is closed and creation of the block icons is completed.
At present, you will not see any visible results of this function. When, however, you open the process picture for the "color_gs" project, you will see the block icons that were created.



7.3.1.4 How to Compile the OS

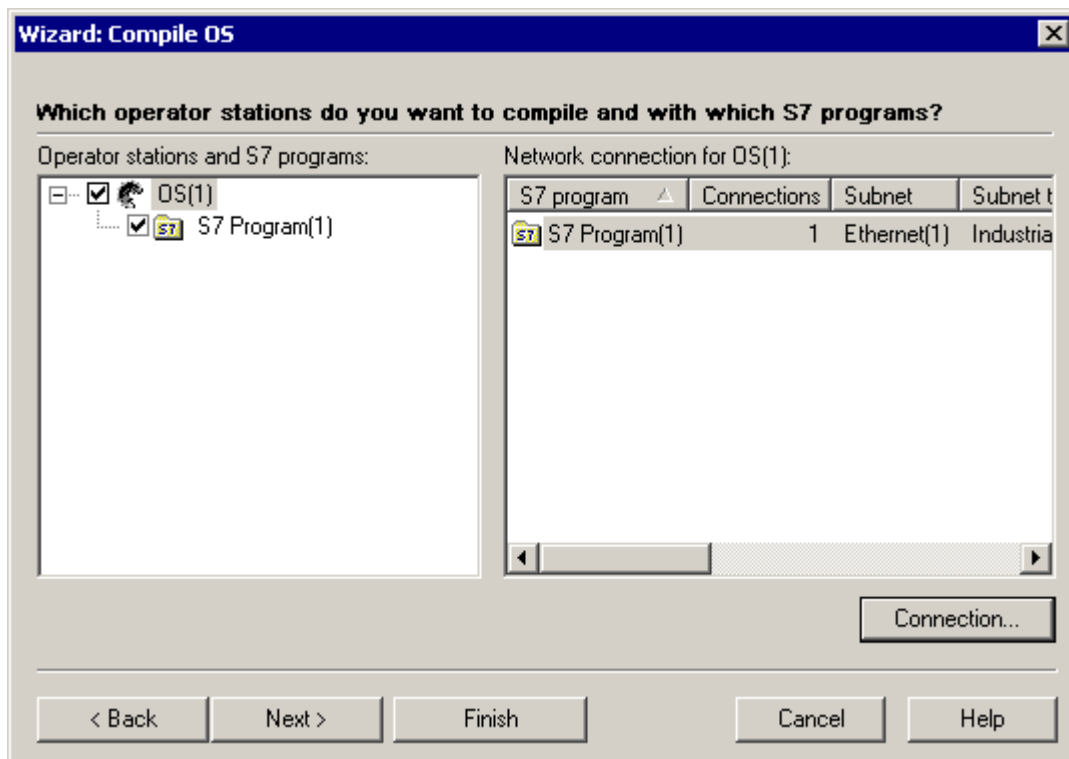
Before you start to configure the data on the PCS 7 OS, you must first compile the OS. With this function, all the data from the SIMATIC Manager, such as variables, messages, texts and the hardware and connection configuration is "made known" to the OS. Do not confuse compiling with downloading: When you compile, the data remains on the computer in the engineering system – it is simply made known to the PCS 7 OS so that you can access this data during configuration.

Ready to Start?

- The "color_gs" multiproject is open in the SIMATIC Manager
- The component view is activated

Follow the steps outlined below...

1. Go to the tree structure and select the entry "color_gs_MP/ color_gs_Prij/ SIMATIC PC Station(1)".
2. Select the menu command **Options > OS > Compile...**
The first step of the "Compile OS" wizard is opened. Below, you will find a brief overview of the steps.
3. In step 1, click the "Next" button.
The step "Which operator stations do you want to compile and with which S7 programs?" opens.
Under "Operator stations and S7 programs", you will see all operator stations and S7 programs that belong to your project. The objects "OS(1)" and "S7 Program(1)" belong to your project and are activated already as default. In the area "Network connection for OS(1)", you will find the entry "S7 Program(1)" and the subnet "Ethernet(1)": This is the connection via which the programmable controller and operator station communicate and that you already created for your CP in HW Config.

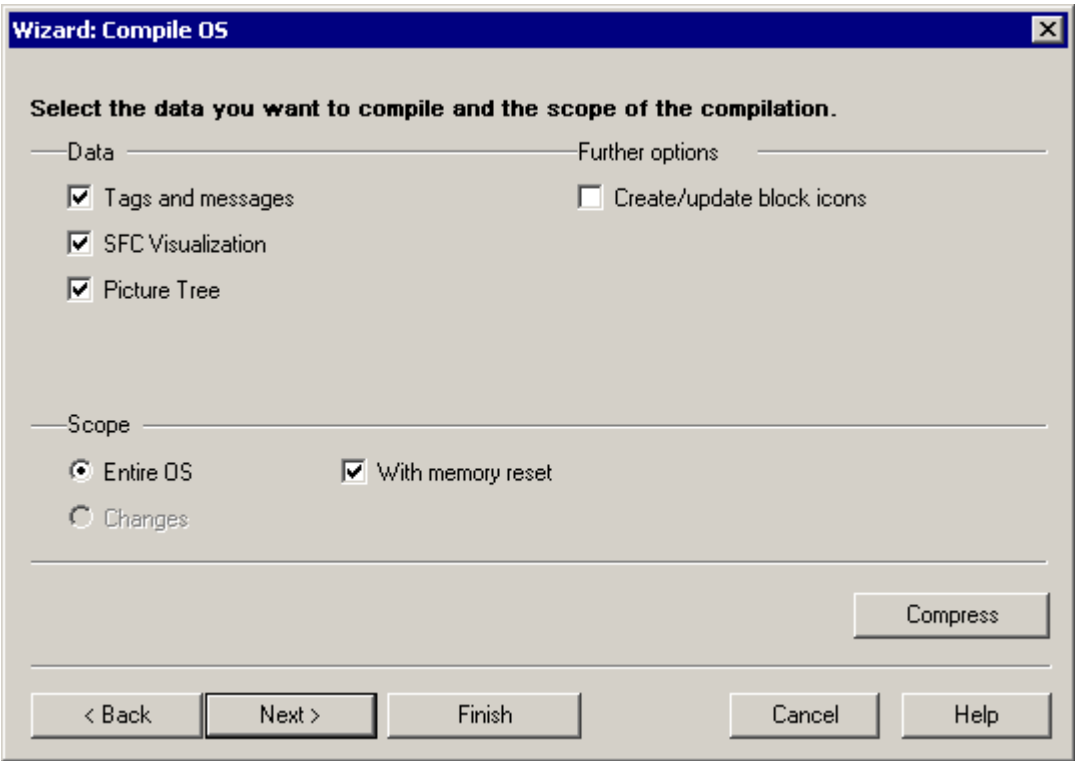


4. If a different connection is displayed here, click on the "Connection..." button, select the Ethernet connection you created for your CP in HW Config in the "Select Network Connection" dialog and then click "OK".
The dialog box closes and you return to the wizard. In the wizard, the connection you have selected is displayed under "Network connection for OS(1)".

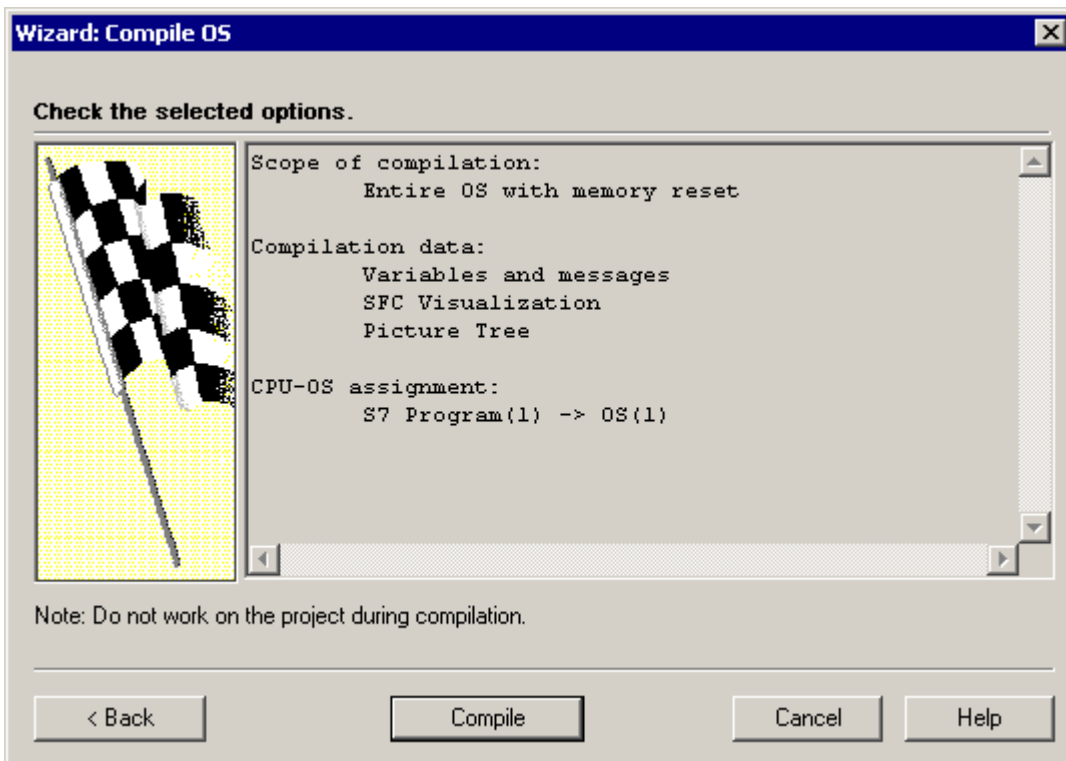
- 5. Click the "Next" button.
The "Select the data you want to compile and the scope of the compilation" step opens. The following check boxes are activated as default when you compile for the first time:

Area	Check Box
"Data"	<ul style="list-style-type: none">• "Tags and Messages"• "Picture Tree"
"Scope"	<ul style="list-style-type: none">• "Entire OS"• "With memory reset"

- 6. Under "Data", activate the "SFC Visualization" check box.



- 7. Click the "Next" button.
The last step of the wizard "Check the selected options" opens and shows you a summary of the settings you have made.



8. Click the "Compile" button.
Compilation is started and a progress bar is displayed.
After compilation, a message window is displayed: "The compilation was completed without errors and warnings".
9. Click the "OK" button.
This completes your compilation.



7.3.1.5 How to Start the PCS 7 OS

You have now completed all the preparations for configuring the PCS 7 OS in the SIMATIC Manager and you can now start to configure the PCS 7 OS. You start by opening the PCS 7 OS.

Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- The component view is activated

Follow the steps outlined below:

1. Select the following object in the tree structure
"color_gs_MP/ color_gs_Prj/ SIMATIC PC-Station/ WinCC Application/ OS(1)".
2. Select the menu command **Edit > Open Object**.
The PCS 7 OS – WinCC Explorer is opened.



7.4 Working on the PCS 7 OS

7.4.1 Structure of the PCS 7 OS - WinCC Explorer

The WinCC Explorer provides you with a series of editors that you can use to configure a PCS 7 OS. But don't worry! – to configure the PCS 7 OS, we only need to use some of these editors.

How is the WinCC Explorer Structured?

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

- In the left pane, there is a navigation window: Here you find all the editors that you can use to configure 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.

In the "color_gs" project, we will work solely with the Graphics Designer. This is the tool you use to create process pictures. You do not require any other editors to configure the PCS 7 OS.

7.4.2 The Function of Process Pictures

Overview

Process pictures represent the plant equipment for the operator. Here, the operator can enter commands and display plant statuses.

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

In the "Graphics Designer" editor, you will edit this process picture; in other words, you will insert the required static and dynamic objects and interconnect them.

7.5 General Aspects of Working with the Graphics Designer

7.5.1 Introduction to the Graphics Designer

User Interface

The Graphics Designer is an editor for the PCS 7 OS. The user interface of the Graphics Designer is structured as follows:

- On the left-hand side, you will see a Color Palette with which you can assign colors to the objects.
- In the middle, you have the file window or drawing board on which you insert the objects for the process picture.
- On the right-hand side, you will see the Object Palette. This is the library with the various standard objects provided by the Graphics Designer. You will also see a Style Palette on the right-hand side with which you can 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, static text etc.
- Dynamic objects – these objects are made dynamic due to a connection to a block I/O or variable; in other words, these objects always show the current values of a tag in the plant in the process mode. In the "color_gs" project, you will get to know various dynamic objects.

7.5.1.1 How to Open a Process Picture

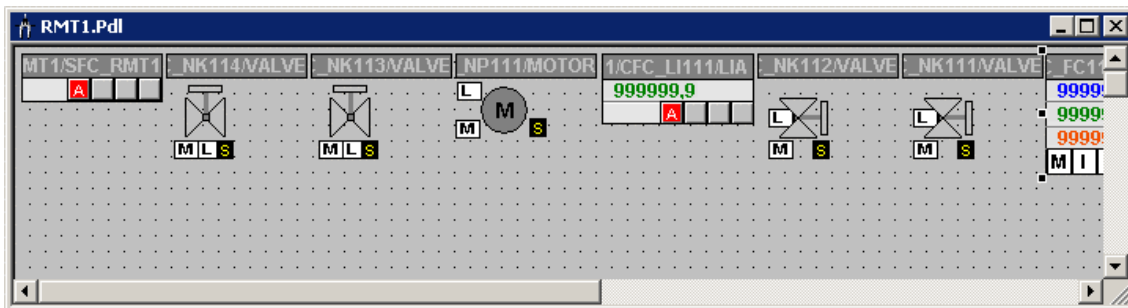
The process picture is edited in PCS 7 OS. The editor used is the "Graphics Designer".

Ready to Start?

The "color_gs" project is open in the WinCC Explorer

Follow the steps outlined below...

1. In the navigation window, select the "Graphics Designer" entry.
The detailed window displays all the 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 preceding "@" character.
2. Select the picture "RMT1.pdl" in the detailed window.
3. Double-click the picture "RMT1".
The process picture is opened in the Graphics Designer.
Here, you can see that there are already objects in this process picture, although you yourself have not yet inserted any objects. These are the block icons that you created in the process picture with the "Create block icons" function in the SIMATIC Manager. You can also see that the block icon for the valve has been inserted aligned both horizontally and vertically. These two versions are influenced by the setting of the process object view in the "Picture Objects" tab that you made when assigning parameter values to the CFC charts.



7.5.1.2 How to Open the Various Toolbars

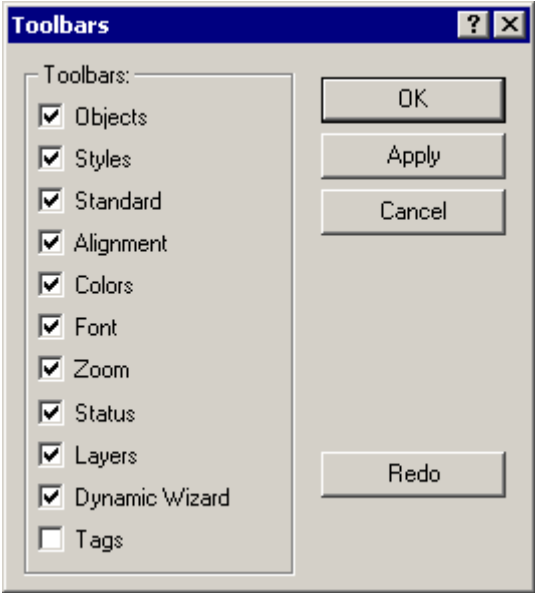
As default, the most important toolbars and palettes are open and you do not need to change the settings. If you accidentally close toolbars or palettes, you should know how to make them visible again.

Ready to Start?

The picture is opened in the Graphics Designer.

Follow the steps outlined below...

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 as shown in the screenshot of the dialog box:



3. Click the "OK" button to enter your settings.
The toolbars and object palettes you have selected will be displayed.

The "Objects" check box is important – you use this to open the object palette from which you take all the static and dynamic objects you require to create the process picture. The object palette contains two tabs: "Standard" and "Controls". In Getting Started, will only use the "Standard" tab.

7.5.2 The Objects in the Graphics Designer

However, before you get started with the actual configuration and work in the Graphics Designer, it is time for a little 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 need a certain amount of background information on interconnecting tags – this is the way you create the relationship between the process picture and the tag.

7.5.3 What Are Static Objects?

To visualize a plant, you require a lot of static objects, for example, to represent a pipe or a tank. These objects do not change during the process mode; in other words, they are not influenced by the status or by a value of a tag.

7.5.4 What Are Text Fields?

In a text field, you can enter any information that you want the 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 document.

For the "color_gs" project, you will insert text fields for all the tags and label them.

7.5.5 What Are I/O Fields?

Input/output fields are used to input or output values. There are different versions of I/O fields:

- Pure output field
- Pure 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 control dosing either in reactor 1 or 2.

7.5.6 How Does Tag Interconnection Work?

The interconnection with tags is a central function when you create process pictures: Objects are entered in the process picture that represent the process values of a measuring point (tag) in the process mode. By interconnecting with a variable, you create the connection between the object and the actual measuring point. This allows the OS to receive or read out data from the PLC and to display and update this data in the process picture.

7.6 Creating the Process Picture

7.6.1 How to Insert Pipes and a Tank for the Process Picture

Ready to Start?

- The "RMT1" picture is opened in the Graphics Designer.
- Block icons exist
Initially, you will not make any modifications to the block icons. You must first create a picture of the plant with static objects before you can move the icons to the positions where they require information.

Follow the steps outlined below...

1. Select the menu command **View > Library**.
This opens the libraries of PCS 7 OS.
2. Select the object "Global Library/PlantElements/Tanks/Tank4" and drag it to the drawing board.

Note

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

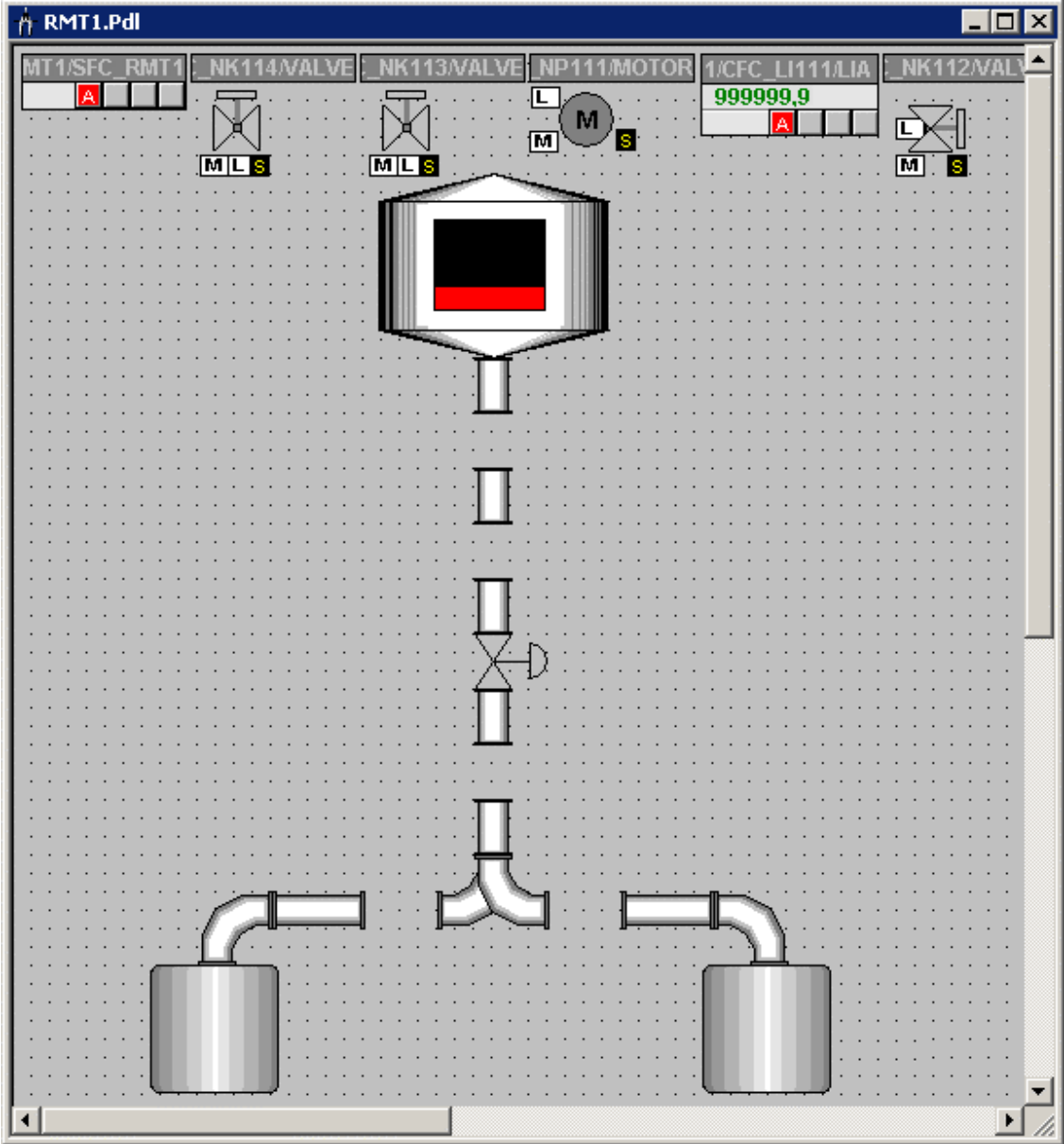


3. Then drag the following objects to the drawing board:

Name of the Object	Number	Path in the Library
Pipe horizontal	2 x	Global Library/PlantElements/Pipes - Smart Objects/3D Pipe Horizontal
Pipe vertical	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 the reactors	2 x	Global Library/Siemens HMI Symbol Library/Tanks/Tank1

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.



7.6.2 Labeling the Various Pieces of Equipment

Labeling the equipment requires three steps:

Step	What?
Step 1	Inserting and formatting a text field
Step 2	Making further settings
Step 3	Duplicating the text field

7.6.2.1 Step 1 - How to Insert a Text Field

Ready to Start?

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

Follow the steps outlined below...

1. Select the entry "Standard Objects/Static Text" in the Object Palette.
2. Move the mouse pointer to the drawing board.
The mouse pointer changes to a small text input symbol.
3. Open a text box under the left reactor.
A rectangle is inserted and the text in the rectangle is already selected.
4. Change this text to "Reactor 1".
5. Press the Enter key to enter the text.
6. Now format the text field using the Style Palette:
 - Click on the "Line Weight/Invisible" entry.
The frame of the text field is then invisible.
 - Click on the "Fill Pattern/Transparent" entry.
The color of the text field is then transparent.



7.6.2.2 Step 2 - How to Set the Text Field

Ready to Start?

- The "RMT1.pdl" picture is opened in the Graphics Designer.
- You have inserted a text field

Follow the steps outlined below...

1. Select the menu command **View > Properties**.
The "Object Properties" dialog box opens and the "Properties" tab is active.
2. Select the entry "Static Text" in the tree structure in which the properties input field is located.
In the detailed window, you will see the name of the text field and the level.
3. Change to the detailed window and double-click on the "Static Text 1" field in the "Static" column.
You can now edit the field.
4. Enter the name "Reactor 1" and press the Enter key.
This enters the name which is then displayed in the top box. When you work on the drawing board, this name will be displayed as a tooltip whenever you move the mouse pointer over the object.
5. Select the "Static Text/Font" entry in the tree structure.
6. Change to the detailed window and double-click on the "No" field of the "Bold" attribute.
The value changes from "No" to "Yes" and the text changes to bold print.
7. Close the "Object Properties" dialog box.
All the changes you have made are displayed.



7.6.2.3 Step 3 - How to Duplicate the Text Field

Ready to Start?

- The "RMT1.pdl" picture is opened in the Graphics Designer.
- You have inserted a text field
- You have made the settings for text fields

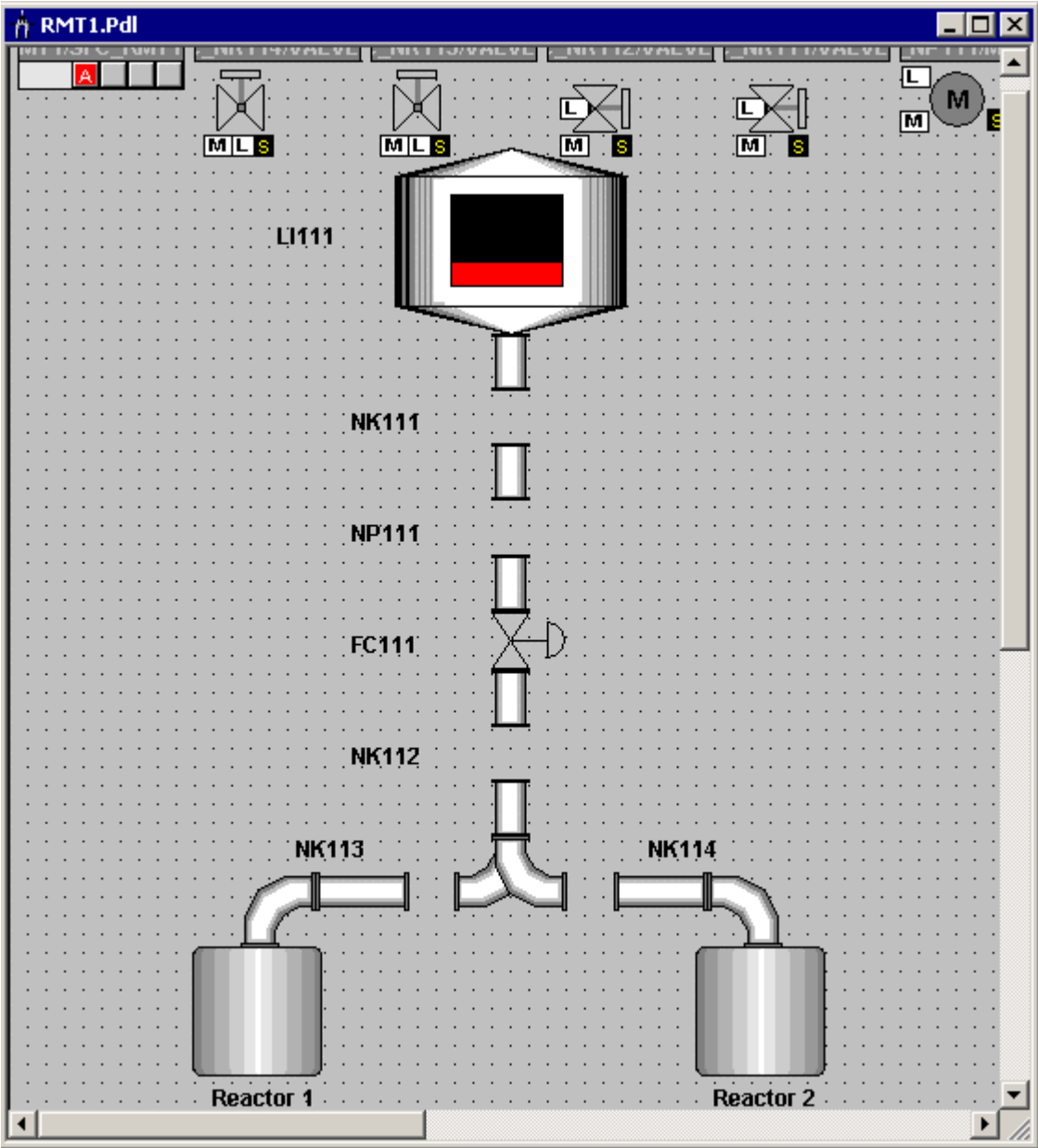
Follow the steps outlined below...

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

1. If the text field is no longer selected, select it and select the menu command **Edit > Duplicate**.
The text field is duplicated.
2. Double-click on the text field and change the text to "Reactor 2".
All other formatting is automatically included because you duplicated the field.
3. Select the menu command **View > Properties**.
4. Change the object name to "reactor2" in the detailed window.
5. Position the text field below the object.
6. Repeat steps 1 through 6 to create the text fields for the following tags and adapt the object names to reflect the name of the tag:
 - LI111
 - NK111
 - NK112
 - NK113
 - NK114
 - NP111
 - FC111
7. Select the menu command **File > Save**.
This saves the process picture.

7.6.3 Current Status of the Process Picture...

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



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

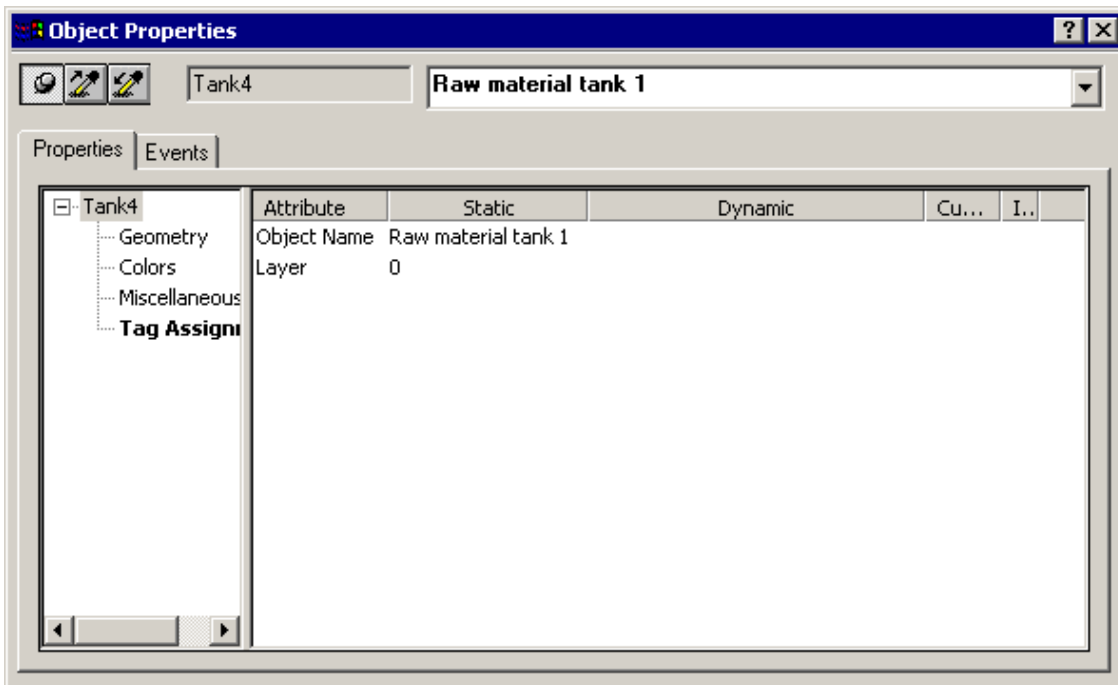
The tank you inserted in your picture represents the raw material tank. You now connect this tank with the relevant block to be able to display the current fill level of the raw material tank in the process mode.

Ready to Start?

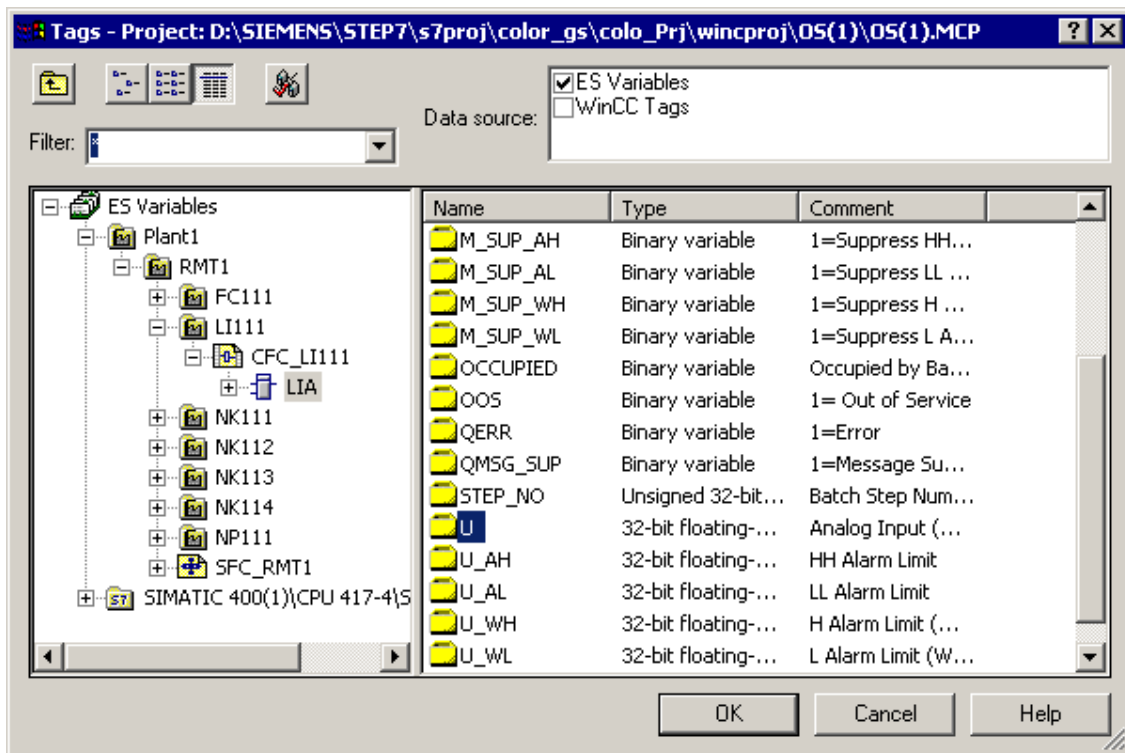
- The "RMT1.pdl" picture is opened in the Graphics Designer.
- The static objects have been inserted

Follow the steps outlined below...

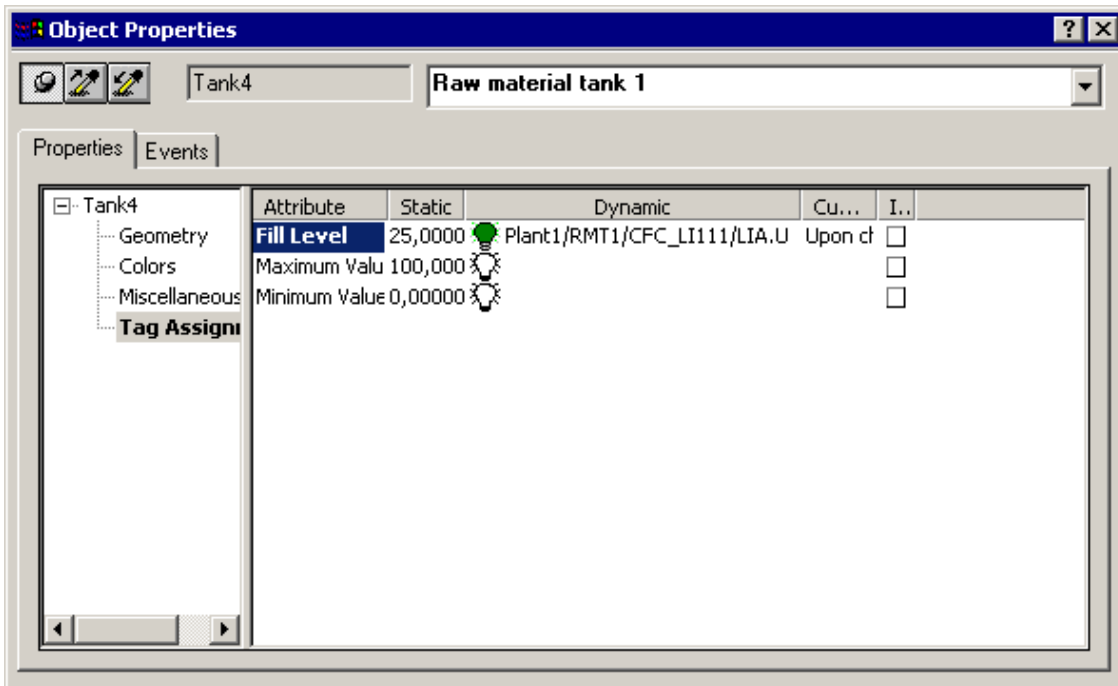
1. Select the "Tank4" object.
2. Select the menu command **View > Properties**.
The "Object Properties" dialog box opens and the "Properties" tab is active.
3. Select the "Tank4" entry in the tree structure.
In the detailed window, you will see the name of the text field and the level.
4. Change to the detailed window and double-click on the "Tank4" field in the "Static" column.
You can now edit the field.
5. Enter the name "Raw material tank 1" and press the Enter key.



6. Select the entry "Tank4/ Tag Assignment" in the tree structure.
7. Change to the detailed window and position mouse pointer on the "lightbulb" symbol of the "Fill Level" attribute and open the context-sensitive menu.
8. Select the menu command **Tag...**
The tag selection dialog opens.
9. Activate the "ES Variables" check box as the "Data source".
The ES variables are displayed in the tree structure.
10. Select the following entry in the tree structure
"ES Variables/ Plant1/ RMT1/ LI111/CFC_LI111/ LIA".
All the variables are then displayed in the detailed window.
11. Select the "U" variable in the detailed window:



12. Click the "OK" button.
As a result, the variable and its entire path are entered in the "Dynamic" column.



13. Position the mouse pointer on the "lightbulb" symbol of the "Maximum Value", open the context-sensitive menu and select the **Delete** menu command.
The default variable is deleted and the default value "100" becomes active.
14. Do the same for "Minimum Value" attribute.
15. Close the "Object Properties" dialog box.
16. Select the menu command **File > Save**.
This saves the process picture.



7.6.3.2 How to Adapt the Block Icons

There are already block icons in your process picture that were inserted in the SIMATIC Manager using the "Create/Update Block Icons" function. If you take a look at the block icons, you will see that PCS 7 has automatically generated block icons in the horizontal and vertical directions due to the settings for the block in the CFC chart.

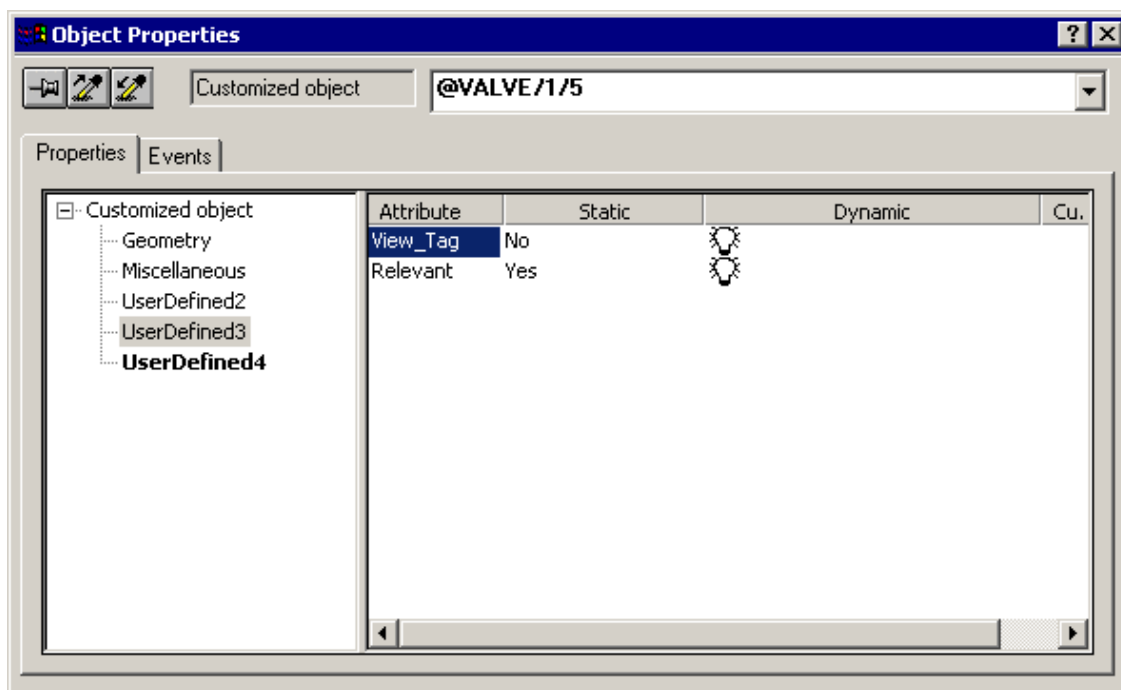
These block icons must now be positioned and certain specific settings made for the "color_gs" project.

Ready to Start?

- The "RMT1.pdl" picture is opened in the Graphics Designer.
- The block icons exist

Positioning Block Icons in the Plant Representation

1. Select the block icon "..._NK111/VALVE" and drag it with the mouse to the required position so that the valve shown in the block icon is exactly between the pipes.
2. Select the menu command **View > Properties**.
The "Object Properties" dialog box opens.
3. Select the entry "Styles" in the tree structure in which the properties of the block icon are located.
Various attributes are then displayed in the detailed window.
4. Change to the detailed window and double-click on the "Yes" field of the "View_Tag" attribute.
The value changes to "No".



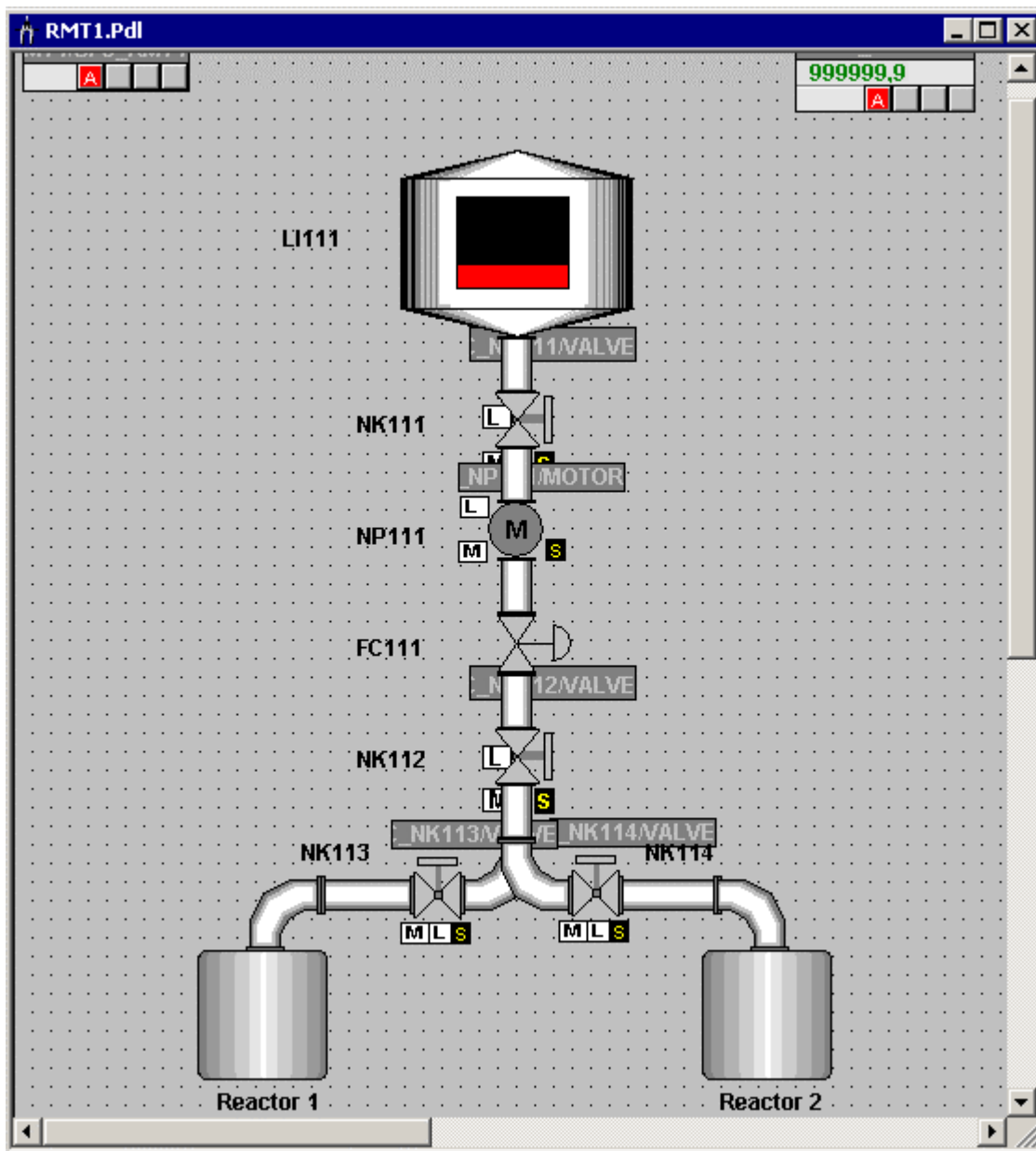
5. Close the Object Properties.
The settings you have made here will only become visible when you change the project to the process mode.



6. Repeat steps 1 through 5 for all block icons according to the list below:

- "..._NK111/VALVE"
- "..._NP111/MOTOR"
- "..._NK112/VALVE"
- "..._NK113/VALVE"
- "..._NK114/VALVE"

Your process picture should now appear as shown below:



7.6.4 Inserting Input/Output Fields for Operator Control

You will provide two methods of operator control in your process picture:

- Reactor selection
- External/internal setpoint

Start with the configuration for selecting the reactor – this involves three steps. Afterwards, you follow practically the same procedure to configure setpoints:

Step	What?
Step 1	Insert I/O field
Step 2	Format I/O field
Step 3	Enter explanatory text
Step 4	Configure setpoint assignment

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

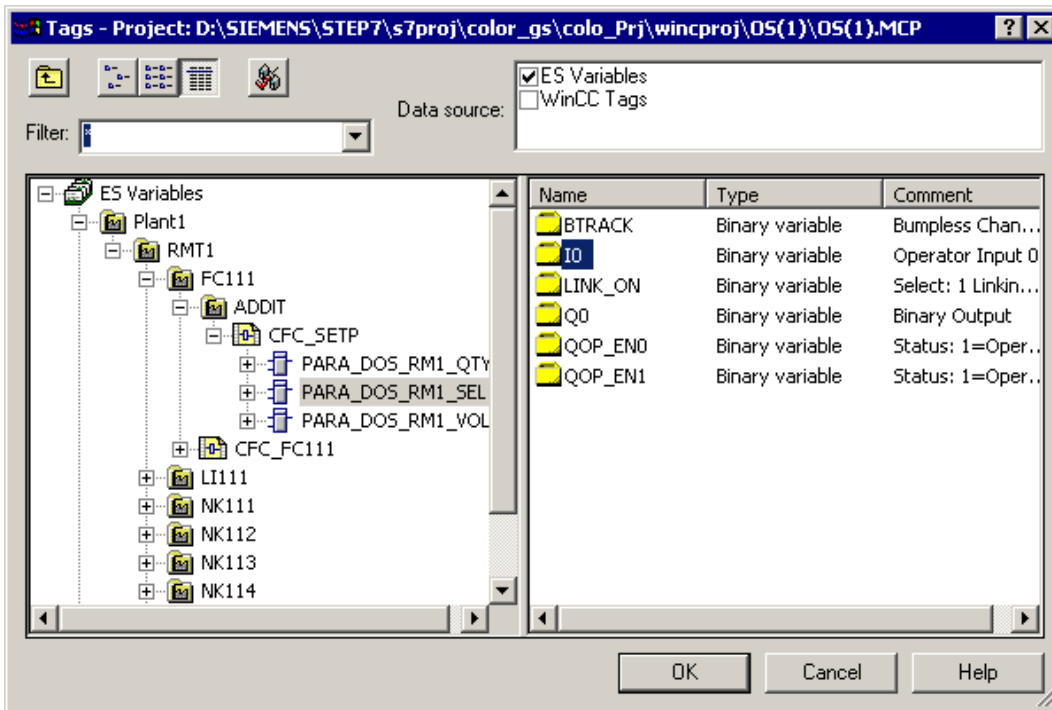
Ready to Start?

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

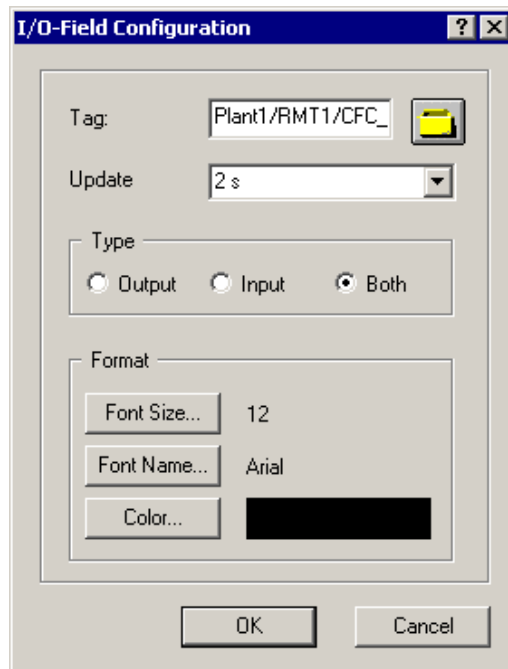
Follow the steps outlined below...

1. Select the "Smart Objects/I/O Field" in the object palette.
2. Move the mouse pointer to the drawing board.
The mouse pointer changes to a small I/O field symbol.
3. Open a rectangle between the reactors holding down the mouser button. The size of the rectangle is the size that your I/O field will have.
The "I/O-Field Configuration" dialog opens.
4. Click on the "Tag selection dialog" button beside the "Tag" box".
This opens the "Tags – Project" dialog box.
5. Activate the "ES Variables" check box as the "Data source".
The ES variables are displayed in the tree structure.
6. Select the following entry in the tree structure:
"ES Variables/Plant1/RMT1/FC111/ADDIT/CFC_SETP/
PARA_DOS_RM1_SEL".
All the variables are then displayed in the detailed window.

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



8. Click the "OK" button to enter your settings. This enters the tag in the "Tag" input field.
9. Make sure that the "Both" check box is activated.



10. Click the "OK" button to enter your settings.

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

Ready to Start?

- The "RMT1.pdl" picture is opened in the Graphics Designer.
- You have inserted the I/O field

Follow the steps outlined below...

In just the same way as you formatted the text fields, you can also format the I/O fields:

1. Select the I/O field 1.
2. Now format the text field using the Style Palette:
 - Click on the "Line Weight/Invisible" entry.
The frame of the text field is then invisible.
 - Click on the "Fill Pattern/Transparent" entry.
The color of the text field is then transparent.
3. Select the menu command **View > Properties**.
The "Object Properties" dialog box opens and the "Properties" tab is active.
4. Select the entry "I/O Field" in the tree structure in which the properties input field is located.
In the detailed window, you will see the name of the text field and the level.
5. Change to the detailed window and double-click on the "I/OField1" field in the "Static" column.
You can now edit the field.
6. Enter the name "SEL_REAC" and press the Enter key.
This enters the name which is then displayed in the top box.
7. Select the entry "I/O Field/Font" in the tree structure and change the value of the "Bold" attribute to "Yes" in the detailed window.
8. Select the entry "I/O Field/Output/Input" in the tree structure and change the value of the "Data Format" attribute to "Binary" in the detailed window.
9. Close the "Object Properties" dialog box.
All the changes you have made are displayed.

7.6.4.3 Step 3 - How to Add Explanatory Text

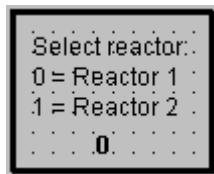
Ready to Start?

- The "RMT1.pdl" picture is opened in the Graphics Designer.
- You have inserted and formatted the I/O field

Follow the steps outlined below...

The operator must, of course, know what can be set with this I/O field. For this purpose, you can use a text field – you have already used text fields when labeling the equipment.

1. Insert a text field – use the "Standard Objects/Static Text" object.
2. Enter the following text: "Select reactor: 0 = Reactor 1, 1 = Reactor 2". Press "Shift + Enter key" to create a line feed.
3. Now format the text field using the Style Palette:
 - Frame invisible – setting "Line Weight/Invisible"
 - Fill transparent – setting "Fill Pattern/Transparent"
4. Drag a frame round the I/O field and the explanatory text – use the "Standard Objects/Rectangle" object.
5. Now format the text field using the Style Palette:
 - Thickness of the frame – setting "Line Weight/3 Pixel"
 - Fill transparent – setting "Fill Pattern/Transparent"
6. Position the object as shown in the picture below:

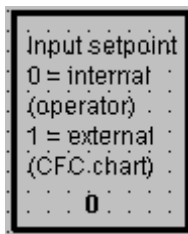


7. Drag a frame around all the objects.
8. Select the menu command **Edit > Group > Group**. All the objects now belong to a group and can be moved easily.
9. Position the object between the reactors.

7.6.4.4 Step 4 - How to Insert Setpoint Assignment

Follow exactly the same procedure as for the selection between reactor 1 and reactor 2. Below, you will find an overview of the individual steps:

1. Insert an I/O field and link it to 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 using the Style Palette:
 - Frame invisible – setting "Line Weight/Invisible"
 - Fill transparent – setting "Fill Pattern/Transparent"
6. Insert a frame – object palette, object "Standard Objects/ Rectangle"
7. Format the frame using the style palette:
 - Thickness of the frame – setting "Line Weight/3 Pixel"
 - Fill transparent – setting "Fill Pattern/Transparent"

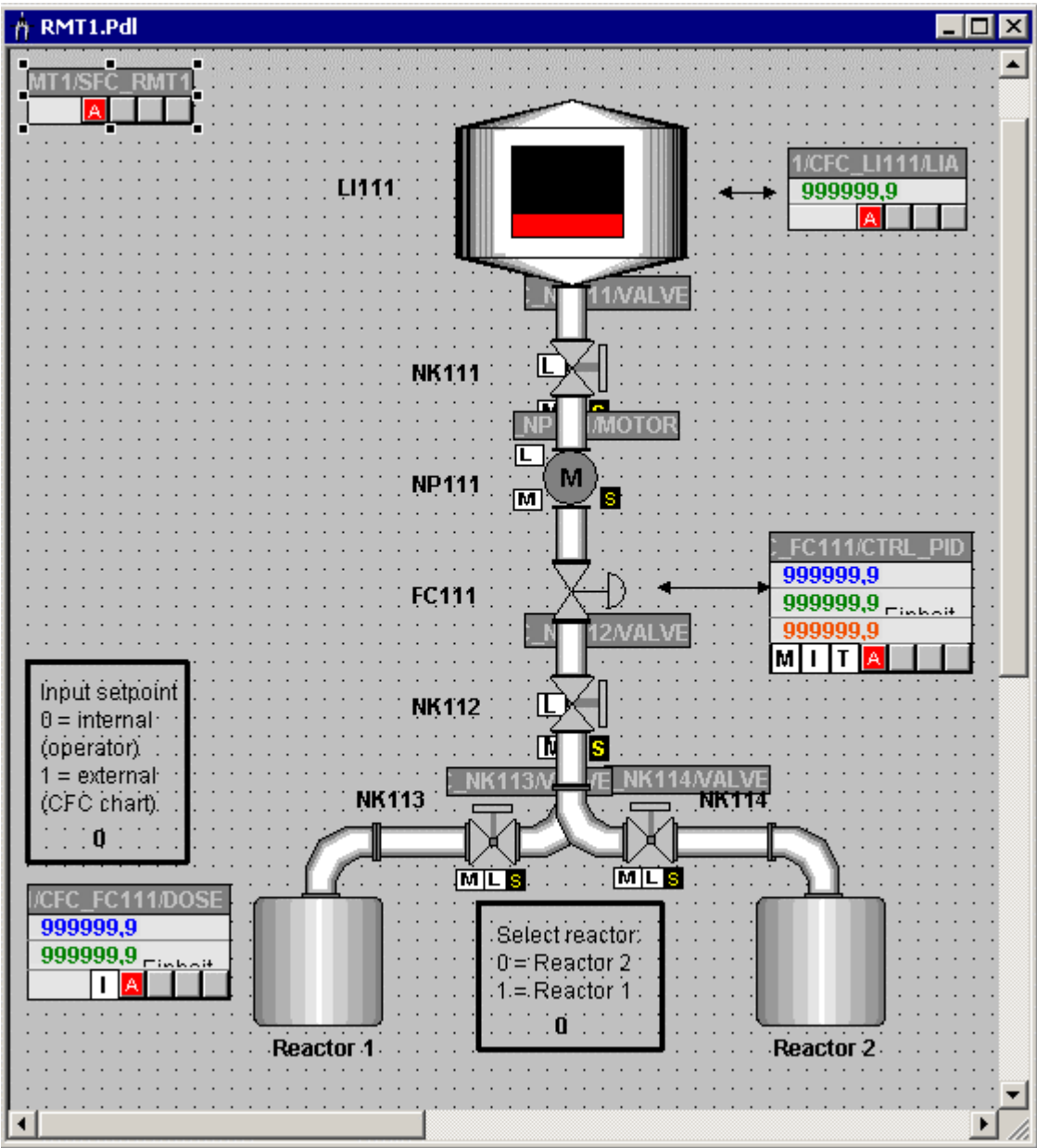


8. Group the objects with the menu command **Edit > Group > Group**.
9. Position the object at the lower left.

7.6.4.5 Finishing Touches

1. Position the block icon "..._FC111/CTRL_PID" to the right beside the control valve "FC111".
2. Insert an arrow between the actuator and the block icon to indicate the relationship between the measuring point and the block icon.
3. Position the block icon "/CFC_LI111/LIA" to the right beside the raw material tank.
4. Insert an arrow between the raw material tank and the block icon to indicate the relationship between the measuring point and the block icon.
5. Position the block icon ".../CFC_FC111/DOSE" to the left beside reactor 1.
6. Position the setpoint selection above the block icon ".../CFC_FC111/DOSE".
7. Position the block icon "...RMT1/SFC_RMT1" in the top left corner.

Your process picture should now appear as shown below:



- 8. Select the menu command **File > Save**.
Your process picture is then saved with all changes and additions.

7.7 The Current Status of Your Project...

The meantime, your project is completed so that you can activate the process mode. Which functions have you got to know during the OS configuration?

- Setting the picture properties in the 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

8 Working in the Process Mode

8.1 Introduction to the User Interface

8.1.1 The Operator Station in the Process Mode

In the process mode, the "color_gs" project provides various options for controlling and monitoring the process.

With the block icons, you have the following options:

- Monitoring the status of the valves: valve open or closed
- Monitoring the status of the pump: pump active or inactive
- Changing from a block icon to the relevant 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 operator sets the setpoint externally
- Assigning the setpoint for the dosing volume in the faceplate

You can, of course, also monitor the CFC and SFC charts at the same time. You have already got to know this function when testing the charts.

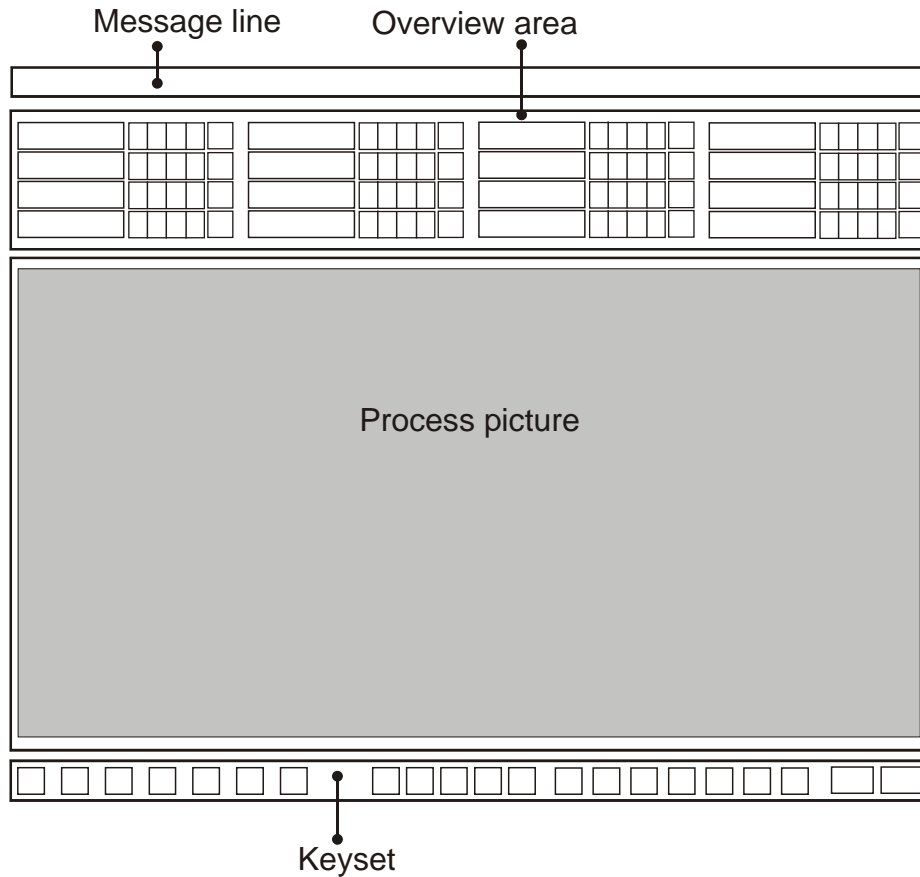
8.1.2 User Interface in the Process Mode

To allow you to monitor and operate the process yourself, we will briefly introduce the user interface of PCS 7 in the process mode.

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

- Message line – the latest message with the highest priority is displayed here
- Overview area – with various buttons, you can select the various areas of a plant and display them. In your "color_gs" project, you have only one button, namely "RMT1" because your plant consists of only one plant section. Beside each button, there are four further small buttons with which alarms and warnings from hierarchically lower levels can be displayed. If you click in this area, you automatically change to the process picture in which the alarm or warning originated. With the arrow button on the extreme right, you can open a tree structure in which you can select a lower area in the hierarchy.

- Process picture – depending on the area you selected in the overview area, you will find the relevant process picture here. In your "color_gs" project, the plant picture you created in the Graphics Designer is displayed.
- Keyset – using the keyset, you can invoke various functions that you can select in the process mode. In the "color_gs" project, you will, of course, only get to know the buttons that are important for this project.



Follow the steps outlined here...

8.2 How to Control and Monitor in the Process Mode

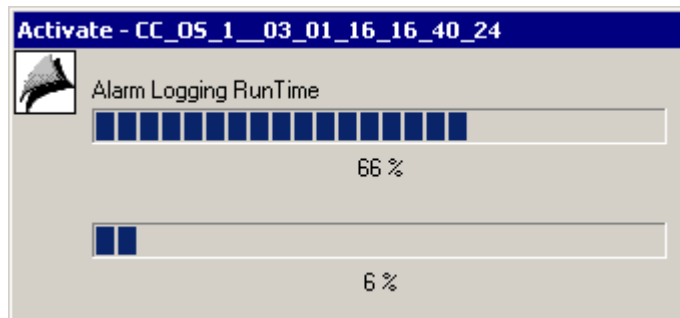
8.2.1 How to Activate the Process Mode

Ready to Start?

- WinCC Explorer is open
- The "color_gs" project is open

Activating the Process Mode

1. Select the menu command **File > Activate**.
The progress bar opens and the standard startup picture opens.



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

8.2.2 How to Start the Process

You must, of course, start the dosing before you can control and monitor all the functions you have configured.

Dosing is started using the SFC chart. You do not return to the SIMATIC Manager now, but will start the SFC chart directly in the process mode.

1. Click on the "Change Keyset" button:

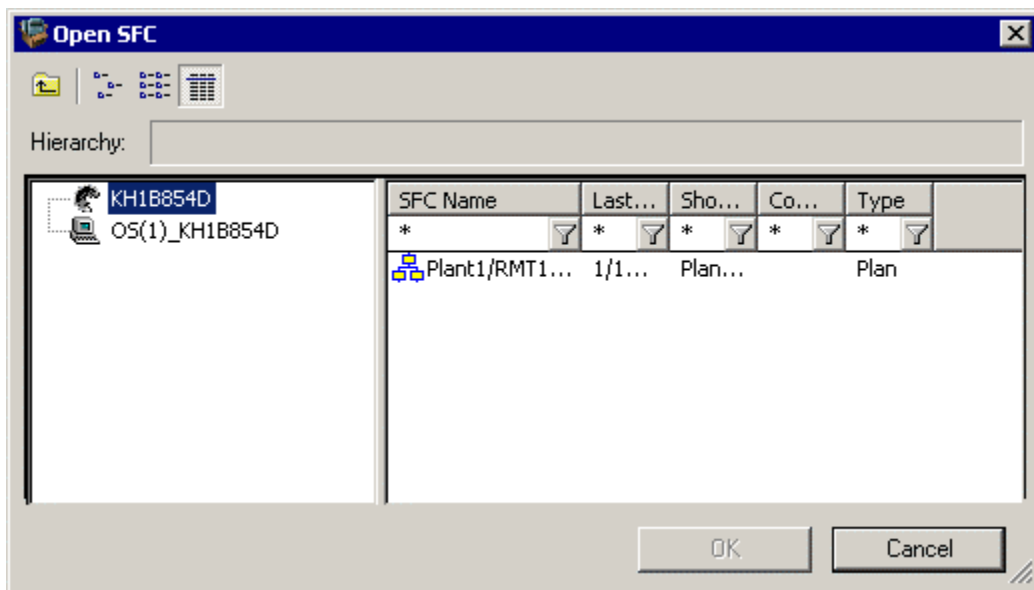


The second button selection is displayed.

2. Click on the "SFC Visualization" button:

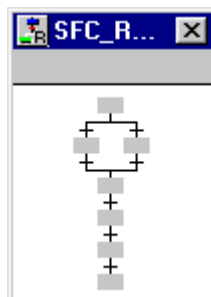


The "Open SFC" dialog box opens. Since you only have one OS and one SFC chart in your project, only this one OS is displayed in the tree structure and only the SFC chart in the detailed window.

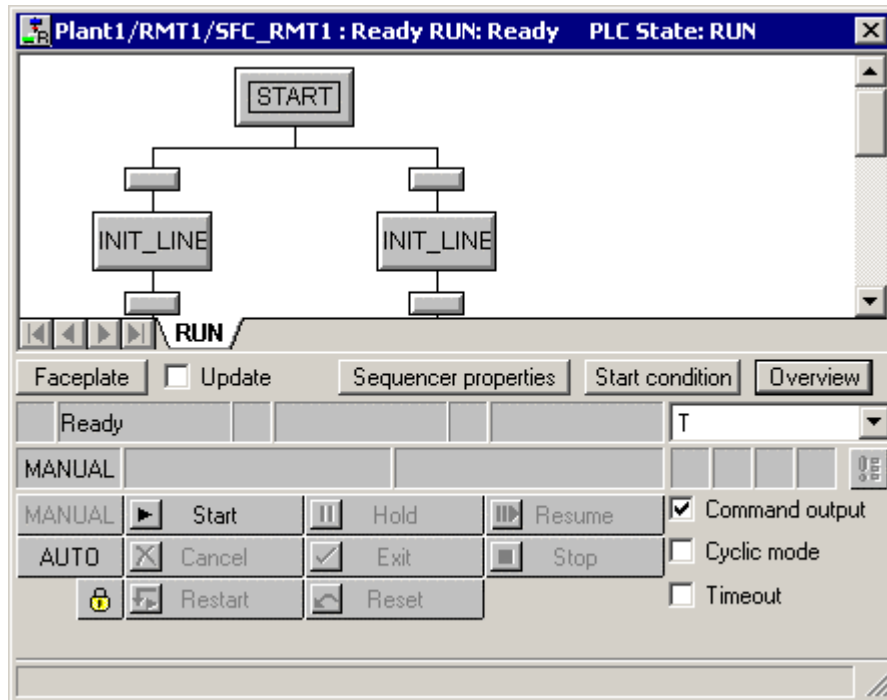


3. Select the chart "RMT1/FC111/SFC_RMT1" in the detailed window and click the "OK" button.

A greatly reduced overview of the SFC chart is opened.



4. Click on this overview.
The detailed display of the SFC chart appears. This detailed display is compatible with the display with which you worked 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 on the "Start" button.
The "SFC Control" dialog box opens.
7. Click the "OK" button.
The sequential 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.

8.2.3 How to Stop the Process

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

1. Click on the "Stop" button in the detailed display of the SFC chart.
The "SFC Control" dialog box opens.
2. Click the "OK" button.
The process is then stopped.
3. Afterwards, click on the "Reset" button and the "OK" button in the "SFC Control" dialog box.
All values are then reset to the initial values.

8.2.4 How to Control the Process from the Process Picture

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

- Selecting the reactor
- Opening faceplates
- Changing the setpoint

8.2.5 How to Select the Reactor

1. Position the mouse pointer on the I/O field in the "Select reactor" area.
The mouse pointer changes to a text selection symbol.
2. Click on the I/O field.
The I/O field is displayed on a gray background.
3. Enter the required number to select the reactor.

If you enter the following number:
want to dose in reactor 1	1
want to dose in reactor 2	0

4. Press the enter key
The new value is entered after a brief delay and displayed in this area.



5. Restart the process and watch the result.

8.2.6 How to Open Faceplates

1. Start the process
2. Click on the "..._FC111/CTRL_PID" block icon.
The relevant faceplate is opened and the "Standard" tab is active.
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 as concrete values and in graphic form.
 - Parameters – here, you can, for example, modify certain values. Using the input fields "Bar HL" and "Bar LL", 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.

8.2.7 How to Change the Setpoint

To change the setpoint assignment requires two steps:

- First you define whether or not the process uses the external or internal setpoint.
- Finally, you enter the concrete setpoint.

Step 1 – Specifying the Setpoint Assignment

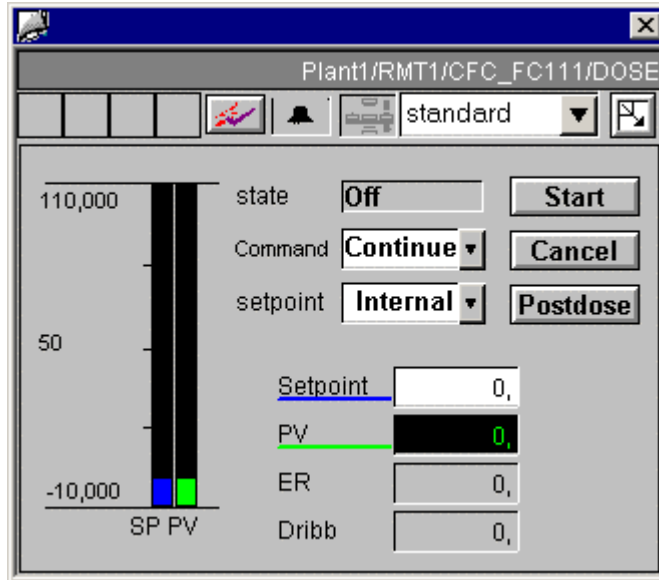
1. Position the mouse pointer on the I/O field in the "Input setpoint" area. You created this area yourself in the process image.
The mouse pointer changes to a text selection symbol.
2. Click on the I/O field and enter the required number of the type of setpoint assignment.

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

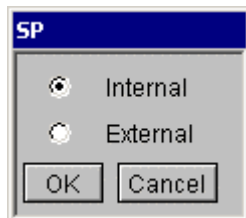
3. Press the enter key
The new value is entered after a brief delay and displayed in this area.

Step 2 – Entering the Setpoint

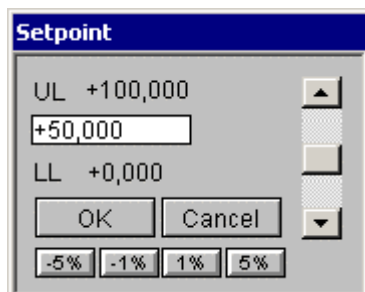
1. Click on the ".../CFC_FC111/DOSE" block icon.
The faceplate is opened and the "Standard" tab is active.



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



4. Click the "Run" button.
The "Setpoint" input field is activated.
5. Click on the "Setpoint" input field.
The "Setpoint" dialog box opens.
6. Click in the input field and enter the required value.



7. Click the "OK" button.
The value is entered in the input field.
8. Close the faceplate.
The changed value is displayed in the block icon.



9. Restart the process and watch the result.

8.2.8 How to Work with Messages

Messages are displayed both in the message line and in a separate message list.



Message Line



While the process is active, 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 Keypad" button.

2. Click the "Message System" button

The message list is displayed.
3. Acknowledge the messages:

If you then
want to acknowledge a single message	click on the line number of the required message and then click on the "Acknowledge single messages" button. 
acknowledge all messages	click the "Acknowledge all visible messages" button. 

4. Click on the buttons in the button area to change to the various message and alarm lists.
5. Click on the "Previous Graphic" button in the button area:



This returns you to the "RMT1" process picture.

8.2.9 How to Exit the Process Mode

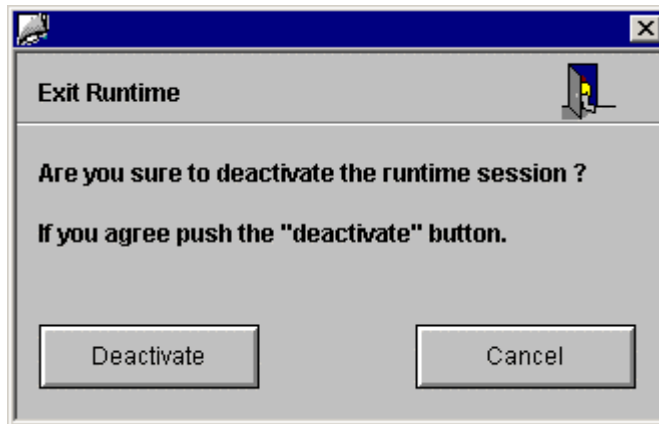
1. Click on the "Change Keyset" button in the button area.



2. Click on the "Exit Runtime" button:



The "Exit Runtime" dialog box opens.



3. Click the "Deactivate" button.
This stops the process mode.

9 The Additional Task

9.1 Introducing the Additional Task

In the "color_gs" project, two identical raw material tanks are required. The additional task is to configure the second raw material tank "RMT2". But don't 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 PCS 7 copy function saves many steps that are handled automatically for you in the background.

When you create the second raw material tank, you will work largely on your own. You have already got to know many of the dialogs you require during configuration of the first raw material tank. In this section, we will not provide you with details step-by-step instructions but will simply without the order in which you configure so that you have guidelines to the general principles of the procedure.

9.1.1 How to Copy the Existing 'RMT1' Plant Section

Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- The plant view is activated
- You have configured RMT1 completely and it is free of errors

Follow the steps outlined below...

1. Using the "Copy/Paste" Windows function, copy the entire "RMT1" hierarchy folder to the "Plant1" hierarchy folder.
2. The SIMATIC Manager makes a copy of the "RMT1" hierarchy folder in the "Plant1" hierarchy folder and calls it "RMT1(1)". The names of the various objects, for example CFC and SFC charts also have a continuous number added to their existing names.
When you copy/move hierarchy folders with CFC charts and process pictures, the references of the dynamic objects from the OS pictures to a CFC blocks are automatically updated in the destination hierarchy folder.

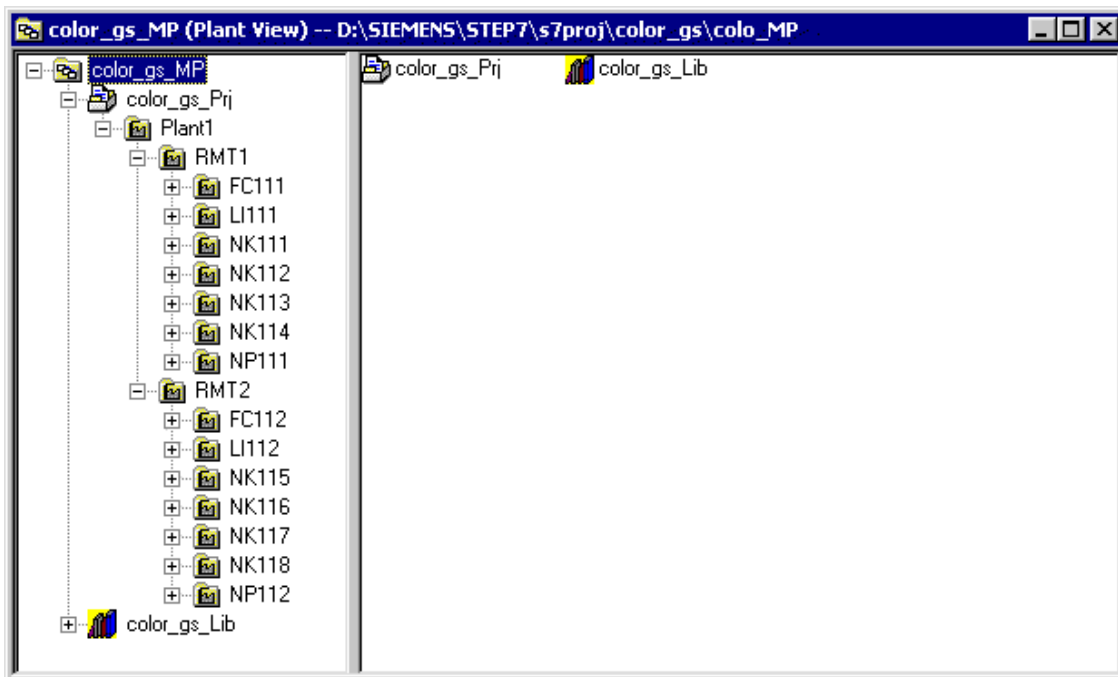
Caution

If you copy or move charts and pictures singly; in other words, copy or move 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.

3. 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	Process picture "RMT1(1)"	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
NK111	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:



9.2 Preparing for the Process Mode

To be able to monitor and control the plant section "RMT2" that you have inserted in the SIMATIC Manager, you must, of course, inform the programmable controller and the OS of the new information. In this situation, PCS 7 provides you with the option of compiling and downloading only changed information. This reduces the time required to compile and download. In your "color_gs" project, this is not yet a problem since you only have a small project. When configuring large systems, this function is, of course, extremely important.

- Downloading charts – Since the copy operations effectively created new charts, these charts must also be downloaded to the programmable controller.
- Creating block icons and compiling the OS – This function is necessary because you have renamed the hierarchy folders and charts. Since the name of the hierarchy folder is included in the tag name, this new name must be made known to the OS so that the tag names can be updated.

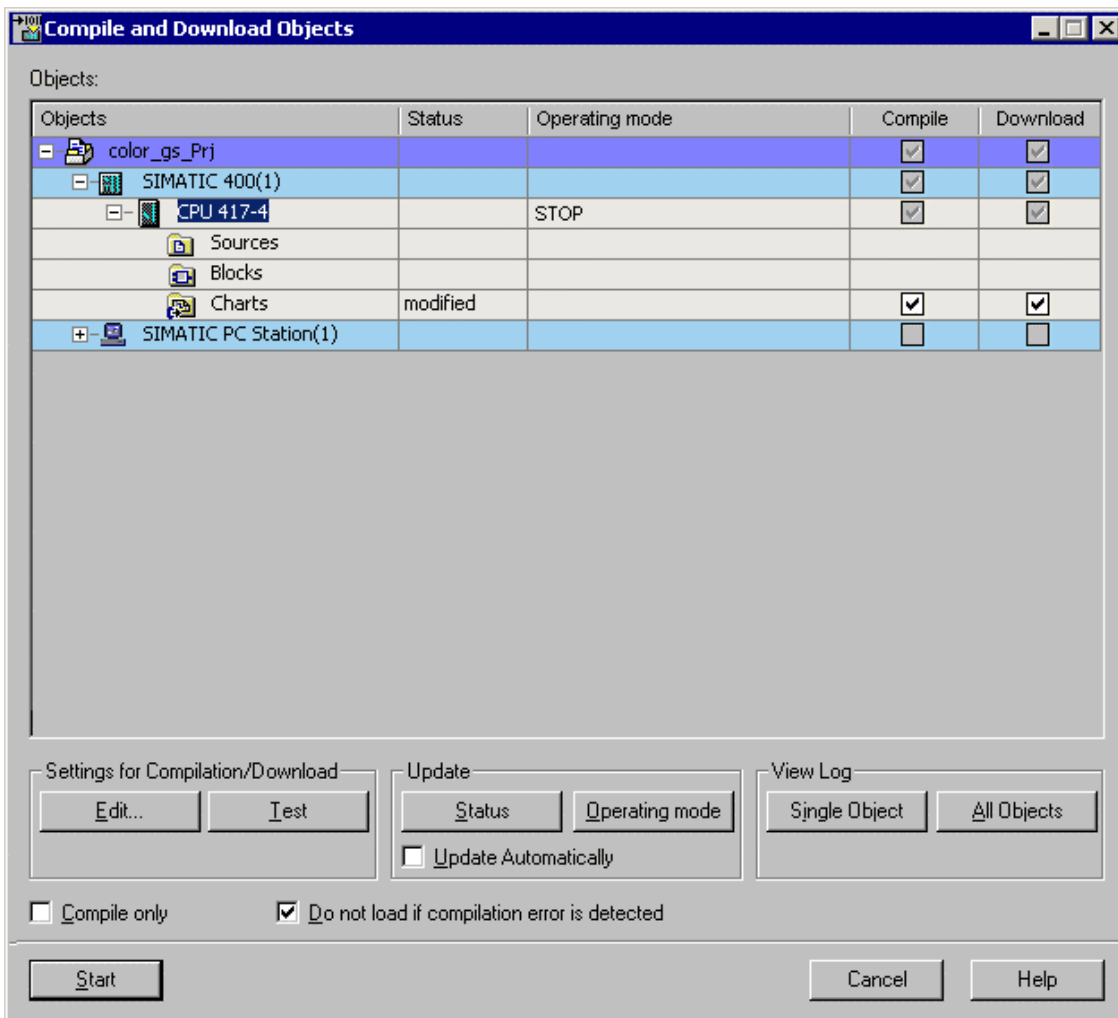
9.2.1 How to Download the New Charts

Ready to Start?

- The "color_gs" project is open in the SIMATIC Manager
- The plant view is activated

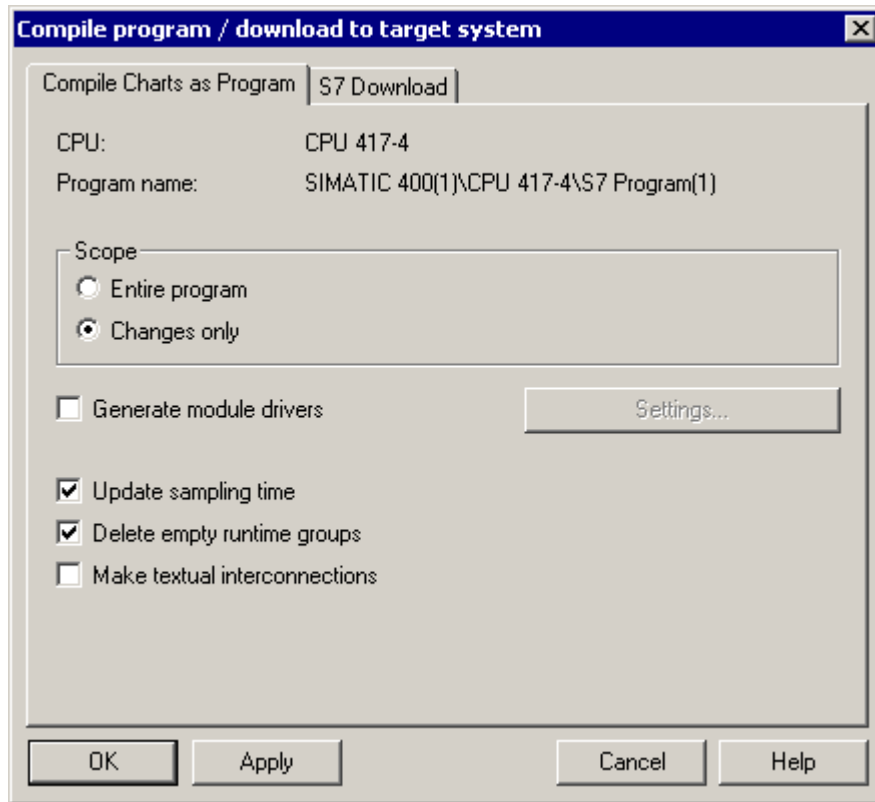
Follow the steps outlined below...

1. Select the "color_gs_Prj" object in the tree structure.
2. Select the menu command **PLC > Compile and Download Objects**.
The status of the "Charts" object is "modified".



3. Select the "Charts" object.

4. Click the "Edit" button.
The "Compile/Download Program to PLC" program opens.



5. Make the following settings:
 - Activate the "Changes" check box – You only need to download the additional charts from the "RMT2" plant section, you have already downloaded all the other charts belonging to "RMT1".

Caution

The CPU remains in RUN only if you select this option.

- "Update sampling time" check box
 - "Delete empty run-time groups" check box
6. Click the "OK" button and click "OK" in the "Download" message window.
 7. Click on the "Start" button.
The "Download" message dialog opens.
 8. Click the "yes" button.
The starts the download and the CPU remains in "RUN".
On completion of the download, the log file is displayed in an additional window.

9. Close the log file.
10. Click on the "Cancel" button in the "Compile and Download" dialog box.
11. Test the sequential control system. Use the same procedure as when you tested the "RMT1" plant section.
If you are no longer sure how to do this, you will find detailed information in the following sections:
 - "Compiling, Downloading, and Testing Charts – How to Test the Program in the SFC Editor"
 - "Compiling, Downloading, and Testing Charts – How to Test the Program in the CFC Editor"

9.2.2 How to Compile the OS after Changes

Ready to Start?

The "color_gs" project is open in the SIMATIC Manager

Follow the steps outlined below...

1. Select the "RMT2" folder in the plant view.
2. Select the menu command **Options > Plant Hierarchy > Create/Update Block Icons**.

Caution

Make sure that you do not select a higher-level hierarchy folder. Otherwise, you might overwrite the block icons in the RMT1 picture as well as the settings you made there.

For more detailed information, referred to "Configuring the Operator Station – Working in the SIMATIC Manager – How to Compile the OS".

3. Select the following entry in the tree structure in the component view "color_gs_MP/ color_gs_Prij/ SIMATIC PC Station(1)".
4. Select the menu command **Options > OS > Compile...**

Caution

In step 4, activate the "Changes" option. This avoids all the information being downloaded. This reduces the time required to compile.

If you no longer know the exact procedure in the various steps of the wizard, you will find detailed information in "Configuring the Operator Station – Working in the SIMATIC Manager – How to Compile the OS".

5. Open the PCS 7 OS and open the "RMT2" process picture in the Graphics Designer.
6. Make the following changes:
 - Adapt static texts to match the names in the plant hierarchy, for example the text "NK111" must be changed to "NK115"
 - Position the block icons
 - Set the "View Tag" attribute to "no" for the block icons

You will find detailed information on these procedures in "Configuring the Operator Station – Creating the Process Picture".

9.2.3 How to Start the Process Mode

Ready to Start?

- You have compiled the OS
- PCS 7 OS "color_gs" is open
- You have completed the changes in the "RMT2" process picture

Follow the steps outlined below...

1. Select the menu command **File > Activate** in the WinCC Explorer.
You then change to the process mode.
You will now see an additional button in the overview with the label "RMT2". By clicking on the "RMT1" and "RMT2" buttons, you can monitor one plant section of the other.
The button of the plant section currently displayed is highlighted in color.
2. Click on the "RMT2" button in the overview area.
3. Change the keyset and click on the "SFC Visualization" button.
The "Open SFC" dialog box opens.
In the detailed window, you will now see to SFC charts: the SFC chart of "RMT1" and the SFC chart of "RMT2".
4. Select the "../RMT2" SFC chart and start the sequential control system.

Note

For more detailed information, refer to "Working in the Process Mode – Operator Control and Monitoring in the Process Mode".

5. Working in the process mode:
 - Change between the plant sections
 - Change the setpoint assignment
 - Select the reactor
 - ...

You will find more detailed information in "Working in the Process Mode".

10 Starting and Adapting the Sample Project

10.1 The Supplied Sample Project 'color_gs'

With Getting Started, you also receive the PCS 7 project "color_gs" that has already been fully configured. You can open this project and start it 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 following sections provide you with an overview of opening the sample project and the work involved in adapting it.

- Opening the sample project
- Adapting the hardware of the sample project
- Compiling and downloading the sample project

10.1.1 How to Open the Sample Project

Ready to Start?

The SIMATIC Manager is open

Note

You receive the sample project as a zip file that you can extract using a PCS 7 function. If you want to store the project in a specific folder, create the folder first in the Windows Explorer and call it, for example, "sampleproj_gs".

Follow the steps outlined below...

1. Open the SIMATIC Manager and select the menu command **File > Retrieve...**
The "Retrieving – Select an archive" dialog box opens.
2. Open the folder "SIEMENS/ STEP7/ Examples_MP"
3. Select the file "color_gs.zip" and click on the "Open" button.
The "Select destination directory" dialog box opens and the "S7proj" folder is selected – this is the default storage location for all PCS 7 projects.

If you then
want to accept the default folder,	click the "OK" button.
have already created a separate folder for the sample project	navigate to this folder and then click the "OK" button.

Retrieval is then started. On completion of the retrieval, the "Retrieving" message window opens.

4. Click the "OK" button.
A further message window is then opened: "The multiproject 'color_gs' has been removed from the archive. Do you want to open it now?".
5. Click the "yes" button.
The sample project opens.

10.1.2 How to Adapt the Hardware for the Sample Project

Ready to Start?

- The sample project is open in the SIMATIC Manager
- The component view is activated

Follow the steps outlined below...

1. Check the hardware settings – this step is basically the same as when you prepared for your own project.

For more detailed information, refer to "First Steps in the Project – Hardware Settings – How to Check the Hardware Settings".

2. Set the PG/PC interface – you also know this step from the preparations for your own project.

For more detailed information, refer to "First Steps in the Project – Hardware Settings – How to Set the PG/PC Interface".

3. Select the "SIMATIC 400(1)" folder in the tree structure.
4. Select the "Hardware" object in the detailed window and then select the menu command **Edit > Open Object**.
HW Config opens.
5. Select your components from the hardware catalog and drag them to the slot in which our component is inserted.
This overwrites our component with your component.
6. Save and compile the hardware configuration and then download it to the CPU.
For more detailed information, refer to "First Steps in the Project – Configuring the Hardware – How to Download the Hardware Configuration".
7. Close HW Config.

10.1.3 How to Compile and Download the Sample Project

Ready to Start?

- The sample project is open in the SIMATIC Manager
- The component view is activated

Follow the steps outlined below...

1. Select the "color_gs_MP/ color_gs_Prj/ SIMATIC 400" folder in the tree structure and select the menu command **PLC > Compile and Download Objects**.
The "Compile and Download Objects" dialog box opens.

Caution

Make sure that you activate the "Entire program" check box in the "Compile Program/Download" dialog box.

For more detailed information refer to "Compiling, Downloading, and Testing the Charts – How to Compile and Download the CFC and SFC Charts".

2. Change to the plant view, select the "color_gs_MP/ color_gs_Prj/ Plant1/ RMT1" folder in the tree structure and then select the menu command **Options > Plant Hierarchy > Create/Update Block Icons...**

For more detailed information, refer to "Configuring the Operator Station – Working in the SIMATIC Manager – How to Create the Block Icons".

3. Change back to the component view, select the "color_gs_MP/ color_gs_Prj/ SIMATIC PC-Station(1)" entry in the tree structure and then select the menu command **Options > OS > Compile...**

Caution

Activate the "Entire OS" check box and the "With memory reset" check box.

For more detailed information, refer to "Configuring the Operator Station – Working in the SIMATIC Manager – How to Compile the OS".

4. Open PCS 7 OS and adapt the computer names:

- Select the OS(1)/Computer entry in the navigation window.
- Select the computer in the detailed window and then select the menu command **View > Properties**.
- Enter the name of the computer on which you open the project in the "Computer name" input field. This name corresponds to the name used for the computer in the network. You can find this name as follows: "Start > Settings > Control Panel > System > "Network Identification" > "Computer name".

5. Activate the process mode.

For more detailed information, refer to "Working in the Process Mode – Operator Control and Monitoring in the Process Mode".

Index

A

Adapting the sample project.....	10-3
Additional task.....	9-1
Applications.....	2-1

B

Block catalog.....	4-18
Block comment.....	4-38
Block icon.....	4-41
specifying the type.....	4-40
block icons	
"View_Tag" attribute.....	7-27
Block icons.....	7-4, 7-6, 7-7, 7-26, 7-27, 7-28
activating creation of.....	7-3
adapting.....	7-26
creating.....	7-6
Blocks.....	4-4, 4-6, 4-7, 4-22
I/Os.....	4-22
inserting in library.....	4-6
master data library.....	4-4
Brief overview.....	2-1

C

Catalog.....	4-20
CFC chart.....	6-5
test mode.....	6-5
CFC charts.....	4-1, 4-12, 4-13, 4-14, 4-16,
.....	4-21, 4-22, 6-1, 9-1
assigning parameter values to blocks.....	4-22
color_gs project.....	4-12
compiling.....	6-1
downloading.....	6-1
inserting.....	4-16
object properties.....	4-14
opening.....	4-21
plant hierarchy.....	4-12
renaming.....	4-14, 9-1
significance of CFC_FC111.....	4-13
significance of CFC_LI111.....	4-14
significance of CFC_NK11x.....	4-14
significance of CFC_NP111.....	4-14
significance of CFC_SETP.....	4-13
CFC editor.....	4-1
CFC Editor.....	4-18, 4-19, 4-20, 6-7
catalog.....	4-20
monitoring.....	6-7
overview.....	4-19

sheet view.....	4-19
test mode.....	6-7
testing a chart.....	6-7
CFC_FC111.....	4-13, 4-26, 4-27, 4-32
assigning parameter values.....	4-27
inserting blocks.....	4-26
interconnecting.....	4-32
CFC_LI111.....	4-14, 4-29, 4-30, 4-34
assigning parameter values.....	4-30
inserting blocks.....	4-29
interconnecting.....	4-34
CFC_NK111x.....	4-38
assigning parameter values.....	4-38
CFC_NK11x.....	4-14
CFC_NP111.....	4-14, 4-31
assigning parameter values.....	4-31
CFC_SETP.....	4-13, 4-22, 4-24
assigning parameter values.....	4-24
inserting blocks.....	4-22
Clear/Reset.....	7-7
CLOSE_LINE.....	5-18
Compile.....	6-2, 6-4, 7-7, 7-8, 7-9
operator station.....	7-7
SFC/CFC charts.....	6-1
Component view.....	2-3, 7-1
Operator station.....	7-1
Configuration.....	3-19
hardware.....	3-19
Configuration Console.....	3-5, 3-7
Copy.....	9-1, 9-2
Creating a project.....	3-12

D

Detailed window.....	2-2
SIMATIC Manager.....	2-2
Device.....	3-32
Download.....	6-2, 6-3, 6-4
Drawing board.....	7-13
Duplicating.....	7-22

E

END.....	5-18
Entering setpoints.....	7-29

F

Faceplates.....	8-7
Function.....	3-32

- G**
- Graphics Designer 7-13, 7-15, 7-16
 - libraries 7-13
 - object palettes 7-15
 - objects 7-13, 7-16
 - toolbars 7-15
- H**
- Hardware 3-20, 3-26
 - catalog 3-20
 - configuration OS 3-26
 - PLC configuration 3-20
 - Hardware configuration 3-19, 3-20, 3-23, 3-26
 - downloading 3-23
 - OS 3-26
 - PLC 3-20
 - Hardware settings 3-5
 - checking 3-5
 - Hierarchy folder 3-35, 9-1, 9-2
 - inserting 3-35
 - renaming 9-1
- I**
- I/O field 7-29, 7-31
 - formatting 7-31
 - inserting 7-29
 - I/O fields 7-16
 - I/Os 4-22
 - invisible 4-22
 - INIT_DOSE 5-17
 - INIT_LINE1 5-17
 - INIT_LINE2 5-17
 - Initialization 5-13
 - input/output fields 7-29
 - Input/output fields
 - inserting 7-29
 - ISO Ind. Ethernet 3-8
- K**
- Keypad 8-2
- L**
- Libraries 4-5, 4-10, 4-11, 4-18, 7-13
 - Graphics Designer 7-13
 - hiding 4-10
 - opening 4-5
- M**
- Master data library 3-12, 4-2, 4-3, 4-4,
 - 4-6, 4-7, 4-8
 - Advantages 4-2
 - blocks 4-4
 - inserting blocks 4-6
 - inserting process tag types 4-8
 - process tag types 4-3, 4-4
 - storage of objects 4-3
 - Message line 8-1
 - Message system 8-9
 - Messages 8-9
 - acknowledging 8-9
 - Mode 3-5
 - monitoring on/off 6-7
 - Multiproject 3-11, 3-12
- N**
- Navigation window 7-12
 - Network adapters 3-7
 - New Project wizard 3-11
 - background information 3-11
 - Node address 3-8
- O**
- Object 2-1
 - project 2-1
 - Object palettes 7-15
 - Objects 6-2, 6-4, 7-13, 7-16
 - compiling 6-1
 - downloading 6-3, 6-4
 - dynamic 7-13
 - I/O fields 7-16
 - static 7-13, 7-16
 - text fields 7-16
 - Operator station 7-7, 7-11
 - compiling 7-7
 - network connection 7-7
 - starting 7-11
 - OS configuration 7-2
 - block icons 7-2
 - compilation 7-2
 - picture properties 7-2
 - Overview 4-19
 - Overview area 8-1, 8-2
- P**
- PCS 7 Library V60 4-6, 4-8
 - PCS 7 OS 7-1, 7-12
 - configuring 7-1
 - structure 7-12
 - PG/PC interface 3-8
 - ISO Ind. Ethernet 3-8
 - node address 3-8
 - Target station 3-8
 - Picture hierarchy 3-29
 - Picture properties 7-3
 - changing a picture name 7-3
 - editing 7-3
 - Picture Tree 7-7
 - Pictures 7-5
 - deleting 7-5

- Piping and instrumentation flow diagram.....3-2
- Plant.....3-32
- Plant designation.....3-29
- Plant hierarchy 3-29, 3-30, 3-32, 3-33,
..... 3-36, 4-12, 4-16, 7-6
 adapting names.....3-33
 CFC charts4-12
 creating block icons.....7-6
 hierarchy folder.....3-35
 hierarchy levels3-30
 inserting CFC charts.....4-16
 making settings3-30
 naming3-32
 Picture hierarchy3-29
 plant designation3-29
- plant sections3-32
 naming3-32
- Plant sections.....9-1
 copying.....9-1
- Plant view.....2-3, 3-32
 device.....3-32
 function.....3-32
 plant3-32
 structuring3-32
 unit3-32
- PLC3-20, 6-2
 configuration.....3-20
- PLC-OS assignment.....3-36
- PLC-OS communication.....3-36
- Process8-4, 8-5, 8-6, 8-7, 8-9, 8-10
 changing the setpoint assignment.....8-7
 controlling.....8-6
 messages.....8-9
 opening faceplates8-7
 selecting the reactor8-6
 starting8-4
 stopping.....8-6
- Process mode7-1, 8-1, 8-2, 8-3, 8-10, 9-7
 exiting.....8-10
 starting8-3, 9-7
 user interface.....8-1
- Process object view.....2-3, 4-35, 4-38, 4-39
 adapting the view4-38
 block comment4-38
 defining I/Os4-35
- Process picture7-17, 7-20
 inserting a tank.....7-17
 inserting pipes7-17
 labeling plant equipment7-20
- Process pictures.....7-1, 7-12
- Process tag types.....4-3, 4-4, 4-8, 4-17, 4-37
 inserting.....4-17, 4-37
 inserting in library4-8
 master data library.....4-3, 4-4
 templates.....4-17
- Project2-1, 3-1, 3-11, 3-12, 3-13, 3-14,
..... 3-15, 3-16, 3-17, 3-18, 9-1
 "color_gs"3-1
 additional task9-1
 closing3-18
 opening3-18
- wizard3-11
- ## R
- Reactor selection.....7-29
- Renaming9-1
- Requirements1-1, 1-2
 hardware.....1-1, 1-2
 software1-2
- run time.....5-17
- Run-time group.....6-1
- ## S
- Sample project.....10-1, 10-2, 10-3, 10-4
 compiling.....10-4
 downloading.....10-4
 opening.....10-1
- Scan time.....6-1
- Sequential control system.....5-5
- Sequential control systems5-1, 5-7
 creating.....5-7
- Setpoint assignment7-33
 inserting7-33
- SFC chart5-4, 6-5
 moving5-4
 test mode6-5
- SFC charts.....5-1, 5-4, 5-5, 5-13, 6-1, 6-3, 9-1
 assigning parameter values5-13
 compiling.....6-3
 downloading.....6-1
 initialization5-13
 opening.....5-5
 renaming.....5-4, 9-1
- SFC Editor5-1, 5-2, 6-6
 functions5-2
 step5-1
 test mode6-6, 6-7
 testing charts6-6
 transition5-1
- SFC Visualization7-7
- Sheet view4-19
- SIMATIC Manager2-2, 2-3, 7-3
 OS compilation7-2
 OS configuration7-2
 structure.....2-2
 user interface2-2
 working with2-3
- Single project.....3-11
- SLOW_DOWN.....5-18
- Static objects7-16
- Step5-1
- Steps5-2, 5-9, 5-10
 properties.....5-2
 renaming.....5-9
- Structure of the plant3-3

T

Tag interconnection 7-17, 7-24
 raw material tank..... 7-24
 Target station..... 3-8
 Task..... 3-2, 3-3
 piping and instrumentation flow diagram.... 3-2
 structure of the plant 3-3
 Templates 4-17
 Test mode 6-5, 6-6, 6-7
 CFC chart 6-5
 CFC Editor 6-7
 mode..... 6-6
 properties 6-6
 SFC chart..... 6-5
 SFC Editor 6-6
 step control mode 6-6
 Text field 7-20, 7-21
 attributes 7-21
 formatting..... 7-20
 inserting 7-20
 labeling 7-20
 setting object properties..... 7-21
 Text fields 7-16, 7-22, 7-32
 adding to 7-32
 duplicating..... 7-22

Toolbars7-15
 Graphics Designer.....7-15
 Transition.....5-1
 Transitions..... 5-2, 5-11, 5-19
 parameters 5-19, 5-20
 properties5-2
 renaming5-11
 Tree structure2-2
 SIMATIC Manager.....2-2

U

Unit.....3-32

V

View_Tag7-26
 Views.....2-3
 component view.....2-3
 plant view2-3
 process object view2-3

W

WinCC Explorer.....7-12
 structure7-12