SIEMENS

SIMATIC

Process Control System PCS 7 SIMATIC Route Control Getting Started (V9.0)

Getting Started

Valid for PCS 7 as of V9.0

06/2018
A5E43618934-AA

Legal information

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Security information

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Preface

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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 7 / Windows 2008 Server operating systems
- Microsoft Windows 10 / Windows 2012 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

This Getting Started is valid for "PCS 7 Engineering Toolset as of V9.0".

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3.1 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 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(Route Control) 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 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.

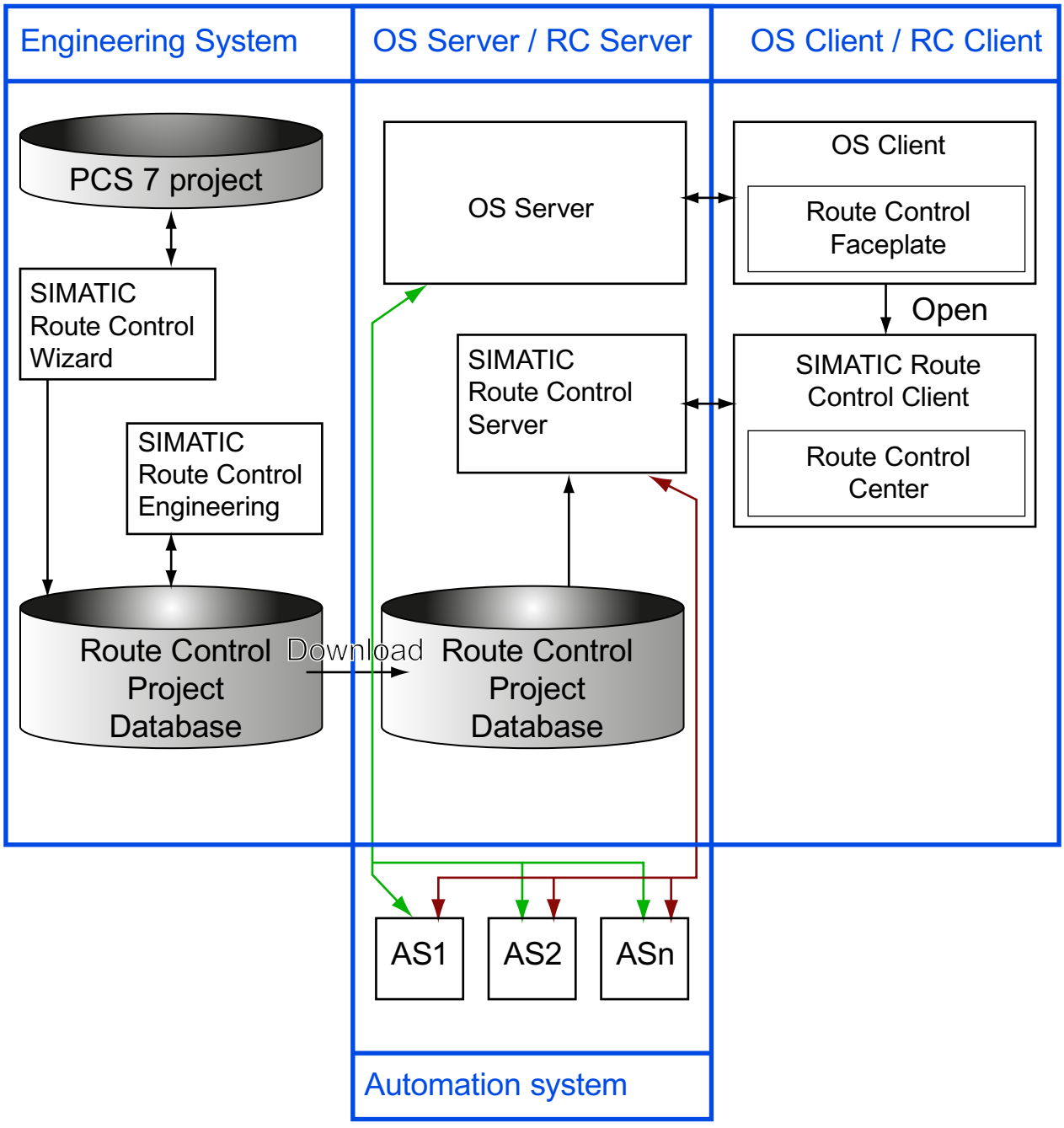
Note

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.

3.2 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)



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 of S7-DOS connection, whereas the OS Server communicates with the AS of STEP 7 standard communication.

3.3 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 operator control 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.

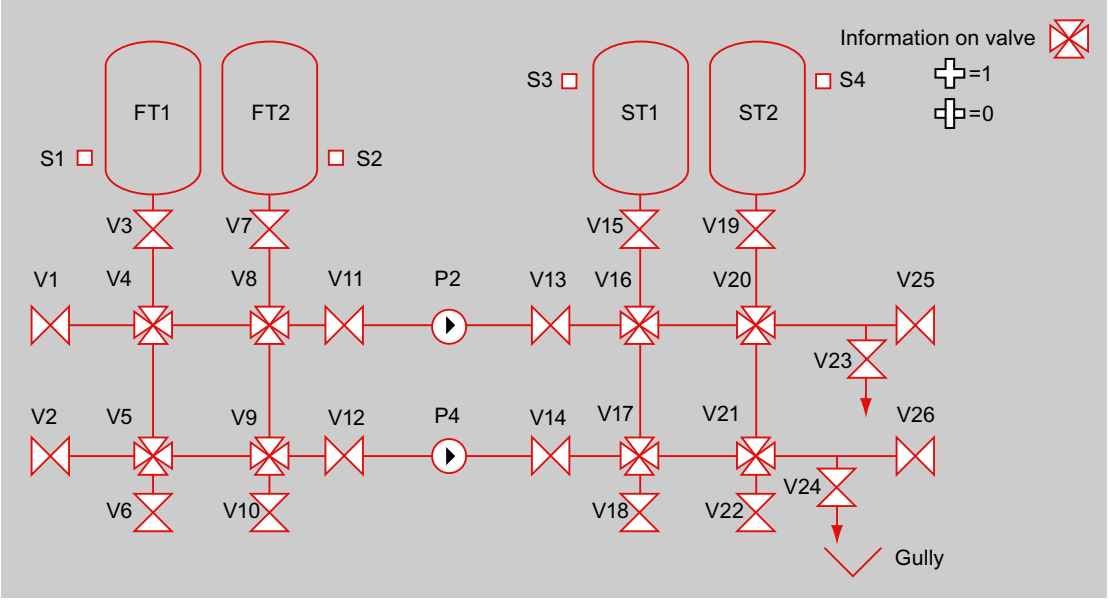
3.4 The Route Control Getting Started project

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

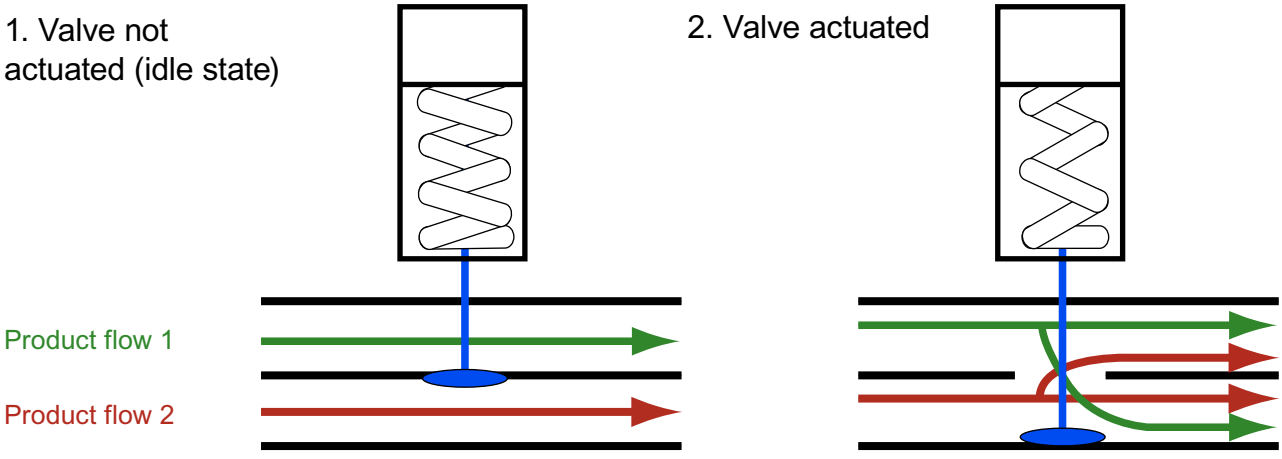
Fermentation is a term used in bioreaction engineering to describe fermentation processes, for example, in a brewery. The storage tanks receive the finished fermentation products. The Getting Started is focused on the configuration of all objects relevant to Route Control within the PCS 7 system. The "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 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 double seat valves. The image below shows the function of this double seat valve.

Double-seated valve, schematic



3.5 System requirement for the Getting Started

System requirements for Route Control Getting Started

- PCS 7 single station with Route Control installation. The system requirements for PCS 7 is of V9.0.
- A communication processor CP 1613 or another network adapter for the PCS 7 station
- Automation system AS 416-3 or higher
- 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

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4.1 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 stored online as a zip file with this manual under "Appendix". Copy the file "rcgsmp_d.zip" to "C:\Programs Files\Siemens\STEP7\examples".

Prerequisite

SIMATIC Manager is open.

Procedure

1. Select the "File > Retrieve..." menu command.
   The "Retrieving - Select an Archive" dialog box opens.
2. Go to the "Programs\Siemens\STEP7\examples" folder, select the file "rcgsmp_0_b.zip" and open it by clicking the "Open" button.
   The "Select destination directory" dialog box opens.
3. Select the "Programs\Siemens\STEP7\S7Proj" folder and click "OK".
   The "Retrieve" message window opens after the file has been successfully extracted.
4. Click "OK".
5. Open the PCS 7 project.

Sample solution

You will find a sample solution for this Getting Started in the same zip file "rcgsmp_0_b.zip" (English) or "rcgsmp_0_a.zip" (German) mentioned in the introduction.

4.2 How to adapt the station name

Introduction

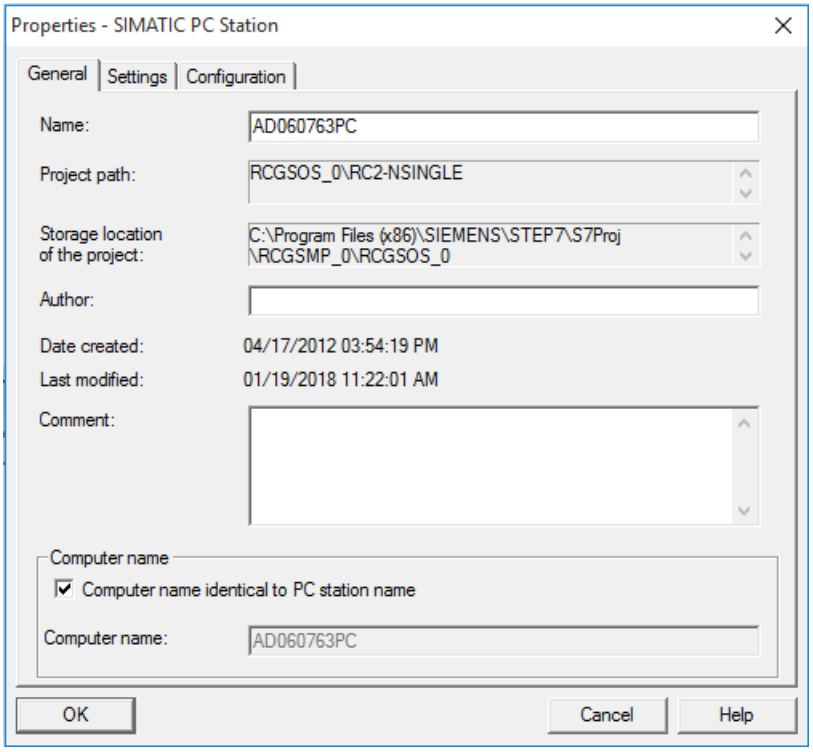
Customize the name of the PC station in the PCS 7 project to suit your specific installation requirements.

Prerequisite

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.
  You can activate this under the menu item "View > Component view".

Procedure

1. Select the "RCGSMP_0/RCGSOS_0/ES" 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.



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. Refresh by pressing the <F5> function key if the PC station is not marked with a yellow arrow.

4. Select "Computer name identical to PC station name".
   The computer name is automatically entered in the "Computer name" input field.
5. Click "OK".

4.3 How to adapt the hardware configuration of the AS

Introduction

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

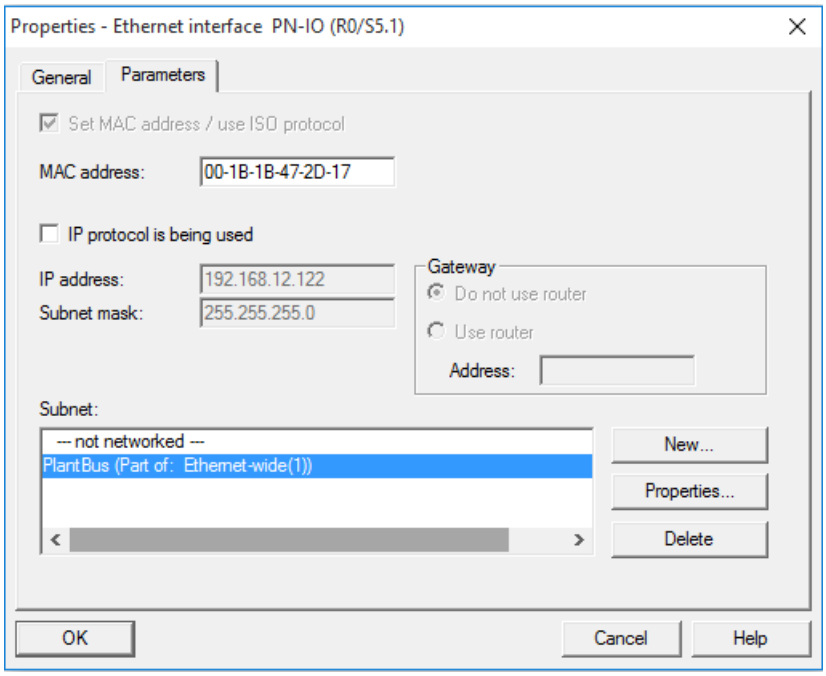
Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select the "RCGSMP_0/RCGSAS_0/AS" folder from the tree view.
2. Select the "Hardware" object from the detailed 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 "Edit > Go To > Ethernet Node".
   The "Go To Ethernet Node" window opens.
5. Click "Go To".
6. Click "Close".
7. Select "Edit > Object Properties".
8. Click "Properties".

9. Click the "Parameters" tab. Enter the MAC address in the "Properties - Ethernet Interface" dialog box.



10. Deactivate the "IP protocol is being used" checkbox.
11. Select the "Plant bus" entry from the "Subnet" list.
12. 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.
13. Close HW Config.
14. Click "Yes" in the "Save changes to AS?" 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.

4.4 How to adapt the OS configuration

Introduction

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

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

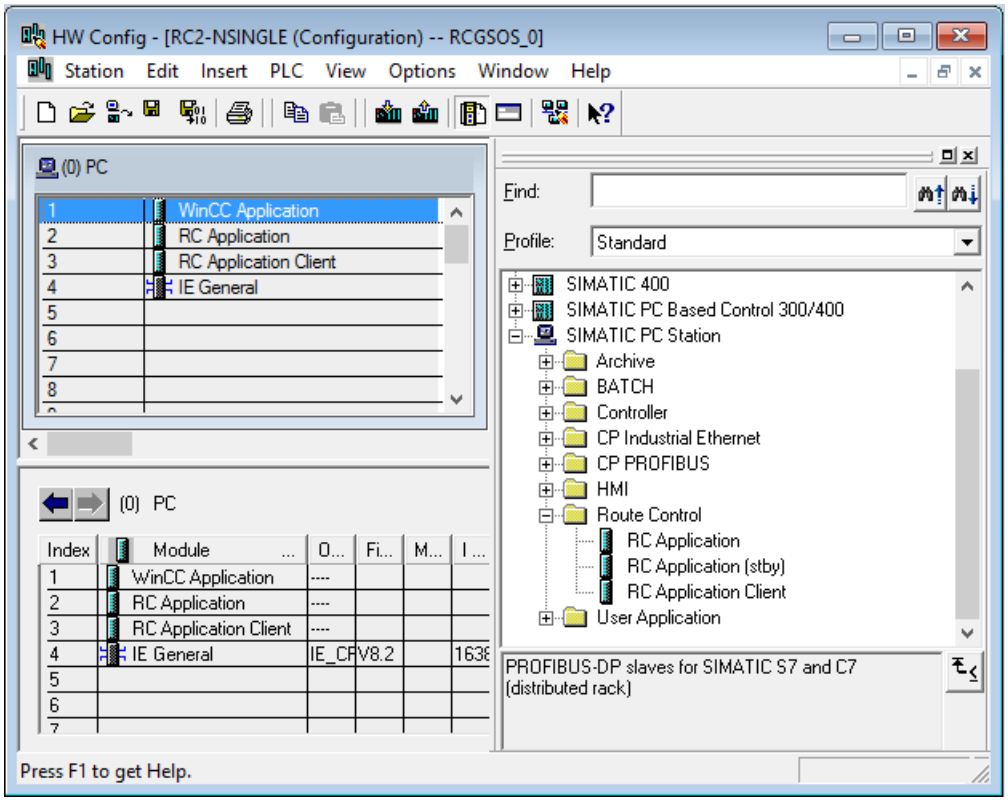
1. Select the "RCGSMP_0/RCGSOS_0/[PC station name]" object from the tree view.
2. Select the "Configuration" entry from the detailed view and then select the "Edit > Open Object" menu command.
3. Select a network adapter from the hardware catalog and drag-and-drop it to slot 4.
   The "Properties" dialog box opens.
4. Activate the "Set MAC Address" checkbox.
5. Select the "MAC Address" input box and enter the MAC address of the PC's network adapter.
6. Deactivate the "IP protocol is being used" check box.
7. Select the "Plant bus" entry from the "Subnet" list.
8. Click "OK" in the "Properties - Ethernet Interface CP 16**" dialog box.

   Note

   Using CP 16** is optional, IE General can also be used instead of a CP card.

9. Click "OK" in the "Properties - CP 16**" dialog box.
10. Insert the "RC application" object from the Route Control catalog to slot 2.
11. Insert the "RC application client" object from the Route Control catalog to slot 3.
12. Select the "Station > Save and Compile" menu command.
13. Close HW Config.

Result


HW Config - [RC2-NSINGLE (Configuration) -- RCGSOS_0]
Station Edit Insert PLC View Options Window Help
(0) PC
1 WinCC Application
2 RC Application
3 RC Application Client
4 IE General
Find:
Profile: Standard
SIMATIC 400
SIMATIC PC Based Control 300/400
SIMATIC PC Station
Archive
BATCH
Controller
CP Industrial Ethernet
CP PROFIBUS
HMI
Route Control
RC Application
RC Application (stby)
RC Application Client
User Application
(0) PC
Index Module ... O... Fi... M... I ...
1 WinCC Application ----
2 RC Application ----
3 RC Application Client ----
4 IE General IE_CP V8.2
PROFIBUS-DP slaves for SIMATIC S7 and C7 (distributed rack)
Press F1 to get Help.

4.5 How to edit the name of the Operator Station

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

1. Select the "OS" object from the "WinCC Application" area of the PC station.
2. Select the menu command "Edit > Open object".
   A dialog box is displayed stating "The configured server is not available. Do you want to open the project using the local computer as the server?"
3. Click "Yes".
   WinCC Explorer opens.
4. Select "Computer" from the navigation window.
5. Double-click the computer icon in the detailed window.
   The "Computer properties" dialog box opens.
6. Click "Use local computer name".
7. Click "OK".
   The "Change computer name" message is output.
8. Click "OK" and close the WinCC Explorer.
   Your changes are activated at the next start of WinCC Explorer.

4.6 How to set parameters in NetPro and configure the hardware

Introduction

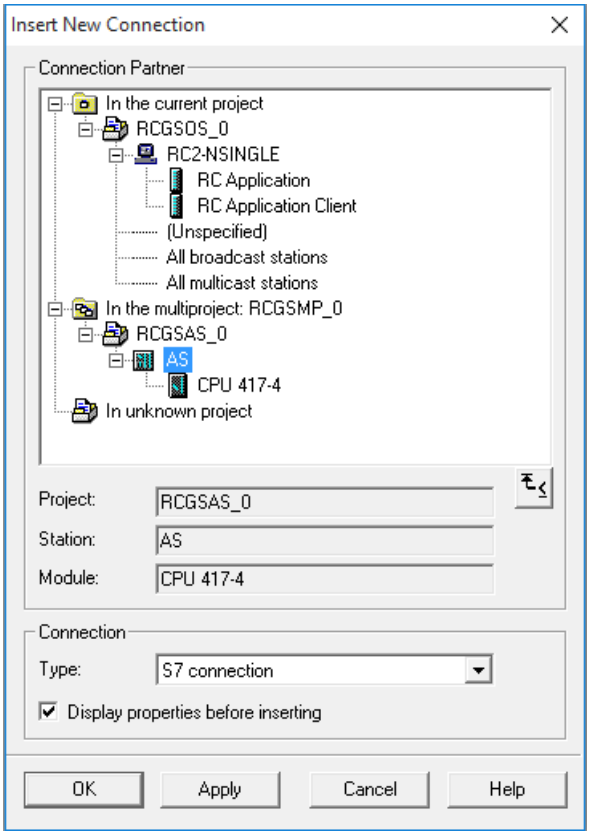
Configure the PC station in NetPro in order to enable its communication with the AS.

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

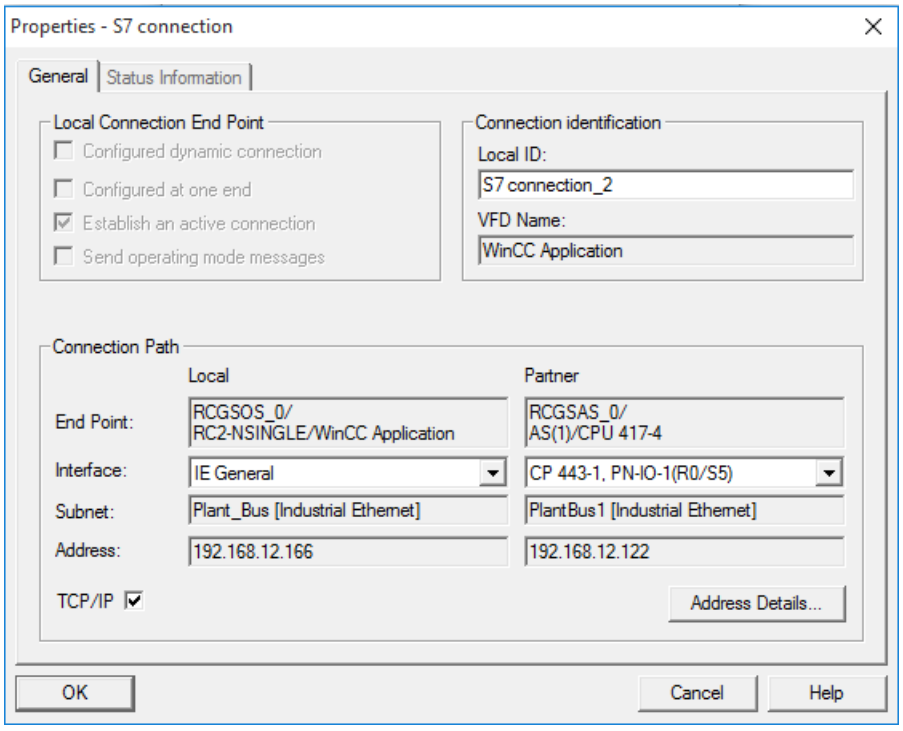
Procedure in NetPro

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 detailed window and then select the "Edit > Open Object" command.
   NetPro opens.
3. Select the "WinCC Application" object at the SIMATIC PC station.
4. Select "Insert > New Connection" in menu command.



5. Select the AS.

6. Click "OK".
   The "Properties - S7 connection" window opens.



7. Click "OK".
8. Select the "Network > Save and compile" menu command.
   The "Save and compile" dialog box opens.
9. Activate the "Compile and check everything" check box and then click "OK".
10. The "Outputs for consistency check" window opens after compilation has been completed.
    Close this window.
11. Close NetPro.

Procedure in SIMATIC Manager for PC configuration

1. Change to SIMATIC Manager.
2. Select the PC station and then select the "PLC > Configure" command.
   The "Configure" dialog box opens.
3. Activate "Use configure computer name".
4. Click "Configure".
   The "Configure: PC name" dialog box opens.
5. Click "OK".
6. Click "OK", if "Information" dialog box opens.
7. Click "Close", after configuration completion message is displayed.

8. 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.
9. Click "Yes".
   The "Stop target modules" dialog box opens.
10. Click "OK".
    The download is completed.

Procedure in SIMATIC Manager for hardware configuration

1. Select the AS.
2. Double click the "Hardware".
   The "HW Config" window opens.
3. Click  to download the hardware.

4.7 How to create the required users

Introduction

For Route Control and WinCC, you must create a user and include the user in the RC_MAINTENANCE user group when using SIMATIC Logon.

Note

Define and memorize your own user name and password if the user name = rcuser and password = RC11**er entries do not conform to rules set up on your PC.

Procedure

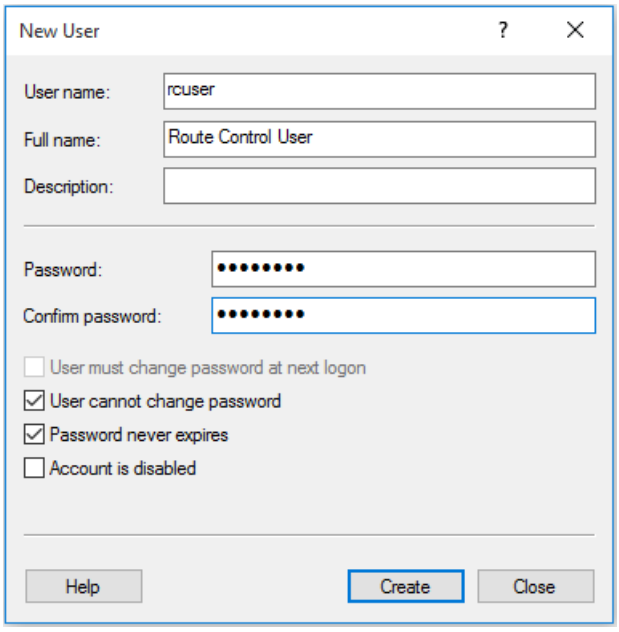
1. Press the  icon + R and insert "compmgmt.msc" in the run dialog.

   Note

   For Windows 7, Start > Control Panel > Administrative Tools > Computer Management.

2. Expand the "Local Users and Groups" tree.
3. Right-click the "User" folder.
4. Select the "New User..." in the menu.
5. Entries to be made in the "New User..." dialog box:
   User name: rcuser
   Full name: Route Control User
   Password: RC11**er
   Confirm the password: RC11**er
   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

6. Click "Create".



7. Double-click the "Groups" folder.
8. Double-click the "RC_MAINTENANCE" group.
9. Click "Add".
   A "Select users" window opens.
10. Type "PC name/Username" in "Enter the object names to select" area.
11. Select "Check Names".
12. Click "OK".

Result

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

4.8 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. 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.
   The communication module is now initialized.

Route Control Project Engineering in the automation system

5

5.1 Route Control blocks

5.1.1 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, ...

5.1.2 Blocks

Route Control interface blocks

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

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.

5.2 The Route Control configuration block

5.2.1 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:

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.

5.2.2 Exercise with RC_IF_CFG

Task

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

Prerequisites

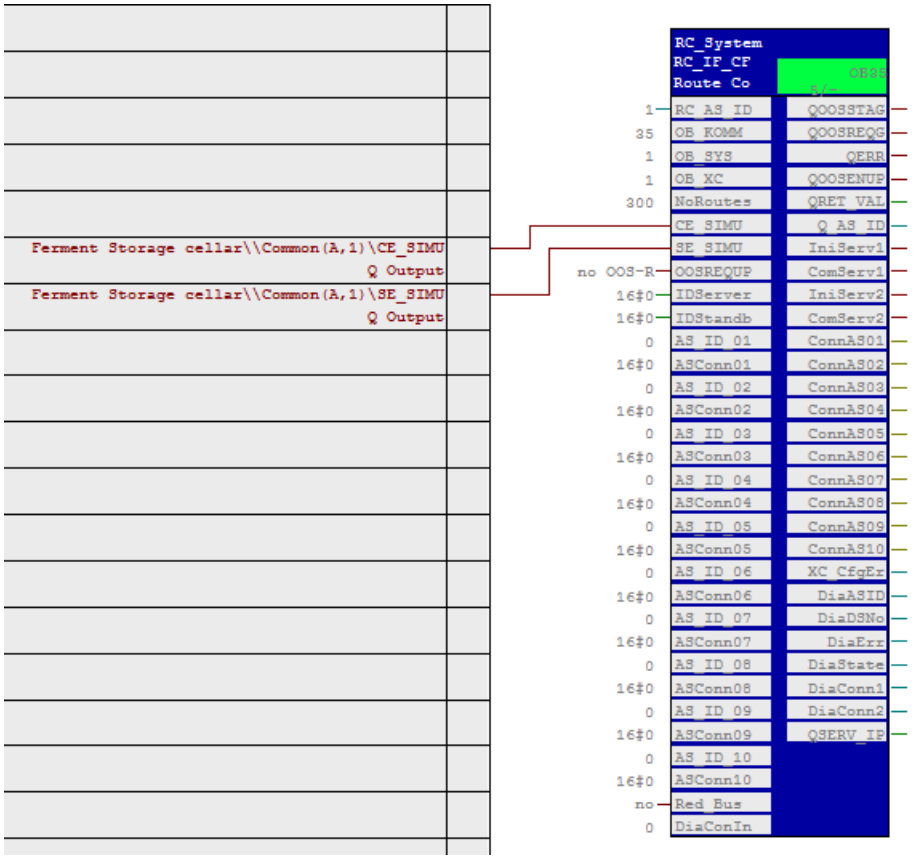
- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

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. Right-click "RC_IF_CFG" block and select "Object properties".
4. Enter the name "RC_System" in the "Name" input box and 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 to use by Route Control. Configuration is completed after the Route Control Wizard session is closed.



5.3 Interface blocks for control elements

5.3.1 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:

Route Control block	Control element type	Technological block
RC_IF_MOTOR (FB 822)	MOTOR	MotL (FB 1850) MotS (FB 1910)
RC_IF_MOT_REV (FB 823)	MOT_REV	MotRevL (FB 1851)
RC_IF_MOT_SPED (FB 824)	MOT_SPED	MotSpdCL (FB 1854) MotSpdL (FB 1856)
RC_IF_VALVE (FB 826)	VALVE	VlvL (FB 1899) VlvS (FB 1911)
RC_IF_VAL_MOT (FB 825)	VAL_MOT	VlvMotL (FB 1900)
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

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.

5.3.2 Exercise with RC_IF_VALVE

Task

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

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

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. Right-click "RC_IF_VALVE" block and select "Object properties".
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

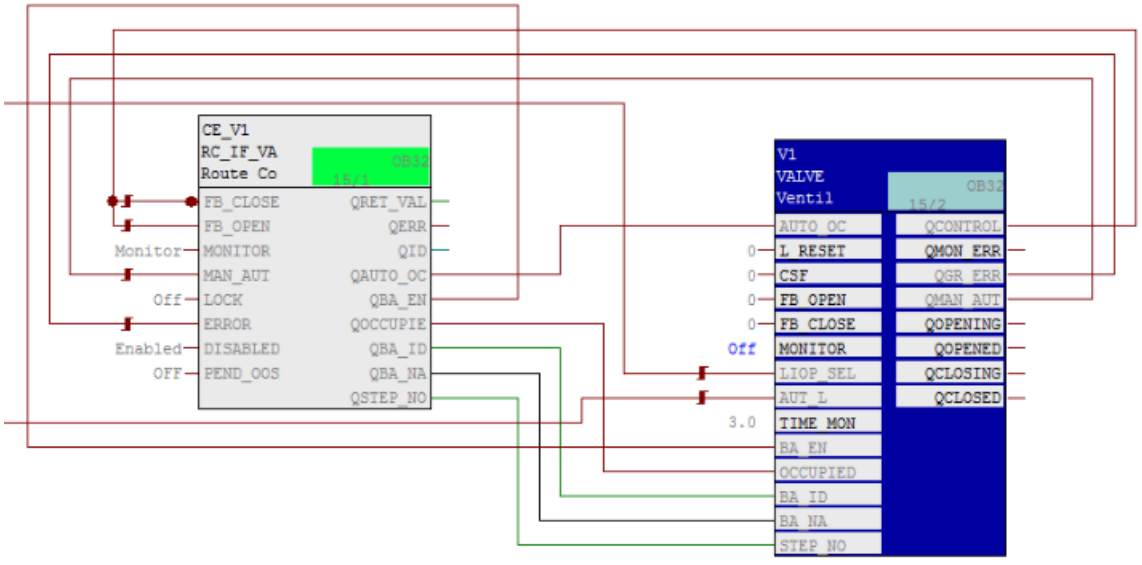
6. Interconnect the following outputs of the "V1" block with the inputs of the "CE_V1" block:

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

7. Right-click on the "FB_CLOSE" in "CE_V1" block and select "Invert" to negate the input.

Result

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



5.3.3 Exercise with RC_IF_MOTOR

Task

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

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

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. Right-click "RC_IF_MOTOR" block and select "Object properties".
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
QSTEP_NO	STEP_NO

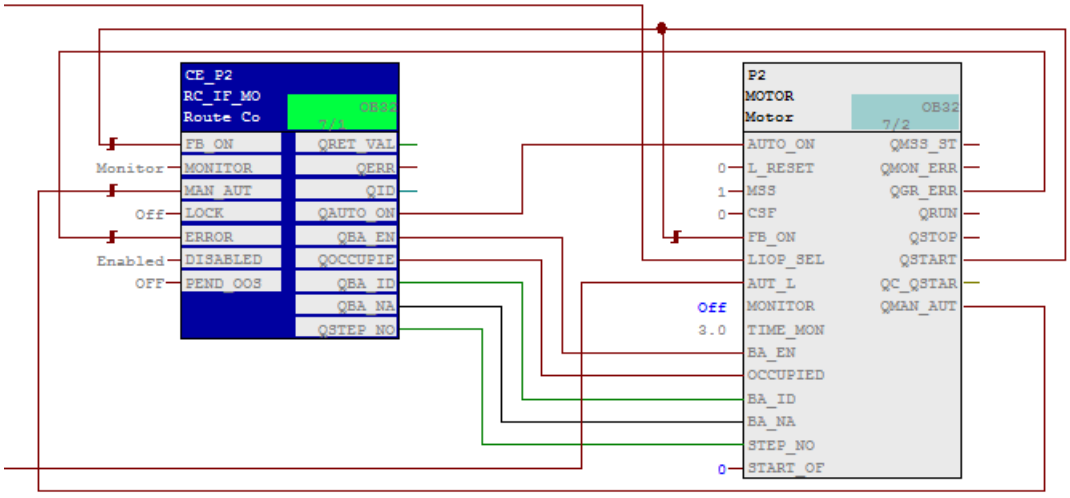
6. Interconnect the following outputs of the "P2" block with the inputs of the "CE_P2" block:

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 have successfully configured a Route Control interface block of the "MOTOR" type.



5.4 Interface blocks for sensor elements

5.4.1 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:

Route Control block	Sensor element type	Technological block
RC_IF_SENSOR (FB 845)	SENSOR	CH_DI (FC 277) among others
RC_IF_CONDUCT (FB 846)	CONDUCT	CH_AI (FC 275) among others
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

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.

Block contact	Meaning
QROUTE	ID of the route which uses this element.
QFUNC_ID	Function ID of the route which uses this element.

5.4.2 Exercise with RC_IF_SENSOR

Task

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

Prerequisites

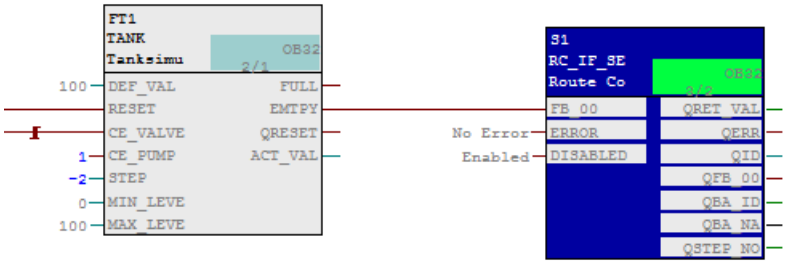
- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

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. Right-click "RC_IF_SENSOR" block and select "Object properties".
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 have successfully configured a control element of the type "SENSOR".



5.5 Interface blocks for parameter elements

5.5.1 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:

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

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.

Block contact	Meaning
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
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.

5.5.2 Exercise with RC_IF_VOLUME

Task

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

Prerequisites

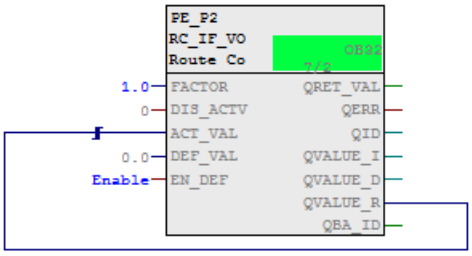
- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

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. Right-click "RC_IF_VOLUME" block and select "Object properties".
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" in input "FACTOR".
7. Program the value "enable" in input "EN_DEF".

Result

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



5.6 Interface block for link elements

5.6.1 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

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.
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.

5.6.2 Exercise with RC_IF_LE

Task

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

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

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.

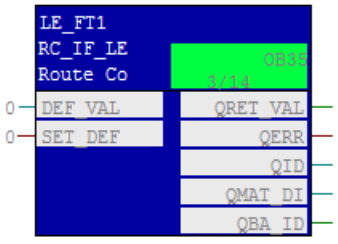
   Note

   The CFC chart already contains blocks of the type RC_IF_LE.

3. Right-click "RC_IF_LE" block and select "Object properties".
4. Enter the name "LE_FT1" in the "Name" input box.

Result

You have successfully configured a link element.



5.7 Interface block for material transport

5.7.1 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, 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 combine licenses as desired for 10 or 50 material transports up to a maximum of 300 material transports. This Route Control Getting Started deploys static route IDs.

Overview of 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 face-plate.
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

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
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.

5.7.2 Exercise with interface block RC_IF_ROUTE for manual mode

Task

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

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

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

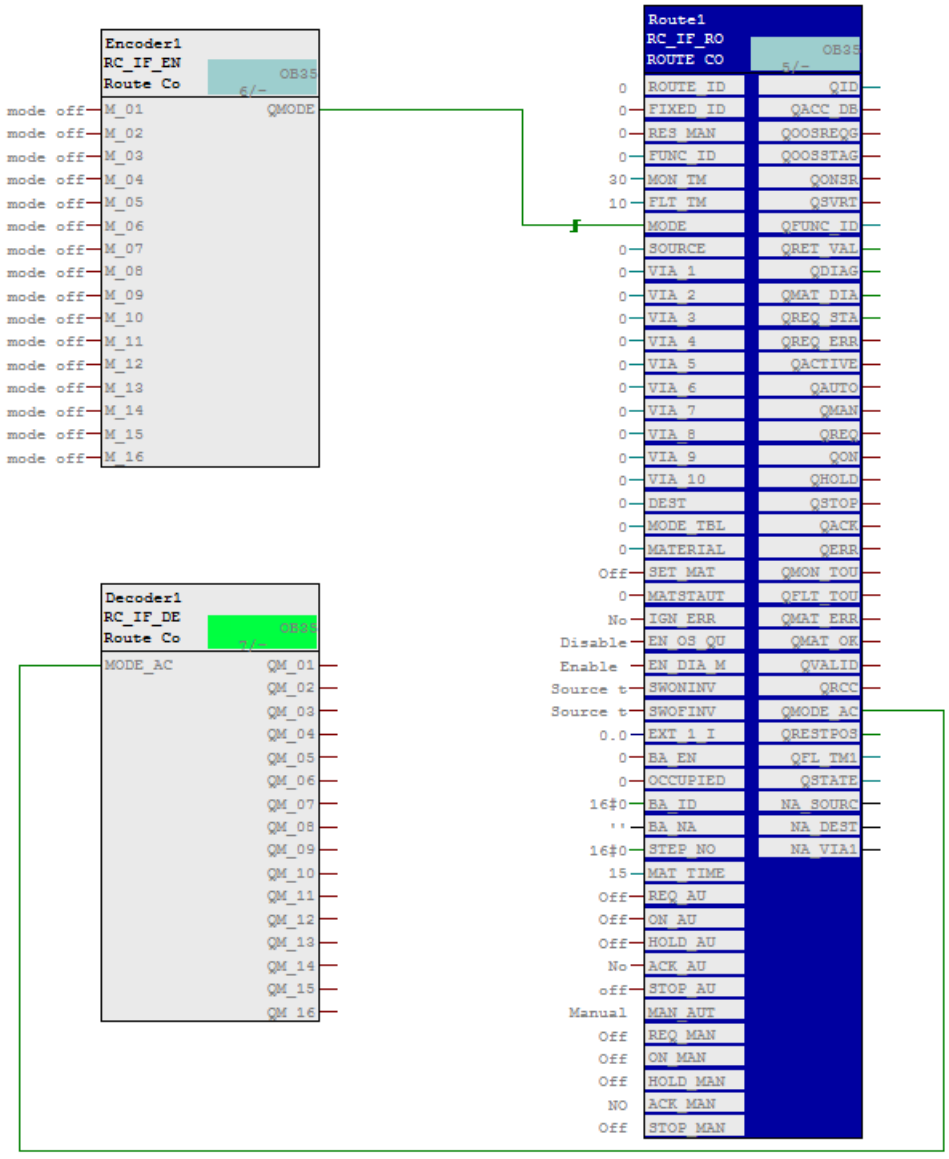
1. Open the "Route1" CFC chart from the partial project "RCGSAS_0".
2. Copy the "RC_IF_ROUTE" block from the "Lib" master data library to the CFC chart.
3. Right-click "RC_IF_ROUTE" block and select "Object properties".
4. Enter the name "Route1" in the "Name" input box.
5. Program the value "1" at input "ROUTE_ID".
6. Program the value "1" at input "FIXED_ID".
7. Insert the "RC_IF_ENCODER" block 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 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_AC" of "Decoder1".

Result

You have successfully configured an interface block for manual material transport.

Note

If you want to run it in automatic mode, configure it with an SFC type as described in 6.2.


Encoder1
RC_IF_EN
Route Co
OB35
6/-
mode off
M_01
M_02
M_03
M_04
M_05
M_06
M_07
M_08
M_09
M_10
M_11
M_12
M_13
M_14
M_15
M_16
QMODE
Route1
RC_IF_RO
ROUTE CO
OB35
5/-
ROUTE_ID
FIXED_ID
RES_MAN
FUNC_ID
MON_TM
FLT_TM
MODE
SOURCE
VIA_1
VIA_2
VIA_3
VIA_4
VIA_5
VIA_6
VIA_7
VIA_8
VIA_9
VIA_10
DEST
MODE_TBL
MATERIAL
SET_MAT
MATSTAUT
IGN_ERR
EN_OS_QU
EN_DIA_M
SWONINV
SWOFINV
EXT_1_I
BA_EN
OCCUPIED
BA_ID
BA_NA
STEP_NO
MAT_TIME
REQ_AU
ON_AU
HOLD_AU
ACK_AU
STOP_AU
MAN_AUT
REQ_MAN
ON_MAN
HOLD_MAN
ACK_MAN
STOP_MAN
QID
QACC_DB
QOOSREQG
QOOSSTAG
QONSR
QSVRT
QFUNC_ID
QRET_VAL
QDIAG
QMAT_DIA
QREQ_STA
QREQ_ERR
QACTIVE
QAUTO
QMAN
QREQ
QON
QHOLD
QSTOP
QACK
QERR
QMON_TOU
QFLT_TOU
QMAT_ERR
QMAT_OK
QVALID
QRCC
QMODE_AC
QRESTPOS
QFL_TM1
QSTATE
NA_SOURC
NA_DEST
NA_VIA1
Decoder1
RC_IF_DE
Route Co
OB35
7/-
MODE_AC
QM_01
QM_02
QM_03
QM_04
QM_05
QM_06
QM_07
QM_08
QM_09
QM_10
QM_11
QM_12
QM_13
QM_14
QM_15
QM_16

Controlling a route using a SFC block

6

6.1 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.

6.2 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.

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

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.
3. Rename the copied "RC_IF_ROUTE" block as "Route2".
4. Program a 2 at ROUTE_ID.
5. Program a 1 at FIXED_ID.
6. Copy the "RC_IF_SFC" block from the "Lib" master data library to the "Route2" CFC chart.
7. Rename the copied "RC_IF_SFC" block as "SFC_R2".
8. Interconnect output "RC_VIA_1" of the "SFC_R2" block with input "VIA_1" of the "Route2" block.
   After this step, all I/O belonging to "SFC_R2" are automatically connected to their corresponding I/Os.

   Note

   The SFC Type features three kinds of block contacts that are a group of 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.
9. Copy the "RC_IF_ENCODER" block into sheet 4 of the "Route2" CFC chart.
10. Rename the copied "RC_IF_ENCODER" block as "Encoder2".
11. Copy the "RC_IF_DECODER" block into sheet 4 of the "Route2" CFC chart.
12. Rename the copied "RC_IF_DECODER" block as "Decoder2".

13. Interconnect output "SP_M_01" of the "SFC_R2" block with input "M_01" of the "Encoder2" block.

Note

Once "SP_M_01" of "SFC_R2" block is interconnected with "M_01" of "Encoder2", the outputs "SP_M_02" to "SP_M_32" are automatically connected to the corresponding inputs "M_02" to "M_32".

14. Interconnect output "QM_01" of the "Decoder2" block with input "AC_QM_01" of the "SFC_R2" block.

Note

Once "QM_01" of "Decoder2" block is interconnected with "AC_QM_01" of "SFC_R2", the outputs "QM_02" to "QM_32" are automatically connected to the corresponding inputs "AC_QM_02" to "AC_QM_32".

15. Interconnect output "QMODE_AC" of the "Route2" block with input "MODE_AC" of the "Decoder2" block.
16. Interconnect output "QMODE" of the "Encoder2" block with input "Mode" of the "Route2" block.
17. Open the "FT1" CFC chart from the partial project "RCGSAS_0".
18. Interconnect output "Empty" of the "FT1" block with input "FT1_Empt" of the "SFC_R2" block.
19. Open the "FT2" CFC chart from the partial project "RCGSAS_0".
20. Interconnect output "Empty" of the "FT2" block with input "FT2_Empt" of the "SFC_R2" block.
21. Open the "ST1" CFC chart from the partial project "RCGSAS_0".
22. Interconnect output "Full" of the "ST1" block with input "ST1_Full" of the "SFC_R2" block.
23. Open the "ST2" CFC chart from the partial project "RCGSAS_0".
24. Interconnect output "Full" of the "ST2" block with input "ST2_Full" of the "SFC_R2" block.
25. Interconnect the following outputs of the block "SFC_R2" with its inputs:

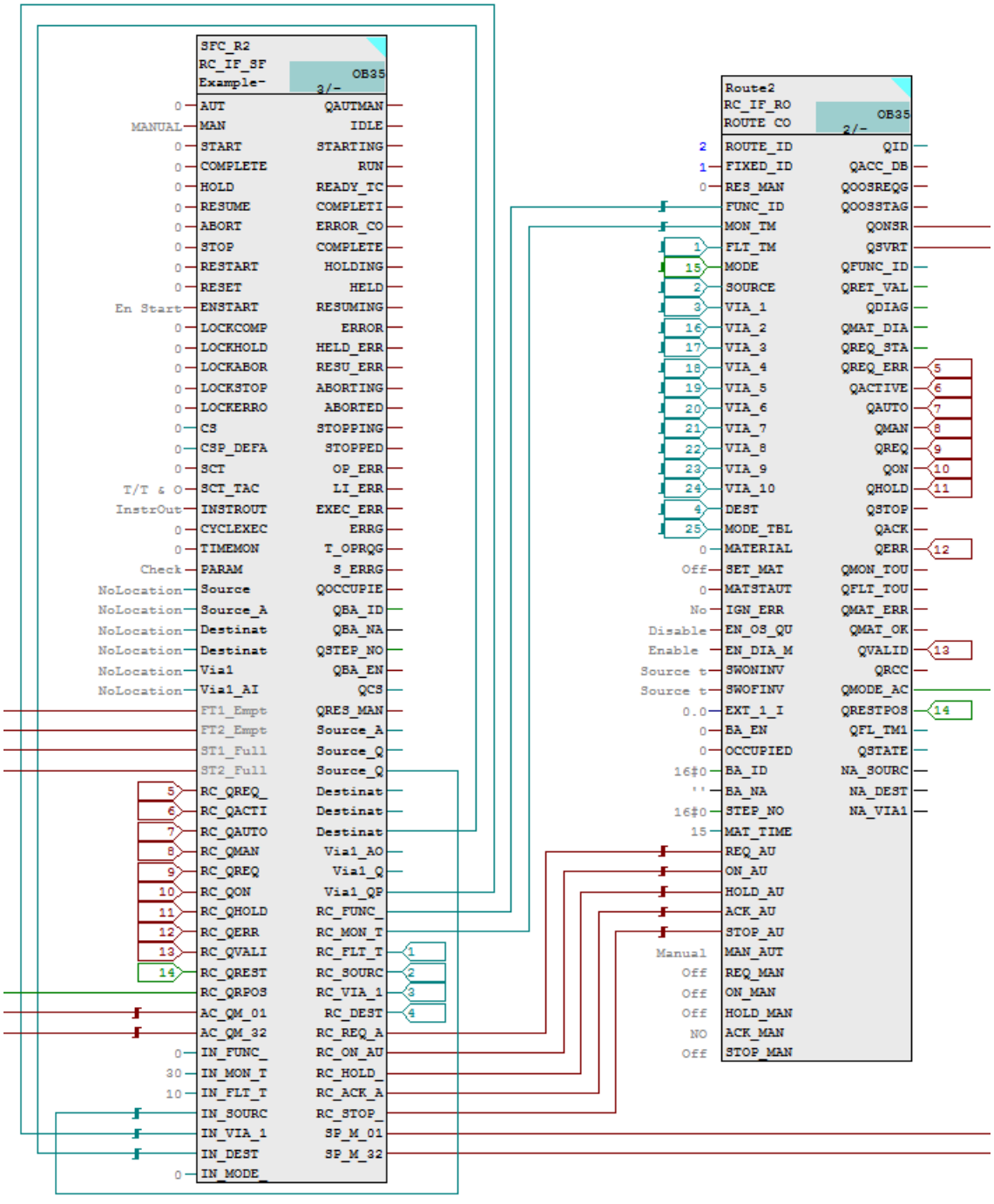
Outputs	Inputs
Source_QP	IN_SOURCE
Destination_QP	IN_DEST
Via1_QP	IN_VIA_1

Note

CFC chart "Route3" contains an example of interconnections between the "Decoder", "Encoder" and the "RC_IF_ROUTE" block.

Result

You have successfully configured a material transport at CFC level from the "Fermenting tank 1" source to "Storage tank 1" destination.



6.3 Exercise for the compilation and download of CFC charts

Task

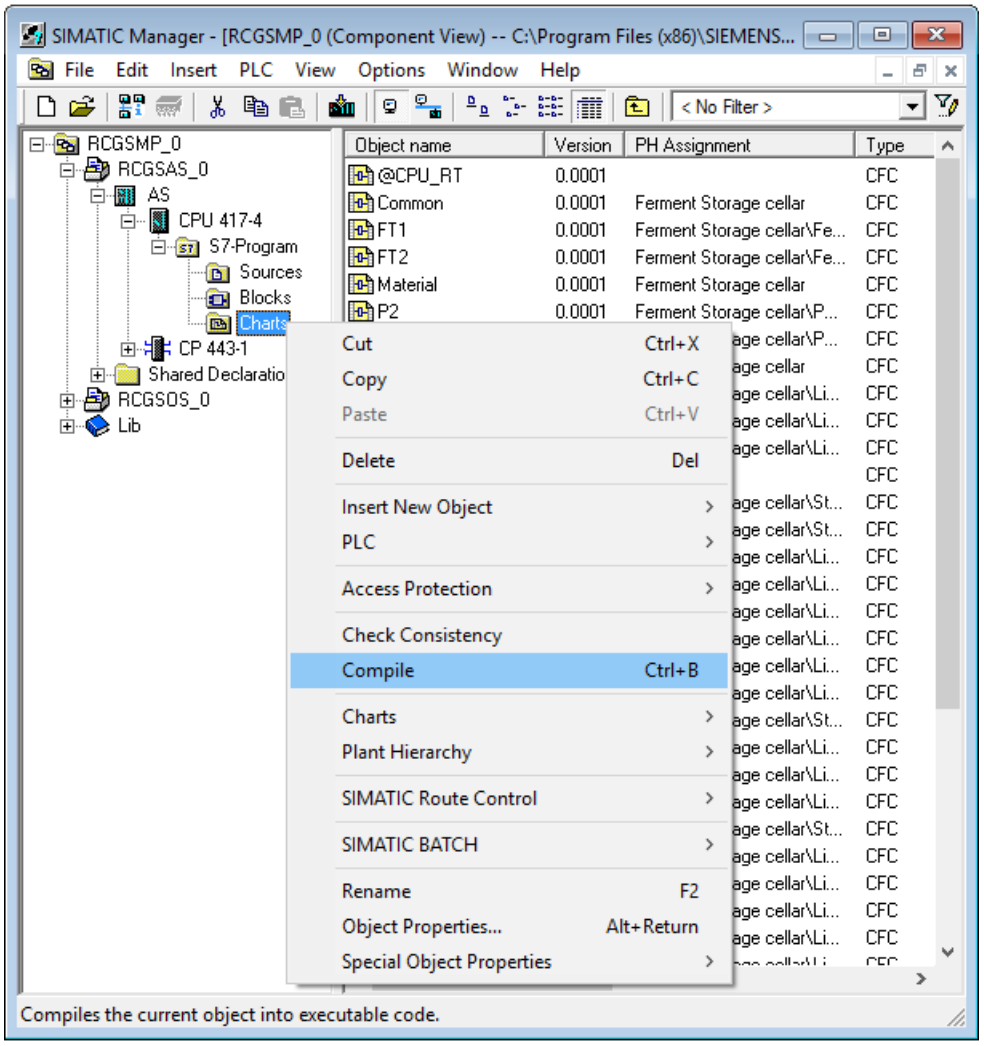
Compile and download the CFC charts.

Prerequisite

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.
- The hardware is downloaded to the AS.

Procedure

1. Right-click the "Charts" folder.

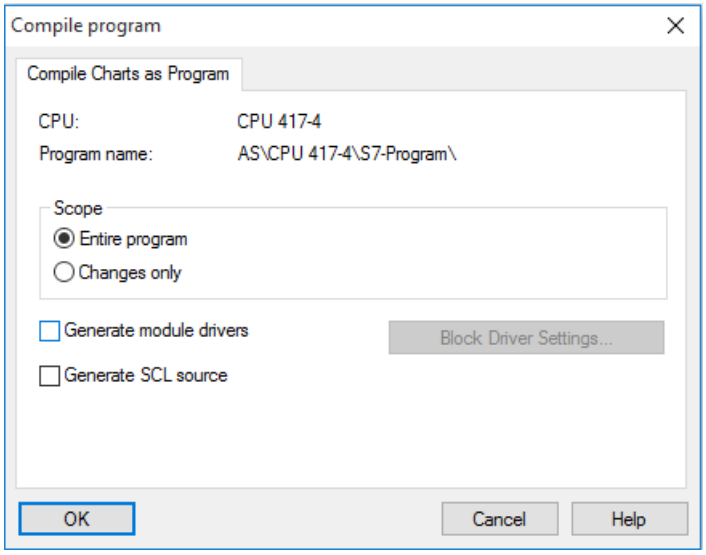


2. Select the "Compile" menu command.
   The "Compile program" dialog box opens.
3. Activate the "Entire program" check box.
4. Deactivate the "Generate module drivers" checkbox.

5. Click "OK".

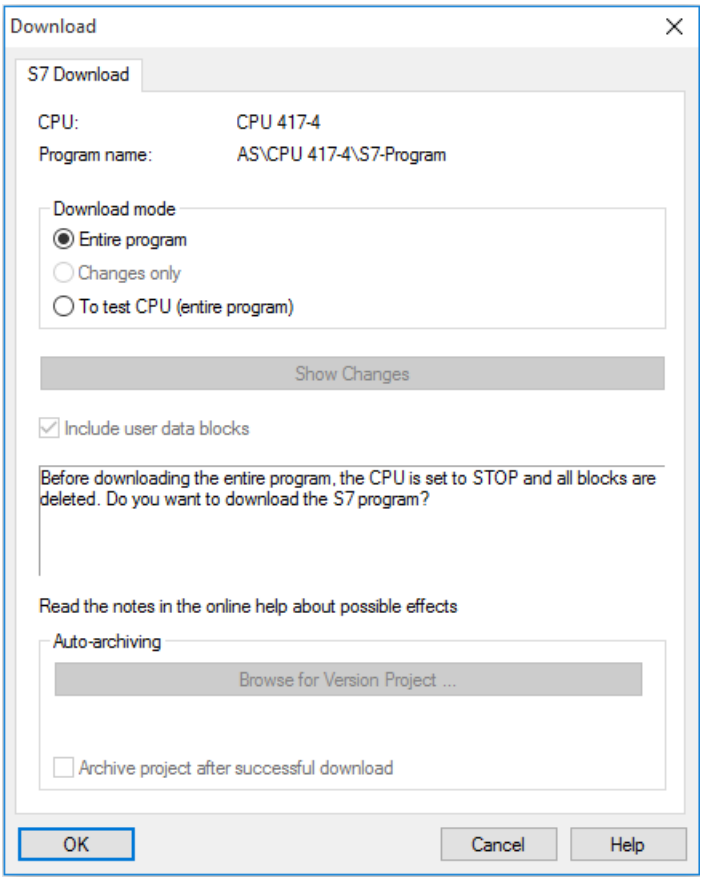
Note

Adapt local data on the AS accordingly, if the compiler reports errors in terms of local data requirements. You can calculate local data requirements using the chart reference data of the CFC editor.

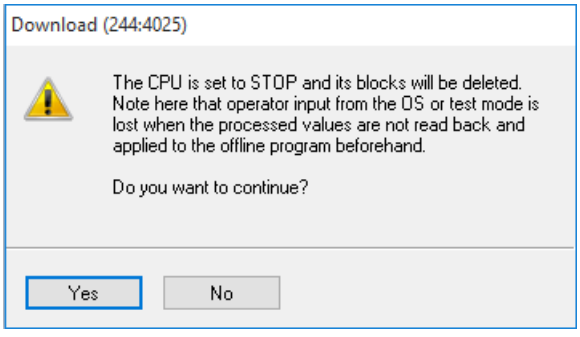


6. Right-click the "Charts" folder.
7. Select the "PLC > Download" menu command.

8. Activate the "Entire program" check box.



9. Click "OK".
   The "Download" dialog box opens.
10. Click "Yes".

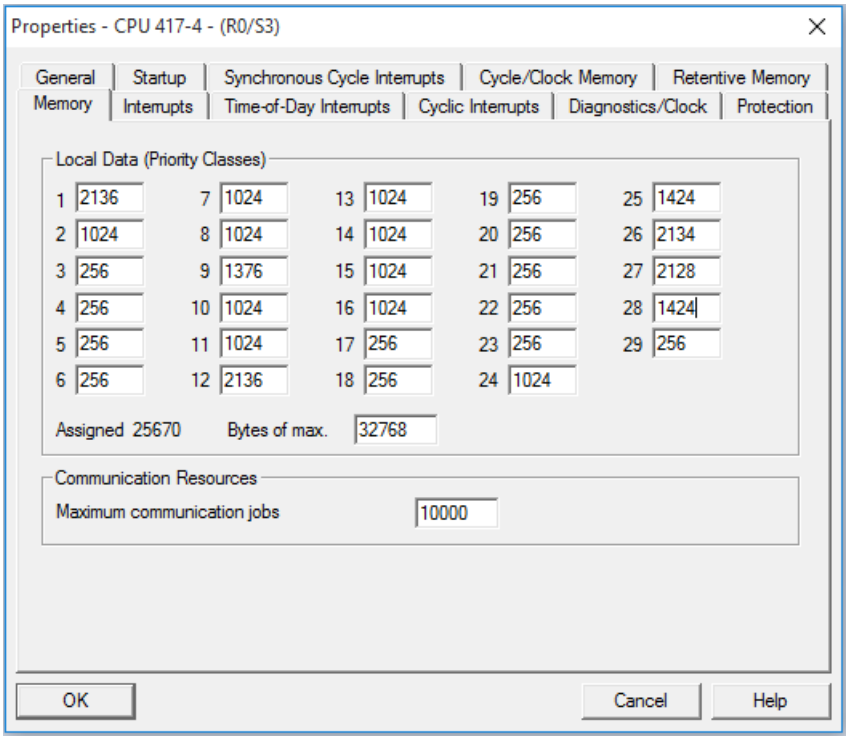


How to customize local data requirements

Note

During compilation of AS, if the compiler reports errors in terms of local data requirements, follow the below mentioned steps.

1. Open a CFC chart.
2. Open 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.



Note

Download the hardware again to AS.

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 have successfully compiled and downloaded the AS program.

Route Control Wizard

7

7.1 Overview of the Route Control Wizard

Overview

Using the Route Control Wizard, you can export the data relevant for Route Control from the S7 project and import it into the Route Control Engineering.

Tasks of the Route Control Wizard

The Route Control Wizard performs the following tasks:

- Export of AS names and IDs from the S7 project, including check and correction of the IDs of the automation systems.
- Export of the plant hierarchy from the S7 project, including the plants and units.
  The export only includes process cells and units which are relevant to SIMATIC BATCH.
- Export of AS elements and routes (route = RC_IF_ROUTE), including check and correction of IDs.
- Establish and modify the communication links between the automation systems relevant to Route Control and Route Control servers.
- Export of AS-server connections.
- Selection of the PCS 7 OS Message Server.
- Generation of Route Control Server messages.
- Generation of operation messages of Route Control faceplates.
- Import of the data to the Route Control project.

Note

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

7.2 Exercise with the Route Control Wizard

Task

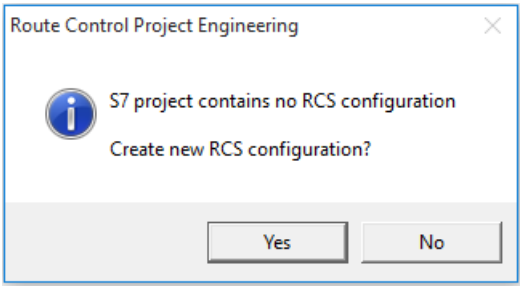
Use the Route Control Wizard to perform all possible actions.

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

Procedure

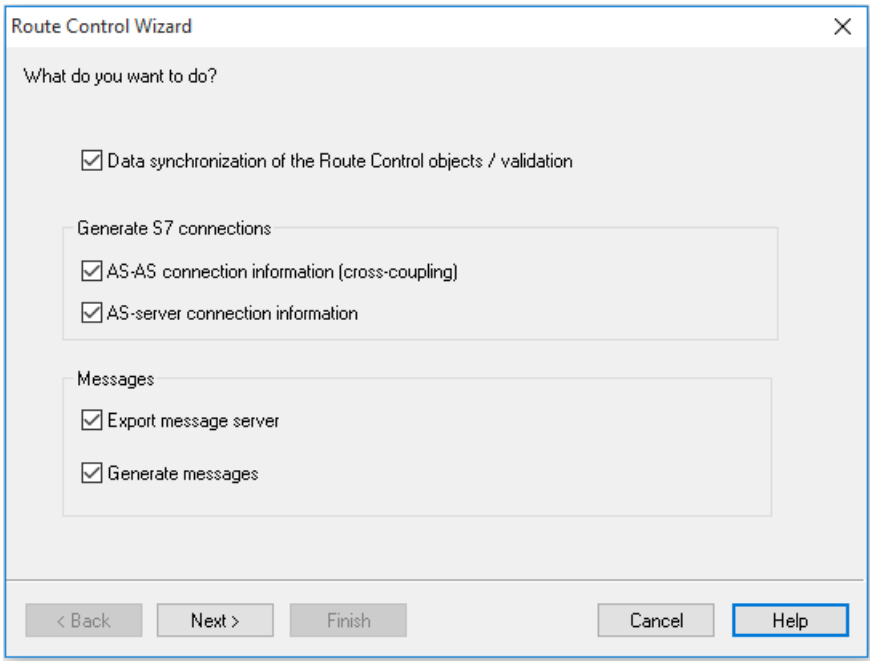
1. Select the "Options > SIMATIC Route Control > Wizard" menu command.
   The Route Control Wizard opens.
2. The "Route Control Configuration" dialog box is opened if the Route Control does not contain a configuration for this S7 project.



3. Click "Yes".
   A Route Control object and the database are created.
   The data is read from the S7 project.
   The step for selecting the actions opens.

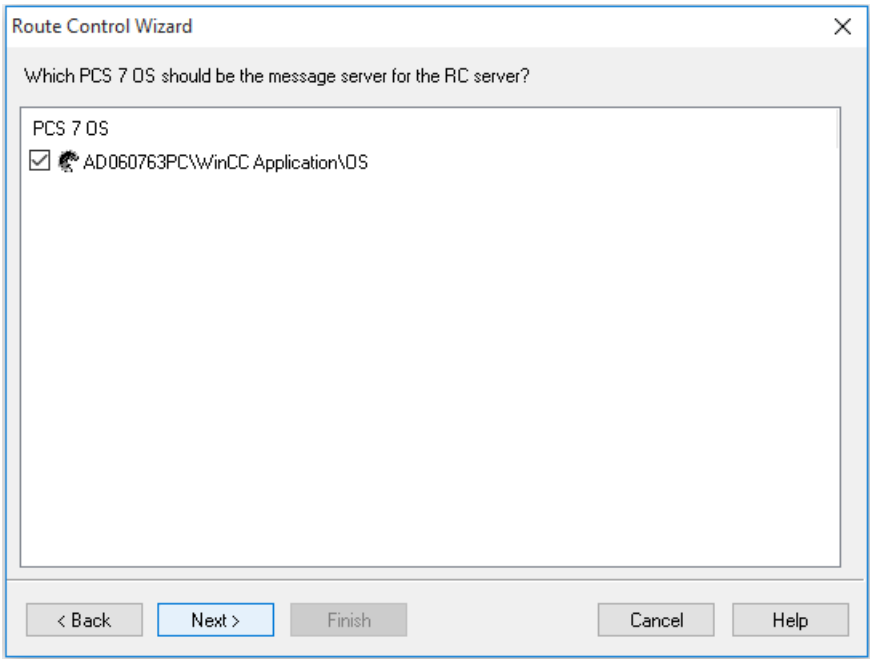
Note

Login with RC maintenance group user credentials described in section 4.7.

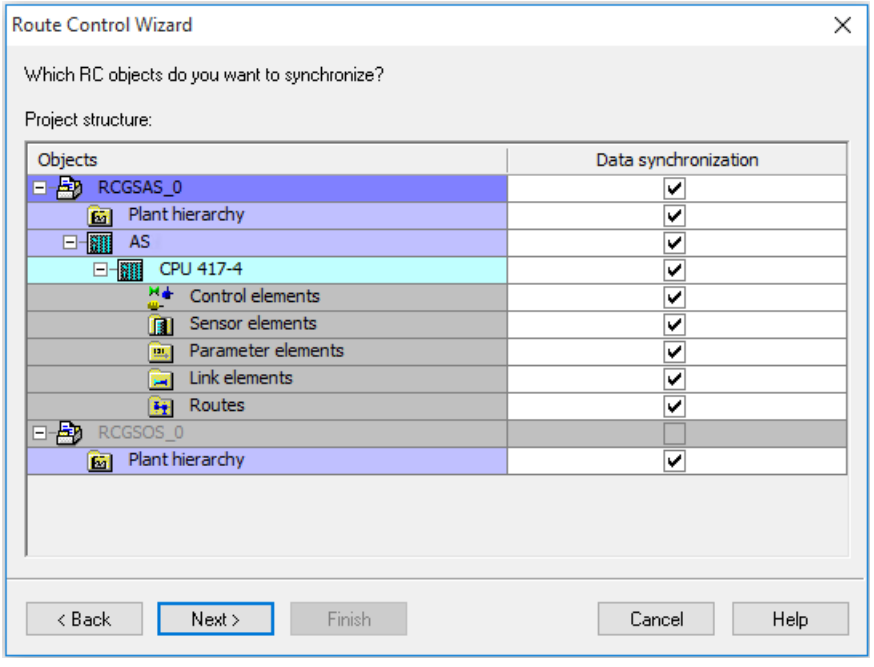


4. Activate all check boxes.

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

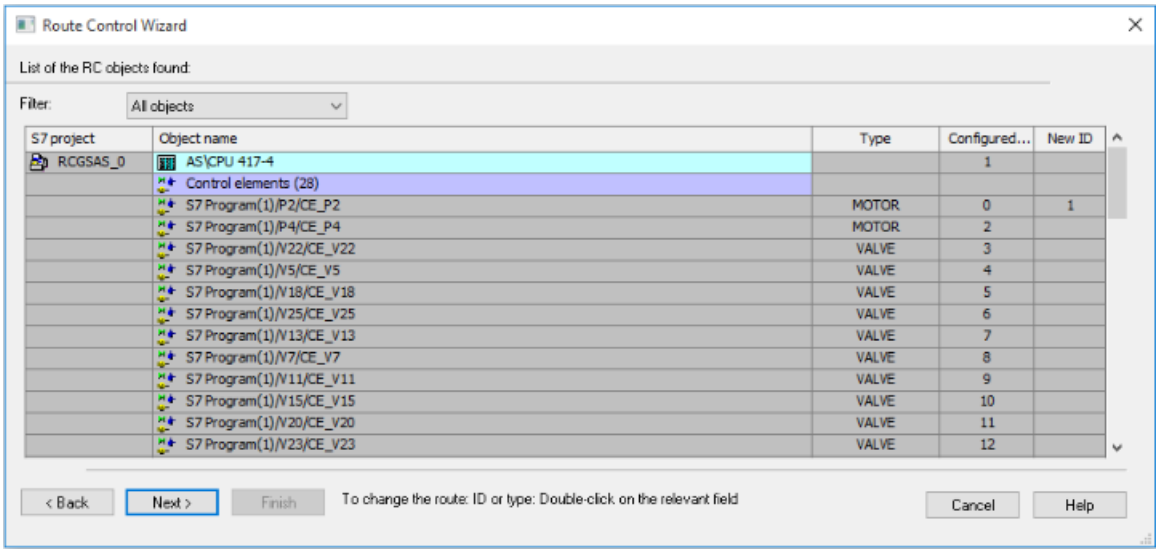


6. Activate the check box for the message server.
7. Click "Next".
   The step for selecting the objects opens.

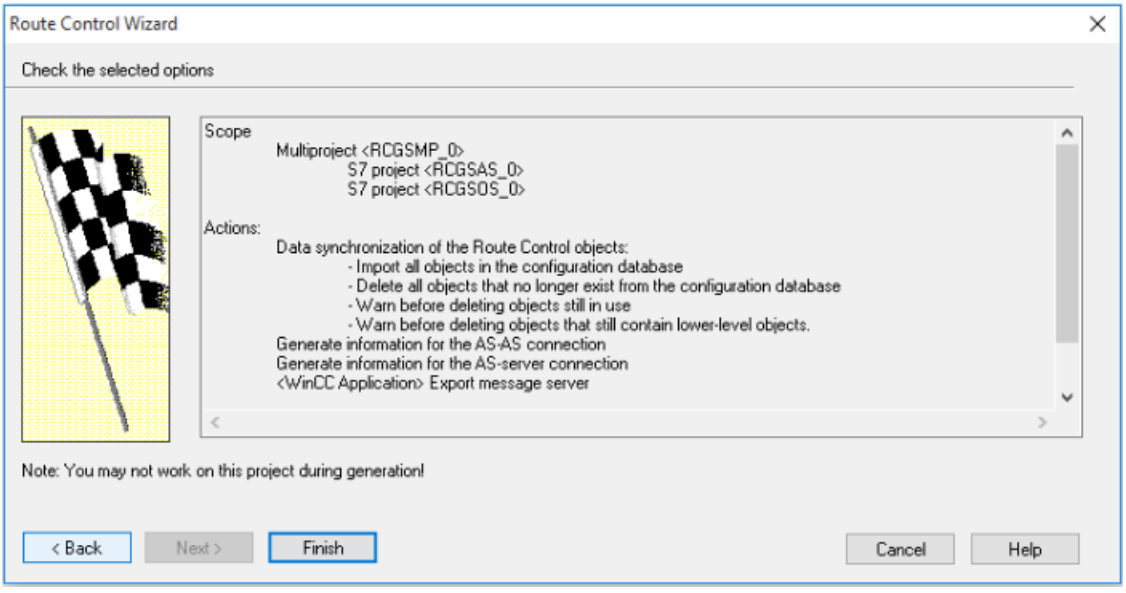


8. Activate all check boxes.

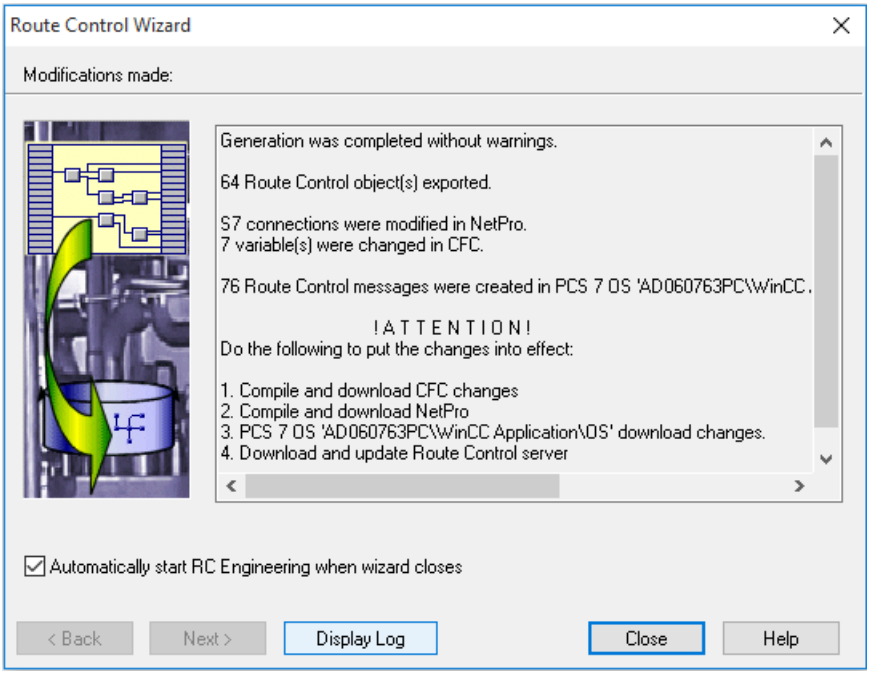
9. Click "Next".
   The list of objects found is listed in the dialog box.



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 "Display logs".
    The log file is opened in a text editor.

    Note

    RC Engineering will automatically start, if the checkbox "Automatically start RC Engineering when the wizard closes" is activated.

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.

7.3 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.

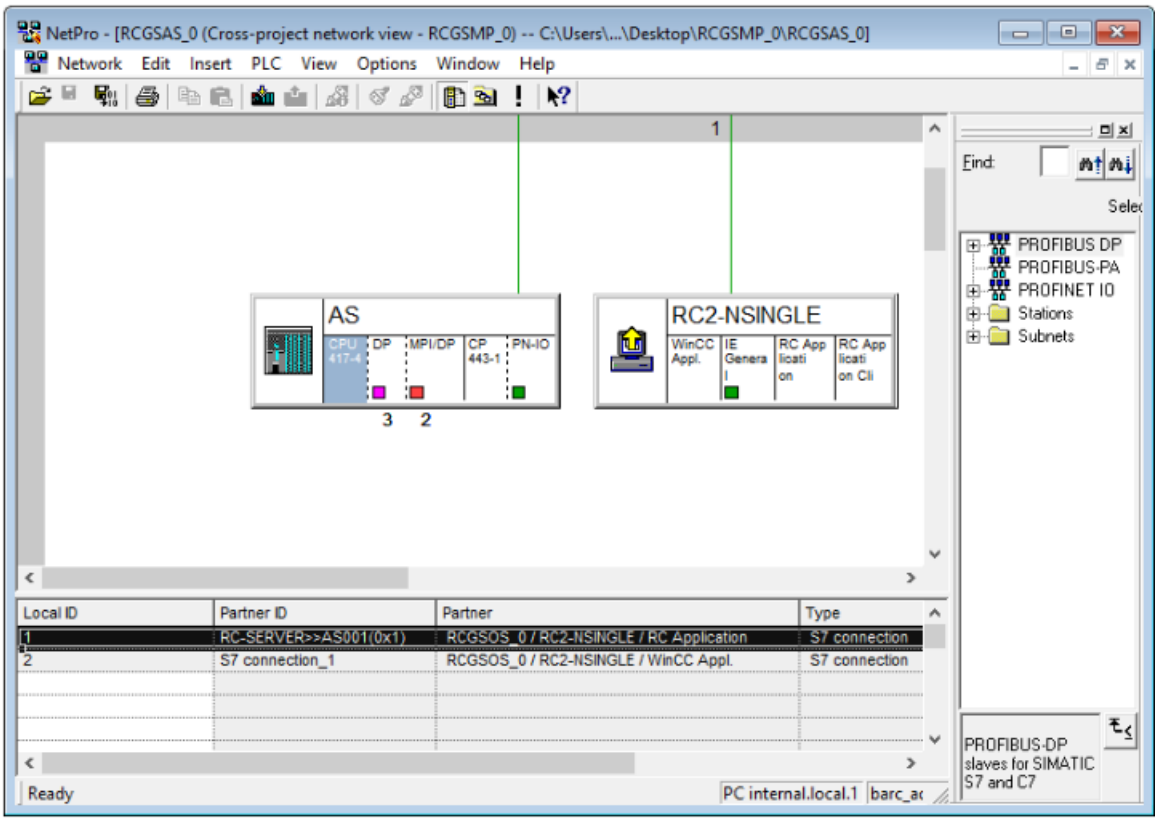
Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

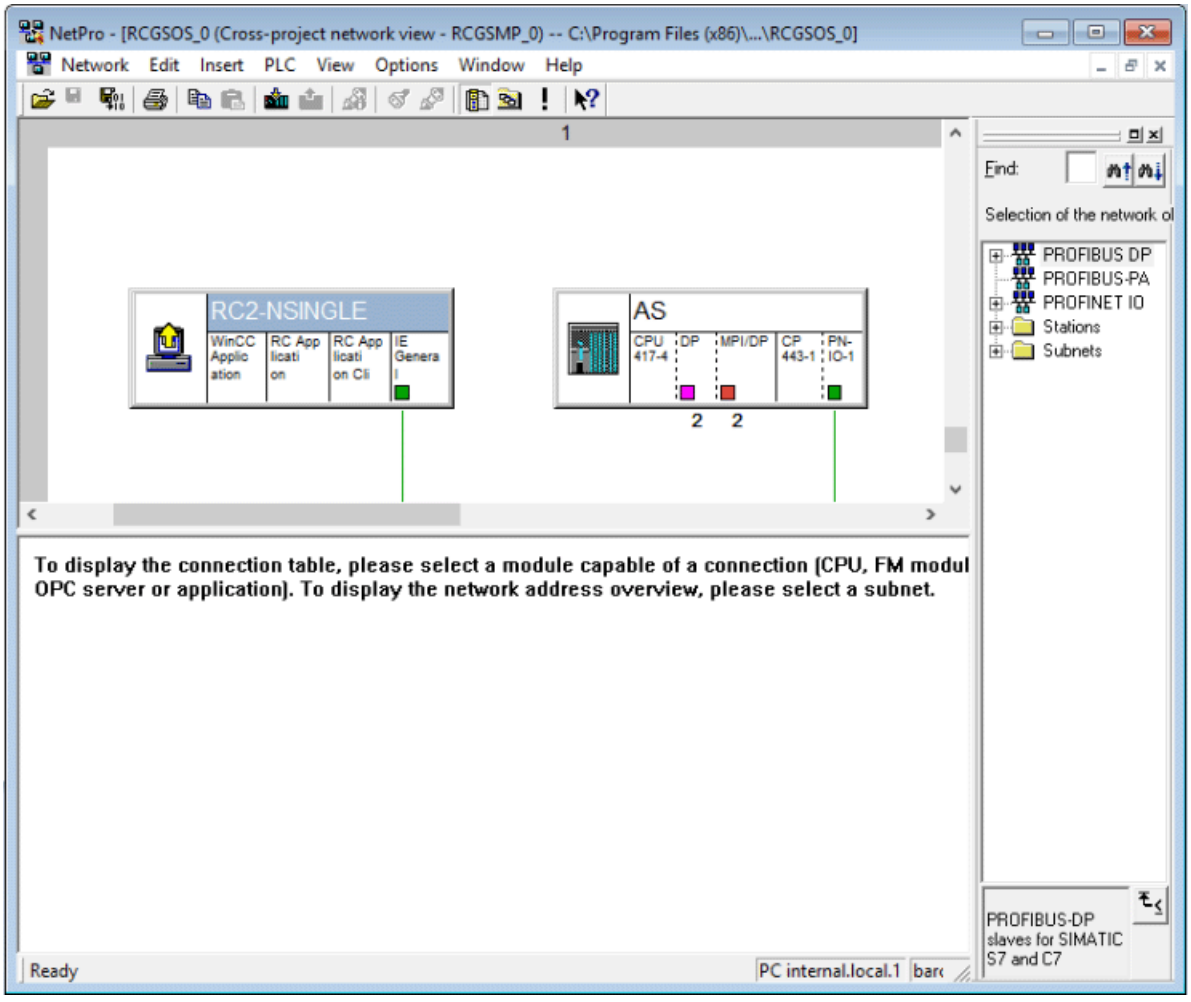
Procedure

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 detailed window and then select the "Edit > Open Object" command.
   NetPro opens.
3. Select "View > Cross project network view" menu command.
4. Select the "Network > Save and compile" menu command.
   The "Save and compile" dialog box opens.
5. Activate the "Compile and check everything" check box and then click "OK".
6. The "Outputs for consistency check" window opens after compilation has been completed. Close this window.

7. Select the CPU and click .



8. Select the PC Station and click .



9. Close NetPro.
10. Download the CFC charts by following the steps described in section 6.3.
11. Go to SIMATIC Manger.
12. Select "RCGSOS > WinCC > OS".
13. Right-click "OS" and select "Compile".

Note

Make sure that the Picture tree option is not checked and the SFC visualization is checked during OS compilation.

Plant structure under the aspect of Route Control

8

8.1 Locations

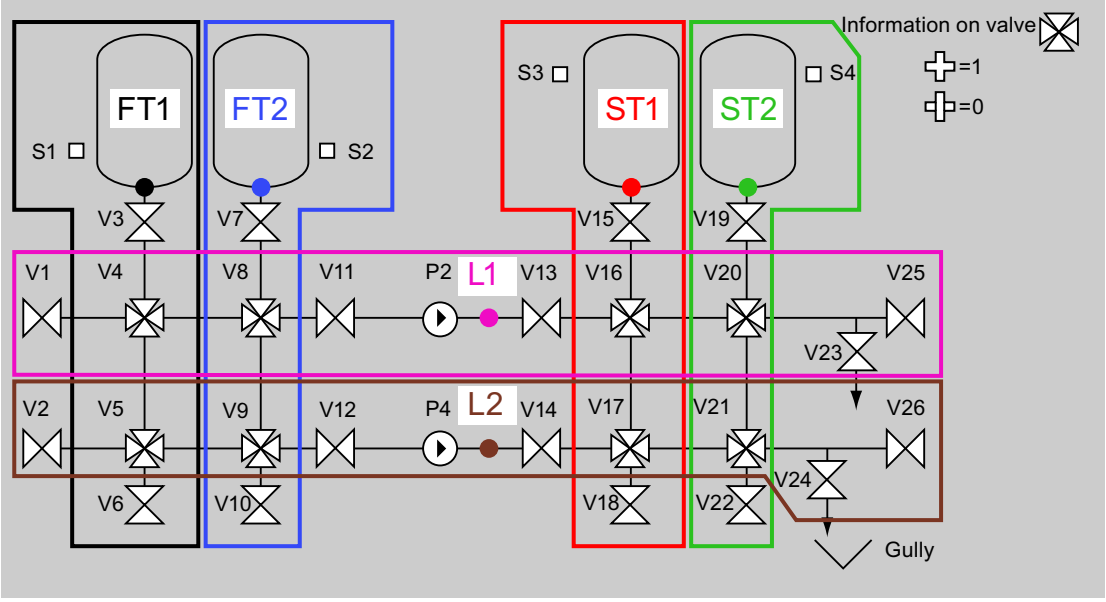
Locations

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.



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
L1	Line1	V1, V4, V8, V11, P2, V13, V16, V20, V23, V25
L2	Line2	V2, V5, V9, V12, P4, V14, V17, V21, V24, V26

8.2 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

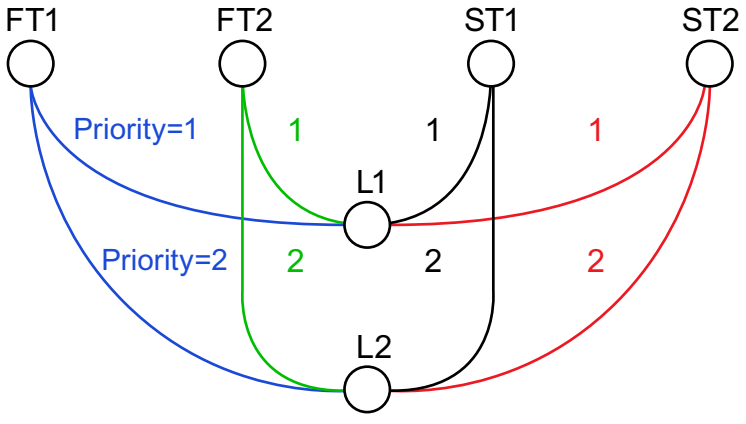
Each partial route is assigned to a Mode Table. A Mode Table contains 32 modes which you can name appropriately. Material transport is controlled in runtime by activating and deactivating modes. This functionality allows you to control and poll all elements of the partial routes of a route according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



Partial routes are always unidirectional. You have two options of setting up a route from FT1 to ST1. The route via location L1 with overall priority class 1 and the route via location L2 with overall priority class 2. 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.

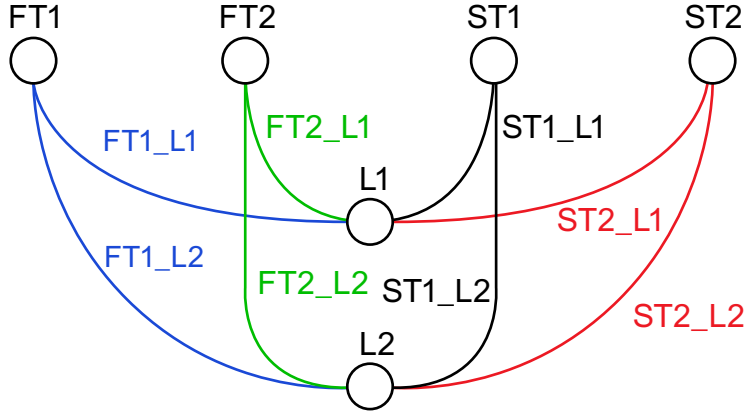
Source / destination

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

Configure the following partial routes:

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

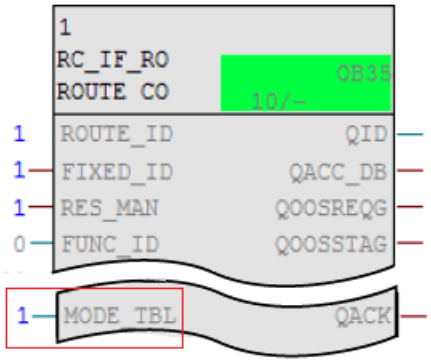
Route network with locations and partial routes:



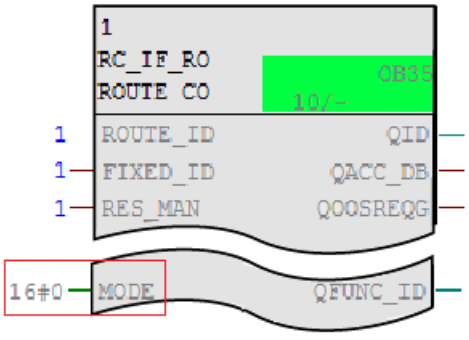
8.3 Mode table

The Mode Table

Each partial route is assigned to a Mode Table. A Mode Table contains 32 modes which you can name appropriately. 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, if a specfic ID is defined for route identification then only the partial routes of that mode table are included.



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.



8.4 Getting Started modes

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 an 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.

8.5 Control tables

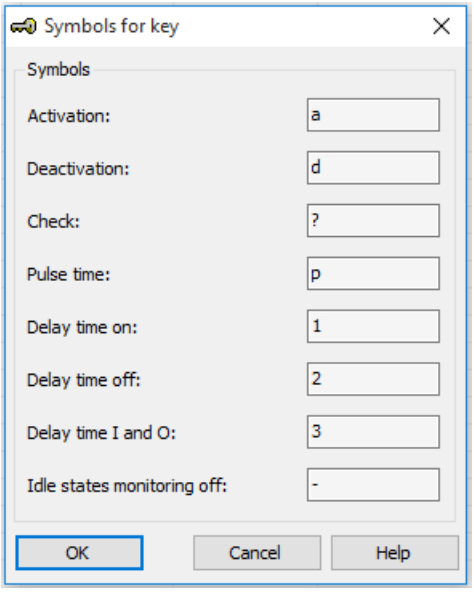
Control tables

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:

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.



Activation table of partial route FT1_L1

Element	Basic setting	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S1						d?	
CE_V3	d?			a			
CE_V4	d?	a					
CE_V5	d?						
CE_V6	d?						
CE_V1	d?						

Element	Basic setting	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
CE_V8	d?						
CE_V11	d?	a					
CE_P2	d?		a				
CE_V13	d?	a					
CE_V16	d?						
CE_V20	d?						
CE_V23	d?						
CE_V25	d?						

Activation table of partial route FT1_L2

Element	Basic setting	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S1						d?	
CE_V3	d?			a			
CE_V4	d?						
CE_V5	d?	a					
CE_V6	d?						
CE_V2	d?						
CE_V9	d?						
CE_V12	d?	a					
CE_P4	d?		a				
CE_V14	d?	a					
CE_V17	d?						
CE_V21	d?						
CE_V24	d?						
CE_V26	d?						

Activation table of partial route FT2_L1

Element	Basic setting	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S2						d?	
CE_V7	d?			a			
CE_V8	d?	a					
CE_V9	d?						
CE_V10	d?						
CE_V1	d?						
CE_V4	d?						

Element	Basic setting	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
CE_V11	d?	a					
CE_P2	d?		a				
CE_V13	d?	a					
CE_V16	d?						
CE_V20	d?						
CE_V23	d?						
CE_V25	d?						

Activation table of partial route FT2_L2

Element	Basic setting	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S2						d?	
CE_V7	d?			a			
CE_V8	d?						
CE_V9	d?	a					
CE_V10	d?						
CE_V2	d?						
CE_V5	d?						
CE_V12	d?	a					
CE_P4	d?		a				
CE_V14	d?	a					
CE_V17	d?						
CE_V21	d?						
CE_V24	d?						
CE_V26	d?						

Activation table of partial route L1_ST1

Element	Basic setting	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S3							d?
CE_V15	d?				a		
CE_V16	d?	a					
CE_V17	d?						
CE_V18	d?						

Activation table of partial route L1_ST2

Element	Basic setting	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S4							d?
CE_V19	d?				a		
CE_V20	d?	a					
CE_V21	d?						
CE_V22	d?						

Activation table of partial route L2_ST1

Element	Basic setting	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S3							d?
CE_V15	d?				a		
CE_V16	d?						
CE_V17	d?	a					
CE_V18	d?						

Activation table of partial route L2_ST2

Element	Basic setting	Set route	Pump On	Open source	Open destination	Source not empty	Dest not full
S4							d?
CE_V19	d?				a		
CE_V20	d?						
CE_V21	d?	a					
CE_V22	d?						

Route Control Engineering

9

9.1 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.

Task

Define the location types.

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- Plant view is activated.
  You can 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 plant hierarchy. The following equipment property types, including their instances, must be created for the project.

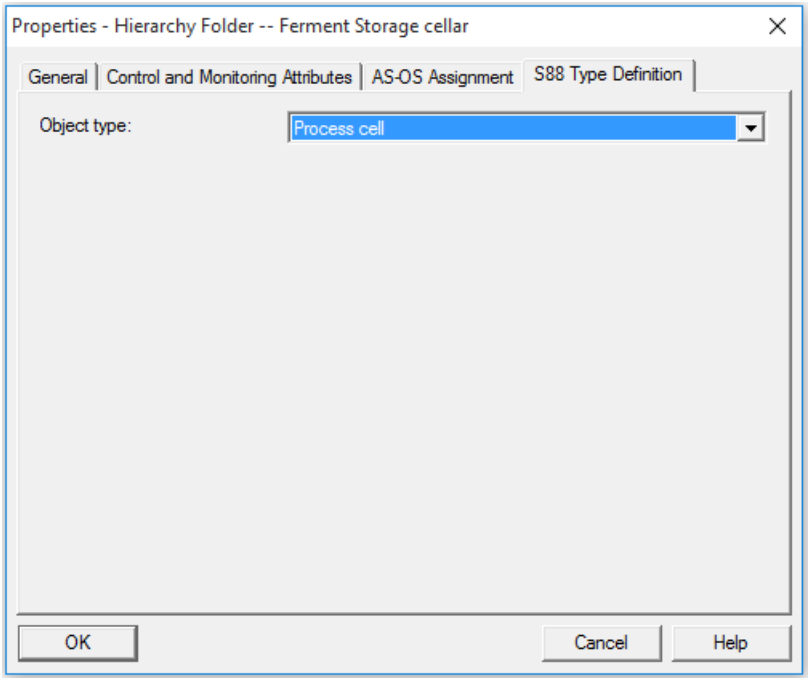
Name	Data type	Source	Destination	Via
Destination	LOCATION		x	x
Line1	LOCATION	x	x	x
Line2	LOCATION	x	x	x
Source	LOCATION	x		x

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

Procedure

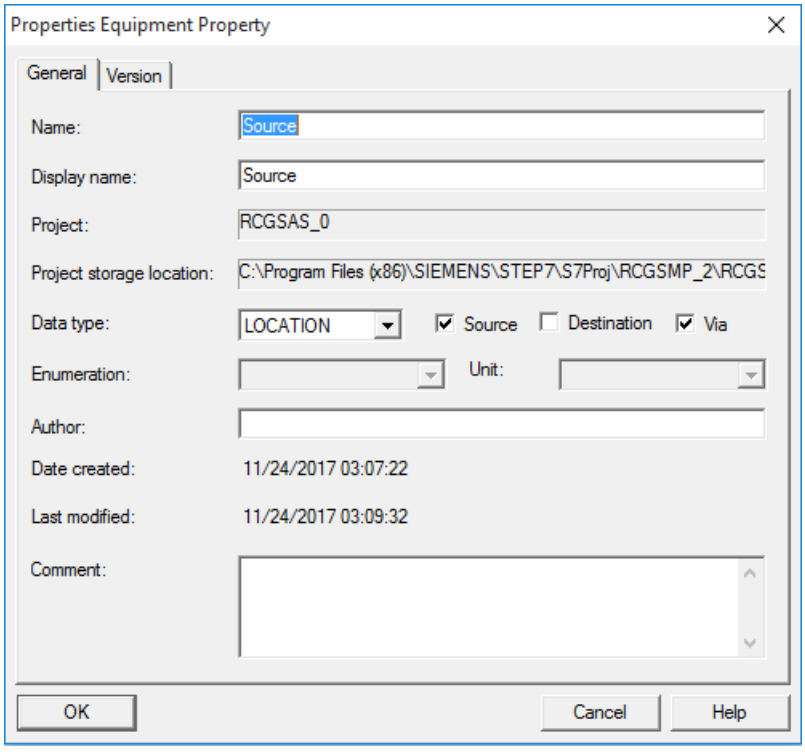
How to define the location types

1. Right-click the "Ferment Storage cellar" folder in the subproject "RCGSAS_0" and select "Object properties".
   The "Properties - Hierarchy folder" dialog box opens.
2. Select the "S88 Type Definition" tab.
3. Select the "Process cell" entry from the "Object type" drop-down list box.



4. Click "OK".
5. Open the object properties of the "Fermenting_cellar > Fermenting tank 1" folder.
6. Set the "Unit" object type in the "S88 Type Definition" tab.
7. Click "OK".
8. Set the "Unit" object type at the "Fermenting cellar > Fermenting tank 2", "Line >Line", "Storage cellar > Storage tank 1" and "Storage cellar > Storage tank 2" folders.
9. Right-click "Shared Declarations" folder and select the "Insert new object > Equipment property".
   A "Equipment properties" folder is created.
10. Repeat step 9 three times.
    You have now created four "Equipment property" objects in the "Equipment properties" folders.
11. Right-click the new "Equipment Property1" object and select "Object properties".
    The "Properties Equipment Property" dialog box opens.

12. Enter the following data:
    Name: "Source"
    Data type: "LOCATION", Source: activated, Dest: deactivated, Via: activated.



13. Click "OK".
14. Enter the following data in the object properties of the new "Equipment properties2" object:
    Name: "Destination"
    Data type: "LOCATION", Source: deactivated, Destination: activated, Via: activated.
    Click "OK".
15. Enter the following data in the object properties of the new "Equipment properties3" object:
    Name: "Line1"
    Data type: "LOCATION", Source: activated, Destination: activated, Via: activated.
    Click "OK".
16. Enter the following data in the object properties of the new "Equipment properties4" object:
    Name: "Line2"
    Data type = "LOCATION", Source: activated, Destination: activated, Via: activated.
    Click "OK".

How to enter the locations

1. Right-click the "Fermenting tank 1" folder and select the "Insert new object > Equipment properties".
   The "Equipment properties" folder is created.
2. Right-click the new "Equipment properties" folder and select the "Insert new object > Equipment property".
   The new "Equipment property" object is created.

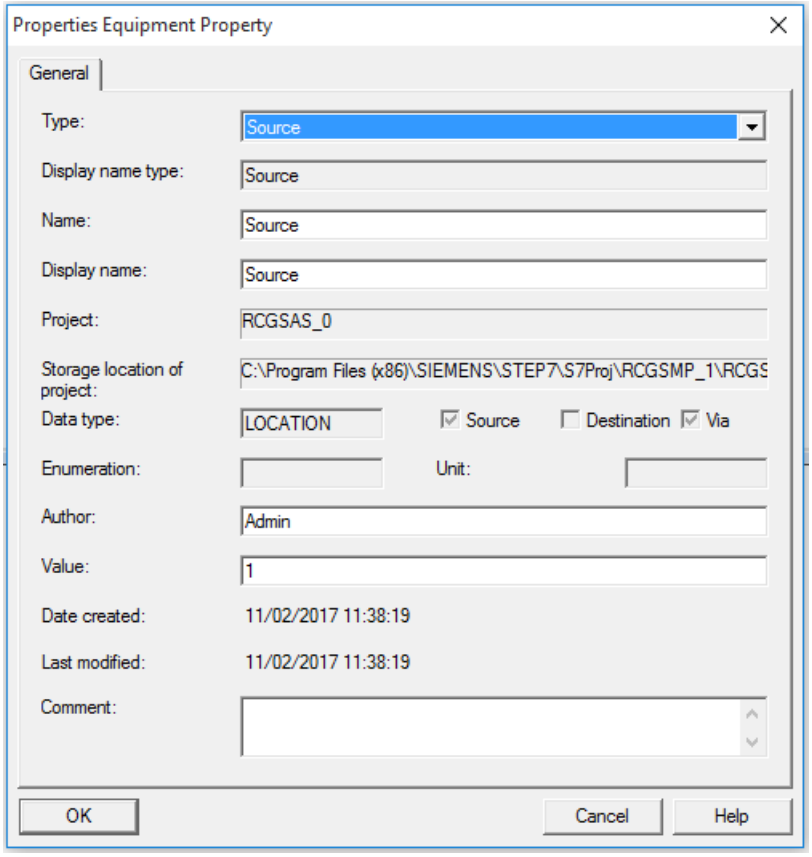
Note

In the case of "Line", the "Equipment property" has to be added twice.

3. Right-click the new "Equipment property" object and select "Object properties".
   The "Properties Equipment Property" dialog box opens.
4. Select the "Source" entry from the "Type" field.

Note

If "Source" entry is selected from "Type" field, the "Name" and "Display name" are selected as "Source" automatically.



5. Click "OK".
   Your entries are applied.

6. Repeat the steps from 1 to 5 to configure all other locations listed in the table.

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

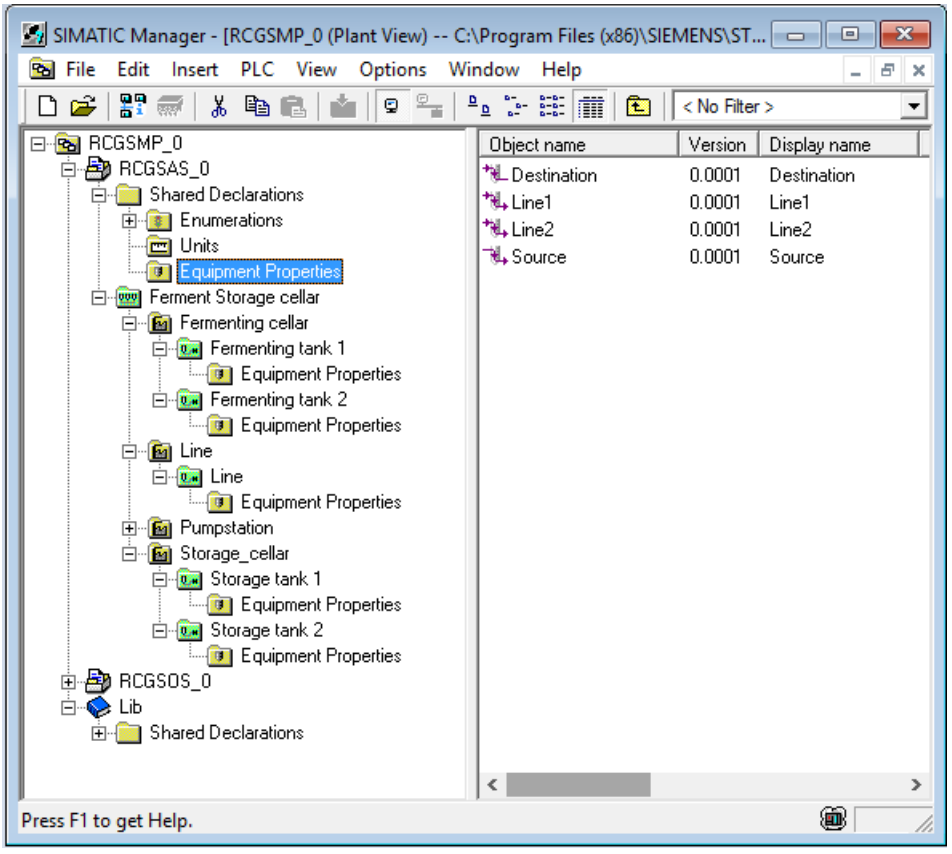
7. Export and import the data using the Route Control Wizard described in section 7.2.

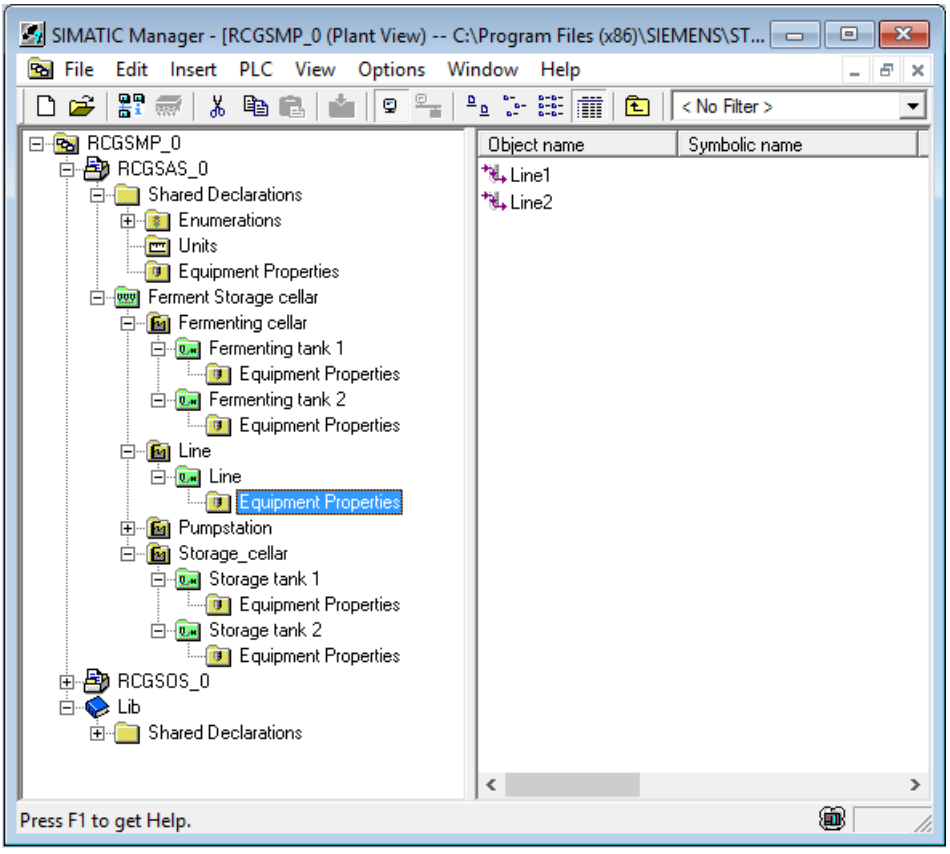
Result

You have successfully configured the following equipment properties:

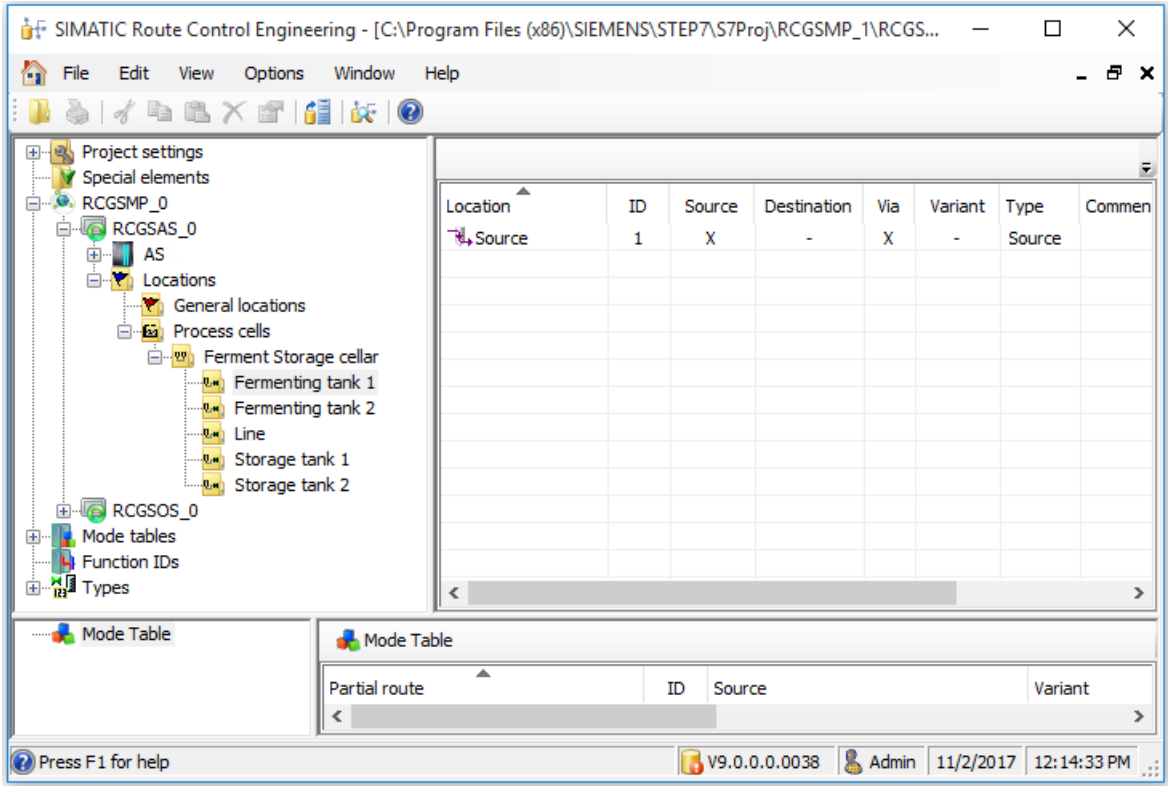
Name	Data type	Source	Destination	Via
Source	LOCATION	x		x
Destination	LOCATION		x	x
Line1	LOCATION	x	x	x
Line2	LOCATION	x	x	x

Results in SIMATIC Manager:




SIMATIC Manager - [RCGSMP_0 (Plant View) -- C:\Program Files (x86)\SIEMENS\ST...
File Edit Insert PLC View Options Window Help
< No Filter >
RCGSMP_0
RCGSAS_0
Shared Declarations
Enumerations
Units
Equipment Properties
Ferment Storage cellar
Fermenting cellar
Fermenting tank 1
Equipment Properties
Fermenting tank 2
Equipment Properties
Line
Line
Equipment Properties
Pumpstation
Storage_cellar
Storage tank 1
Equipment Properties
Storage tank 2
Equipment Properties
RCGSOS_0
Lib
Shared Declarations
Object name
Symbolic name
Line1
Line2
Press F1 to get Help.

Result in Route Control Engineering:



9.2 Exercise with the mode table

Task

Configure a Mode Table named "Transfer".

Prerequisite

Route Control Engineering is open.

Note

Follow the instructions described in 7.2 to open Route Control Engineering.

Modes of the "Transfer" Mode Table

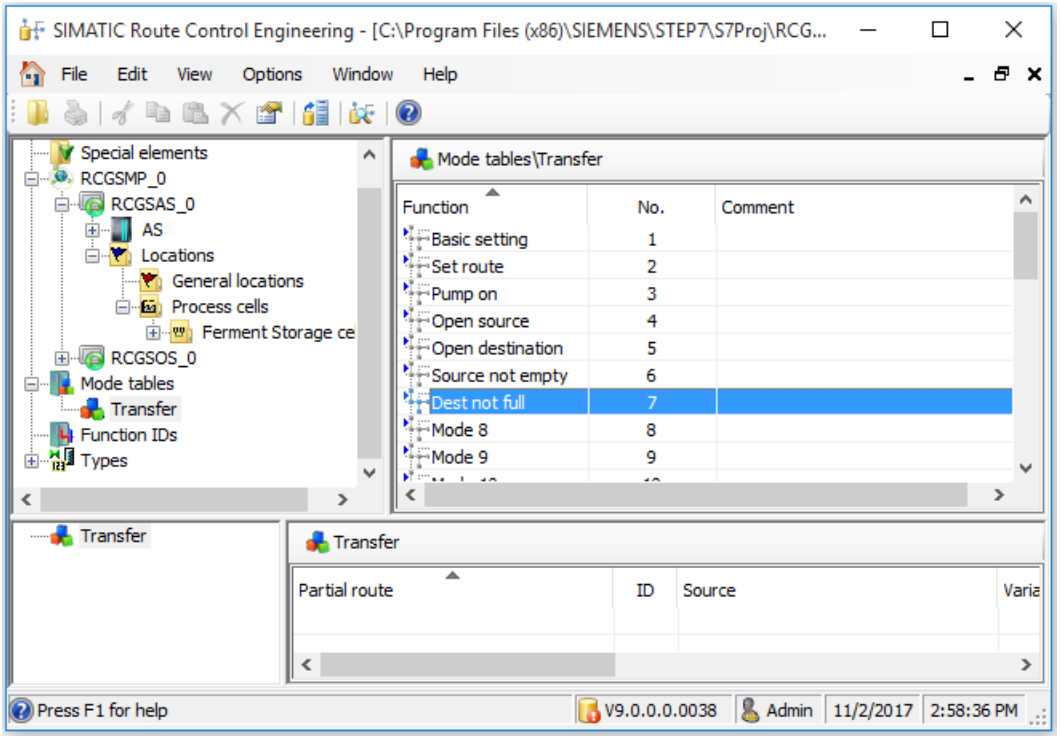
The table below shows the modes which should be provided in the Mode Table:

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 on the upper left column in "SIMATIC Route Control Engineering" window.
2. Right-click the "Mode Table" folder and select "Rename".
3. Change the name to "Transfer".
4. Right-click the "Mode 1" in the "Transfer" table and select "Rename".
5. Change the name to "Basic setting".
6. Repeat the steps from 4 to 5 for "Mode 2" to "Mode 7" in accordance with the "Mode table functions" shown above.

Result


SIMATIC Route Control Engineering - [C:\Program Files (x86)\SIEMENS\STEP7\S7Proj\RCG...
File
Edit
View
Options
Window
Help
Special elements
RCGSMP_0
RCGSAS_0
AS
Locations
General locations
Process cells
Ferment Storage ce
RCGSOS_0
Mode tables
Transfer
Function IDs
Types
Mode tables\Transfer
Function
No.
Comment
Basic setting 1
Set route 2
Pump on 3
Open source 4
Open destination 5
Source not empty 6
Dest not full 7
Mode 8 8
Mode 9 9
Transfer
Transfer
Partial route
ID
Source
Varia
Press F1 for help
V9.0.0.0.0038
Admin
11/2/2017
2:58:36 PM

9.3 Exercise in configuring partial routes

Task

Configure the partial routes as required.

Prerequisite

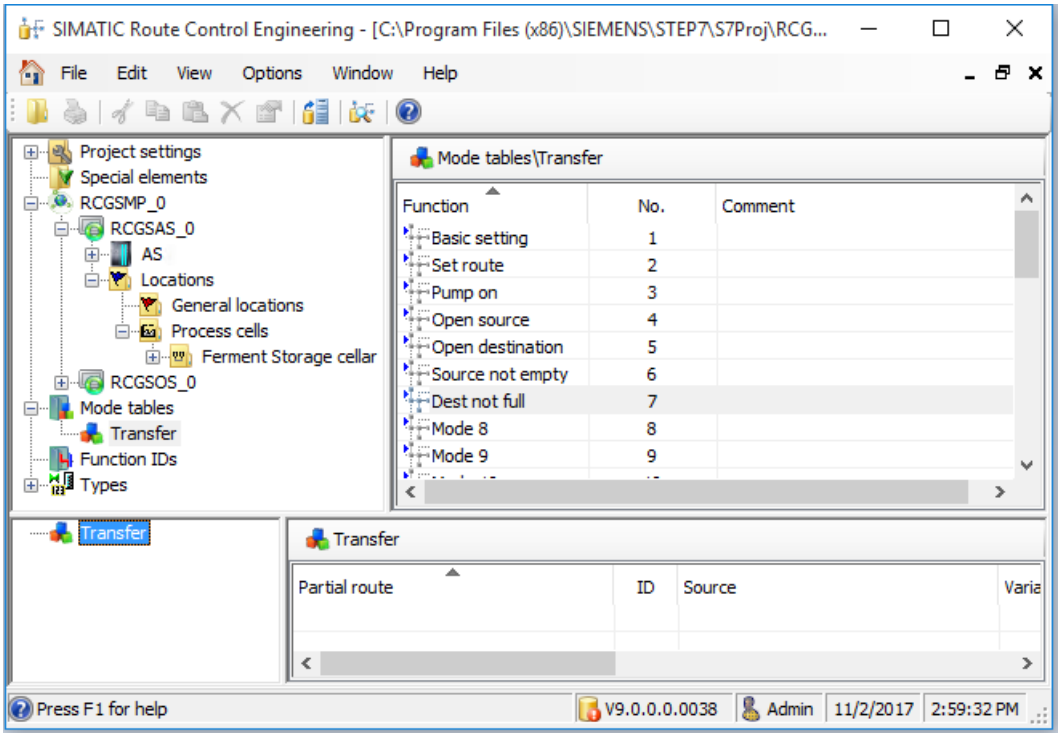
Route Control Engineering is open.

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

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. Right-click "Transfer" folder in the lower half of Route Control Engineering and select "Add partial route".

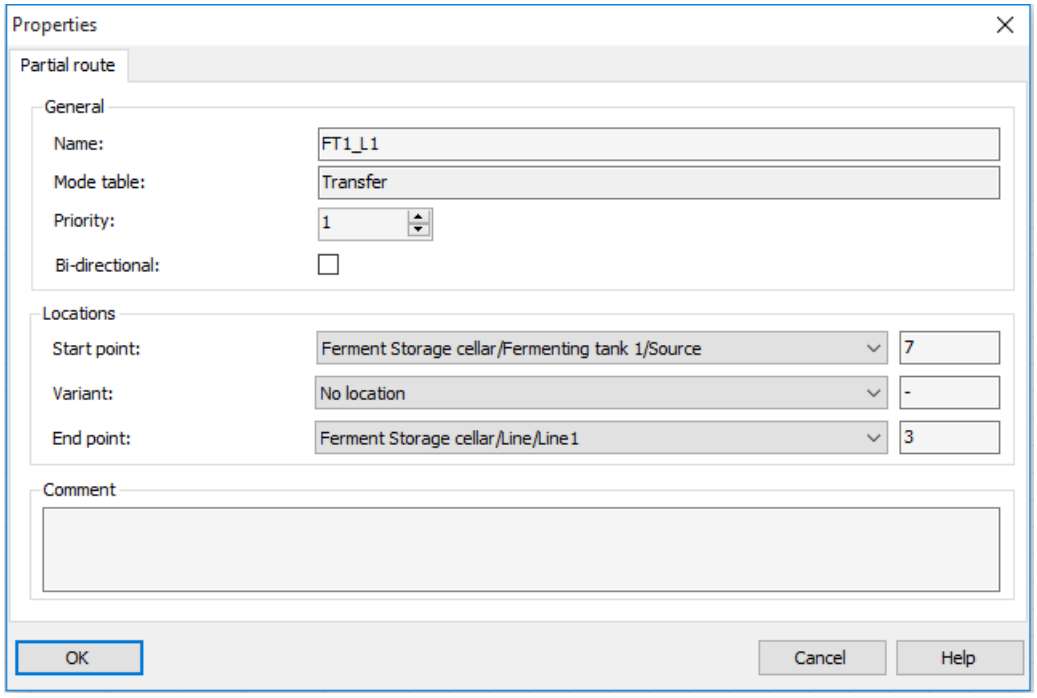


2. Enter the name "FT1_L1" in the "Properties" dialog box.
3. Select the "Start point:" as "Fermenting tank 1/Source".

4. Select the "End point:" as "Line/Line1".

Note

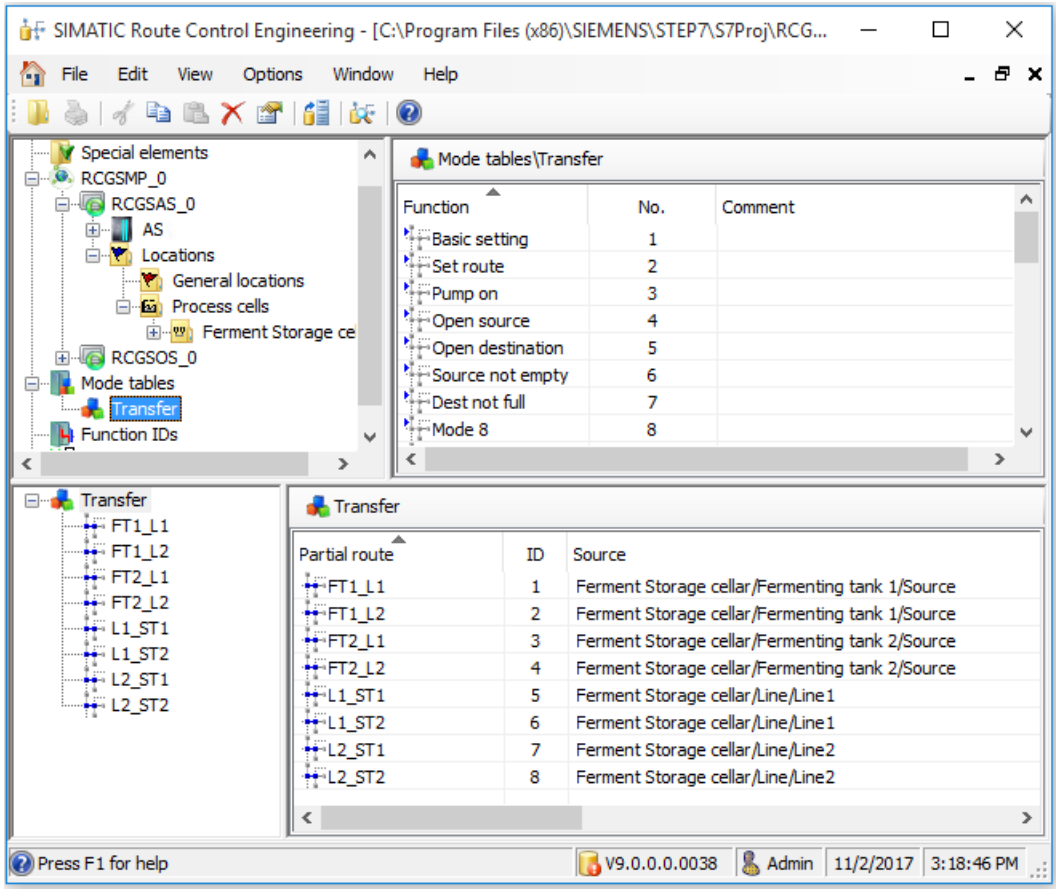
The values for "Start point:" and "End point:" are generated automatically and differ from system to system.



5. Click "OK".
   The program saves your entries.
6. Configure all partial routes according to the table shown below.

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

Result



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.

9.4 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.

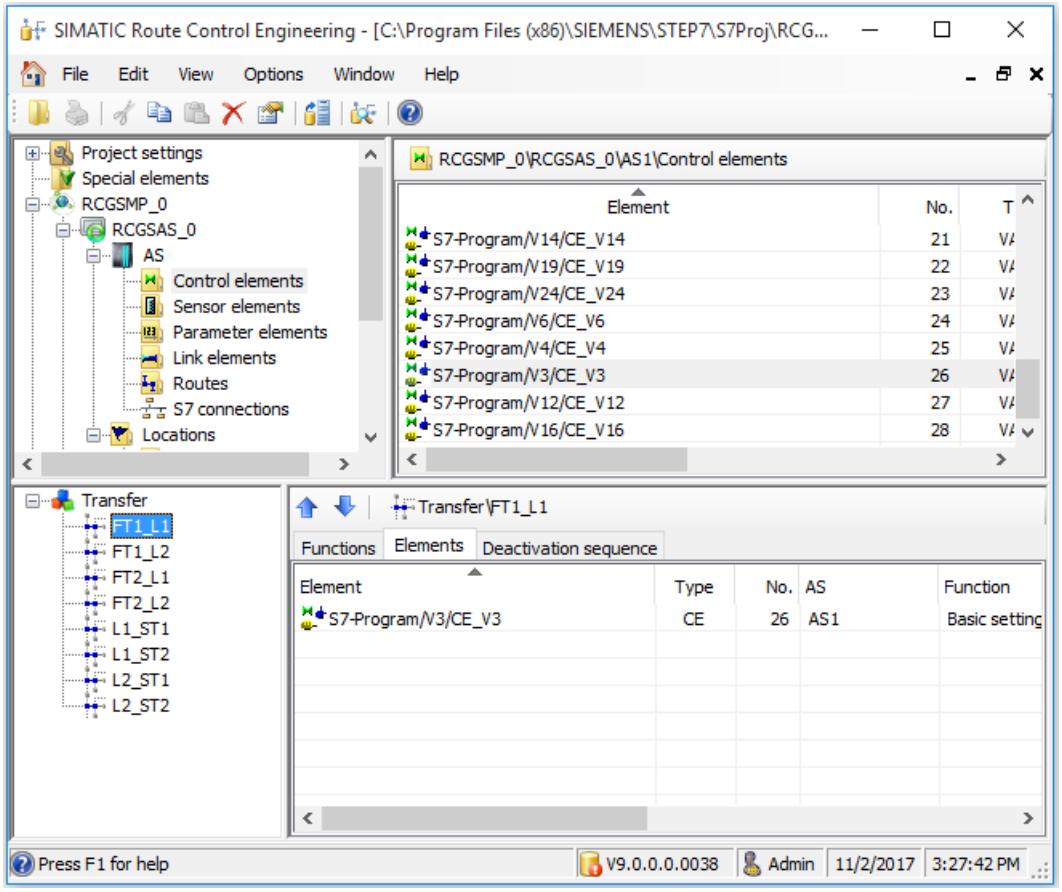
Prerequisite

Route Control Engineering is open.

Procedure

1. Select the partial route "FT1_L1" in the bottom section of Route Control Engineering.
2. Select the "Elements" tab.
3. Expand the folders "RCGSMP_0 > RCGSAS_0 > AS" in upper left corner of the "SIMATIC Route Control Engineering" window.
4. Select "Control elements" in the tree view.

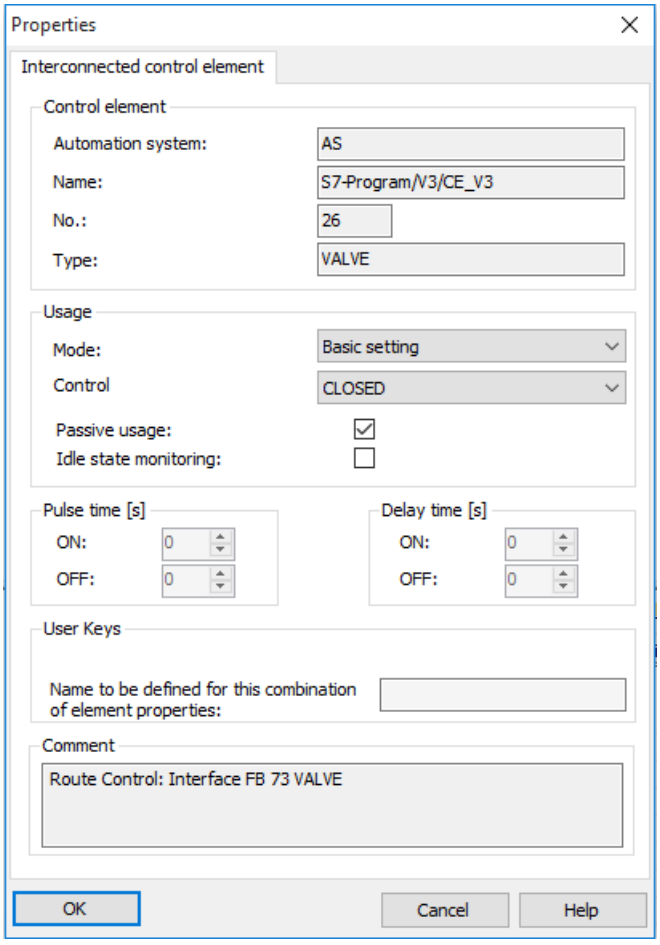
5. Drag-and-drop valve "CE_V3" from the detailed view to the "Elements" table.



A "Properties" dialog box opens.

6. Select the "Type:" as "VALVE".

7. Activate the "Passive usage:" checkbox.



8. Click "OK".
9. Configure the elements of all partial routes in accordance with the "Activation tables" described in section 8.5.

Note

These elements of partial routes can also be configured in the "Functions" tab. You can also copy and then edit partial routes and their assigned elements.

9.5 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 is open.

Procedure

1. Select the "Windows icon > All apps > Siemens Automation > Serverdialog" menu command.

   Note

   For Windows 7, Select the "Start > All programs > Siemens Automation > SIMATIC > ROUTE CONTROL > Serverdialog" menu command.

   For Windows 2012 server or higher, type "Serverdialog" in the search box of the Windows task bar.

   The Route Control server dialog starts and is displayed as icon  in the task bar.
2. Select the "Options > Download to server" menu command in Route Control Engineering. The "Download to server" dialog box opens.
3. Select the client configured in 4.4.
4. Click "Start".
   The server is loaded along with the selected client.
5. Click "OK" in the summary dialog box.
   Both dialog boxes are closed.
6. Activate the Route Control server: Open the server window and select "Activate".

   Note

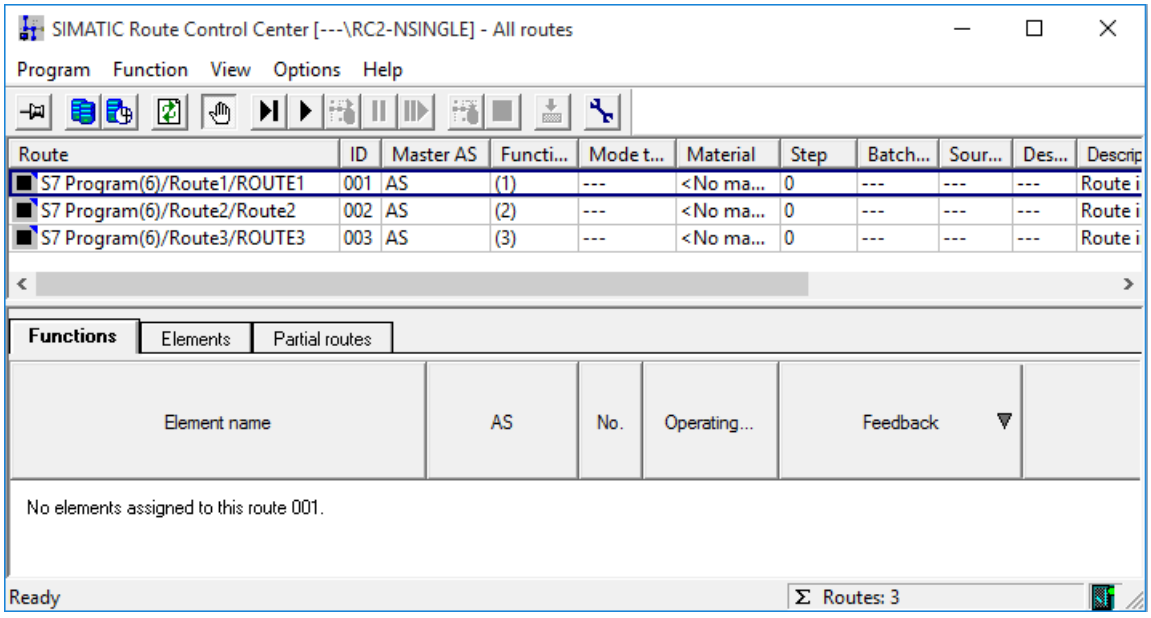
   Before Activation of Server dailog, the CFC charts have to be downloaded. Follow the steps described in section 6.3.

7. Select the "Windows icon > All apps > Siemens Automation > Center" menu command on client.
   The Route Control Center opens for Windows 10.

Note

For Windows 7, select the "Start > All programs > Siemens Automation > SIMATIC > ROUTE CONTROL > Center" menu command on client.

For Windows 2012 server or higher, type "Center" in the search box of the Windows task bar.



8. Click the icon  in the Route Control Center.
   The "SIMATIC RC Server" dialog box opens.
9. Click "Update".
   The "Update SIMATIC RC Server" dialog box opens.
10. Click "OK".
    The Route Control Server is updated.
11. Click "Close".

Note

During the first load operation or if no new data has been transferred, the "Update" button is grayed out. In these two cases, the server data is already up to date.

Result

The Route Control Server is updated and up.

9.6 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.

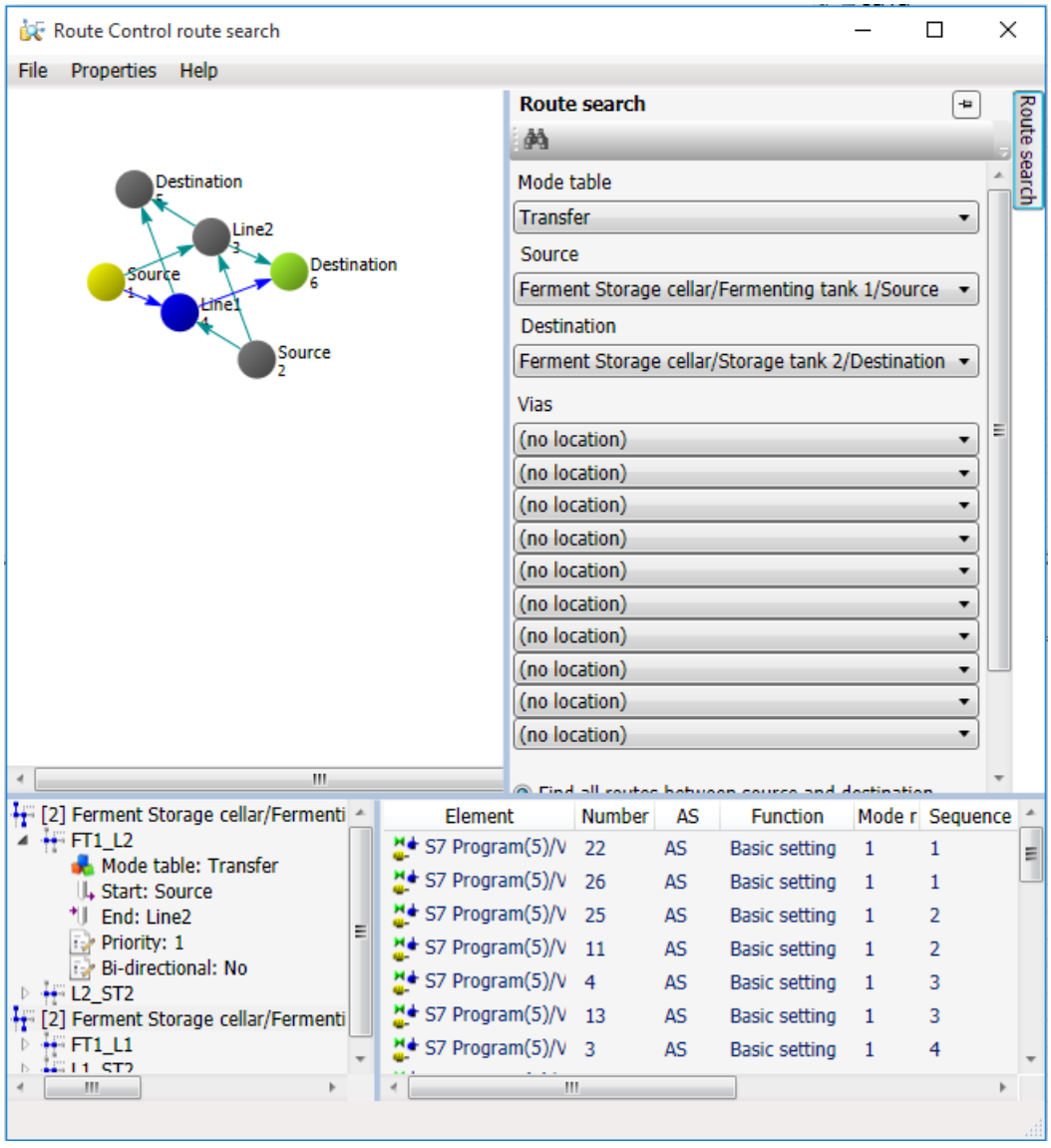
Prerequisite

Route Control Engineering is open.

Procedure

1. Select the "Options > Verify route" menu command.
   The "Route Control route search" window opens.
2. Select the "Route search" tab on the right side of the window.
   The route search settings are displayed.
3. Select the "Transfer" entry from the "Mode Table" drop-down list box.
4. Activate the "Find all routes between source and destination" radio button.
5. Select the "Fermenting tank 1" entry from the "Source" drop-down list box.
6. Select the "Storage tank 2" entry from the "Destination" drop-down list box.

7. Click .
   The search tool finds two potential routes.
8. The details of the partial routes of a route are displayed in the lower windows.



9.7 Materials and material sequences

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

9.8 Exercise in the configuration of materials and material successions

Exercise in the configuration of materials and material sequences

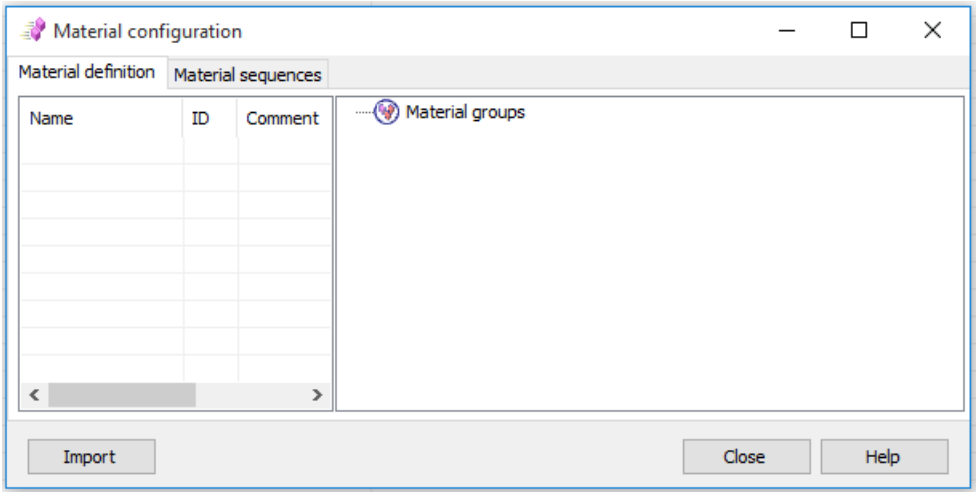
Configure the materials, the material groups, and the material successors.

Prerequisite

Route Control Engineering is open.

Procedure

1. Select the "Options > Material..." menu command.
   The "Material Configuration" dialog box opens.

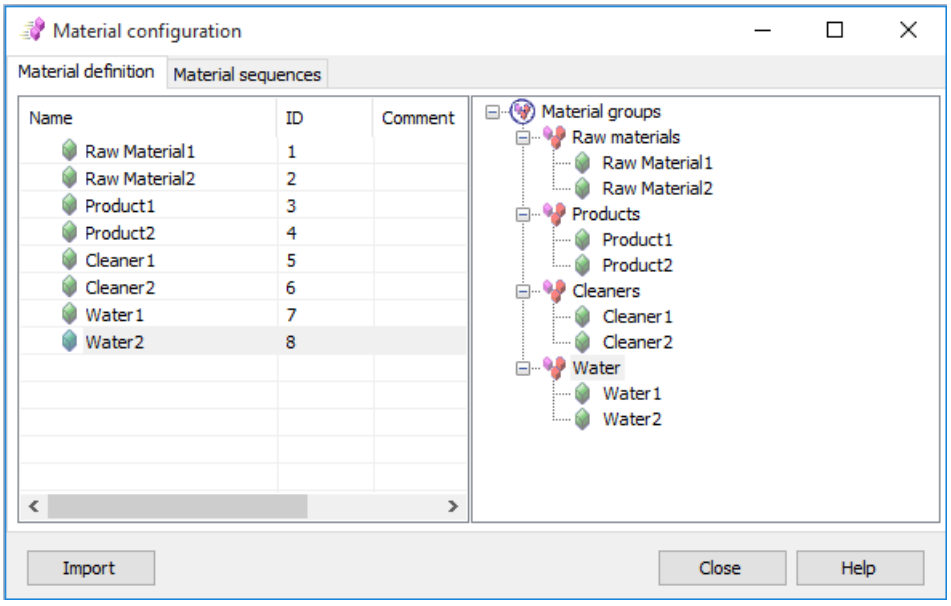


2. Right-click in the Name column and select "New" to create a material in the "Material definition" tab.
3. Rename it as "Raw material 1".
4. Repeat step 2 to 3 to create all the other materials in the "Material definition" tab.
5. Right-click the "Material groups" and select "New" to create a material group in the "Material groups" tree.
6. Rename it as "Raw materials".

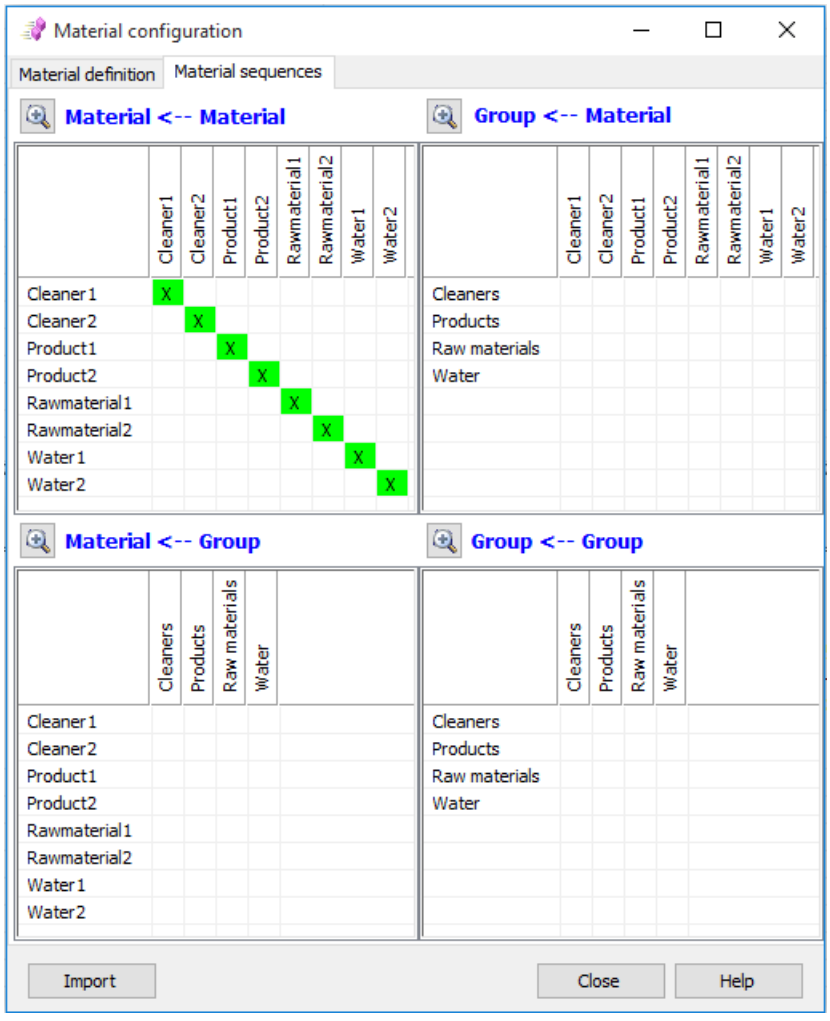
7. Repeat step 5 to 6 to create all the other material groups in the "Material groups" tree. Configure the material and material groups listed in the table by following the above steps.

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

8. Select the "Cleaners" group from the "Material groups" tree.
9. Assign the "Cleaner1" and "Cleaner2" materials to "Cleaners" group in the "Material groups" tree using drag-and-drop.
10. Assign all materials to their material groups in the same way.



11. Open the "Material sequences" tab.



Note

The material sequence shown in the figure is a result of the above steps. The user can edit the material sequence as per their requirements.

12. Download and update the Route Control Server.

Route Control Center 10

10.1 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 "Windows icon > All apps > Siemens Automation > Center" for Windows 10.

Note

For Windows 7, "Start > All programs > Siemens Automation > SIMATIC > Route Control > Center" from the Windows Start menu.

For Windows 2012 server or higher, type "Center" in the search box of the Windows task bar.

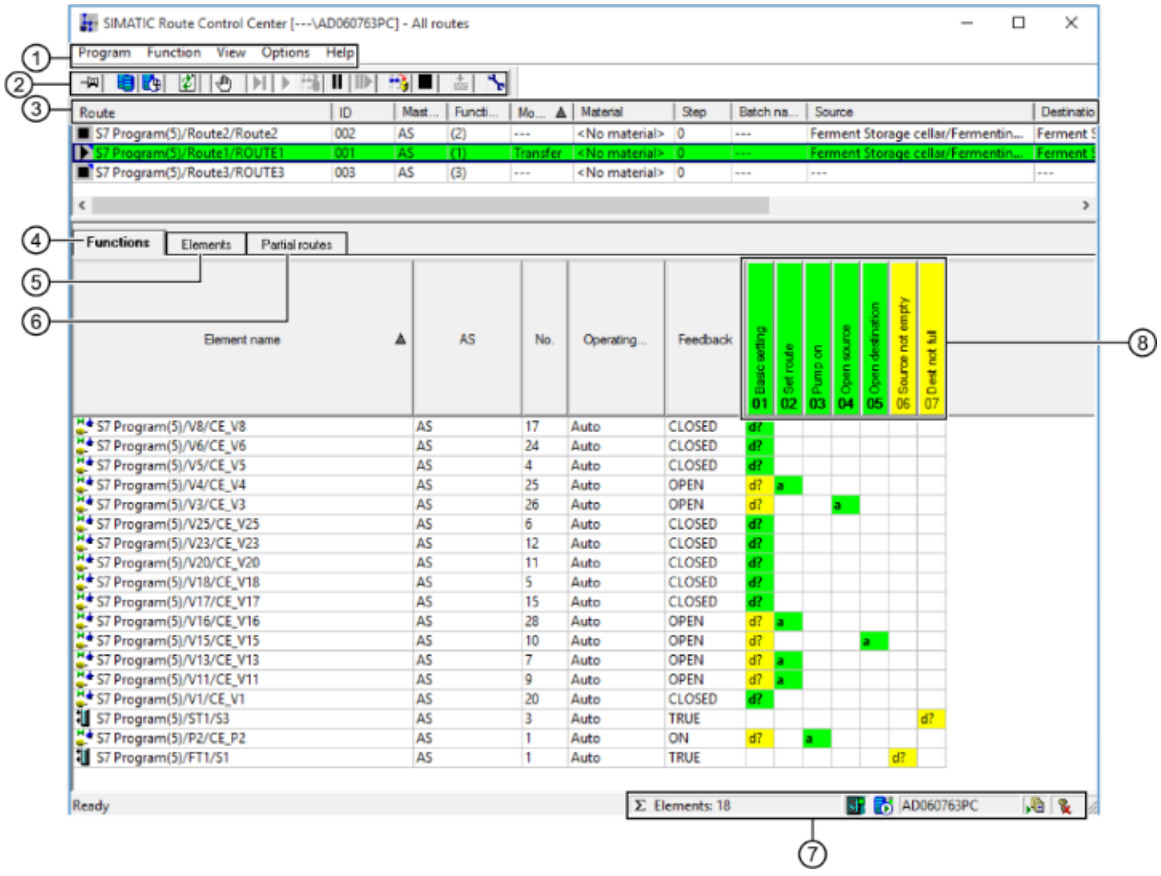
If opened from a faceplate the RCC only displays information of the material transport and the route ID of the faceplate. If the Route Control project is opened using the Windows Start menu, all the configured routes are displayed.

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.

10.2 Functions of the Route Control Center

Route Control Center

The figure below lists the defined areas of Route Control Center:



1. Menu bar
2. Tool bar
3. Route line of material transport
4. Functions
5. Elements
6. Partial routes
7. Status bar
8. Modes of material transport

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.
	Log On	Opens a user log on dialog. This function is only available if no other user is logged on.
	Log Off	Opens a dialog where a user can log off and log on again. This function is only available if a user is logged on.
	Exit	Closes the Route Control Center application.
Function	Manual Operation	Toggles between manual and auto mode.
	Start Saved Route	If a route has been saved for a combination of sources, destination and vias, it can be started using this button.
	Request Route	This function triggers a route request.
	Start Route	Starts the route. There are no modes activated as yet.
	Pause Route	Holds the route
	Resume Route	Restarts a route from hold state. If the route was in error state the error is acknowledged.
	Stop Route	Stops the route
	Save Current Route	Saves the currently selected route with its route properties.
	Apply Material	Activates the material information at the Route Control Server.
	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.
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.
	Maintenance	Hides/shows the maintenance view for the AS
	Toolbar	Hides or shows the toolbar
	Status Bar	Hides or shows the status bar
	Always On Top	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 again from the Route Control Server and initializes the view.
Options	Language	Sets the user language
	Routes Log	Opens the route log file
	Settings...	Settings of the Route Control Center

Menu item	Submenu	Meaning
Help	Contents...	Opens the Help system.
	Context-sensitive Help	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 switching 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.
	Starts a saved route.
	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.
	Saves the current route.
	Stops the route. Modes will be disabled. Enables 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.
	Switches to the maintenance view of the Route Control Center.

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

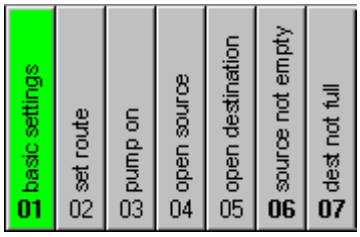
the material transport.
The current state of material transport is visualized in color.

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.



Note

This part of the Route Control window is only visible after a route is requested. It is bound to the "Functions" tab.

"Functions" tab

Displays all elements of the selected route in one line.

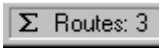
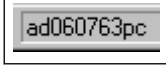
"Elements" tab

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 routes
	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 and the number of days for a circular buffer. 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

Note

The user is only logged off, if the Route Control Center was the last application connected to SIMATIC Logon.

10.3 Exercise in requesting a route using the Route Control Center

Task

Request a route in the Route Control Center.

Prerequisite

- The Route Control Server is loaded and in ACTIVE state.
- The Route Control Center is open.
- If you are not yet logged on, log on by means of credentials described in 4.7.

Procedure

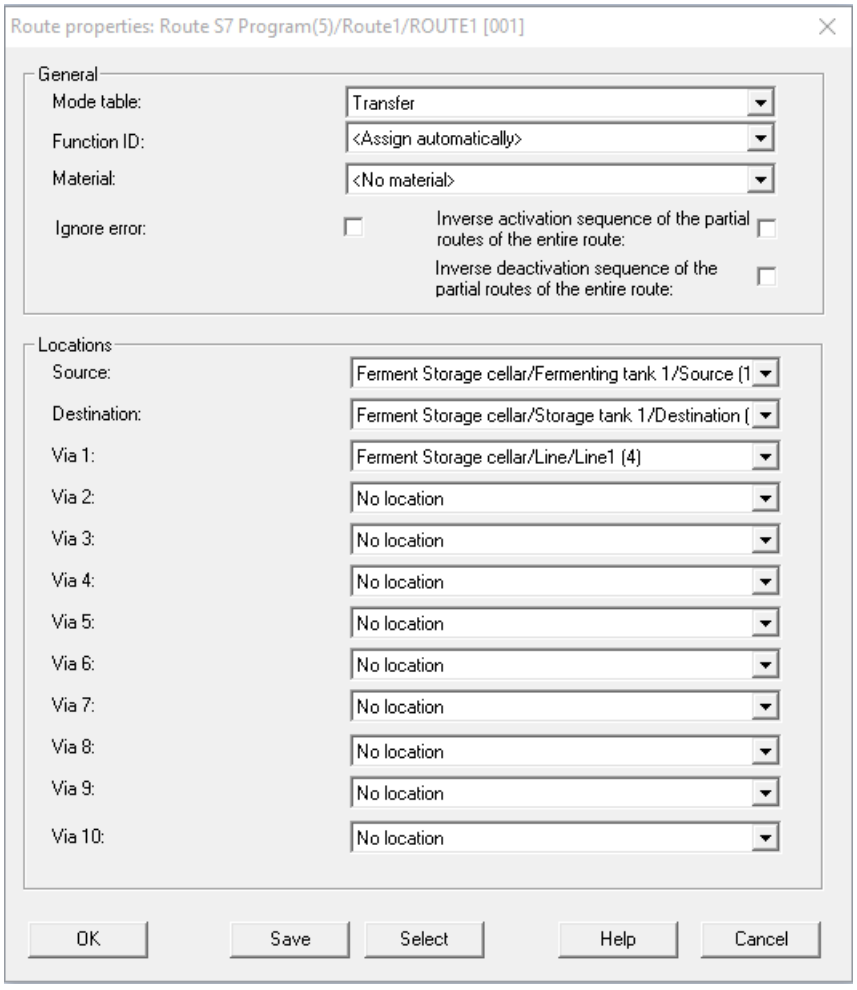
1. Select the route line Route1 in the top section of the Route Control Center.
2. Click the  toolbar icon.

   Note

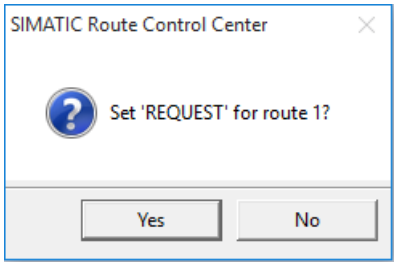
   By default, the route is in "Manual" mode. If it is not in "Manual" mode, then use this icon.

3. Double-click route line Route1.
   The "Route properties" dialog box opens.

4. Select the following paths:
   Mode table: Transfer
   Source: Ferment Storage cellar/Fermenting tank 1/Source
   Destination: Ferment Storage cellar/Storage tank 1/Destination
   Via1: Ferment Storage cellar/Line/Line1.
   Select the paths by clicking these in the drop-down list boxes.

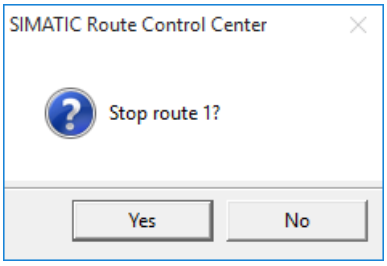


5. Click "OK".
6. Click the "Request route" toolbar button .
   A dialog box opens.



7. Click "Yes".

8. The route line is displayed on a yellow background. The "Functions" 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 "Stop route" toolbar button .
    A dialog box opens.



11. Click "Yes".
    The route request is stopped.

Route Control Project Engineering in the Operator Station

11

11.1 The Route Control block icon

The Route Control block icon

The block icon displays the main statuses of a route. The block icon is not yet interconnected with the process tag.

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 row displays the route status.

The footer shows the route ID of the current material transport. Any active messages are visualized in the PCS 7 group display.

The block icon is available in the WinCC picture "@pcs7typicalsrc.pdl". You can copy this icon to your own picture. To interconnect this copy with the instance of RC_IF_ROUTE, see 11.4.

Description of the route states in the block icon

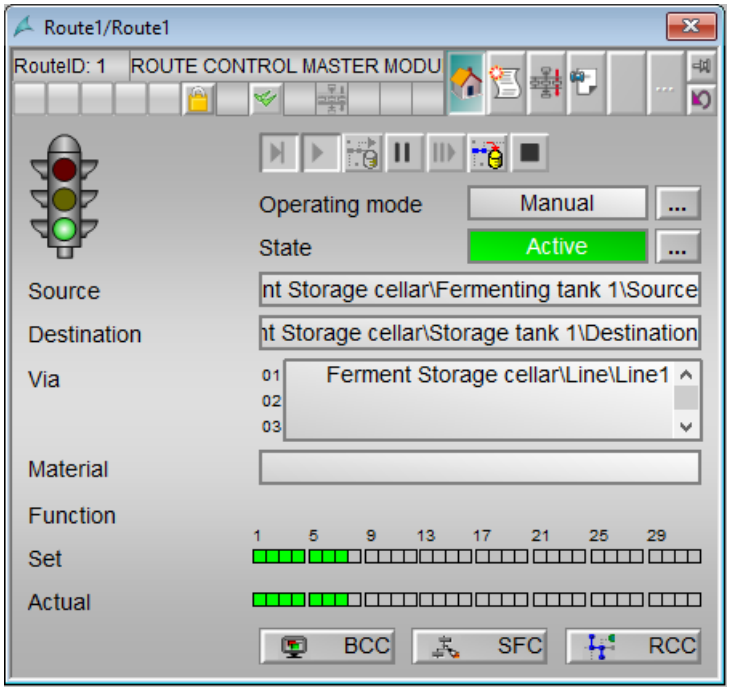
Icon	Meaning
	Route is deactivated and inactive (automatic mode)
	Route is deactivated and inactive (manual mode)
	Route request is active (automatic mode)
	Route request is active (manual mode)
	Route is active and running (automatic mode)
	Route is active and running (manual mode)
	Route is held (automatic mode)
	Route is held (manual mode)
	Route is in error state (automatic mode)
	Route is in error state (manual mode)

11.2 Route Control faceplate

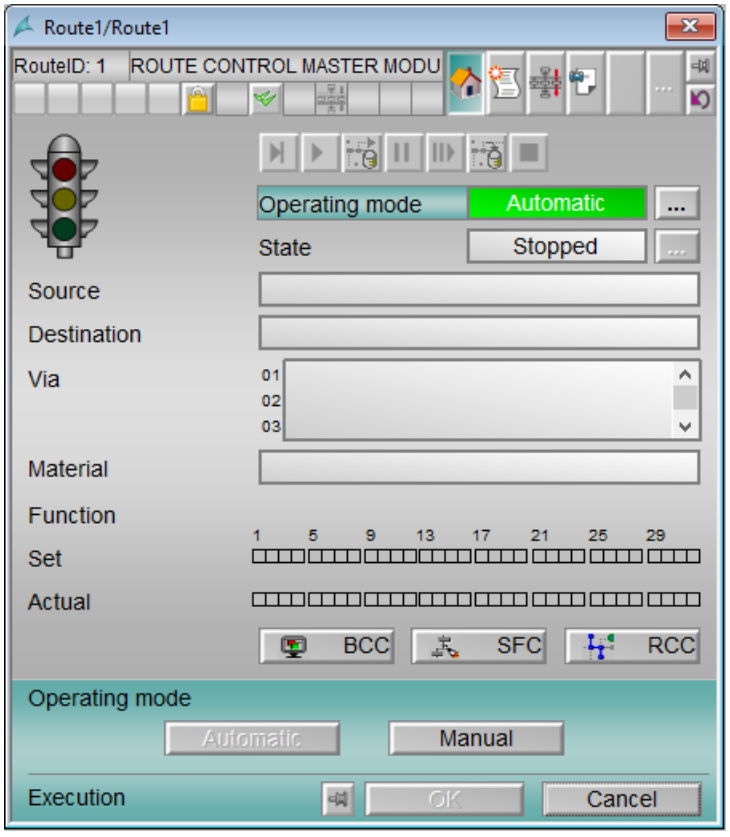
Route Control faceplate

The Route Control faceplate is used to control routes in manual mode. Open the faceplate by 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 the Route Control Center.

Route Control faceplate in active state:



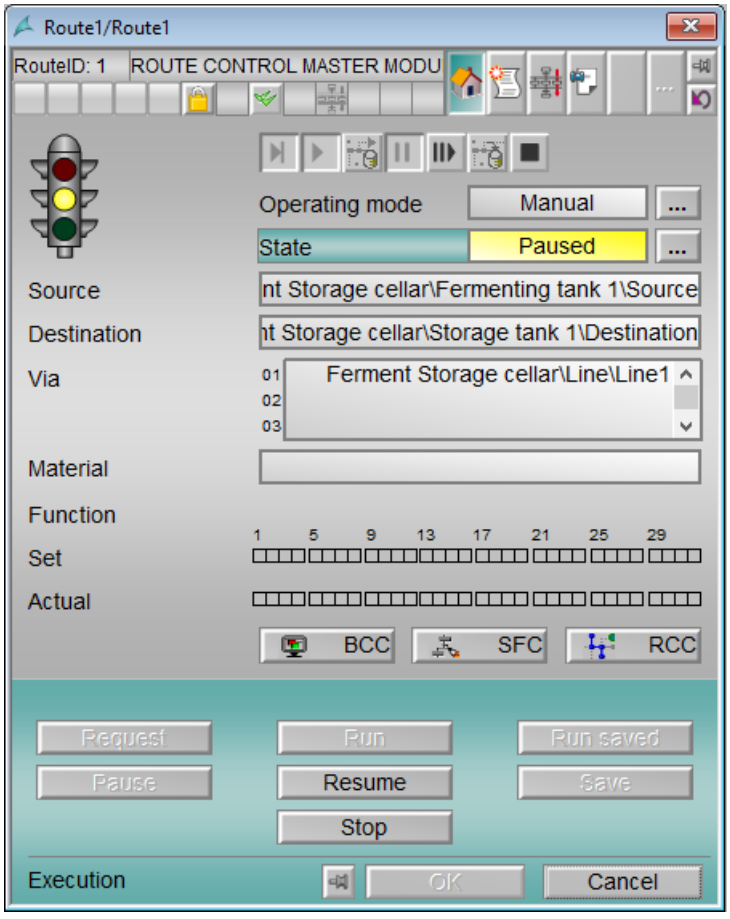
Route Control faceplate in Automatic mode:



Note

To change the mode from Manual to Automatic, Click "..." beside the "Operating mode" display and select "Automatic" in the Route Control Faceplate.

Route Control faceplate in Manual mode:



The Route Control faceplate contains the following operator controls:

Icon	Meaning
Automatic	Runs the route in Automatic mode.
Manual	Runs the route in Manual mode.
Request	Requests the route (in Manual mode)
Run	Start route (in Manual mode)
Pause	Pauses the route (in Manual mode)
Resume	Resume route (in Manual mode)
Stop	Stops the route (in Manual mode)
Save	Save the route (in Manual mode)
Run saved	Run the saved route (in Manual mode)
BCC	Opens the BATCH Control Center if this is installed on your computer. It will be unavailable if the BATCH client is not installed.

Icon	Meaning
SFC	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. (For example: using the RC Wizard in the Graphics Designer.)
RCC	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
	Inactive state 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.

11.3 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
AS block RC_IF_ROUTE	Element(s) with incorrect status
AS block RC_IF_ROUTE	Material compatibility error

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

11.4 Exercise in configuring the Route Control block icon in the process picture

Task

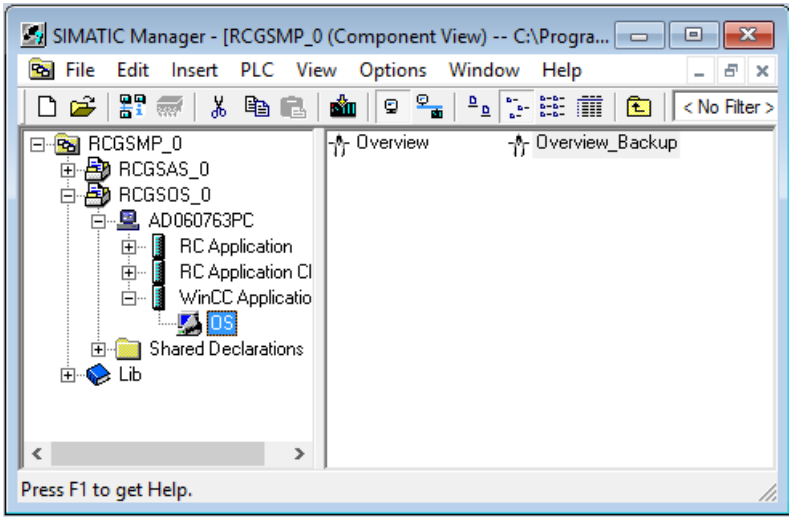
Configure the Route Control block icons.

Prerequisite

- The Getting Started project is open in SIMATIC Manager.
- The Component view is activated.

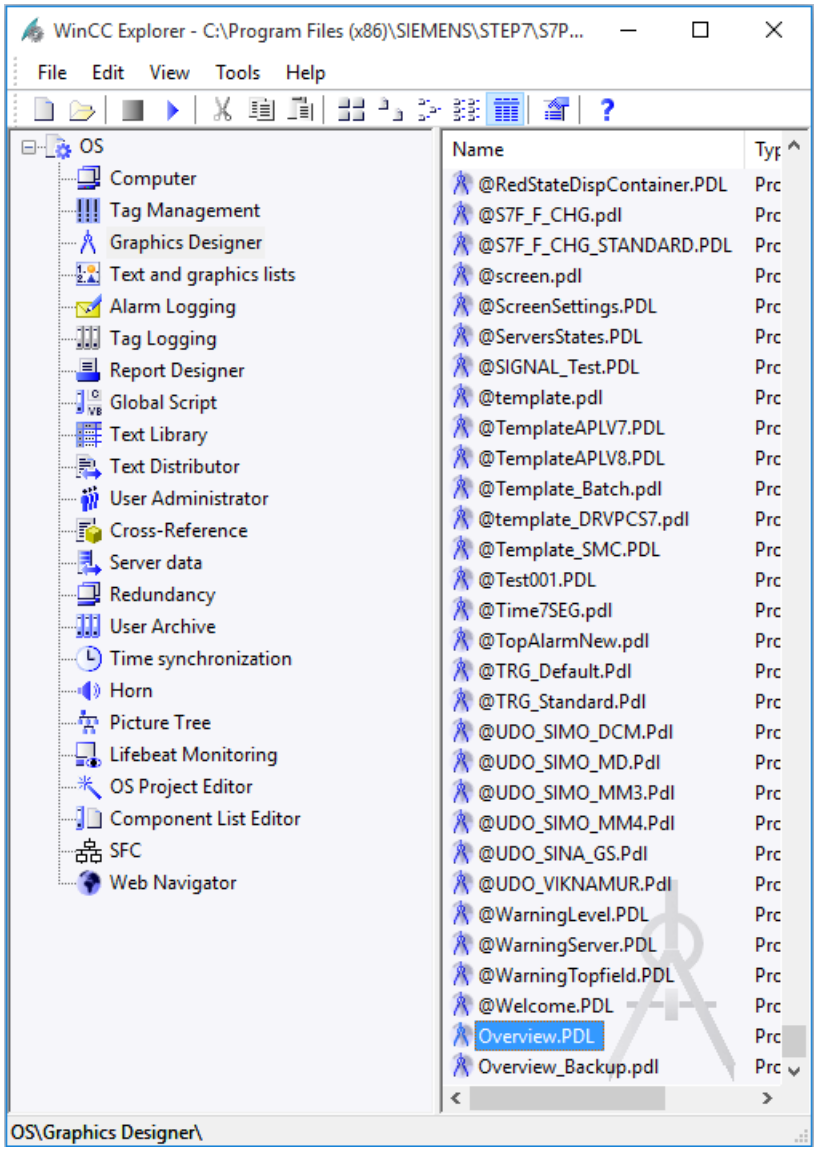
Procedure

1. Select the "RCGSOS_0 > PC STATION > WinCC Application > OS" object.
2. Select the "Edit > Open object" menu command.
   WinCC Explorer opens.

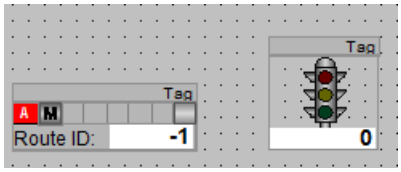


3. Select the Graphics Designer object in the tree view on the left side.

4. Select the "Overview.pdl" object in the detailed view on the right side.
   Graphics Designer opens with the "Overview" screen.



5. Select the "File > Open" menu command in Graphics Designer.
   The "Open" dialog box opens.
6. Select the picture "@pcs7typicalsrc.pdl" and click "Open".
7. Select both block icons.



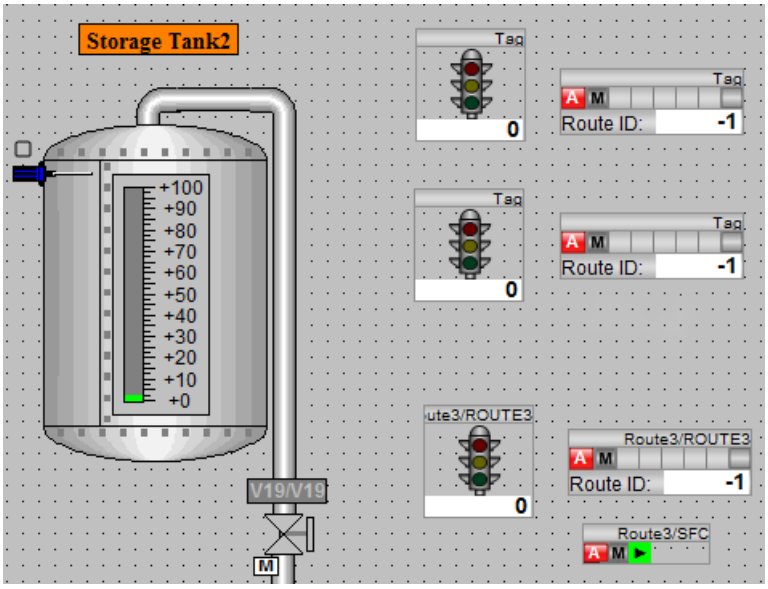
8. Copy to the clipboard using the "CTRL+C" keystroke.
9. Switch to the "Overview.pdl" picture.

10. Insert the blocks using the "CTRL+V" keystroke.

Note

The blocks have to be copied twice.

11. Arrange the block icons as shown below.

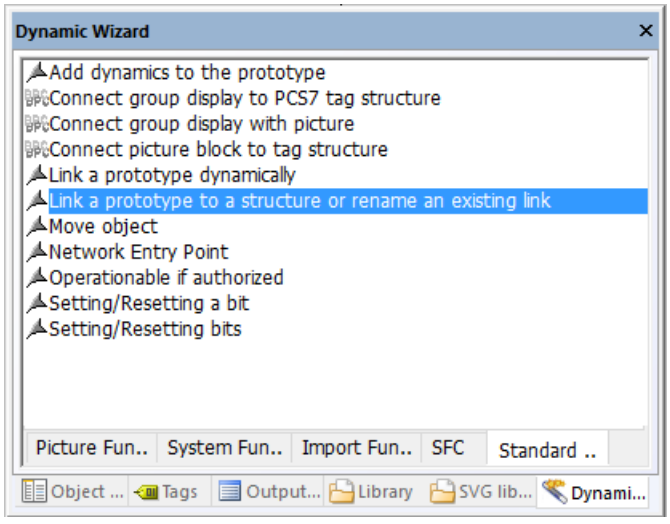


12. Select the block icon.
13. Select the "Dynamic Wizard > Standard Dynamics".

Note

The Dynamic Wizard is visible by default in Graphics Designer and can be found in "View > Toolbars > Dynamic Wizard".

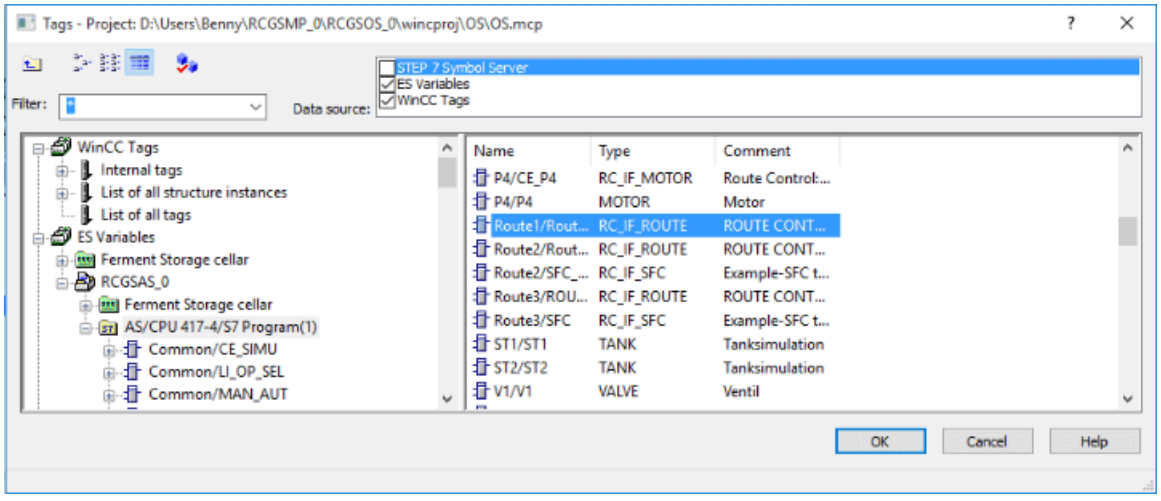
14. Double-click the "Link a prototype to a structure or rename an existing link".



Note

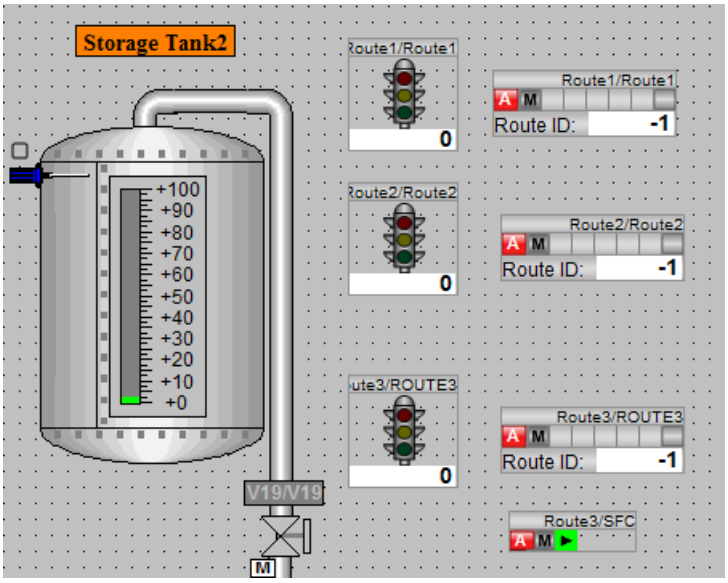
The available options shown in Dynamic Wizard differ for each selected object or if no object is selected in the "Overview.pdl" picture.

15. Click "Next" in the "Welcome to the Dynamic Wizard" dialog box.
16. Click the "..." button in the "Set options" dialog box.
17. Activate the "ES Variables" checkbox in the "Tags" window.
18. Select "ES Variables > RCGSAS_0 > AS/CPU 417-4/S7 Program(1)" from the tree view.



19. Select "Route1" from the detailed view.
20. Click "OK".
21. Select the network, if it is prompted.
22. Click "Next" in the "Set options" dialog box.

23. Click "Finish" in the "Finished !" dialog box. The block icon is now interconnected with CFC block "Route1".
24. Repeat the steps 12 to 23 to link the other block icons as shown below.



Note

Interconnect the two upper block icons with CFC block "Route1" and the lower pair of block icons with CFC block "Route2".

25. Save the "Overview.pdl" picture.

11.5 Exercise in configuring the SFC block icon in the process picture

Task

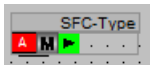
Configure the SFC faceplate in the process picture.

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- WinCC Explorer is open.
- The "Overview.pdl" picture is open in Graphics Designer.

Procedure

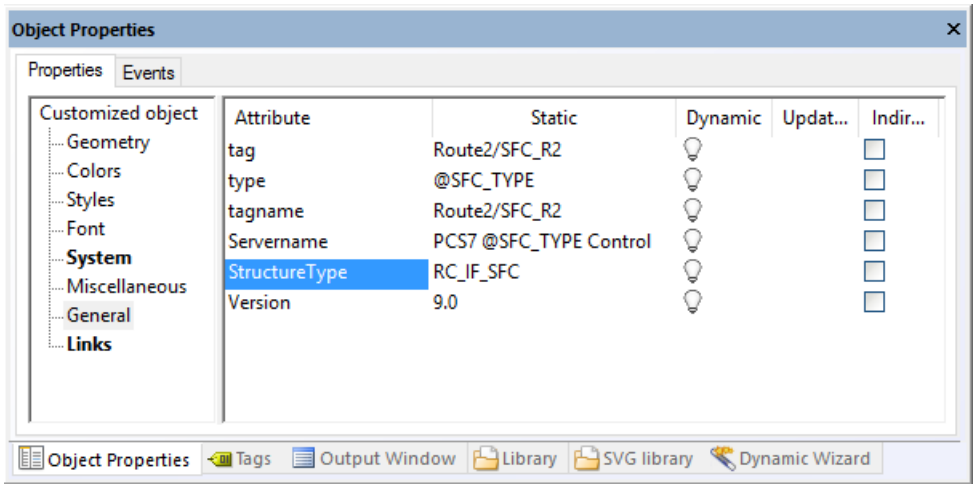
1. Open the "@TemplateAPLV8.PDL" picture in Graphics Designer.
2. Select the block icon.



3. Copy to the clipboard using the "CTRL+C" keystroke.
4. Switch to the "Overview.pdl" picture.
5. Insert the block using the "CTRL+V" keystroke.
6. Position the block icon below the "Route2/Route2" block icon as shown below.
7. Select the copied block icon in "Overview.pdl" picture.
8. Select "Object Properties > Properties".

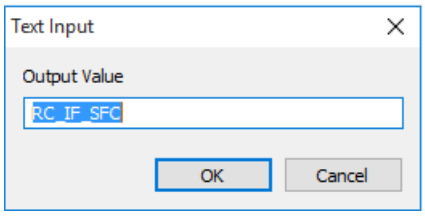
Note

The "Object Properties" and "Dynamic Wizard" are visible by default in Graphics Designer and can be found in "View > Toolbars".

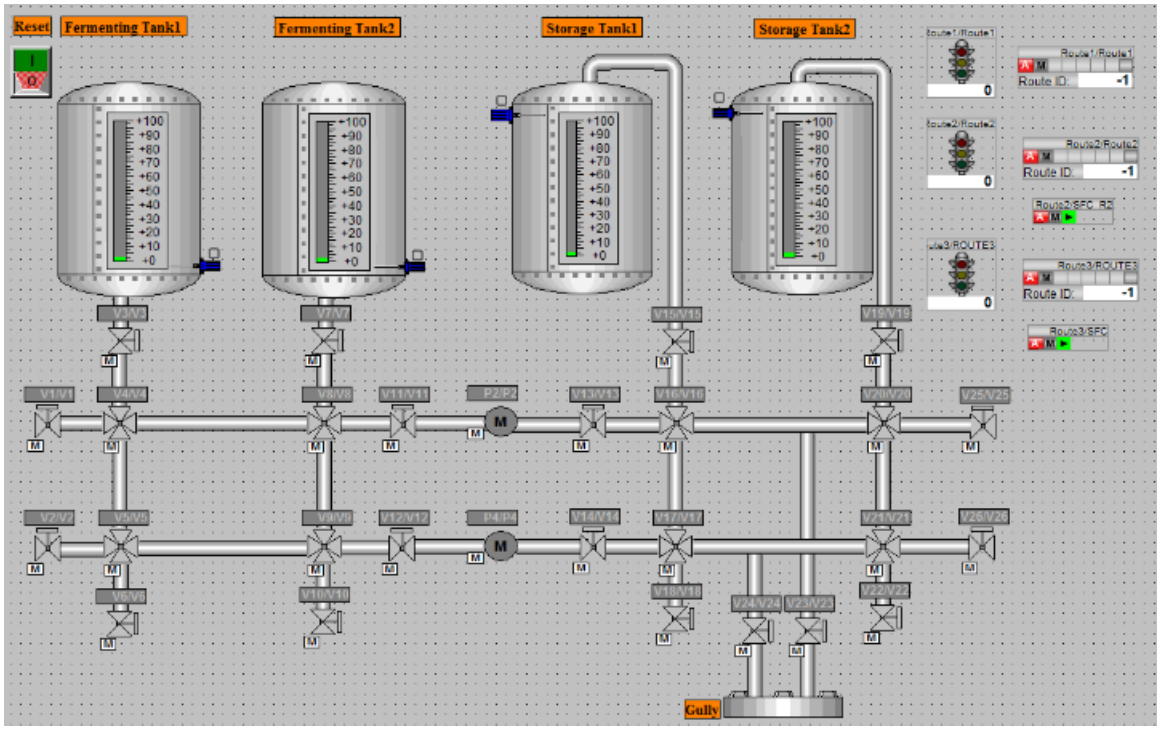


9. Select the "General" submenu in the "Properties" tab and then double-click "StructureType".

10. Enter "RC_IF_SFC" as output value and then click "OK".



11. Select the copied block icon in "Overview.pdl" picture.
12. Select the "Dynamic Wizard > Standard Dynamics".
13. Double-click the "Link a prototype to a structure or rename an existing link".
14. Link the block icon with the SFC instance "Route2/SFC_R2" by following the steps 14 to 23 described in 11.4.
15. Save the "Overview.pdl" picture.



16. Select "File > Exit" to close the Graphics Designer.

Handling material transports using Route Control 12

12.1 Exercise in executing and monitoring material transport using the RCC

Task

Execute and monitor material transport using the Route Control Center

Prerequisites

- The Getting Started project is open in SIMATIC Manager.
- The Route Control Server is loaded and in "ACTIVE" state.
- The Route Control Center is open.
- The WinCC project "OS" is open in WinCC Explorer.
- If you are not yet logged on, log on by means of credentials described in 4.7.

Procedure

1. Select "File > Activate" in WinCC Explorer.

   Note

   The reset button for simulation tank levels should be set as shown  .

2. Select the route line "Route1" in the top section of the Route Control Center.
3. Click the  toolbar icon.

   Note

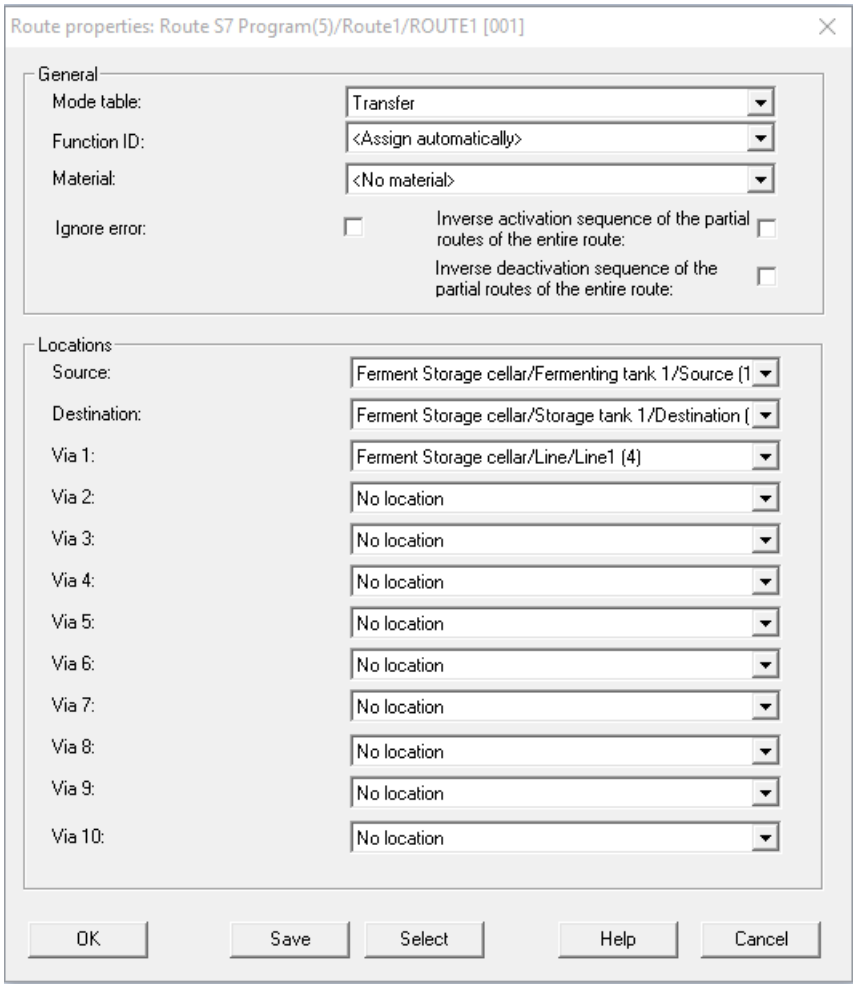
   By default, the route is in "Manual" mode. If it is not in "Manual" mode, then use this icon.

4. Double-click route line "Route1".
   The "Route properties" dialog box opens.

5. Select the following paths:
   Mode table: Transfer
   Source: Ferment Storage cellar/Fermenting tank 1/Source
   Destination: Ferment Storage cellar/Storage tank 1/Destination
   Via1: Ferment Storage cellar/Line/Line1.
   Select the paths by double-clicking these in the drop-down list boxes.

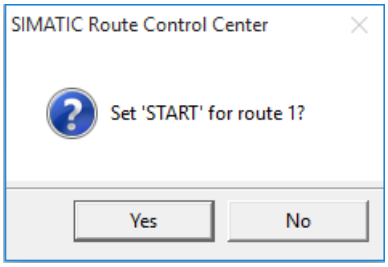
   Note

   Due to following the steps in 10.3, these paths are already selected. You need to just check them before running the route.

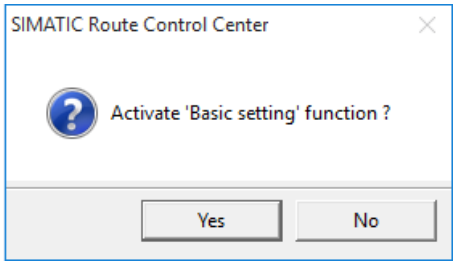


6. Click "OK".

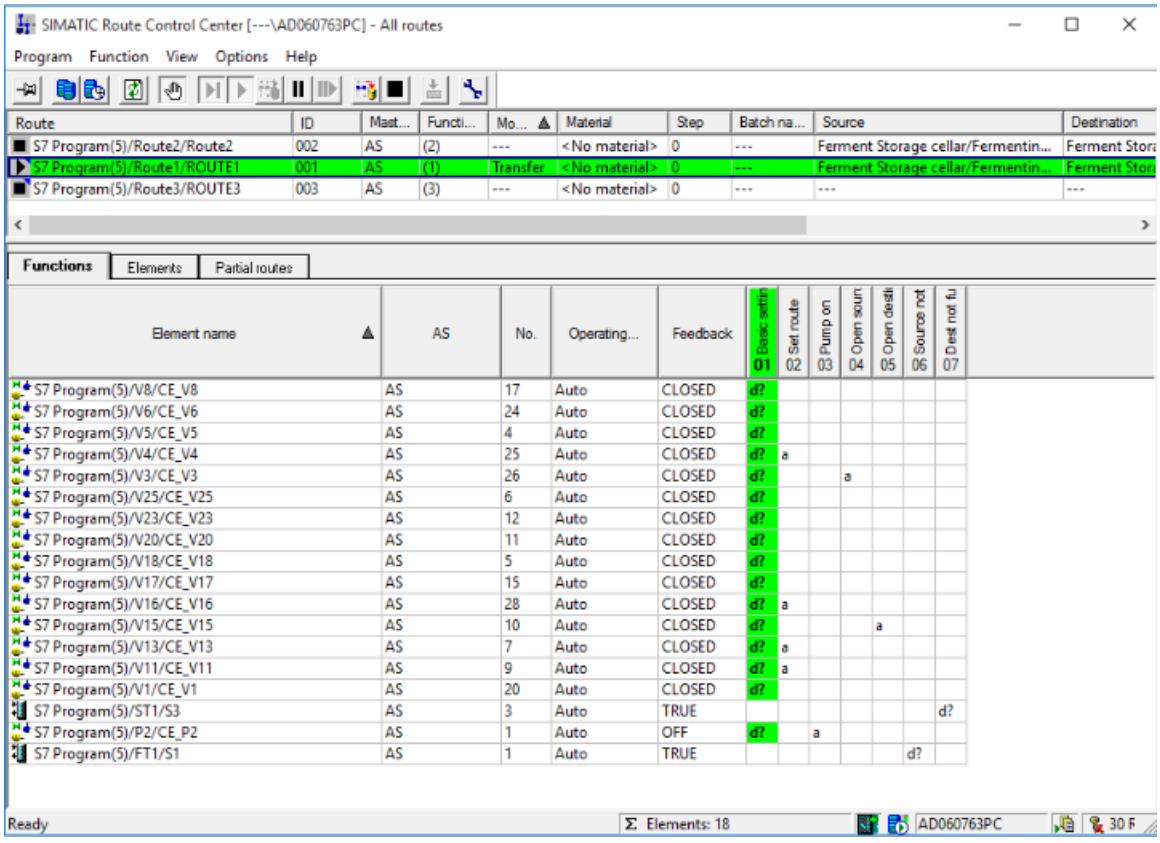
7. Click "Start route" in the toolbar.
   A dialog box opens.



8. Click "Yes".
   The route line is displayed on a green background. The "Functions" tab displays all Route Control elements and associated modes which are active during the material transport
9. Click the Basic settings column in the "Functions" tab in the lower section of the RCC. This opens a dialog box where you can activate the Basic settings mode.



10. Click "Yes". The Basic settings are activated.

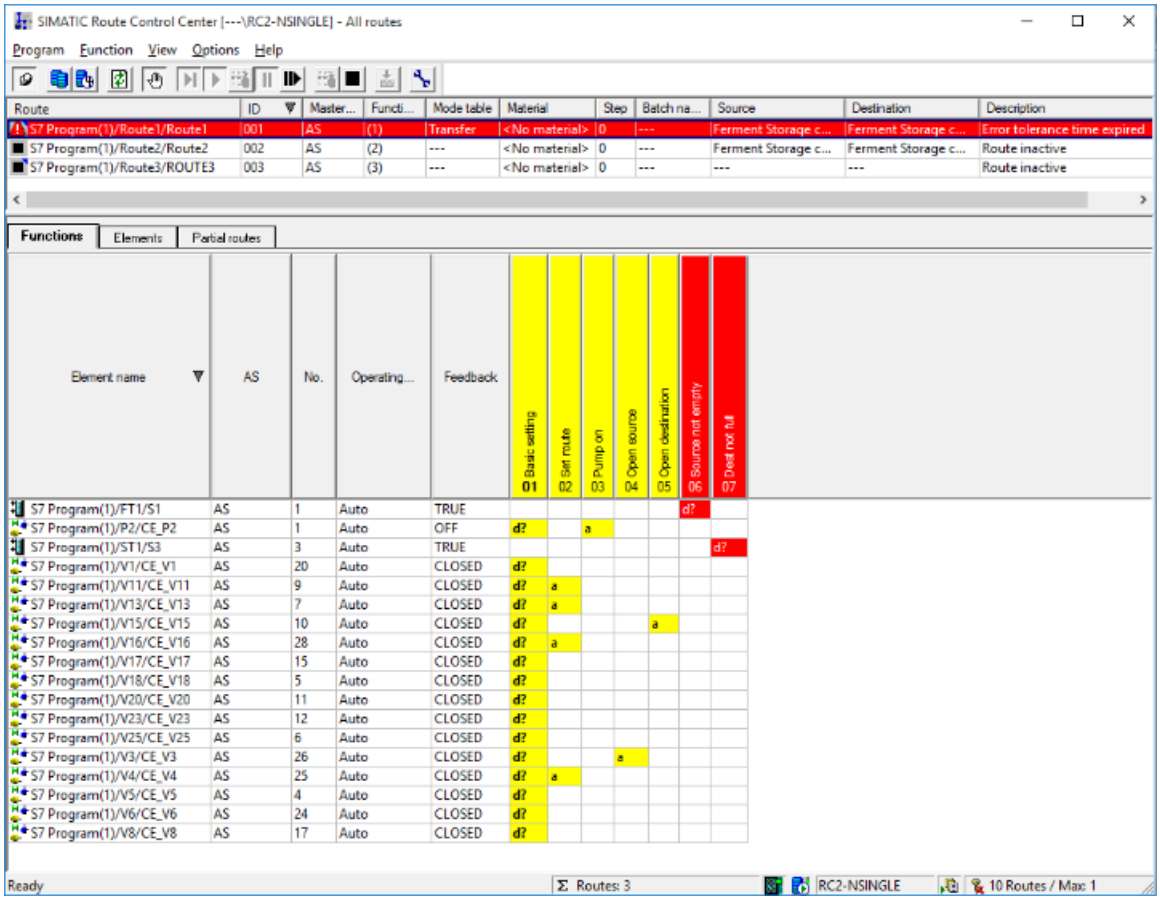


11. Activate the "Set Route" mode.
12. Change to the WinCC Runtime window to monitor the reaction of the valves.
13. Activate all modes.

14. 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.



15. Click "Stop route" in the RCC.
16. Acknowledge the error in WinCC using the "Acknowledge error" button in Route 1 faceplate.

17. Activate the Reset switch  in the "Overview" process picture.
18. Deactivate the Reset switch  in the "Overview" process picture.

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

Task

Execute and monitor material transport by means of SFC

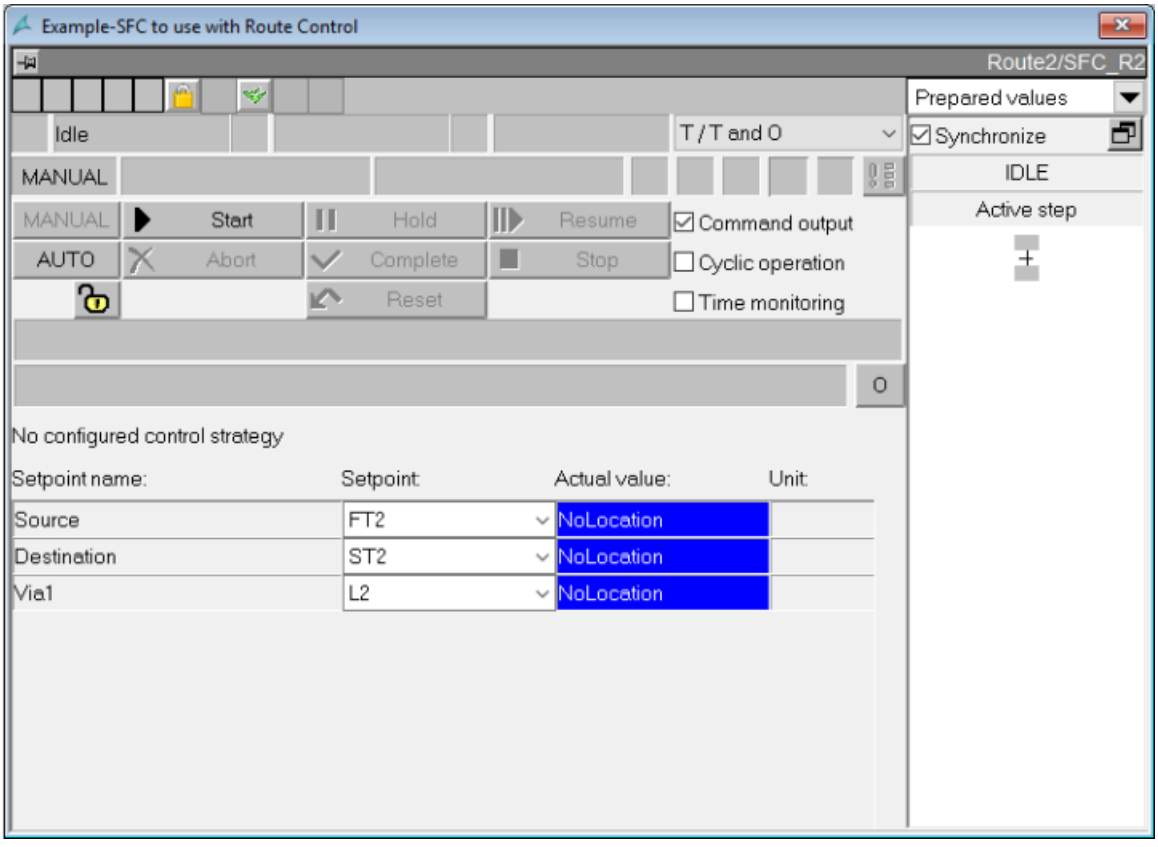
Prerequisites

- The Route Control Server is loaded and in "ACTIVE" state.
- WinCC Runtime is active.
- Route Control Center is open.
- If you are not yet logged on, log on by means of credentials described in 4.7.

Procedure

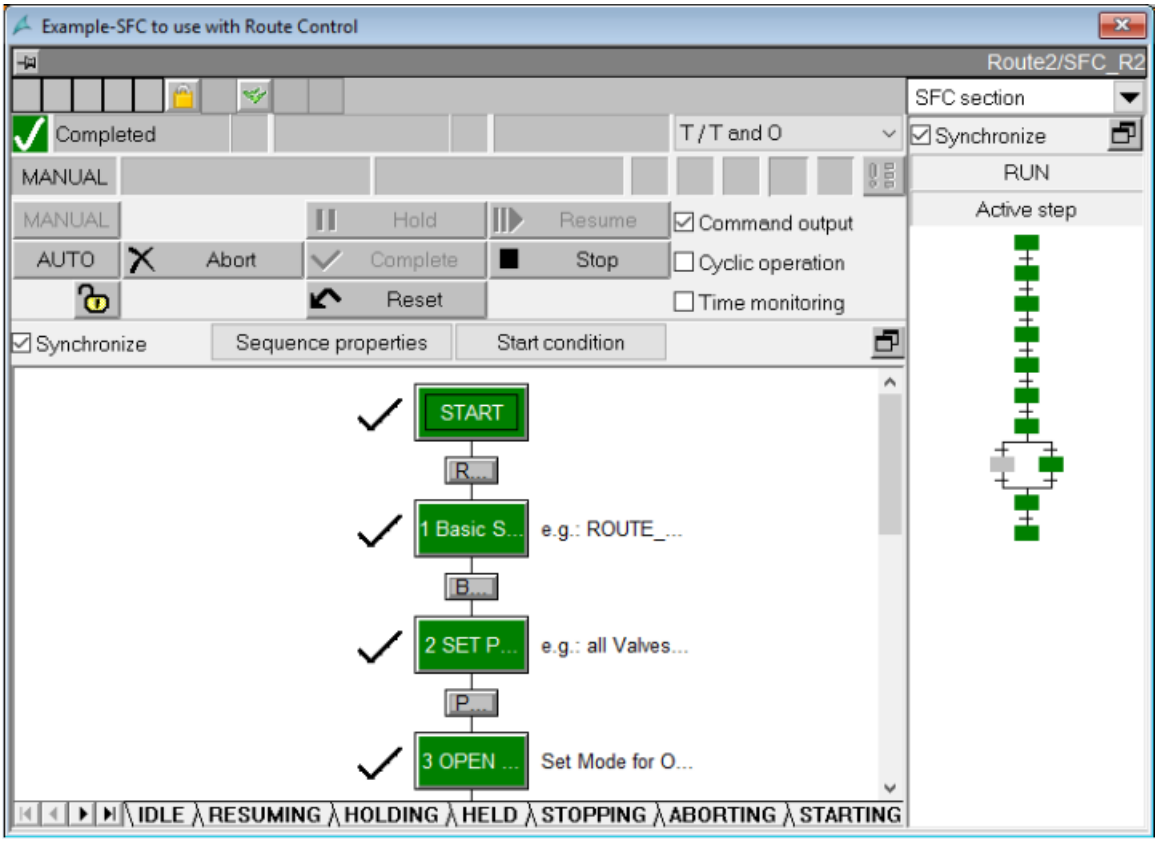
1. Click the "Route2" block icon in the "Overview" screen of WinCC Runtime.
   The "Route2" block icon's faceplate opens.
2. Click "..." in "Route2" block icon faceplate.
3. Select "Automatic" in the "Route2" block icon faceplate, if necessary.
4. Click the "Route2_SFC" block icon in the "Overview" screen of WinCC Runtime.
5. Select the "Prepared values" view from the drop-down menu in the "Example-SFC to use with Route Control" window.

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



7. Click "Start" button in the "Example-SFC to use with Route Control" window.

8. Select "SFC section" from the drop-down menu in the "Example-SFC to use with Route Control" window.



9. Monitor the material transport.
10. Activate the Reset switch in the "Overview" process picture.
11. Deactivate the Reset switch in the "Overview" process picture.

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	Operator 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