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Process Control System PCS 7 SIMATIC Route Control V8.0

Getting Started

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Preface

1

Purpose of this documentation

The Getting Started for Route Control provides an initial overview of the Route Control system and supports you in creating a simple project. The project can be configured on a SIMATIC PC station. This Getting Started addresses newcomers to Route Control who are active in the fields of

- Engineering
- Commissioning and service

Basic knowledge required

You should be accustomed to working in the following fields:

- Microsoft Windows XP \ Windows 2003 Server operating systems
- Functions and configurations of SIMATIC S7 (S7-400, STEP 7)
- Functions and configurations of SIMATIC NET (network components, data transmission media)
- Functions and configurations of PCS 7 OS, PCS 7 ES and PCS 7 AS

Scope of this manual

Information in this Getting Started is valid for "PCS 7 Engineering Toolset V 7.0 SP1".

SIMATIC Route Control Getting Started 2

2.1 Overview

General

SIMATIC Route Control is a program package for the automated material and product transport in plants. SIMATIC Route Control encompasses both the configuration and the runtime system, and provides many interfaces to the PCS 7 basic system and user programs.

Route Control can provide anything ranging from simple transport processes to a large number of complex route combinations, depending on the process cell design. The Route Control tool is predominantly used to simplify and standardize the configuration, processing and diagnostics of material transport (routes). The route control functions support the determination, verification, control, supervision and monitoring of route requests, starting at the material source, and ending at the destination via the corresponding routes.

Route Control features:

- Comfortable functions for configuring and interconnecting technological elements in CFC.
- Wizard-assisted configuration of parameters for the coupling the Route Control automation systems and the Route Control Servers.
- Wizard-assisted configuration of the communication (cross-linking) between the AS relevant to Route Control.
- Transfer of elements from the S7 project (CFC) to the Route Control project.
- Installation of the elements in partial routes by means of drag-and-drop.
- Interface in the form of a file in CSV format for the configuration of partial routes by means of external tools such as MS EXCEL.

Runtime system

The runtime system is used for automatic route search, the grouping of all partial routes and their integrated Route Control elements, and for controlling, operating and monitoring material transport. It also supports the control of transport operations on multiple automation systems. The user interface for material transport is installed in an AS which is the master station. The Route Control elements can be distributed to several AS. The RC system supports operation with one master and up to 31 slave stations. The SW also provides comprehensive functions for the diagnostics of material transport and of corresponding messages. RC supports the redundant configuration of the Route Control Server to obtain a fault-tolerant system.

Note

The terms route and material transport are used synonymously in this Getting Started.

Note

The SIMATIC Route Control system is designed for the transport of products and materials; it is not designed for the automation of packaging units or package tracing.

2.2 Route Control components

Route Control can be divided into three areas:

1. Engineering System (ES)
2. Runtime system (client-server system)
3. Automation system (AS)

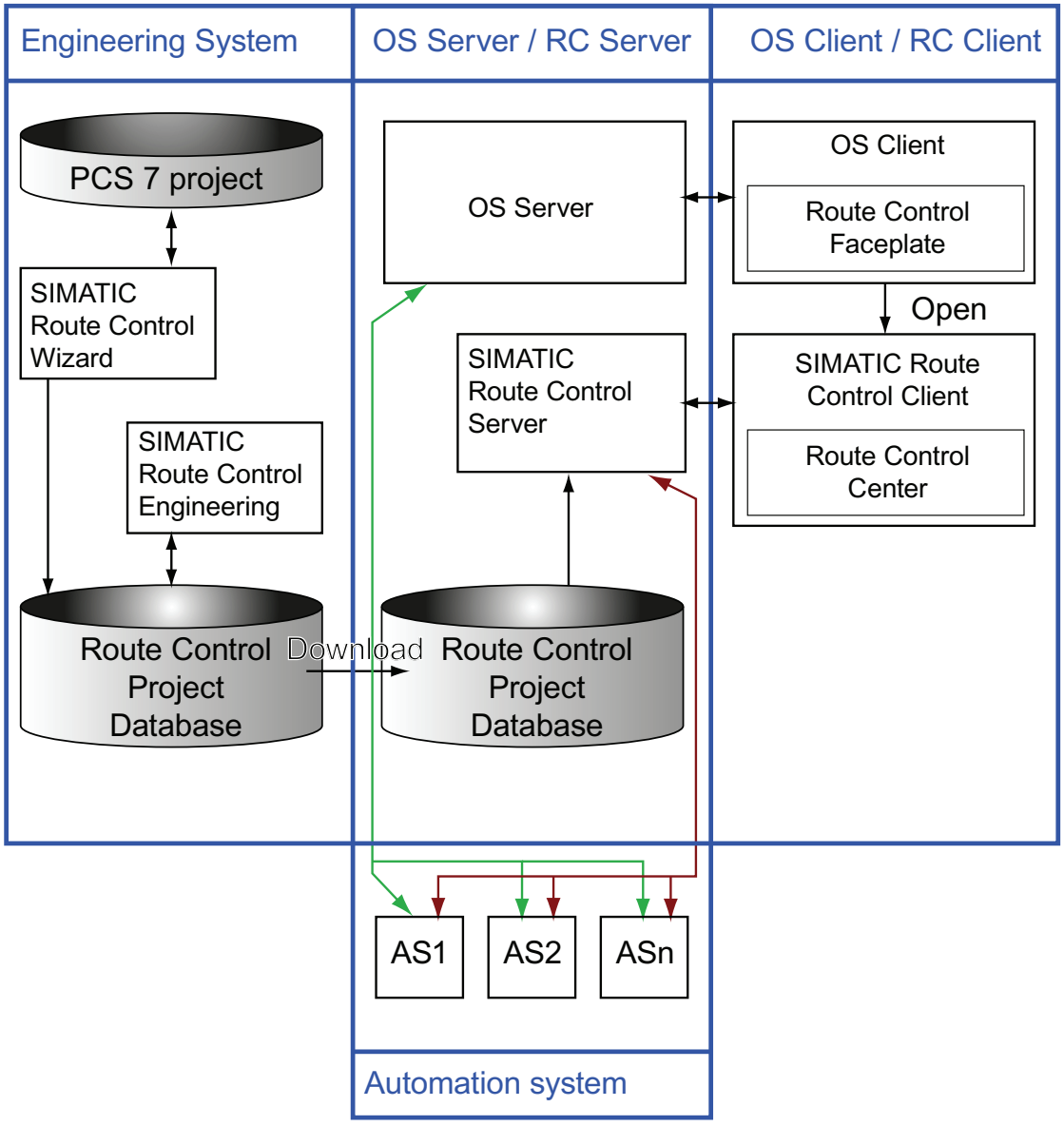


Figure 2-1 Components of the Route Control system

Engineering System

The Engineering-System is used to create the configuration data for Route Control. The Route Control Wizard is used to read data which is relevant to Route Control from other configuration tools and to edit this data, for example, the CFC charts. This data is then passed to Route Control Engineering for further processing. All information is saved to a database. This database forms the basis of route control.

Runtime system (Client-Server system)

The runtime system is usually configured as a client-server architecture which consists of the server of the Operator System (OS), the SIMATIC Route Control Server, the OS Client and of the SIMATIC Route Control Client. SIMATIC Route Control Server is based on the configuration database. This data is supplemented by route control-relevant runtime information received from the automation system. The main task of the SIMATIC Route Control Server involves flexible route finding based on configuration and runtime data. Online data represent information pertaining, for example, to faults, manual mode, maintenance, and to routes and their elements. SIMATIC Route Control Server downloads the element lists of a route to the automation systems. Material transport is controlled after its start by the AS. The SIMATIC Route Control Client is used to operate and monitor material transports. The OS Client is used in the context of Route Control to operate and monitor the Route Control faceplates.

Automation system (AS)

The separation between the OS and AS is derived from the time-sensitive requirements of the process. The AS handles the actual control of the route and controls and monitors the route elements. Route search is not a time-sensitive function. As the SIMATIC Route Control Server also holds the central image of the route network, it also handles route search functions. This task splitting facilitates maximum flexibility in terms of route searches and the execution of time-sensitive processes. The Route Control Server communicates with the AS by way of S7-DOS connection, whereas the OS Server communicates with the AS by way of STEP 7 standard communication.

2.3 Route Control and PCS 7

Integration of Route Control in PCS 7 Engineering

PCS 7 software components used in SIMATIC Route Control:

- SIMATIC Logon for the administration of user rights
- SIMATIC CFC for creating Route Control elements and route blocks in the AS
- SIMATIC NetPro for managing S7 communication
- PCS 7 OS as operating and monitoring system, including visualization of Route Control messages
- SIMATIC SFC for the creation of user programs for automated material transport
- SIMATIC NET provides the basis for runtime communication.

Integration of Route Control in the PCS 7 OS

Route Control provides a block icon, a faceplate and a Route Control Center (RCC) button for integration in the OS process control interface. The "RCC" button on the PCS 7 OS interface is used to open the Route Control Center. The faceplate is opened by clicking the block icon in the process picture. The faceplate visualizes route details and provides options of operating the material transport. The blocks of the Route Control library use the ALARM blocks and communication routes for reporting to a PCS 7 OS message server.

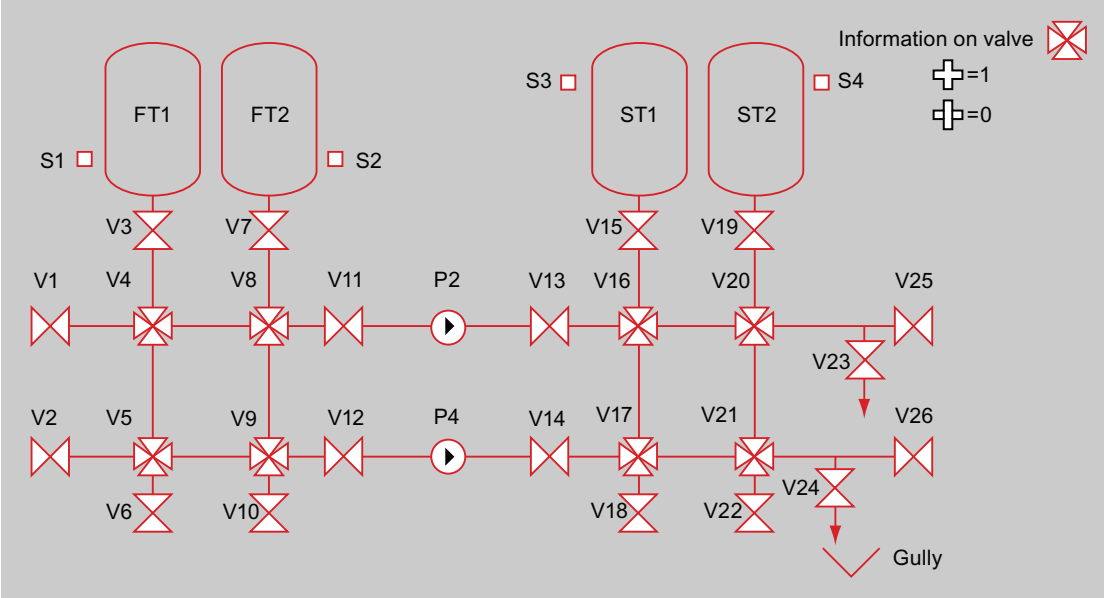
2.4 The Route Control Getting Started project

Introduction

The Route Control Getting Started project is based on the fermentation and storage cellar of a brewery. The plant consists of two fermenting tanks (FT) and two storage tanks (ST).

Description of the plant

Fermentation is a term used in bioreaction engineering to describe fermentation processes, for example, in a brewery. The storage tanks receive the finished fermentation products. The Getting Started is focused on the configuration of all objects relevant to Route Control within the PCS 7 system. The "Route Control Getting Started plant" shown in the picture forms the basis of the Getting Started project. All processes are simulated on CFC level as a real process is not available for the project. A "Reset" button is available in the WinCC process picture for resetting the fill levels in the fermenting tanks and storage tanks. The purpose of the project to be created is is to control the transport of products from the fermenting tanks to the storage tanks through different piping routes. The Route Control System controls the valves and pumps.



Double seat valve

The valves V4, V5, V8, V9, V16, V17, V20 and V21 are so-called double seat valves. The image below shows the function of this double seat valve.

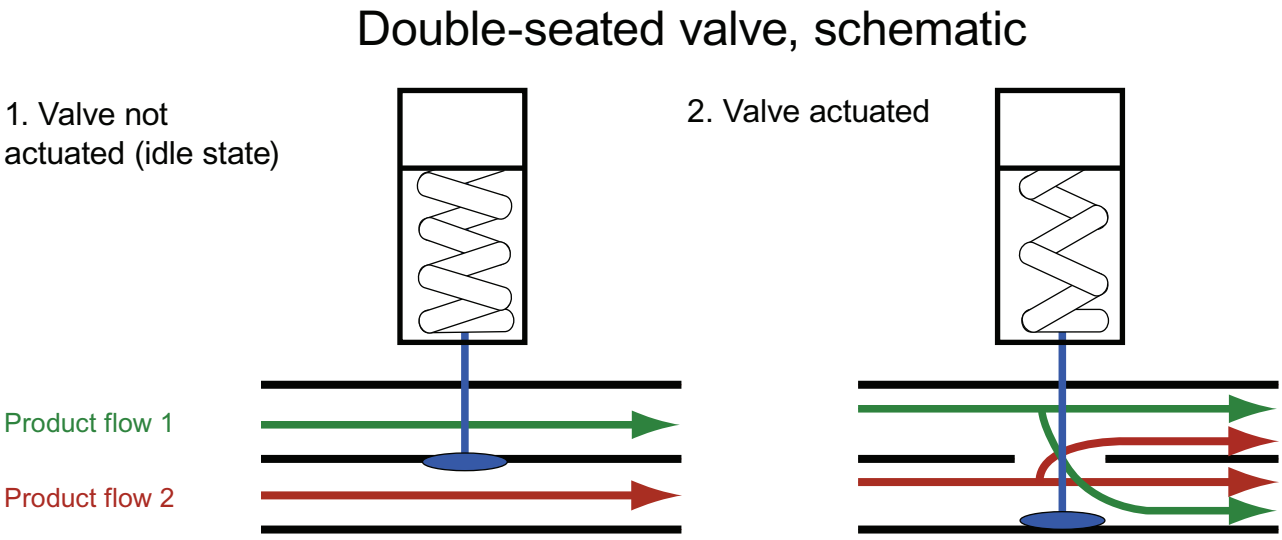


Figure 2-2 Double seat valve

2.5 System requirement for the Getting Started

System requirements for Route Control Getting Started

- PCS 7 single station with Route Control installation. The PCS 7 V7.0 SP1 system requirements apply
- A communication processor CP 1613 or another network adapter for the PCS 7 station
- Automation system AS 416-3 or larger
- CPU firmware V3.1.0 or higher
- Communication processor CP 443-1 for the AS
- Hard-wired network connection between the PCS 7 station and the AS

Preparations 3

3.1 How to unpack the PCS 7 project from an archive file

Introduction

The PCS 7 project must be unpacked from the archive file so that you can open and edit it in SIMATIC Manager. The basic project is copied in ZIP format to your system during installation of Route Control Getting Started. Unpack this ZIP file using the PCS 7 "Dearchive" function.

Prerequisite

SIMATIC Manager is opened.

Procedure

1. Select the "File > Dearchive..." menu command
   The "Dearchive - Select Archive" dialog box opens.
2. Go to the "Programs\Siemens\STEP7\examples" folder, select the file "rcgsmp_0_a.zip" and open it by clicking the "Open" button.
   The "Select target folder" dialog box opens.
3. Select the "Programs\Siemens\STEP7\S7Proj" folder and click "OK".
   The "Dearchive" message window opens after the file was successfully unpacked.
4. Click "OK".
5. Open the PCS 7 project

3.2 How to adapt the station name

Introduction

Customize the name of the PC station in the PCS 7 project to suit your specific installation requirements.

Prerequisite

- The Getting Started project is opened in SIMATIC Manager.
- The component view is activated.

Procedure

1. Select the "RCGSMP_0/RCGSOS_0/ES1" object from the tree view.
2. Select the "Edit > Object Properties" menu command.
3. Enter the name of the local computer as defined on the network system and confirm your entry.

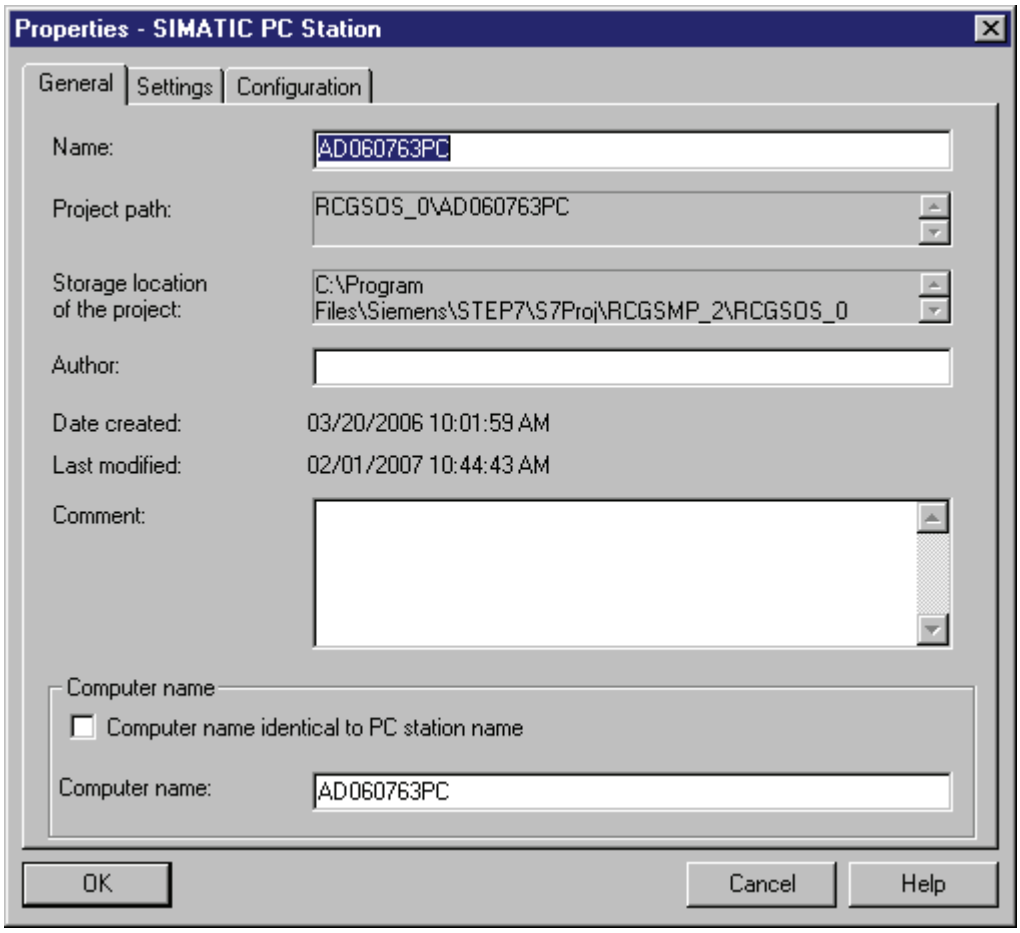


Figure 3-1 Customizing the name of the PC station

Note

The name of your local computer is available in the Windows Control Panel under "System". The icon of the PC station is identified in the component view by a yellow arrow. Update your screen display by pressing the <F5> function key if the PC station is not marked with a yellow arrow.

3.3 How to set parameters in the Configuration Console

Introduction

Set up the network adapter, the operating mode of the module, the access point and the parameters of the assigned interfaces in the Configuration Console. These parameters must be set in order to enable communication between your PC station and the AS.

Procedure

1. Open the Configuration Console in Windows by selecting the "Start > SIMATIC > SIMATIC NET > Configure PC Station" command.
2. Go to the "SIMATIC NET Configuration/Modules/[network adapter name]" entry in the tree view. Select the network adapter which controls AS-OS communication, for example CP 1613.
3. Select the "General" entry in the tree view.
4. Select the "Configured mode" entry from the "Mode of the Module" drop-down list box.
5. Click "Apply".
   Your settings will be activated.
   If a message box appears, click "OK".
   The network adapter is now active.
6. Select the "Address" entry in the tree view.
   The detail view shows all address details of the selected network adapter. Note down the "Ethernet (MAC) address". You need these data for the subsequent hardware configuration.
7. Select the "Access points" entry in the tree view.
8. Double-click the access point "S7ONLINE" in the detail view.
   The "Properties S7ONLINE" dialog box opens.
9. Select the "PC internal (local)" entry from the "Interface Parameter Assignment Used" drop-down list box. Click "OK" to save your entries.
10. Set "PG mode" for the modules in the "General" object for all other network adapters.
11. Close the Configuration Console.

3.4 How to adapt the hardware configuration of the AS

Introduction

The AS hardware configuration must be adapted to suit your automation system requirements.

Prerequisites

- You opened the example project in SIMATIC Manager.
- The component view is open.

Procedure

1. Select the "RCGSMP_0/RCGSAS_0/AS1" folder from the tree view.
2. Select the "Hardware" object from the detail view and then select the "Edit > Open Object" menu command.
3. If you are using a different version of the CP 443-1 in your project, select the required CP from the hardware catalog and drag it to the position of the existing CP.
   Confirm the first message dialog by clicking "Yes" and the second by clicking "OK".
4. Select CP 443-1 and then select the "Edit > Object properties..." menu command.
5. Click the "Properties" button. Enter the MAC address in the "Properties - Ethernet Interface" dialog box.

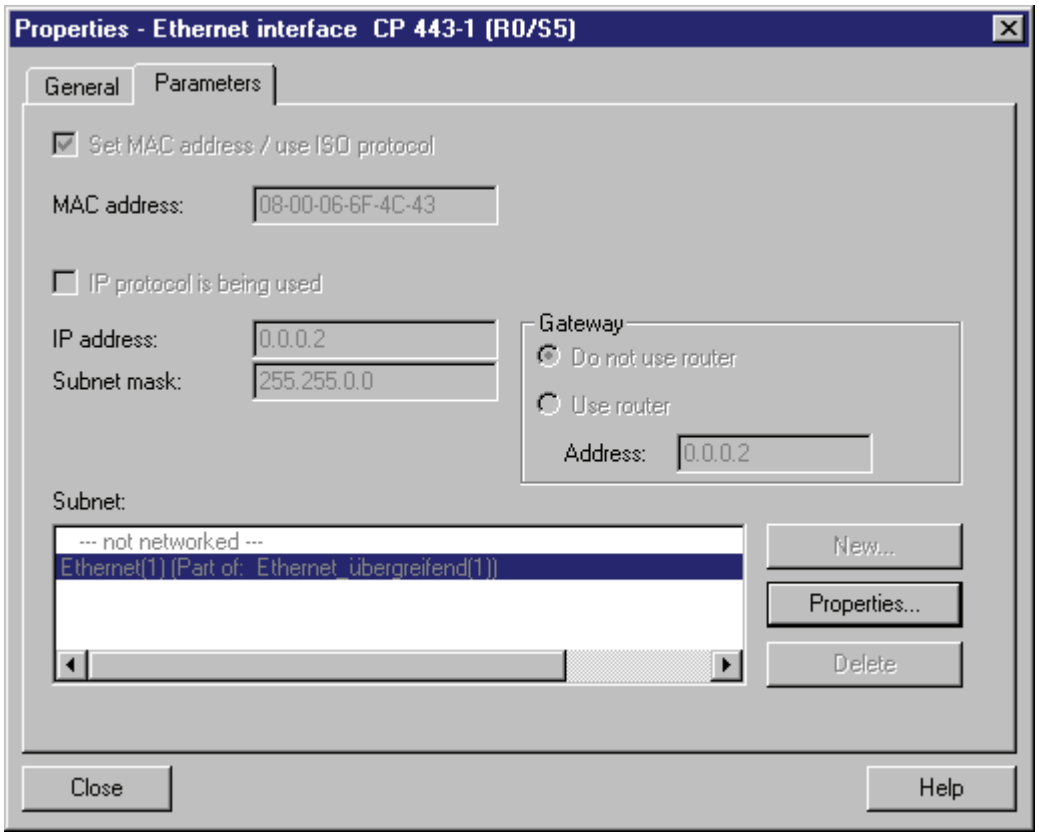


Figure 3-2 Setting the MAC address for AS1

6. Deactivate the "IP protocol is being used" check box.
7. Select the "Ethernet" entry from the "Subnet" list.

8. Click "OK" in the "Properties - Ethernet interface" dialog box, and then click "OK" in the "Properties - CP 443-1" dialog box.
   The CP is customized for the Route Control Getting Started project.
9. Close HW Config with "Station" and the option "Close".
10. Click "Yes" in the "Save changes to AS1?" message dialog box.

Note

You also have to adapt your hardware configuration in HW Config if you are operating with a different power supply module which occupies fewer or more slots in the rack. Example: PS 407 20 A = 3 slots, PS 407 10 A = 2 slots.

3.5 How to adapt the OS configuration

Introduction

Customize the OS configuration in the PCS 7 project to suit your installation requirements.

Prerequisites

- You opened the example project in SIMATIC Manager.
- The component view is open.

Procedure

1. Select the "RCGSMP_0/RCGSOS_0/[PC station name]" object from the tree view.
2. Select the "Configuration" entry from the detail view and then select the "Edit > Open Object" menu command.
3. Select a network adapter from the hardware catalog and drag-and-drop it to slot 4.
4. Confirm the first message dialog by clicking "Yes", and the second by clicking "OK".
5. Select the network adapter and then select the "Edit > Object properties..." menu command.
   The "Properties" dialog box opens.
6. Click "Properties" in the "General" tab.
7. Select the "MAC Address" input box and enter the MAC address you previously noted down while working in the Configuration Console.
8. Deactivate the "IP protocol is being used" check box.
9. Select the "Ethernet (1)" entry from the "Subnet" list.
10. Click "OK" in the "Properties - Ethernet Interface CP 1613" dialog box.
11. Click "OK" in the "Properties - CP 1613" dialog box.

12. Copy the "RC application" object from the Route Control catalog to slot 2.
13. Copy the "RC application client" object from the Route Control catalog to slot 3.
14. Select the "Station > Save and Compile" menu command.
15. Close HW Config.

Result

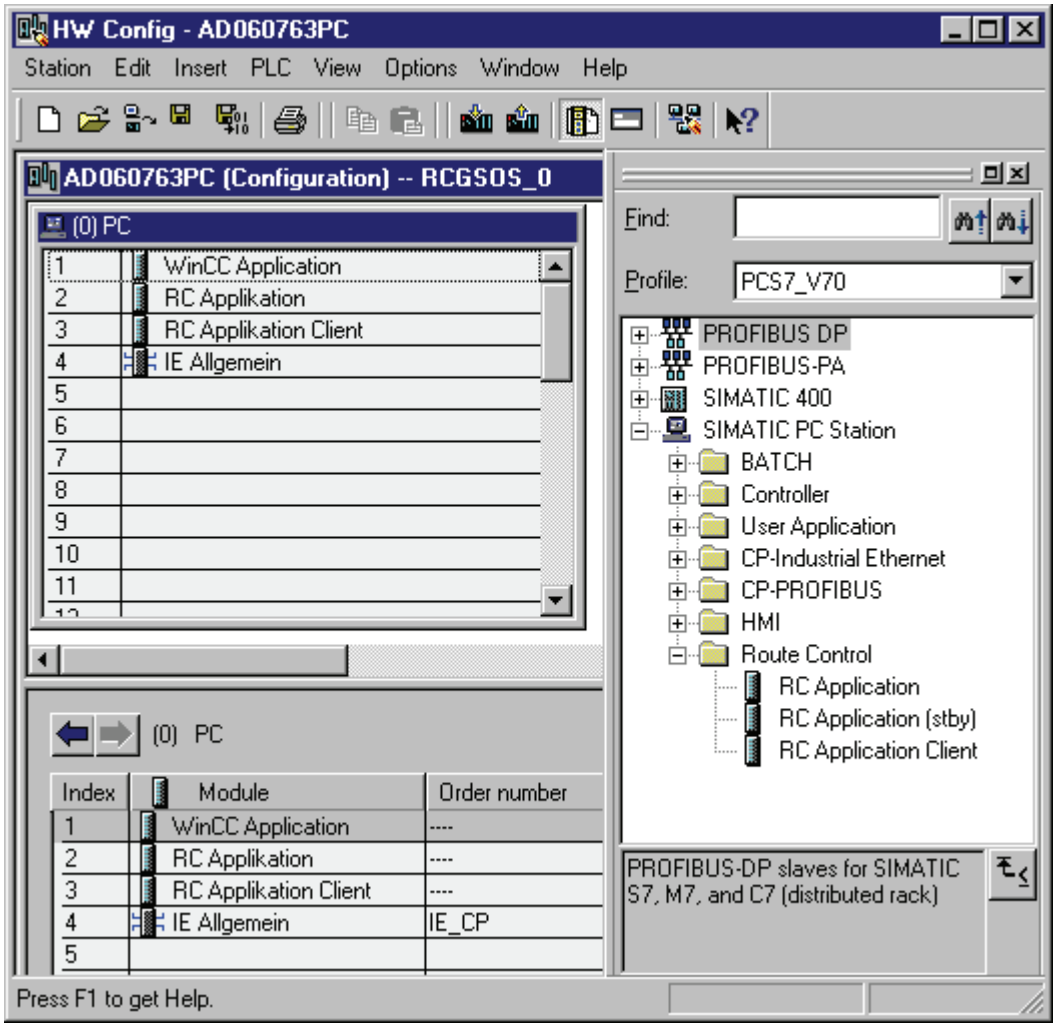


Figure 3-3 HW Config PC station

3.6 How to edit the name of the Operator Station (OS)

Prerequisites

- You opened the example project in SIMATIC Manager.
- The component view is open.

Procedure

1. Select the "OS" object from the "WinCC Application" area of the PC station.
2. Select the "Edit > Open object" menu command.
   WinCC Explorer opens.
3. Select the "Station" object from the navigation window.
4. Double-click the computer icon in the detail view.
   The "Properties Computer" dialog box opens.
5. Click "Use local computer name".
6. Click "OK".
   The "Rename computer" message is output.
7. Click "OK".
   The computer icon in the detail view is now crossed out in red color.
8. Close WinCC-Explorer.
   Your changes are activated at the next start of WinCC Explorer.

3.7 How to set parameters in NetPro

Introduction

Configure the PC station in NetPro in order to enable its communication with the AS.

Prerequisites

- You opened the example project in SIMATIC Manager.
- The component view is open.

Procedure in NetPro

1. Select the "RCGSMP_0/ RCGSOS_0/[name of your local computer]/WinCC Application" object from the tree view.
2. Select the "Connections" entry from the detail view and then select the "Edit > Open Object" command.
   NetPro opens.

3. Select the "WinCC Application" object at the SIMATIC PC station.
4. If necessary, move the window until the lower detail window is visible.
   In the lower detail window, select the S7 connection and then the menu command "Edit > Object Properties".
   The "Properties - S7 connection" dialog box opens.
5. Verify that you have selected the correct communication partners:
   Local > Interface "[network adapter of the OS]", for example, general IE;
   Partner > Interface "[CP of the AS]", for example, CP 443-1
6. Click "OK".
7. Select the "Network > Save and compile" menu command
   The "Save and compile" dialog box opens.
8. Activate the "Check and compile all" check box and then click "OK".
9. The "Outputs for consistency check" window opens after compilation has been completed. Close this window.
10. Close NetPro

Procedure in SIMATIC Manager

1. Change to SIMATIC Manager. Select the PC station and then select the "PLC > Configure" command.
   The "Configure" dialog box opens.
   Use the configured computer name.
2. Click "OK".
3. Select the PC station and then select the "PLC > Download" menu command.
   The message dialog box "This action overwrites configuration data which are already... Do you want to continue loading?" opens.
4. Click "Yes".
   The "Stop target modules" dialog box opens.
5. Click "OK".
   The download is completed.

3.8 How to create the required users

Introduction

Create a Route Control and WinCC user in the RC_MAINTENANCE user group.

Note

Define and memorize your own user name and password if the user name = rcuser and password = RCuser1+ entries do not conform to rules set up on your PC.

Procedure

1. Select "Start > Settings > Control Panel" in Windows to open the Control Panel
2. Double-click the "Administrative Tools" icon
3. Double-click the "Computer Management" icon
4. Expand the "Local Users and Groups" tree
5. Right-click the "User" folder
6. Select the "New User..." menu item
7. Entries to be made in the "New User..." dialog box:
   User name: rcuser
   Full name: Route Control User
   Password: RCuser1+
   Confirm the password:: RCuser1+
   User must change the password at next logon: deactivate this check box
   User cannot change password: activate
   Password never expires: activate
   Account is disabled: deactivate
8. Click "Create".

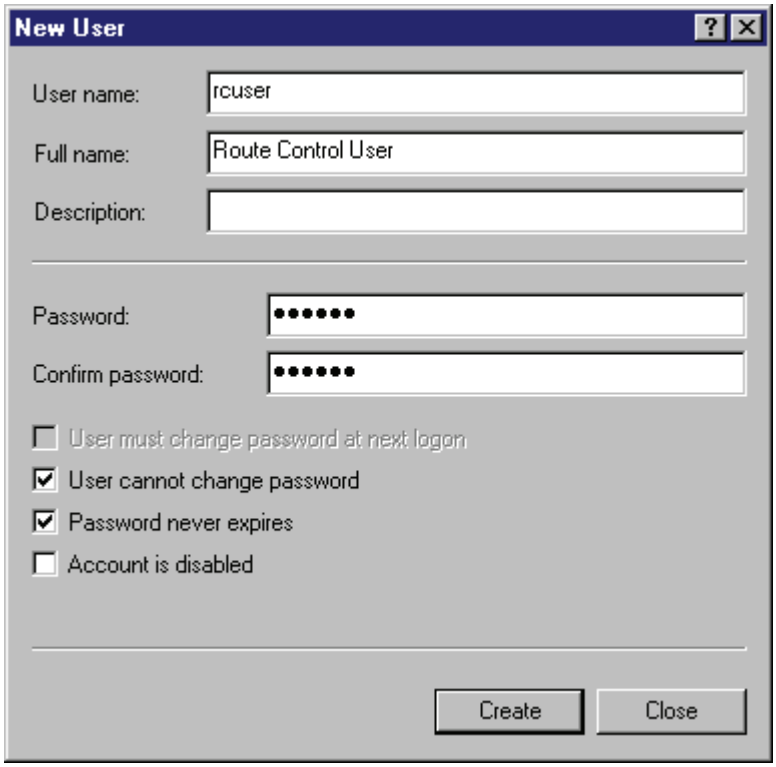


Figure 3-4 New user

9. Double-click the "Groups" folder.
10. Double-click the "RC_MAINTENANCE" group.
11. Click "Add".

12. Click "Advanced".
13. Click "Find now".
14. Select the "rcuser" from the list .
15. Click "OK".

Result:

You have successfully created a user named "rcuser" as a member of the "RC_MAINTENANCE" group.

3.9 How to select the communication module in SIMATIC Shell

Introduction

You now select the communication module you are going to use to configure the PC stations.

Note

You can discard this configuration for a single-user PC station which is not networked with other PC stations.

Procedure

1. Select the PC station (workstation) from the tree view in Windows Explorer.
2. Select the "Simatic Shell" folder.
3. Double-click "Settings" in the shortcut menu.
   The "Settings" dialog box opens.
4. Select the network adapter (communication module) you are going to use for communication with the Engineering Station.
5. Click "OK" to save your entries.
6. Confirm the next dialog.
7. The communication module is now re-initialized.

Route Control configuration in the automation system 4

4.1 Route Control blocks

4.1.1 Overview

General

Each process involves the operation of control elements such as valves or motors. The AS controls these elements using the CFC blocks of the PCS 7 library. An interface block of the Route Control library interconnects these PCS 7 blocks. This shows the RC Wizard that these control elements are to be used in the Route Control system. The Route Control Wizard "imports" these interface blocks by creating a corresponding data record in the Route Control database. This data record makes the element visible in the Route Control configuration and allows its use in partial routes.

Route Control is represented in the automation system by means of function blocks (FB), functions (FC), and data blocks (DB).

These blocks can be organized in four groups under the aspect of Route Control:

1. General configuration of Route Control: RC_IF_CFG
2. Control of material transport: RC_IF_ROUTE
3. Interface blocks for interfacing with the process: RC_IF_VALVE, for example
4. Tool blocks: "Subprograms" for route control, cross-coupling, and communication

You can also distribute the DBs to four groups:

1. Configuration: RC_CFG (DB 00)
2. Route lists: RC_ROUTnnn (DB 101 to DB 400)
3. Element lists: RC_xE_FIELD (DB 96 to DB 99)
4. Tool DBs: Communication, cross-coupling, …

4.1.2 Blocks

Route Control interface blocks

The name of the Route Control interface blocks start with RC_IF....
These blocks form the interface for the Route Control system within the AS.

Blocks for activating a route

RC_IF_ROUTE (FB 800), RC_IF_DECODER (FC 801), RC_IF_ENCODER (FC 800)

Blocks for interfacing the control elements (CE)

RC_IF_VAL_MOT (FB 825), RC_IF_VALVE (FB 826), RC_IF_MOTOR (FB 822), RC_IF_MOT_REV (FB 823), RC_IF_MOT_SPED (FB 824), RC_IF_USER_CE (FB 829)

Blocks for interfacing the sensor elements (SE)

RC_IF_CONDUCT (FB 846), RC_IF_SENSOR (FB 845), RC_IF_USER_SE (FB 848)

Blocks for interfacing the parameter elements (PE)

RC_IF_VOLUME (FC 808), RC_IF_TIMER (FC 809), RC_IF_USER_PE (FC 807)

Blocks for interfacing the link elements (LE)

RC_IF_LE (FB 828)

Note

Take all blocks to be installed in CFC charts in the course of exercises from the "Lib" master data library.

Note

You can use the RC_IF_USER_CE, RC_IF_USER_SE and RC_USER_PE blocks to develop user-specific block types.

4.2 The Route Control configuration block

4.2.1 Overview of the configuration block

The RC_IF_CFG configuration block

One instance of this block must be installed in a central CFC chart for each Route Control CPU (AS). This block is the central instance where you configure the AS. The block itself calls three system components:

1. Communication to the Route Control Server .
   Sending message frames using the AS system block BSEND.
2. Communication with the partner AS within a Route Control project if a material transport uses elements in several AS (AS system block PUT).
3. Execution of the route list DBs, and corresponding activation / monitoring of all elements of this route. The block generates central messages of the AS Route Control system, for example, error in communication with RC Server.

Most important parameters of the RC_IF_CFG block:

Table 4- 1 Table of the most important parameters of the RC_IF_CFG block

Block contact	Meaning
RC_AS_ID	Unique identifier for this AS within the project.
OB_KOMM	Defines the OB which handles server communication
OB_SYS	Defines the OB which is used to process the route lists.
OB_XC	Defines the OB which is used to process the cross-coupling.
CE_SIMU	Defines whether to simulate processing of the values returned by the control elements. 1 -> simulation, 0 -> no simulation.
SE_SIMU	Defines whether to simulate processing of the values returned by the sensor elements. 1 -> simulation, 0 -> no simulation.
QERR	Indicates error events.
NoRoutes	Maximum number of routes used in this Route Control project.

Note

In addition to the organization block (OB) in which you have installed it, the RC_IF_CFG block is installed automatically in the following OBs:

Startup OBs (OB 100, OB 101 and OB 102), OB 1 and the error OBs (OB 121 and OB 80).

Note

The system is limited to 300 simultaneous material transport operations. If your application only requires a small number of simultaneous material transport operations, you can reduce load on CPU memory by deleting the obsolete DBs from the SIMATIC project. The DBs for RC_ROUTE201...300 and DB 301 to DB 400 can be deleted if you are operating with a maximum of 200 routes. Reduce the maximum number of material transport operations in the same way at all automation systems of the RC project. Report the required number of routes to the RC system by way of the "NoRoutes" input at the RC_IF_CFG block. The value 200 must be set at this input in the example described above.

4.2.2 Exercise with RC_IF_CFG

Task

Configure the "RC_IF_CFG" block in the CFC chart "RC_System".

Prerequisite

You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.

Procedure

1. Open the "RC_System" CFC chart from the partial project "RCGSAS_0".
2. Copy the RC_IF_CFG (FB 850) block from the "Lib" master data library to the CFC chart.
3. Select the "Object properties" command from the shortcut menu of the block.
4. Enter the name "RC_System" in the "Name" input box.
   Click "OK".
5. Open the "Common" CFC chart from the partial project "RCGSAS_0".
6. Interconnect output "Q" of the "CE_SIMU" block with input "CE_SIMU" of the "RC_System" block
7. Interconnect output "Q" of the "SE_SIMU" block with input "SE_SIMU" of the "RC_System" block

Result

The AS is ready for use by Route Control. Configuration is completed after the Route Control Wizard session is closed.

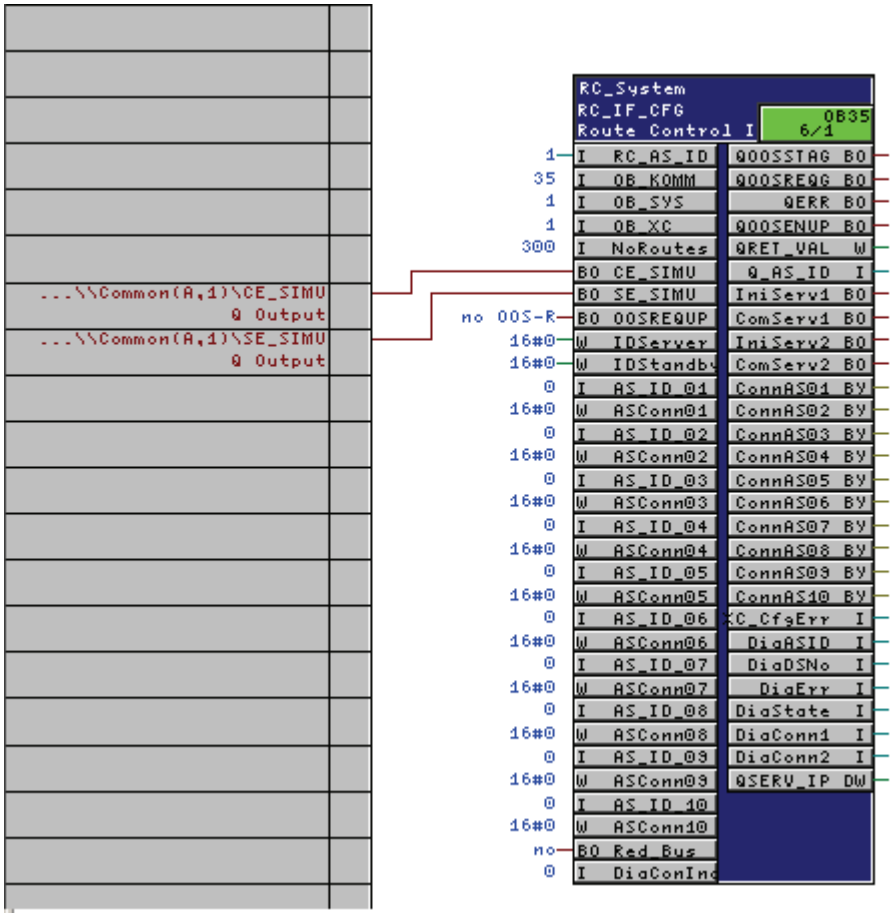


Figure 4-1 Image: RC_IF_CFG

4.3 Interface blocks for control elements

4.3.1 Overview of the interface blocks for control elements

"Control Element" (CE) interface block

Each material transport involves the operation of control elements such as valves or motors. The AS operates these actuating elements using the technological blocks of the PCS 7 library. In order to make these actuators available for use in Route Control you must interconnect each technological block with an interface block of the type "Control Element" (CE) of the Route Control library. These control elements are the active elements of a route control system, that is, they represent the actuating elements within the route control.

Control element types

Various types of suitable control elements are provided for Route Control in order to be able to control the technological blocks according to their type.
Other blocks, or blocks from other libraries can be implemented by means of a user-defined interface block.

The following interface blocks of the type "Control Element" are available:

Table 4- 2 Control elements

Route Control block	Control element type	Technological block
RC_IF_MOTOR (FB 822)	MOTOR	MOTOR (FB 66)
RC_IF_MOT_REV (FB 823)	MOT_REV	MOT_REV (FB 67)
RC_IF_MOT_SPED (FB 824)	MOT_SPED	MOT_SPED (FB 68)
RC_IF_VALVE (FB 826)	VALVE	VALVE (FB 73)
RC_IF_VAL_MOT (FB 825)	VAL_MOT	VAL_MOT (FB 74)
RC_IF_USER_CE(FB 829)	User type, template for user-specific interface blocks	Other block

Basic procedure for configuring the blocks

Step	Handling
1	Installation of a technological block such as MOTOR in the CFC chart
2	Interconnection of the technological block with the I/O devices
3	Installation of the corresponding RC_IF_xxx, for example, RC_IF_MOTOR
4	Interconnection of both blocks
5	Starting the Route Control Wizard in order to automatically generate the element ID

Important block contacts for all control elements

Table 4- 3 Important block contacts for all CEs

Block contact	Meaning
ID	Unique ID within the AS. Checked by the Route Control Wizard. A new ID is assigned if the value is zero.
FB_CLOSE	Return value of the process valve. Only with RC_IF_VALVE and RC_IF_VAL_MOT.
FB_OPEN	Return value of the process valve. Only with RC_IF_VALVE and RC_IF_VAL_MOT.
FB_ON	Motor feedback. Only with RC_IF_MOTOR, RC_IF_MOT_SPED and RC_IF_MOT_REV.
MONITOR	Monitoring of the feedback signals. 1 -> activated, 0 ->deactivated.
MAN_AUT	operating mode (manual / auto) of the downstream block.
LOCK	Defines whether a downstream block is interlocked.
ERROR	Defines whether a downstream block is in error state.
DISABLED	Defines whether an element is available.
QAUTO_OC	Automatic control, 1 -> OPEN, 0 -> CLOSE. Only RC_IF_VALVE and RC_IF_VAL_MOT.
QAUTO_ON	Automatic control, 1 -> ON, 0 -> OFF. Only with RC_IF_MOTOR, RC_IF_MOT_SPED and RC_IF_MOT_REV.
QROUTE	ID of the route which actively controls this element.
QMODE_NO	Mode level of the route which actively controls this element.
QMODE_ID	Function ID of the route which actively controls this element.

Note

An example in the Online Help and a CFC example with textual interconnections in the Route Control library show which parameters must be / may be interconnected.

4.3.2 Exercise with RC_IF_VALVE

Task

Configure the "RC_IF_VALVE" block in the CFC chart "V1".

Prerequisite

You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.

Procedure

1. Open the "V1" CFC chart from the partial project "RCGSAS_0".
2. Copy the "RC_IF_VALVE" block from the "Lib" master data library to the CFC chart
3. Select the "Object properties" command from the shortcut menu of the block.
4. Enter the name "CE_V1" in the "Name" input box.
5. Interconnect the following outputs of the "CE_V1" block with the "V1" block:

Output CE_V1	Input V1
QAUTO_OC	AUTO_OC
QBA_EN	BA_EN
QOCCUPIED	OCCUPIED
QBA_ID	BA_ID
QBA_NA	BA_NA
QSTEP_NO	STEP_NO

6. Interconnect the following outputs of the "V1" block with the inputs of the "CE_V1" block:

Output V1	Input CE_V1
QCONTROL	FB_OPEN
QCONTROL	Negated to FB_CLOSE
QGR_ERR	ERROR
QMAN_AUT	MAN_AUT

Result

You successfully configured a control element of the type "VALVE".

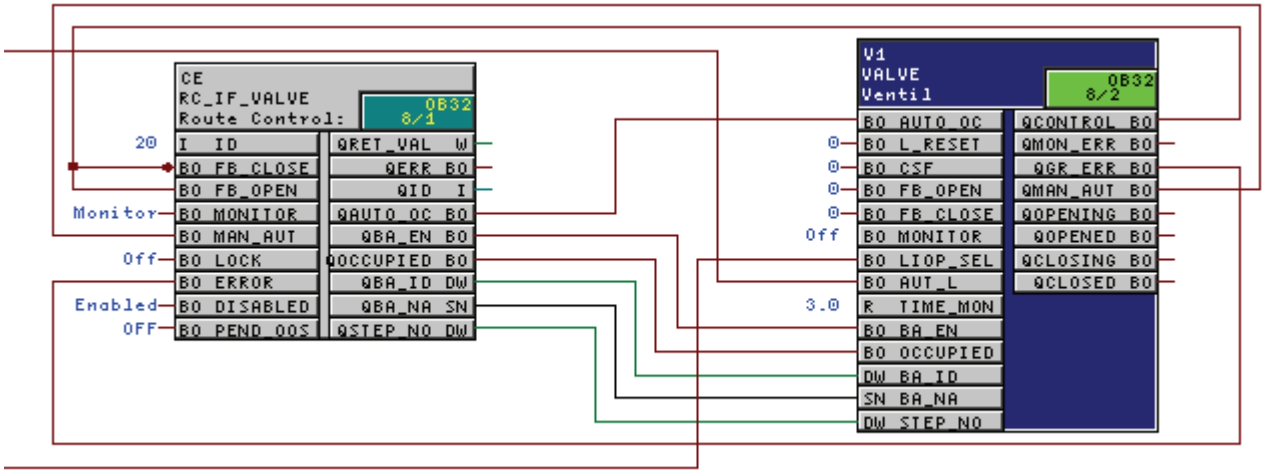


Figure 4-2 Interconnection of the "CE_V1" and "V1" blocks

4.3.3 Exercise with RC_IF_MOTOR

Task

Configure the "RC_IF_MOTOR" block in the CFC chart "P2".

Prerequisite

You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.

Procedure

1. Open the "P2" CFC chart from the partial project "RCGSAS_0".
2. Copy the "RC_IF_MOTOR" block from the "Lib" master data library to the CFC chart
3. Select the "Object properties" command from the shortcut menu of the block.
4. Enter the name "CE_P2" in the "Name" input box.
5. Interconnect the following outputs of the "CE_P2" block with the inputs of the "P2" block:

Output CE_P2	Input P2
QAUTO_ON	AUTO_ON
QBA_EN	BA_EN
QOCCUPIED	OCCUPIED
QBA_ID	BA_ID
QBA_NA	BA_NA
QBA_STEP_NO	STEP_NO

6. Interconnect the following outputs of the "P2" block with the inputs of the "CE_P2" block:

Output P2	Input CE_P2
QGR_ERR	ERROR
QSTART	FB_ON
QMAN_AUT	MAN_AUT

7. Interconnect output "QSTART" of the "P2" block with input "FB_ON" of the "P2" block.

Result:

You successfuly configured a Route Control interface block of the "MOTOR" type.

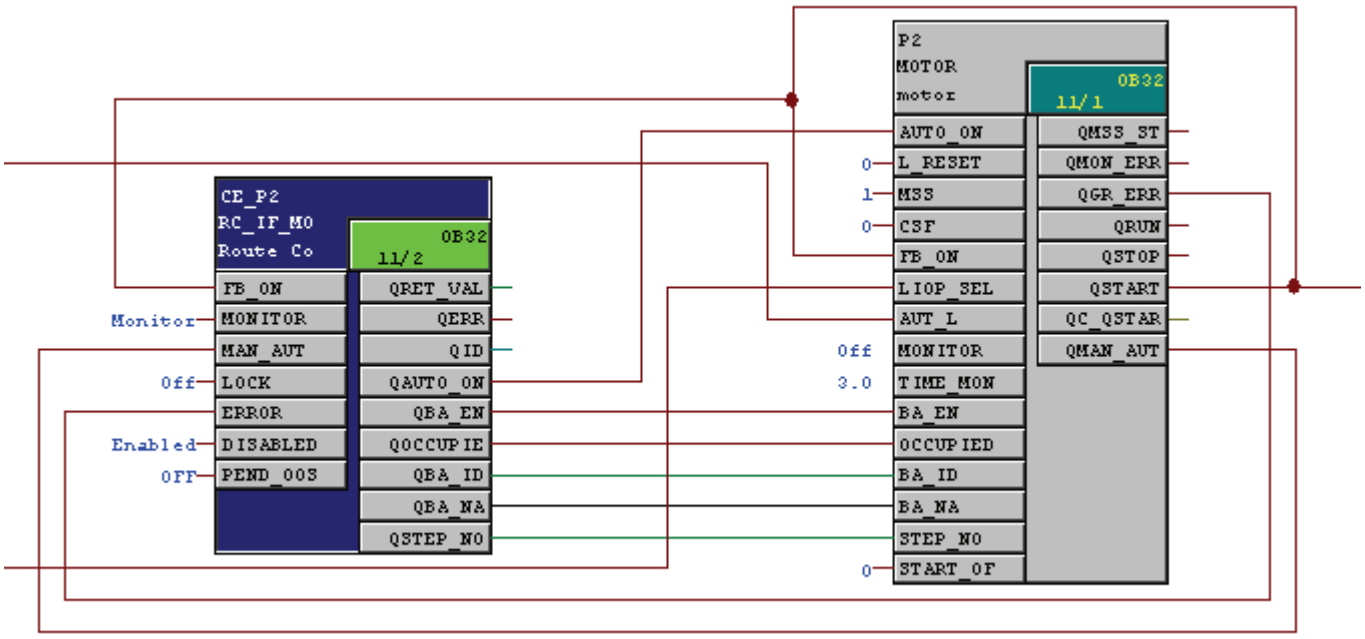


Figure 4-3 Interconnection of the "CE_P2" and "P2" blocks

4.4 Interface blocks for sensor elements

4.4.1 Overview of the interface blocks for sensor elements

"Sensor Element" (SE) interface block

Sensor elements are passive elements of the route control system. These elements are used to poll states without actively changing these. You assign the SEs to a specific type similar to the CEs. The system supports the use of SENSOR (binary sensor) and CONDUCT (analog sensor with 4 levels) element types.

Sensor element types

The Route Control block library contains two interface blocks for sensor elements (SE) for interfacing with the process. The "SENSOR" type is suitable for acquiring binary signals, and the "CONDUCT" type can be used to acquire analog signals with four switching states.

Users can implement their own feedback function by means of a user-specific interface block.

The following interface blocks of the "Sensor Element" type are available:

Table 4- 4 Sensor elements

Route Control block	Sensor element type	Technological block
RC_IF_SENSOR (FB 845)	SENSOR	CH_DI (FC 277), for example
RC_IF_CONDUCT (FB 846)	CONDUCT	CH_AI (FC 275), for example
RC_IF_USER_SE (FB 848)	User type, template for user-specific interface blocks	Other block

Basic procedure for configuring the blocks

Step	Handling
1	Installation of an RC_IF_xxx such as RC_IF_SENSOR in a CFC chart
2	Interconnection of RC_IF_xxx with the signal to be monitored
3	Starting the Route Control Wizard in order to automatically generate the element ID

Important contacts of the RC_IF_SENSOR block

Table 4- 5 RC_IF_SENSOR parameters

Block contact	Meaning
ID	Unique ID within the AS. Checked by the Route Control Wizard. A new ID is assigned if the value is zero.
ERROR	Defines whether an interconnected block is in error state.
DISABLED	Defines whether an element is available.
FB_00	Actual value of a sensor returned by the process. 1 -> interconnected sensor returns TRUE 0 -> interconnected sensor returns FALSE
QRET_VAL	Return value of the block 0 -> no error, 8xxx -> error.
QROUTE	ID of the route which uses this element.
QFUNC_ID	Function ID of the route which uses this element.

4.4.2 Exercise with RC_IF_SENSOR

Task

Configure the "RC_IF_SENSOR" block in the CFC chart "FT1".

Prerequisite

You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.

Procedure

1. Open the "FT1" CFC chart from the partial project "RCGSAS_0".
2. Copy the "RC_IF_SENSOR" block from the "Lib" master data library to the CFC chart
3. Select the "Object properties" command from the shortcut menu of the block.
4. Enter the name "S1" in the "Name" input box.
5. Interconnect the "EMPTY" output of simulation block "FT1" with input "FB_00" of the "S1" block

Result

You successfully configured a control element of the type "SENSOR".

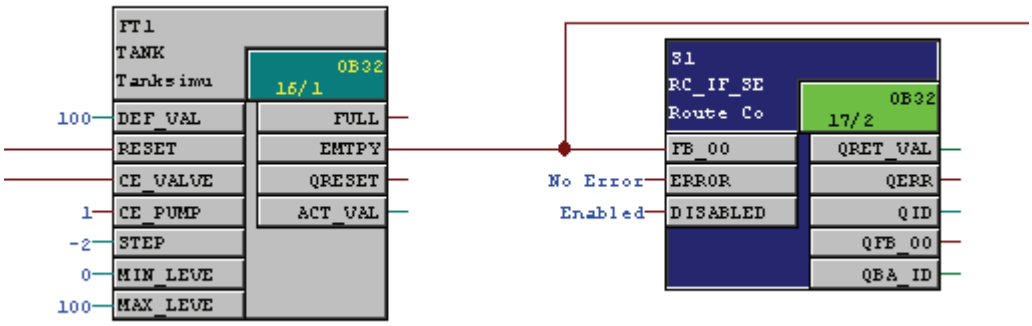


Figure 4-4 Interconnection of the "FT1" and "S1" blocks

4.5 Interface blocks for parameter elements

4.5.1 Overview of the interface blocks for parameter elements

"Parameter Element" (PE) interface block

Parameter elements represent setpoints in the route control system. They do not evaluate feedback signals.

Parameter element types

The Route Control block library contains three interface blocks for parameter elements for interfacing with the process.

Users can implement their own parameter elements by means of a user-specific interface block.

The following interface blocks of the "Parameter Element" type are available:

Table 4- 6 Interface blocks for parameter elements

Route Control block	Parameter Element type	Technological block
RC_IF_VOLUME (FC 808)	VOLUME	OP_A_LIM (FB 46), for example
RC_IF_TIMER (FC 809)	TIMER	OP_A_LIM (FB 46), for example
RC_IF_USER_PE (FC 807)	User type, template for user-specific interface blocks	Other block

Basic procedure for configuring the blocks

Step	Handling
1	Installation of an RC_IF_xxx such as RC_IF_VOLUME in a CFC chart
2	Interconnection of the RC_IF_xxx with the block which is to receive the parameter.
3	Interconnection of the feedback signal of the PE block Input ACT_VAL as real value
4	Definition of the conversion factor used to calculate the integer outputs QVALUE_I and QVALUE_D. QVALUE_I = QVALUE_D = QVALUE_R * FACTOR
5	Programming a substitute value DEF_VAL
6	Setting up the response to deactivation of the element at input EN_DEF
7	Starting the Route Control Wizard in order to automatically generate the element ID

Important contacts of the RC_IF_VOLUME block

Table 4- 7 Important contacts of the RC_IF_VOLUME block

Block contact	Meaning
ID	Unique ID within the AS. Checked by the Route Control Wizard. A new ID is assigned if the value is zero.
FACTOR	Scaling ratio for the output values QVALUE_I and QVALUE_D.
DIS_ACTV	Internal activation of the actual value can be prevented.
DEF_VAL	Substitute value
EN_DEF	Reaction after deactivation of the element: 1: the substitute value is output 0: the last valid setpoint is output

Block contact	Meaning
ACT_VAL	Feedback value received from the process
Q_VALUE_I	Setpoint as 16-bit integer
QVALUE_D	Setpoint as 32-bit integer
QVALUE_R	Setpoint as 32-bit floating point number
QRET_VAL	Return value of the block 0 -> no error, 8xxx -> error.
QROUTE	ID of the route which actively controls this element.
QFUNC_ID	Function ID of the route which actively controls this element.

4.5.2 Exercise with RC_IF_VOLUME

Task

Configure the "RC_IF_VOLUME" block in CFC chart "P4".

Prerequisite

You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.

Procedure

1. Open the "P2" CFC chart from the partial project "RCGSAS_0".
2. Copy the "RC_IF_VOLUME" block from the "Lib" master data library to the CFC chart
3. Select the "Object properties" command from the shortcut menu of the block.
4. Enter the name "PE_P2" in the "Name" input box.
5. Interconnect output "QVALUE_R" with input "ACT_VAL"
6. Program the value "1" at input "FACTOR"
7. Program the value "enable" at input "EN_DEF"

Result

You successfully configured a parameter element of the type "VOLUME".

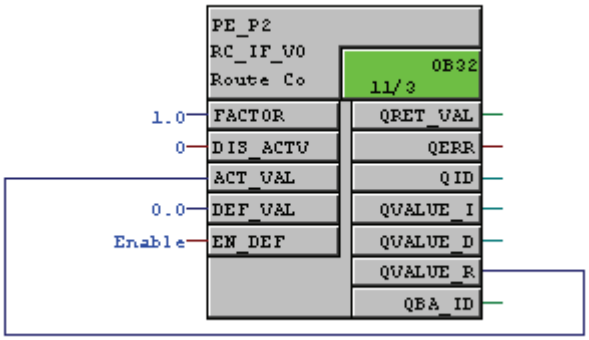


Figure 4-5 Interconnection of the "PE_P2" block

4.6 Interface block for link elements

4.6.1 Overview of the interface block for link elements

"Link Element" (LE) interface block

Link elements are used to store the current material within partial routes. The route request, or a separate trigger of the AS program, initiates a check of material compatibility based on these elements.

Prior to material transport you can only save the material information the connection elements contain by way of SET_MAT input at the route block of the AS program.

Connection element types

We do not distinguish between different subtypes of connection elements.

Basic procedure for configuring the block

Step	Handling
1	Installation of RC_IF_LE in a CFC chart
2	Starting the Route Control Wizard in order to automatically generate the element ID

Important contacts of the RC_IF_LE block

Table 4- 8 RC_IF_LE parameters

Block contact	Meaning
ID	Unique ID within the AS. Checked by the Route Control Wizard. A new ID is assigned if the value is zero.
DEF_VAL	Default value which can be activated in the connection element by setting input SET_DEF.
SET_DEF	Activation of the default value at the positive edge
QID	ID value of this element
QRET_VAL	Return value of the block 0 -> no error, 8xxx -> error.
QERR	Indicates whether an error is active at the block.
QMAT_I	Material ID of the connection element as integer value (INT).
QMAT_DI	Material ID of the connection element as Double Integer value (INT).
QBA_ID	Element is occupied by a SIMATIC BATCH Charge with this ID.
QROUTE	ID of the route which actively controls this element.
QFUNC_ID	Function ID of the route which actively controls this element.

Note

The material can be visualized in the process picture by way of output QMAT_DI.

4.6.2 Exercise with RC_IF_LE

Task

Configure the "RC_IF_LE" block in the CFC chart "Material".

Prerequisites

You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.

Note

The CFC chart already contains blocks of the type RC_IF_LE

Procedure

1. Open the "Material" CFC chart from the partial project "RCGSAS_0".
2. Copy the "RC_IF_LE" block from the "Lib" master data library to the CFC chart

3. Select the "Object properties" command from the shortcut menu of the block.
4. Enter the name "LE_FT1" in the "Name" input box.

Result

You successfully configured a link element.

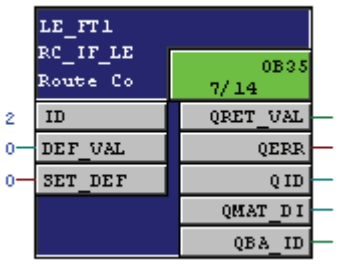


Figure 4-6 Image: RC_IF_LE

4.7 Interface block for material transport

4.7.1 Overview of the interface block for material transport

The RC_IF_ROUTE interface block of a route

This block represents the central route interface to the user program and the AS block for the Route Control faceplate in the process picture.
The block handles the following tasks:

1. Definition of route parameters (source, destination, via, mode level, and material, for example)
2. Starting, stopping, ending and resuming material transports
3. Definition of monitoring times (system monitoring time, fault tolerance time)
4. Definition of dynamic setpoints for external parameter elements
5. Transfer of the batch ID / batch name and of the step number from a BATCH system

The block controls exactly one route, that is, one material transport. It returns additional information about the status of the route and its elements to the user program by means of output parameters. Usually, one user-defined SFC derived from RC_IF_ROUTE_SFC and one RC_IF_ENCODER (FC800) is connected upstream and one RC_IF_DECODER (FC801) is connected downstream of RC_IF_ROUTE.

Dynamic or static route ID

A route can be operated with a static or a dynamic route ID. Up to 300 simultaneous material transports are supported. Operation with no more than 300 routes can be handled by means of static route ID. However, you can also handle more than 300 routes by assigning dynamic route IDs. In this case system resources are allocated dynamically to the active routes. This dynamic ID concept also facilitates engineering as it prevents the Route Control system from assigning redundant IDs. Dynamic IDs can also be used to handle less than 300 routes. This could be a practical workaround in situations where the maximum number of simultaneous routes is limited by license, for example. You can purchase licenses for 30, 100 and 300 simultaneous material transports. This Route Control Getting Started deploys static route IDs.

Overview of interface blocks for material transport

Table 4- 9 Interface blocks for material transport

Block	Function
RC_IF_ROUTE	Central interface block for controlling material transport The instances of this block can be interconnected with the Route Control faceplate.
RC_IF_ENCODER	Auxiliary block which converts 32 binary signals into a 32-bit DWORD. The block can be used, for example, to convert 32 bits for the control function of input MODE at RC_IF_ROUTE.
RC_IF_DECODER	Auxiliary block which converts a 32-bit DWORD into 32 bits. The block can be used to convert the mode feedback signals of RC_IF_ROUTE to single bits.

Most important parameters of the RC_IF_ROUTE block

Table 4- 10 Important contacts of the RC_IF_ROUTE block

Block contact	Meaning
ROUTE_ID	Route ID which is unique across all automation systems of an RC project. The Route Control Wizard checks this ID and assigns a new one if the value is zero.
FIXED_ID	Defines whether a dynamic or a static route ID is assigned. 0 -> dynamic, 1 -> static
FUNC_ID	Function ID of the route
MON_TM	Substitute value of the process monitoring time
FLT_TM	Substitute value of the fault tolerance time
MODE_TBL	Mode table parameter for the route request
VIA_1 to VIA_10	Interim locations for transport of materials
MODE	Modes to be activated
SOURCE	Start position of a route
DEST	Destination of a route
MATERIAL	Material to be transported

Block contact	Meaning
REQ_AU	Interconnectable input for activating the route request
ON_AU	Interconnectable input for starting the route
ACK_AU	Interconnectable input for acknowledging the route
HOLD_AU	Interconnectable input for holding the route
STOP_AU	Interconnectable input for stopping the route
QMODE_AC	Returns the current mode IDs
QREQ_ERR	Return value of the route request 1 -> error, 0 -> OK
QACTIVE	Route status
QAUTO	Automatic route control is active
QMAN	Manual route control is active
QREQ	Diagnostics information pertaining to the route request
QON	Defines whether the route is in "busy" state.
QHOLD	Defines whether the route was held.
QVALID	Validation of static route data
QRESTPOS	Defines whether all actively used control elements of a mode level are currently in idle position.

4.7.2 Exercise with interface block RC_IF_ROUTE for manual mode

Task

Configure the "RC_IF_ROUTE" block in the CFC chart "ROUTE1".

Prerequisite

You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.

Note

The term manual mode denotes controlling of a route using the Route Control Center, without using any SFC blocks or an AS user program.

Procedure

1. Open the "ROUTE1" CFC chart from the partial project "RCGSAS_0".
2. Copy the "RC_IF_ROUTE" block from the "Lib" master data library to the CFC chart
3. Select the "Object properties" command from the shortcut menu of the block.
4. Enter the name "ROUTE1" in the "Name" input box.
5. Program the value "1" at input "ROUTE_ID"
6. Program the value "1" at input "FIXED_ID"

7. Insert the "RC_IF_ENCODER" block on the left side of the "RC_IF_ROUTE" block in the CFC chart
8. Select the "Object properties" command from the shortcut menu of the block.
9. Enter the name "Encoder1" in the "Name" input box.
10. Interconnect output "QMODE" of "Encoder1" with input "Mode" of the "ROUTE1" block
11. Insert the "RC_IF_DECODER" block below the "Encoder1" block in the CFC chart
12. Select the "Object properties" command from the shortcut menu of the block.
13. Enter the name "Decoder1" in the "Name" input box.
14. Interconnect output "QMODE_AC" of "Route1" with input "MODE" of "Decoder1"

Result

You successfully configured an interface block manual material transport

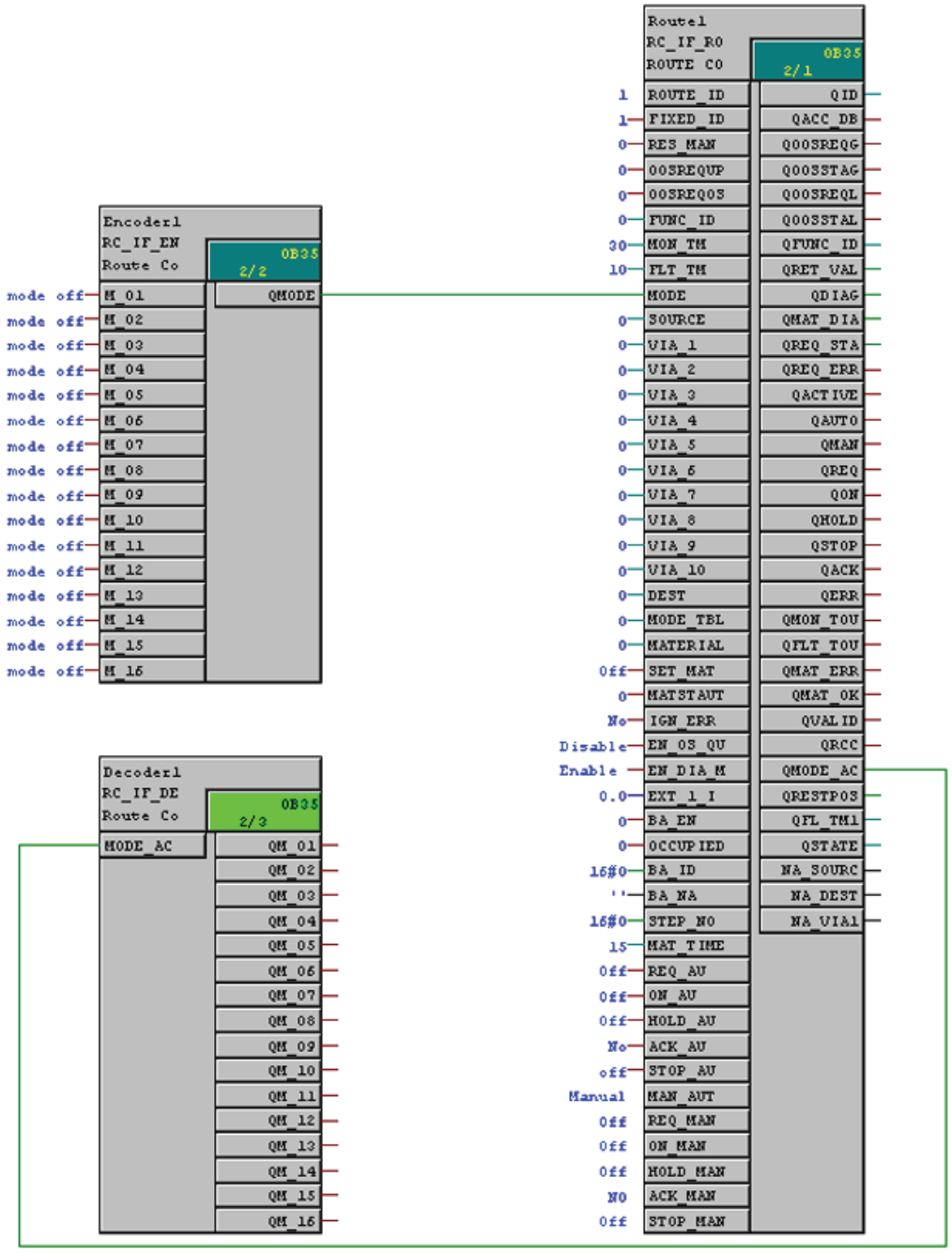


Figure 4-7 Interconnection of the "Encoder1", "Route1" and "Decoder1" blocks

Controlling a route using an SFC block 5

5.1 SFC Typical of the RC library

SFC Typical of the Route Control library

The Route Control library contains an SFC Typical which can be used as sample for user-specific blocks. This SFC block is prepared for controlling a route.

It handles the following tasks:

- Transfer of the static parameters for route requests to the "RC_IF_ROUTE" block ("Starting" sequencer)
- Starting and evaluating the route request ("Starting" sequencer).
- After having successfully completed the route request, the SFC changes to simple control mode ("Run" sequencer).

This SFC Typical can be customized to suit your requirements as follows:

- Customizing the functionality of the "Run" sequencer to suit the modes used in your Mode Table. (An overview of the modes used in SFC Typical is available in the "Run" sequencer)
- Customizing reactions to route errors, for example: Using the "QERR", "QMON_TOU" or "QMON_FLT" error outputs as start condition for the "Holding" sequencer and setting the SFC to "Stop" in case of errors.
- Expansion of parameters for material functions (input "I_MATERIAL", outputs "QMATERIAL" and "QSET_MATERIAL"). Activation and evaluation of the materials in "Run" sequencer in preparation of the transport operation.

SFC Typical and the "RC_IF_ROUTE", "RC_IF_ENCODER" and "RC_IF_DECODER" interface blocks are interconnected with an SFC block instance accordingly.

Note

The "ROUTE_SFC" chart in the Route Control library contains an example of the entire interconnection.

5.2 Exercise with SFC Type

Task

Interconnect an SFC instance with an "RC_IF_ROUTE" block.

Note

Auto mode means that material transport is controlled by means of an SFC block.

Prerequisite

You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.

Procedure

1. Open the "Route2" CFC chart from the partial project "RCGSAS_0".
2. Copy the "RC_IF_ROUTE" block from the "Lib" master data library to sheet 1 of the "Route2" CFC chart and name it "Route2".
3. Program a 2 at ROUTE_ID
4. Program a 1 at FIXED_ID
5. Copy the "RC_IF_SFC" block from the "Lib" master data library to the "Route2" CFC chart and name this instance "SFC_R2".
6. Interconnect output "RC_VIA1" of the "SFC_R2" block with input "VIA_1" of the "Route2" block

   Note

   The SFC type features three block contacts: "RC" of the type "RC_IF_ROUTE", "SP" of the type "RC_IF_ENCODER", and "AC" of the type "RC_IF_DECODER". All I/O belonging to a block contact which is connected to the corresponding block is automatically interconnected with the block.

7. Insert the "RC_IF_ENCODER" block into sheet 4 of the "Route2" CFC chart and name it "Encoder2".
8. Insert the "RC_IF_DECODER" block into sheet 4 of the "Route2" CFC chart and name it "Decoder2".
9. Interconnect output "SP_M_01" of the "SFC_R2" block with input "M_01" of the "Encoder2" block
10. Interconnect output "QM_01" of the "Decoder2" block with input "AC_QM_01" of the "SFC_R2" block
11. Interconnect output "QMODE_AC" of the "Route2" block with input "MODE_AC" of the "Decoder2" block

12. Interconnect output "QMODE" of the "Encoder2" block with input "Mode" of the "Route2" block
13. Program the value "1" at input "IN_SOURCE" of the "SFC_R2" block
14. Program the value "3" at input "IN_DEST" of the "SFC_R2" block

Note

CFC chart "Route3" contains an example of an interconnected "RC_IF_ROUTE" block.

Result

You successfully configured a material transport at CFC level from the "Fermenting Tank1" source "to the Storage Tank1" destination.

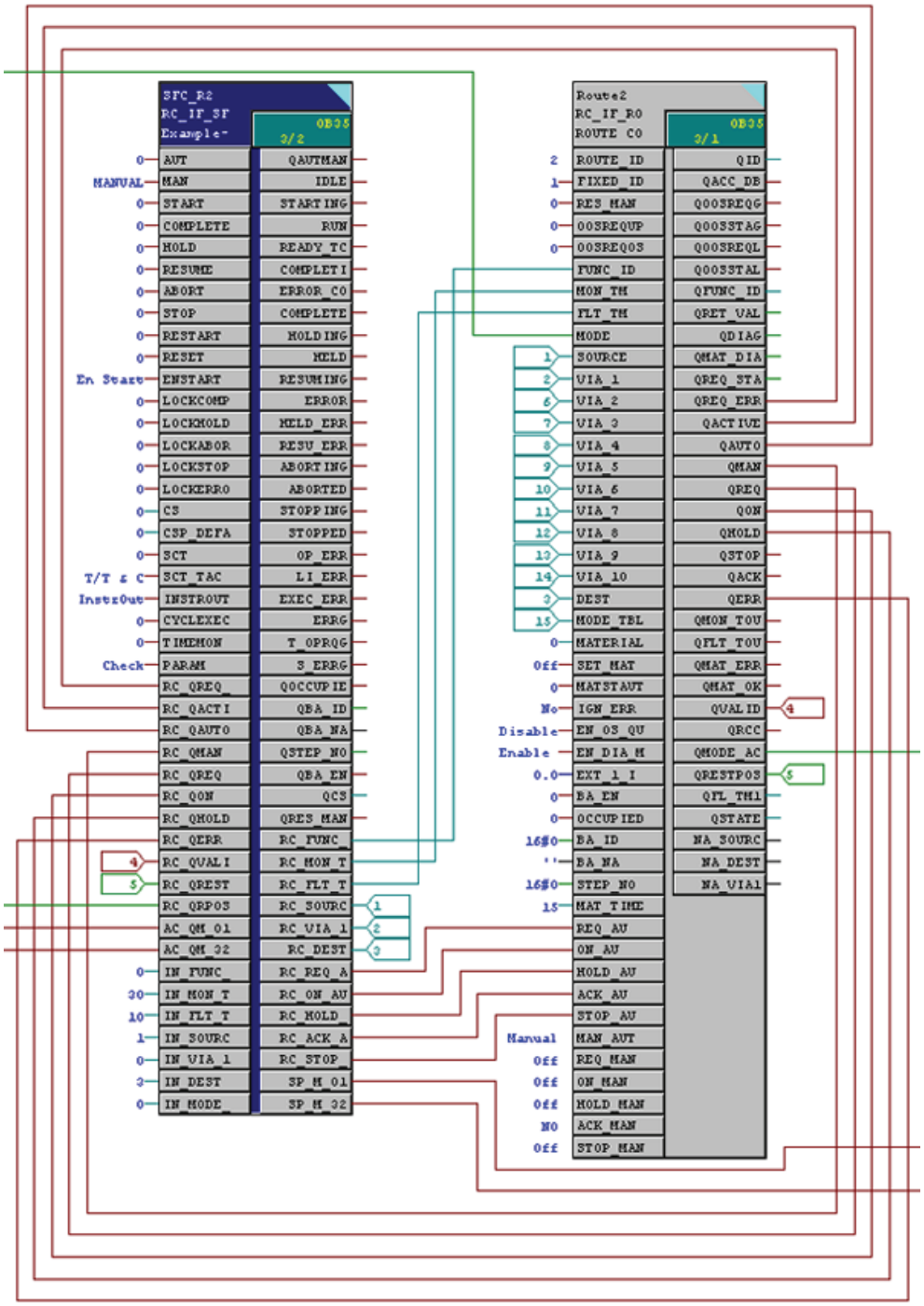


Figure 5-1 Route2

5.3 Exercise for the compilation and download of CFC charts

Task

Compile and download the CFC charts.

Prerequisite

You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.

Procedure

1. Right-click the "Charts" folder.

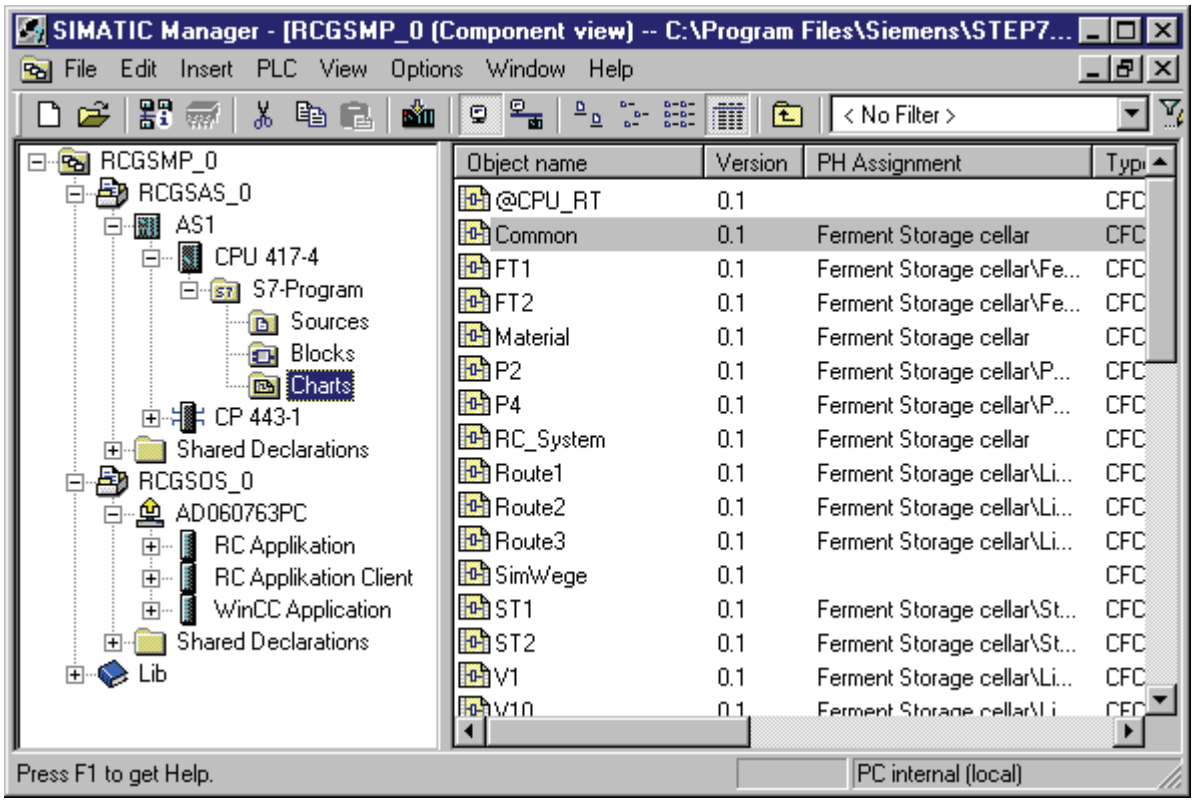


Figure 5-2 Compile1

2. Select the "Compile" menu command.
   The "Compile program" dialog box opens.
3. Activate the "Complete program" check box.

4. Click "OK".

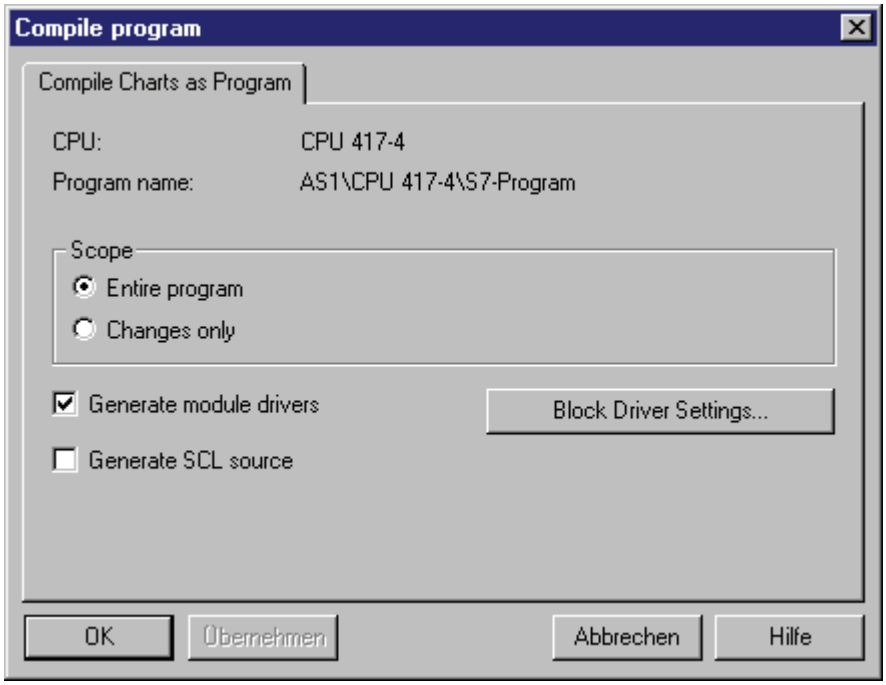


Figure 5-3 Compile2

5. Right-click the "Charts" folder.
6. Select the "PLC > Download" menu command.

7. Activate the "Complete program" check box.

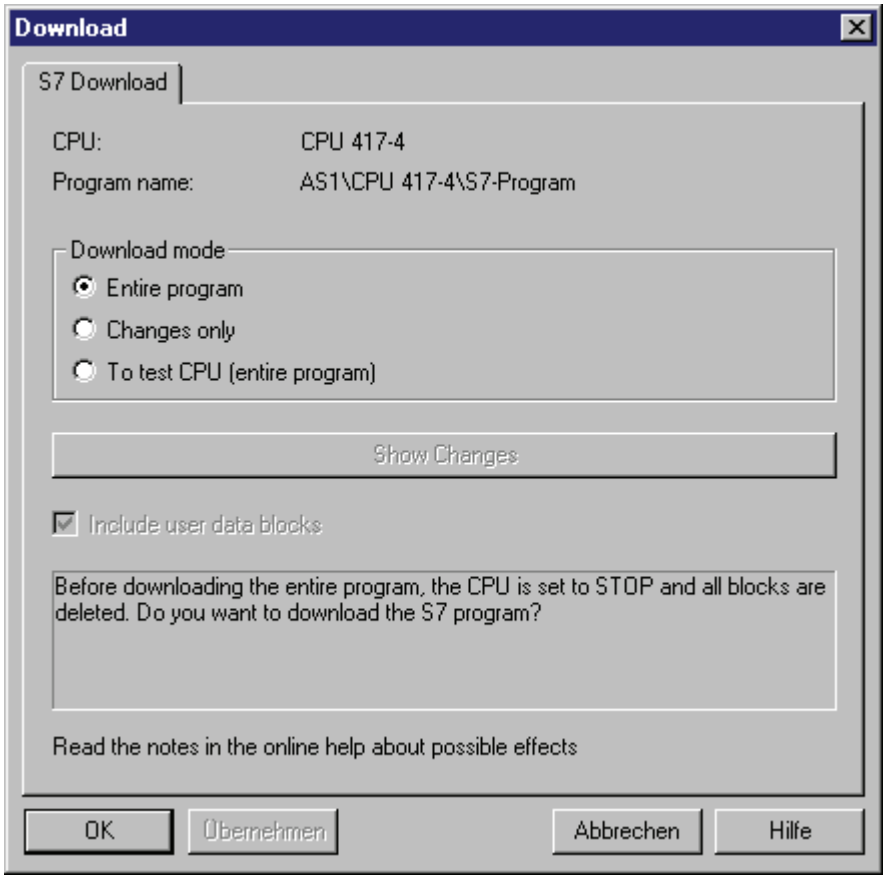


Figure 5-4 Download1

8. Click "OK".
   The "Download S7" dialog box opens.
9. Click "No".

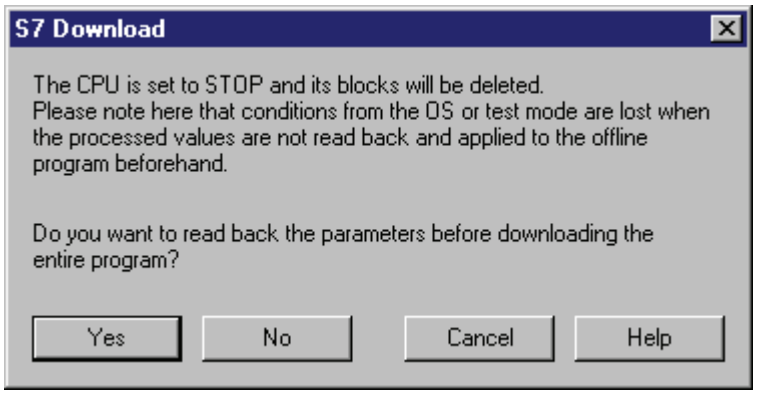


Figure 5-5 Download2

Note

Adapt local data on the AS accordingly if the compiler reports errors in terms of local data requirements. This concerns priority classes 1,12 and 25 to 29. You can calculate local data requirements using the chart reference data of the CFC editor.

Procedure

1. Open a CFC chart.
2. Open the the chart reference data by selecting the "Options > Chart reference data" menu.

3. Calculate local data requirements using the "View > Local data" menu.
4. Customize local data accordingly in the "Properties" dialog box of the AS.

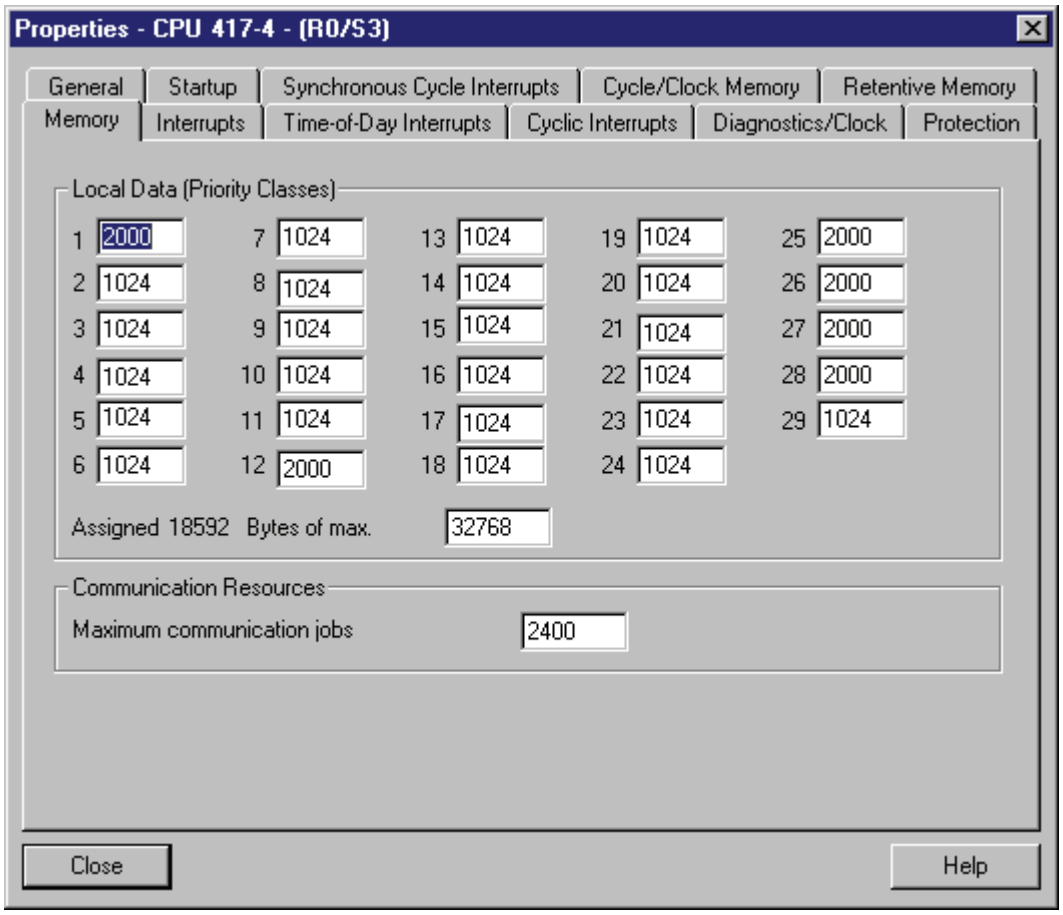


Figure 5-6 AS memory settings

Note

The priority classes relate to the following OBs:

Priority class 1 = OB 1 and OB 80; priority class 12 = OB 35; priority class 25 = OB 70, OB 73, OB 81-87, and OB 60 to 65; priority class 26 = OB 80; priority class 27 = OB 100 to 102; priority class 28 = OB 80 to 87; priority class 29 = OB 90.

Result

You successfully compiled and downloaded the AS program.

Route Control Wizard

6

6.1 Overview of the Route Control Wizard

Overview

Using the Route Control Wizard you can export the data which is relevant to Route Control from the S7 project and import this data to Route Control Engineering.

Tasks of the Route Control Wizard:

The Route Control Wizard handles the following tasks:

- Export of AS names and IDs from the S7 project, including the check and correction of the AS IDs.
- Export of the plant hierarchy, including plants and units of the S7 project
  The export is only carried out for plants and units which are relevant to SIMATIC BATCH.
- Export of elements and routes (route = RC_IF_ROUTE), including the check and correction of IDs.
- Setup and modification of communication between the AS which are relevant to Route Control and the Route Control servers.
- Setup and modification of communication between the AS which are relevant to Route Control.
- Export of the AS to Server connections.
- Selection of the PCS 7 OS message servers
- Generation of messages of the Route Control servers
- Generation of operator messages of the Route Control faceplates
- Import of data to the Route Control project.

Note

The Route Control Wizard assigns the IDs for the Route Control elements and connections, for example, and writes these IDs to the block inputs in the CFC charts.

6.2 Exercise with the Route Control Wizard

Task

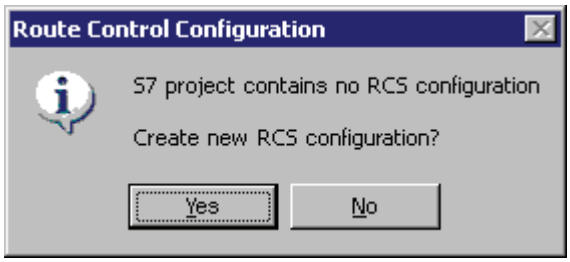
Use the Route Control Wizard to perform all possible actions.

Prerequisite

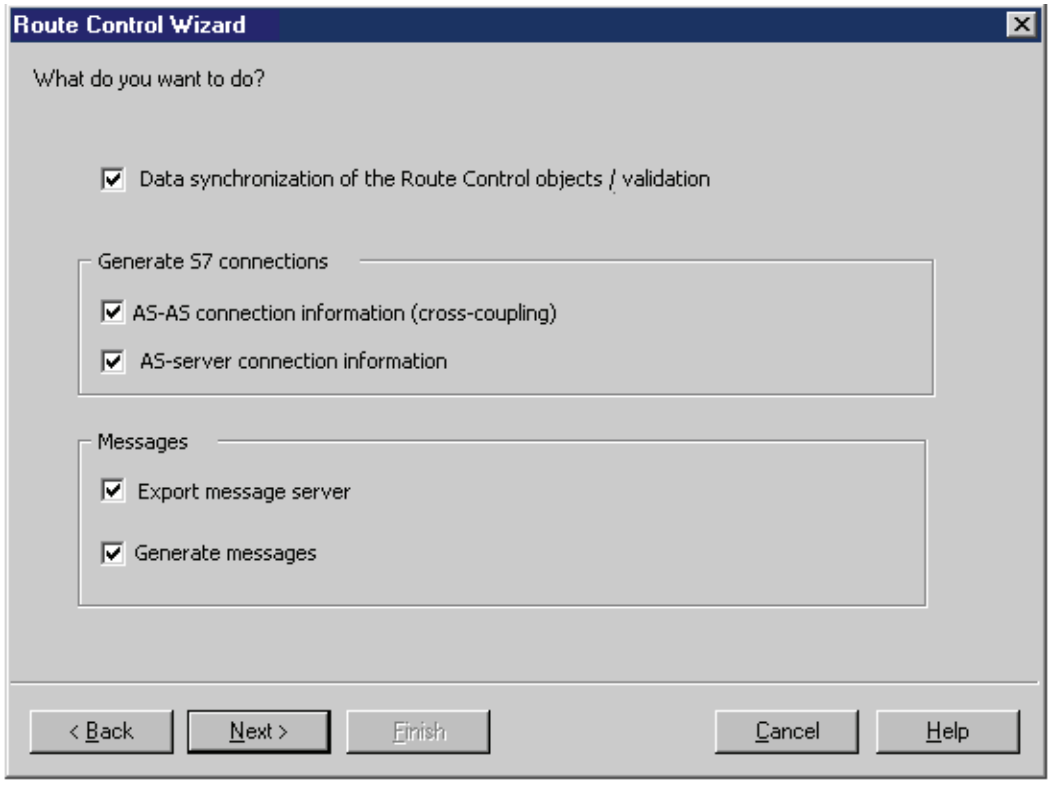
You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.

Procedure

1. Select the "Options > SIMATIC Route Control > Wizard" menu command.
   The Route Control Wizard opens.
2. The "Route Control Configuration" dialog box is opened if the Route Control does not yet contain a configuration for this S7 project.

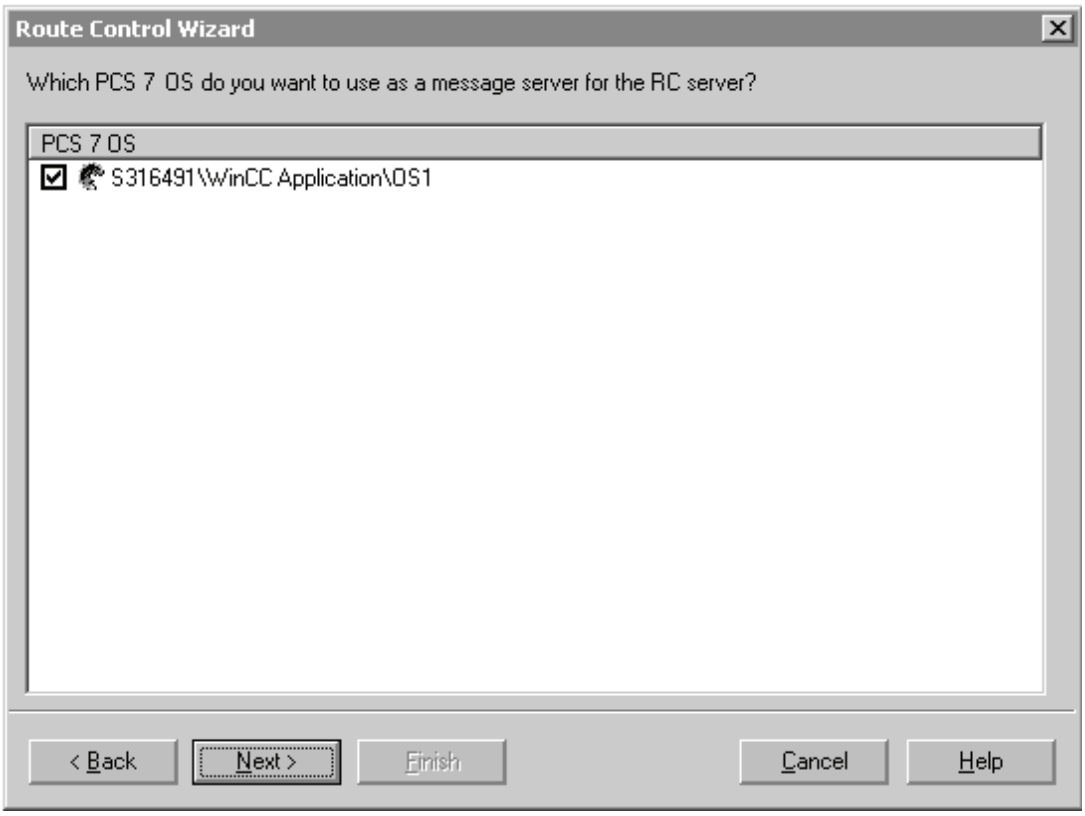


3. Click "Yes".
   The database is created.
   The data is read from the S7 project.
   The step for selecting the actions opens.



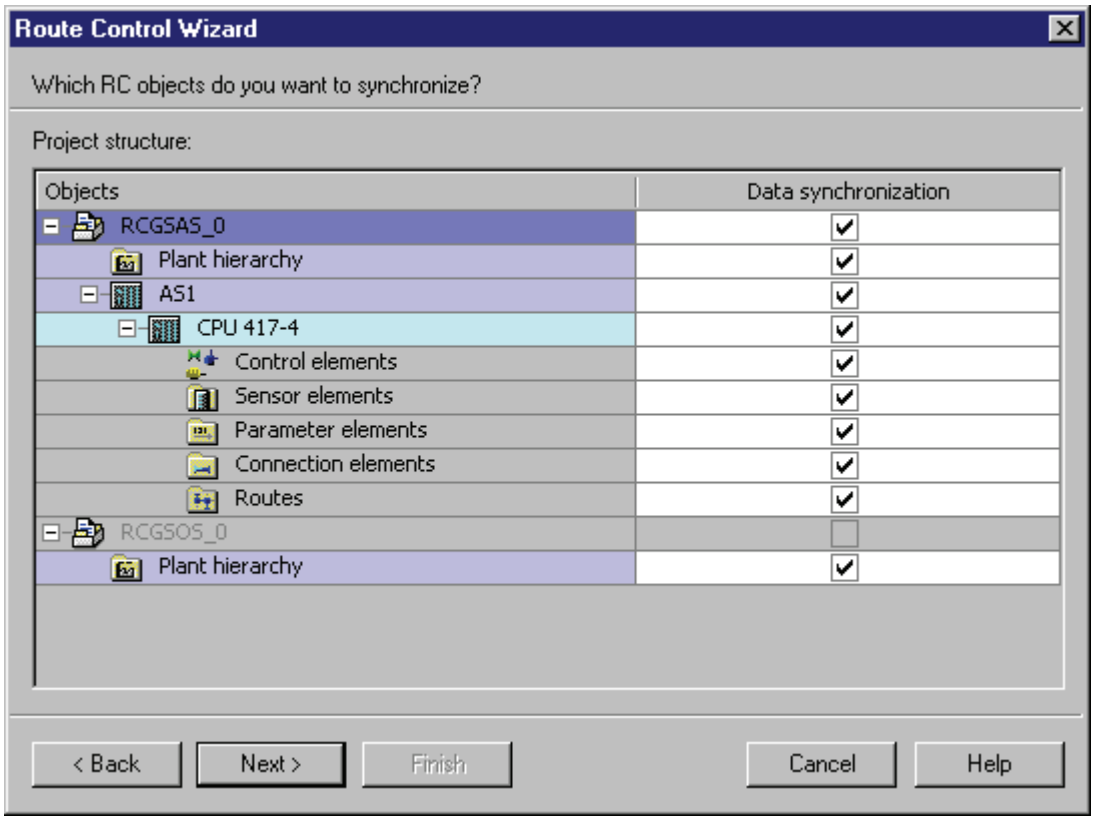
4. Activate all check boxes.

5. Click "Next".
   The step for selecting the message server opens.



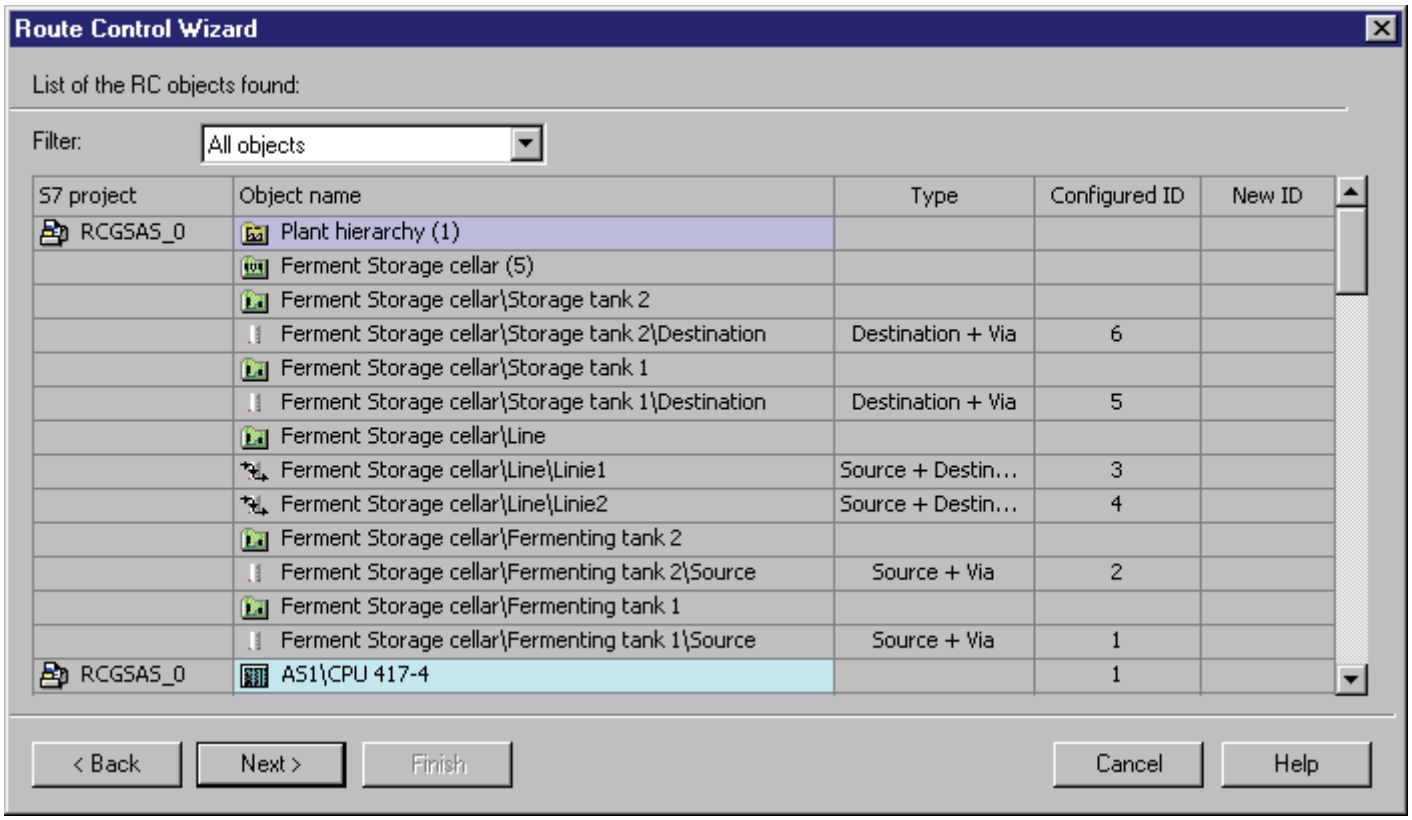
6. Activate the check box for the message server.

7. Click "Next".
   The step for selecting the objects opens.

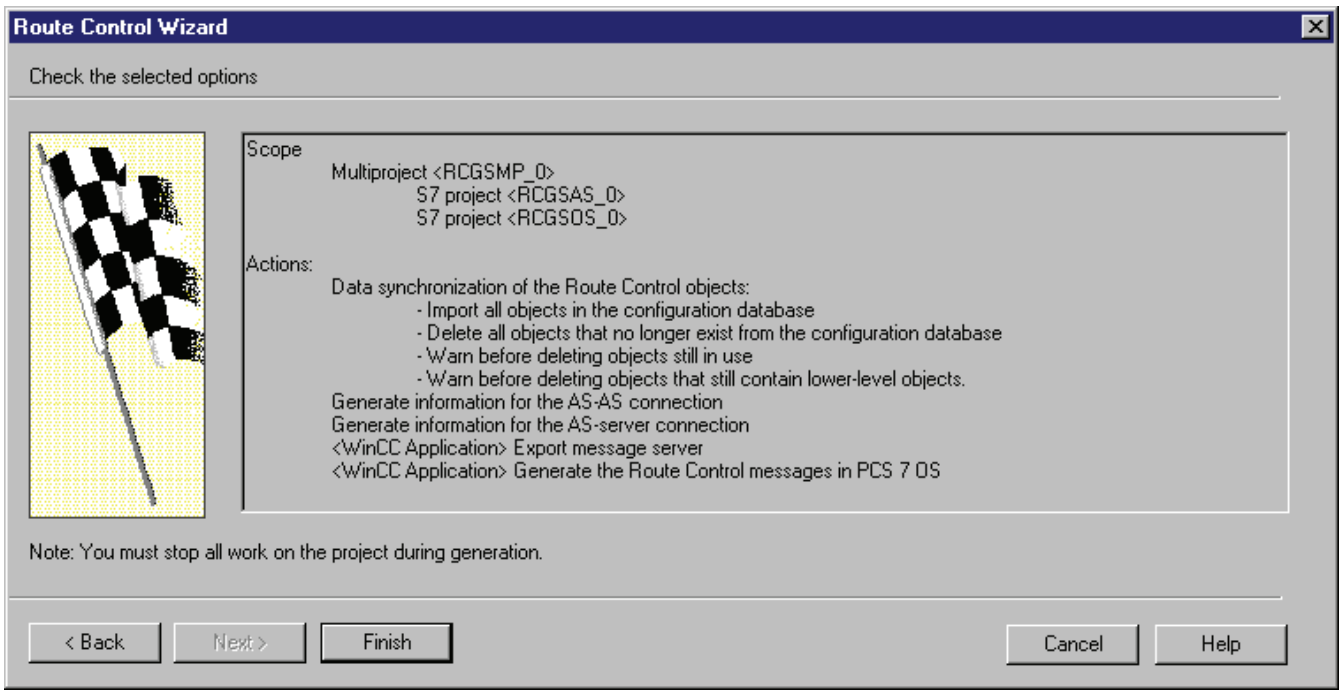


8. Activate all check boxes.

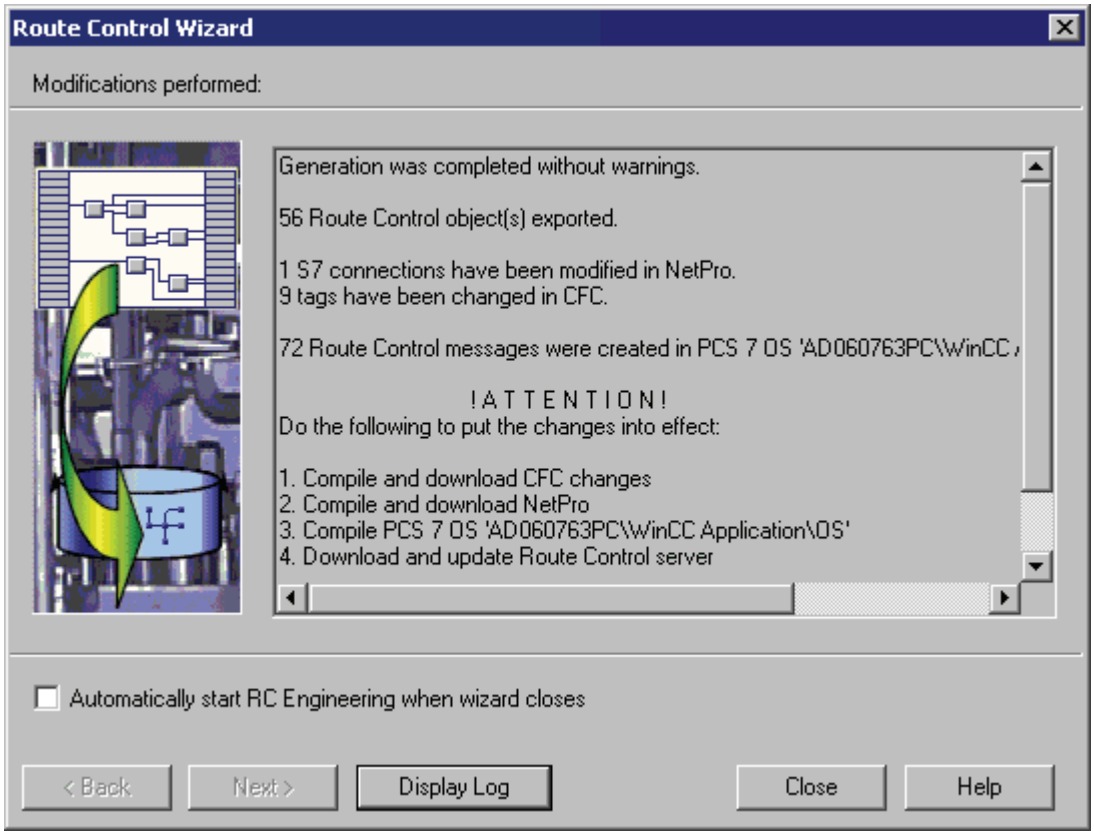
9. Click "Next".
   The list of objects found opens.



10. Click "Next".
    The step for displaying the selected options opens.



11. Click "Finish".
    The selected actions are executed.
    The step for displaying your changes opens.



12. Click "Show logs".
    The log file is opened in a text editor.
13. Check the log.
    You can also find this log in SIMATIC Manager via the menu

Note

You can also find this log in SIMATIC Manager via the menu "Options > SIMATIC Route Control > Show Wizard Log…" menu command.

14. Close the log file.
15. Click "Close".

Result

The selected actions were executed.

6.3 Configuring connections

Configuring the connection to the Route Control server

Communication between a Route Control AS and a Route Control server is implemented by means of S7-DOS functionality. The Route Control Wizard sets up all necessary connections in NetPro.

Conventions

- The AS to Server connection is created as S7-Connection.
- The Route Control Wizard sets all addressing parameters (partner address, connection resource) required for this S7-Connection.
- The Route Control Wizard activates the connection information in the Route Control configuration.
- The Route Control Wizard transfers the connection information to the "RC_IF_CFG" block.
- The Route Control server goes online to the AS during its startup.

6.4 Exercise for the configuration of connections

Exercise for the configuration of connections

Use the Route Control Wizard to set up the connection between the Route Control server and the AS.

Note

This exercise is optional as the Route Control Wizard has already created the connections.

Prerequisite

You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.

Procedure

1. Select the "Options > Configure network"menu command.
   NetPro opens.
2. Delete the connection between the Route Control server and the AS.
3. Save your changes and exit NetPro.
4. Select the "Options > SIMATIC Route Control > Wizard" menu command.
   The Route Control Wizard opens.
5. Click "Next".
6. Select the "AS-Server connection information" action and deactivate all other check boxes.
7. Run through all steps of the Route Control Wizard and then check the results of the actions you executed in the log file.
8. Close the log file and exit the Wizard.
9. Select the "Options > Configure network"menu command in SIMATIC Manager.
   NetPro opens.
10. Check the AS connections set up by the Route Control Wizard.
11. Select the "Network > Save and compile" menu command
    The "Save and compile" dialog box opens.
12. Activate the "Compile and check all" check box.
13. Click "OK".
    The "Consistency check" dialog box opens.
14. Close the "Consistency check" dialog box.
15. Close NetPro.

Result

You successfully configured the AS to Server connections and activated these in the Route Control configuration.

Plant structure under the aspect of Route Control

7

7.1 Locations

Locations

Locations are virtual elements of the route control system which are used to break down the plant into partial routes.

Starting with PCS7 V7.0, the locations are configured as equipment properties in the plant view of the S7 project and are then transferred to Route Control Engineering using the Route Control Wizard.

Locations in the Route Control Getting Started project

Locations required for the Route Control Getting Started project.

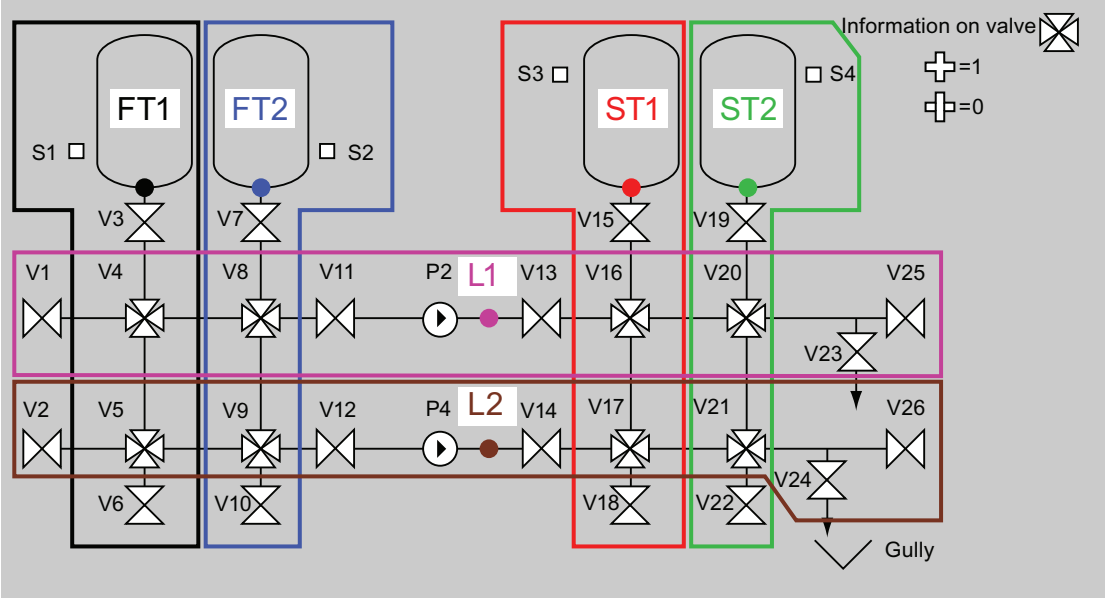


Figure 7-1 Locations and corresponding actuators / sensors

Table 7- 1 Locations and corresponding actuators / sensors:

Location	Meaning	Actuators / sensors
FT1	Fermenting Tank1	S1, V3, V4, V5, V6
FT2	Fermenting Tank2	S2, V7, V8, V9, V10
ST1	Storage Tank1	S3, V15, V16, V17, V18
ST2	Storage Tank2	S4, V19, V20, V21, V22

Location	Meaning	Actuators / sensors
L1	Line1	V1, V4, V8, V11, P2, V13, V16, V20, V23, V25
L1	Line2	V2, V5, V9, V12, P4, V14, V17, V21, V24, V26

7.2 Partial routes

Partial routes

You do not configure any routes in SIMATIC Route Control. Instead, you configure partial routes as connections between two locations. The partial routes form the route network. Runtime route requests contain the definition of the source and destination location. You can define up to 10 additional VIA locations. The Route Control server sets up the optimal route based on the available partial routes.

Each element to be used for material transport must be assigned to a partial route in your configuration.

Mode table

Each partial route is assigned to a Mode Table. A Mode Table contains 32 modes which you can name appropriately. Material transport is controlled in runtime by activating and deactivating modes. This functionality allows you to control and poll all elements of the partial routes of a route according to their configuration.

Priority

The partial routes are weighted by the priority class. Priority classes are defined as numbers ranging from 1 to 9999. Value 1 represents the highest weighting level. Routes and partial routes with high weighting are preferred for route searches.

Example:

The partial routes are assigned priorities as shown in the diagram below.

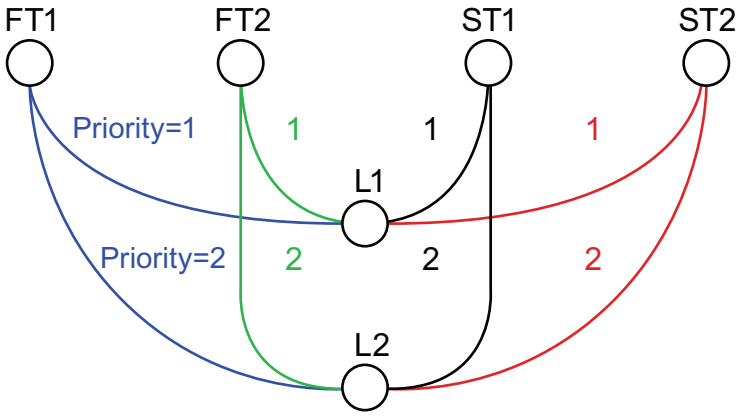


Figure 7-2 Priorities

Partial routes are always unidirectional. You have two options of setting up a route from FT1 to ST1. The route across VIA location L1 with overall priority class 2 and the route across VIA location L2 with overall priority class 4. The system would select the route via L1 with overall priority class 2.

Bidirectional

The "Bidirectional" parameter is not set when users create new partial routes. Unidirectional partial routes are always directed from the source to the destination. The direction of the partial route can be reversed by setting the Bidirectional parameter.

Source / destination

Always define different locations to the source and destination of partial routes.

Configure the following partial routes:

Table 7- 2 Partial routes

No.	Partial route name	Description
1	FT1_L1	Fermenting Tank1 to Line1
2	FT1_L2	Fermenting Tank1 to Line2
3	FT2_L1	Fermenting Tank2 to Line1
4	FT2_L2	Fermenting Tank2 to Line2
5	L1_ST1	Line1 to Storage Tank1
6	L1_ST2	Line1 to Storage Tank2
7	L2_ST1	Line2 to Storage Tank1
8	L2_ST2	Line2 to Storage Tank2

Route network with locations and partial routes:

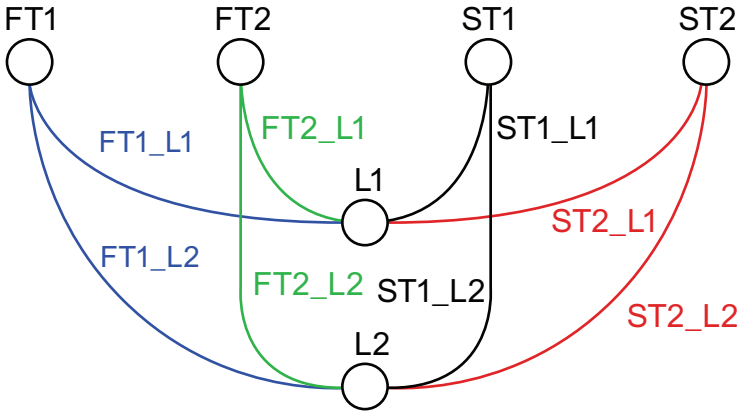


Figure 7-3 Route network

7.3 Mode table

The Mode Table

The mode tables are assigned the partial routes. Mode Tables are a means of structuring the partial routes in order to improve the overview. The Mode Table is a parameter which influences the route search. The route search includes all partial routes if input "MODE_TBL" = 0 at the "RC_IF_ROUTE" block. However, only the partial routes of this mode table are included if a specific ID is defined for route identification.

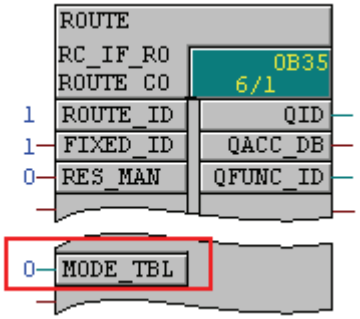


Figure 7-4 "Mode Table" parameter at the "RC_IF_ROUTE" block

Each Mode Table contains 32 modes. The modes are represented by 32 control bits which can be activated separately. These modes are used to activate all elements which are assigned to this mode in the partial routes. The modes can be assigned meaningful names in the Mode Table which can be visualized in runtime. Modes represent the actual control functions of a route. Each mode corresponds with one bit of a 32-bit control word (input "MODE" at "RC_IF_ROUTE"). Each mode can be assigned partial route elements with specific runtime properties. Activation of the mode always includes its elements.

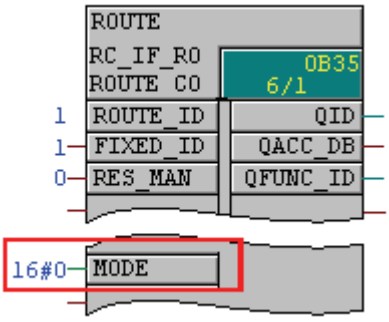


Figure 7-5 "Mode" parameter at the RC_IF_ROUTE block

7.4 Modes of the Getting Started project

Introduction

It is not useful to activate all control operations simultaneously when handling complex material transports which involve a large number of control elements. For this reason, the Mode Table contains 32 modes which can be activated and deactivated separately. Elements can be controlled in different ways in different modes.

Mode table

We shall define a Mode Table named "**Transfer**" in this Getting Started project.

Modes

As a rule you should always check the position of the valves before starting a material transport. This check is in actual fact prerequisite for the transfer.
This function is named "**Basic position**".

Verify that the corresponding valves are in open state before you start the pump. There should be a delay between the opening of the valves and activation of the pump. We shall now open all valves for the transport operation by calling the "**Set route**" function and activating the pump by calling the "**Pump On**" function.

The "**Set route**" function can always be used to activate the transport valves. Practical experience shows, however, that it is of advantage to activate the source and destination valves separately. For this reason we shall implement the "**Open Source**" and "**Open Destination**" functions.

The sensors for fill level evaluation are interconnected in separate functions:
"**Source not empty**" and "**Dest not full**".

These functions can be activated to suit application requirements and form the basis for the user program to be created.

7.5 Control tables

Control tables

The elements are to be activated in the corresponding modes as shown in the tables below. You need these tables for the exercise "Assigning Route Control elements to partial routes".

The activation key is defined as follows:

Table 7- 3 Activation key

Symbol	Meaning
a	Activation
d	Deactivation
?	Check
a?	Check for activated state
d?	Check for deactivated state

You can change the symbols in Route Control Engineering using the "Options > Symbols" menu commands.

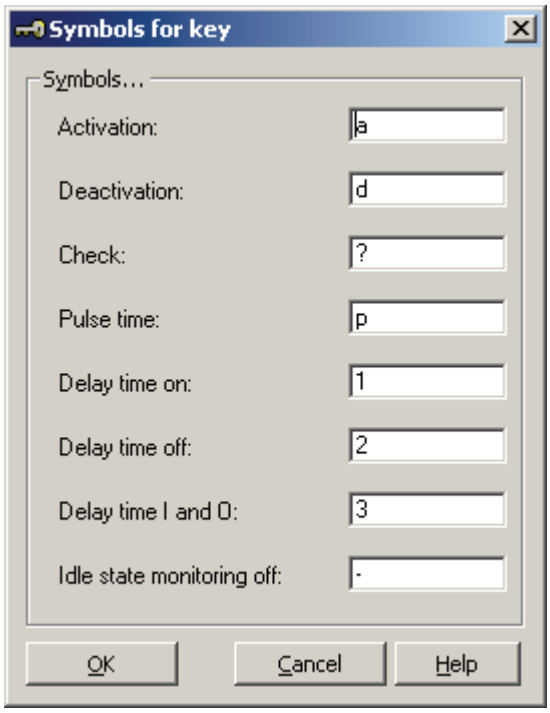


Figure 7-6 Key symbol

Activation table of partial route FT1_L1

Table 7- 4 Activation table FT1_L1

Element	Basic position	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S1						d?	
V3	d?			a			
V4	d?	a					
V5	d?						
V6	d?						
V1	d?						
V8	d?						
V11	d?	a					
P2	d?		a				
V13	d?	a					
V16	d?						
V20	d?						
V23	d?						
V25	d?						

Activation table of partial route FT1_L2

Table 7- 5 Activation table FT1_L2

Element	Basic position	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S1						d?	
V3	d?			a			
V4	d?						
V5	d?	a					
V6	d?						
V2	d?						
V9	d?						
V12	d?	a					
P4	d?		a				
V14	d?	a					
V17	d?						
V21	d?						
V24	d?						
V26	d?						

Activation table of partial route FT2_L1

Table 7- 6 Activation table FT2_L1

Element	Basic position	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S2						d?	
V7	d?			a			
V8	d?	a					
V9	d?						
V10	d?						
V1	d?						
V4	d?						
V11	d?	a					
P2	d?		a				
V13	d?	a					
V16	d?						
V20	d?						
V23	d?						
V25	d?						

Activation table of partial route FT2_L2

Table 7- 7 Activation table FT2_L2

Element	Basic position	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S2						d?	
V7	d?			a			
V8	d?						
V9	d?	a					
V10	d?						
V2	d?						
V5	d?						
V12	d?	a					
P4	d?		a				
V14	d?	a					
V17	d?						
V21	d?						
V24	d?						
V26	d?						

Activation table of partial route L1_ST1

Table 7- 8 Activation table L1_ST1

Element	Basic position	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S3							d?
V15	d?				a		
V16	d?	a					
V17	d?						
V18	d?						

Activation table of partial route L1_ST2

Table 7- 9 Activation table L1_ST2

Element	Basic position	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S4							d?
V19	d?				a		
V20	d?	a					
V21	d?						
V22	d?						

Activation table of partial route L2_ST1

Table 7- 10 Activation table L2_ST1

Element	Basic position	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S3							d?
V15	d?				a		
V16	d?						
V17	d?	a					
V18	d?						

Activation table of partial route L2_ST2

Table 7- 11 Activation table L2_ST2

Element	Basic position	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S4							d?
V19	d?				a		
V20	d?						
V21	d?	a					
V22	d?						

Route Control Engineering

8

8.1 Exercise for the configuration of locations

Introduction

The locations are created in SIMATIC Manager as equipment properties in the plant hierarchy of the S7 project. These locations are exported from the S7 project and imported to the Route Control Engineering database using the Route Control Wizard.

Prerequisites

- You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.
- Plant view is activated.
  You activate this under the menu item "View > Plant view".

Equipment properties

Start by defining the equipment property types in the shared declarations. A location represents an instance of one of these types in the equipment properties of the PH. The following equipment property types, including their instances, must be created for the project.

Table 8- 1 Equipment property types

Name	Data type	Source	Destination	Via
Destination	LOCATION		x	x
Line1	LOCATION	x	x	x
Line2	LOCATION	x	x	x
Source	LOCATION	x		x

Table 8- 2 Instances of the equipment property types

OH folder name	S88 Type Definition	Equipment properties
Fermenting tank 1	Unit	Source
Fermenting tank 2	Unit	Source
Line	Unit	Line1, Line2
Storage tank 1	Unit	Destination
Storage tank 2	Unit	Destination

How to define the location types

1. Select the "Object properties" command from the shortcut menu of the "Ferment Storage cellar" folder in the partial project "RCGSAS_0".
   The "Properties - Hierarchy folder" dialog box opens.
2. Select the "S88 Type Definition" tab.
3. Select the "Plant" entry from the "Object type" drop-down list box.

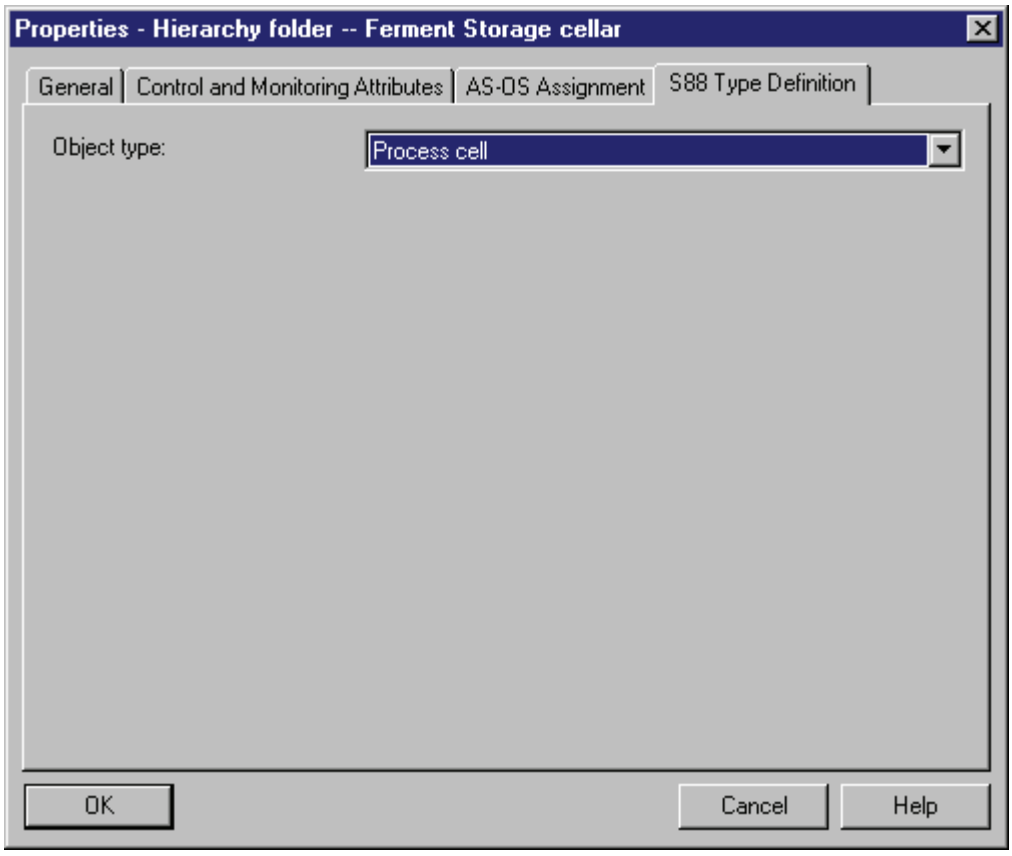
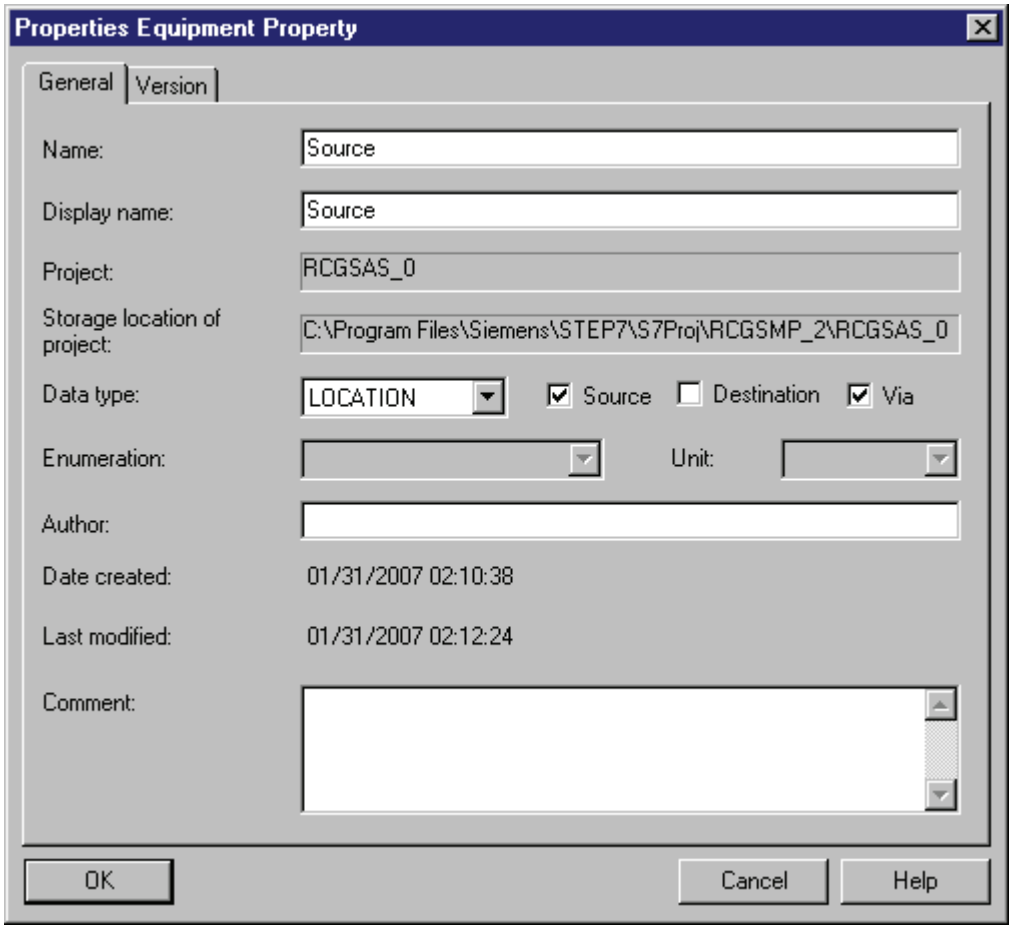


Figure 8-1 S88 Type Definition

4. Right-click the "OK" button.
5. Open the object properties of the "Fermenting_cellar > Fermenting tank1" folder.
6. Set the "Unit" object type in the "S88 Type Definition" tab.
7. Click "OK".
8. Set the unit type definition at the "Fermenting cellar > Fermenting tank2", "Line >Line", "Storage cellar > Storage tank1" and "Storage cellar > Storage tank2" folders.
9. Select the "Insert new object > Equipment properties" command from the shortcut menu of the "Shared Declarations" folder in the partial project "RCGSAS_0".
   The "Equipment properties" dialog box opens.
10. Select the "Insert new object > Equipment properties" command from the shortcut menu of the new "Equipment properties" folder.
    A new object is created.

11. Repeat step 10 three times.
    You have now created four objects.
12. Select the "Equipment properties" command from the shortcut menu of the new "Equipment properties1" object.
    The "Properties - Equipment properties" dialog box opens.
13. Enter the following names:
    Name: "Source"
    Data type: "LOCATION", Source: activated, Dest: deactivated, Via: activated.



14. Click "OK".
15. Enter the following data in the object properties of the new "Equipment properties2" object:
    Name: "Destination"
    Data type: "LOCATION", Source: deactivated, Dest: activated, Via: activated.
    Click "OK".

16. Enter the following data in the object properties of the new "Equipment properties3" object:
    Name: "Line1"
    Data type: "LOCATION", Source: activated, Dest: activated, Via: activated.
    Click "OK".
17. Enter the following data in the object properties of the new "Equipment properties4" object:
    Name: "Line2"
    Data type = "LOCATION", Source: activated, Dest: activated, Via: activated.
    Click "OK".

How to enter the locations

1. Select the "Insert new object > Equipment properties" command from the shortcut menu of the "Fermenting tank1" folder.
   The "Equipment properties" dialog box opens.
2. Select the "Insert new object > Equipment properties" command from the shortcut menu of the new "Equipment properties" folder.
   The new "Equipment property" object is created.

3. Open the object properties of "Equipment property" and select the "Source" entry from the Name field.

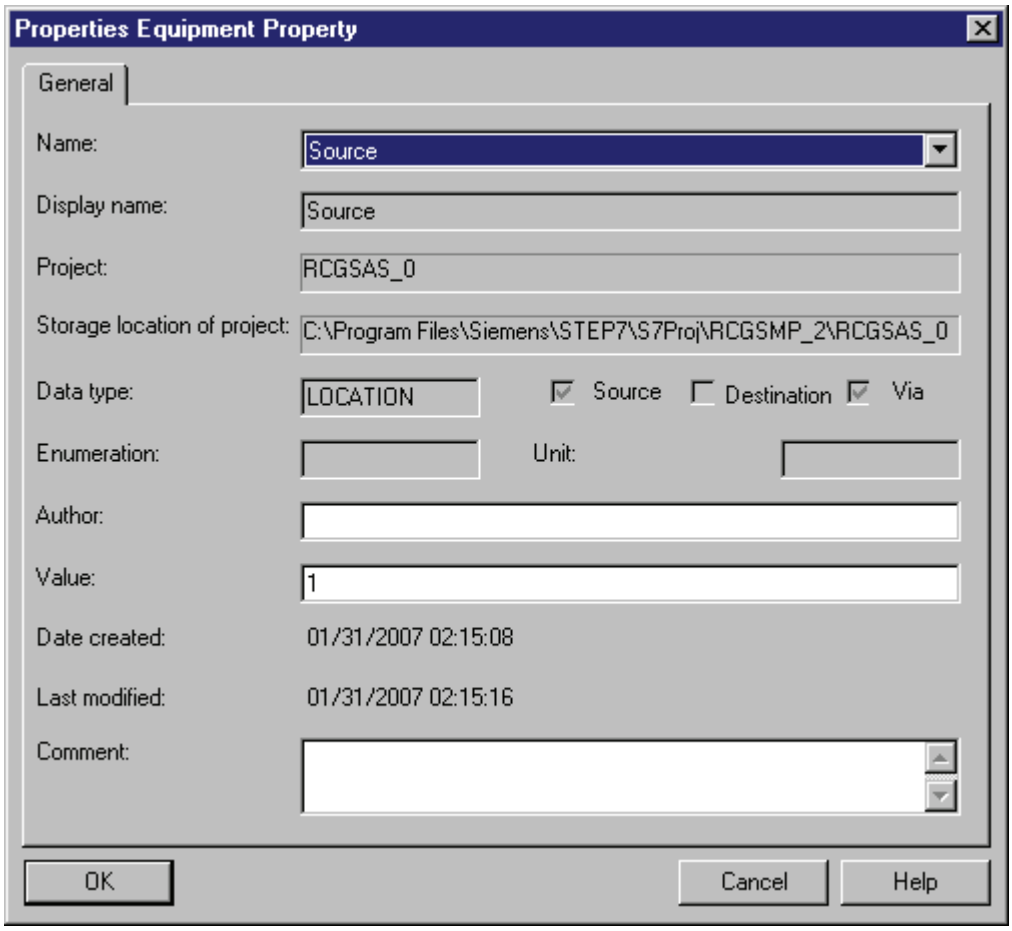


Figure 8-2 Source properties

4. Click "OK".
   Your entries are activated.
5. Configure all locations listed in the "Instances of equipment properties" table above in the same way.
6. Export and import the data using the Route Control Wizard as described in chapter 6.2.

Result:

You successfully configured the following equipment properties:

Name	Data type	Source	Destination	Via
Source	LOCATION	x		x
Destination	LOCATION		x	x
Line1	LOCATION	x	x	x
Line2	LOCATION	x	x	x

Results in SIMATIC Manager:

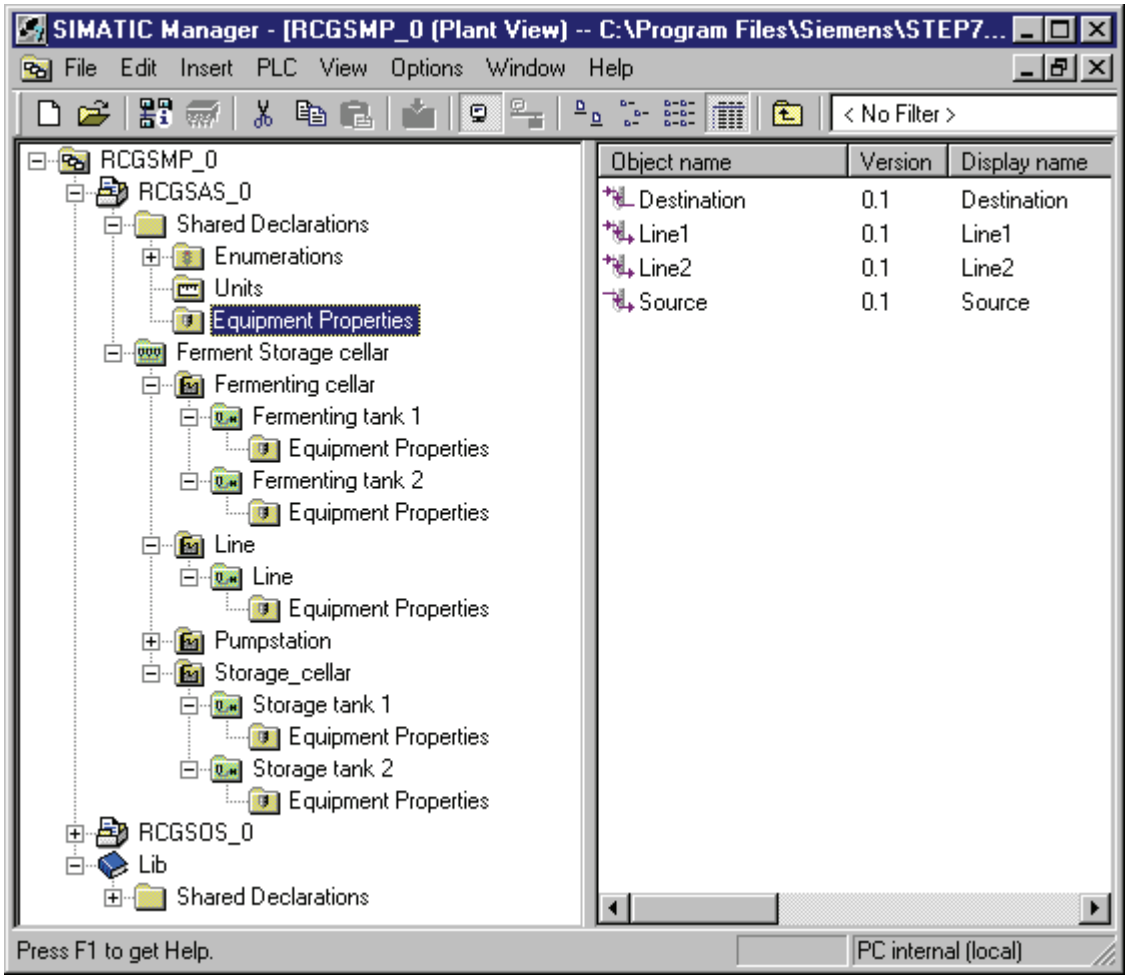


Figure 8-3 Results in SIMATIC Manager 1

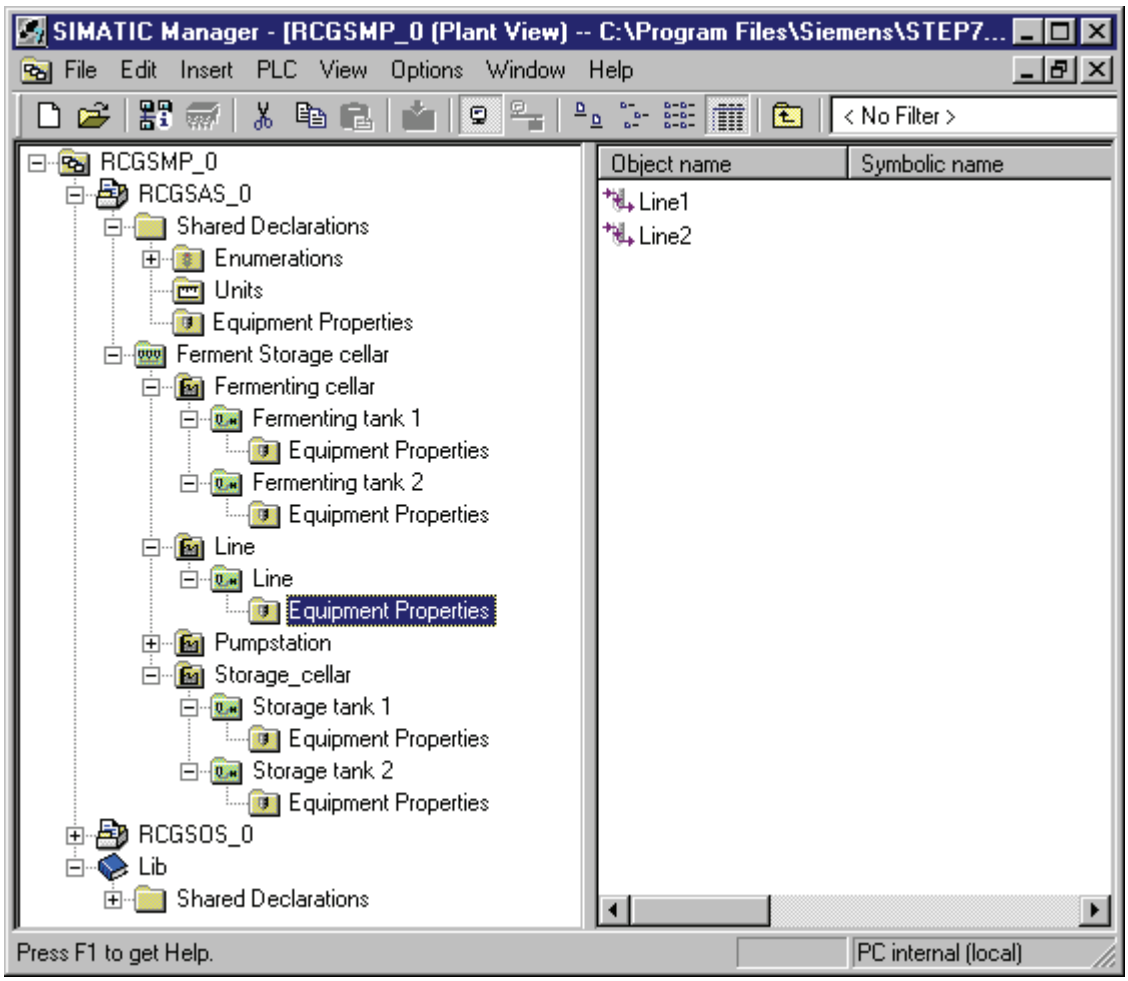


Figure 8-4 Results in SIMATIC Manager 2

Result in Route Control Engineering:

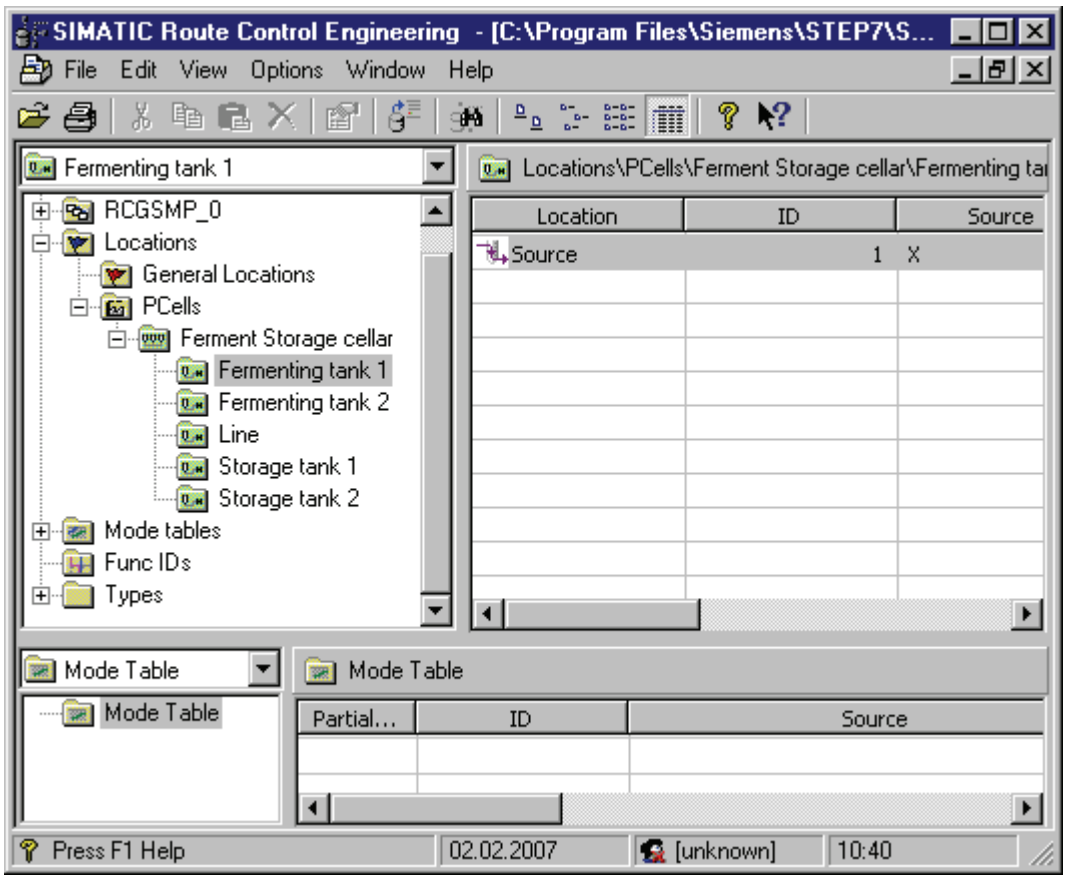


Figure 8-5 Result in Route Control Engineering

8.2 Exercise with the mode table

Task

Configure a Mode Table named "Transfer".

Prerequisite

Route Control Engineering of the "RCGSMP_0" project was opened.

Modes of the "Transfer" Mode Table

The table below shows the modes which should be provided in the Mode Table:

Table 8- 3 Mode table functions

No.	Function
1	Basic setting
2	Set route
3	Pump on
4	Open source
5	Open destination
6	Source not empty
7	Dest not full

Procedure

1. Expand the Mode Tables folder.
2. Select the "Rename" command from the shortcut menu of the "Mode Table" folder.
3. Change the name to "Transfer".
4. Select the "Rename" command from the shortcut menu of "Mode 1" in the "Transfer" table.
5. Change the name to "Basic position".
6. Rename "Mode 2" to "Mode 7" in accordance with the table "Modes of the Mode Table" shown above.

Result

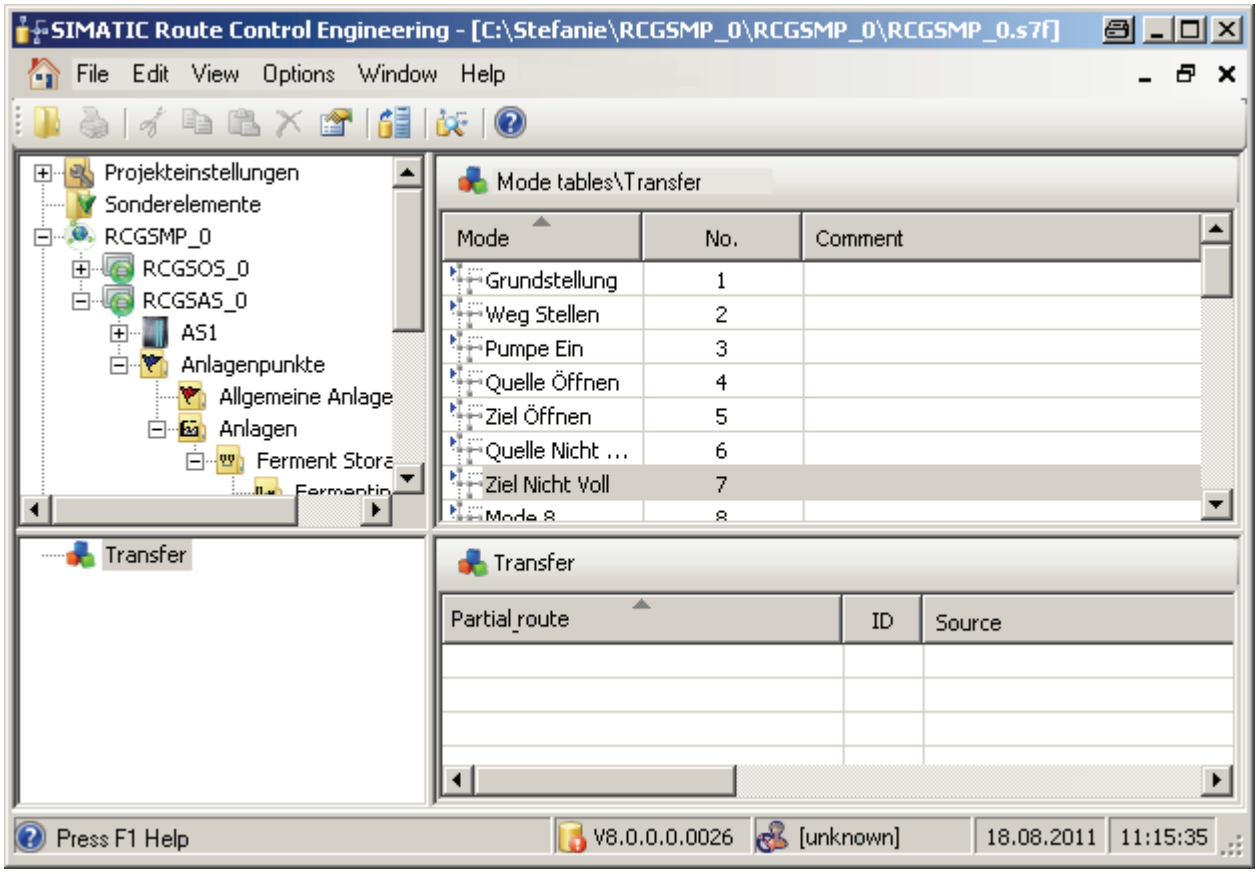


Figure 8-6 "Transfer" Mode Table

8.3 Exercise in configuring partial routes

Task

Configure the partial routes as required.

Prerequisite

Route Control Engineering of the "RCGSMP_0" project was opened.

The partial routes listed below are to be created for the Transfer Mode Table:

Table 8- 4 Partial routes

Partial route name	Source	Destination
FT1_L1	Fermenting tank 1/Source	Line/Line1
FT1_L2	Fermenting tank 1/Source	Line/Line2
FT2_L1	Fermenting tank2/Source	Line/Line1
FT2_L2	Fermenting tank2/Source	Line/Line2
L1_ST1	Line/Line1	Storage tank 1/Destination
L1_ST2	Line/Line1	Storage tank 2/Destination
L2_ST1	Line/Line2	Storage tank 1/Destination
L2_ST2	Line/Line2	Storage tank 2/Destination

Procedure

1. Select the "Add partial route" command from the shortcut menu of the "Transfer" folder in the lower half of Route Control Engineering.

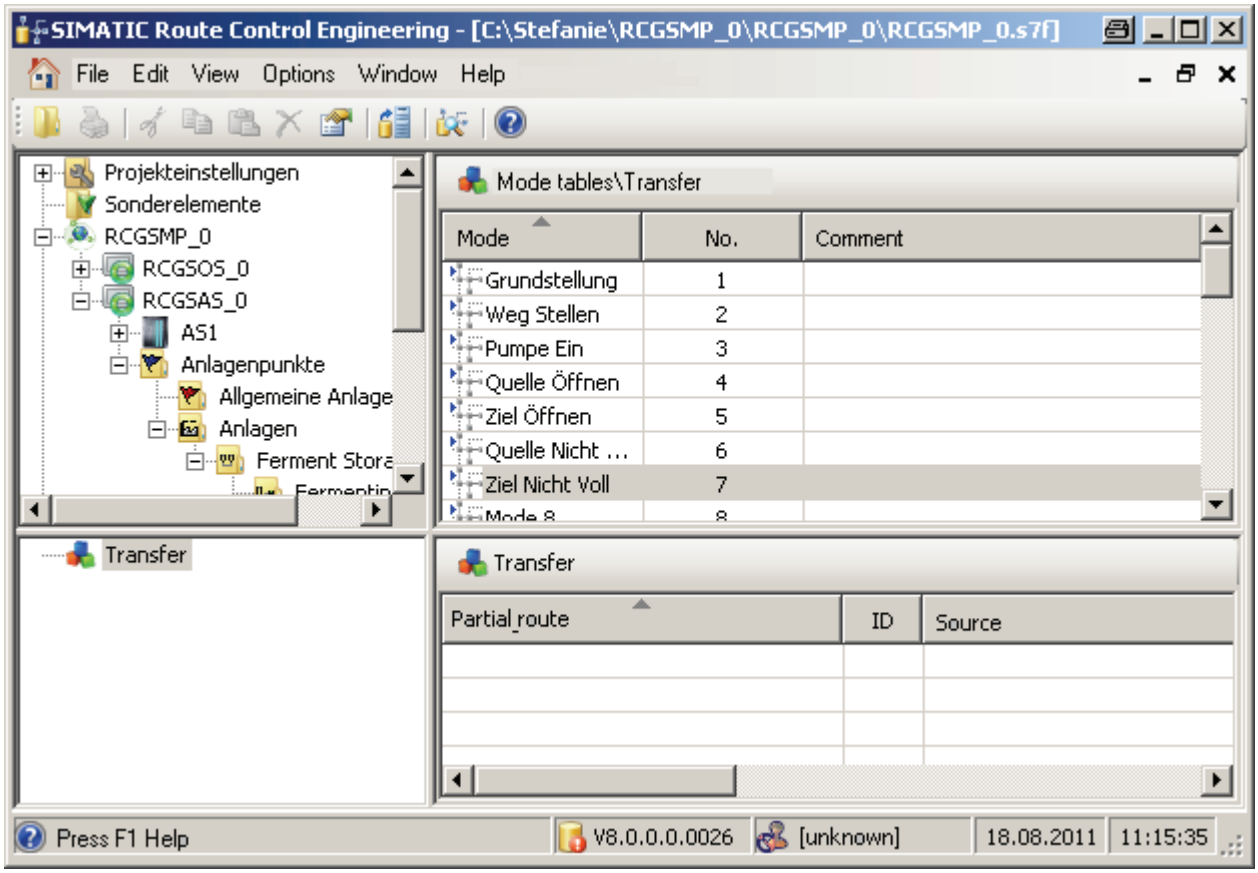


Figure 8-7 Adding new partial routes

2. Enter the name "FT1_L1" in the "Properties" dialog box.

3. Select the source "Fermenting tank 1/Source".
4. Select the destination "Line/Line1".

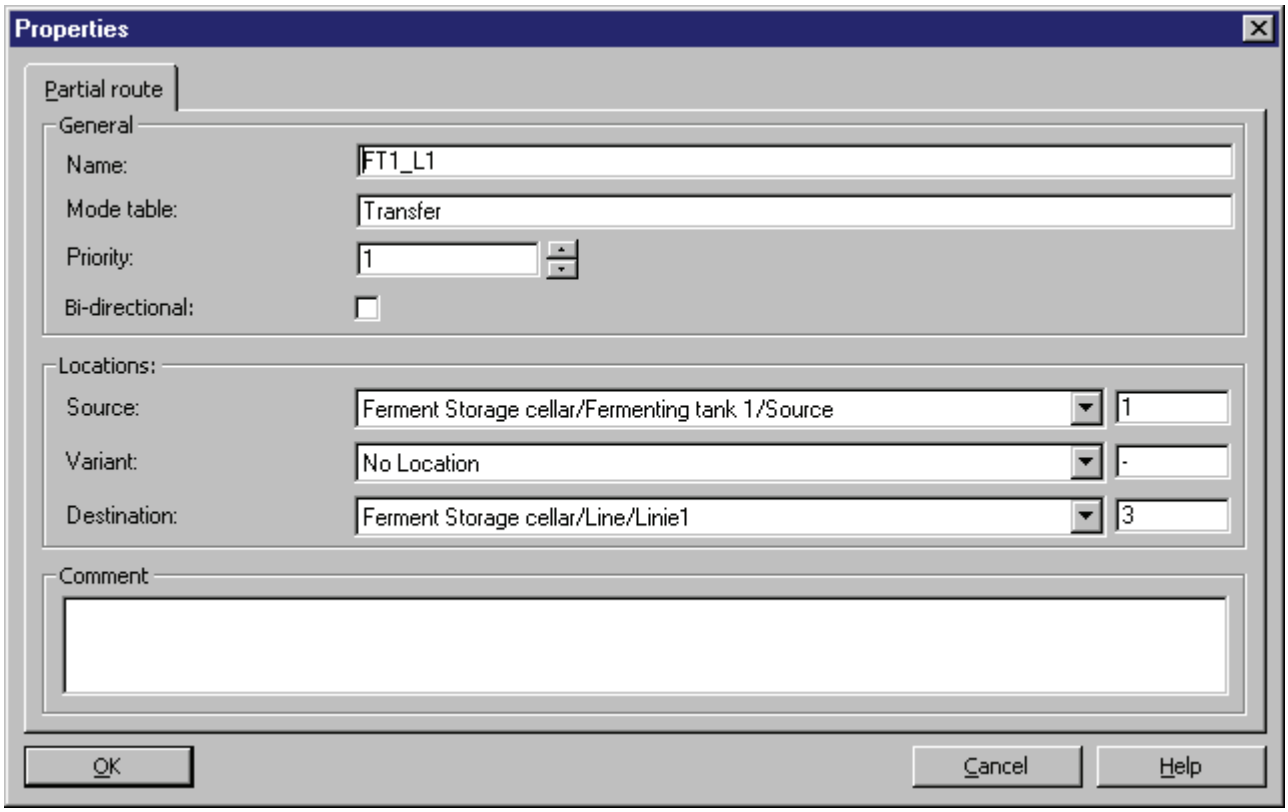


Figure 8-8 Properties of a partial route

5. Click "OK".
   Your entries are activated.
6. Configure all partial routes according to the table shown above.

Result

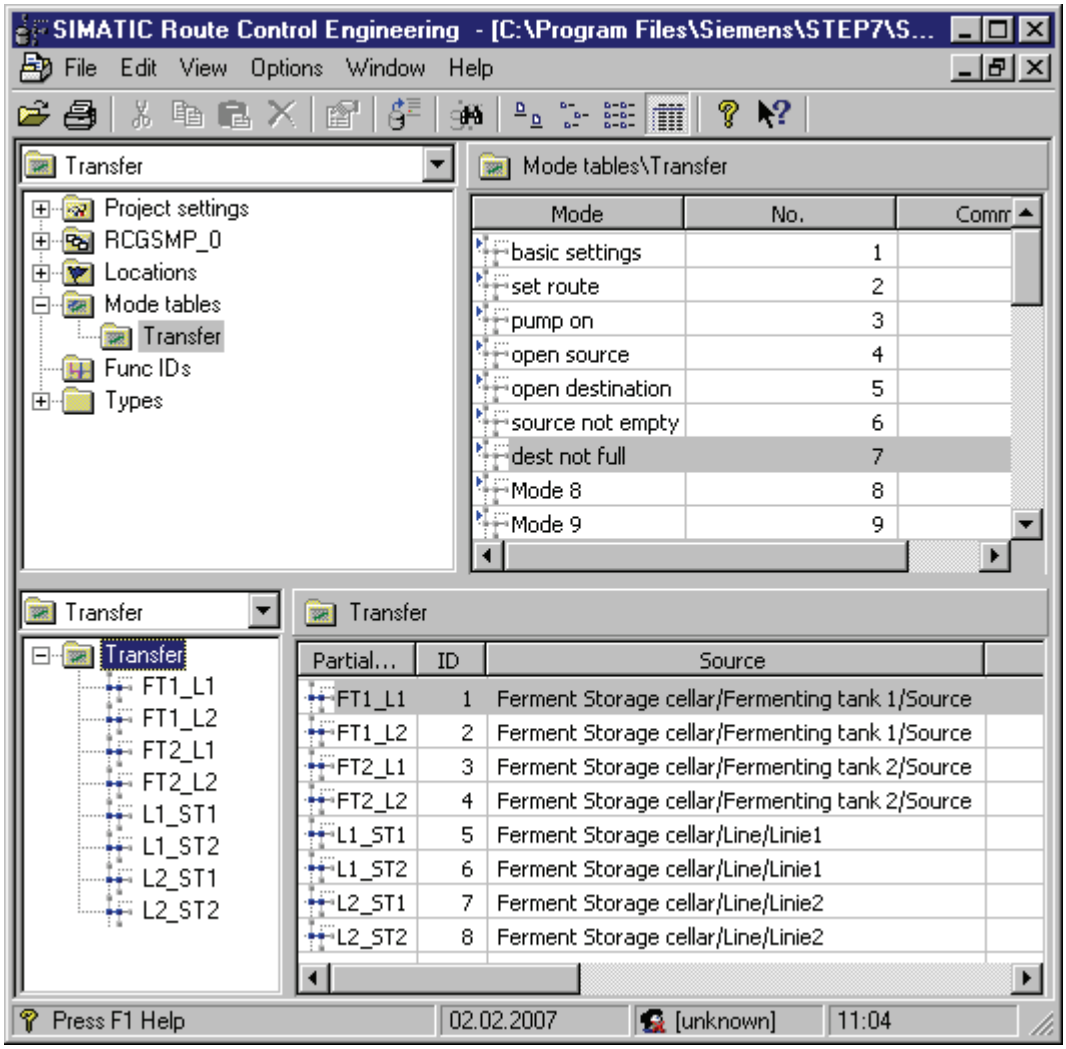


Figure 8-9 Result of Add partial routes

Note

If you start by programming the source and the destination in the properties of a partial route, the system proposes a name which is derived from the source and the destination.

8.4 Exercise in assigning Route Control elements to the partial routes

Task

Assign the control elements, sensor elements, parameter elements and connection elements to the partial routes. Refer to the information in the "Activation tables" section.

Prerequisite

Route Control Engineering was opened.

Procedure

1. Select the partial route "FT1_L1" in the bottom section of Route Control Engineering.
2. Select the "Elements" tab.
3. Drag-and-drop valve "V3" to the "Elements" table.

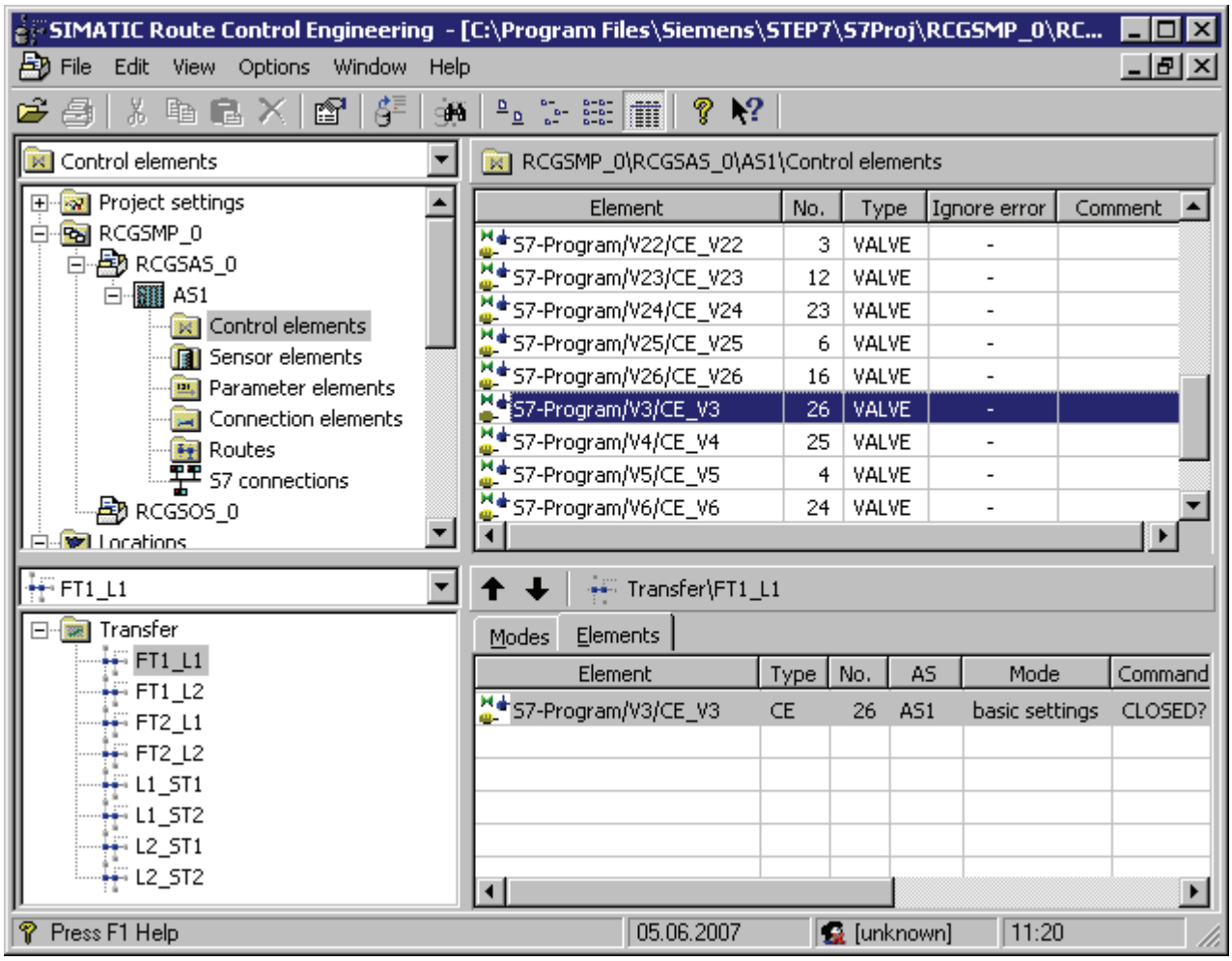


Figure 8-10 Assignment of control elements to the partial routes

4. Program the object properties for the activation of valves as follows:

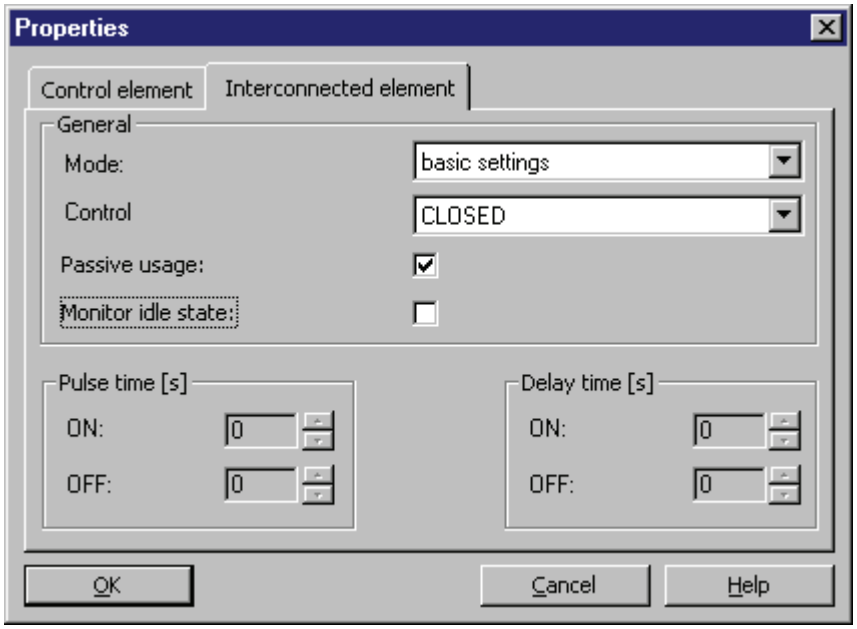


Figure 8-11 Activation of the valves

5. Configure the elements of all partial routes in accordance with the "Activation tables".

Note

You can also copy and then edit partial routes and their assigned elements.

8.5 Exercise in loading and updating the Route Control Server

Task

- Program your runtime parameters so that the Route Control Server starts up independent of WinCC.
- Starting, loading and updating the Route Control Server

Prerequisite

Route Control Engineering was opened.

How to program the runtime parameters

1. Click the "Project Settings > Runtime Parameters > General" folder in Route Control Engineering.

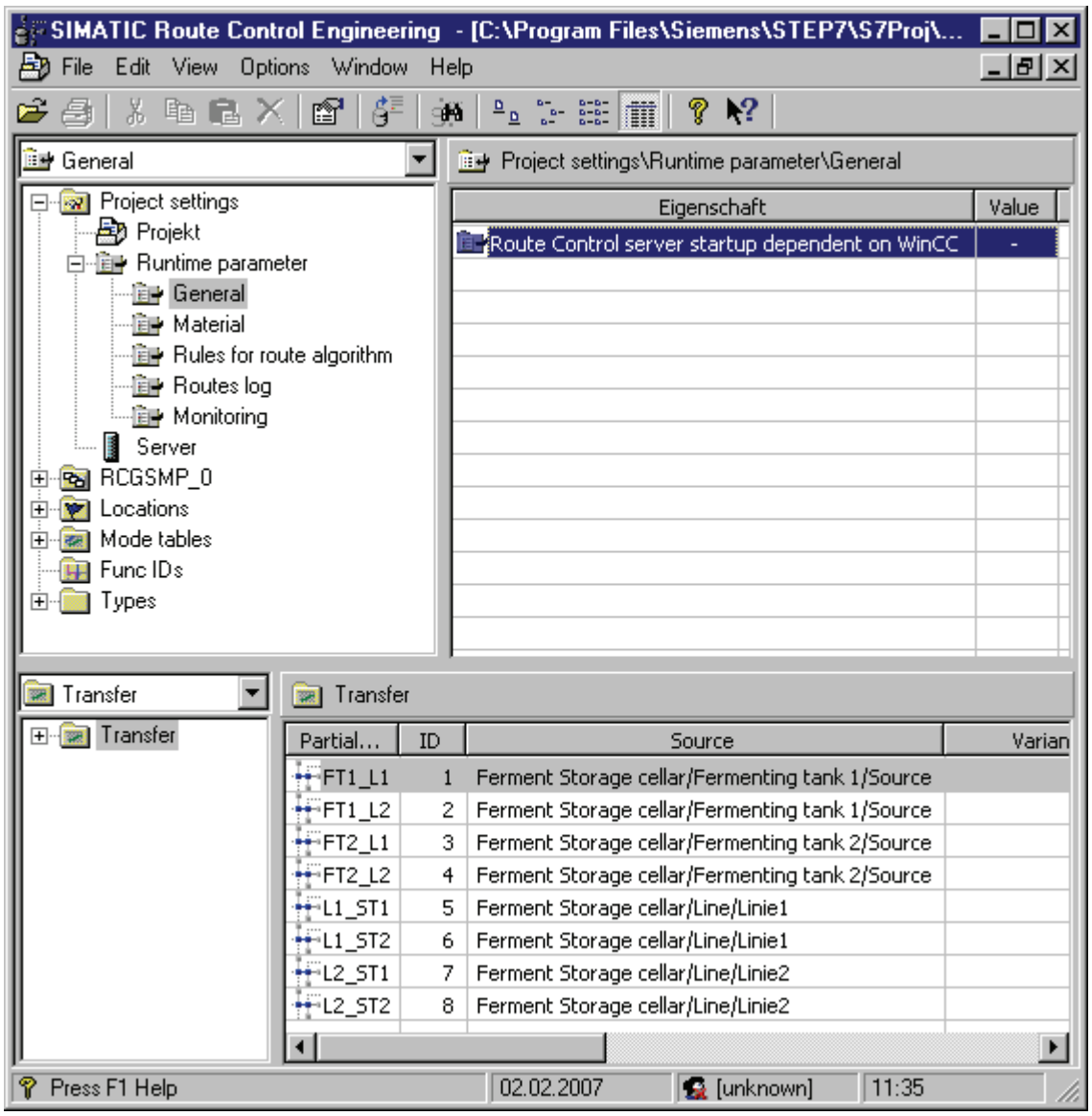


Figure 8-12 Image: Route Control Engineering

2. Double-click the "Route Control Server startup depending on WinCC-Runtime" entry in the "Properties" list.
The "Properties" dialog box opens.

3. Deactivate the "Value" check box.

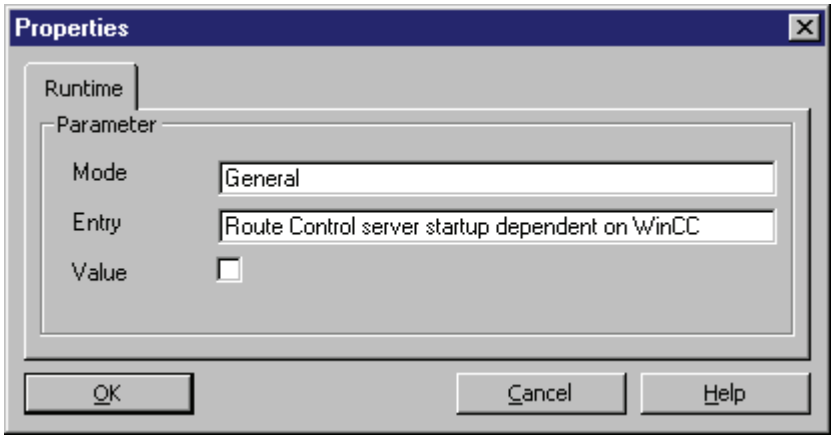


Figure 8-13 Image: WinCC check box

4. Click "OK".
   The Route Control Server is started independent of WinCC.

Starting the servers

1. Select the "Start > SIMATIC > ROUTE CONTROL > Server" menu command.
   The Route Control Server is started and displayed as icon in the task bar.

How to load and activate the server

1. Select the "Options > Load Server" menu command in Route Control Engineering.
   The "Load Server" dialog box opens.
2. Click "Start".
   The server is loaded.
3. Click "OK" in the next dialog box.
   The dialog box is closed.

4. Select the "Start > SIMATIC > ROUTE CONTROL > Center" menu command.
   The Route Control Center opens.

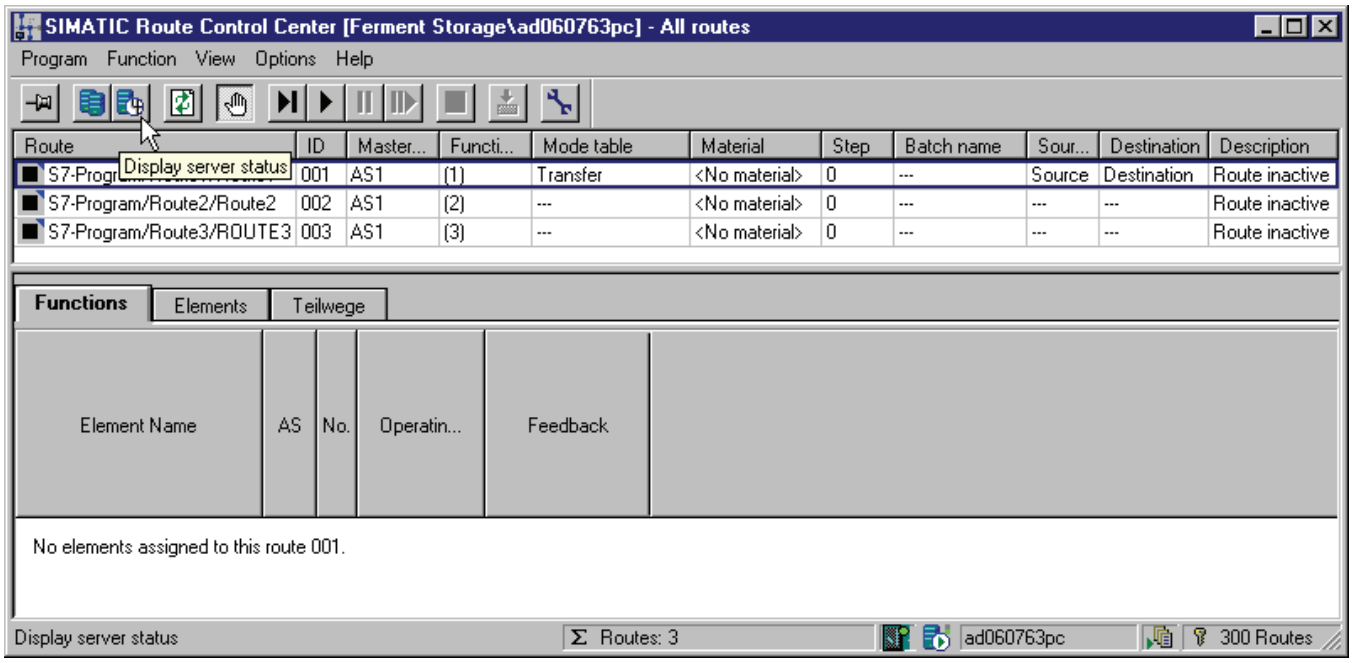


Figure 8-14 Image: Displaying the server status

5. Click the icon  in the Route Control Center.
   The "SIMATIC RC Server" dialog box opens.
6. Click "Update".
   The "Update SIMATIC RC Server" dialog box opens.
7. Click "OK".
   The Route Control Server is updated.
8. Click "Close".

Result

The Route Control Server is updated and up.

8.6 Exercise in checking routes in offline mode

Introduction

Use the "offline" route search functions in order to check routes configured offline in Route Control Engineering before you download these to the server. The search tool does not access the Route Control Server in offline mode.

Prerequisite

Route Control Engineering of the "RCGSMP_0" project was opened.

Procedure

1. Select the "Options > Check Route" menu command in Route Control Engineering. The "Route Control route check" dialog box opens.
2. Select the "Transfer" entry from the "Mode Table" drop-down list box.
3. Activate the "Find all routes between source nad target" check box.
4. Select the "Fermenting tank 1" entry from the "Source" drop-down list box.
5. Select the "Storage tank 2" entry from the "Destination" drop-down list box.

6. Click "Start".
   The search tool finds tow possible routes.
7. Click .
   The partial route details of a route are displayed.

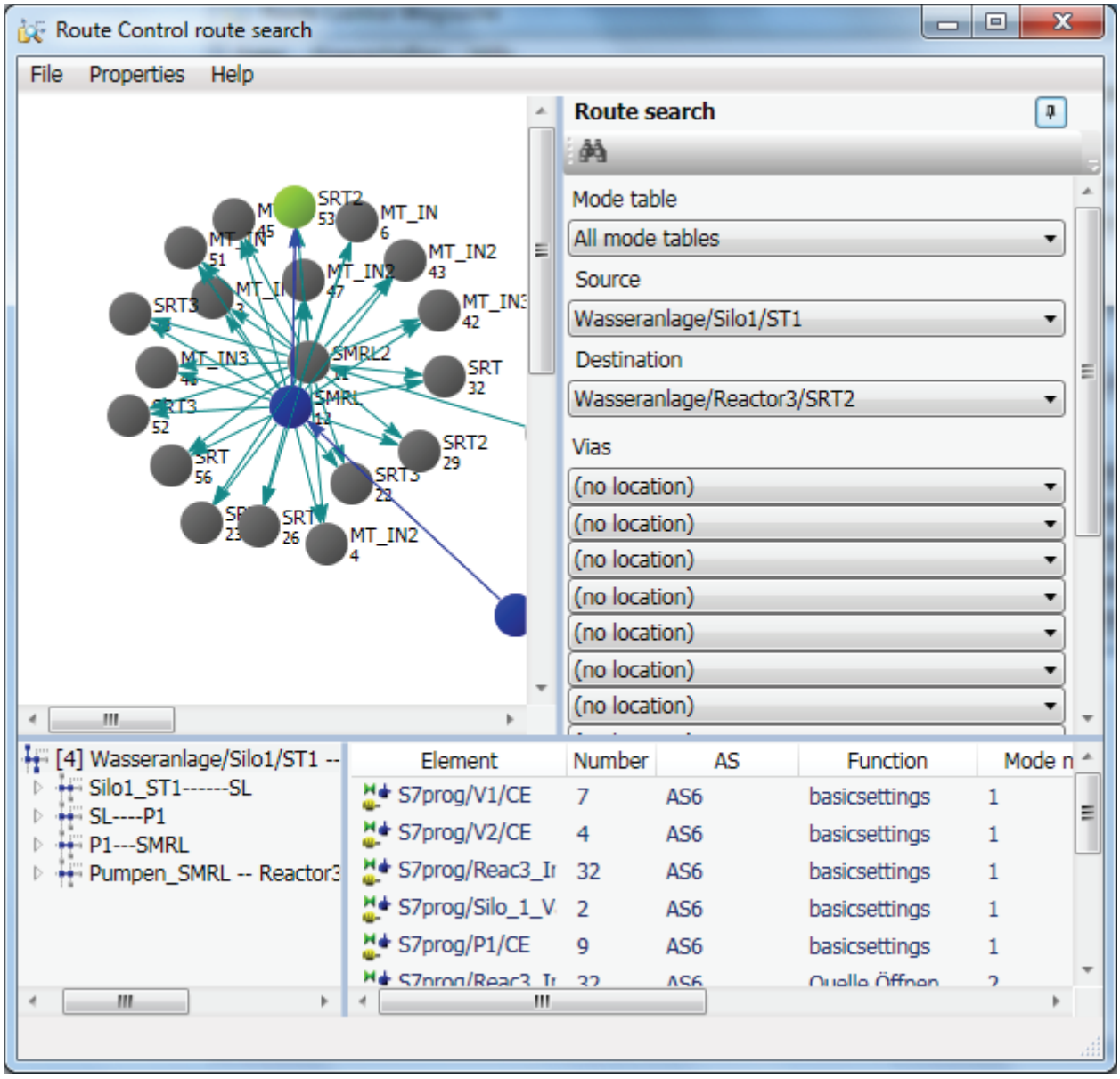


Figure 8-15 Route check

8.7 Materials and material successors

Introduction

Route Control Engineering allows you to create materials and to configure the material sequence. Example: a piping system which was cleaned with a caustic solution must be neutralized with water. You can configure this rule in the Route Control Engineering. The materials can be allocated to groups.

Engineering

The following material groups and materials are to be used:

Material group	Material name
Raw materials	Raw Material1
	Raw Material2
Products	Product1
	Product2
Cleaners	Cleaner1
	Cleaner2
Water	Water1
	Water2

Observe the following predecessor / successor relationships of the material groups:

Predecessor	Successor
Products	Cleaners
	Products
Raw materials	Cleaners
	Raw materials
Cleaners	Water
Water	Cleaners
	Products
	Raw materials

Note

The runtime user program can transfer the requested new material **prior** to the route request. The new material is included in the route search and is checked whether or not it is a valid successor material.

8.8 Exercise in the configuration of materials and material successions

Exercise in the configuration of materials and material successions

Configure the materials, the material groups, and the material successors.

Prerequisite

Route Control Engineering was opened.

Procedure

1. Select the "Options > Material > Configure Material..." menu command in Route Control Engineering.
   The "Material Configuration" dialog box opens.

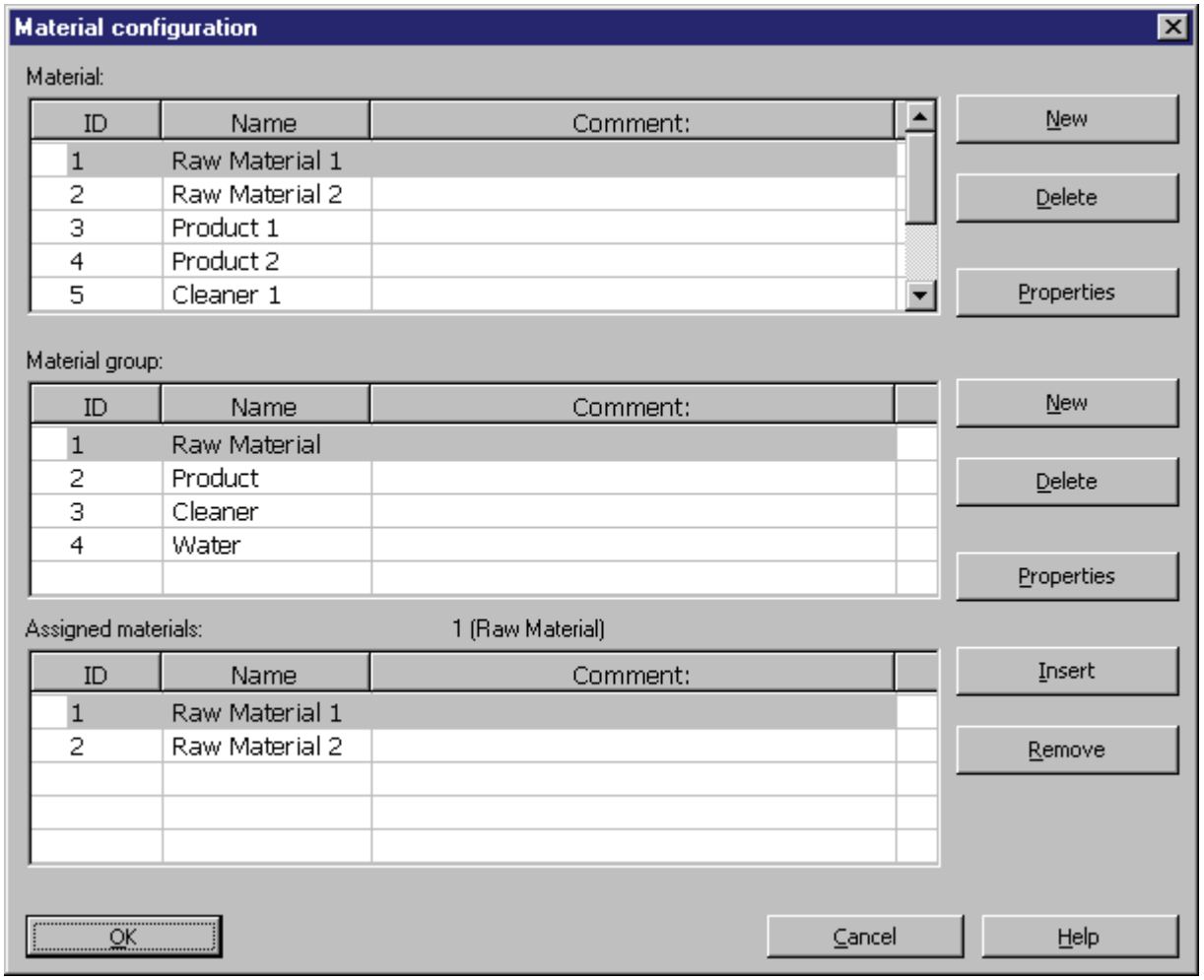


Figure 8-16 Materials

2. Setup all materials in the "Material" table using the "New" button.

3. Setup all material groups in the "Material group" table using the "New" button.
4. Select the "Cleaner" group from the the "Material group" table.
5. Assign the "Cleaner1" and "Cleaner2" materials in the "Assigned Materials" table using the "Insert" button.
6. Assign all materials to their material groups in the same way.
7. Exit this dialog with "OK".
8. Select the "Options > Material > Configure Material Sequences..." menu command in Route Control Engineering.
   The "Material Successor" dialog box opens.

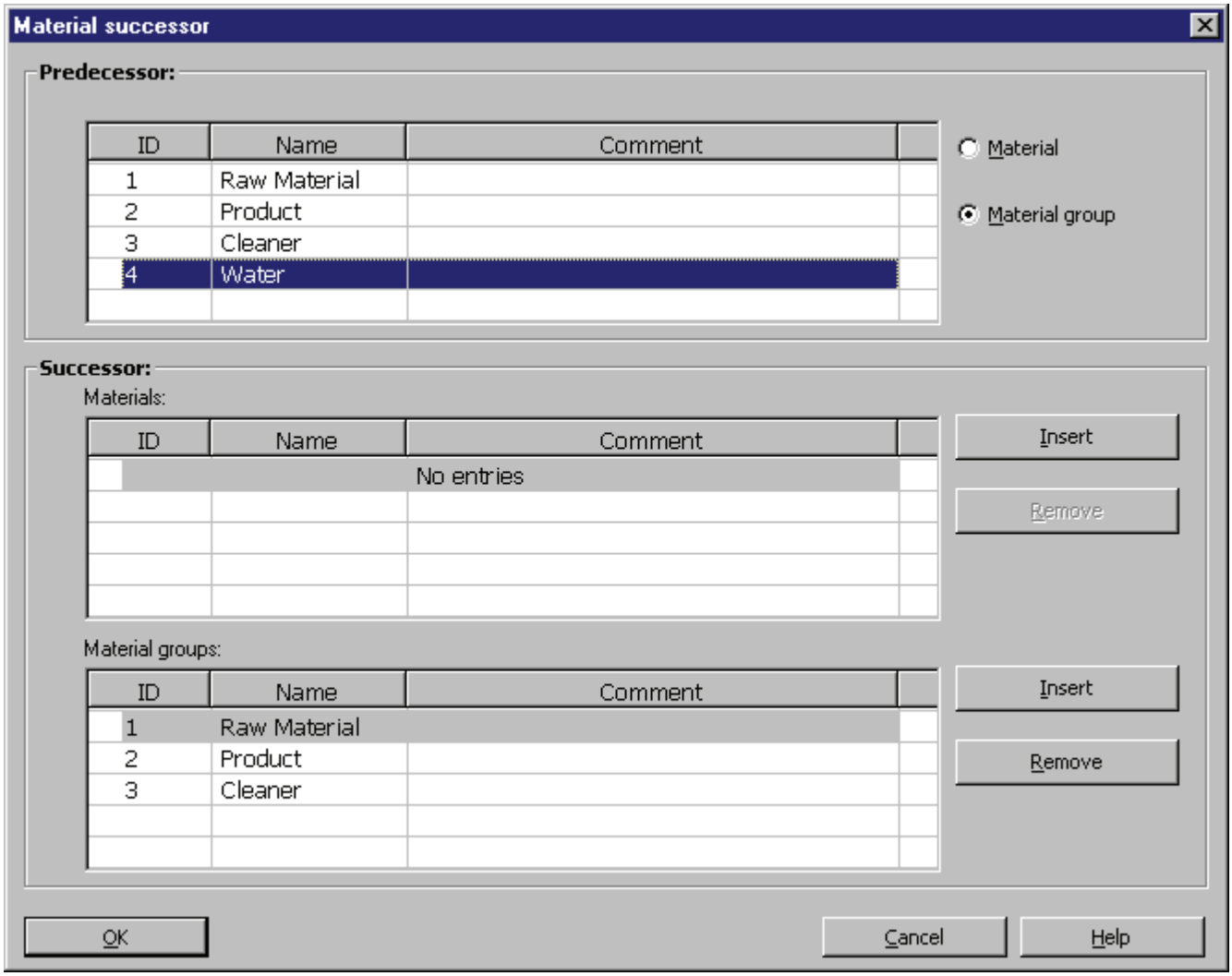


Figure 8-17 Material sequence

9. Activate the "Material group" check box.
10. Select the "Water" material group from the "Predecessor" list .

11. Add the material groups to the "Successor > Material groups" list using the "Insert" button.
12. Repeat this operation for all material groups in the "Predecessor" list.
13. Load and update the Route Control Server.

Route Control Center

9

9.1 General

General

The Route Control Center is the user interface for operators of the Route Control system. Automatic material transports are visualized in the WinCC process picture by means of SFCs.

The Route Control Center can be used to control material transport in manual mode. The various material transport modes can be started manually if the route is in manual mode. The operator can view and trace all material transports and their states in online mode.

The Route Control Center can be started from a Route Control faceplate, or by selecting "Start > SIMATIC > Route Control > Center" from the Windows Start menu. If opened from a faceplate the RCC only displays information of the material transport and the route ID of the faceplate. It shows all routes configured in the Route Control project if opened using the Windows Start menu.

The relevant route data and error information of a material transport are displayed in several views. The elements of a material transport and their corresponding activation functions can be visualized.

9.2 Functions of the Route Control Center

Route Control Center

The Route Control Center can be started from a Route Control faceplate, or by selecting "Start > SIMATIC > Route Control > Center" from the Windows Start menu. If opened from a faceplate the RCC only displays information of the material transport and the route ID of the faceplate. It shows all routes configured in the Route Control project if opened using the Start menu.

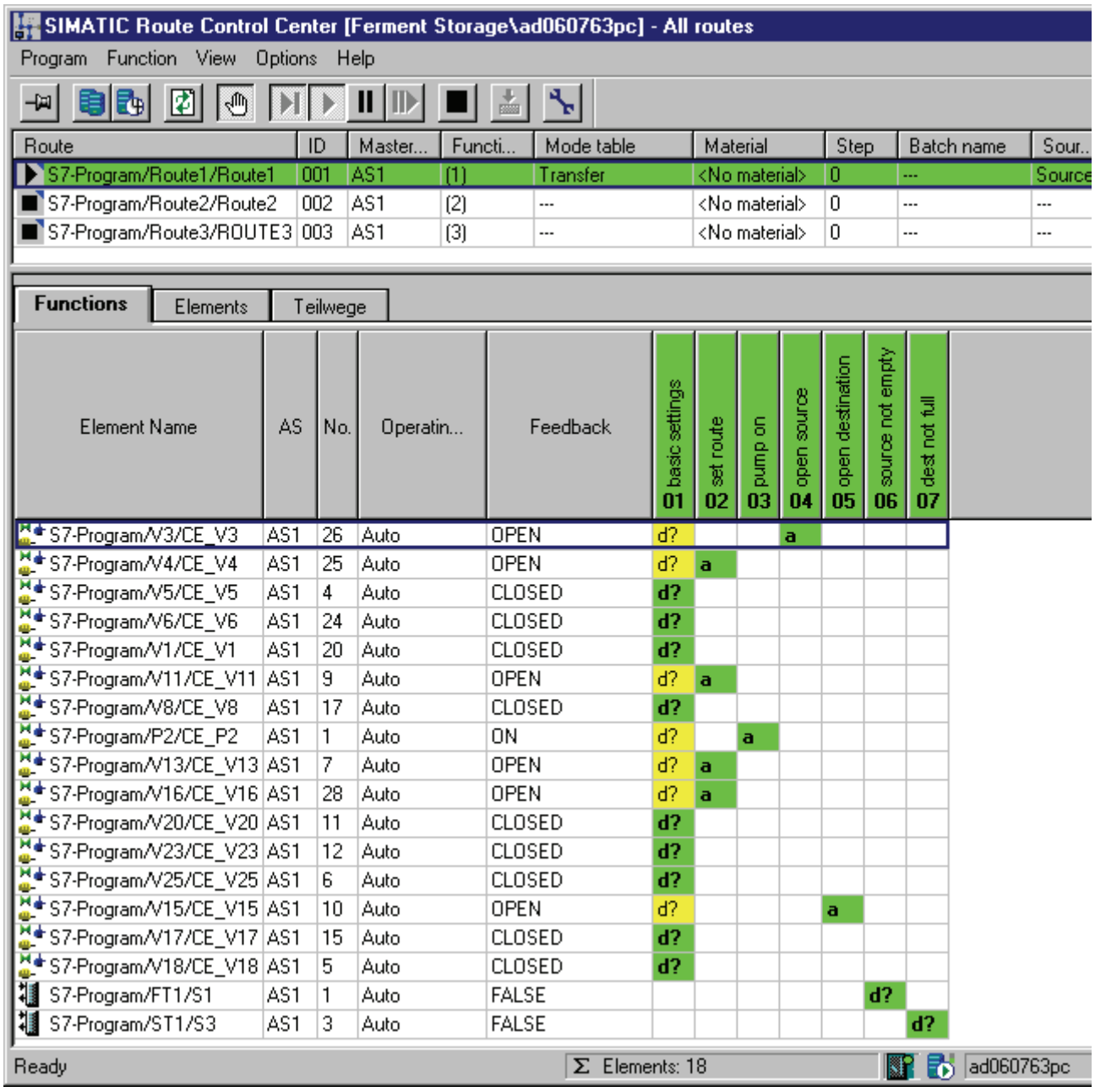


Figure 9-1 Route Control main window

The menu bar



Menu item	Submenu	Meaning
Program	Server selection	Opens a dialog box where you can select the Route Control Server to which you want to connect the Route Control Center.
	Logon	Opens a user logon dialog. This function is only available if no other user is logged on.
	Logoff	Opens a dialog where a user can log off and log on again. This function is only available if a user is logged on.
	Close	Closes the Route Control Center application. The user is only logged off if the Route Control Center was the last application connected to SIMATIC Logon.
Functions	Manual mode	Toggles between manual and auto mode.
	Set route request	This function triggers a route request.
	Set route start.	Starts the route; there are no modes activate as yet.
	Set route hold	Holds the route
	Restart route	Restarts a route from hold state; if the route was in error state the error is acknowledged.
	Set route stop	Stops the route
	Update route	Updates the list of elements and the route status, and requests the data from the Route Control Server once again.
	Update elements	Updates the list of elements and requests the data from the Route Control Server once again.
	Route properties	Opens the Route properties dialog box. This property can only be changed if the route is not active.
	Activate material	Activates the material information at the Route Control Server.
View	Element list	Changes to the "Elements" view in the lower section of the Route Control Center. The view displays the "Elements" and "Modes" tabs.
	Request details	Changes to the view which shows the result of a route request in the lower section of the Route Control Center.
	Toolbar	Hides or shows the toolbar
	Status bar	Hides or shows the status bar
	Always in the foreground	The Route Control Center is always displayed in the foreground and cannot be moved to the background, irrespective of any change to another application or window.
	Server status	Opens a dialog box which displays the status of the Route Control Server.
	Update	Fetches the data for the once again from the Route Control Server and initializes the view.
	Maintenance on/off	Hides/shows the maintenance view for the AS
Options	Language	Sets the user language
	Route log	Opens the route log file

Menu item	Submenu	Meaning
	Settings	Settings of the Route Control Center
Help	Help topics	Opens the Help system.
	Context-sensitive Help F1	Opens the Help system and jumps to the corresponding description of the active dialog box.
	Introduction	Opens the Help system and jumps to the introduction
	Getting started	Opens the Help system and jumps to the description of the first steps.
	Using Help	Information on how to use the help.
	About	Opens a dialog with information pertaining to the product name and version, to the Copyright, and to the manufacturer.

The toolbar



Symbol	Description
	Anchors the Route Control Center to its position. It is not moved to the background or closed after a change to another application.
	Opens a selection dialog box for a Route Control Server. This dialog box can be used on a multiclient to address a different Route Control Server.
	Opens the dialog box which displays the status of the Route Control Server.
	Updates the view The data is fetched explicitly from the server again.
	Changes to the inactive route operating mode, that is, to ""Manual" or "Auto" mode.
	Requests the route; only available in manual mode.
	Starts the route. Modes will not be activated at this time. Only available in manual mode.
	Interrupts the route. Modes will be deactivated; the actual route remains in active state and the route lists remain loaded. Not enabling elements. Only available in manual mode.
	Acknowledges errors and resumes route processing.
	Stops the route. Modes will be disabled. Enabling elements of the route list. Only available in manual mode.
	Transfer of the material for transport. This icon can only be operated if at least one connection element of the route differs from the defined material of the route.
	Displays the maintenance view of the Route Control Centers.

Route line of a material transport

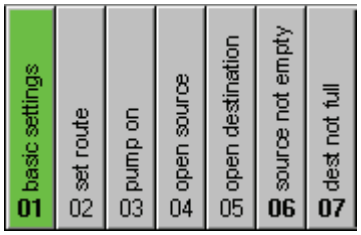
This line returns the name of the route block, the route ID, the AS, the mode ID, the mode table, the material, the step number, the Batch name, the source and destination, and a description of the material transport.
The current state of material transport is visualized in color.

Note

The short info provides additional information relating to column entries, for example, the instance DB number of the route block.

Modes of material transport

Route Control Engineering allows you to create up to 32 modes in each Mode Table.



"Modes" tab

Displays all elements of the selected route in one line.

"Elements" tab

Displays all modes of the elements of the selected route in one line.

Partial routes tab

Displays all partial routes of the selected route.

Status bar



Element	Description
	Total number of displayed elements
	AS status
	Status of the Route Control Server to which the Route Control Center is connected
	Station name of the Route Control Server

Element	Description
	Display of the route log The small green triangle indicates the active state of the route log. The corresponding short info indicates the path of the log file. The route log is opened by double-clicking the icon.
	The license is installed for 300 simultaneous routes. Only one other route was simultaneously active since the last startup of the server.
	Name of the logged on user

9.3 Exercise in requesting a route using the Route Control Center

Task

Request a route in the Route Control Center.

Prerequisite

The Route Control Server was loaded and is in ACTIVE state.

Procedure

1. Select the "Start > SIMATIC > ROUTE CONTROL > Center" menu command.
   The Route Control Center opens.
2. Log on by means of SIMATIC Logon Service if you are not yet logged on. (user name = rcuser, password = rcuser)
3. Select the route line Route1 in the top section of the Route Control Center.
4. Click the  toolbar icon.
   The route is toggled to "Manual" mode.
5. Double-click route line Route1.
   The "Route properties" dialog box opens.

6. Enter the following route properties:
   Mode table: Transfer
   Source: Fermenting tank 1
   Destination: Storage tank 1
   Via1: Line1.
   Double-click in the corresponding drop-down list box.

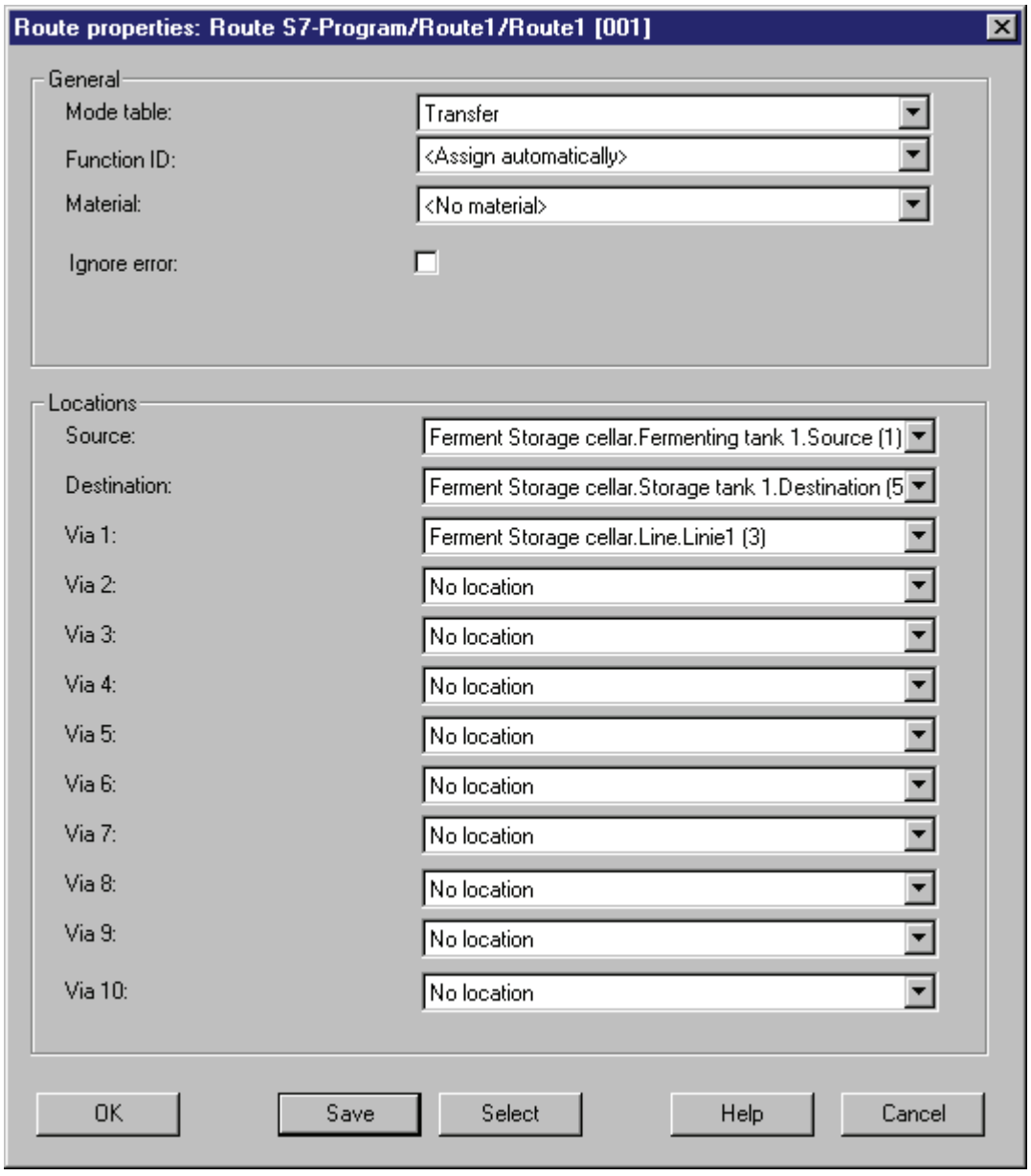


Figure 9-2 Fig.: Route_Property2

7. Click the "Set route request" toolbar button .
8. The route line is displayed on a yellow background. The "Modes" tab displays all Route Control elements and associated modes which are active during material transport.

9. The route request was successfully completed.
10. Click the "Set route stop" toolbar button .
    The route request is stopped.

Route Control configuration in the Operator Station 10

10.1 Route Control block icon

Route Control block icon

The block icon displays the most important states of a route. The block icon is not yet interconnected with the process tag.

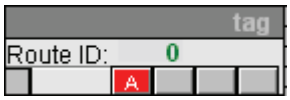


Figure 10-1 Block icon

The title bar displays the route name, that is, the instance name of the block in the CFC chart of the type "RC_IF_ROUTE" which is interconnected with this icon.

The next line displays the route ID of the current material transport (0 to 300).

The footer visualizes the route status and any active messages in a PCS 7 group display.

The block icon is available in the WinCC picture "@pcs7typicalsrc.pdl". You can copy this icon to your own picture. Interconnect this copy with the instance of RC_IF_ROUTE using the Dynamic Wizard.

Description of route states in the block icon

Table 10- 1 Icons within the block icon

Symbol	Meaning
	The route is shut down and inactive (Auto mode)
	The route is shut down and inactive (Manual mode)
	Route request is active (Auto mode)
	Route request is active (Manual mode)
	Route is active and busy (Auto mode)
	Route is active and busy (Manual mode)
	Route is in Hold state (Auto mode)
	Route is in Hold state (Manual mode)

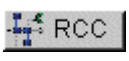
Symbol	Meaning
	Route is in error state (Auto mode)
	Route is in error state (Manual mode)

10.2 Route Control faceplate

Route Control faceplate

The Route Control faceplate is used to control routes in manual mode. Open the faceplate by double-clicking a block icon in the process picture. The faceplate cannot be used to modify source, destination and Via parameters. The modes cannot be controlled by means of the faceplate. These parameters must be entered for manual mode by means of Route Control Center.

The Route Control faceplate contains the following control elements:

Symbol	Meaning
	Manual mode; the route is controlled by means of the faceplate
	Request route (in Manual mode)
	Start route (in Manual mode)
	Hold route (in Manual mode)
	Resume route (in Manual mode)
	Stop route (in Manual mode)
	Opens the BATCH Control Center if this is installed on your computer.
	Opens the SFC dialog box with the SFC which controls this route The path to the corresponding SFC must have been configured at the RC faceplate. (Example: using the RC Wizard in Graphics Designer)
	Opens the Route Control Center with additional details of this route, including all elements and their status

The route status is visualized in the Route Control faceplate by the following icons:

Icon	Meaning
	Gray indicates that the route is in IDLE state.
	Yellow indicates the active state of the route request, the ready state of the route, or the held state of the route.
	Green indicates the busy state of the route and the activated state of the elements
	Red indicates that the route is in error state

10.3 Route Control messages in the Operator Station

Route Control messages on the Operator Station

SIMATIC Route Control outputs messages from the Route Control Server and from the AS blocks. Instead of listing the Route Control-Server messages based on a specific order, the next sections classify the Route Control-Server messages based on their tasks and meaning within the Route Control system. The listing is incomplete as it only covers the most important messages related to the handling of the Route Control system.

A large number of messages refer to configuration errors within the AS, such as missing DBs or FBs of Route Control. The messages are not covered in these sections as they are self-explanatory.

The Online Help contains additional comments relating to the message.

Route request messages

Reporting component	Message text
RC Server	Partial route is currently being used
RC Server	Element is in manual mode
RC Server	Element is faulty
RC Server	Element in maintenance
RC Server	Maintenance concerns elements
RC Server	Element material error
RC Server	Element disabled
RC Server	Error downloading route list to AS
AS block RC_IF_ROUTE	Error transferring route list to AS
AS block RC_IF_ROUTE	Route request timeout
AS block RC_IF_ROUTE	Unassigned / available route not found
AS block RC_IF_ROUTE	Invalid locations

Reporting component	Message text
AS block RC_IF_ROUTE	Element(s) with incorrect status
AS block RC_IF_ROUTE	Material compatibility error

Table: Messages due to route request

Runtime messages

Reporting component	Message text
AS block RC_IF_ROUTE	Route ID error
AS block RC_IF_ROUTE	Cross-coupling time monitoring error
AS block RC_IF_ROUTE	Status monitoring time error
AS block RC_IF_ROUTE	Fault tolerance time error
AS block RC_IF_ROUTE	Idle state error
AS block RC_IF_ROUTE	No available route ID found
AS block RC_IF_ROUTE	AS is not configured for this route ID

Table: Runtime messages

10.4 Exercise in configuring a Route Control block icon in the process picture

Task

Configure the Route Control block icons.

Prerequisite

You opened the "RCGSMP_0" multiproject in SIMATIC Manager.

Procedure

1. Open the component view of the PCS 7 project in SIMATIC Manager by selecting the "View > Component view" menu command.
2. Select the "OS" object in partial project "RCGSOS_0", and then select the "Edit > Open object" menu command.
   WinCC Explorer opens.

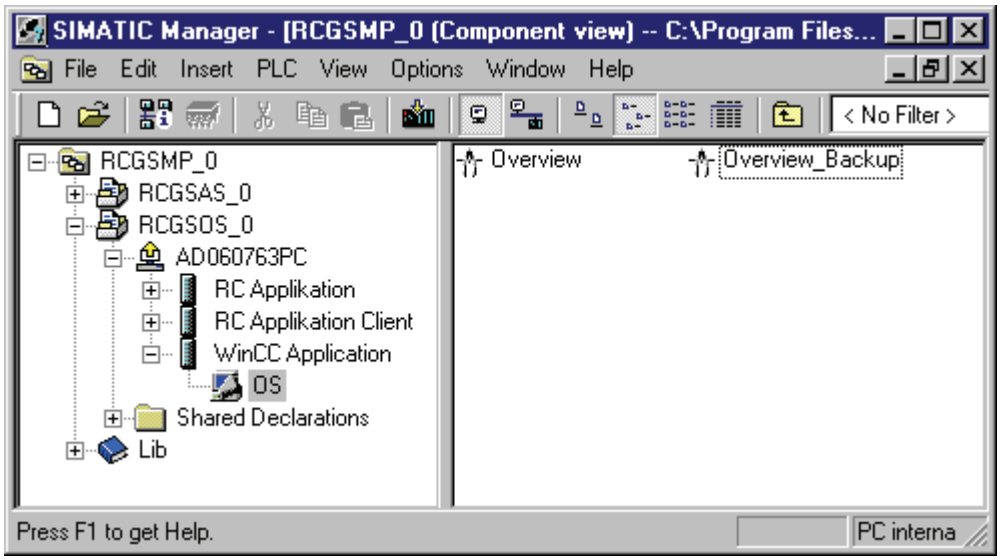


Figure 10-2 SIMATIC Manager

3. Select the Graphics Designer object in WinCC Explorer. Double-click the "Overview.pdl" object in the right area of WinCC Explorers.
   Graphics Designer opens with the "Overview" screen.

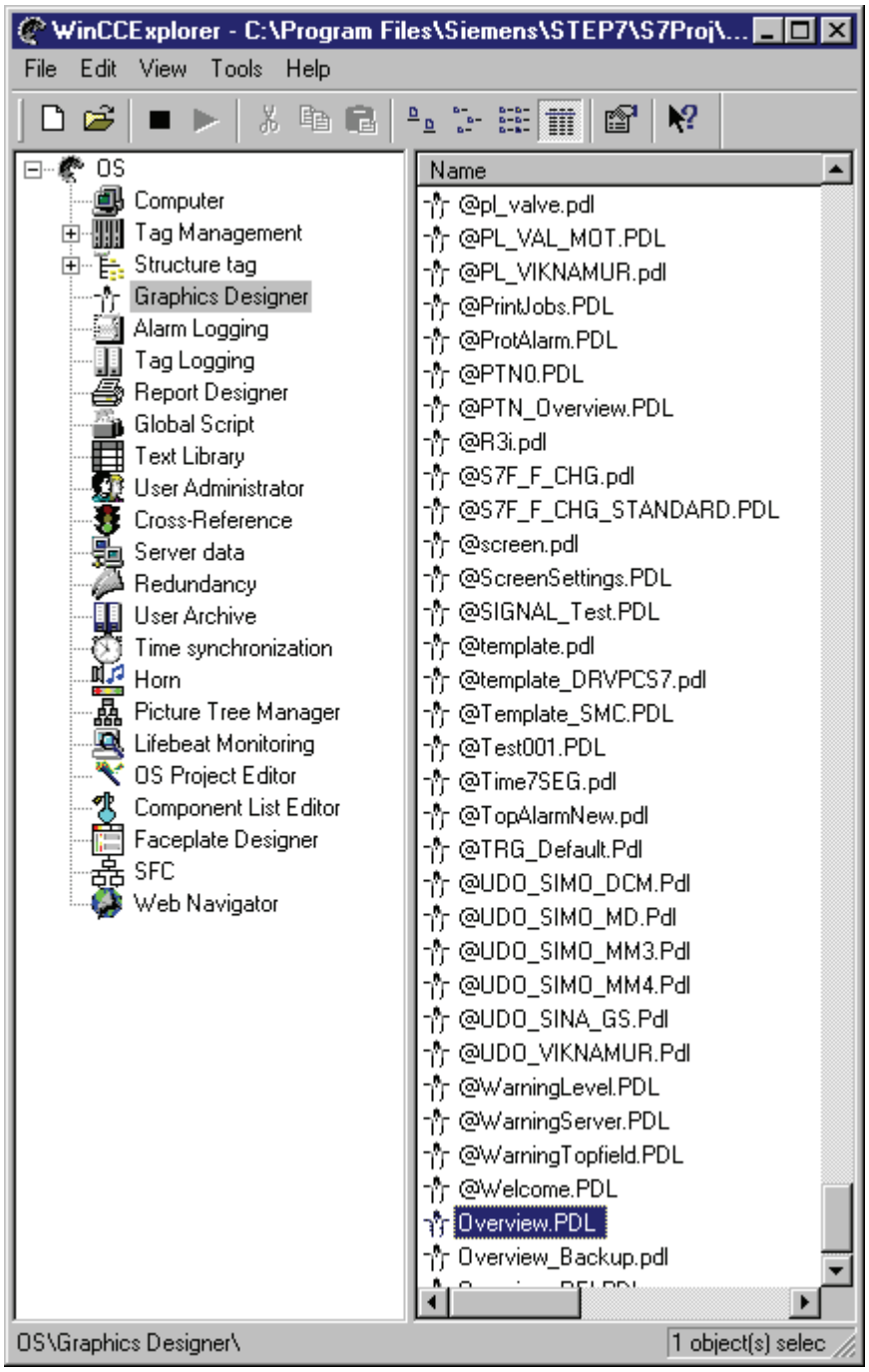


Figure 10-3 WinCC Explorer

4. Select the "File > Open" menu command in Graphics Designer.
   The "Open" dialog box opens.
5. Select the picture "@pcs7typicalsrc.pdl" and click "Open".

6. Select both block icons and copy these to the clipboard using the "CTRL+C" keystroke.



Figure 10-4 Block icons

7. Press the "CTRL+V" keystroke to paste two copies of the two block icons into the "Overview.pdl" picture.
8. Interconnect the two upper block icons with CFC block "Route1", and the lower pair of block icons with CFC block "Route2".
   Start by selecting the top left block icon (signal column).

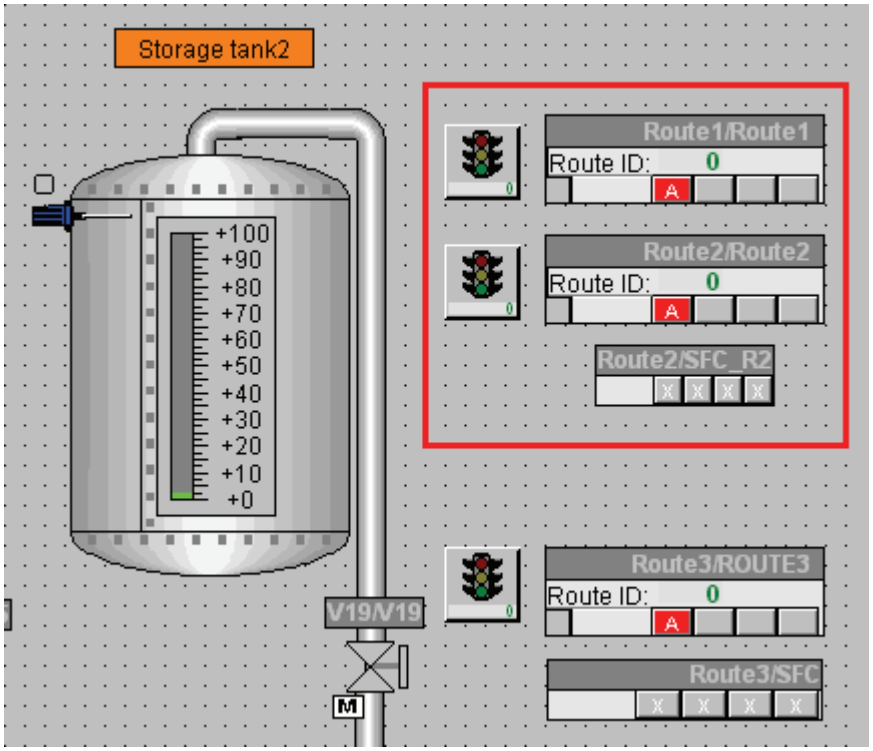


Figure 10-5 Result of the block icon copy operation

9. Double-click the "Interconnect faceplate with process tag" Dynamic Wizard.

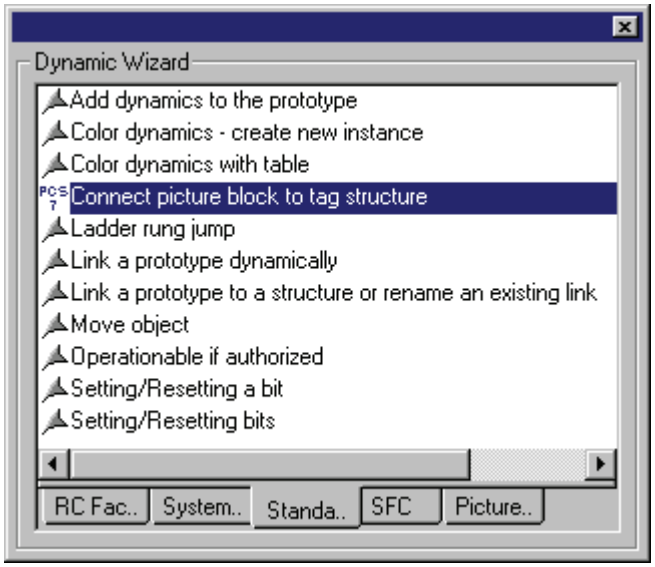


Figure 10-6 Dynamic Wizard

10. Click "Next" in the "Welcome to the Dynamic Wizard" dialog box
11. Click the "..." button in the "Set options" dialog box
12. Select "Route1" from the "Tags" dialog box and then click "OK".
13. Click "Next" in the "Set options" dialog box
14. Click "Finish" in the "Finished !" dialog box. The block icon is now interconnected with CFC block "Route1".
15. Interconnect all other block icons as shown in steps 8 to 14.
16. Save the "Overview.pdl" picture.

10.5 Exercise in configuring a block icon of the SFC in the process picture

Task

Configure the SFC faceplate in the process picture.

Prerequisites

- You opened the "RCGSMP_0" multiproject in SIMATIC Manager.
- WinCC Explorer is open.
- You opened the "Overview.pdl" picture in Graphics Designer.

Procedure

1. Open the "@template.pdl" picture in Graphics Designer.
2. Copy the "SFC Type" block icon to the clipboard using the "CTRL+C" keystroke.

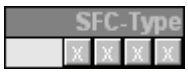


Figure 10-7 Block icon of the SFC Type

3. Press the "CTRL+V" keystroke to paste the block icon into the "Overview.pdl" picture.
4. Select the "Properties" command from the shortcut menu of the block icon.
   The "Object properties" dialog box opens.

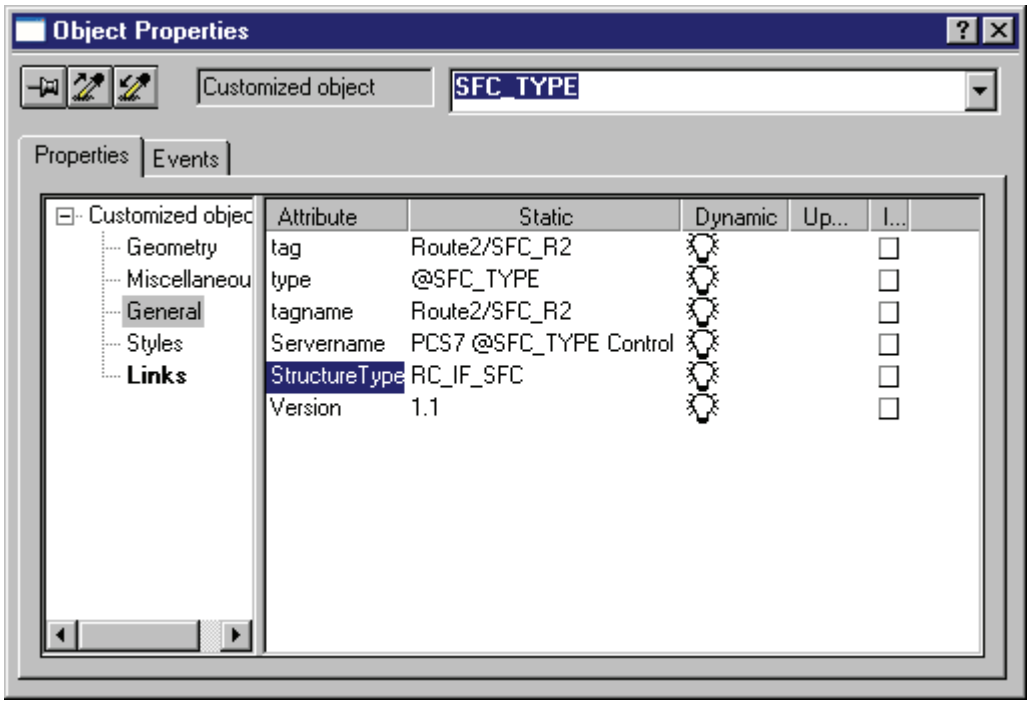


Figure 10-8 Object properties of the SFC Type

5. Select the "General" submenu in the "Properties" tab and then double-click "StructureType".
6. Enter "RC_IF_SFC" as output value and then click "OK".

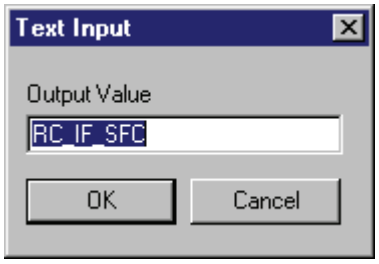


Figure 10-9 Output value

7. Close this object properties.

8. Start the "Interconnect faceplate with process tag" Dynamic Wizard.
9. interconnect the block icon with the SFC instance "Route2_SFC".
10. Save the "Overview.pdl" picture.

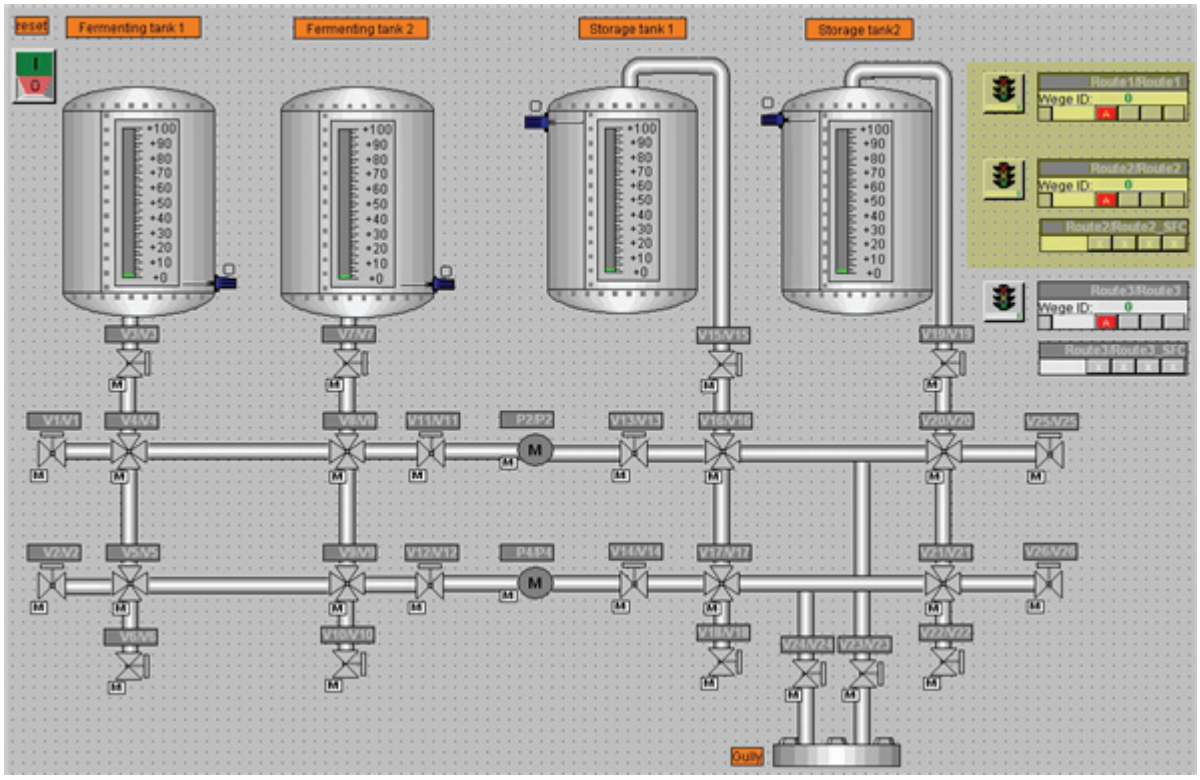


Figure 10-10 Overview.pdl

Handling material transports using Route Control 11

11.1 Exercise in executing and monitoring material transport using the RCC

Task

Execute and monitor material transport using the Route Control Center

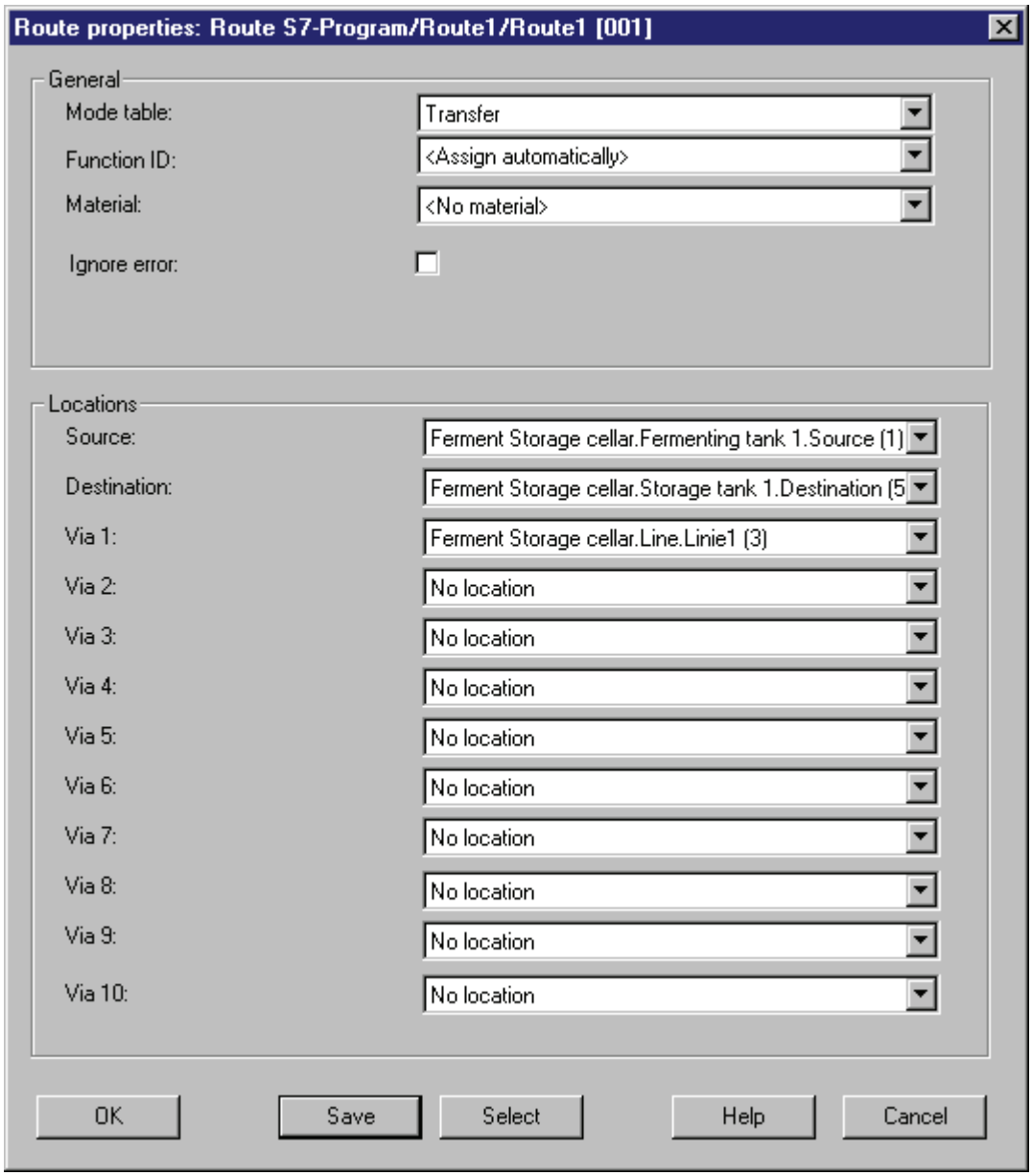
Prerequisites

- You opened the PCS 7 multiproject "RCGSMP_0" in SIMATIC Manager.
- The Route Control Server is loaded and in "ACTIVE" state.
- The WinCC project "OS" was opened in WinCC Explorer.

Procedure

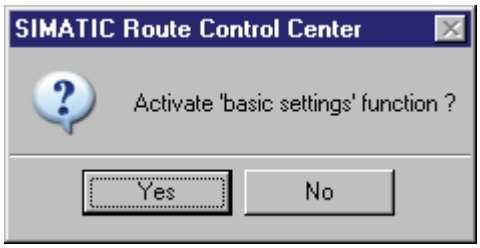
1. Activate the WinCC project by clicking "Activate".
2. Log on to WinCC (user name = rcuser, password = rcuser).
3. Select the "Start > SIMATIC > ROUTE CONTROL > Center" menu command.
   The Route Control Center opens.
4. Log on by means of SIMATIC Logon Service if you are not yet logged on. (user name = rcuser, password = rcuser)
5. Select the route line "Route1" in the top section of the RCC
6. Click the hand icon in the toolbar.
   The route is toggled to manual mode.
7. Double-click route line "Route1".
   The "Route properties" dialog box opens.

8. Enter the following route properties:
   Mode table: Transfer
   Source: Fermenting tank1
   Destination: Storage tank1
   Via1: Line1.
   Select the locations by double-clicking these in the drop-down list boxes.



9. Click "Set route start" in the toolbar.
10. The route line is displayed on a green background. The "Modes" tab displays all Route Control elements and associated modes which are active during material transport.

11. Click in the Basic position column in the "Modes" tab in the lower section of the RCC. This opens a dialog box where you can activate the Basic position mode.



12. Click "Yes". The Basic position was activated.

SIMATIC Route Control Center [Ferment Storage\ad060763pc] - All routes

Program Function View Options Help

Route	ID	Master...	Functi...	Mode table	Material	Step	Batch name	Sour...
S7-Program/Route1/Route1	001	AS1	(1)	Transfer	<No material>	0	---	Source
S7-Program/Route2/Route2	002	AS1	(2)	---	<No material>	0	---	---
S7-Program/Route3/ROUTE3	003	AS1	(3)	---	<No material>	0	---	---

Functions | Elements | Teilwege

Element Name	AS	No.	Operatin...	Feedback	basic settings 01	set route 02	pump on 03	open source 04	open destination 05	source not empty 06	dest not full 07
S7-Program/V3/CE_V3	AS1	26	Auto	CLOSED	d?			a			
S7-Program/V4/CE_V4	AS1	25	Auto	CLOSED	d?	a					
S7-Program/V5/CE_V5	AS1	4	Auto	CLOSED	d?						
S7-Program/V6/CE_V6	AS1	24	Auto	CLOSED	d?						
S7-Program/V1/CE_V1	AS1	20	Auto	CLOSED	d?						
S7-Program/V11/CE_V11	AS1	9	Auto	CLOSED	d?	a					
S7-Program/V8/CE_V8	AS1	17	Auto	CLOSED	d?						
S7-Program/P2/CE_P2	AS1	1	Auto	OFF	d?		a				
S7-Program/V13/CE_V13	AS1	7	Auto	CLOSED	d?	a					
S7-Program/V16/CE_V16	AS1	28	Auto	CLOSED	d?	a					
S7-Program/V20/CE_V20	AS1	11	Auto	CLOSED	d?						
S7-Program/V23/CE_V23	AS1	12	Auto	CLOSED	d?						
S7-Program/V25/CE_V25	AS1	6	Auto	CLOSED	d?						
S7-Program/V15/CE_V15	AS1	10	Auto	CLOSED	d?				a		
S7-Program/V17/CE_V17	AS1	15	Auto	CLOSED	d?						
S7-Program/V18/CE_V18	AS1	5	Auto	CLOSED	d?						
S7-Program/FT1/S1	AS1	1	Auto	FALSE						d?	
S7-Program/ST1/S3	AS1	3	Auto	FALSE							d?

Ready | Σ Elements: 18 | ad060763pc

Figure 11-1 Basic position activated

13. Activate the "Set route" mode.
14. Change to the WinCC Runtime window to monitor the reaction of the valves.
15. Activate all modes.

16. Change to the WinCC Runtime window to monitor the material transport.

Note

The route enters the error state at the end of material transport because the setpoint monitoring time at Sensor1 or Sensor2 is exceeded.

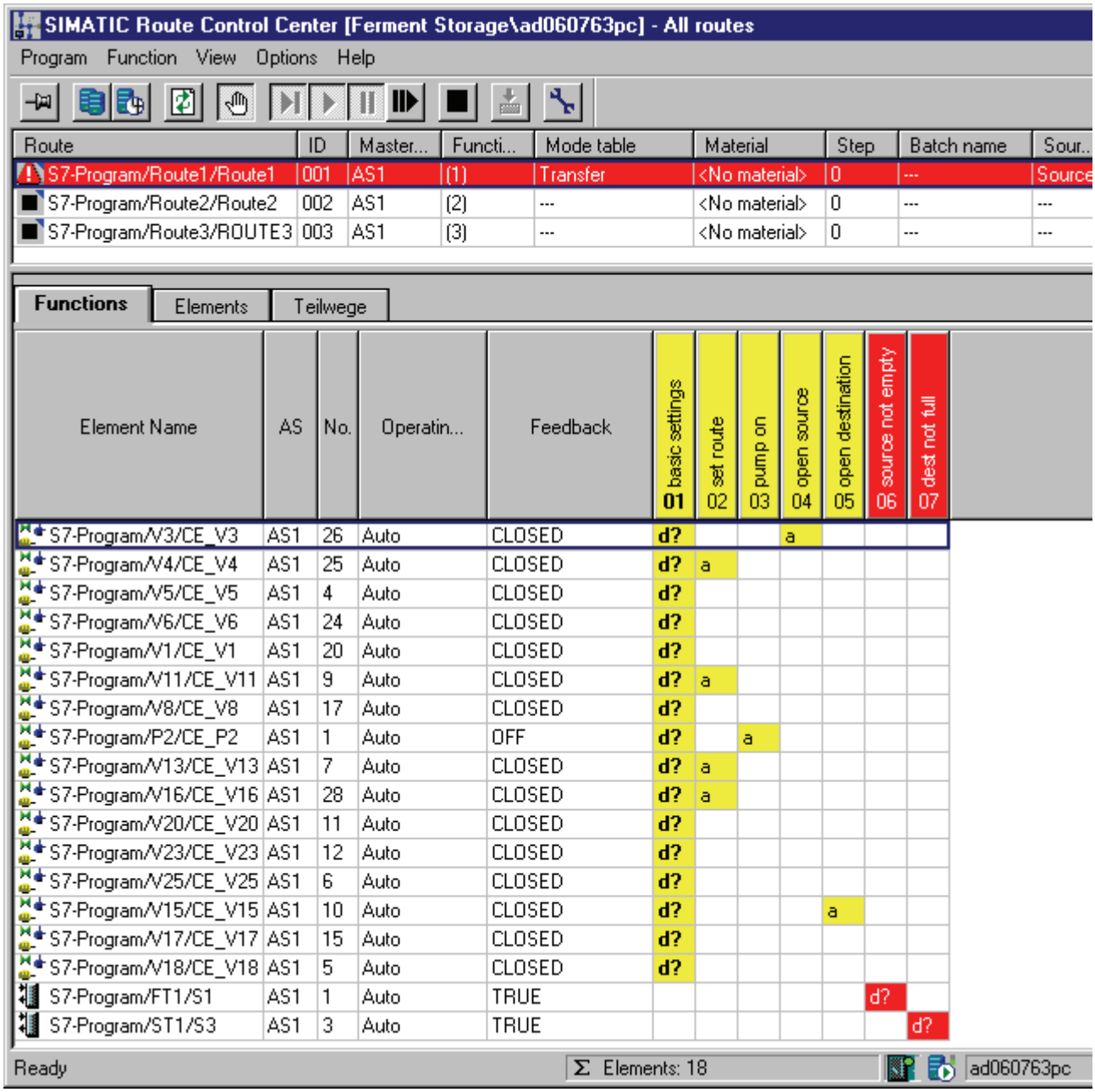


Figure 11-2 Route in error state

17. Click "Set route stop" in the RCC.

18. Acknowledge the error in WinCC using the "Acknowledge error" button.



Figure 11-3 Acknowledge error

19. Activate and then deactivate the Reset switch in the "Overview" process picture.

11.2 Exercise in executing and monitoring material transport by means of SFC

Task

Execute and monitor material transport by means of SFC

Prerequisites

- The Route Control Server is loaded and in "ACTIVE" state.
- WinCC Runtime is active.
- Route Control Center was opened.
- User "rcuser" is logged on to WinCC and to the Route Control Center.

Procedure

1. Click the "Route2" block icon in the "Overview" screen of WinCC Runtime.
2. Toggle the route from manual to auto mode if necessary.
   Click the hand icon on the faceplate to toggle the mode.
3. Click the "Route2_SFC" block icon in the "Overview" screen of WinCC Runtime.
4. Select the "Prepared values" view from the drop-down list box.

5. Enter the following setpoints:
   Source: "FT2"
   Destination: "ST2"
   Via1: "L2".

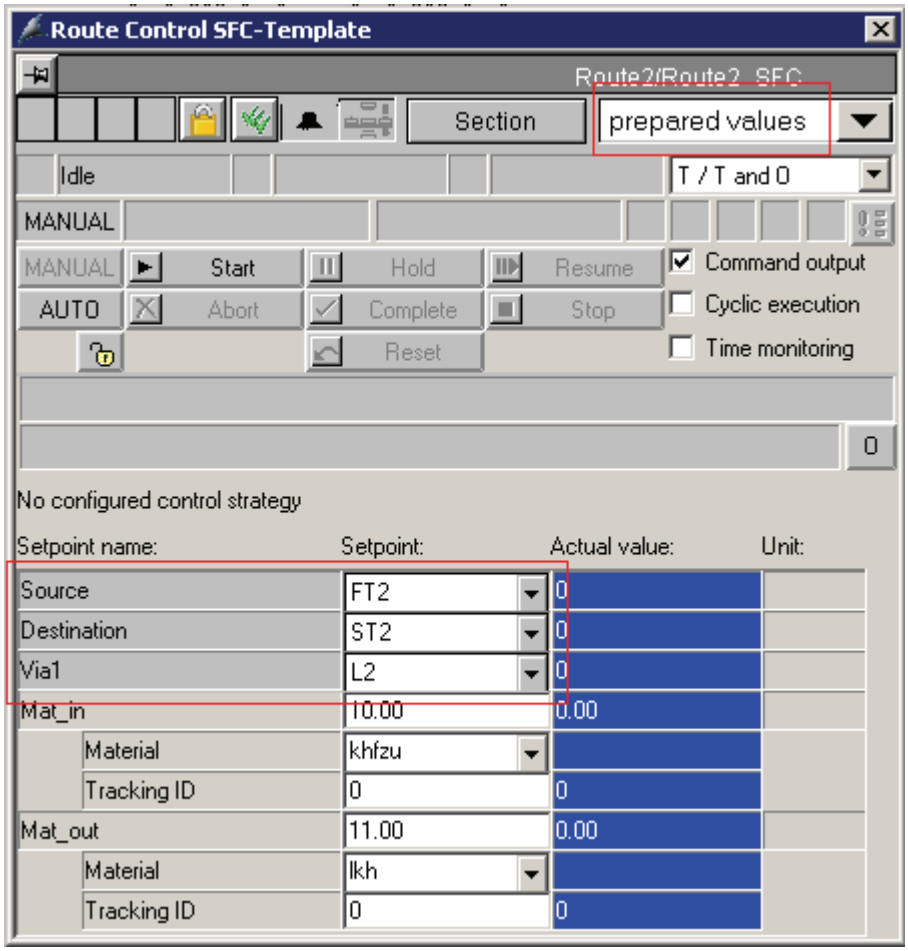


Figure 11-4 SFC faceplate

6. Click "Pane" button in the SFC faceplate.

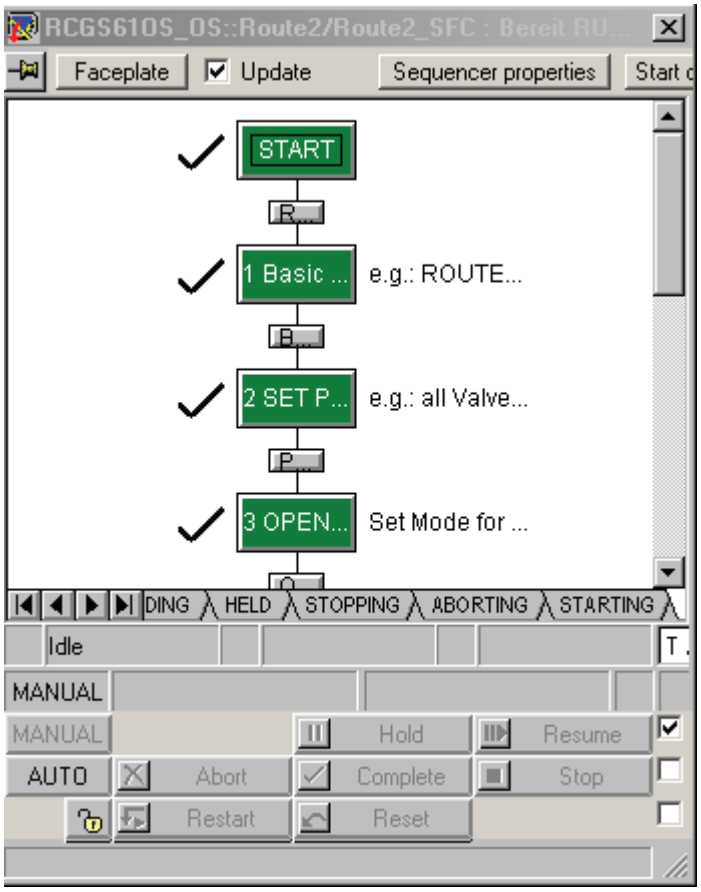


Figure 11-5 SFC sequencer

7. Click "Start" button in the SFC faceplate.
8. Monitor the material transport.
9. Activate and then deactivate the Reset switch in the "Overview" screen in WinCC Runtime.

List of abbreviations

A

A.1 Abbreviations

Abbreviations

Abbreviation	Meaning
AS	Automation system
CE	Control Element
CFC	Continuous Function Chart
CPU	Central Processing Unit
CSV	File format - Comma-Separated Values
DB	Data Block
ES	Engineering Station
FB	Function Block
FC	Function
FT	Fermenting Tank
GS	Getting Started
HW	Hardware
IP	Internet Protocol
ISA-88	Standard that describes the structure of a batch plant
LE	Link Element
MAC address	Media Access Control address
MP	Multiproject
OB	Organization Block
OS	Operating Station
PCS 7	Process Control System 7
PE	Parameter Element
RC	Route Control
RCC	Route Control Center
SE	Sensor Element
SFC	Sequential Function Chart
ST	Storage Tank