

# SIEMENS

## SIMATIC

### Process Control System PCS 7 Fault-tolerant Process Control Systems (V8.1)

Function Manual

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Valid for PCS 7 as of V8.1

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

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# Preface

## Purpose of this documentation

This documentation informs you about the following aspects of configuring fault-tolerant systems with the SIMATIC PCS 7 Process Control System:

- The basic solution concepts
- The functional mechanisms
- The most important configurations

It presents the availability solutions on all automation levels (control, process, field).

You will find references to other product manuals containing specific information for working with individual components.

## Options for accessing PCS 7 documentation

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

- On the *Process Control System; SIMATIC PCS 7* DVD
- After installation, on the computer
- On the Internet

Full versions of the documentation are available from the "Technical Documentation SIMATIC PCS 7" web pages: <http://www.siemens.com/pcs7-documentation> (<http://www.siemens.com/pcs7-documentation>)

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### Note

#### PCS 7 Readme (Internet version)

The information provided in the *PCS 7 Readme* on the Internet takes precedence over **all** PCS 7 documentation.

Please read this *PCS 7 Readme* carefully; it contains important information and amendments on PCS 7.

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### PCS 7 documentation on the *Process Control System; SIMATIC PCS 7* DVD

- **PCS 7 Readme (DVD version)**

The *PCS 7 Readme* on the *Process Control System; SIMATIC PCS 7* DVD contains important information about PCS 7 and takes precedence over the PCS 7 documentation supplied with the product. After installation of PCS 7, you can find the *Process Control System PCS 7; PCS 7 Readme* document in the Windows Start menu using the following path:

**Siemens Automation > SIMATIC > Product Information > <language>**

- You will find the most important PCS 7 system documentation at the following locations:
  - On the *SIMATIC PCS 7* DVD in the "\_Manuals" folder
  - On the engineering station as online help (CHM file) for the SIMATIC Manager application
  - On the engineering station as a PDF file in the Windows Start menu using the following path:  
**Siemens Automation > SIMATIC > Documentation > <language>**

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#### Note

The following PCS 7 system documentation is included:

- Catalog Overview *Process Control System PCS 7; PCS 7 Documentation*
  - Configuration manual *Process Control System PCS 7; Engineering System*
  - Function manual *Process Control System PCS 7; PCS 7 PC Configuration*
  - Configuration manual *Process Control System PCS 7; Operator Station*
  - Function manual *Process Control System PCS 7; OS Process Control*
- 

- The product documentation is installed with the relevant product.

### Documentation for PCS 7 on the Internet (current versions)

The latest documentation for the PCS 7 versions is available from the "Technical Documentation SIMATIC PCS 7" web page:

- In the section "**Software manuals for SIMATIC PCS 7 ...**"
  - The link to the latest system and product documentation of the particular PCS 7 version.
  - The link to download the Setup for the latest system documentation "PCS 7 Documentation Portal Setup".

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#### Note

##### PCS 7 Documentation Portal Setup

Setup includes the complete system documentation for PCS 7 (PDF files and online help).

- You can install this Setup without PCS 7.
- If you install the Setup on the engineering station, the following documents are updated (missing documents are added and existing documents are overwritten if the original installation folder is selected):
  - Online help of the "SIMATIC Manager" application: (CHM files)
  - System documentation for PCS 7 in the Windows Start menu:  
**Siemens Automation > SIMATIC > Documentation > Language > PDF files**
- The PCS 7 Newsletter keeps you informed when new versions of the system documentation become available.

- 
- The link for downloading the entire PCS 7 documentation as a *Manual Collection* in the My Documentation Manager (<http://support.automation.siemens.com/WW/view/en/38715968>).  
 The *Manual Collection* includes the manuals for hardware and software.

- In the section "**Hardware Manuals for SIMATIC PCS 7 ...**"
  - The link to the latest manuals for components released with a PCS 7 version.
  - The link to the latest manuals for approved SIMATIC PCS 7 industry software for PCS 7.

#### Catalogs, brochures, customer magazines and demo software

You can find this information on the Internet at: Information and Download Center (<http://www.automation.siemens.com/mcms/infocenter>)

### Required basic knowledge

General knowledge in the area of automation engineering and basic knowledge of PCS 7 is required to understand this documentation. It is also assumed that the reader knows how to use computers or other equipment similar to PCs (such as programming devices) with the Windows operating system.

The configuration manuals and the Getting Started documentation for PCS 7 will provide you with basic information regarding the use of PCS 7.

### Position in the information landscape

The following documentation provides more information about fault-tolerant process control systems and the handling of the individual components. This documentation is part of the PCS 7 software.

Manual	Contents
Getting Started <i>Process Control System PCS 7; Part 1 - Getting Started</i>	<ul style="list-style-type: none"> <li>• Creating projects</li> <li>• Working with the CFC Editor</li> <li>• Working with the Import/Export Wizard</li> <li>• Working with the SFC Editor</li> <li>• Compiling, downloading and testing</li> <li>• Working with the operator station</li> </ul>
Configuration manual <i>Process Control System PCS 7; Engineering System</i>	<ul style="list-style-type: none"> <li>• Basics of PCS 7</li> <li>• Creating projects</li> <li>• Configuring hardware</li> <li>• Configuring networks</li> </ul>
Configuration manual <i>Process Control System PCS 7; Operator Station</i>	<ul style="list-style-type: none"> <li>• Configuring SIMATIC connections</li> <li>• Interconnecting faceplates</li> <li>• Configuring operator stations</li> <li>• Compiling the OS</li> <li>• Installation guidelines</li> </ul>
<i>Process Control System PCS 7; Maintenance Station function manual</i>	<ul style="list-style-type: none"> <li>• Activation of the maintenance functions</li> <li>• Configuration of redundancy</li> <li>• Adding the OPC server</li> </ul>
Configuration manual <i>WinCC</i>	<ul style="list-style-type: none"> <li>• Getting Started</li> <li>• Operating principle of WinCC redundancy</li> <li>• User archives</li> <li>• Creating the "Project_Redundancy_Server" example project</li> <li>• Description of the WinCC projects</li> <li>• Server project</li> </ul>
Manual <i>WinCC Hardware Options, Part 3 Redundancy</i>	<ul style="list-style-type: none"> <li>• Structure of a redundant WinCC system</li> <li>• Operating principle of WinCC redundancy</li> <li>• Configuring the OS server pair</li> <li>• Guide for setting up a redundant system</li> <li>• Entering the servers in Windows</li> </ul>
Manual <i>Process Control System PCS 7; SIMATIC BATCH</i>	<ul style="list-style-type: none"> <li>• Structure of a redundant BATCH system</li> <li>• Configuring the BATCH server pair</li> <li>• Installation guidelines</li> </ul>
Manual <i>Process Control System PCS 7; SIMATIC Route Control</i>	<ul style="list-style-type: none"> <li>• Setting up a redundant Route Control system</li> <li>• Configuring the Route Control server pair</li> <li>• Installation guidelines</li> </ul>

Manual	Contents
Manuals for PCS 7 Software Update	<ul style="list-style-type: none"> <li>• Updating a PCS 7 Project with and without use of new functions</li> <li>• Upgrading a redundant system during online operation</li> </ul>
Manual <i>Automation System S7-400H, Fault-tolerant Systems</i>	<ul style="list-style-type: none"> <li>• Redundant SIMATIC automation systems</li> <li>• Increasing availability</li> <li>• System and operating modes of the S7-400H</li> <li>• Linking and updating</li> </ul>
Manual <i>Modifying the System in Runtime via CiR</i>	<ul style="list-style-type: none"> <li>• Modifying standard systems in runtime</li> </ul>
Manual <i>Distributed I/O Device ET 200M</i>	<ul style="list-style-type: none"> <li>• Configuration options</li> <li>• Mounting</li> <li>• Wiring</li> <li>• Commissioning and diagnostics</li> </ul>
Manual <i>Distributed I/O Device ET 200iSP</i>	<ul style="list-style-type: none"> <li>• Configuration options</li> <li>• Mounting</li> <li>• Wiring</li> <li>• Commissioning and diagnostics</li> </ul>
Operating instructions <i>SIMATIC NET; Industrial Ethernet Switches SCALANCE X-200</i>	<ul style="list-style-type: none"> <li>• Configuration options</li> <li>• Mounting</li> <li>• Wiring</li> <li>• Commissioning and diagnostics</li> </ul>
Operating instructions <i>SIMATIC NET; Industrial Ethernet Switches SCALANCE X-400</i>	<ul style="list-style-type: none"> <li>• Configuration options</li> <li>• Mounting</li> <li>• Wiring</li> <li>• Commissioning and diagnostics</li> </ul>
Manual <i>SIMATIC NET Manual Industrial Twisted Pair and Fiber-Optic Networks</i>	<ul style="list-style-type: none"> <li>• Networks with Industrial Ethernet and Fast Ethernet</li> <li>• Network configuration</li> <li>• Passive components for electrical and optical networks</li> <li>• Active components and topologies</li> </ul>
Manual <i>SIMATIC Diagnostic Repeater for PROFIBUS-DP</i>	<ul style="list-style-type: none"> <li>• Configuration options</li> <li>• Mounting</li> <li>• Wiring</li> <li>• Commissioning and diagnostics</li> </ul>
Manual <i>SIMATIC DP/PA Coupler, DP/PA Link and Y Link</i>	<ul style="list-style-type: none"> <li>• Fundamentals of PROFIBUS PA</li> <li>• DP/PA Coupler</li> <li>• DP/PA Link</li> <li>• DP/PA Link in redundant operation with the S7-400H</li> </ul>
Documentation <i>PCS 7 - Released Modules</i>	<ul style="list-style-type: none"> <li>• Components released for redundancy in PCS 7</li> </ul>

## Guide

This manual is organized into the following topics:

- Basics of fault-tolerance in PCS 7
- Description of fault-tolerant solutions in PCS 7
- Description of configurations for various redundant components in PCS 7
- Failure scenarios and diagnostic options
- Options for quantitative analysis of fault-tolerant process control systems
- Glossary with important terms for understanding this documentation
- Index of important keywords

## Conventions

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

## Changes compared to the previous version

Below you will find an overview of the most important changes in the documentation compared to the previous version:

- Using the redundant, fault-tolerant terminal bus  
You can find information on this in the section "Solutions for the terminal bus (Page 51)"
- Using the Process Historian and Information Server for central archiving
  - For additional information on this topic, refer to the *SIMATIC HMI; SIMATIC Process Historian* documentation.
  - Migration of the central archive server (CAS) to Process Historian  
You can find additional information on this in the "WinCC Classic Information System".
- Using a fault-tolerant fieldbus based on PROFINET  
You can find information on this in the section "Fault-tolerant fieldbus based on PROFINET (Page 70)"
- Using the redundant FOUNDATION Fieldbus  
You can find information about this in the "Fault-tolerant FOUNDATION Fieldbus (Page 80)" section

# Basics of Fault Tolerance

## 2.1 Rationale for using fault-tolerant process control systems

### Advantages of fault-tolerant components

Process control systems are responsible for controlling, monitoring and documenting production and manufacturing processes. Due to the increasing degree of automation and the demand for improved efficiency, the availability of these systems is playing an increasingly important role.

Failure of the control system or any of its components can lead to costly downtime in production and manufacturing. The expense involved in restarting a continuous process also has to be taken into consideration along with the actual production losses resulting from a failure. In addition, the loss of an entire batch may occur due to lost quality data. If the process is intended to operate without supervisory or service personnel, a process control system must be configured fault-tolerant for all of the components.

You can minimize the risk of a production failure and other detrimental effects by using fault-tolerant components in a process control system. A redundant design ensures increased availability of a control system. This means that all components involved in the process have a backup in continuous operation that simultaneously participates in the control tasks. When a fault occurs or one of the control system components fails, the correctly operating redundant component takes over the continuing control task. The ultimate goal is to increase the fault tolerance and fail-safe performance in process control systems.

The following applies to you as the plant operator:

The higher the cost of a production stoppage, the more you need a fault-tolerant system. The higher initial investment usually associated with a fault-tolerant system is soon offset by the savings resulting from decreased production downtimes.

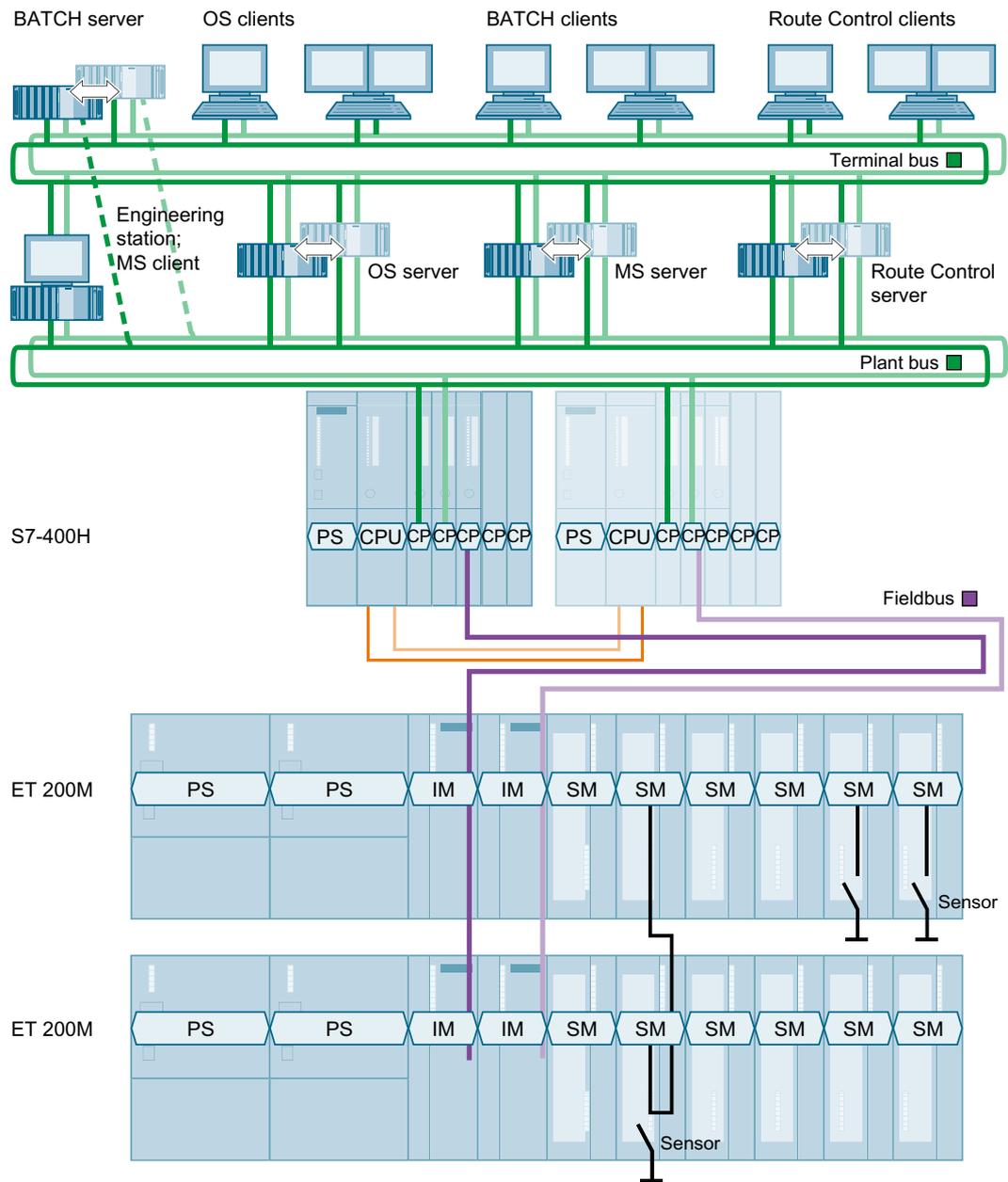
### Fault-tolerant PCS 7 process control system

The following components of the PCS 7 process control system allow you to implement fault-tolerance at all automation levels in the form and to the degree you require:

- Operator stations, maintenance station, central archive server, BATCH stations, Route Control stations (management level)
- Bus system
- Automation systems (process level)
- Distributed I/O (field level)

The following figure shows an example of a fault-tolerant process control system with PCS 7 components.

2.1 Rationale for using fault-tolerant process control systems



Legend for the above illustration:

**Note**

The following short designations are commonly used in this documentation.

Short designation	Meaning
Engineering Station	Engineering station, PC
OS server	Operator station, PC project data station in the project form "WinCC Server"

## 2.1 Rationale for using fault-tolerant process control systems

Short designation	Meaning
OS client	Operator station, PC visualization station in the project form "WinCC Client"
BATCH server	BATCH station, PC recipe and batch data station
BATCH client	BATCH station, PC recipe creation and batch visualization station
Route Control server	Route Control station, PC Route Control data station
Route Control client	Route Control station, PC Route Control visualization station
Plant bus, terminal bus	Bus systems for communication over Industrial Ethernet (electrical or optical)
S7-400H	SIMATIC S7 fault-tolerant automation system, or H system for short
PS	Power supply
CPU	Central processing unit
CP	Communications processor
IM	Interface module
SM	Signal module / I/O module in analog or digital form
ET 200M	Distributed I/O device
Fieldbus	Fieldbus for distributed I/O
Sensor	Transmitters, sensors

## 2.2 System-wide availability analyses

### Introduction

Availability must be analyzed globally for the system as a whole. Based on the degree of availability needed, each system level, each system and each component within a level should be evaluated. It is important to know the importance of each of these for the availability requirements as well as the ways and means that the required availability will be achieved.

### Avoiding repair time

In many industrial processes, it is not enough to simply correct the failure of a component and then continue the process. The repair has to be made without interruption to the continuing production process. The repair time can be considerably reduced by keeping replacement parts in stock on site. The use of fault-tolerant components in the process control system enables you to correct the cause of the system or component failure in runtime. The function of the component is retained if no fault occurs in the remaining active (redundant) components during the time a failed counterpart component is being repaired. That is, the plant continues operation without disruption.

### Avoiding impermissible signal edge transitions

A reserve system with connected backup I/O may not cause an impermissible signal edge transition when a change occurs in the operating state (power on or off) or operating mode (master or slave).

## 2.3 PCS 7 redundancy concept

### Advantages of the PCS 7 redundancy concept

Fault-tolerant process control systems can be realized with SIMATIC PCS 7 at minimal cost in all phases of a system lifecycle:

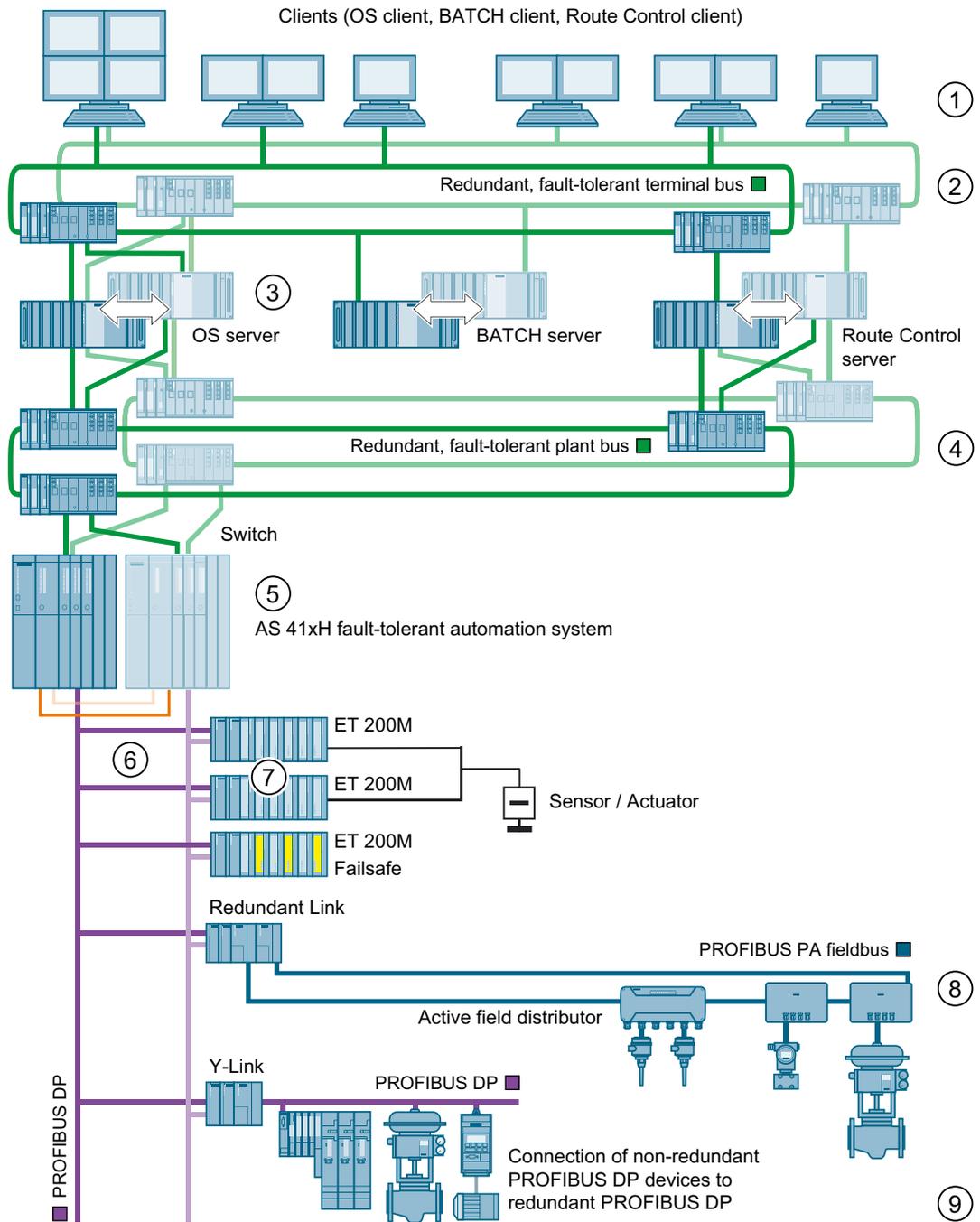
- Configuration
- Commissioning/operation
- Servicing
- Expansion

PCS 7 offers the following essential advantages:

- It provides you with system-wide scalable solutions based on the PCS 7 modular design.  
Advantage: The availability can be matched to your requirements. Your process control system can be upgraded with the SIMATIC PCS 7 components that are actually needed.
- Hardware upgrades for fault tolerance do not depend on the software configuration.  
Advantage: If the user program has been configured with PCS 7, it does not have to be adapted following a hardware upgrade. You only need to download the new hardware configuration into the CPU.
- Fault-tolerant automation system S7-400H with CPU (types: see documentation *Process Control System PCS 7; Released Modules*), whose module racks can be set up in separate locations.  
Advantage: Protection for the spatially separated CPUs resulting in increased availability in case of fire or explosion, for example.
- The use of redundant components in the process control system means isolated errors are tolerated.  
Advantage: The entire system does not fail when a single component in the process control system fails. The redundant component takes over its tasks therefore allowing the process to continue.
- Every failure of a redundant component is indicated on the OS clients in the form of a process control message.  
Advantage: You immediately receive crucial information about the status of your redundant component. Specific components that have failed can be quickly replaced to restore the redundancy.
- Software updates on redundant OS servers can be performed without loss of process operability or loss of data.

Overview of the PCS 7 redundancy concept

PCS 7 offers you a redundancy concept that reaches all levels of process automation.



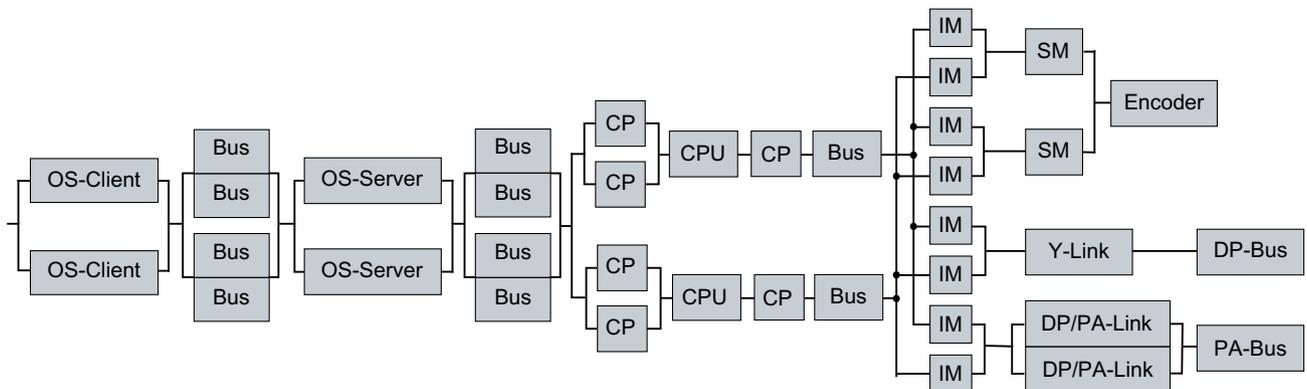
**Note**

The numbering of the components in the illustration relates to the descriptions provided below.

Number	Description
1	Several clients (OS clients, BATCH clients, Route Control clients) can access data on a server (OS server, BATCH server, Route Control server).
2	Communication between the operator stations (client and server) and communication with the engineering station is over a redundant, fault-tolerant terminal bus (Industrial Ethernet). The clients and server are connected to the terminal bus via switches.
3	The servers (OS server, BATCH server, Route Control server, maintenance server, central archive server) can, when necessary, be set up redundantly.
4	Automation systems communicate with the OS servers/Route Control servers and engineering stations and among themselves over the redundant, fault-tolerant plant bus (Industrial Ethernet). The automation system, server and engineering station are connected to the plant bus via switches.
5	Each part of the redundant, fault-tolerant S7-400H automation systems is connected to the plant bus with an Ethernet communications processor (CP). Each part of the AS be connected to several PROFIBUS DP chains. The internal PROFIBUS DP interfaces or additional communications processors are used for the attachment.
6	The redundant connection to the DP master system is achieved using two 153-2 IM modules in each ET 200M. <b>Equivalent connection via PROFINET</b> - You can find information about this in the section "Fault-tolerant fieldbus based on PROFINET (Page 70)"
7	Using redundant digital or analog input/output modules, you can evaluate signals from sensors/actuators. If one of the two redundant modules fails, the input/output signal of the functioning module are evaluated.
8	Fieldbus systems can be connected to the redundant PROFIBUS DP. The configuration of a redundant fieldbus can be realized with a redundant gateway (for example, PA link). The field devices are connected to the subsystem (for example, PROFIBUS PA) via AFD, active field distributors, (or AFS when ring/coupler redundancy is used).
9	The Y Link allows you to connect non-redundant PROFIBUS distributed I/O devices to a redundant PROFIBUS DP.

### Illustration of fault tolerance using redundancy nodes

Redundancy nodes can be used to provide an overview of the fault tolerance of a process control system. As an introductory example, the following illustration presents the process control system shown above as a block diagram with the individual redundancy nodes.



## 2.4 Overview of the PCS 7 redundancy features

### Introduction

The easiest way to increase availability is to keep replacement parts in stock on site and to have fast service at your disposal to replace defective components.

In this documentation, we provide you with PCS 7 software and hardware solutions that go well beyond fast service and replacement part warehousing. It focuses on "automated fault-tolerant process control systems".

### System-wide, scalable solutions in PCS 7 available

Plants are divided into the following layers in PCS 7:

- Field layer
- Process layer
- Management level

The components of PCS 7 enable you to implement fault-tolerant solutions at all automation system levels in the form and to the degree you desire. In PCS 7, individual components (such as signal modules), complex systems (such as operator control and monitoring systems) and complete plants can be configured in such a way that one sub-component can automatically take on the function of another sub-component if it fails.

You decide which components in the plant require increased availability.

The following table lists the fault-tolerant components for the three layers.

Process layer	Components
Management level	OS clients, maintenance clients, BATCH clients, Route Control clients OS servers, maintenance servers, central archive servers, Process Historian, information servers, BATCH servers, Route Control servers Terminal bus (Industrial Ethernet)
Process layer	Plant bus (Industrial Ethernet) Automation system AS 41xH
Field layer	Fieldbus PROFIBUS DP, PROFIBUS PA, Foundation Fieldbus Distributed I/O device ET 200M, ET 200iSP S7-300 distributed I/O modules PROFIBUS DP, PROFIBUS PA and HART devices

## Basics of increased availability

Increased availability in PCS 7 is based on the following principles:

- Duplication of a component  
Example:  
Use of duplicate signal modules
- Duplication of a component and a software component that performs an automatic fail-over from active and passive components in the case of malfunction.  
Example of redundant components:  
A signal is acquired with two signal modules and the redundancy software. The failure of one module remains non-critical for operation of the plant.
- Technical solutions for configuring components that prevent the failure of a sub-component.  
Example:  
Configuration of a network in a ring topology with redundancy manager component. If part of the ring is disrupted (by a defective cable, for example), the operation of the network is maintained.

## 2.5 Features for the configuration phase

### Features for the configuration phase

In the configuration phase, PCS 7 provides you with support with the following features.

Feature	Meaning
Fault prevention through simplified configuration of the various components	You do not need additional training to configure the redundant components. Configuration can be performed in a similar way as for standard systems.
Simple integration of redundant I/O	No special knowledge is needed about redundant I/O modules.
The communication links between the system components are configured transparent to the application.	With the HW Config or NetPro graphical user interface, the configuration of the communication links is performed transparent to the application.

## 2.6 Features for the commissioning and operation phases

### Features for the commissioning and operation phases

The following table lists the features PCS 7 offers for the commissioning and operation phases.

The redundant components allows the continuation of the process of a component fails. Operator control and monitoring of the process remains unaffected. In addition, the archiving of process data is not interrupted during the commissioning phase. Defective components can be replaced in runtime.

#### Note

If a component fails in a redundant control system, the fault tolerance is lost. This means that another failure could potentially result in the failure of the entire system, although such occurrences are rare (for example, if both bus lines are disconnected in the case of a redundant bus system).

You can find additional information on this in the section "Redundancy nodes (Page 28)".

Feature	Meaning	Possible error / possible reason
Toleration of an isolated error	An isolated error is tolerated since the fault-tolerant redundant component continues the process.	Fault or failure of servers and clients Examples: <ul style="list-style-type: none"> <li>• Hard disk failure</li> <li>• Operating system failure</li> <li>• Connection failure</li> <li>• Hard disk capacity for archiving exhausted</li> </ul> Error or failure of the automation system Examples: <ul style="list-style-type: none"> <li>• Failure of power supply</li> <li>• Failure of a CPU</li> </ul> Error or failure of the communication Examples: <ul style="list-style-type: none"> <li>• Line break</li> <li>• Electromagnetic compatibility (EMC)</li> </ul> Error or failure of central or distributed I/O modules Example: <ul style="list-style-type: none"> <li>• Component failure</li> <li>• Short circuit</li> </ul> Fault in distributed I/O devices Examples: <ul style="list-style-type: none"> <li>• Failure of the power supply (PS)</li> <li>• Failure of an interface (IM)</li> </ul>
Ensure uninterrupted operation through redundant components.	The system can continue process control without operator intervention.	Failure of an individual component in a fault-tolerant process control system. Upgrade and expansion of the system.

2.6 Features for the commissioning and operation phases

Feature	Meaning	Possible error / possible reason
Ability of process to continue to be controlled and monitored even when a server switchover occurs.	If an OS server fails, the system switches over to the configured redundant partner server. All OS clients are automatically switched over to the now activate OS partner server. The process can continue to be controlled and monitored through the OS clients even during the failover period.	Failure of the OS server Examples: <ul style="list-style-type: none"> <li>• Operating system failure</li> <li>• Hard disk defect</li> </ul>
Display of the master / standby identification of the OS server.	Information about the master / standby identification of the OS server can be requested and visualized using the OS clients.	The master / standby identification changes if the active OS server (master) fails.
No loss of data; gap-free data archiving.	The project data are saved according to the interval configured.	Failure of the OS server, for example, due to a hard disk defect.
Permanent operability of the control process by configuring a preferred server for each OS client.	The failure of some OS clients can be tolerated if the remaining clients continue to be connected to the process.	One or more client operator stations fail, for example, due to a hardware or software error. Duration of the failover of the OS clients to the redundant OS server
Replacement of faulty components and reconnection to the system in runtime.	The failed components can be replaced without influencing the ongoing process and subsequently reconnected. A redundancy update is then performed.	OS client failure: e.g., operating system OS server failure: e.g., network adapter Plant bus failure: e.g., wire break Central rack failure: e.g., PS, CPU, synchronization line, CP, SM Fieldbus failure: e.g., defective PROFIBUS bus connector Failure of the distributed I/O device: e.g., PS, IM, SM
Update of faulty component with current system status after being reintegrated into the system.	Redundancy synchronization is performed for all fault-tolerant components, for example, a CPU or a server after return to operation.	Switching on a redundant component after a redundancy fault. Example: Startup of the module after a CPU is replaced with subsequent data synchronization on the CPU conducting the process.
System upgrades and expansions in runtime	Redundantly designed components can be upgraded, expanded or replaced in runtime.	Copying BIOS versions to redundant PC stations Software updates for redundant PC stations without utilization of new functions
Displays and documentation	Documentation of availability, for example, testing based on the mean time between failure (MTBF) residual time with optional printout.	Displays and documentation of a potential component failure in advance.

## 2.7 Features for servicing and system expansions

### Features for servicing and system expansions

PCS 7 offers the following features for servicing and system expansions:

Feature	Meaning
Asset management with the maintenance station	The maintenance station provides comprehensive information for servicing and diagnostics of PCS 7 plants.
Integrated diagnostics of components (for example, LEDs) for fast, local error detection.	Diagnostics of components without an additional programming device (PG).
Faster service from SIEMENS Customer Support.	The service is on site within 2 to 48 hours to maintain the availability guarantee.
Repairs and component expansions (upgrades, conversions and updates) in runtime.	Repair and component expansions can be made in a fault-tolerant system. System components are installed redundantly so that repairs and expansions can be made in runtime.

## 2.8 Definition of availability

### Definitions

Availability is usually defined as follows:

Quotient of MTBF and (MTBF + MTTR)

or in short form

actual operating condition / nominal operating condition.

Whereby:

- MTBF = mean time between two successive error events, repair time excluded
- MTTR = mean time to repair

### Increasing the basic availability

Based on this definition, the basic availability of a standard component or a standard system can be increased by the following:

- Reduction of error frequency
- Decreasing the period necessary for repairs  
A variety of measures can reduce the repair time:
  - Proximity to customer service
  - Replacement parts warehousing
  - Repairs in runtime or repairs without downtime

With "repairs during ongoing operation", no repair time is needed in the system to correct unscheduled operation disruptions.

## 2.9 Definition of the standby modes

### Introduction

The availability of a system can be increased by additional components in the system (standby components). The operating mode of these components distinguishes them from the components that are active in process mode.

### Standby operating mode

Operating mode	Definition
Hot standby	Hot standby means the parallel redundant processing of signals in redundant components. This allows a bumpless failover of the entire system to the standby components.
Warm standby	Warm standby means the fast continuation of the aborted function by standby components at a program continuation point.
Cold standby	Cold standby means that there is a component of the system available that can be activated if a fault occurs. Following a restart, the newly activated component takes over the function of the previously failed component.

## 2.10 Redundancy nodes

### Functionality

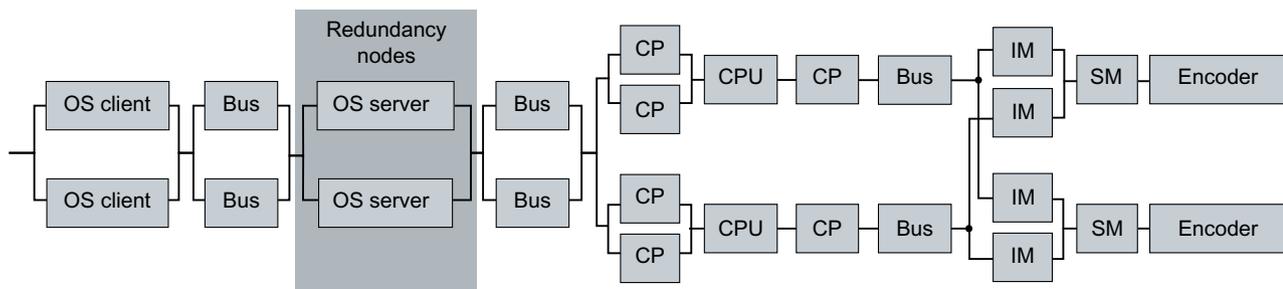
Redundancy nodes provided protection from failure of systems with redundant components. A redundancy node is independent when the failure of one component within the node does not affect the reliability in other nodes or in the entire system.

The availability of a complete system is illustrated in block diagrams. In a redundant system, a component in the redundancy node can fail without affecting the operation of the complete system. In the chain of redundancy nodes, the weakest link determines the availability of the entire system.

The block diagrams below present examples to illustrate this point.

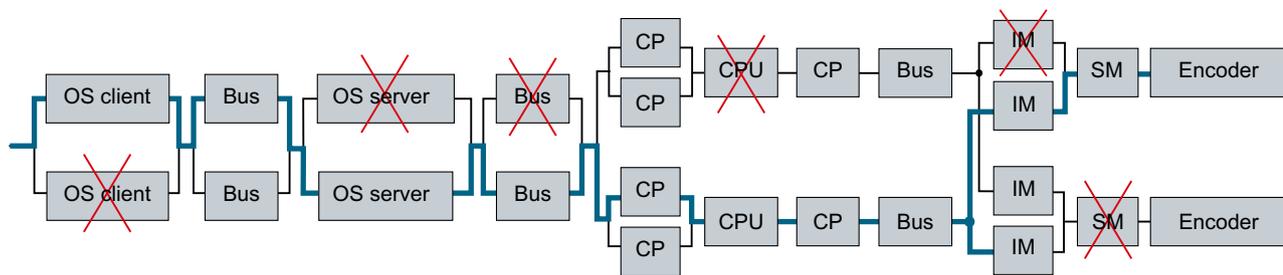
### Redundancy nodes without fault

The following is a block diagram showing individual redundancy nodes operating without a fault.



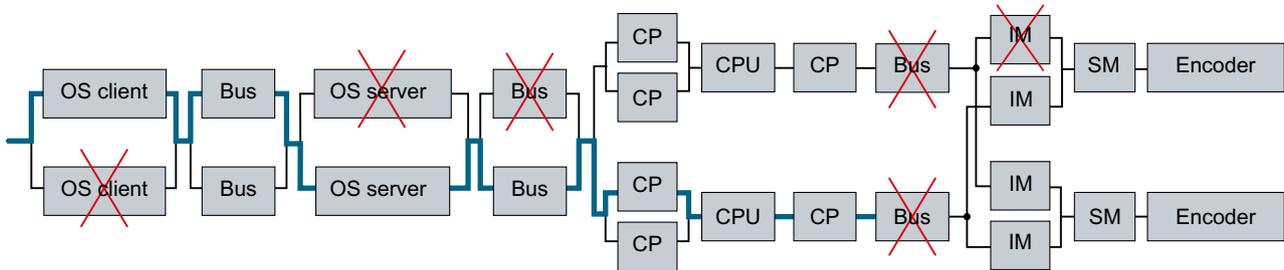
### Availability of a redundancy node despite faults

If a component in a redundancy node fails, the overall system continues to operate.



### Total failure of a redundancy node

The following figure shows a complete system that has ceased to operate due to a failure of the "Field bus (PROFIBUS DP)" redundancy node.





# Fault-tolerant Solutions in PCS 7

## 3.1 Solutions for the I/O

### Introduction

In this section you will learn about the I/O systems and components that contribute to increasing the availability of your system. This means using the distributed I/O in PCS 7.

### Distributed I/O

Distributed I/O refers to modules (input/output modules and function modules) that are used in a modular, distributed I/O device such as the ET 200M, ET 200SP or ET 200iSP.

Distributed I/O devices are often spatially separated from the central rack and located in direct proximity to the field devices themselves. This minimizes the requirements for wiring and ensuring the electromagnetic compatibility. Communication connections between the CPU of the automation system and the distributed I/O can be established with the following network types:

- PROFIBUS DP
- PROFINET

In addition to the I/O devices, distributed I/O includes field devices such as actuators, weighing systems, motor protection control equipment and all other field devices that can be integrated in PCS 7 via the bus system.

HART devices are connected and addressed via the corresponding modules in the (ET 200M / ET 200iSP) distributed I/O. HART devices are actuators and sensors that can be configured per HART protocol (HART: Highway Addressable Remote Transducer).

Network components that are integrated at the fieldbus belong to the distributed I/O. These include, for example, the following network components:

- DP/PA-Link  
The DP/PA-Link enables the connection of a lower-level bus system such as PROFIBUS PA to a redundant PROFIBUS DP.
- Y-Link  
With the Y-Link, you connect singular PROFIBUS components to a redundant system.
- FF-Link  
The FF-Link enables the connection of a lower-level bus system such as Foundation Fieldbus to a redundant PROFIBUS DP.
- PROFINET switches  
With the PROFINET switches, you integrate PROFINET networks in the fieldbus of an AS.

An AS interface can be connected using AS-Interface master modules (CPs) that are used in the distributed I/O device. This enables the connection of simple sensors and actuators to PCS 7 with AS-Interface. PCS 7 integrates other I/O levels in a project in this way.

### Increasing availability

The availability of the I/O can be increased through the following configuration options:

- **Redundant I/O** (distributed I/O)  
The entire signal path up to the sensor/actuator is configured redundantly. Additional information on this topic is available in section "Redundant I/O (Page 32)"
- **Switched I/O** (distributed I/O)  
The communication path to the I/O (station) is redundant. There is only one input/output module (SM) for processing a process signal.  
Additional information on this topic is available in section "Switched I/O (Page 34)"

### Modules for the distributed I/O

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#### Note

Information on which modules are released for the distributed I/O in PCS 7 can be found in the documentation *PCS 7 - Released modules*. You will find this documentation on the Internet at: <http://www.siemens.com/pcs7-documentation> (<http://www.siemens.com/pcs7-documentation>).

---

### 3.1.1 Redundant I/O

#### Redundant I/O

Redundant I/O describes the situation when the I/O modules (SM) for processing a process signal are doubly available and can be addressed by both CPUs. The CPU signal or process signal will continue to be processed by a functioning module even when its partner fails. The entire signal path up to the sensor/actuator is configured redundantly.

---

#### Note

With PCS 7, you can determine if errors in redundantly acquired signals will have an effect of a module or channel. You can find additional information about this in the following sections:

- Section "Redundant input/output modules (Page 37)"
  - Section "Failure of redundant input/output modules (Page 189)"
- 

#### Configuration

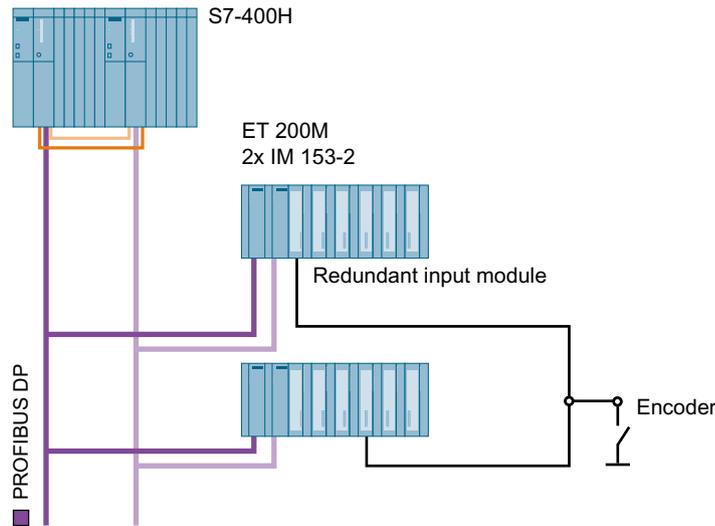
In PCS 7, you can configure redundant I/O with selected S7-300 I/O modules of ET 200M.

The ET 200M distributed I/O device is connected as redundant DP slave to a fault-tolerant automation system operating as the DP master via PROFIBUS DP. A redundant configuration is achieved by installing an additional ET 200M and an additional PROFIBUS DP connection.

**Note**

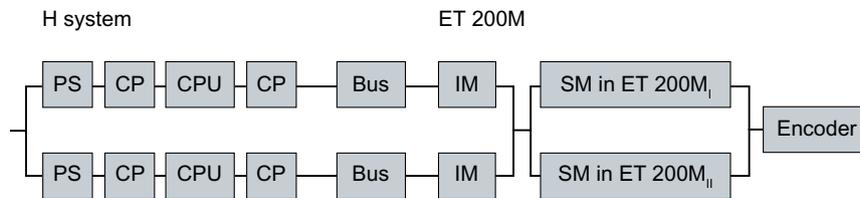
Use only active bus modules for the ET 200M in a fault-tolerant system with PCS 7. Active bus modules enable you to plug and pull modules in runtime.

The following figure illustrates this configuration with ET 200M. Signals from redundant sensors can be registered.

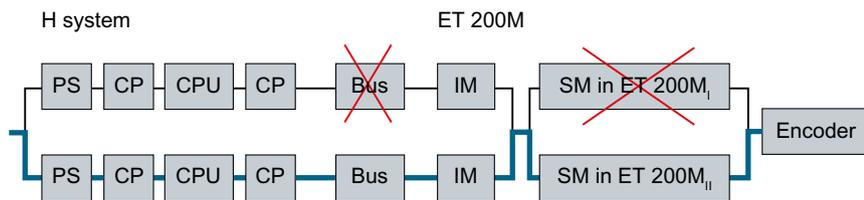


**Availability**

The block diagram shows an example configuration with ET 200M without a fault.



If a fault occurs in a maximum of one signal path per redundancy node (e.g. bus line (bus = PROFIBUS DP) in the first redundancy node and an input module (SM) in the second redundancy node), the overall system remains operable. The connected device continues to supply data to the central device, which remains available. If any other component in the redundancy chain fails, however, the complete system will fail.



### Installation rules

The configuration always has to be symmetrical when using redundant I/O. Observe the following configuration rules:

- Both subsystems of the S7 400H must be configured identically. The same modules are located at the same slots.  
Example: CPU and CPs are located in both subsystems at the same slot.
- The communication paths and interfaces must be configured the same way in both subsystems.  
Example: The PROFIBUS cables in both subsystems are connected to the same PROFIBUS DP interface of the CPU 41x-4H.
- Redundant modules are always identical (article number, firmware version)

### Configuration rules

- A DP slave must have the same PROFIBUS address in the mutually redundant DP master systems.

### Additional information

- Section "Redundant interface modules in distributed I/O (Page 36)"
- Section "Redundant I/O modules (Page 37)"
- Manual *Automation System S7-400H; Fault-tolerant Systems*

## 3.1.2 Switched I/O

### Switched I/O

Switched I/O describes the situation when there is only one I/O module (SM) for processing a process signal. The communication path to the I/O (station) is redundant. In the event that a communication path fails, the distributed I/O (station) switches to the functioning communication path. The non-redundant I/O modules of the distributed I/O can be addressed via the redundant interface module (DP slave) of both central modules (CPU) of a fault-tolerant system.

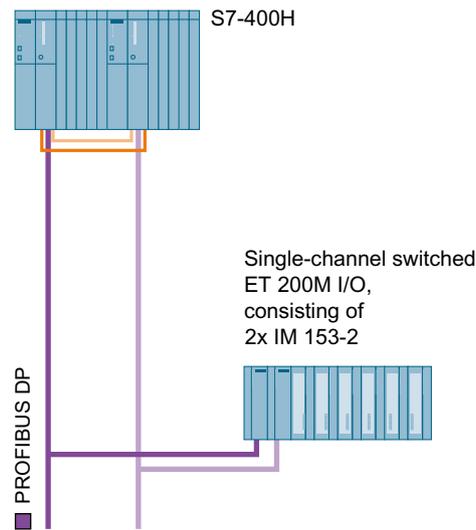
## Configuration

A switched I/O can be set up in PCS 7 with the following distributed I/O devices:

- ET 200M  
For this setup, you require an ET 200M with active backplane bus modules and a redundant IM 153-2 interface module.
- ET 200iSP  
For this setup, you require an ET 200iSP and a redundant IM 152-1 interface module.

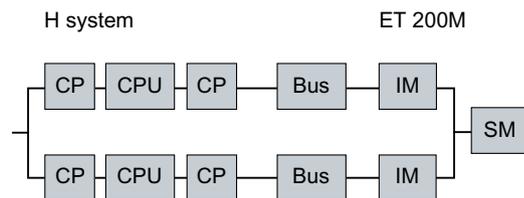
Each subsystem of the S7-400H is connected to one of the two PROFIBUS DP interfaces of the interface module via a DP master interface.

The following figure illustrates this configuration for the ET 200M.

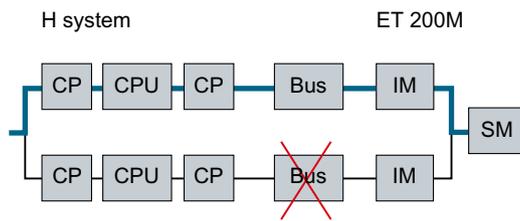


## Availability

The block diagram shows the availability of the configuration illustrated above. When both systems are operating without fault, the block diagram appears as follows:



The following figure shows how one component may fail without this affecting the operation of the complete system.



The system remains available even when one component in part of a line of the redundancy node fails. There is only one I/O module and therefore no corresponding redundancy node. It is the weakest link in the complete system's chain.

### Installation rules

The configuration always has to be symmetrical when using switched I/O. Follow these installation rules:

- CPU 41x-xH and additional DP masters must be located in the same slots in each subsystem (for example, in slot 4 of both subsystems).
- The PROFIBUS cables in both subsystems must be connected to the same interface (for example, to the PROFIBUS DP interfaces of the two CPU 41x-xH).

### Configuration rules

- A DP slave must have the same PROFIBUS address in the mutually redundant DP master systems.

### Additional information

- Section "Redundant interface modules (Page 36)"
- Manual *Automation System S7-400H; Fault-tolerant Systems*

## 3.1.3 Components in the distributed I/O

### 3.1.3.1 Redundant interface modules in distributed I/O

#### Redundant interface modules

By using two interface modules in one distributed I/O device, the following can be implemented:

- Setup of a switched distributed I/O
- Setup of a redundant distributed I/O

If the active interface module or the communication path fails via this interface module, the passive interface module takes over the relevant functions without interruption. The active interface is indicated by an illuminated "ACT" LED on the respective interface module.

Configuration:

The configuration is provided as an example in the section "Redundant I/O (Page 32)".

- ET 200M with redundant IM 153-2  
Two IM 153-2 interface modules are mounted on the active bus module in the distributed I/O device for redundant operation.
- ET 200iSP with redundant IM 152-1  
Two IM 152-1 interface modules are mounted on the active TM-IM/IM terminal module in the distributed I/O device for redundant operation.

---

**Note**

The signal modules of the ET 200iSP cannot be used redundantly.

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**Additional information**

- Section "How to configure the redundant interface module for the I/O device (Page 126)"
- Section "Failure of redundant interface modules (Page 189)"
- Manual *SIMATIC, Distributed I/O Device ET 200M*
- Manual *SIMATIC, Distributed I/O Device ET 200iSP*
- Manual *Automation System S7-400H; Fault-tolerant Systems*

**3.1.3.2 Redundant I/O modules****Configuring redundant input/output modules**

Redundant I/O modules enable you to increase the availability in the I/O area.

The following configurations are possible with redundant I/O modules:

- Redundant input/output modules in redundant distributed I/O  
An example of this is the configuration shown in the section "Redundant I/O (Page 32)"
- Redundant input/output modules in single-channel switched distributed I/O  
An example of this is the configuration shown in the section "Switched I/O (Page 34)"

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**Note**

Refer to the interconnection examples for redundant I/O (redundant input/output modules) in the manual *Automation System S7-400H; Fault-tolerant Systems*.

---

**Redundant operation of S7-300 I/O modules**

The following requirements must be met to operate redundant S7-300 I/O modules in the automation system:

- PCS 7 as of V6.0
- H-CPU as of firmware version V3.1
- Suitable S7-300 I/O modules (documentation: *PCS 7 - Released Modules*)

### Required software and configuration

You select and configure the redundant modules in HW Config.

- In order for both subsystems of the H system to be able to address redundant input/output modules, S7 driver blocks from the "Redundant I/O" library and PCS 7 driver blocks from the *PCS 7 Library* as of PCS 7 V6.0 are required in addition to the necessary hardware.
- Modules with the same article number and version number are configured redundantly to one another

You interconnect the signals in the CFC chart. You can find information on this in the section "Configuration of redundant signals (Page 141)".

When the user program is compiled, the required driver blocks are placed, interconnected and configured automatically.

### Reaction to a channel fault

You can define the passivation characteristics, for example how redundant input/output modules react to a channel fault (such as broken wire, short-circuit on the signal line). The reaction to a channel fault depends on the following aspects:

- Module employed
- Configuration
- Version of the PCS 7 library
  - As of PCS 7 V7.1, the potential passivation reaction is automatically detected based on the configured modules. The passivation reaction is set channel-by-channel.
  - Only the module-based passivation reaction can be selected with the Redlib V3.x library.
  - You can set the channel-based passivation reaction with the Redlib library as of V4.

You will find information on the passivation reaction for individual modules in the documentation *PCS 7 - Released Modules*.

### Additional information

- Section "How to configure redundant I/O modules (Page 129)"
- Section "Failure of redundant I/O modules (Page 189)"
- Section "How to set the failure reaction of the input/output modules on the CPU (Page 105)"
- Manual *Automation System S7-400H; Fault-tolerant Systems*
- Online help for *STEP 7*

### 3.1.3.3 Redundant actuators and sensors

#### Failure detection

Actuators and sensors on the field level can be configured redundantly for PCS 7. Depending on the I/O module to which the redundant actuators or sensors are connected, failure of an actuator or sensor can be detected and reported to the process control system as an error. If an actuator/sensor fails, the automation system continues to operate with the intact actuator/sensor. This ensures that the current status of the process values can be read in or output at any time.

---

#### Note

Refer to the product description of the I/O module you are using to see whether it can detect and report failures of connected actuators and sensors.

---

#### Additional information

- Manual *Automation System S7-400H; Fault-tolerant Systems*

## 3.2 Solutions for automation systems

### Introduction

This chapter presents solutions that can be used to increase the availability of an automation system.

### S7-400H fault-tolerant programmable controller

Only a fault-tolerant automation system can ensure an extremely short process safety time, for example, a switchover time in the milliseconds range. PCS 7 enables you to configure your process control system with redundancy using the S7-400H fault-tolerant programmable controller.

### Functionality

The S7-400H programmable controller and all the other components in the PCS 7 environment are tuned to one another.

With this solution, a second backup CPU, which is event-synchronized to the master CPU, performs the same processing tasks of the user program as the master. If the active master CPU fails, the standby CPU continues processing the user program without delay. This type of standby is referred to as "Hot standby".

There are always two CPUs and two power supplies in an S7-400H. The communications processors and I/O modules are expansion modules.

### 3.2.1 S7-400H hardware components

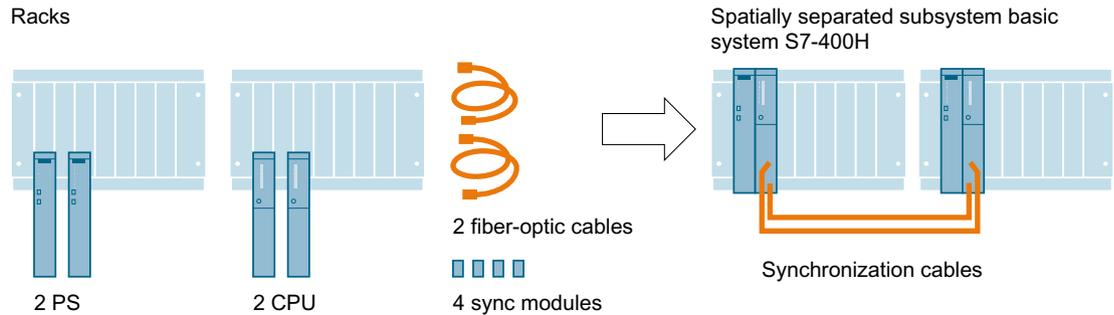
#### Hardware components

The following hardware components are available for the configuration of the fault-tolerant automation system.

Hardware components	
Racks	Rack UR2-H
	Rack UR2
	Rack UR1
	Rack CR3
Central processing units	Central processing unit CPU 410-5H
	Central processing unit CPU 412-3H ... 5H PN/DP
	Central processing unit CPU 414-4H ... 5H PN/DP
	Central processing unit CPU 416-5H PN/DP
	Central processing unit CPU 417-4H ... 5H PN/DP
Synchronization modules	Synchronization modules
Synchronization cable	Synchronization cable (up to 10 km)

Hardware components	
Communication processors	Communication processor CP 443-5 Extended
	Communication processor CP 443-1

## Setup



## Racks

The following racks are available for installing the S7-400H. Normally, the UR2-H rack is used.

Type	Slots	Special feature
Rack UR2-H	2 x 9	Installation of two separate subsystems each with nine modules. The two subsystems are electrically isolated (not mechanically). It is not possible to replace a rack in runtime.
Rack UR2	1x 9	Two racks are required for an S7-400H . You can replace a rack in runtime.
Rack UR1	1x 18	Two racks are required for an S7-400H . You can replace a rack in runtime.
Rack CR3	1x 4	Two racks are required for an S7-400H . You can replace a rack in runtime.

## Central processing units

There are two CPUs in an H-system. The two CPUs are connected to one another using synchronization modules and fiber-optic cables.

## Power supply

A separate power supply module from the standard S7-400 series is needed for each subsystem of the S7-400H. Two power supply modules can be used in each subsystem to increase the availability of the fault-tolerant system. In this case, use the following power supply modules that can be used for redundancy.

Power supply modules for 24 VDC as well as for 120/230 VAC nominal input voltages with output currents of 10 and 20 A.

## Synchronization modules

Synchronization modules are used to link the two central processing units. They are installed in the central processing units and interconnected with fiber-optic cable. Two synchronization modules are installed in each CPU.

Set the rack number for the H CPU as of firmware version V4.X directly on the CPU. The synchronization modules can be replaced in runtime.

The same rack number must be set at all synchronization modules up to firmware V3.x.

## Fiber-optic cables for synchronization

The fiber-optic cables are connected to the synchronization modules and form the physical connection (redundancy link) between the two automation stations. The synchronization cables must not be cross-connected.

In addition to the standard lengths of 1 m, 2 m, and 10 m, custom-made synchronization cables are available in lengths up to 10 km.

## Transmission medium

The suitable physical transmission medium depends on the range, resistance to interference and the transmission rate.

- Industrial Ethernet using fiber-optic cables or triaxial or twisted-pair copper lines can be used for communication between the automation system and the OS servers.
- PROFIBUS DP with electrical or optical components is used for communication from the automation system to the distributed I/O devices.

The transmission media and communications processors can be configured redundantly. If the active communication component (CP, bus) fails, the communication automatically continues through the redundant connection.

Only Industrial Ethernet with ISO protocol can be used as the plant bus for a fault-tolerant system. The communication modules must also support the ISO protocol.

## Equipping the rack

The hardware setup in the automation system and the configuration in HW Config must match:

- Rack (4, 9 or 18 slots for redundant and, in some cases, remote configuration)
- Power supply modules (in some cases redundant configuration)
- H CPU with sync modules in slots "IF1" and "IF2"
- If necessary: Communications processors (CP 443-1, CP 443-5 Extended)

## Configuration

A pre-existing network can be used for fault-tolerant communication between non-redundant SIMATIC stations and (redundant) SIMATIC H stations. You set the parameters of the fault-tolerant S7 connections in NetPro.

The required communication blocks for data transmission (measured values, binary values, interlocks) are available in the *PCS 7 Library*. The communication blocks differ in their transmission mechanism which, for example, may be secured or unsecured.

#### Additional information

- Section "How to add a SIMATIC H station to your project (Page 100)"
- Section "How to insert synchronization modules into the H CPU (Page 102)"
- Section "How to configure redundant communication processors (Page 103)"
- Section "Time synchronization (Page 97)"
- Manual *Automation System S7-400H; Fault-tolerant Systems*

### 3.2.2 How the SIMATIC S7-400H AS operates

#### Active redundancy

The automation system consists of two redundantly configured subsystems, which are synchronized through fiber-optic cables.

The two subsystems form a fault-tolerant automation system that operates with a dual-channel design according to the principle of active redundancy. Active redundancy, often referred to as functional redundancy, means that all redundant components are in continual operation and simultaneously involved in the acquisition of process data. The control task is the responsibility of the redundancy partner that is active at any given time. The user programs loaded in both CPUs are fully identical and are run synchronously by both CPUs.

If the active CPU fails, the automation system automatically switches to the redundant CPU (see section "S7-400H hardware components (Page 40)" and Documentation *Process Control System, SIMATIC PCS 7, Released Modules*). The failover has no effect on the ongoing process because it is bumpless.

#### Additional information

- Section "Failure of the master CPU (Page 192)"
- Section "Failure of a fiber-optic cable (Page 192)"
- Manual *Automation System S7-400H; Fault-tolerant Systems*

## 3.3 Solutions for communication

### Introduction

In this section, you will learn about the redundancy concepts for the various levels of the process control system.

### Requirements for communication systems

The availability of a process control system is not only determined by the automation system, the environment also plays a considerable role. This includes not only the operator control and monitoring components but also a high-performance communication system that connects the management level to the process level and the process level to the field level.

Distributed control systems are also needed in the manufacturing and processing automation. Complex control tasks are broken down into smaller, simpler steps with distributed form. The demand for communication between distributed systems increases.

High-performance, comprehensive communication system is needed to fulfill this demand. The communication connections between the systems involved should be **redundant**.

Local networks (LAN) form the basis of the communication system. The following are options that can be implemented based on the specific system requirements:

- Electrical
- Optical
- Electrical/optical combination

The communication connections are grouped in three areas:

- Terminal bus
- Plant bus
- Fieldbus

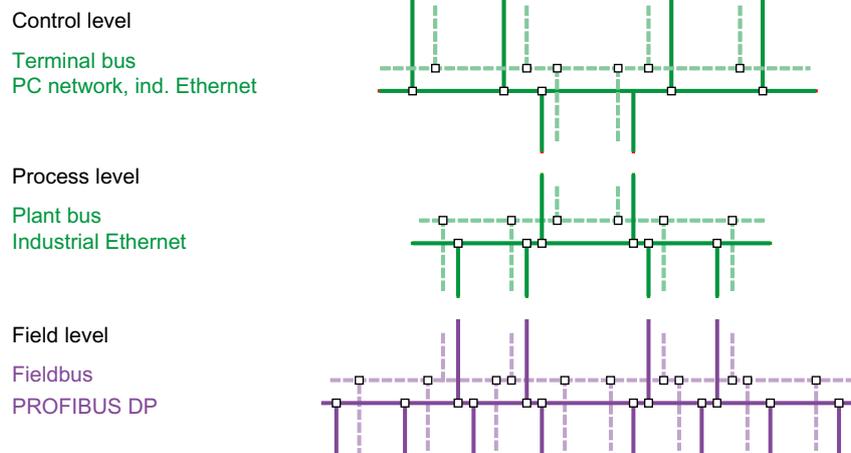
In PCS 7, we recommend that the bus systems are set up in a ring structure. The ring structure makes the bus "fault-tolerant", since it can compensate for the failure of a bus line.

### Redundant communication connections

Redundant communication connections can be formed on all levels of the process control system.

When a communication error occurs, communication automatically switches over from the active connection to the backup connection. Both connections use the same media and protocols. The failover has no effect on the user program running in the CPU.

Redundantly designed communication cables



## Overview of the redundant and fault-tolerant bus systems

In PCS 7 systems, you can configure **fully redundant bus systems** with redundant components for the following bus systems:

- Redundant, fault-tolerant terminal bus (Page 53)
- Redundant, fault-tolerant plant bus (Page 63)
- Redundant PROFIBUS DP (Page 68)

**Bus systems set up as a ring** are **fault-tolerant**. In ring structures, the signal path remains intact even if there is a disconnection on the transmission cable at any point in the ring (for example due to a wire break). The availability is ensured by ring redundancy.

This fault-tolerance is used in the following bus systems:

- Fault-tolerant terminal bus (Page 51)
- Fault-tolerant plant bus (Page 61)
- Fault-tolerant PROFIBUS PA (Page 74)
- Fault-tolerant FOUNDATION Fieldbus (Page 80)
- Fault-tolerant PROFINET bus (Page 70)

The following sections describe the basics of these communications solutions.

### 3.3.1 Network components

#### Introduction

Local networks (LAN) form the basis of the communication system. The following are options that can be implemented based on the specific system requirements:

- Electrical
- Optical
- Optical/electrical (mixed operation)

#### Overview of the network components

You can set up bus systems with the following link and switch modules of SIMATIC NET.

Network component	Bus system	Application
<b>Switch (from the SCA-LANCE series)</b>	Terminal bus Plant bus	Type-specific use in network setup Selected SCALANCE X components enable the following: <ul style="list-style-type: none"> <li>• Transmission rates up to 1 Gbps</li> <li>• Media converter (electrical/optical bidirectional)</li> <li>• Function as redundancy manager (configuration of ring redundancy)</li> <li>• Function as standby manager (redundant linking of networks)</li> </ul> Depending on the type, either optical or electrical connections are used.
<b>SCALANCE X204 RNA</b> (communication on the basis of the Parallel Redundancy Protocol - PRP)	Terminal bus	Connecting a singular infrastructure component to the redundant terminal bus. For example: <ul style="list-style-type: none"> <li>• a master clock for a system, e.g. SICLOCK TC400</li> <li>• domain controller</li> <li>• File server</li> </ul> Ports: <ul style="list-style-type: none"> <li>• 2 ports for the infrastructure components</li> <li>• 2 ports for the connection to the redundant terminal bus (LAN A and LAN B)</li> </ul>
<b>Switch (from the SCA-LANCE series)</b>	Fieldbus <ul style="list-style-type: none"> <li>• PROFINET</li> </ul>	<ul style="list-style-type: none"> <li>• Fieldbus as fault-tolerant PROFINET ring</li> </ul>
<b>OLM (Optical Link Module)</b>	Fieldbus <ul style="list-style-type: none"> <li>• PROFIBUS DP</li> </ul>	Setup of optical transmission paths Configuration variants: <ul style="list-style-type: none"> <li>• DP master (electrical) &gt; OLM &gt; FO &gt; OLM &gt; interface module (<b>electrical</b> connection)</li> <li>• DP master (electrical) &gt; OLM &gt; FO &gt; interface module (<b>optical</b> connection)</li> </ul>

Network component	Bus system	Application
<b>AFD</b> (Automatic Field Distributor) <b>AFDiS</b>	Fieldbus <ul style="list-style-type: none"> <li>• PROFIBUS PA</li> <li>• FOUNDATION Fieldbus</li> </ul>	Connection of field devices via ring redundancy <ul style="list-style-type: none"> <li>• Maximum of 31 fieldbus components on one bus</li> <li>• Maximum of 8 AFD/ADFiS on a redundant fieldbus coupler</li> <li>• Maximum of 4 field devices per AFD</li> <li>• Maximum of 6 field devices per AFDiS</li> </ul>
<b>AFS</b> (Automatic Field Splitter)	Fieldbus <ul style="list-style-type: none"> <li>• PROFIBUS PA</li> <li>• FOUNDATION Fieldbus</li> </ul>	Connection of field devices via coupler redundancy <ul style="list-style-type: none"> <li>• 1 AFS on a redundant fieldbus coupler</li> <li>• Up to 31 fieldbus components on the AFS</li> </ul>

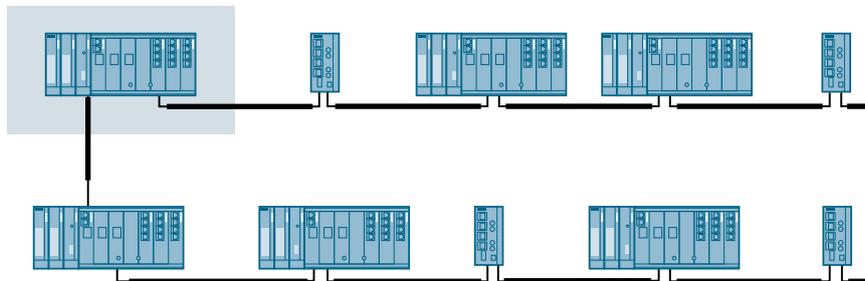
### Redundancy manager

Certain network components in the SIMATIC NET product range support the redundancy manager function.

This function enables the configuration of ring redundancy. Network components operating as the redundancy manager can ensure that the bus connections remain undisturbed if there is a fault on a bus line (such as a cable break).

#### Example of a ring structure with SCALANCE X400 and X200

The SCALANCE X414-3E as the redundancy manager has a gray background in the figure.



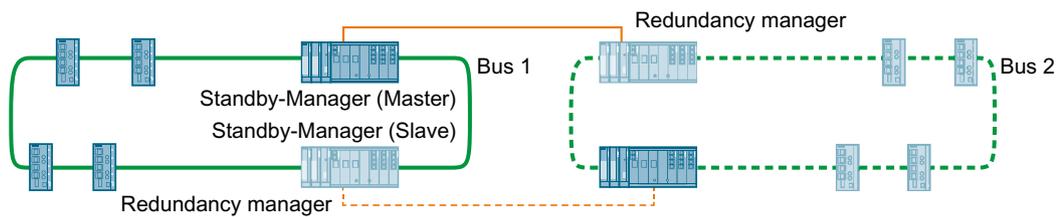
### Standby manager

Switches and data links (network cable) connect the redundant networks. Redundant coupling of networks is only possible if two devices (switches) within a network segment support the standby manager function. Certain network components from the SIMATIC NET product range support this function.

Within a network segment, both devices are configured for the standby manager function. The two devices exchange data frames via the bus line and thereby synchronize their operating status. One network component becomes the standby manager (master) and the other standby manager (slave).

When operation is error-free, the data link running between the redundant networks is active for the standby manager (master). If this data link fails (e.g., due to a defective device or cable break), the standby manager (slave) activates its data link while the fault remains pending.

#### Example of a ring structure with SCALANCE X



### SCALANCE X switches for setting up redundant networks

You can find additional information on SCALANCE X switches approved for PCS 7 in the *Process Control System PCS 7; Released Modules* documentation. The switches must have the necessary functions available to set up the relevant redundant network:

- Redundancy manager
- Standby manager
- Parallel Redundancy Protocol

### PC stations on networks

The PC stations are connected to the networks via network adapters and network cables.

The network adapters occupy a slot in the PC or programming device (PG). The following different network adapters are used depending on requirements. You can find information about this in the following sections:

- Section "Connecting PC stations to the terminal bus (Page 51)"
- Section "Connecting PC stations to the plant bus (Page 60)"

### Additional information

- Documentation *Process Control System PCS 7; PCS 7 Readme*
- Documentation *Process Control System PCS 7; Released modules*
- Manual *SIMATIC Net Twisted Pair and Fiber-Optic Networks*
- Manual *SIMATIC Net PROFIBUS Networks*
- Manual *SIMATIC; Communication with SIMATIC*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-200*
- Operating instructions *SIMATIC NET; Industrial Ethernet; SCALANCE X204RNA, SCALANCE X204RNA EEC*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-300*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-400*
- Configuration Manual *SIMATIC NET; Industrial Ethernet Switches; SCALANCE X-300; SCALANCE X-400*

### 3.3.2 Media Redundancy Protocol

#### Use of media redundancy protocol

**Note**

**High Speed Redundancy Protocol (HRP) and Media Redundancy Protocol (MRP)**

The X200 IRT switches cannot serve as redundancy manager and standby manager at the same time.

The standby manager can only be operated with the High Speed Redundancy Protocol. Standby redundancy and media redundancy protocol do not work together.

	HRP	MRP
Separate terminal and plant bus	X	-
Common terminal and plant bus	X	-
PROFINET fieldbus	-	X

**Note**

**Industrial Ethernet switches that support MRP**

The following Industrial Ethernet switches support the MRP function:

- SCALANCE X-200 as of firmware V4.0
- SCALANCE X-200 IRT as of firmware V4.0
- SCALANCE X-300 as of firmware V3.0
- SCALANCE X-400 as of firmware V3.0

**Note**

**PROFINET fieldbus**

If you configure a fieldbus ring with PROFINET, you must use the Media Redundancy Protocol (MRP). The High Speed Redundancy Protocol (HRP) and MRP cannot be used simultaneously in a ring. The PROFINET fieldbus ring may only consist of devices that support MRP functionality.

#### High Speed Redundancy Protocol (HRP)

HRP is used for redundant coupling in a terminal and plant bus ring.

Ring redundancy and redundant connection of rings are possible by means of configuration of the following functions:

- Redundancy manager
- Standby manager

### High Speed Redundancy (HSR - obsolete)

Obsolete term: This term can be found in older firmware versions of Industrial Ethernet switches. The functionality corresponds to that of HRP. You can find additional information about High Speed Redundancy and High Speed Redundancy Protocol in the documentation of the Industrial Ethernet switches.

### Media Redundancy Protocol (MRP)

For redundant coupling in a fieldbus ring based on PROFINET, all devices must support MRP.

### Configuration of the watchdog time

When a transmission path fails, it may take up to 200 ms to reconfigure the network (switching to the redundant transmission path).

Increase the watchdog time for each station by adjusting the following values:

- Select the "fixed update time" setting.
- Increase the update time to a value that is less than the fastest update of the process image partition (PIP) for this station.
- Increase the number of accepted update cycles with missing I/O data, so that the watchdog time is > 200 ms.

See also <http://support.automation.siemens.com/> (<http://support.automation.siemens.com/WW/view/en/55422236>)

### Additional information

- You can find information about HRP and MRP in the documentation of the Industrial Ethernet switches.
- You can find information about High-availability Seamless Redundancy (HSR) in the section "Redundant, fault-tolerant terminal bus based on the Parallel Redundancy Protocol (PRP) (Page 54)".

### See also

How to configure the redundant terminal bus on the basis of the Parallel Redundancy Protocol (Page 107)

How to configure a fault-tolerant plant bus (Page 112)

How to configure a media-redundant fieldbus on the basis of PROFINET (Page 120)

### 3.3.3 Solutions for the terminal bus

#### 3.3.3.1 Connecting PC stations to the terminal bus

You connect the following PC stations to industrial Ethernet via network adapters (communication modules or communication processors):

- Operator stations
- BATCH stations
- Route Control stations
- Engineering stations

The network adapters occupy a slot in the PC or programming device. Depending on the requirement.

#### Network adapters for connection to the terminal bus

The following network adapters are released in PCS 7 (standard communication modules):

- PCIe network adapters:
  - Intel® PRO/1000 PT Server Adapter
  - (Intel® Gigabit CT Desktop Adapter (Intel® PRO/1000 PT Desktop Adapter is permitted)
- Integrated network adapter
  - INTEL ... (LM-Adapter)
  - INTEL ... (L-Adapter)

#### Variants for the redundant connection of the PC station to a terminal bus

- Fault-tolerant terminal bus (Page 51)
- Redundant, fault-tolerant terminal bus (Page 53)

Using the product documentation, check whether the network adapters are suitable for realizing the respective concept for the terminal bus.

#### Additional information

- Documentation *Process Control System PCS 7; Released modules*
- Documentation *Process Control System PCS 7; PCS 7 Readme*

#### 3.3.3.2 Fault-tolerant terminal bus

The terminal bus connects the servers (OS servers, BATCH servers, Route Control servers) with the clients of the process control system (OS clients, BATCH clients, Route Control clients).

fault-tolerant terminal bus can be set up in a ring structure with network components of SIMATIC NET. The network components enables unrestricted operation of the terminal bus.

For example, a broken cable in the connection between the modules is tolerated and communication remains uninterrupted.

If the terminal bus experiences problems, no process data are sent from the servers to the clients.

### Fault-tolerant communication solutions

The following solutions are available to guard against failure of the terminal bus:

- Ring structure in an electrical network. The connection to the switches is electrical.
- Ring structure in an optical network with switches and FO cables. The connection to the switches is electrical or optical.
- Ring structure in a combined network with optical and electrical switches and FO cables. The connection to the switches is electrical.
- Ring structures as optical, electrical and combined networks with transfer rates up to 1 Gbps based on the modular switches

### Configuration

In the following figure, the terminal bus is shown as a ring with switches as an example. The OS servers are connected to the switches in a distributed pattern in order to take optimal advantage of the switch functionality. The probability of OS server failure due to the failure of a switch and the bus load are thereby reduced.

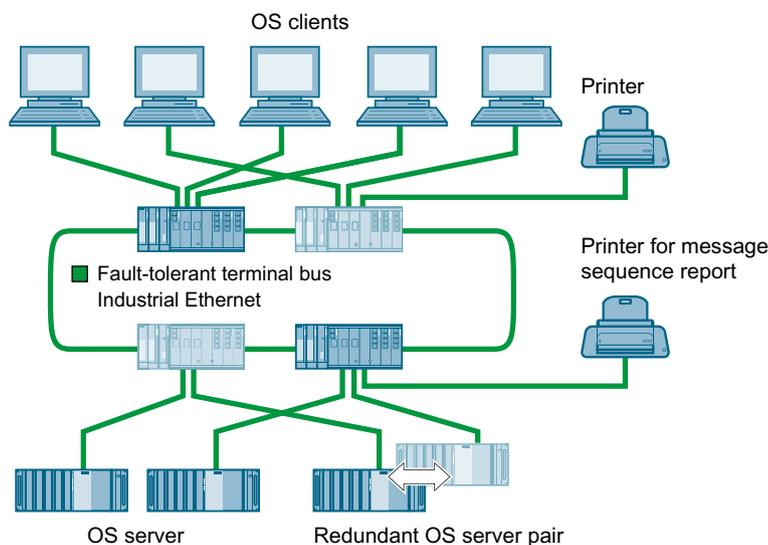
The log data of the control process is secured and continuously available if you use two OS clients each equipped with a line printer for printing the message sequence reports.

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#### Note

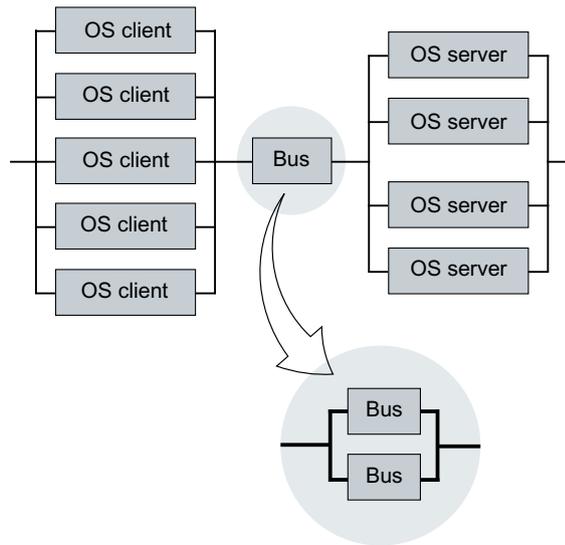
If a switch fails, the connection to the associated nodes will also fail. Therefore, redundant servers must not be connected to the same switch.

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## Availability

If there is a fault in a ring line, the communication between clients and servers via the switches remains unaffected. However, if one of the switches fails, the link between the connected OS servers and the OS clients is interrupted. To increase the fault-tolerance even more, however, the redundant ring described in the following section can be used.



## Additional information

- Manual *SIMATIC Net Twisted Pair and Fiber-Optic Networks*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-400*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-300*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-200*

### 3.3.3.3 Redundant, fault-tolerant terminal bus

## Functionality

The terminal bus connects the servers (OS servers, BATCH servers, Route Control servers) etc. with the clients of the process control system (OS clients, BATCH clients, Route Control clients).

The following solutions for a redundant, fault-tolerant terminal bus are offered as of PCS 7 V8.0:

- Redundant, fault-tolerant terminal bus based on the Parallel Redundancy Protocol (PRP) (Page 54)  
Separate double ring with PRP; solution in accordance with IEC 62439-3)
- Redundant, fault-tolerant terminal bus based on the INTEL TEAM mode (Page 57)  
Coupled double ring based on redundant coupling of network segments - formed by two identical coupled terminal bus rings

## Redundant components

The following components are configured redundantly:

- Electrical or optical network with Ethernet switches
- Switches, fiber optic cables and electrical connections
- Ring structures based on switches from the SCALANCE series.

You can find additional information on the switches used with PCS 7 in the section "Network components (Page 46)".

## Additional information

- Section "How to configure the redundant terminal bus on the basis of the Parallel Redundancy Protocol (Page 107)"
- Section "How to configure the redundant terminal bus on the basis of the INTEL TEAM mode (Page 108)"
- Documentation *PCS 7 Released Modules*
- Manual *SIMATIC Net Twisted Pair and Fiber-Optic Networks*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-400*
- Configuration manual *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-400*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-200*
- Operating instructions *SIMATIC NET; Industrial Ethernet; "SCALANCE X204RNA, SCALANCE X204RNA EEC"*
- Operating instructions *SIMATIC NET; PG/PC - Industrial Ethernet; SOFTNET-IE RNA*
- Online help for SOFTNET IE RNA

### 3.3.3.4 Redundant, fault-tolerant terminal bus based on the Parallel Redundancy Protocol (PRP)

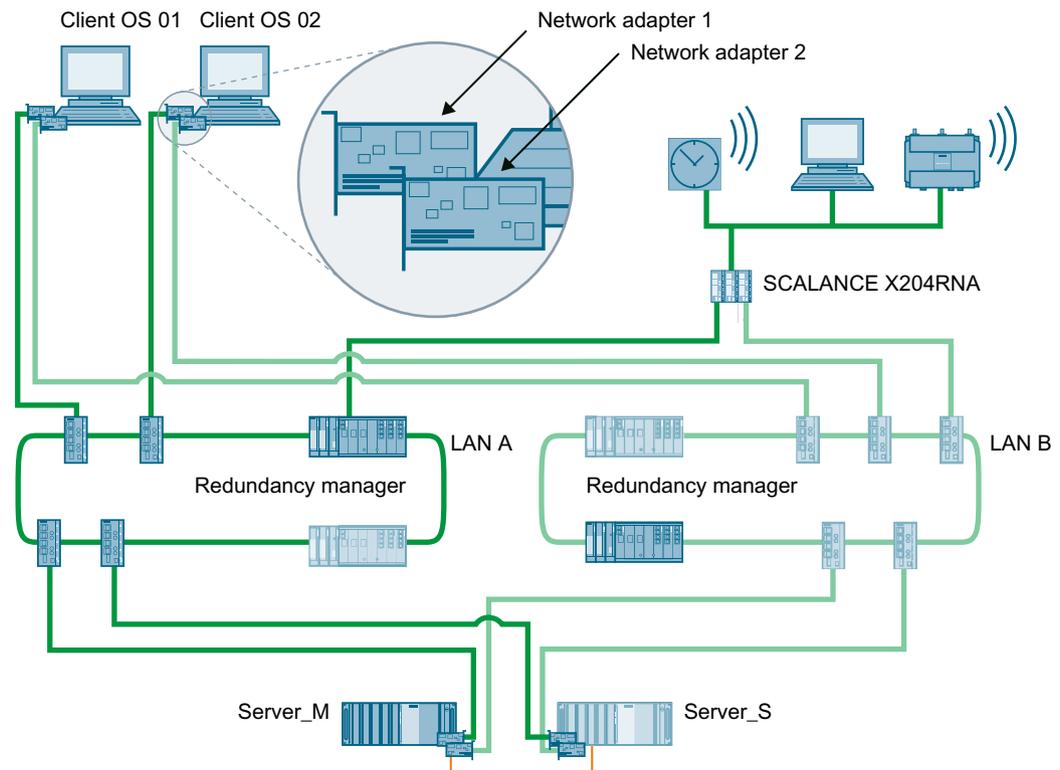
The section below describes the basic structure of a redundant fault-tolerant terminal bus using the SIMATIC NET SOFTNET-IE RNA software. This software is based on the Parallel Redundancy Protocol (PRP) as specified in IEC 62439-3.

Each PC station is connected to 2 separate redundant networks with two network adapters each. The communications processes on the redundantly connected PC stations are organized by the SIMATIC NET SOFTNET-IE RNA software.

The SIMATIC NET SOFTNET-IE RNA software package is required on each redundantly connected PC station.

You can find additional information on this in the section "How to configure the redundant terminal bus on the basis of the Parallel Redundancy Protocol (Page 107)".

The following diagram illustrates a sample configuration based on the SIMATIC NET SOFTNET-IE RNA software:



### Configuration limits for the operator station

You can find information about this in the documentation *Process Control System PCS 7; Licenses and Configuration Limits*.

### Redundant, fault-tolerant terminal bus with SIMATIC NET SOFTNET-IE RNA

All protocols among the redundantly connected components are automatically duplicated, sent and distributed in the mutually redundant networks. The receiver uses the first incoming frame with the same information from the redundant networks.

#### Advantages:

- Easy administration
- A fault on one bus has no effect on the redundant bus

### Components

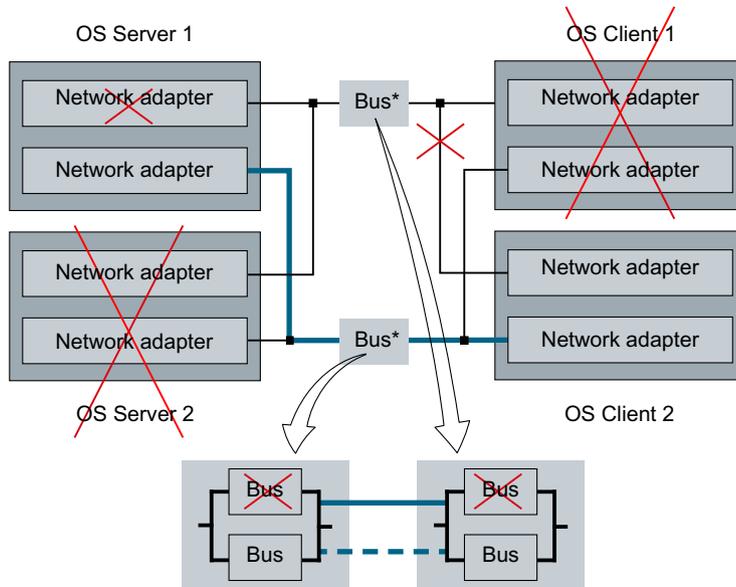
SCALANCE series switches are used to connect the components. Recommended switches that support the Parallel Redundancy Protocol may be found in the *Process Control System PCS 7; Released modules* documentation.

### Encrypted communication

"Encrypted communication" is not approved for stations with SIMATIC NET SOFTNET-IE RNA.

### Availability - redundant fault-tolerant terminal bus

The entire transmission route can be configured redundantly. A transmission route remains operational for communication on the terminal bus if any of the network components fails.



### Connecting non-redundant networks and components

An integrated solution of network components and protection devices can be implemented for a substation or process application using PRP-compatible SCALANCE X products. Connect components having only one network connection to the redundant, fault-tolerant terminal bus using the SCALANCE X204RNA . Select this connection for infrastructure components, for example:

- Central plant clock (e.g. SICLOCK TC400)
- Domain controllers (DCs), DNS, WINS, DHCP, WSUS
- WLAN access point
- File server

#### Requirements

- A maximum of 2 non-redundant networks and components with only one network connection for each SCALANCE X204RNA
- Two separate, redundant terminal bus networks
- Maximum distance to network node (component/switch):
  - Standard Ethernet cable up to 10m
  - IE FastConnect cable up to 100m

#### Recommendation for use

The PRP protocol requires the transmission of additional protocol information. The transmission rate of 100 Mbps is not fully reached when PRP is used.

*Recommendation:*

Stations that transport a high volume of data over the network should always be connected directly to the redundant rings using two network adapters and the "SIMATIC NET SOFTNET-IE RNA" software. This recommendation applies to the following PC stations in PCS 7:

- Process Historian
- BATCH server
- OpenPCS 7 station

Do not connect these PC stations via SCALANCE X204RNA.

### Common bus system for terminal bus and plant bus

As of PCS 7 V8.0 SP1, you can operate redundant, separate bus systems as a common terminal bus and plant bus. Configure each redundant bus system as described in the following sections:

- Section "How to configure the redundant terminal bus on the basis of the Parallel Redundancy Protocol (Page 107)"
- Section "How to configure a fault-tolerant plant bus (Page 112)"

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**Note****Using VLAN**

You can use a Virtual Local Area Network (VLAN) to divide a physical bus system into logical subnets (e.g. terminal bus and plant bus).

You can find additional information on this on the Internet: <http://support.automation.siemens.com> at Entry ID: 66807297 (<http://support.automation.siemens.com/WW/view/en/66807297>).

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### Additional information

- Online help for "SIMATIC NET SOFTNET-IE RNA" software
- Section "How to configure the redundant terminal bus on the basis of the Parallel Redundancy Protocol (Page 107)"
- You can find information on the available operating systems in the *PCS 7 Readme* file

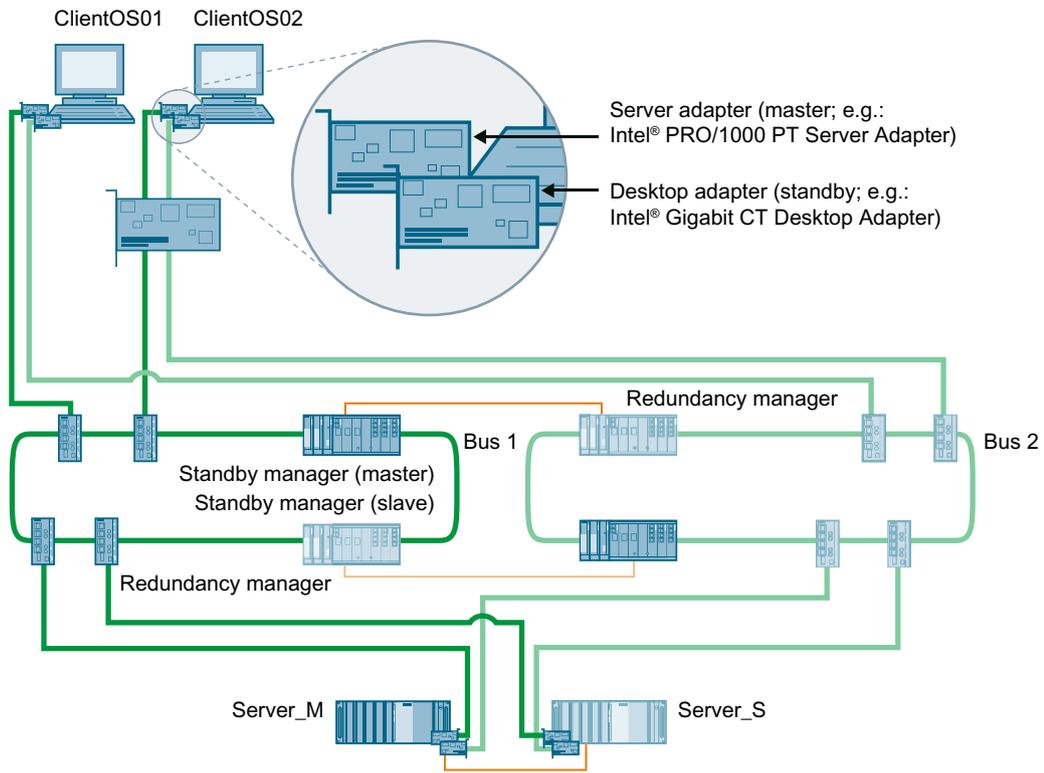
You can find additional information on this on the Internet <http://www.siemens.com/pcs7-documentation> (<http://www.siemens.com/pcs7-documentation>):

- Operating Instructions *SIMATIC NET; Industrial Ethernet; "SCALANCE X204RNA, SCALANCE X204RNA EEC*
- Operating instructions *SIMATIC NET; PG/PC - Industrial Ethernet; SOFTNET-IE RNA V8.2*

#### 3.3.3.5 Redundant, fault-tolerant terminal bus based on the INTEL TEAM mode

The following section describes the basic configuration of a redundant, fault-tolerant terminal bus using network adapters that operate in "INTEL Team mode".

The following figure shows this configuration.



**Note**

**Redundant linking of network segments**

The redundant linking of two network segments is only possible when the linking switches are capable of acting as standby manager.

Example:

- Linking with SCALANCE X414-3E
- For Gigabit Ethernet: Linking with SCALANCE X408-2

**Redundant, fault-tolerant terminal bus with redundant linking of network segments (rings)**

One pair of redundancy-capable network adapters is used for each PC station in each **server** to be connected to the terminal bus (for example, OS server, BATCH server, domain controller); see section "Connecting PC stations to the terminal bus (Page 51)". Team-capable network adapters are required for this configuration. They work in "INTEL Team mode" with only one logical network address. Each network adapter is connected to one of the redundant terminal bus rings (bus1/bus2). The link between the redundant network segments (rings) is implemented using two switches in each network.

## Components

The use of switches from the SCALANCE series is recommended. Modules for optical and electrical connection are available for these switches.

## Configuration of the switches

For redundant linking of networks, configure one SCALANCE switch as the standby master and one as the standby slave within a network segment. A redundancy manager (RM) must be configured in each network segment to enable ring redundancy. Switches and data links (network cable) connect the redundant networks. The switches configured in this way exchange data frames with one other and synchronize their operating status (standby master/standby slave).

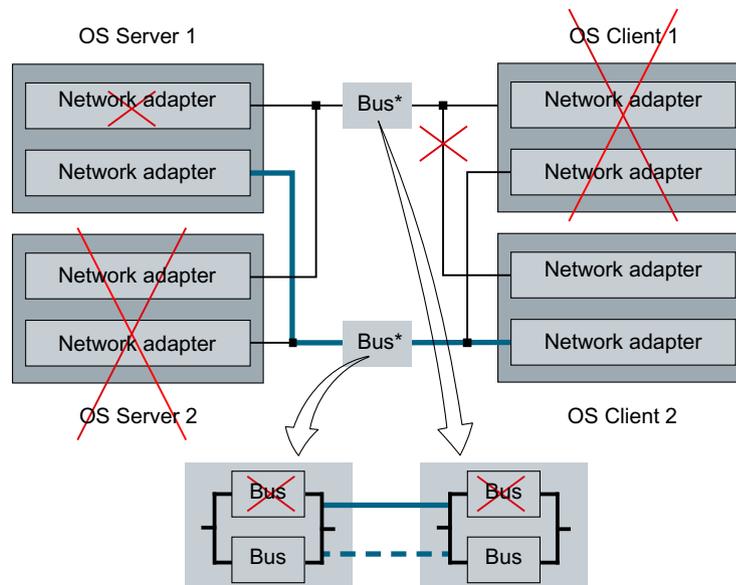
You will find details of how to configure switches in the documentation for *Industrial Ethernet Switches SCALANCE X* under the following topics:

- Configuration using Web-Based Management and Command Line Interface
- Configuration and diagnostics via SNMP

## Availability - redundant terminal bus

The entire transmission route can be configured redundantly. A transmission route remains operational via a terminal bus if any of the network components fails.

In process mode, one switch automatically takes over the standby master function for linking the networks. In error-free status, the data link to the other network is active only for the active standby master. If this data link fails (for example, due to a defective cable), the standby slave activates its data link.



**Additional information**

- Section "How to configure the redundant terminal bus on the basis of the INTEL TEAM mode (Page 108)"
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-400*

**3.3.4 Solutions for the plant bus**

**3.3.4.1 Connecting PC stations to the plant bus**

**Network adapters for connection to the fault-tolerant plant bus**

Suitable network adapters are required in the PC station to establish the connection to the communication partners in the plant.

Number of communication connections to communication partners (automation systems or servers) per PC station	Network adapter
<ul style="list-style-type: none"> <li>• Maximum of 8 communication partners</li> <li>• Fault-tolerant automation systems with CPUs (firmware version as of V6.0)</li> </ul>	Standard communication modules
<ul style="list-style-type: none"> <li>• up to 64 communications partners (including redundant systems)</li> <li>• Fault-tolerant automation systems with CPUs (firmware versions earlier than V6.0)</li> </ul>	Communications processors (CP 16xx) with software S7-16xx

**Network adapter for connection to the redundant, fault-tolerant plant bus**

You need communication modules with an integrated processor for connection to the redundant, fault-tolerant plant bus.

AS 41xH: For redundant communication with redundant automation systems, the licensed S7-REDCONNECT software is required.

Application	Network adapter
Connection of up to 64 communication partners (including redundant systems) per operator station	<ul style="list-style-type: none"> <li>• 2x CP 1623 with S7-1623 software</li> <li>• 2x CP 1613 A2 with S7-1613 software</li> </ul>

## License key for AS communication

Depending on the network adapters used, you need a license key for PC stations with communication to the AS:

Network adapter	License key
Standard Ethernet network adapter	BCE
Standard Ethernet network adapter with fault-tolerant connections	From product: SOFTNET-IE S7 REDCONNECT VM
When using SIMATIC NET CP (e.g. CP 1623)	Industrial Ethernet
When using SIMATIC NET CP (e.g. CP 1623) with fault-tolerant connections.	From product: HARDNET-IE S7 REDCONNECT

## Additional information

- You can find approved network adapters in the Catalog Overview *Process Control System PCS 7; Released Modules*
- Documentation *Process Control System PCS 7; PCS 7 Readme*

### 3.3.4.2 Fault-tolerant plant bus

The plant bus connects automation systems to servers (OS server, Route Control server). The connection to a fault-tolerant plant bus is implemented with Ethernet communications processors (CPs) that are installed in each subsystem of the automation system and in the servers.

fault-tolerant plant bus can be set up in a ring structure with network components of SIMATIC NET. The network components ensure unrestricted operation of the plant bus. For example, a broken cable in the connection between the modules is tolerated and communication remains uninterrupted.

If the plant bus is disrupted, no process data are transferred between the servers and the automation systems or between the automation systems themselves.

## Fault-tolerant communication solutions

The following communication solutions are offered to prevent a possible failure:

- Ring structure in an electrical network.  
The connection to the switches is electrical.
- Ring structure in an optical network with switches and FO cable.  
The connection to the switches is electrical or optical.
- Ring structure in a combined network with optical and electrical switches and a FO cable.  
The connection to the switches is electrical.
- Ring structures as optical, electrical and combined networks with transmission rates up to 1 Gbps based on modular SCALANCE X switches

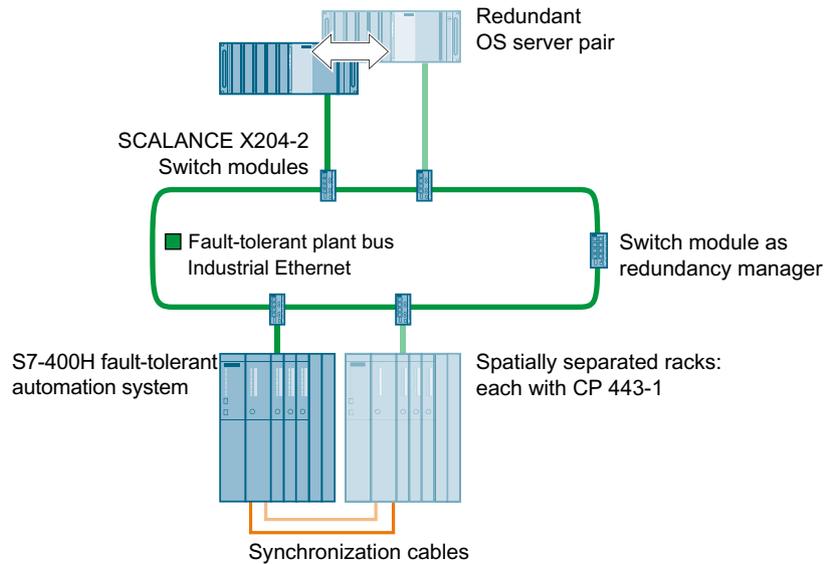
The use of switches from the SCALANCE series is recommended. Modules for optical and electrical connection are available for these switches.

**Configuration - ring structure**

The following figure represents a fault-tolerant plant bus in a ring structure with switches.

The following automation systems can be used:

- AS 41xH

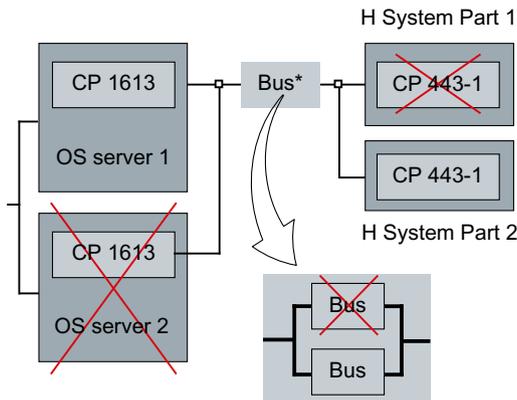


**Availability - ring structure**

In this system, one CP 443-1 may fail in each subsystem of the AS without this affecting the complete system.

The plant bus (identified by an \* in the following figure) is equipped with switches for fault-tolerant operation. Each OS server is wired to two switches. The bus can be separated at any location. The overall system remains functional even if a switch fails. The redundant OS partner server then communicates via the functional switch. The same scenario applies to the switches that each have a CP of a subsystem of the H system connected.

To guard against the failure of all switches, however, the redundant double ring described in the following section can be used.



### Additional information

- Section "How to configure a fault-tolerant plant bus (Page 112)"
- Manual *SIMATIC Net Twisted Pair and Fiber-Optic Networks*
- Manual *SIMATIC; Communication with SIMATIC*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-400*

### 3.3.4.3 Redundant, fault-tolerant plant bus

#### Functionality

The plant bus connects automation systems to servers (OS server, Route Control server). The connection to a redundant, fault-tolerant plant bus is implemented with Ethernet communication processors (CPs) that are installed in each subsystem of the automation system and in the servers.

A redundant, fault-tolerant plant bus is set up using two identical, separate plant bus rings (double ring). The network components ensure unrestricted operation of the plant bus. If one of the plant buses fails, communication is maintained over the second plant bus.

#### Redundant communication solutions

The following communication solutions are offered to prevent a possible failure:

- Redundant electrical or optical network with switches set up as Industrial Ethernet
- Combined redundant network with switches, FO cables and electrical connection
- Ring structures can be set up based on modular switches from the SCALANCE series. (Can be implemented as optical, electrical and combined networks)

The use of switches from the SCALANCE series is recommended. Modules for optical and electrical connection are available for these switches. You can find additional information on the switches used with PCS 7 in the "Network components (Page 46)" section.

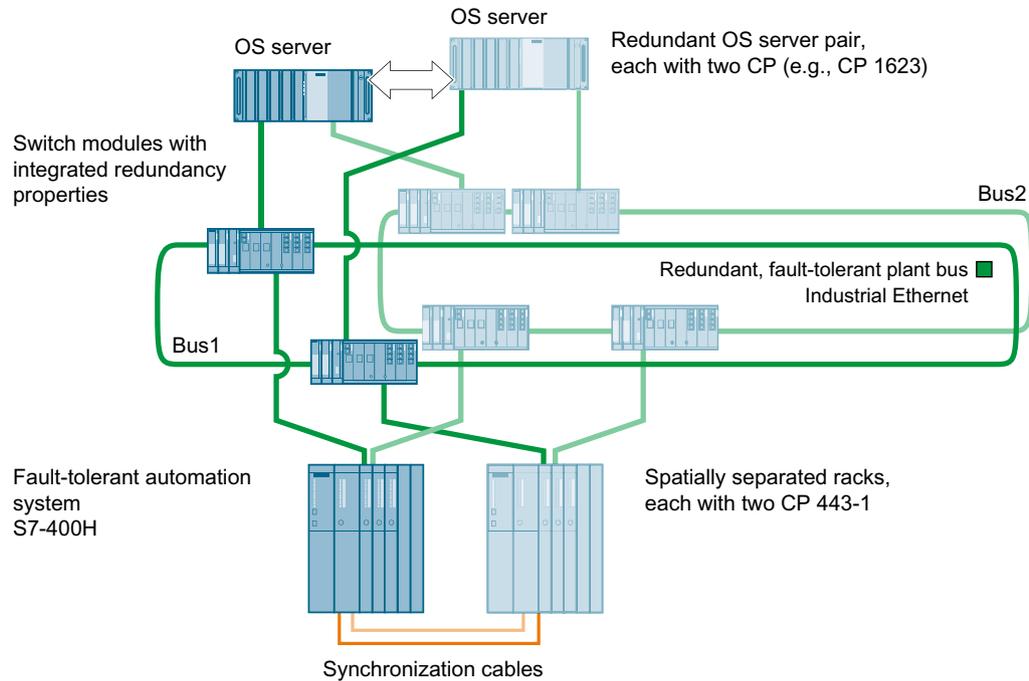
### Configuration - redundant, fault-tolerant plant bus

The figure below shows the basic configuration of the redundant, fault-tolerant plant bus.

- Bus1 shows the functionally correct configuration (shared switches for AS and OS).
- Bus2 shows the typical configuration in PCS 7 plants (separate switches for AS and OS).

#### Note

Check the redundancy behavior of the individual components during commissioning.



#### Note

##### Address areas and IP addresses of the components on the plant bus

Always assign IP addresses in different IP address ranges to the network adapters (separate address range for Bus1 and separate address range for Bus2).

Example:

- Ring 1:
  - IP address range: 192.168.1.0 - 192.168.1.255
  - Subnet mask: 255.255.255.0
- Ring 2:
  - IP address range: 192.168.2.0 - 192.168.2.255
  - Subnet mask: 255.255.255.0

**AS 41xH on redundant, fault-tolerant plant bus**

You may connect one redundant AS per CPU without redundant communication modules. Connection possibilities:

- Single connection of an AS 41xH with one CP each per CPU. Availability is then reduced accordingly.
- Single connection of an AS 41xH via an internal Ethernet interface of the CPU. Availability is then reduced accordingly.
- Redundant connection of an AS 410H via internal Ethernet interfaces of the CPU

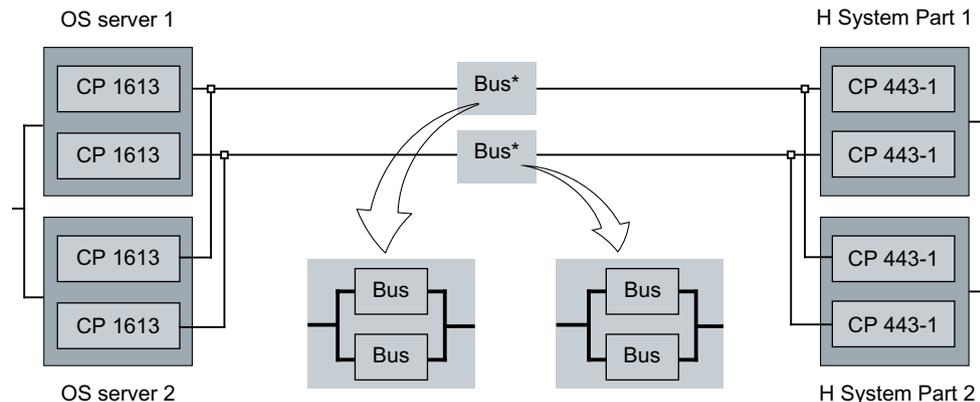
**AS 410 on redundant, fault-tolerant plant bus**

An AS 410 can be connected to the redundant, fault-tolerant plant bus without communication modules. You can find additional information on this in the section "AS 410H on redundant, fault-tolerant plant bus (Page 66)".

**Availability - redundant, fault-tolerant plant bus**

The block diagram for a redundant, fault-tolerant plant bus with two CPs each in both OS servers and additional switches appears as follows:

In this system, one CP 16x3 can fail in each OS server or one CP 443-1 in each subsystem of the AS without this affecting the complete system. The plant bus (bus) is configured redundantly and with redundant switches in each case. As a result, a failure of the bus component and all components involved (switches) is covered.

**Additional information**

- Section "Connecting PC stations to the plant bus (Page 60)"
- Section "Media Redundancy Protocol (Page 49)"
- Section "How to configure a fault-tolerant plant bus (Page 112)"
- Documentation *PCS 7 Released Modules*
- Manual *SIMATIC Net Twisted Pair and Fiber-Optic Networks*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-400*
- Manual *SIMATIC Communication with SIMATIC*

### 3.3.4.4 AS 410H on redundant, fault-tolerant plant bus

#### Functionality

The plant bus connects automation systems to servers (OS server, Route Control server).

An automation system with a SIMATIC S7 410H-type CPU can be connected to a redundant, fault-tolerant plant bus.

In the event a plant bus fails, the two Ethernet connections of the CPU allow the plant bus to operate without restrictions. If one of the plant buses fails, communication is maintained over the second plant bus.

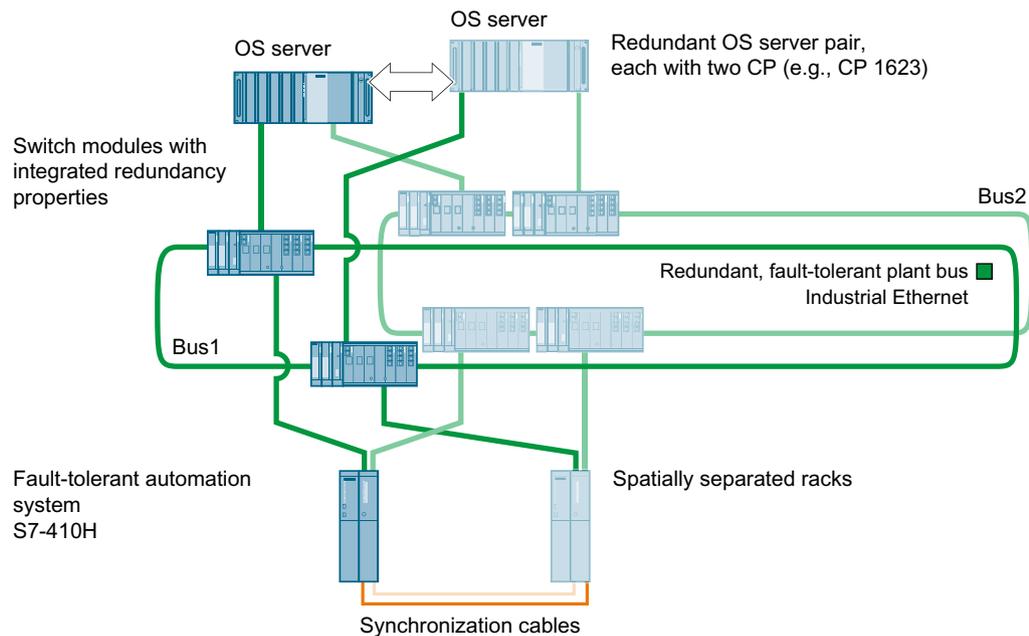
#### Configuration - AS 410H on redundant, fault-tolerant plant bus

The figure below shows the basic structure of the redundant, fault-tolerant plant bus with an AS 410H. The AS 410H also has 2 Ethernet connections and can be connected to the redundant, fault-tolerant plant bus.

- Bus1 shows the functionally correct configuration (shared switches for AS and OS).
- Bus2 shows the typical configuration in PCS 7 plants (separate switches for AS and OS).

#### Note

Check the redundancy behavior of the individual components during commissioning.



**Note****Address areas and IP addresses of the components on the plant bus**

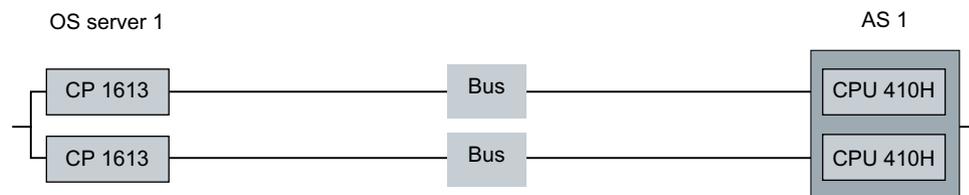
Always assign IP addresses in different IP address ranges to the network adapters (separate address range for Bus1 and separate address range for Bus2).

Example:

- Ring 1:
  - IP address range: 192.168.1.0 - 192.168.1.255
  - Subnet mask: 255.255.255.0
- Ring 2:
  - IP address range: 192.168.2.0 - 192.168.2.255
  - Subnet mask: 255.255.255.0

**Availability - redundant, fault-tolerant plant bus**

The block diagram for a redundant, fault-tolerant plant bus with a CPU 410H and two CPs in the OS server is shown below:



In this system, one CP 16x3 or one subsystem of the AS can fail in the OS server without affecting the overall system. The plant bus (bus) is configured redundantly and with redundant switches in each case. As a result, a failure of the bus component and all components involved (switches) is covered.

**Additional information**

- Manual *SIMATIC; PCS 7 Process Control System; CPU 410-5H Process Automation*
- Section "How to add a SIMATIC H station to your project (Page 100)"
- Manual *SIMATIC; Automation System S7-400H; Fault-tolerant Systems*

### 3.3.5 Solutions for the fieldbus

#### 3.3.5.1 Redundant PROFIBUS DP

##### Functionality

The field bus is used for data exchange between the automation system (AS) and the distributed I/O. PROFIBUS DP (distributed peripheral)-- the field bus standard for manufacturing and process automation--is used. PROFIBUS DP includes the specifications for the following elements:

- Physical bus characteristics
- Access method
- User protocol
- User interface

PROFIBUS DP is suitable for fast, cyclic data exchange with field devices. It is used to connect distributed I/O, for example, ET 200M, with very fast response times.

It is often advantageous to connect several DP master systems to an automation system in order to increase the number of I/O components that can be connected. This also enables segments to be formed, allowing individual production areas to operate independent of one another.

##### Fault-tolerant communication solutions

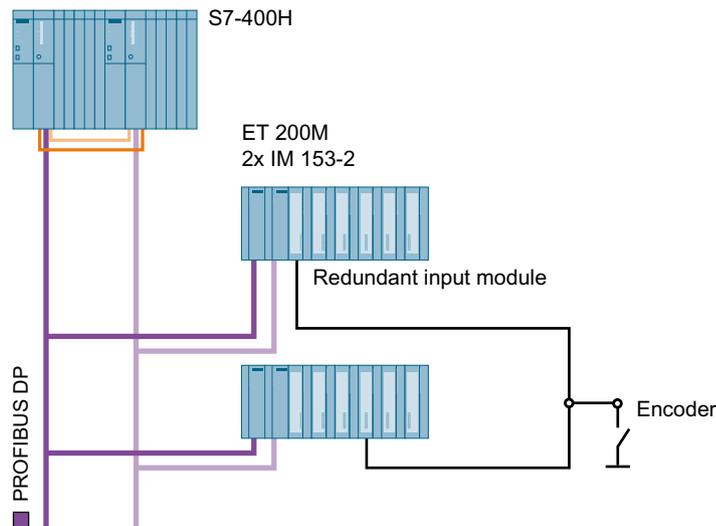
The following fault-tolerant communication solutions are offered for PROFIBUS DP:

- Redundant PROFIBUS DP as an electrical network
- Redundant PROFIBUS DP with OLMs (optical network)

##### Configuration

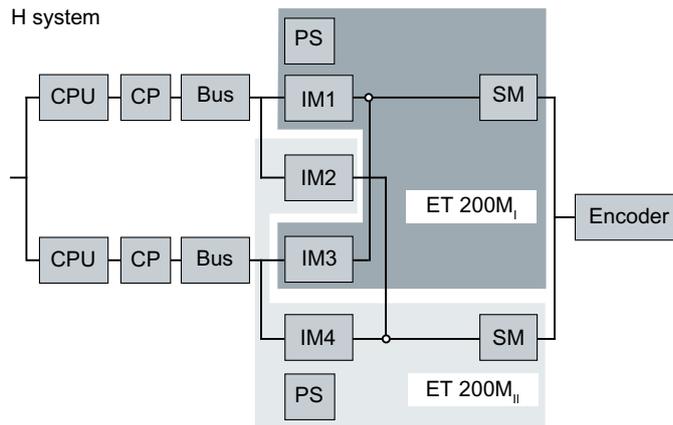
The S7-400H fault-tolerant automation system features a DP master interface on each CPU for connecting to PROFIBUS DP. The redundant PROFIBUS DP connects the redundant DP master to the redundant interface modules of the distributed I/O.

The following figure shows an example for connecting redundant distributed I/O based on ET 200M to a redundant PROFIBUS DP.



### Availability

If the active PROFIBUS DP fails, sensors and H system can communicate with each other over the redundant bus connection. The configuration shown in the following figure provides increased availability due to the redundant interfacing of the distributed I/O.



### Additional information

- Section "How to configure redundant PROFIBUS DP (Page 114)"
- Manual *SIMATIC Net PROFIBUS Networks*
- Manual *SIMATIC; Communication with SIMATIC*

### 3.3.5.2 Fault-tolerant fieldbus based on PROFINET

#### Functionality

The fieldbus is used for data communication between the automation system (AS) and the distributed I/O. PROFINET is a standard for manufacturing and process automation. The PROFINET-based fieldbus comprises the specifications for the following elements:

- Physical bus characteristics
- Access method
- User protocol
- User interface

PROFINET is suitable for fast, cyclic data communication with field devices.

#### Fault-tolerant communication solutions

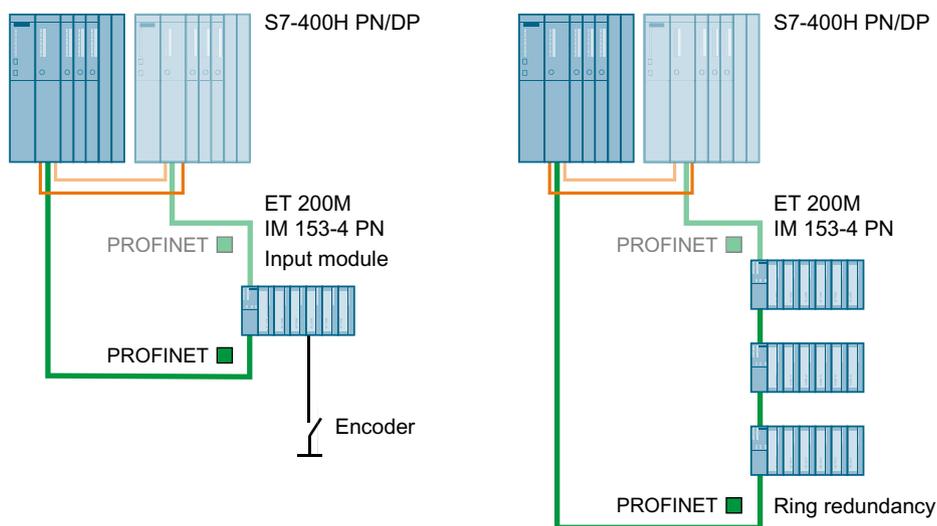
The following fault-tolerant communication solutions are offered for the PROFINET-based fieldbus:

- Electrically designed network
- Optically designed network

#### Configurations

The S7-400H fault-tolerant automation system features a PROFINET interface on each CPU 4xx-5H PN/DP for connecting to PROFINET. The fault-tolerant PROFINET connects the CPU with the distributed I/O.

The following figure shows the connection of I/O based on PROFINET.

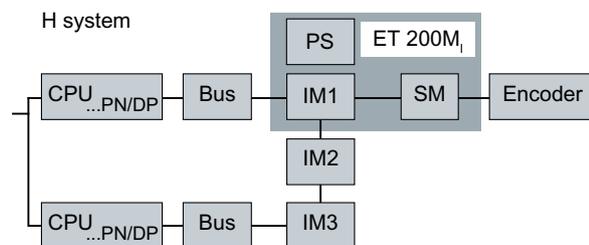


**Note****Fault-tolerant PROFINET**

It is absolutely necessary to operate the fieldbus ring with MRP (media redundancy protocol) when using rings with PROFINET.

**Availability**

If the communication connection via a CPU fails, the stations of the distributed I/O can communicate with the H system over the fault-tolerant bus line. The configuration shown in the following figure provides increased availability due to the interfacing of the distributed I/O.

**Note**

Changes to PROFINET modules only take effect when you load your hardware configuration with the updated STEP 7 version to the CPU, which is in "STOP" mode.

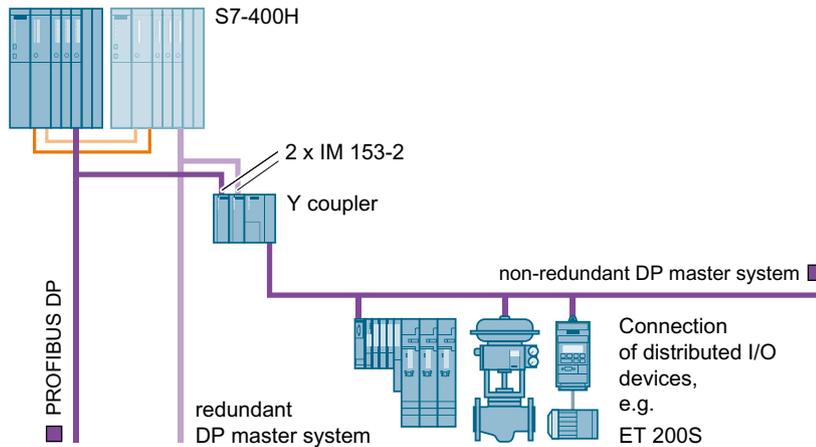
**Additional information**

- Section "How to configure a fault-tolerant fieldbus on the basis of PROFINET (Page 117)"
- Manual *SIMATIC NET; PROFINET Networks*
- Manual *SIMATIC; Communication with SIMATIC*
- Manual *SIMATIC STEP 7; Modifying the System during Operation via CiR*

**3.3.5.3 Gateway between redundant and non-redundant PROFIBUS DP****Y Link**

The Y-Link consists of two IM 153-2 interface modules and a Y coupler that are interconnected through the corresponding bus modules (BM IM/IM and BM Y coupler).

### Configuration



### Functionality

The Y-Link creates a gateway from the redundant DP master system of an S7-400H to a non-redundant DP master system. This enables devices with only one PROFIBUS DP interface to be connected to a redundant DP master system as switched I/O.

DPV1 slaves can be connected downstream from the Y-Link in addition to the standard PROFIBUS DP slaves.

Y-Link with integrated repeater can forward diagnostic requests from the corresponding function modules or input/output modules to the CPU.

### Additional information

- Section "How to configure the Y Link (Page 136)"
- Manual *DP/PA Link and Y Link Bus Couplings*
- Product overview *Process Control System PCS 7; Released Modules*

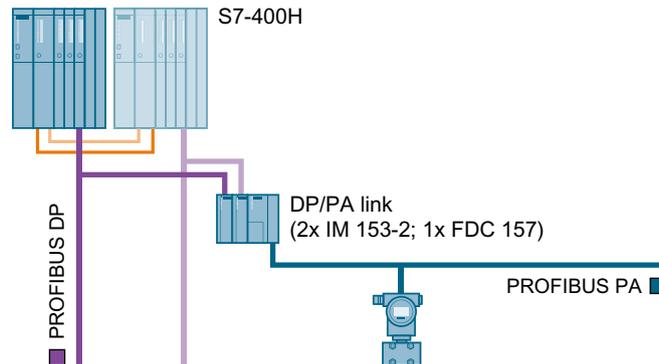
#### 3.3.5.4 Connection of PROFIBUS PA to PROFIBUS DP

##### DP/PA Link

The DP/PA Link allows a connection between PROFIBUS DP and PROFIBUS PA. DP/PA link includes the following modules, which are interconnected via the backplane bus:

- Interface module IM 153-2
- one or more FDC 157 DP/PA couplers

## Configuration



## Functionality

The DP/PA Coupler is a transceiver that interconnects PROFIBUS DP and PROFIBUS PA and decouples the various transmission rates. It is a slave on the PROFIBUS DP and a master on the PROFIBUS PA. Seen from the automation system, the DP/PA Link is a modular slave. The individual modules of this slave are the field devices that are connected to the lower-level PROFIBUS PA lines.

The PA devices connected to the PROFIBUS PA are assembled at a PROFIBUS address by DP/PA Link.

The DP/PA link can be connected directly to the PROFIBUS DP interface of programmable controllers (S7 400) for the coupling between PROFIBUS DP and PROFIBUS PA.

## Versions

You can connect a PROFIBUS PA to the PROFIBUS DP. The following variants can be realized:

- Connection to a singular PROFIBUS DP
  - Connection via DP/PA Link (1 x interface module, 1 x DP/PA coupler)
  - Connection via DP/PA coupler (45.45 Kbps on PROFIBUS DP)
  - Connecting a redundant PROFIBUS PA:  
You can find additional information on this in the section "Fault-tolerant PROFIBUS PA (Page 74)".
- Connection to a redundant PROFIBUS DP
  - Connection of a singular PROFIBUS PA via DP/PA Link with redundant interconnection (2 x interface module and 1 x DP/PA coupler)
  - Connecting a redundant PROFIBUS PA:  
You can find additional information on this in the section "Fault-tolerant PROFIBUS PA (Page 74)".

### Physical bus characteristics

- The application protocols for PROFIBUS DP and PROFIBUS PA are defined according to IEC 61158-2 and are identical for these two fieldbus variants.
  - You can set the transmission speed on the PROFIBUS DP. The maximum transmission speed with the Y-link is 12 Mbps.
  - The transmission speed on the PROFIBUS PA is 31.25 Kbps.
- If the DP/PA coupler is connected directly on PROFIBUS DP, the transfer rate is set to 45.45 Kbps. The DP/PA coupler can be operated with SIMATIC S7 automation systems and all DP masters that support the transmission rate of 45.45 Kbps.
- Depending on the power consumption of the PA devices, up to 31 PA devices can be connected to the PROFIBUS PA.

### Use in hazardous areas

- The intrinsically safe PROFIBUS DP is specified for the type of protection EEx(ib).
- The following components can be used in operating environments of the Ex zone:
  - DP/PA link in Ex version, up to Ex Zone 2
  - DP/PA link or FDC 157-0 DP/PA coupler in a housing that meets at least degree of protection IP54; up to Ex Zone 2
  - DP/PA coupler Ex [i] cannot be used for redundant configuration (coupler redundancy, ring); up to Ex Zone 1
- If you use a SIMATIC AFDiS as a field barrier between the DP/PA link or DP/PA coupler and the field devices, you can connect the field devices in hazardous areas of Zone 0 or Zone 1. The outputs of the SIMATIC AFDiS fulfill the requirements for types of protection EEx(ia) and EEx(ib).
- The number of devices is limited by the current.

### Additional information

- Section "Configuring DP/PA Link (Page 138)"
- Section "Fault-tolerant PROFIBUS PA (Page 74)"
- Section "How to configure the redundant PROFIBUS PA (Page 123)"
- Manual *DP/ PA Link and Y Link Bus Couplings*

#### 3.3.5.5 Fault-tolerant PROFIBUS PA

### Functionality

PROFIBUS PA allows the connection of PA devices. A redundant PROFIBUS PA is connected to FDC 157-0 redundant DP/PA couplers. If the communication path of the PROFIBUS PA fails, the communication path is preserved as far as the spur line to the field devices.

## Fault-tolerant communication solutions

The following communication solutions are offered to prevent a possible failure:

- Ring redundancy with the AFD (Active Field Distributor)
- Coupler redundancy with the AFS (Active Field Splitter)

The DP/PA coupler can be used stand-alone or in the DP/PA-Link .

---

### Note

#### Mixed configurations

You can connect only one redundant DP/PA coupler pair per DP/PA-Link . In mixed configurations, you can operate up to 3 additional non-redundant DP/PA couplers. The coupler pair (FDC 157-0 DP/PA coupler) should be installed for redundant operation in the last two slots of the ET 200 station.

---

## Connecting the fault-tolerant PROFIBUS PA to PROFIBUS DP

You can connect a fault-tolerant PROFIBUS PA to the PROFIBUS DP. The following variants can be realized:

- Redundant connection to the redundant PROFIBUS DP
  - The redundant DP/PA-Link is the transition to the fault-tolerant PROFIBUS PA. (2 x interface module and 2 x DP/PA coupler)
- Connection to a single PROFIBUS DP PROFIBUS DP
  - A DP/PA-Link with redundant coupler pair is the transition to the fault-tolerant PROFIBUS PA. (1 x interface module and 2 x DP/PA coupler)
  - A coupler pair FDC 157 is the transition to the fault-tolerant PROFIBUS PA. (2 x DP/PA coupler directly to PROFIBUS DP)

We recommend the following configuration limits in PCS 7 when connecting PA devices using AFD or AFS :

- In the case of ring redundancy (fault-tolerant connection):
  - In the interest of increased availability, connect a maximum of 4 field devices (one field device per branch line) to an active field distributor AFD (maximum of 8 AFD to a redundant DP/PA coupler).
  - You can connect a total of 31 field devices.
- In the case of coupler redundancy:
  - 1 AFS connected to one redundant DP/PA coupler
  - Connect field devices via AFD (max. 8 AFD).
  - In the interest of increased availability, connect a maximum of 4 field devices (one field device per branch line) to an active field distributor AFD (maximum of 8 AFD to an AFS).

- You can connect a maximum of 31 field devices per PROFIBUS PA.
- The maximum power consumption of 1 A must not be exceeded. This figure includes all components connected to the PROFIBUS PA.

### Configuration

Examples for connections of field devices via AFD and AFS are shown in the following figures.

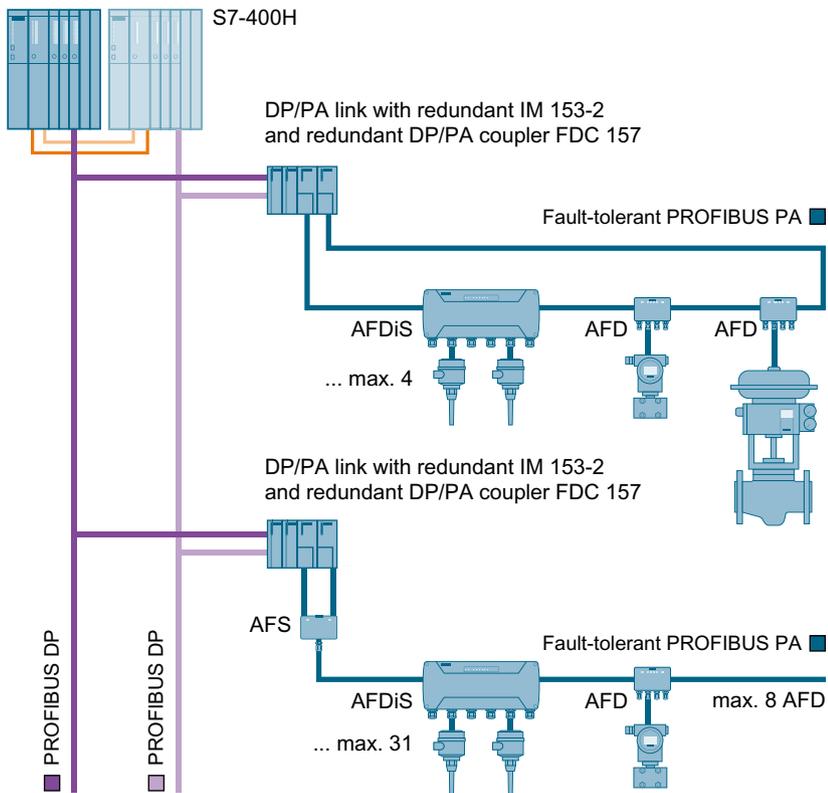


Figure 3-1 Redundant connection to the redundant PROFIBUS DP

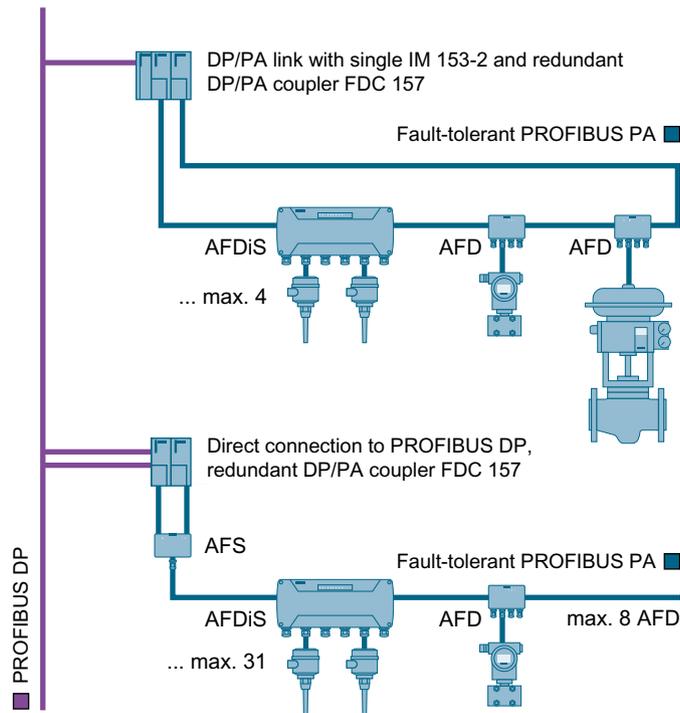


Figure 3-2 Connection to a single PROFIBUS DP

### Transmission rate

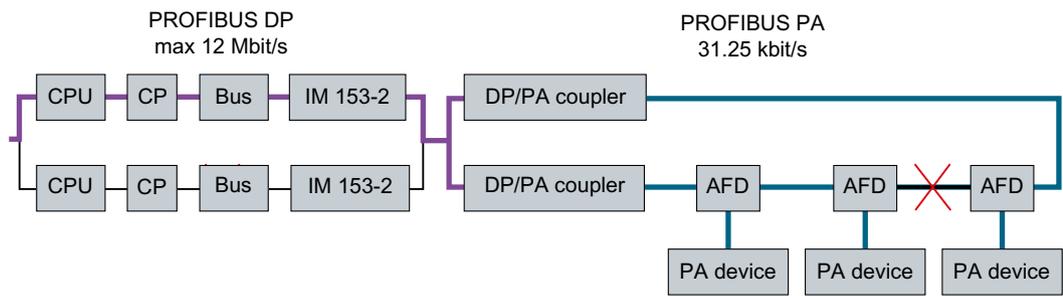
You have two interfacing options for the gateway between PROFIBUS DP and PROFIBUS PA. These result in different transmission rates on PROFIBUS DP.

- If you connect the DP/PA couplers via a DP/PA-Link, a transmission rate of up to 12 Mbps is possible on the PROFIBUS DP.
- If you connect the DP/PA couplers directly, the transmission rate on PROFIBUS DP is 45.45 Kbps.
- The transmission speed on the PROFIBUS PA is 31.25 Kbps.

### Availability - redundant interfacing

In a redundant system, we recommend that you implement the connection to the PROFIBUS DP redundantly (redundant IM 153-2).

If a PA bus cable, an IM 153-2 or a DP/PA coupler fails, the communication connection to the field devices is retained. The AFD or AFS automatically switches the connection to the available signal path.



**Additional information**

- Section " Connection of PROFIBUS PA to PROFIBUS DP (Page 72)"
- Section "How to configure redundant PROFIBUS PA (Page 123)"
- Operating Instructions *SIMATIC; DP/PA Coupler, DP/PA Link and Y Link Bus Couplers*

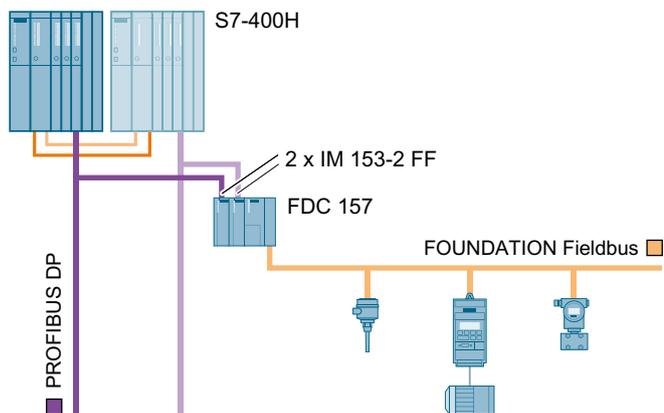
**3.3.5.6 Connecting the FOUNDATION Fieldbus to PROFIBUS DP**

**FF Link**

FF Link enables connection between PROFIBUS DP and FOUNDATION Fieldbus. FF Link includes the following modules, which are interconnected via the backplane bus:

- Interface module IM 153-2 FF
- Coupler module FDC 157

**Configuration**



## Functionality

FF Link connects PROFIBUS DP and FOUNDATION Fieldbus with one another and decouples various transmission rates. It is a slave on the PROFIBUS DP and master on the FOUNDATION Fieldbus. From the point of view of the automation system, the FF Link is a modular slave. The individual modules of this slave are the field devices that are connected to the lower-level FF segment.

The FF devices connected to the FF segment are assembled at one PROFIBUS address by the FF Link .

The FF Link can be connected directly to the PROFIBUS DP interface of data record gateway capable PLCs for the coupling between PROFIBUS DP and FOUNDATION Fieldbus .

## Versions

You can connect one FF segment to the PROFIBUS DP for each FF Link . The following variants can be realized:

- Connection to a singular PROFIBUS DP
  - Connection via FF Link (1 x IM 153-2 FF, 1 x FDC 157)
  - Connection of a redundant FF segment:  
You can find additional information on this in the "Configuring FF Link (Page 140)" section.
- Connection to a redundant PROFIBUS DP
  - Connection of a singular FOUNDATION Fieldbus via FF Link to a redundant interface (2 x IM 153-2 FF und 1 x FDC 157)
  - Connection of a redundant FF segment:  
You can find additional information on this in the section "Fault-tolerant FOUNDATION Fieldbus (Page 80)".

## Physical bus characteristics

- The application protocols for PROFIBUS DP and FOUNDATION Fieldbus are determined according to IEC 61158-2.
  - You can set the transmission speed on the PROFIBUS DP . The maximum transmission rate is 12 Mbps.
  - The transmission speed on the FOUNDATION Fieldbus is 31.25 Kbps. The transmission method is determined by IEC 61158-2 .
- Depending on the power consumption of the FF devices, up to 31 FF devices can be connected to the FOUNDATION Fieldbus .

## Use in hazardous areas

- The intrinsically safe PROFIBUS DP is specified for the type of protection EEx(ib) .
- When the FF Link is built into an enclosure conforming to at least an IP 54 degree of protection, the FF Link can be installed in operating environments up to Ex Zone 2.

- If you use a SIMATIC AFDiS as a field barrier between the FF Link and the field devices, you can connect the field devices in hazardous areas of zones 0 or 1. The outputs of the SIMATIC AFDiS fulfill the requirements for types of protection EEx(ia) and EEx(ib).
- The number of devices is limited by the current.

#### Additional information

- Documentation *SIMATIC; Process Control System PCS 7; PCS 7 Readme*
- Documentation *SIMATIC; PCS 7 process control system; PCS 7 - FOUNDATION Fieldbus*
- Operating instructions *SIMATIC; Bus links; FF Link bus link*

### 3.3.5.7 Fault-tolerant FOUNDATION Fieldbus

#### Functionality

PCS 7 enables the connection of field devices to the FOUNDATION Fieldbus H1 (referred to only as FOUNDATION Fieldbus or FF from this point). A fault-tolerant FOUNDATION Fieldbus is connected to the redundantly configured FF Link . If the transmission path fails, the communication path of the FOUNDATION Fieldbus is preserved as far as the spur line to the field devices.

#### Fault-tolerant communication solutions

The following communication solutions are offered to prevent a possible failure:

- Ring redundancy with the AFD (Active Field Distributor)
- Coupler redundancy with the AFS (Active Field Splitter)

#### Connection of the fault-tolerant FOUNDATION Fieldbus to PROFIBUS DP

You can connect a fault-tolerant FOUNDATION Fieldbus to the PROFIBUS DP . The following variants can be realized:

- Connection to a redundant PROFIBUS DP  
Connecting a fault-tolerant FOUNDATION Fieldbus via redundant FF Link  
(2x IM 153-2 FF, 2 x FDC 157)
- Connection to a singular PROFIBUS DP  
Connecting a fault-tolerant FOUNDATION Fieldbus via FF Link with redundant coupler pair  
(1x IM 153-2 FF, 2 x FDC 157)

We recommend the following configuration limits in PCS 7 when connecting FF devices using AFD or AFS :

- You can connect one FF segment to the FF Link .
- For the purpose of increasing availability when using ring redundancy (fault-tolerant connection), connect a maximum of 4 field devices (one field device per spur line) to an active field distributor AFD(maximum of FDC 157 8 AFD to a redundant coupler).

- Connect an active field splitter (AFS) to a redundant coupler in the case of coupler redundancy. Connect the field devices via AFD (max. 8 AFD). For the purpose of increasing availability, connect a maximum of 4 field devices per AFD.
- You can connect a maximum of 31 field devices per FF segment.
- The maximum power consumption of 1 A must not be exceeded. This figure includes all components connected to the FF segment.

## Configuration

Examples for connections of field devices via AFD and AFS are shown in the following figures.

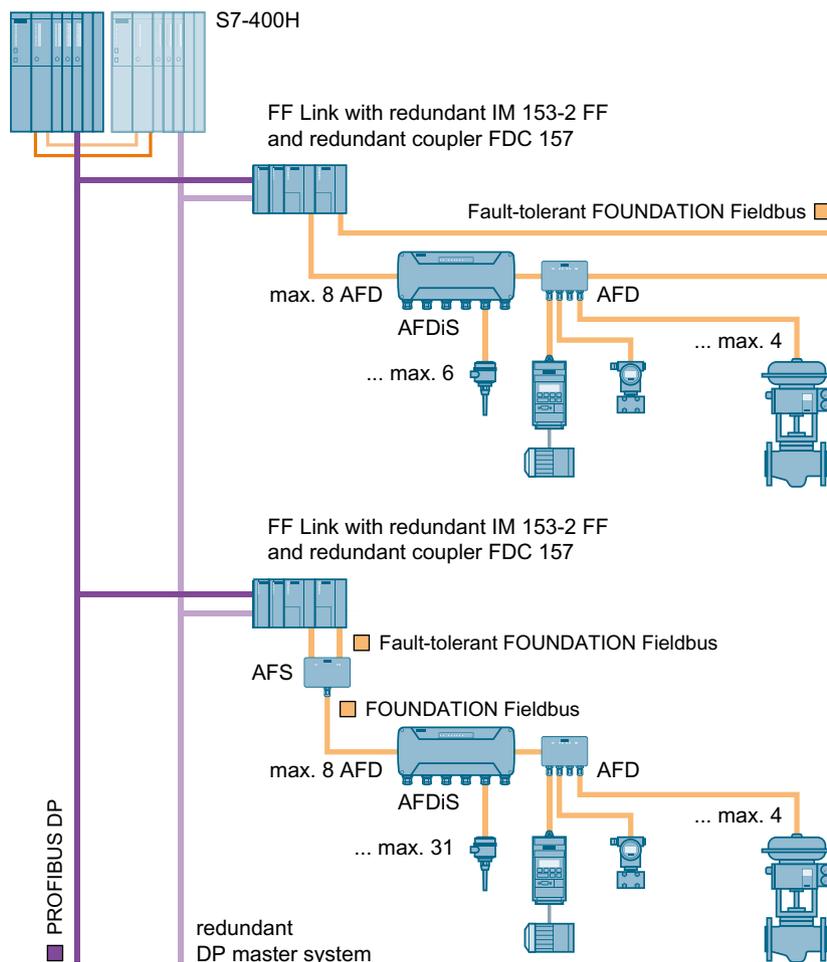


Figure 3-3 Connection to a redundant PROFIBUS DP

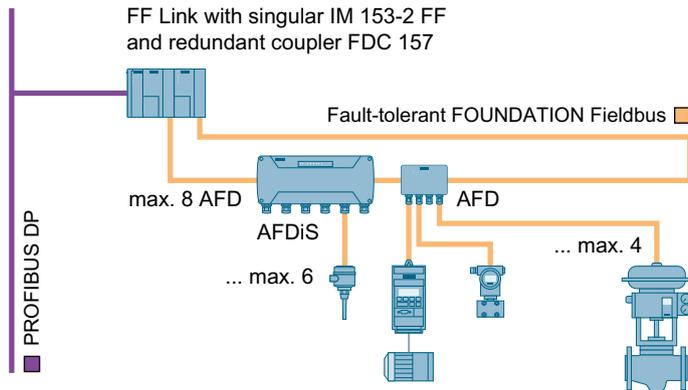


Figure 3-4 Connection to a singular PROFIBUS DP

### Transmission rate

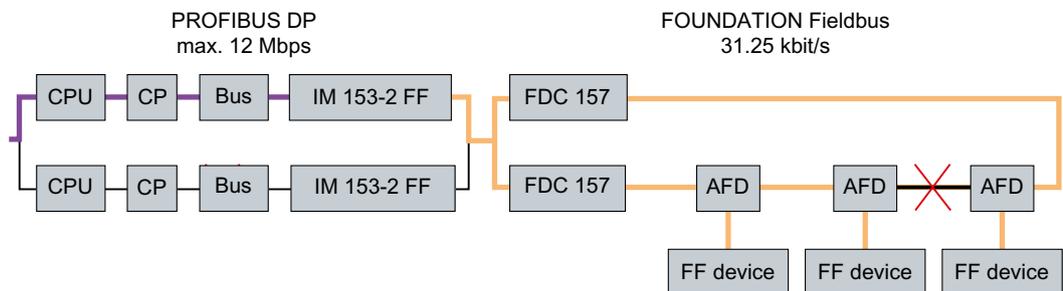
You have two interconnection options for the gateway between PROFIBUS DP and FOUNDATION Fieldbus . These result in different transmission rates on PROFIBUS DP .

- If you connect via an FF Link , a transmission rate of up to 12 Mbps is possible on PROFIBUS DP .
- The transmission speed on the FOUNDATION Fieldbus is 31.25 Kbps .

### Availability - fault-tolerant interfacing

In a redundant system, we recommend that you implement the interface to PROFIBUS DP redundantly (redundant IM 153-2 FF).

If an FF line, (IM 153-2 FF) interface module or (FDC 157) coupler fails, the communication connection to the field devices is maintained. The AFD or AFS automatically switches the connection to the available signal path.



### Additional information

- Section "Connecting the FOUNDATION Fieldbus to PROFIBUS DP (Page 78)"
- Section "Configuring FF Link (Page 140)"
- Documentation *SIMATIC; Process Control System PCS 7; PCS 7 Readme*

- Documentation *SIMATIC; PCS 7 process control system; PCS 7 - FOUNDATION Fieldbus*
- Operating instructions *SIMATIC; Bus links; FF Link bus link*

## **3.4 Solutions for integrating a PCS 7 system in a domain**

For additional information, please refer to the following documents:

- Function manual *Process Control System PCS 7; Time Synchronization*
- On the Internet pages of Customer Support in Whitepaper SIMATIC; Safety Concept PCS 7 and WinCC; Basic document (<http://support.automation.siemens.com/WW/view/en/26462131>)

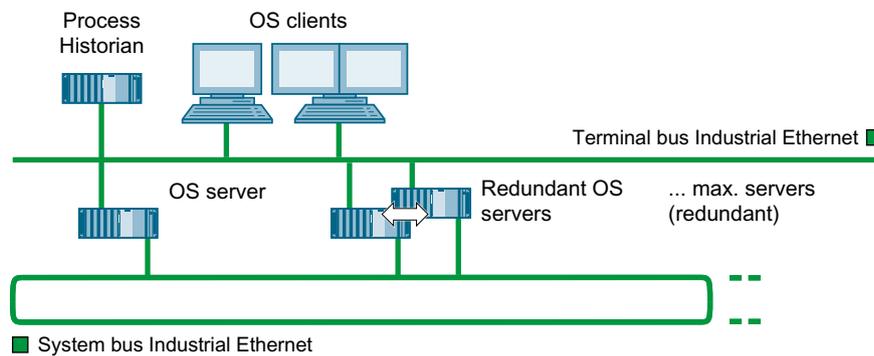
## 3.5 Solutions for OS servers

### Redundant OS servers

PCS 7 enables you to configure two OS servers redundantly for fault-tolerant operation. This ensures that you can monitor and control your process at all times. The solution represents the entry level into fault-tolerant process control systems.

### Configuration

The figure below shows an example of a configuration with redundant OS server and redundant central archive server.



### Functionality

Redundant OS servers monitor each other in runtime. If one OS partner server fails, the event is detected in time.

If one of the two OS server fails, the OS partner server takes over the process. The interface between OS clients and the automation system remains available.

The OS clients are automatically switched to the redundant OS partner server. This means that the OS clients always remain available for the control and monitoring of the process. During the failure period, the redundant OS partner server continues to archive all messages and process data in the WinCC project. Once the failed OS server comes back online, the contents of all the message, process value and user archives are automatically copied to the returning OS server. This copy process is referred to as redundancy synchronization. Redundancy synchronization fills the gaps in the various archives that result from failures.

During the failure period, the internal master/standby identification changes from the failed OS server to its OS partner server. The master identification remains with the OS partner server even when the failed OS server comes back online.

### Configuring the archives

Tag logging and alarm logging have to be configured functionally identical for redundant OS servers. Functionally identical configuration means the same archives, whereby extensions in the form of additional measuring points and archives are permitted.

### 3.5 Solutions for OS servers

OS partner servers (OS\_Stby) are configured in the SIMATIC Manager. Using the menu command **PLC > Download** synchronizes the functionality.

#### Redundant external archive server

If an external archive server of a server pair fails, the data is automatically synchronized on the return of the failed external archive server.

PCS 7 provides the following options for centralized collection of archive information for the process control system:

- **Process Historian**  
You can set up two Process Historians with redundancy functionality for fault-tolerant operation. The associated information server can be configured in such a way that it connects to the active Process Historian to execute tasks.
- **Central archive server**  
You can set up two central archive servers with redundancy functionality for fault-tolerant operation.

This server does not require a connection to the plant bus.

#### Redundant maintenance station

PCS 7 allows you to configure two maintenance servers with redundancy functionality for fault-tolerant operation.

#### Setting up a redundant OS server

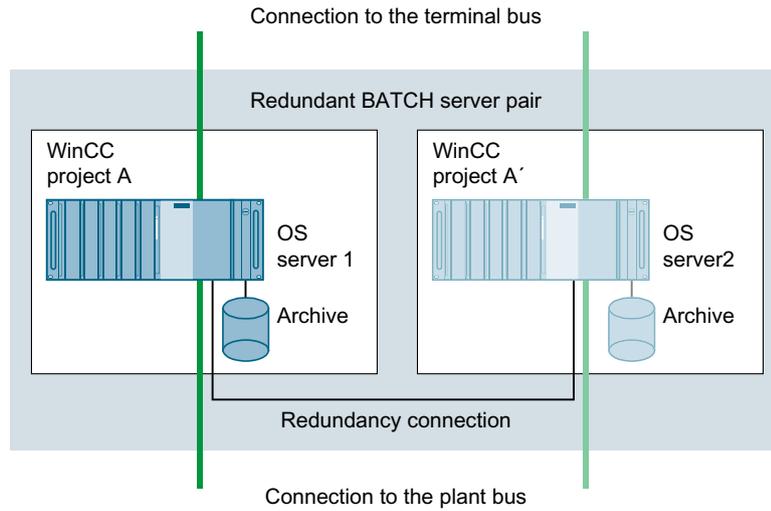
The following configuration shows the basic operating principle of redundant OS servers.

---

##### Note

You need to connect the redundant PC stations through a redundancy connection. This connection offers security against problematic behavior during communication between the OS servers.

---



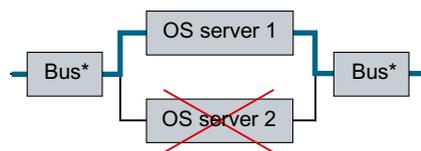
### Redundancy connection

You need the following components to make the redundancy connection, depending on the distance to be bridged:

Maximum distance	Required components	Connection
10 m	Null modem cable	Serial connection
100 m	<ul style="list-style-type: none"> <li>Crossover network cable</li> <li>Per server: A free network connection (see section "Network components (Page 46)")</li> </ul>	Ethernet connection
1000 m	Fiber-optic cable Per server: <ul style="list-style-type: none"> <li>A free network connection (see section "Network components (Page 46)")</li> <li>1 Ethernet cable</li> <li>1 media converter (e.g., SCALANCE X101-1)</li> </ul>	Ethernet connection

### Availability

The availability of the complete system is ensured even if one of the two OS servers fails because the two OS servers form an independent redundancy node.



---

**Note**

The buses marked with \* (terminal bus and plant bus) can be configured redundantly with optical or electronic switch modules.

---

**Additional information**

- Section "Network components (Page 46)"
- Section "How to configure an OS server and its redundant OS partner server (Page 143)"
- Online help for *WinCC*, *WinCC Redundancy*
- Documentation on the Process Historian

## 3.6 Solutions for OS clients

### 3.6.1 Additional OS clients

#### Additional OS clients

OS clients are PC stations that are used for control and monitoring of an automation process. They are connected to the OS servers through the terminal bus. The OS servers form the process connection to the automation system.

An OS client has its own WinCC project and visualizes the process data generated on an OS server.

If an OS client fails, this does not disrupt the overall process because the automation program in the CPU continues to control the process and the OS servers continue to process and archive the process data. However, the visualization of the process is lost and you can only influence the process through the OS servers. You should therefore protect against such failure by integrating additional OS clients.

By specifying a preferred server, you can distribute multiple OS clients between the redundant OS servers. The automation process can therefore be operated continuously, even during a failover from the active OS to its OS partner server.

#### Additional information

- Section " How to configure an OS client (Page 154) "
- Online help for *WinCC*

### 3.6.2 Permanent operability

#### Permanent operability

"Permanent operability" in a redundant environment is the unrestricted ability to influence the system at any time even when confronted with the failure of one of the redundant OS servers. It is the most important safety characteristic for plants with critical operations.

This function is important in all systems in which the ability to handle failure of an OS server in a redundant configuration is not enough and in which continuous control of a process must be maintained. In the event of an OS server failure, all OS clients connected to the failed server will temporarily lose their connection to the process while they switch over. In order to ensure that the OS clients can control and monitor the automation process continuously, the OS clients are distributed between the redundant OS servers with specification of a preferred OS server. The failure of some OS clients can therefore be tolerated because the other clients remain connected to the process.

### Preferred server

A "preferred server" is an OS server in the redundant OS server pair that the OS client connects to preferentially. A preferred server can be defined separately for each OS client in order to ensure permanent operability. The distribution of the OS clients between the OS servers distributes the loads and increases the performance of the system as a whole.

### Operating principle

If the active OS server fails, the process values on all of the connected OS clients are no longer updated and there is no operator control on these OS clients during the failover. Other OS clients that are connected in parallel to the redundant OS partner server are not affected by this. The plant operator can therefore change to these OS clients if needed.

Generally, the following applies: The OS clients always connect to the specified preferred server if it is available. If it is not available, the OS clients automatically connect to its redundant OS partner server. If you do not specify a preferred server for an OS client, it will connect to the OS server that has the master identification.

When the failed OS server comes online again, the OS client automatically reconnects to its preferred server. The master identification of the OS server does not change even when the failed OS server comes back online.

### Additional information

- Section "How to configure an OS client for permanent operability (Page 156)"
- Online help for *WinCC*

## 3.7 Solutions for SIMATIC BATCH

### Redundant BATCH servers

SIMATIC BATCH enables you to configure two BATCH servers redundantly for fault-tolerant operation. This ensures that you can monitor and control your batch process at all times.

### Functionality

Redundant BATCH servers monitor each other in runtime to detect the failure of a BATCH server as early as possible.

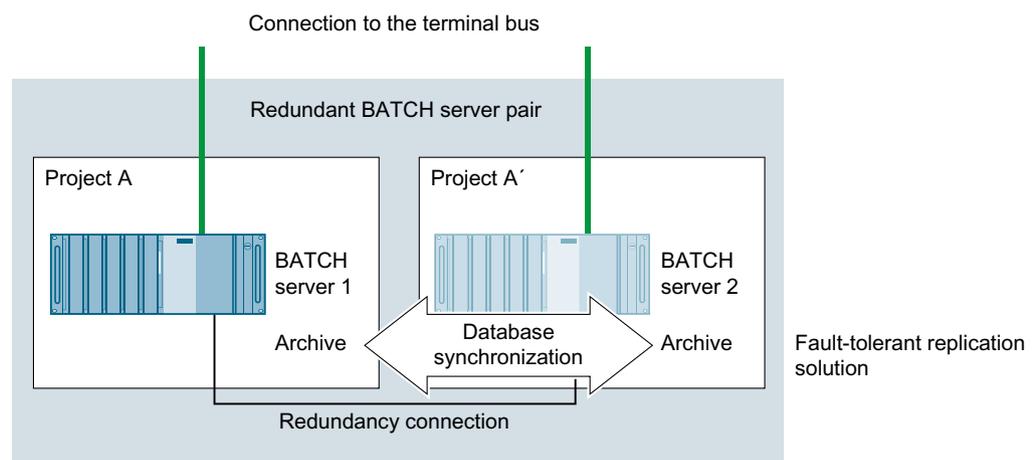
If one of the two BATCH servers fails, the process can be controlled over the second BATCH server after the failover.

- The interface for message processing between the active BATCH server and the OS server remains available.
- The BATCH clients automatically fail over to the functioning (active) BATCH server. After the failover, it is possible to control and monitor the process from all BATCH clients.

In SIMATIC BATCH, the consistency of the databases is achieved by data replication. In this solution, each of the BATCH servers of a server pair has its own database in which the batch data stored. The two databases are continuously synchronized.

### Setting up a redundant BATCH server

The following configuration shows the basic operating principle of redundant BATCH servers. The BATCH servers are also connected to the plant bus if SIMATIC BATCH is operated "AS-based".



### Redundancy connection

You need the following components to make the redundancy connection, depending on the distance to be bridged:

Maximum distance	Required components	Connection
100 m	<ul style="list-style-type: none"> <li>• Crossover network cable</li> <li>• Per server: A free network connection (see section "Network components (Page 46)")</li> </ul>	Ethernet connection
1000 m	Fiber-optic cable Per server: <ul style="list-style-type: none"> <li>• A free network connection (see section "Network components (Page 46)")</li> <li>• 1 Ethernet cable</li> <li>• 1 media converter (e.g., SCALANCE X101-1)</li> </ul>	Ethernet connection

**Note**

When a redundant server pair is used as an OS server and BATCH server, the redundancy connection must be configured via the Ethernet connection.

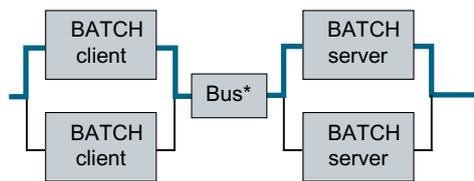
Serial linking of the BATCH server pair is not possible in PCS 7.

### Availability

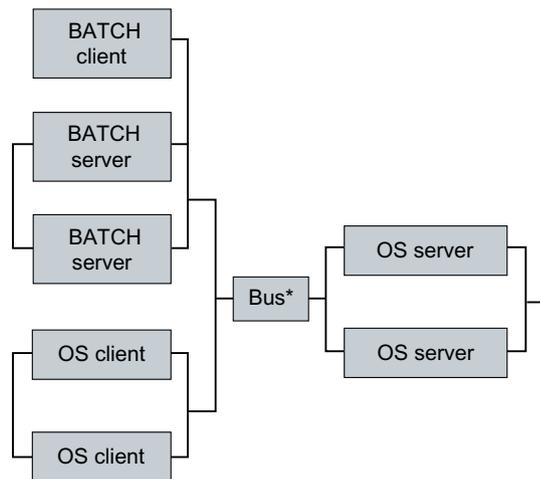
The following two block diagrams of fully operational systems illustrates the availability of the BATCH clients and BATCH servers. All BATCH components form an independent redundancy node since they are redundant. This ensures the independence of the subsystem.

**Note**

Only the BATCH components and the terminal bus are shown in the block diagrams. The terminal bus marked with \* can be configured redundantly with switch modules.



The communication between BATCH clients and BATCH servers is performed over the terminal bus.



The BATCH servers also communicate with OS servers over the terminal bus. The OS servers are connected to the automation system over the plant bus.

---

#### Note

##### SIMATIC BATCH in "AS-based" operating mode

The BATCH servers are also connected to the plant bus if SIMATIC BATCH is operated "AS-based". The redundant interface is implemented as on OS servers. You will find additional information on this topic in section "Solutions for OS servers (Page 85)".

---

#### Additional information

- PC station identified as faulty; see section "Solutions for OS servers (Page 85)"
- Section "How to configure a BATCH server and its redundant BATCH partner server (Page 161)"
- Section "How to configure a BATCH client (Page 163)"
- Manual and online help for *SIMATIC BATCH*

### 3.8 Solutions for Route Control server

#### Redundant Route Control servers

SIMATIC Route Control allows you to implement two Route Control servers with redundancy functionality for fault-tolerant operation. This ensures that you can monitor and control your route control at all times.

#### Functionality

The Route Control software automatically takes over the monitoring of the redundancy. The redundant Route Control servers monitor each other in runtime.

If the active Route Control servers fails, the process can be controlled via the second Route Control server following failover.

The Route Control clients automatically fail over to the functioning (active) Route Control server.

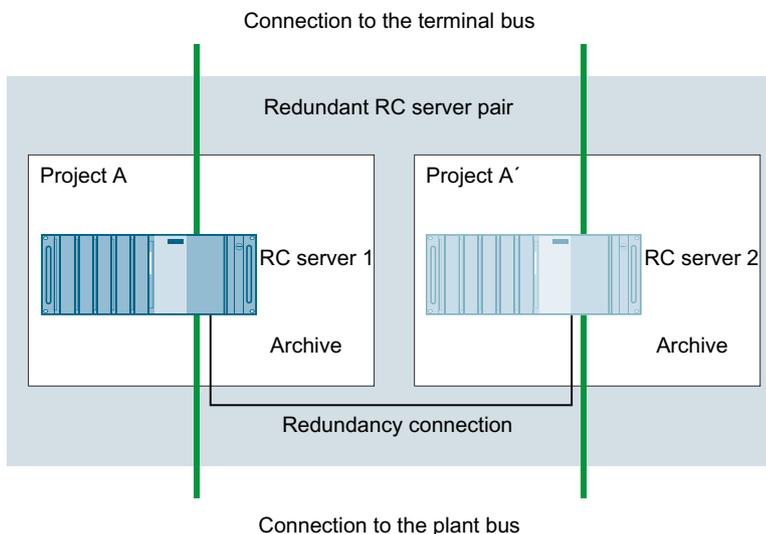
When the failed Route Control server resumes normal service, it retrieves the current process image from the automation system.

During the failure, the functioning Route Control server automatically receives the internal Master ID. If the active master server failed, the master ID is passed from the failed Route Control server to its Route Control partner server.

When the failed Route Control server becomes available again, it is given the standby ID. The master ID remains with the Route Control partner server.

#### Configuration of a redundant Route Control server

The following configuration shows the basic operating principle of redundant Route Control servers.



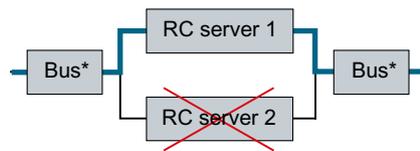
## Redundancy connection

You need the following components to make the redundancy connection, depending on the distance to be bridged:

Maximum distance	Required components	Connection
10 m	Null modem cable	Serial connection
100 m	<ul style="list-style-type: none"> <li>• Crossover network cable</li> <li>• Per server: A free network connection (see section "Network components (Page 46)")</li> </ul>	Ethernet connection
1000 m	Fiber-optic cable Per server: <ul style="list-style-type: none"> <li>• A free network connection (see section "Network components (Page 46)")</li> <li>• 1 Ethernet cable</li> <li>• 1 media converter (e.g., SCALANCE X101-1)</li> </ul>	Ethernet connection

## Availability

The availability of the complete system is also ensured even if one of the two Route Control servers fails because the two Route Control servers form an independent redundancy node.



### Note

The buses marked with \* (terminal bus and plant bus) can be configured redundantly with optical or electronic switch modules.

## Additional information

- PC station identified as faulty; see section "Solutions for OS servers (Page 85)"
- Section "How to configure a Route Control server and its redundant Route Control partner server (Page 169)"
- Manual *Process Control System PCS 7; SIMATIC Route Control*

## 3.9 Solutions for engineering station

### Engineering station

The engineering station (ES) serves as a central configuration station.

There are no redundant engineering stations in PCS 7.

The ES is generally used to make changes in the configuration data of project components such as AS, OS and BATCH and to then download the changes to the target systems. This makes PCS 7 configuration centralized and transparent.

### Configuration

In order to use an ES as an OS client, you need to configure a PC station in the PCS 7 project for the ES. This PC station is configured and downloaded the same way as an operator station with regard to hardware (Station Configuration Editor), networks and connections (NetPro). The ES is displayed in NetPro.

If you specify permanently configured connections under "Named Connections", the following rules apply:

- When configuring the connections for the ES, you must configure a connection for every AS. This will ensure that a connection can be established to every AS regardless of which WinCC project is loaded.
- For connections from the individual PC stations (OS servers and ES) to the automation systems, the following rules apply:
  - All connections within an AS must have the same name.
  - Two connections must be configured for each OS server and the ES: one in AS 1 and one in AS 2.
  - The connections to AS 1 and the connections to AS 2 must always have the same name.

### Backing up configuration data

The configuration data should always be backed up following a change in the configuration.

## 3.10 Time synchronization

### Introduction

Time synchronization in a PCS 7 plant is of utmost importance for synchronizing, tracing, documenting and archiving all time-critical processes. Time synchronization is particularly important for the redundancy functions in PCS 7 such as the redundancy synchronization between OS servers or BATCH servers.

Time synchronization is active after one component has assumed the time master function in a PCS 7 system. All other time-dependent components receive the time from this time master.

### Planning and setting up time synchronization in PCS 7

The information necessary for planning and setting up time synchronization within a Windows network is available in the following documentation:

Function manual *Process Control System PCS 7; PCS 7 Time Synchronization*

### Setting the time synchronization of SIMATIC H stations

When a SIMATIC H station is connected to the redundant fault-tolerant plant bus each with two CP443-1 per CPU, the settings for time synchronization should be made according to the table below.

Set the time synchronization of CP 443-1 by selecting the "Time synchronization" tab in the object properties dialog of the CP.

Bus	CPU 1/rack 1		CPU 2/rack 2	
Plant bus1	CP 1/1	Time synchronization <b>ena- bled</b>	CP 2/1	Time synchronization <b>dis- abled</b>
Plant bus2	CP 1/2	Time synchronization <b>dis- abled</b>	CP 2/2	Time synchronization <b>ena- bled</b>



## Advantages of fault-tolerant components

### 4.1 Creating and expanding a project with pre-configured stations

#### PCS 7 wizards "New Project" and "Extend Project"

You can create fault-tolerant stations for the AS and PC stations using the PCS 7 "New Project" and "Expand Project" wizards in the SIMATIC Manager. For redundant PC stations, you configure a redundant multiple station system using the PCS 7 wizard.

- **PCS 7 "New Project" Wizard**

Use the PCS 7 "New Project" wizard to create a new PCS 7 project as a multiproject. You are guided through the individual configuration steps of the PCS 7 wizard. While working through the wizard, you specify the CPU, select the number of levels in the plant hierarchy and the AS objects to be created (CFC/SFC charts) and OS objects (PCS 7 OS, SIMATIC BATCH, SIMATIC Route Control). Technological names such as plant, unit and function are specified and you can adapt these later to the requirements of your plant.

- **PCS 7-"Expand Project" wizard (pre-configured stations)**

Using this wizard, you can expand a project with pre-configured stations, such as an AS or a PC station for OS, BATCH or Route Control.

The AS is set up using the configuration bundles which you can find in the PCS 7 catalog and know from the PCS 7 "New Project" wizard. If you use such bundles in your plant, all required objects are created when you insert pre-configured stations.

#### Additional information

- Configuration manual *Process Control System PCS 7; Engineering System*

## 4.2 SIMATIC H Station

### 4.2.1 Overview of configuration tasks

#### Overview of configuration tasks

You configure the redundancy functionality of the SIMATIC fault-tolerant station (H station) by performing the following steps:

Step	What?
1	Inserting a SIMATIC H station in a project (Page 100)
2	Inserting synchronization modules in the H_CPU (Page 102)
3	Configuring redundant communications processors (Page 103)
4	Setting the CPU for the error response of input/output modules (Page 105)

### 4.2.2 How to add a SIMATIC H station to your project

#### Introduction

The SIMATIC H station is contained in the hardware catalog of HW Config as a stand-alone station type. This station type is required if you want to configure two central devices each with a H CPU, thereby configuring the entire process control system with redundancy.

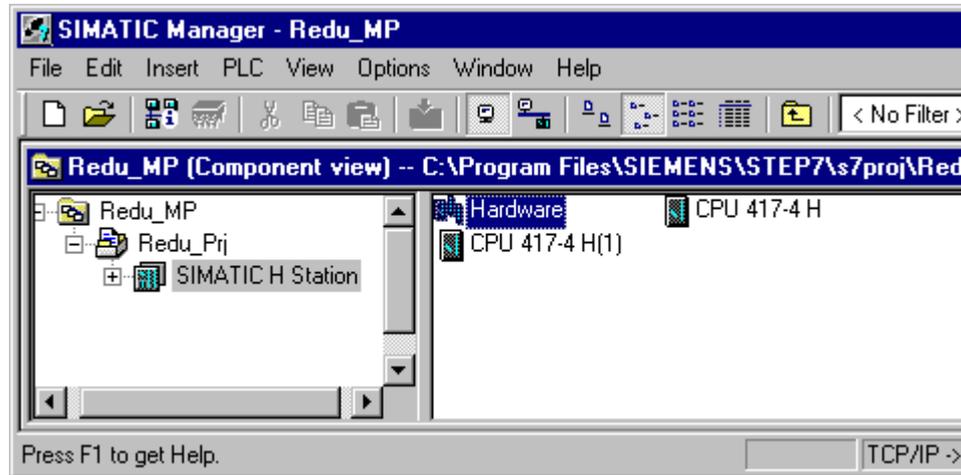
The direct connection of a singular CPU to the redundant, fault-tolerant plant bus is possible with a CPU 410H.

#### Procedure

1. Open your PCS 7 project in the component view of SIMATIC Manager.
2. Select the menu command **View > Component View**.
3. Select the project.
4. Select the following menu command: **Insert > Station > SIMATIC H Station**.
5. Click the inserted SIMATIC H station.

## Result

The configuration in the SIMATIC Manager appears as follows:



## Configuring the AS in HW Config

1. Double-click the **Hardware** object in the detail view.  
The HW Config dialog box opens.
2. Open the catalog and select the profile of the current PCS 7 version.
3. Insert the following objects of the SIMATIC 400 (**Insert > Object** menu command):  
You can find information about the objects in the information section of the catalog.
  - **Rack 400**
  - **PS 400**
  - CPU 400 > **CPU 400 H**  
Communication connections can be configured later. You can find information about this in the following sections:
    - Section "How to configure a redundant PROFIBUS DP (Page 114)"
    - Section "How to configure a fault-tolerant fieldbus on the basis of PROFINET (Page 117)"
    - Section "How to configure a media-redundant fieldbus on the basis of PROFINET (Page 120)"
  - **CP-400** (optional)  
Communication connections can be configured later. You can find information on this in the section "How to configure redundant communication processors (Page 103)".

## Additional information

- Manual *Automation System S7-400H; Fault-tolerant Systems*

### 4.2.3 How to insert synchronization modules into the H CPU

#### Requirements

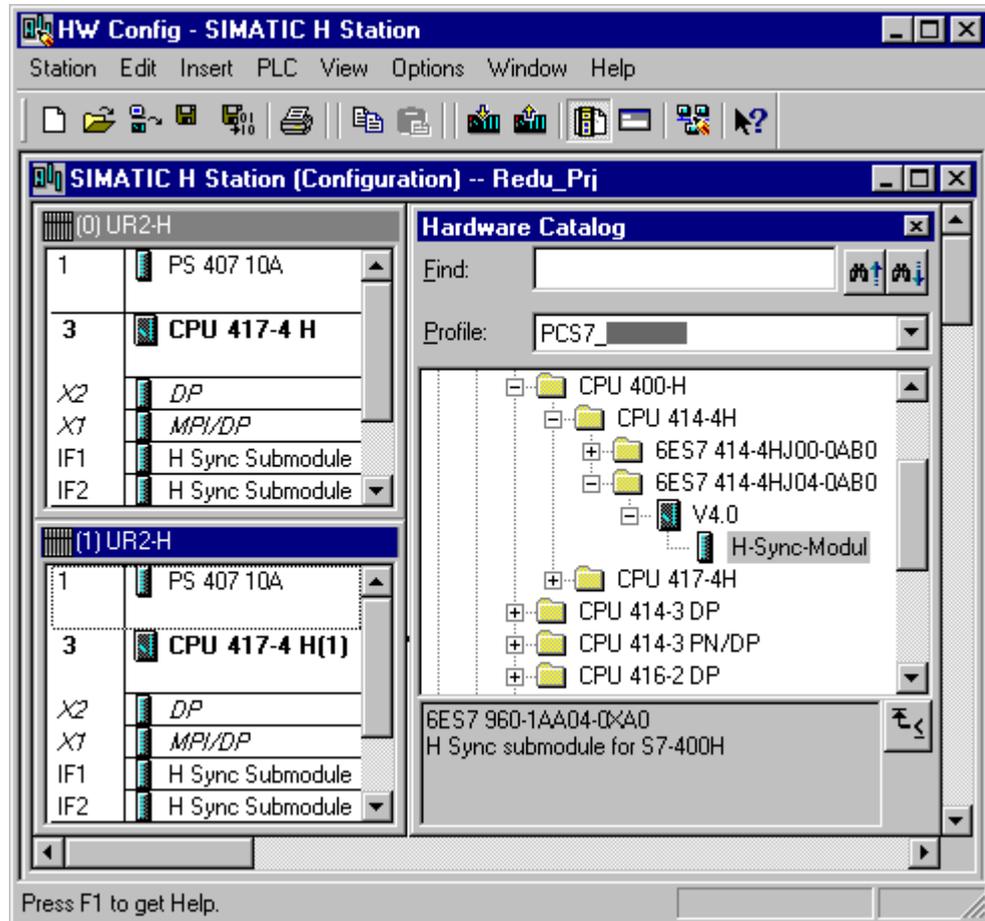
- The PCS 7 project is open in SIMATIC Manager.
- HW Config is open.
- The rack has been inserted according to the configuration in HW Config.
- Each rack has been fitted with an H CPU in HW Config.

#### Procedure

1. In HW Config, select the menu command **View > Catalog**.
2. In the hardware catalog, double-click the H CPU you are using. Within the active tree view, double-click on the version of the H CPU you have selected.  
The H sync module is located below the version folder, e.g., V4.0.
3. Select the H Sync Module and drag it onto slots "IF1" and "IF2" of each H CPU.

## Result

The following figure shows an example of the configured subsystems of the fault-tolerant station in HW Config:



## Additional information

- Documentation *Process Control System PCS 7; PCS 7 - Released Modules*
- Manual *Automation System S7-400H; Fault-tolerant Systems*

### 4.2.4 How to configure redundant communication processors

#### Introduction

Configure at least one CP 443-1 for each H CPU on a plant bus. You can also make a redundant interconnection.

## Requirements

- The PCS 7 project with a SIMATIC H station is open in SIMATIC Manager.
- HW Config is open.
- The racks for the SIMATIC H station are inserted in HW Config, for example, 2 UR2-H racks.
- In HW Config, each rack has been fitted with an H CPU and the required synchronization modules.

## Procedure

1. In the hardware catalog, double-click the "SIMATIC 400" folder. Then double-click the "CP-400" folder and finally the "Industrial Ethernet" folder.
2. Select the CP you are using and drag it to a free slot on the rack.

---

### Note

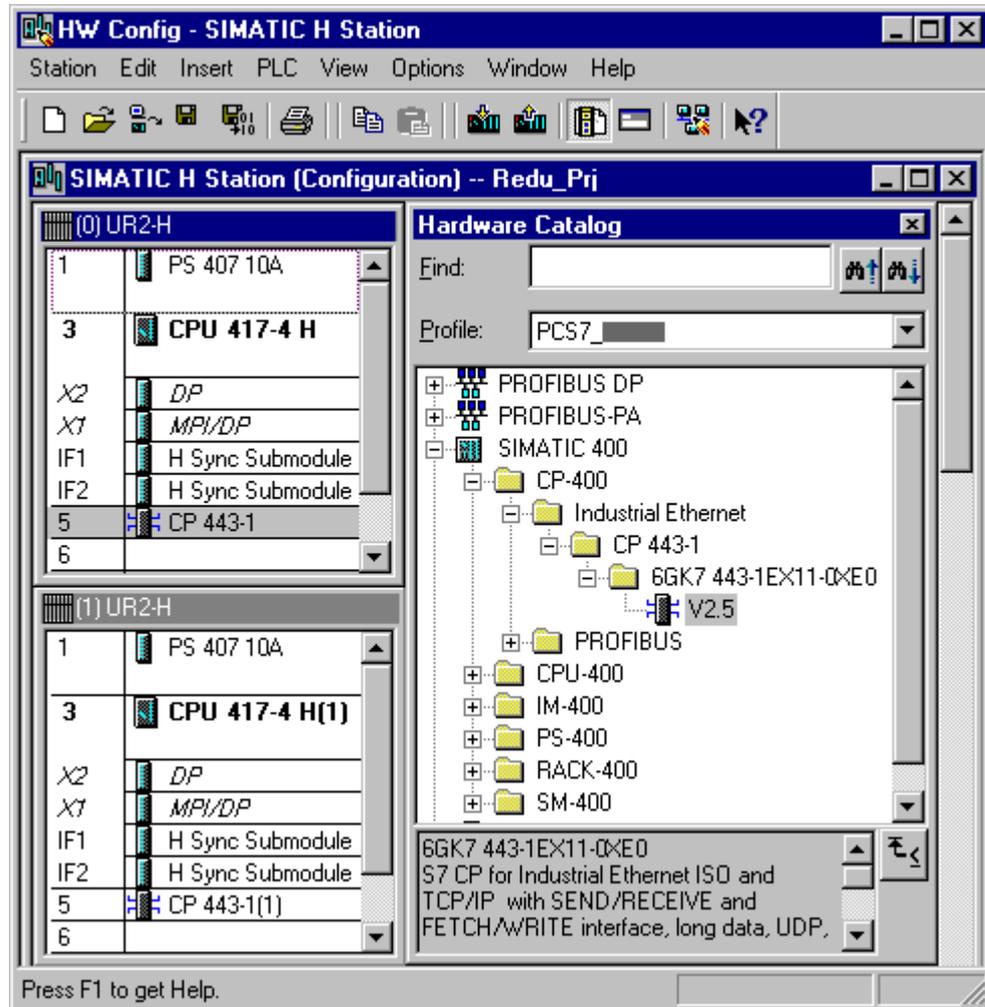
#### **Using a communication processor that supports multiple communication protocols**

Configure the ISO interface for the "Fault-tolerant S7 connection" in the "Parameters" tab of the "Properties - Ethernet Interface CP 443-1" dialog box.

---

## Result

The following figure shows an example of configuration in HW Config. Connection to a fault-tolerant plant bus is possible.



## Additional information

- Manual *Automation System S7-400H; Fault-tolerant Systems*

### 4.2.5 How to set the failure reaction of the input/output modules on the CPU

#### Introduction

Only perform the following procedure when the libraries "Redundant IO (V3.0)" or "Redundant IO (V4.0)" are used.

4.2 SIMATIC H Station

As of PCS 7 V7.1, the characteristics of the redundant input/output modules are set for channel-based reaction to channel faults. The function in the AS depends on the employed PCS 7 library and the modules.

Depending on the configured module, the code is automatically generated for the automation system based on the optimal capabilities of the module.

Passivation reaction of the modules

You will find information on which modules are released for which passivation reaction in the documentation *PCS 7 - Released Modules*.

Passivation reaction	Reaction of the module
Module-based	The module is passivated if a fault occurs.
Group-based	If a fault occurs in a channel, the group of channels is passivated in a module in which a least one fault has occurred.
Channel-based	Only the channels on which the fault occurred are passivated.

Requirements

- The PCS 7 project is open in SIMATIC Manager.
- An H-CPU is configured in HW Config.
- S7 driver blocks from the "Redundant IO (V3.0)" or "Redundant IO (V4.0)" library

Procedure

1. In the component view, select the SIMATIC H station.
2. Double-click the "Hardware" object in the detail window. HW Config opens.
3. Select the CPU you are using on slot 3.
4. Select the menu command **Edit > Object Properties**. The "Properties - CPU ..." dialog box opens.
5. Select the "H Parameters" tab.
6. Please make a note of which data blocks in the "Data block no." input box are defined as standard transmitters so that you do not use them in your configuration.
7. Select the required setting for the passivation behavior from the "Passivation behavior" list in the "Redundant I/O" area.
  - **Module-based** when the "Redundant IO (V3.0)" library is used
  - **Channel-based** when the "Redundant IO (V4.0)" library is used

Additional information

- Function manual *Process Control System PCS 7; software update without utilization of new functions*
- Documentation *Process Control System PCS 7; PCS 7 - Released Modules*

## 4.3 Communication connections

### 4.3.1 Overview of configuration tasks

#### Introduction

After you have inserted all of the components (AS, OS and ES) in your project, you can use NetPro to configure the network connections between the SIMATIC components. When the configuration of the connections and network is complete, the configuration needs to be compiled, saved and downloaded to the CPU of the automation system.

#### Downloading connection configurations

Connection configurations can be downloaded to the CPU in RUN mode. To do this, select the connection to be downloaded in NetPro and transfer it to the CPU by selecting the menu command **Target systems > Download > Selected Connections**. Process interfacing for operation stations is not possible until the connections are made known to the AS.

You need to change the MAC addresses after failure of network adapters. You adapt the addresses in the properties dialog box of the individual operator stations in NetPro. The configuration has to be compiled and downloaded in NetPro each time it is changed.

#### Overview

This section describes the configuration steps for the following topics:

- Configuring a redundant, fault-tolerant terminal bus (Page 108)
- Configuring a fault-tolerant plant bus (Page 112)
- Configuring a redundant PROFIBUS DP (Page 114)
- Configuring a fault-tolerant fieldbus based on PROFINET (Page 117)
- Configuring a media-redundant fieldbus based on PROFINET (Page 120)
- Configuring a redundant PROFIBUS PA (Page 123)

### 4.3.2 Configuring the connection to the terminal bus

#### 4.3.2.1 How to configure the redundant terminal bus on the basis of the Parallel Redundancy Protocol

#### Introduction

The NetPro and HW Config programs do not support configuration of the terminal bus. The "SIMATIC NET SOFTNET-IE RNA" software is used in PCS 7 for the connection of a PC station to separate redundant networks.

### Conditions and rights required

You require the following to be able to install and operate SOFTNET-IE RNA on your PC:

- 2 free Ethernet network adapters
- 2 separate Ethernet network adapters
- Administrator rights for installation
- Exactly one software license for SOFTNET-IE RNA per PC.

### Installation and configuration

You can install the "SIMATIC NET SOFTNET-IE RNA" software with the PCS 7 system setup.

Select the "User-defined Installation" installation mode and select the "SOFTNET-IE RNA ..." program in "Options".

You can find information about the configuration in the *SIMATIC NET; PG/PC - Industrial Ethernet Operating Instructions; SOFTNET-IE RNA*.

### Additional information

- Online help for "SIMATIC NET SOFTNET-IE RNA" software
- You can find additional information on this on the Internet <http://www.siemens.com/pcs7-documentation> (<http://www.siemens.com/pcs7-documentation>):
  - Operating instructions *SIMATIC NET; SCALANCE X204RNA, SCALANCE X204RNA EEC*
  - Operating instructions *SIMATIC NET PG/PC; Industrial Ethernet SOFTNET-IE RNA V8.2*
- You can find information on the individual SIMATIC NET products and their configuration on the Internet (<http://www.siemens.com/automation/service&support>).

#### 4.3.2.2 How to configure the redundant terminal bus on the basis of the INTEL TEAM mode

### Introduction

The NetPro and HW Config programs do not support configuration of the terminal bus. The PC stations are connected to the redundant terminal bus by means of network adapters capable of redundancy. The section below describes how you install and configure the drivers for network adapters of these PC stations.

## Requirements

Each redundant PC station (for example, OS server, OS client, domain controller) connected to the terminal bus must meet the following requirements:

- Redundant connection of the PC station to the terminal bus:  
Two network adapters working in INTEL Team mode on a PC.
- The operating system specific (32/64 bit) driver for the network adapter is installed. You can find the driver on the "Software\_Support\_and\_Tools" DVD in the folder **Drivers > Network > INTEL**.

## Network adapters for the redundant terminal bus

The table below shows the recommended network adapters for the redundant terminal bus depending on the type of PC.

**Network adapter onboard** with SIMATIC IPC

SIMATIC IPC are the recommended Industry PCs for PCS 7. You can find information about this in the documentation *Process Control System PCS 7; PCS 7 Readme (Internet version)*

PC-Typ	Network adapter 1 (LAN #01...)	Network adapter 2 (LAN #02...)
IPC547E, IPC627D, IPC677D, IPC647D, IPC847D	Intel Ethernet Connection I217-LM	Intel I210 Gigabit Network Connection
IPC547D, IPC427D, IPC477D	Intel 82579LM Gigabit Network Connection	Intel 82574L Gigabit Network Connection
IPC627C, IPC677C, IPC647C, IPC847C	Intel 82577LM Gigabit Network Connection	Intel 82574L Gigabit Network Connection
IPC427C	Intel 82574L Gigabit Network Connection	Intel 82574L Gigabit Network Connection

### Additional network adapter

You can find detailed information in the catalog overview *Process Control System PCS 7; Released Modules* or the catalog *ST PCS 7*

PC-Typ	Network adapter 1 (LAN #01...)	Network adapter 2 (LAN #02...)
Suitable PC	Server adapter network card <sup>2)</sup>	Desktop adapter network card <sup>2)</sup>

### Note

#### Message when creating TEAM or adding ports to the existing team

If you receive a message when using the released network adapters that the network adapters "NDIS ... Receive-Side Scaling" are not supported, you can ignore this message.

## Procedure – installing and configuring drivers

1. Unzip the compressed driver file (Zip).
2. Install the device driver using the autostart file with standard settings.
3. Open the **Device Manager > Network adapters**.

4.3 Communication connections

4. If no onboard network adapters are being used for connecting to the terminal bus, select the internal network adapter of the PC station and deactivate the internal network adapter via the shortcut menu.
5. Select the adapter "Network adapter 1" (see section "Network adapter for the redundant terminal bus"). Select the shortcut menu command **Properties**.
6. In the "Teaming" tab, select the "Team this adapter with other Adapters" option button. Click "New Team".  
The "New Team Wizard" dialog opens.
7. Enter a name for the team (for example, "TerminalBusTeam #0"). Click "Next".
8. In the "Select the adapters to include in this team" list, select the network adapters through which the computer should be connected to the redundant terminal bus.
  - "Network adapter 1" (see table under 5.)
  - "Network adapter 2" (see table under 5.)
9. Click "Next".
10. In the "Select a team type" list, select "SFT (Switch fault tolerance)". Click "Next".
11. Click "Finish".  
The "New Team Wizard" dialog box closes.  
The group ("TerminalBusTeam #0" in the example) is entered in the "Properties (settings)" dialog of the network adapter.
12. The "Properties of team: <team name>" dialog box opens ("TerminalBusTeam #0" in the example).
13. Select the "Settings" tab and click "Change group... (Modify Team...)".
14. In the "Adapters" tab, select network adapter 1 on the preferred terminal bus.  
Click "Set Primary".
15. Select the "network adapter 2" on the redundant terminal bus. Click "Set Secondary".
16. Click "OK" to confirm the Team dialog boxes.
17. The Team dialog boxes close.  
The two network adapters are entered as a group (team) in the Device Manager (Example: Team: Intel (R) Pro/1000 ...).
18. Open the dialog window "Network connections" ("Change adapter settings") via the control panel.
19. If the entry "File" is missing in the menu bar, select the menu command **Organize > Layout > Menu bar**.
20. Activate the detailed view of the list.  
**Recommendation:** Name the network adapters (**File > Rename**)  
Example:
  - 1. <Team name> <Team> ("TerminalBusTeam #0" in the example)
  - 2. <Team name> <Master> ("TerminalBusTeam #0 (Master)" in the example)
  - 3. <Team name> <Standby> ("TerminalBusTeam #0 (Standby)" in the example)

21. Check the order of network adapters under "Advanced > "Advanced Settings...". In the "Adapters and Connections" tab, the team must be at the top of the list under "Connections":
  - 1. <Team name>" (in the example, "TerminalBusTeam #0")
  - 2. <Team name> <Master ... Adapter> (INTEL server adapter or LM adapter for INTEL onboard network adapters)
  - 3. <Team name> <Standby ... Adapter> (INTEL desktop adapter or L adapter for INTEL onboard network adapters)
22. Click "OK" to close the dialog box.

### **4.3.2.3 How to connect singular components to the redundant terminal bus on the basis of the Parallel Redundancy Protocol**

#### **Introduction**

You can connect the following non-redundant objects to a redundant network with the SCALANCE X204RNA .

- Non-redundant networks
- Components that have just one network connection, for example

You will find additional information on this topic in section "Redundant, fault-tolerant terminal bus based on the Parallel Redundancy Protocol (PRP) (Page 54)".

#### **Procedure**

1. Connect the networks for the redundant terminal bus (referred to as LAN A and LAN B below) to the following ports of the SCALANCE X204RNA :
  - PRP A (LAN A)
  - PRP B (LAN B)
2. Connect the non-redundant objects to the following ports:
  - P1
  - P2
3. Configure the SCALANCE X204RNA.

#### **Messages**

- SCALANCE X204RNA has signaling contacts.

### Additional information about configuration

You can find additional information on this on the Internet <http://www.siemens.com/pcs7-documentation> (<http://www.siemens.com/pcs7-documentation>):

- Operating instructions *SIMATIC NET; SCALANCE X204RNA, SCALANCE X204RNA EEC*
- Operating instructions *SIMATIC NET PG/PC; Industrial Ethernet SOFTNET-IE RNA V8.2*

## 4.3.3 How to configure a fault-tolerant plant bus

### Introduction

You configure the communication connections for the plant bus with NetPro. Industrial Ethernet is used for the plant bus.

### Fault-tolerant plant bus

You can set up a fault-tolerant plant bus with a ring structure.

The components of the process control system are connected to the plant bus using switch modules.

The degree of availability you require determines whether or not you should use additional network adapters in the OS servers and in each subsystem of the automation system.

This section describes the procedure for a fault-tolerant plant bus (ring) with switch modules without additional CPs.

Additional information is available in the section "Fault-tolerant plant bus (Page 61)".

### Redundant, fault-tolerant plant bus

To configure a redundant, fault-tolerant plant bus, two network adapters each have to be physically present in the OS servers that will be connected redundantly and in each subsystem of the H system and they must be configured in NetPro. Two networks must also be configured in NetPro.

The procedure is identical to the procedure for the fault-tolerant plant bus. This procedure must be performed for one network adapter per bus and subsystem (H system or PC station on the plant bus).

Additional information is available in the section "Redundant, fault-tolerant plant bus (Page 63)".

### Server or single-station system with standard network adapters

When connecting a server or a single-station system via two standard network adapters, e.g. Intel Desktop Adapter, to a redundant plant bus (two separate rings - "Ring 1" and "Ring 2" in this case), please note the following:

Assign IP addresses in different IP address ranges to the network adapters in Ring 1 and Ring 2.

Example:

- Ring 1:
  - IP address range: 192.168.1.0 - 192.168.1.255
  - Subnet mask: 255.255.255.0
- Ring 2:
  - IP address range: 192.168.2.0 - 192.168.2.255
  - Subnet mask: 255.255.255.0

## Requirements

- The PCS 7 project with a SIMATIC H station is open in SIMATIC Manager.
- In HW Config, one 443-1 type CP has been configured in each H subsystem.
- Two SIMATIC PC stations each with one CP 1613 have been configured in HW Config.

## Procedure

1. Open NetPro in SIMATIC Manager with the menu command **Options > Configure Network**.
2. Select the menu command **Insert > Network Objects** to open the hardware catalog.
3. In the hardware catalog, click the plus sign to open the submenu containing the subnets.
4. Double-click the "Industrial Ethernet" subnet to insert it into the network view.

---

### Note

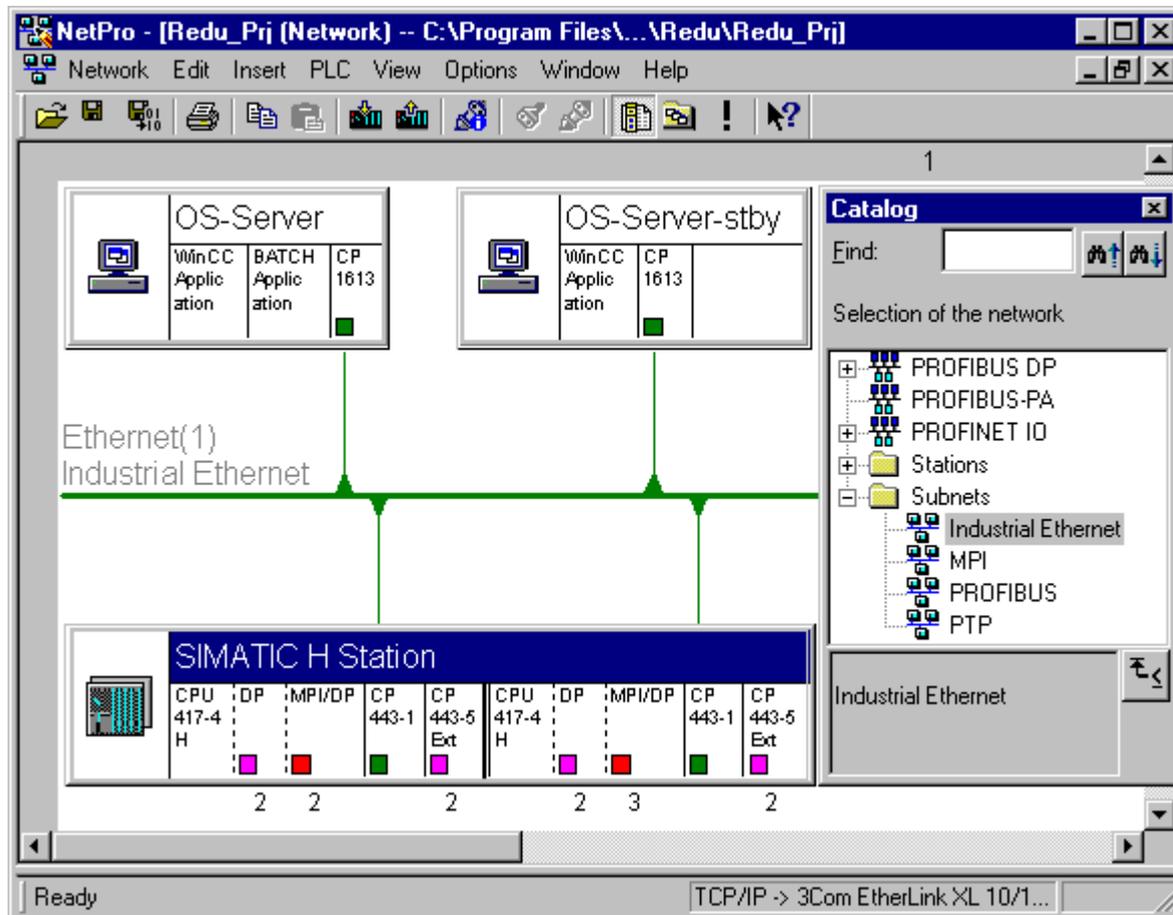
To drag subnets into the NetPro project window, click the network, hold down the left mouse button and drag it to the desired location. If you cannot place the object where you want it, you may need to move other objects to make the necessary space.

---

5. In the left subsystem of the SIMATIC H station, select the interface icon for the CP 443-1 and drag a connection to the Industrial Ethernet subnet. Repeat the procedure for the CP of the right subsystem.
6. Follow the same procedure for the CPs in both OS servers.
7. Save your configuration.

## Result

The following figure shows the resulting configuration:



## Additional information

- Online help for *STEP 7*

### 4.3.4 How to configure a redundant PROFIBUS DP

#### Introduction

The following section describes how to create and connect a redundant PROFIBUS DP.

#### Requirements

- The PCS 7 project with a SIMATIC H station is open in SIMATIC Manager.
- HW Config is open.

- The UR2-H rack has been inserted twice in HW Config.
- In HW Config, each mounting rack has been fitted with an H CPU in slot 3 and the required synchronization modules.

## Procedure

---

### Note

Steps 1 through 4 are necessary only when a CP 443-5 Extended is used for the connection to the redundant PROFIBUS.

---

1. In HW Config, select the menu command **Insert > Hardware Components**.
  2. In the hardware catalog, double-click the "SIMATIC 400" folder. Then double-click the "CP-400" folder and finally the "PROFIBUS" folder.
  3. Select the version of the CP 443-5 Extended you are using and drag it to a free slot on the module rack.  
The "Properties - PROFIBUS Interface CP 443-5 Ext ..." dialog box opens.
  4. Click "OK".
  5. Select the slot on the rack for which you want to specify a redundant PROFIBUS DP interface:
    - Slot X2 to use the PROFIBUS DP interfaces of the CPU
    - Slot of the CP 443-5 Extended to use the PROFIBUS DP interfaces of the CP 443-5 Extended
  6. Select the menu command **Edit > Master System > Insert**.  
The "Properties - PROFIBUS Interface CP 443-5 Ext..." dialog box opens.
- 

### Note

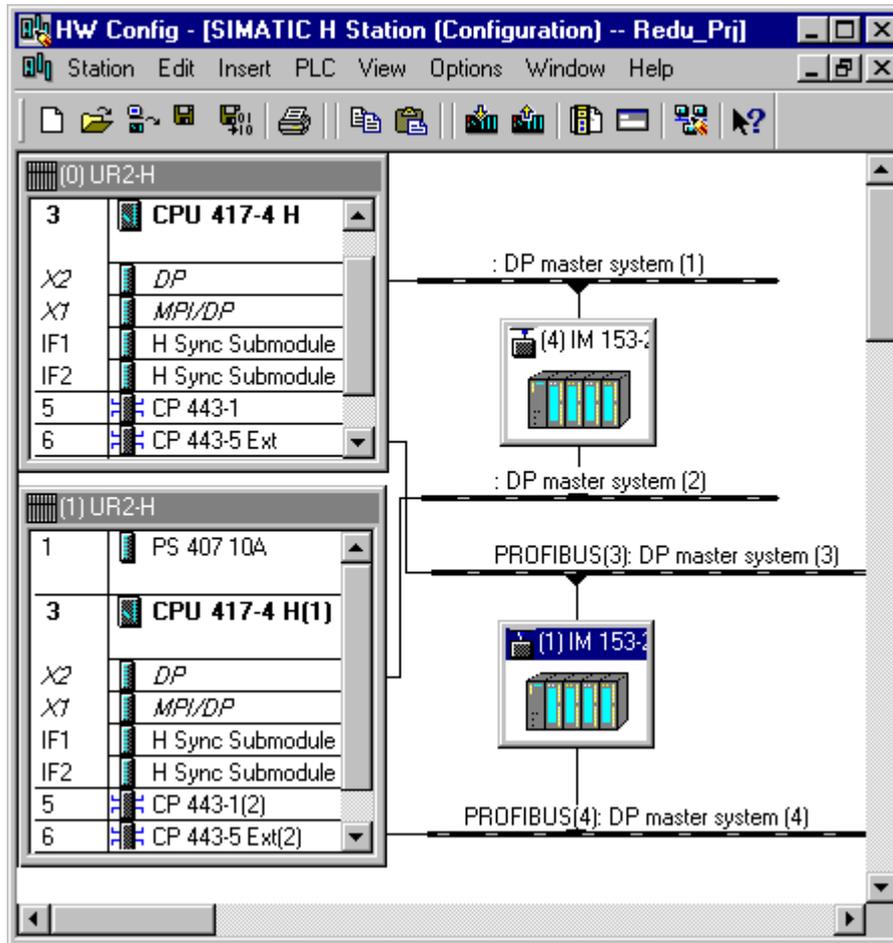
When inserting the DP master system for the redundant PROFIBUS DP interface, the entry "Redundant subnet ..." is displayed below the "Subnet" list.

---

7. Click "New".  
The "New Subnet" dialog box opens.
8. Make any necessary system-specific settings in the "New Subnet ..." dialog box (for example, bus name, transmission rates, etc.).
9. Click "OK".  
The new DP master system is entered in the "Subnet" list.
10. Click "OK".
11. Repeat steps 1 to 10 for the redundant rack.

## Result

The figure below shows the result of the configuration process in HW Config. Here, a distributed I/O has already been assigned to the DP master systems for the purpose of illustrating the redundancy principle:



## Additional information

- Online help on *STEP 7*

## 4.3.5 How to configure a fault-tolerant fieldbus on the basis of PROFINET

### Introduction

The following section describes how to create and connect a fault-tolerant fieldbus on the basis of PROFINET.

- Configure the components in HW Config.
- In the Topology Editor, configure the connections between the components in accordance with the cable sequence in the system.

### Requirements

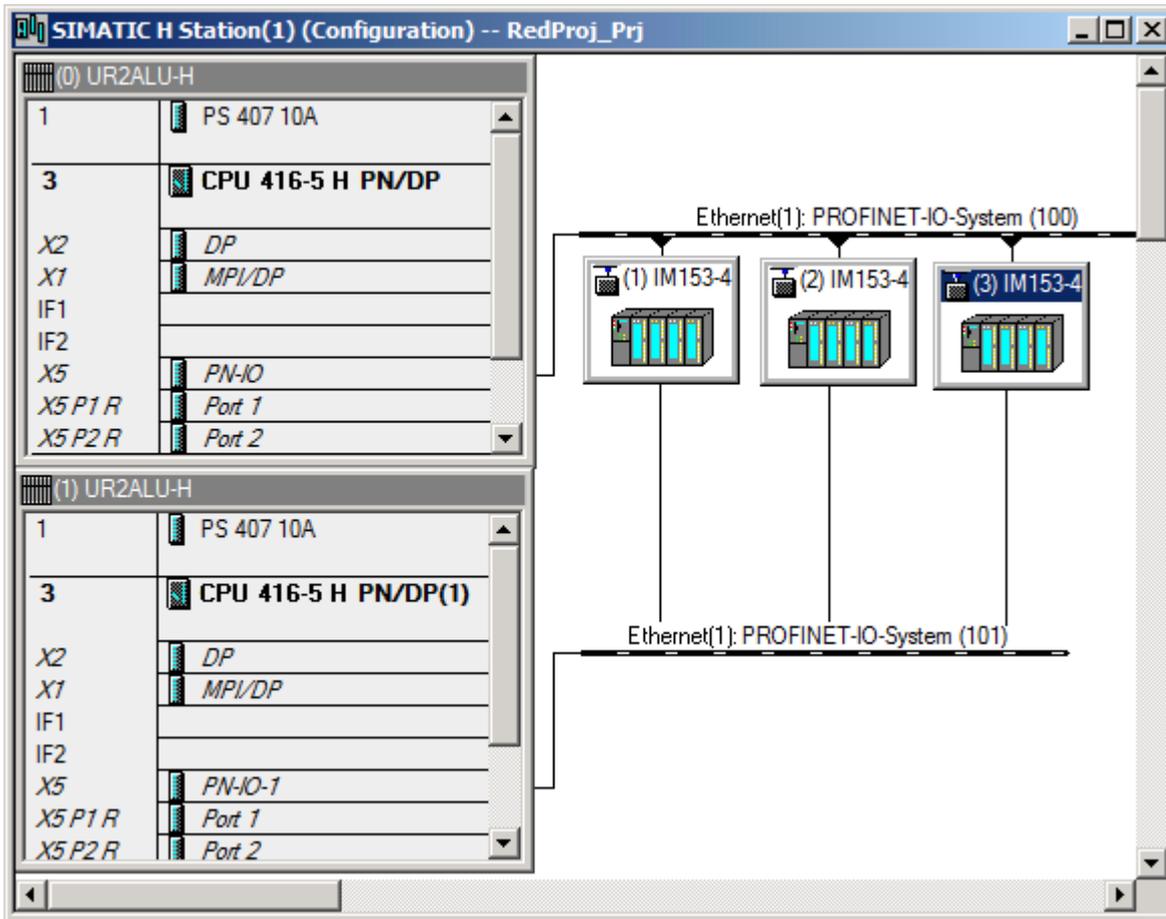
- The PCS 7 project with a SIMATIC H station is open in SIMATIC Manager.
- HW Config is open.
- The redundant backplane is inserted in HW Config.
- In HW Config, each rack has been fitted with an 4xx-xH PN/DP H CPU and the required synchronization modules.
- The PROFINET IO systems are added to the H-CPU. This can be done using Insert on the H-CPU.

### Configuring in HW Config

1. In the hardware catalog, open the **PROFINET IO > I/O > ET 200M** folder.
2. Select the version of the interface module (IM 153-4 ...) you are using and move it onto the PROFINET IO system using drag-and-drop.

## Result

The following figure shows the result of the configuration in HW Config. The distributed I/O is connected to the PROFINET IO system. The physical setup is configured below with the Topology Editor.



## Connecting the components with the Topology Editor

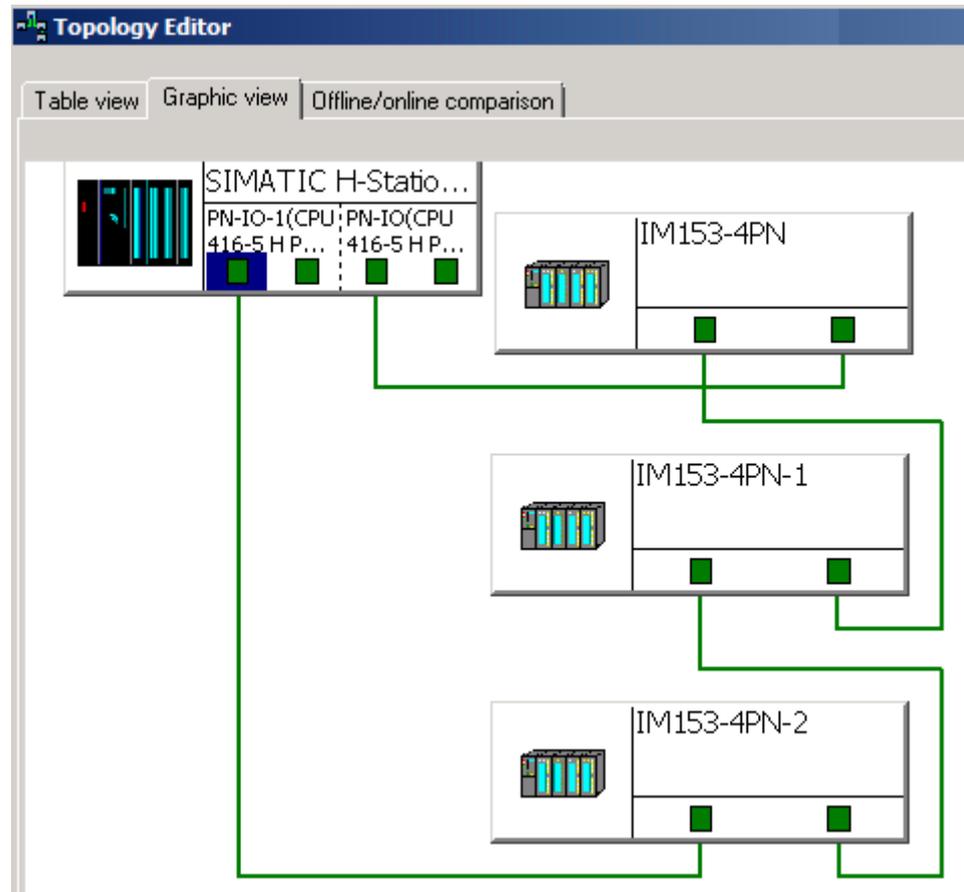
1. Select the **PROFINET IO System** of the first CPU of this automation system.
2. Select the **Edit > PROFINET IO > Topology** menu command.  
The "Topology Editor" dialog box opens.

3. Select the "Graphic view" tab.

**Note:**

You can move the displayed objects. You can select the section displayed via the thumbnail view. Position the objects in accordance with the cable sequence in the system.

4. Using drag-and-drop, connect the I/Os of the CPU and the interface modules (green squares) in accordance with the cable sequence in the system.  
You can make additional system-specific settings on the "Table View" tab. For additional information, refer to the online help of the dialog box.

**Additional information**

- Online help on *STEP 7*

## 4.3.6 How to configure a media-redundant fieldbus on the basis of PROFINET

### Introduction

The following section describes how to create and connect a media-redundant ring on the basis of PROFINET.

- Configure the components in HW Config.
- In the Topology Editor, configure the connections between the components in accordance with the cable sequence in the system.
- Configure the media redundancy for the following modules:
  - CPU
  - IM

### Requirements

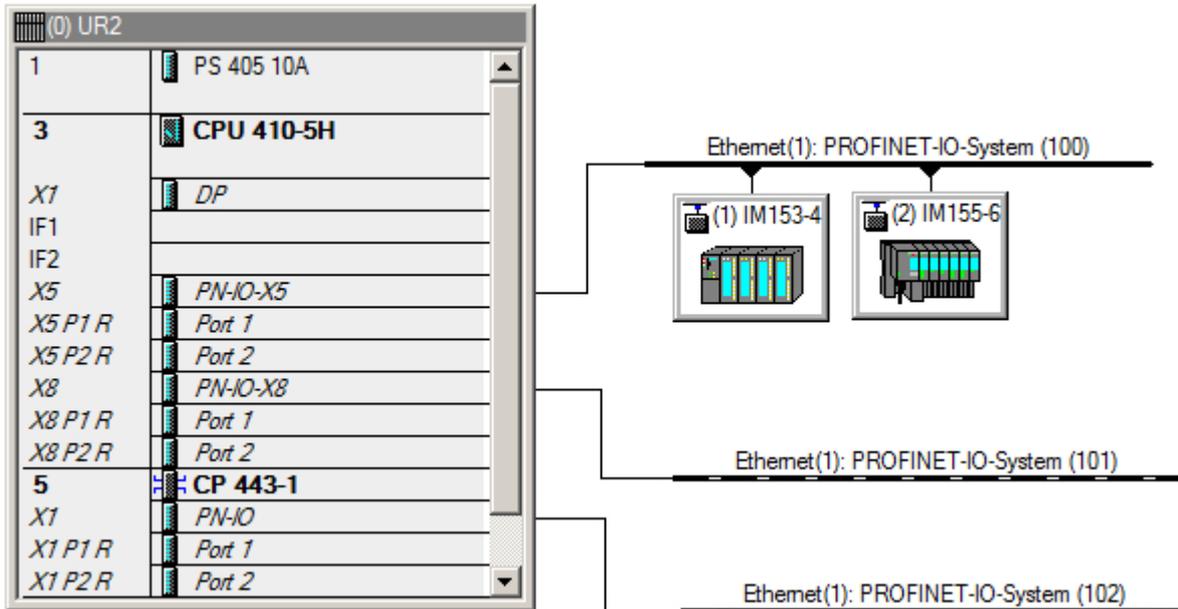
- The PCS 7 project with a SIMATIC H station is open in SIMATIC Manager.
- HW Config is open.
- A rack with a PROFINET-capable module (CPU or CP) has been inserted in HW Config.
- The PROFINET IO systems have been inserted at the PROFINET-capable modules (CPU or CP). This can be done by inserting the PROFINET-capable module.

### Configuring in HW Config

1. In the hardware catalog, open the **PROFINET IO > I/O > ET 200M** folder.
2. Select the version of the interface module (IM 153-4 ...) you are using and move it onto the PROFINET IO system using drag-and-drop.

## Result

The figure below shows the resulting configuration in HW Config for the X5 interface of the CPU. The distributed I/O is connected to the PROFINET IO system. The physical setup is configured below with the Topology Editor.



## Connecting the components with the Topology Editor

1. Select the **PROFINET IO system** of the PROFINET-capable modules (CPU or CP) of this automation system.
2. Select the **Edit > PROFINET IO > Topology** menu command.  
The "Topology Editor" dialog box opens.

4.3 Communication connections

- 3. Select the "Graphic View" tab.

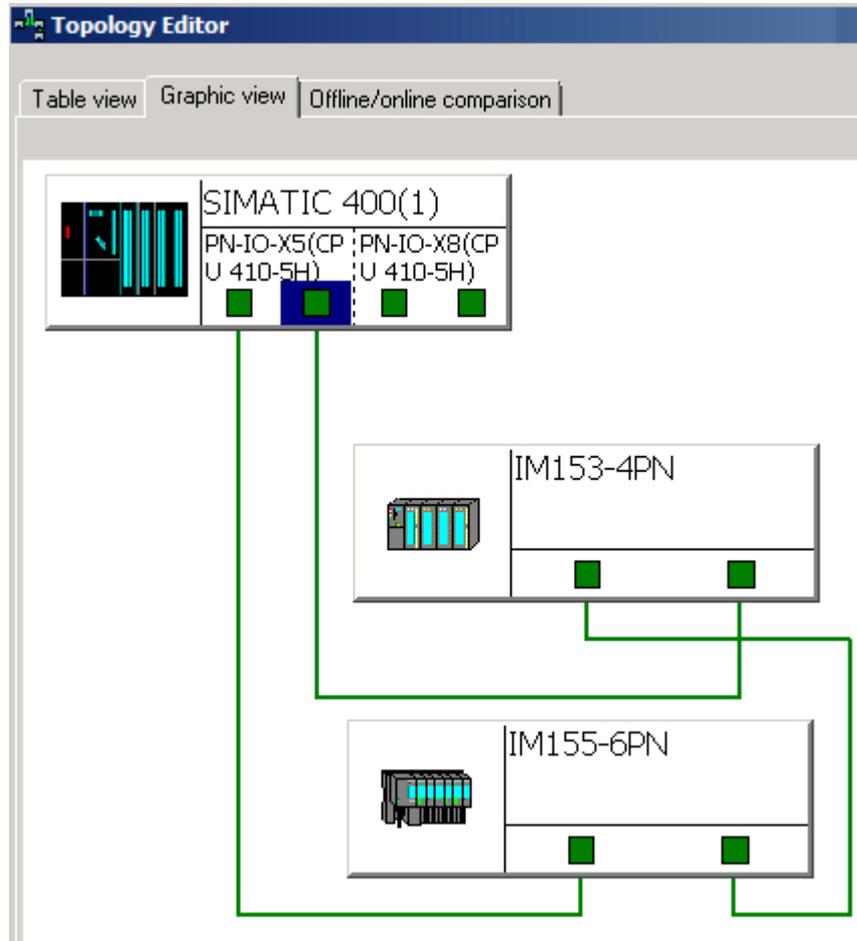
**Note:**

You can move the displayed objects. You can select the section displayed via the thumbnail view. Position the objects in accordance with the cable sequence in the system.

- 4. Using drag-and-drop, connect the I/Os of the PROFINET-capable modules (CPU or CP) and the interface modules (green squares) in accordance with the cable sequence in the system. Connection path for an interface of the PROFINET-capable module:

From Port1 > via the interface modules of the distributed I/O > to Port 2

You can make additional system-specific settings on the "Table View" tab. For additional information, refer to the online help of the dialog box.



Configuring media redundancy (interface PN IO...)

**Note**

**Media redundancy**

Only one MRP ring can be operated on a PROFINET interface.

If you are operating multiple MRP rings on a CPU with multiple PROFINET interfaces, you must not connect the MRP rings to one another.

1. In HW Config, select the PROFINET-capable module (CPU or CP).
2. Open the "Properties" dialog box of the PROFINET interface.
3. Select the "Manager" role on the "Media Redundancy" tab.
4. Click "OK".
5. Select the interface modules (IM) in HW Config.
6. Open the "Properties" dialog box of the IM.
7. Select the "Client" role on the "Media Redundancy" tab.
8. Click "OK".

#### Additional information

- Online help on *STEP 7*

### 4.3.7 How to configure the redundant PROFIBUS PA

#### Introduction

The following is a description of how to configure a redundant PROFIBUS PA that is connected to a redundant PROFIBUS DP.

You can find configuration variants in the section "Fault-tolerant PROFIBUS PA (Page 74)".

#### Requirements

- The PCS 7 project with a SIMATIC H station is open in SIMATIC Manager.
- Two DP master systems are configured for the SIMATIC H station in HW Config and these are used as connection paths for the redundant interface.
- For commissioning: The PROFIBUS addresses are set with the DIL switches on the FDC 157-0 DP/PA couplers.
- You can install a maximum of 5 FDC 157-0 DP/PA couplers, one coupler pair of which is used at the end of the configuration in redundant mode.

## Hardware setting on the DP/PA coupler

---

### Note

The redundancy mode set on the DP/PA coupler (DIL switch bit 7) must match the configured redundancy mode:

- OFF: coupler redundancy (default setting)
- ON: ring redundancy (line redundancy)

If there is a discrepancy between the set redundancy mode and the configured redundancy mode, a diagnostic message is generated.

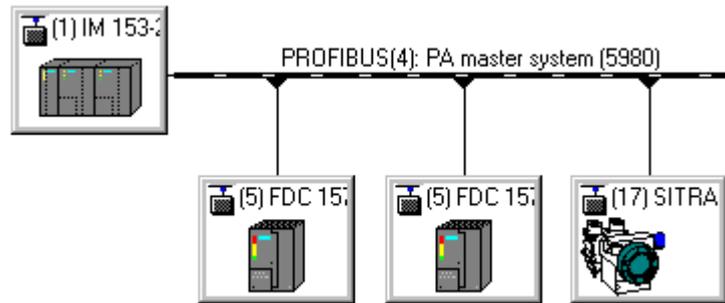
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## Procedure

1. In the component view, select the SIMATIC H station and double-click the "Hardware" object in the detail window.  
HW Config opens.
2. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
3. In the current PCS 7 profile, double-click "PROFIBUS DP" and then "DP/PA Link".
4. Select the FDC 157-0 DP/PA coupler and drag it onto one of the two PROFIBUS DP lines.
5. Select shortcut menu command **Object Properties**.  
The "Properties - DP Slave" dialog box opens.
6. Click "PROFIBUS".
7. Enter the PROFIBUS address (PROFIBUS DP) in the "Properties - PROFIBUS Interface FDC 157-0" dialog box and click "OK".  
The "Properties - PROFIBUS" dialog box opens.
8. Open the "Network Settings" tab.
9. Select the "User-defined" item in the "Profile" list.
10. Click "Bus parameters...".
11. Ensure the value **3** is set for the "Retry Limit" parameter.
12. Click "OK" in the dialog boxes that were opened for this procedure.
13. Repeat steps 1 to 13 for the second DP/PA coupler for coupler redundancy.

## Result

The following figure shows the resulting configuration in HW Config:



## Additional information

- Manual *SIMATIC DP/PA Link and Y Link Bus Couplings*

## 4.4 Distributed I/O

### 4.4.1 Overview of configuration tasks

#### Introduction

The following sections describe configuring redundancy of the individual components of the distributed I/O.

#### Overview

This section describes the configuration steps for the following topics:

- Configuring the redundant interface for the I/O device (Page 126)
- Configuring redundant input/output modules (Page 129)
- Configuring the DP/PA Link (Page 138)
- Configuring the Y Link (Page 136)
- Configuration of redundant signals (Page 141)

### 4.4.2 How to configure the redundant interface for the I/O device

#### Introduction

Once you have integrated the interface module (IM 153-2 for ET 200M, IM 152-1 for ET 200iSP) as hardware in the distributed I/O device, the component is made known to the system in SIMATIC Manager with HW Config or NetPro.

#### Requirements

- The PCS 7 project with a SIMATIC H station is open in SIMATIC Manager.
- A redundant DP master system is configured for the SIMATIC H station in HW Config.

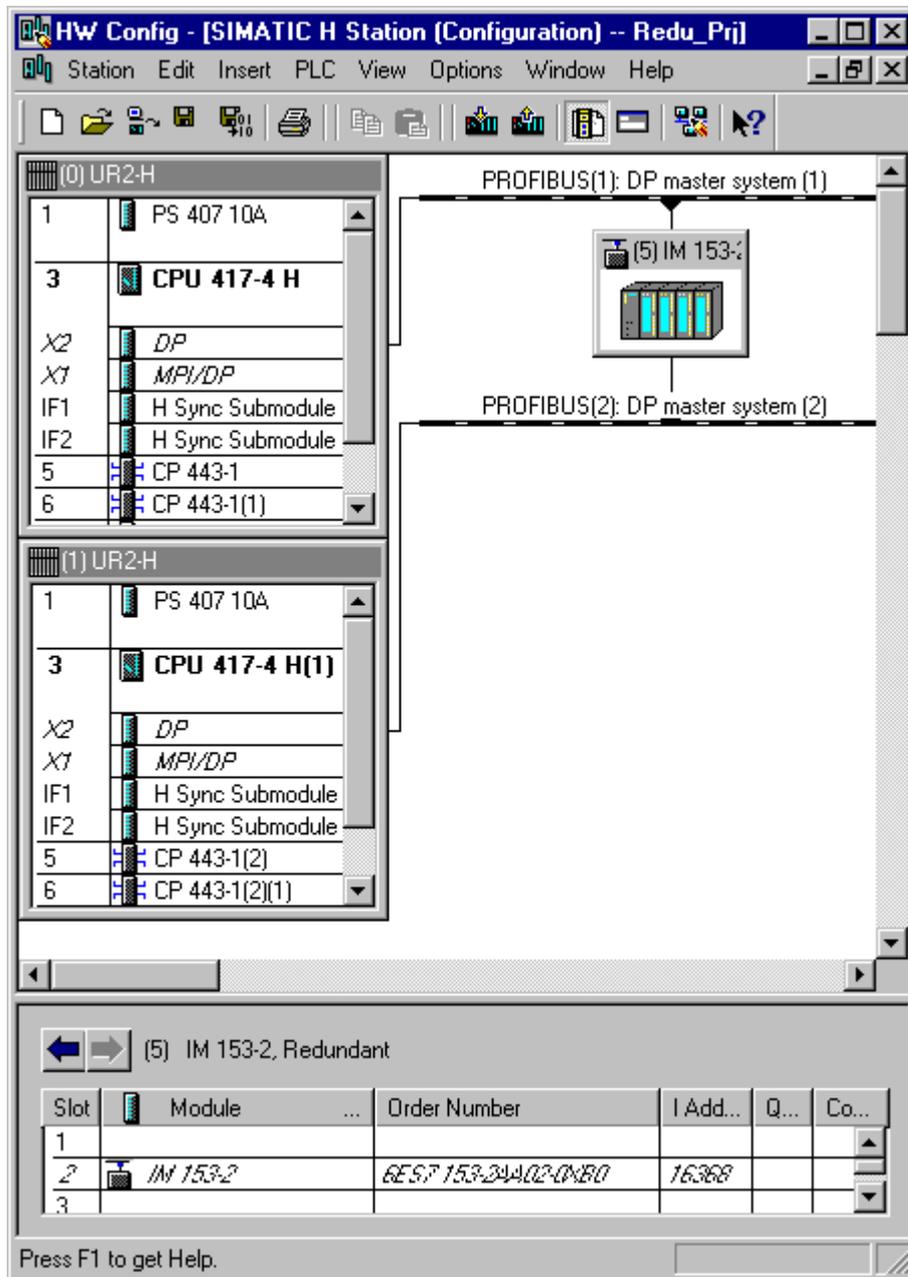
#### Procedure

1. In the component view, select the SIMATIC H station and double-click the "Hardware" object in the detail window.  
HW Config opens.
2. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
3. Double-click on "PROFIBUS DP" in the current PCS 7 profile.

4. Double-click the I/O device you want to connect:
  - ET 200M
  - ET 200iSP
5. Select the interface module:
  - For ET 200M: IM 153-2 in the hardware catalog.
  - For ET 200iSP: IM 152-1 whose hardware catalog description is "..., can be used redundantly in the H system".
6. Drag the interface module to one of the two PROFIBUS DP lines.  
The connection to the redundant line is established automatically.
7. Enter the PROFIBUS address in the "Properties - PROFIBUS Interface IM..." dialog box and click "OK".

## Result

The following figure shows an example configuration in HW Config:



## Additional information

- Function manual *Process Control System PCS 7; High-Precision Time Stamping*
- Manual *DP/PA Link and Y Link Bus Couplings*

### 4.4.3 How to configure redundant I/O modules

#### Introduction

You configure the redundant I/O modules using HW Config.

---

**Note**

Redundant operation is possible only with certain S7-300 I/O modules of the ET 200M. For additional information, please refer to the following documents:

- Documentation *PCS 7 - Released Modules*
  - Manual *Automation System S7-400H; Fault-tolerant Systems*
- 

**Note**

Only input/output modules with the same article number and the same product version in analog or digital version can be used.

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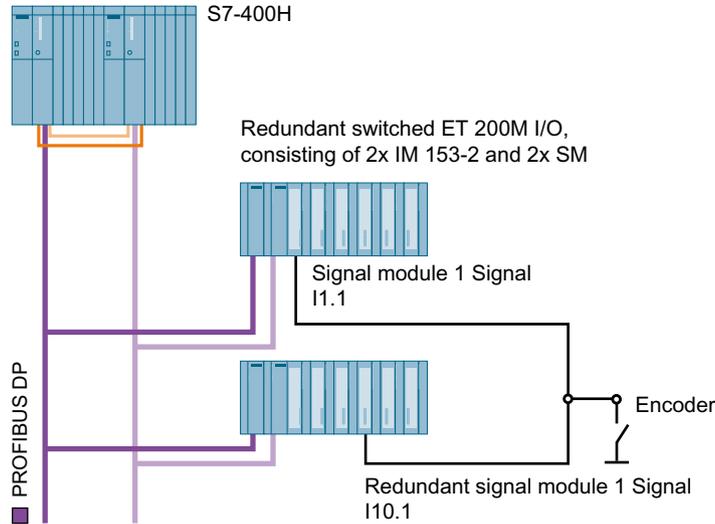
#### Assigning redundant modules

Redundant modules can be assigned to each other for the ET 200M as follows:

- The modules are located in two different ET 200M stations on the same redundant PROFIBUS DP (see sample configuration).
- The modules are located in two different ET 200M stations on different redundant PROFIBUS DPs.
- The modules are located in the same ET 200M station.

### Example configuration

The figure below shows the setup for redundant input modules in a switched distributed configuration.



### Method of operation in the example configuration

"Signal Module 1" is configured redundantly to "Redundant Signal Module 1". As a result, Signals E1.1 and E10.1 are redundant to one another.

If a fault is detected in "Signal module 1", the user program continues to work with the address I1.1, but the signal comes from the address I10.1. The user program does not detect an error, because the signal status is still correct. The event generates a diagnostic message that provides information about the passivated signals.

As of PCS 7 V7.1, the passivation reaction of the redundant I/O modules are set for channel-based reaction to channel faults. Additional information about passivation reaction is available in the section "How to set the CPU for the reaction of the input/output modules to channel faults (Page 105)".

### Requirements

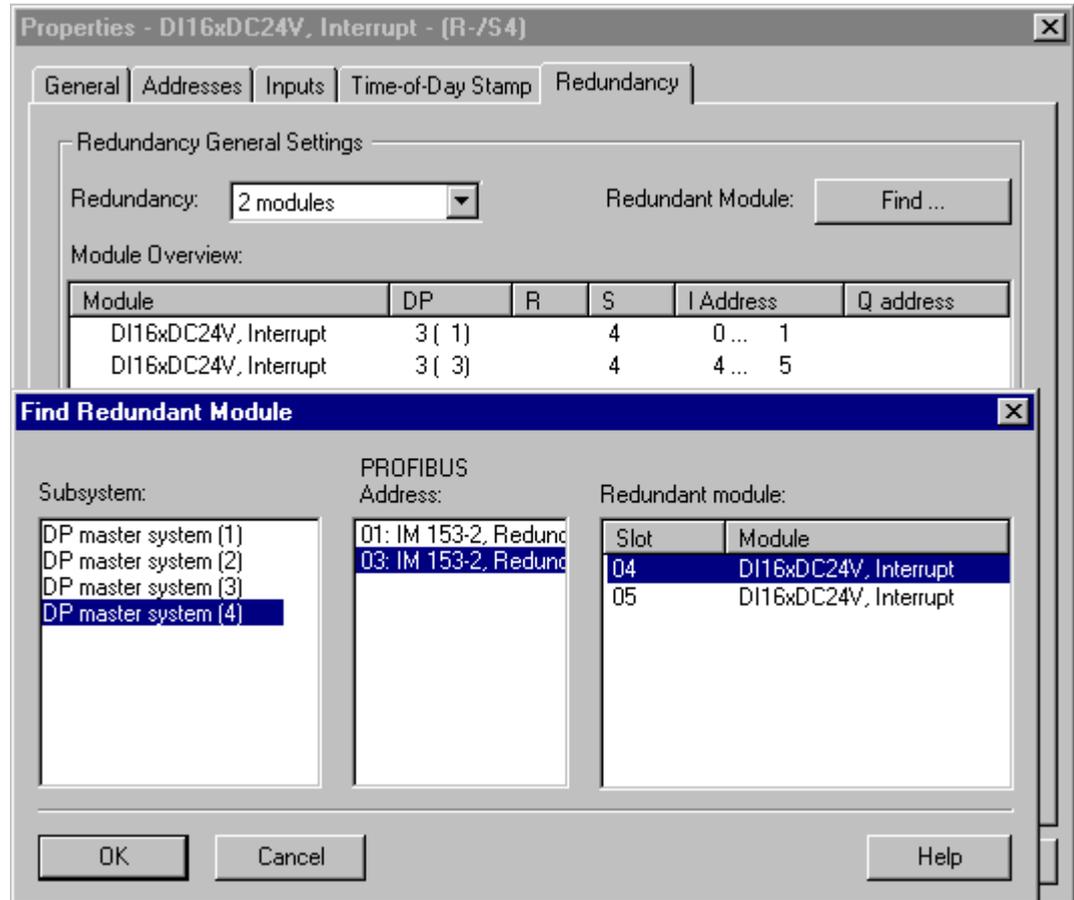
- The PCS 7 project involving an H CPU must have been created and opened in SIMATIC Manager.
- A redundant DP master system is configured for the SIMATIC H station in HW Config.
- The interface modules for ET 200M (IM 153-2) on the redundant PROFIBUS DP are configured in HW Config.

## Procedure

1. In the component view, select the SIMATIC H station and double-click the "Hardware" object in the detail window.  
HW Config opens.
2. If the hardware catalog is not visible, select the **View > Catalog** menu command.  
The hardware catalog opens.
3. Select the IM 153-2 (ET 200M) in which you want to configure the redundant module.  
The module overview is displayed in the lower window pane.
4. In the hardware catalog, select a signal module that supports redundancy.  
Using drag-and-drop, move the signal module onto a free slot in the IM 153-2 (lower window pane).
5. Repeat steps 3 and 4 for the second signal module.  
The modules for which redundancy is to be configured are inserted.
6. Select the first IM 153-2 again.
7. Double-click the inserted signal module in the module overview.  
The "Properties ..." dialog box for this module opens.
8. Open the "Addresses" tab.
9. Select the process image partition in the "Process image" drop-down list.
10. Select the "Redundancy" tab.
11. Select the entry "2 modules" in the "Redundancy" drop-down list.

12. Click "Find".

The "Find Redundant Module" dialog box opens.



13. In the "Subsystem" list, select the DP master system in which the redundant signal module is configured.

All the available PROFIBUS addresses in this DP master system are displayed in the "PROFIBUS address" box.

14. In the "PROFIBUS address" box, select the IM 153-2 in which the redundant signal module is configured.

The redundancy-capable signal modules available in this IM 153-2 for which no redundancy has yet been configured are displayed in the "Redundant module" list.

15. Select the signal module you want to use as a redundant signal module in the "Redundant module" list.

16. Click "OK" to close the dialog box.

17. In the "Additional parameters" area, make any additional settings required for input modules.

18. Click "OK".

### **Additional information**

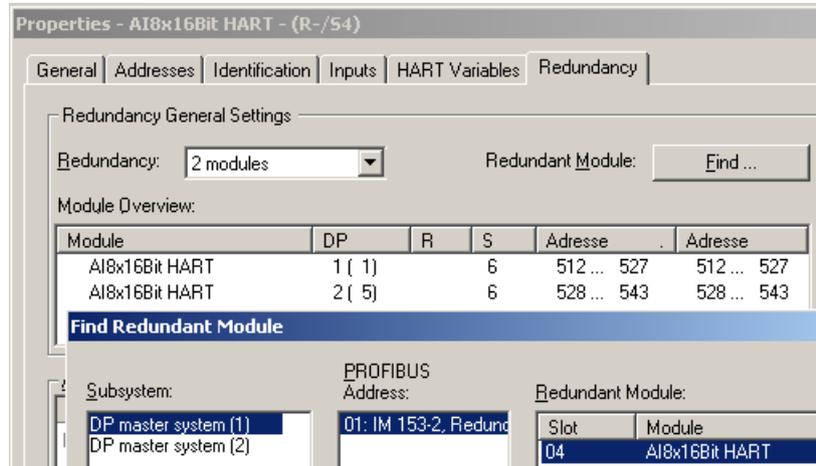
- Online help on *STEP 7*
- Documentation *Process Control System PCS 7; PCS 7 - Released Modules*
- Manual *Automation System S7-400H; Fault-tolerant Systems*

### **4.4.4 How to configure the redundancy for HART field devices**

HART field devices can be configured with redundant modules. HART field devices can only be redundant, if they are configured separately, for example, by a 1 of 2 selection.

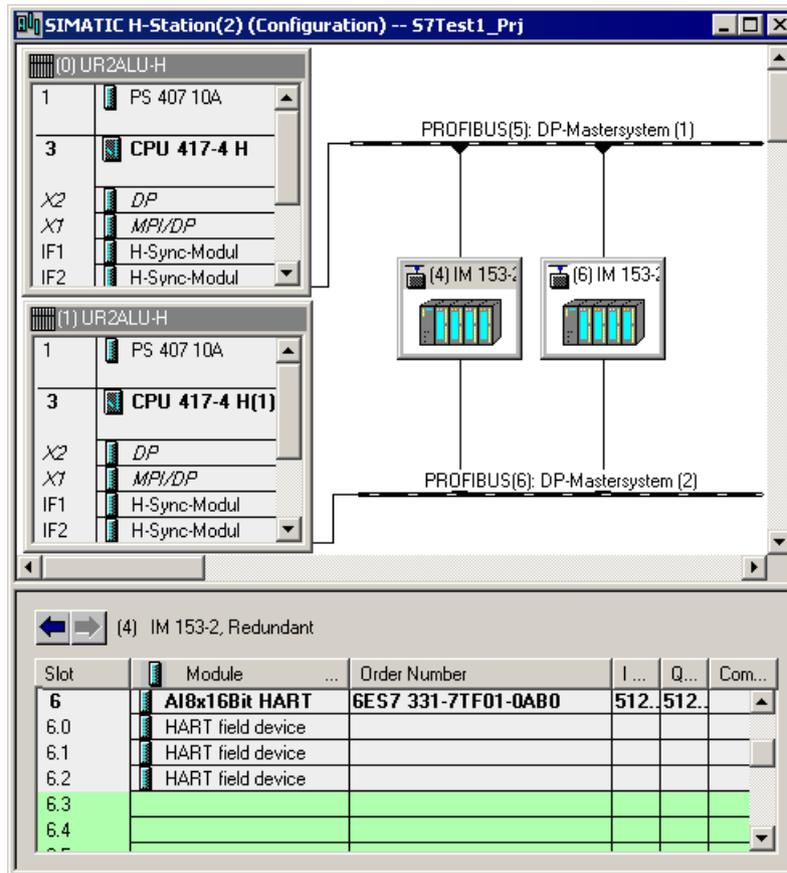
## Procedure

1. Configure redundant modules for HART field devices in HW Config as described in section "How to configure redundant I/O modules (Page 129)".



In the example, the module on slot 6 is configured in each case:

- ET 200M station with PROFIBUS address 4: Module 6
  - ET 200M station with PROFIBUS address 6: Module 6
2. Place the "HART field device" in the detail view of the redundant module. In the example, module 6 on ET 200M station with PROFIBUS address 4.



- Place the "HART field device" in the detail view of the redundant module. In the example, module 6 on ET 200M station with PROFIBUS address 6.
- Select the menu command **Station > Save**. The settings are saved.
- Double-click the added HART field device in one of the ET 200M stations. SIMATIC PDM will open.
- Make the necessary settings for the HART field device.

### Retrospect implementation of the module redundancy for HART devices

There are no mechanisms set aside to implement a module redundancy for HART devices in PCS 7.

### Additional information

Operating Manual *Process Control System PCS 7; SIMATIC PDM*

## 4.4.5 How to configure the Y Link

### Introduction

The Y Link consists of two IM 153-2 interface modules and a Y coupler. The Y Link creates a gateway from a redundant DP master system to a non-redundant DP master system.

The following describes how to install and configure the Y Link.

Configuration examples are available in the section "Gateway between redundant and non-redundant PROFIBUS DP (Page 71)".

### Requirements

- The PCS 7 project with a SIMATIC H station is open in SIMATIC Manager.
- A redundant DP master system is configured for the SIMATIC H station in HW Config.

### Procedure

1. In the component view, select the SIMATIC H station and double-click the "Hardware" object in the detail window.  
HW Config opens.
2. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
3. In the current PCS 7 profile, double-click "PROFIBUS DP" and then "DP/PA Link".
4. Select the IM 153-2 interface module whose hardware catalog description is "Y Link".
5. Drag the IM 153-2 interface module to one of the two PROFIBUS DP lines.
6. Enter the PROFIBUS address in the "Properties - PROFIBUS Interface IM 153-2" dialog box and click "OK".
7. Click on "Interface module for PROFIBUS DP" in the "Define Master System" dialog box and click "OK".

## Result

The following figure shows an example configuration in HW Config:

Hardware Catalog

Find:

Profile: PCS7\_

- PROFIBUS DP
  - Additional Field Devices
  - CIR-Object
  - Closed-Loop Controller
  - DP/AS-i
  - DP/PA Link

of product version 2: Redundantly configurable interface module for connecting a non-redundant PROFIBUS-DP ("Y-Link").

PROFIBUS(3): DP master system (4)

PROFIBUS(9): DP master system (5980)

(1) IM 153-2

(3) SIMOCODE-CP

PROFIBUS(4): DP master system (3)

PROFIBUS(9): DP master system (5980)

PROFIBUS address	Module	Order number	...	Fi...	D...	C...
3	SIMOCODE-DP	3UF50.1-3...0-1			1637	

Press F1 to get Help.

## Additional information

- Manual *DP/ PA Link and Y Link Bus Couplings*

### 4.4.6 Configuring DP/PA Link

#### Functionality

When connecting a redundant PROFIBUS DP, the DP/PA Link consists of two IM 153-2 interface modules and one or more DP/PA couplers. The DP/PA coupler is used to build a gateway between a redundant PROFIBUS DP subnet and a non-redundant PROFIBUS PA subnet. When configuring in HW Config in SIMATIC Manager, you can only select the IM 153-2 interface modules and not the DP/PA coupler.

The DP/PA coupler is transparent in regard to addressing and communication. It does not have its own bus address or diagnostic address; it simply forwards message frames. The field devices connected to the PROFIBUS PA are addressed directly from the automation device.

The DP/PA coupler can be reconfigured in runtime but it cannot be replaced.

---

#### Note

You can find a list of PA slaves that can be connected in the manual *SIMATIC Bus Couplers; DP/PA Link and Y Link*. Note that PCS 7 driver blocks are not available for all of the devices listed. Contact the PCS 7 Support Center to check if such a driver block is available for the device you have selected.

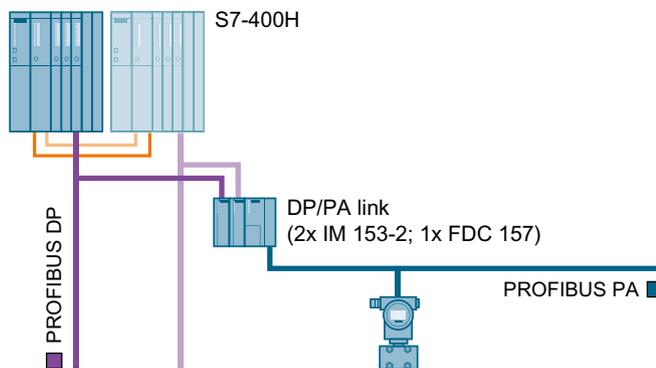
---

#### Requirements

- The PCS 7 project with a SIMATIC H station is open in SIMATIC Manager.
- A redundant DP master system is configured for the SIMATIC H station in HW Config.

#### Example configuration

The following figure shows how the DP/PA Link is used.



#### Procedure

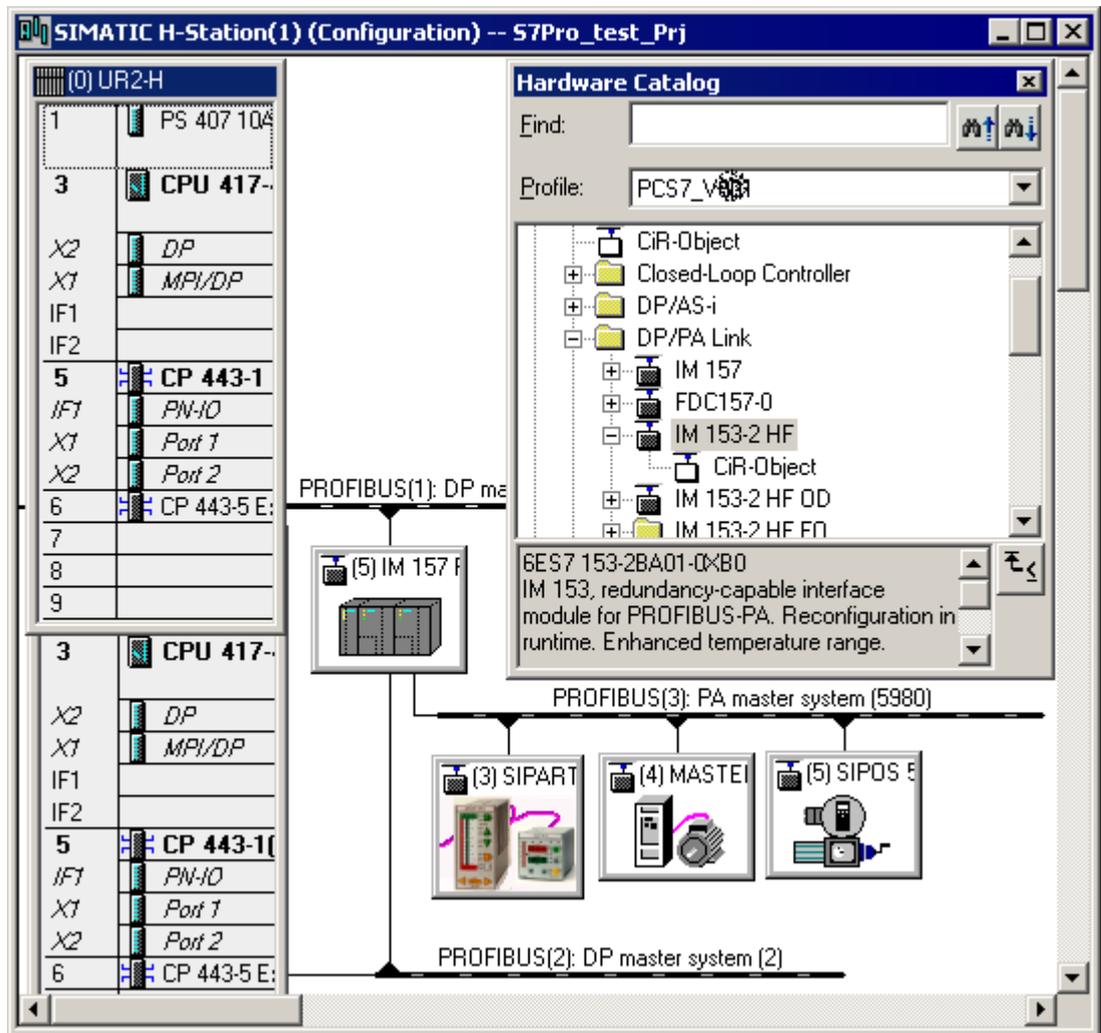
Configure the DP/PA Link as described in the section "How to configure the Y Link (Page 136)".

The DP/PA Coupler does not appear in the hardware catalog for the configuration of the bus system.

When configuring in HW Config, you only need to set the transmission speed for the selected PROFIBUS DP network in the "Network Settings" tab of the "Properties PROFIBUS dialog box.

## Result

The following figure shows the configuration in HW Config with the "PCS7\_V70" library as an example:



## Additional information

- Manual *SIMATIC DP/PA Link and Y Link Bus Couplings*

### 4.4.7 Configuring FF Link

#### Functionality

The FF Link consists of two IM 153-2 FF interface modules and one or more FDC157-0 couplers for a connection to a redundant PROFIBUS DP. The FDC157-0 coupler is used to build a gateway between a redundant PROFIBUS DP subnet and a non-redundant FF segment. During configuration in HW Config, you can only select the FF Link in SIMATIC Manager; the FDC157-0 coupler is not displayed.

The FDC157-0 coupler is not displayed for addressing and communication. It does not have its own bus address or diagnostic address; it simply forwards message frames. The field devices connected to the FF segment are addressed directly from the PLC.

The FDC157-0 coupler can be reconfigured in runtime but it cannot be replaced.

---

#### Note

You can find a list of FF devices that can be connected in the operating instructions *SIMATIC; Bus link; FF Link bus link*. Please note that PCS 7 driver blocks are not available for all of the devices listed. Contact the PCS 7 Support Center to determine if a driver block is available for the device you have selected.

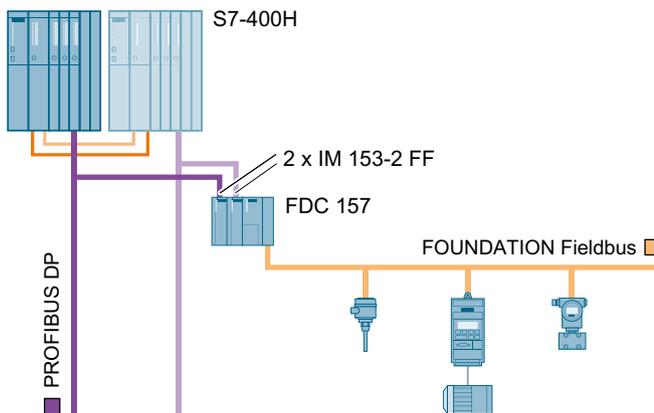
---

#### Requirements

- The PCS 7 project with a SIMATIC H station is open in SIMATIC Manager.
- A redundant DP master system is configured for the SIMATIC H station in HW Config.
- SIMATIC PDM V8.0 SP1 or higher

#### Example configuration

The following figure shows how the FF Link is used:



## Procedure

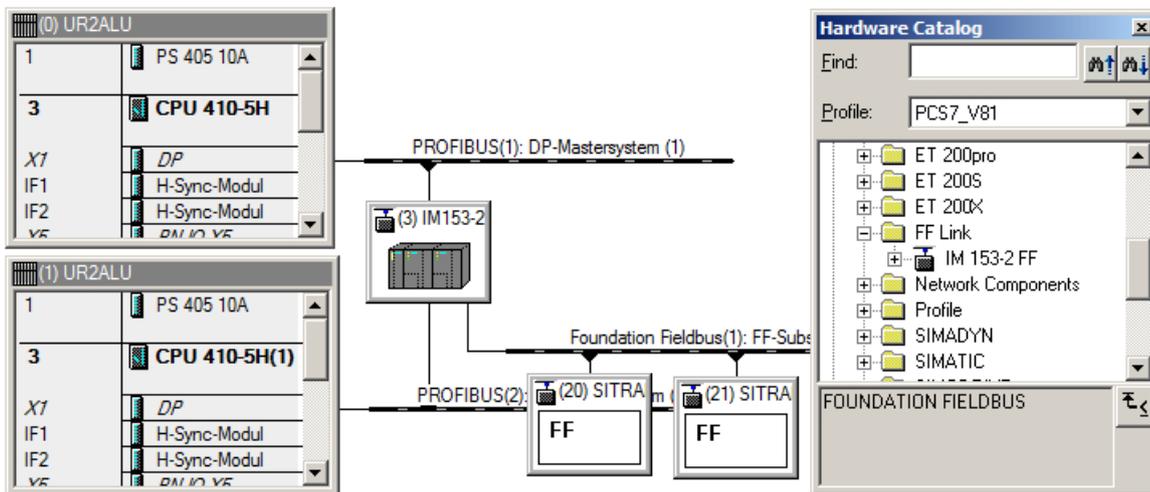
Configure the FF Link in the same way as the PA link. You can find information on this in the section "Configuring DP/PA Link (Page 138)".

The FDC157-0 coupler does not appear in the hardware catalog for the configuration of the bus system.

When configuring in HW Config, you only need to set the transmission rate for the affected PROFIBUS DP network in the "Network Settings" tab of the "FOUNDATION Fieldbus Properties" dialog box.

## Result

The figure below shows the configuration in HW Config with the "PCS7\_V81" library as an example:



## Additional information

- Operating instructions *SIMATIC; Bus links; FF Link bus link*
- Commissioning manual *SIMATIC; PCS 7 - FOUNDATION Fieldbus*
- Operating manual *SIMATIC; SIMATIC PDM*

### 4.4.8 Configuration of redundant signals

You configure only one signal in CDC for redundantly acquired signals.

**Basic procedure**

1. Place one channel block in the CFC chart for each redundantly acquired signal.
2. For redundantly registered signals (e.g. input 1.1 and input 10.1), connect the symbol only with the lowest value address (e.g. input 1.1).
3. Compile the user program when the configuration is completed.  
The required driver blocks are automatically inserted, interconnected and configured during compilation of the user program.

## 4.5 Operator stations

### 4.5.1 Overview of configuration tasks

#### Introduction

The following sections describe how to configure redundancy for operator stations.

#### Overview of configuration tasks

You configure the redundancy functionality of the operator stations by performing the following steps:

Step	What?
1	Configuring the PC stations for a redundant OS server pair (Page 143)
2	Setting the project path for destination OS and standby OS (Page 146)
3	Creating a redundant connection between OS and AS (Page 147)
4	Configuring redundancy for OS servers on the Engineering Station (Page 150)
5	Setting the redundancy connection for OS servers (Page 152)
6	Assignment of S7 programs to the OS (Page 153)
7	Configuring an OS client (Page 154)
8	Configuring an OS client for permanent operability (Page 156)
9	Downloading the SIMATIC PCS 7 project to the target systems (Page 159)

### 4.5.2 How to configure an OS server and its redundant OS partner server

#### Introduction

The following describes the individual steps involved in installing the OS server and its redundant OS partner server.

The example below shows the redundant connection of the two OS servers of the server pair to the plant bus (using two CP 1623 or CP 1613 communication processors, for example, per server).

#### Requirements

- The PCS 7 project with a SIMATIC H station is open in SIMATIC Manager.
- The PCs have two communication processors each for connection to the plant bus.
- Each PC has a standard network adapter for connection to the terminal bus.

## Procedure

---

### Note

Steps 1 to 11 of this procedure have already been performed if an OS server was created in the project.

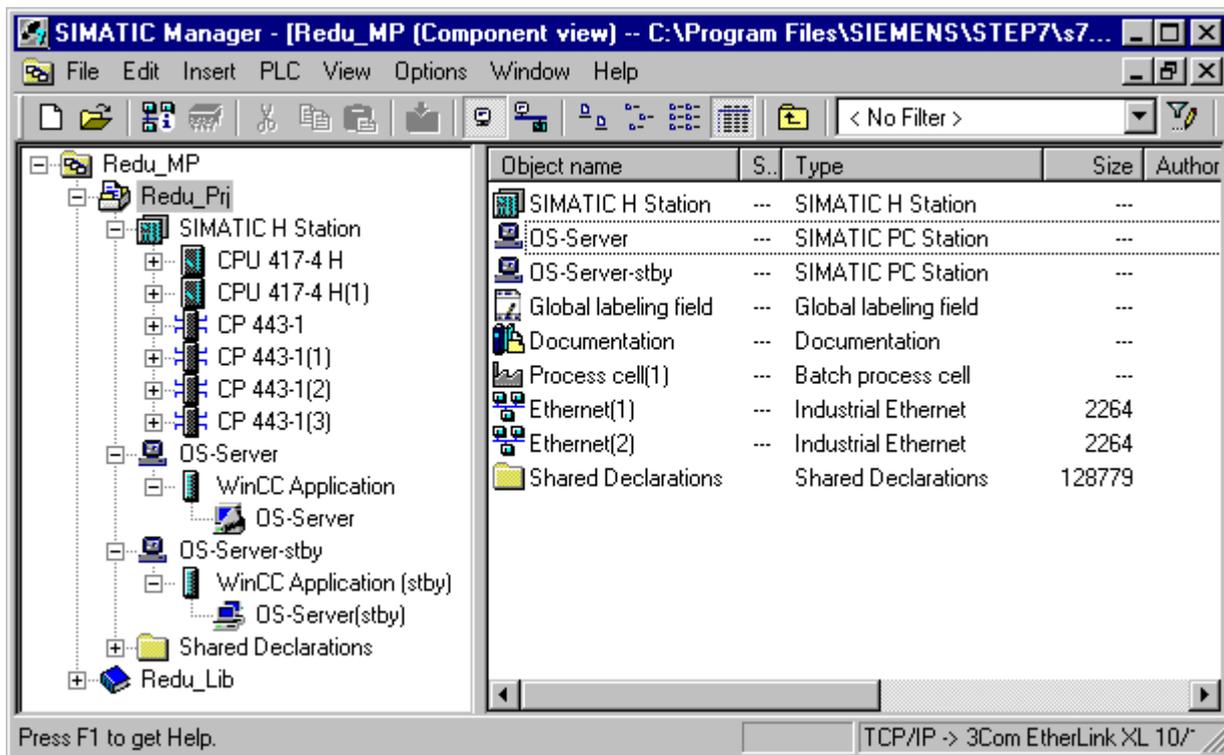
---

1. In the component view of SIMATIC Manager, select the project where you want to add the operator station.
2. Select the menu command **Insert > Station > SIMATIC PC Station**.  
A new SIMATIC PC station is inserted in the selected project.
3. Select the SIMATIC PC station, select the menu command **Edit > Object Properties** and enter the desired name (in the example, OS server).
4. Enter the Windows name of the computer to be used as the OS server in the "Computer name" box.
5. In the component view, select the SIMATIC PC station and double-click the "Configuration" object in the detailed view.  
The hardware configuration of the SIMATIC PC station opens.
6. If the hardware catalog is not visible, select the **View > Catalog** menu command.  
The hardware catalog opens.
7. In the hardware catalog under "SIMATIC PC Station > HMI...", select the "WinCC application" and insert it in the configuration table by means of drag-and-drop.
8. Select the communication processor (CP 1623 or CP 1613) from the "SIMATIC PC Station > CP Industrial Ethernet" folder of the hardware catalog and drag it to the PC station.  
The "Properties - Ethernet Interface" dialog box opens.
9. Set the required address on the bus for the CP.  
Select the "Set MAC address/Use ISO protocol" check box and click "OK".
10. Repeat steps 8 and 9 for the second communication processor.
11. Select the menu command **File > Save**, exit HW Config and change to SIMATIC Manager.
12. In the component view of SIMATIC Manager, select the project where you want to insert the redundant operator station.
13. Select the menu command **Insert > Station > SIMATIC PC Station**.  
A new SIMATIC PC station is inserted in the selected project.
14. Select the SIMATIC PC station, select the menu command **Edit > Object Properties** and enter the desired name (in the example, OS partner server).
15. Enter the Windows name of the computer to be used as the OS partner server in the "Computer name" box.
16. In the component view, select the SIMATIC PC station and double-click the "Configuration" object in the detail window.  
The hardware configuration of the SIMATIC PC station opens.
17. If the hardware catalog is not visible, select the **View > Catalog** menu command.  
The hardware catalog opens.

18. In the hardware catalog under "SIMATIC PC Station > HMI...", select the "WinCC application (stby)" and insert it in the configuration table by means of drag-and-drop.
19. In the hardware catalog under **SIMATIC PC Station > CP Industrial Ethernet**, select the communication processor and drag it to the PC station.  
The "Properties - Ethernet Interface" dialog box opens.
20. Set the required address on the bus for the CP.  
Select the "Set MAC address/Use ISO protocol" check box and click "OK".
21. Repeat steps 19 and 20 for the second communication processor.
22. Select the menu command **File > Save** and exit HW Config.

## Result

Your project should now correspond to the project shown in the following figure. You can change the names of the components as you wish.



## Additional information

- Configuration manual *Process Control System PCS 7; Engineering System*, section "How to Expand a Project with Pre-Configured Stations Using the PCS 7 Wizards"
- Online help for *STEP 7*
- You can find information about NDIS settings of a Maintenance Station in the manual *Process Control System PCS 7; PCS 7 - PC Configuration and Authorization*

### 4.5.3 How to set the project paths of the destination OS and standby OS

#### Introduction

---

##### Note

The procedure described in this section applies to the following servers:

- OS server
- Maintenance server

The description for the OS server is used here.

---

The OS servers of an OS server pair must be made known to each other. You do this by making the following settings for the SIMATIC PC stations:

- For both OS servers: "Destination OS Computer"
- On the "master OS": OS name of the redundant OS server "Standby OS"

The destination OS computer is the Windows name of the PC in the Windows network to which the server data (configuration data) for an OS server of an OS server pair was downloaded.

Master OS and standby OS mean the OS servers that make up an OS server pair.

#### Requirements

- The PCS 7 project is open in SIMATIC Manager.
- Two SIMATIC PC stations have been configured in HW Config as an OS server and OS partner server.

#### Procedure

1. In the component view, select the OS that you want to specify as the master OS.
2. Select the menu command **Edit > Object Properties**.  
The "Properties - [name of the OS]" dialog box opens.
3. Select the "Destination OS and Standby OS" tab.
4. Click the "Browse" button next to the "Path to destination OS computer" box and enter the path to the MCP file of the destination OS.  
The destination OS computer is the computer where the project is to run.  
The mcp file is generated automatically when you create the OS.

---

##### Note

Enter the network path for the destination OS using UNC (Universal Naming Convention) notation: \\Server name\Share name\Directory name

---

5. Select the OS that you want to use as the standby OS from the "Standby OS" list.  
All of the standby operator stations that you have created in SIMATIC Manager are displayed in this drop-down box.

6. Click "OK".  
You have completed all settings for the master OS.
7. In the component view, select the OS that you want to use as the standby OS.
8. Select the menu command **Edit > Object Properties**.  
The "Properties - [name of the OS]" dialog box opens.
9. Select the "Destination OS and Master OS" tab.
10. Click the "Browse" button next to the "Path to destination OS computer" box and enter the path to the MCP file of the destination OS.  
The destination OS computer is the computer where the project is to run.  
The mcp file is generated automatically when you create the OS.
11. Click "OK".  
You have completed all settings for the standby OS.

### Additional information

- Online help for *STEP 7*

## 4.5.4 How to configure a redundant connection between an OS and AS

### Introduction

To complete the configuration of the OS server and its redundant OS partner server, you need to create the fault-tolerant network connections to the AS in NetPro.

### Requirements

- The PCS 7 project is open in SIMATIC Manager.
- The AS is connected to the plant bus in NetPro.
- The plant bus has been configured.
- Two SIMATIC PC stations with network adapters have been configured in HW Config as an OS server and OS partner server.

### Procedure

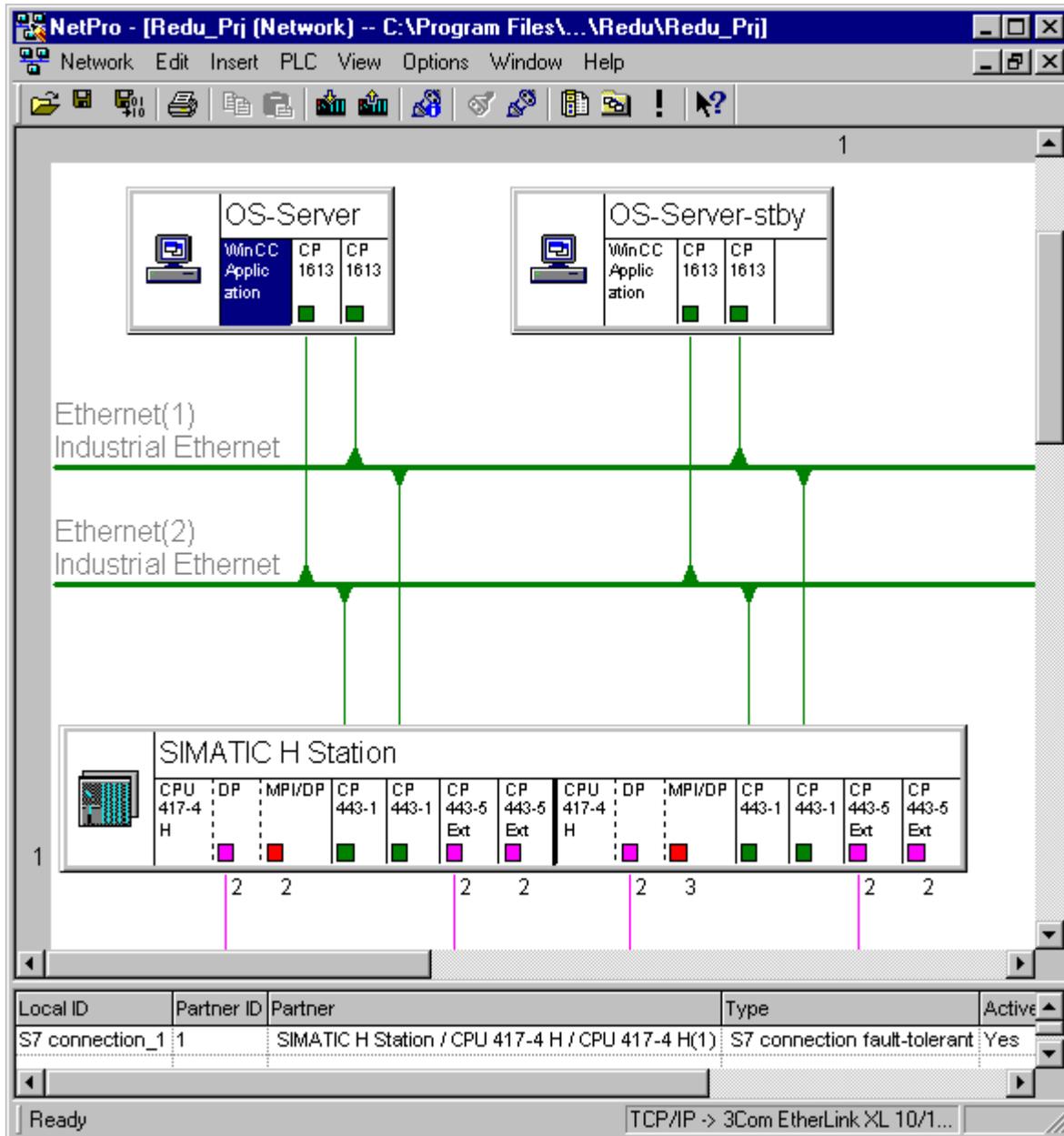
1. Open NetPro in SIMATIC Manager with the menu command **Options > Configure Network**.
2. Select the interface symbol in the first network adapter (e.g. CP 1613) in the picture of the OS server and use the mouse to draw a connection to the plant bus.  
The network adapter is now connected to the plant bus.
3. If two network adapters are configured for the plant bus in the OS server, connect the second network adapter of the OS server to the (redundant) plant bus in the same way.
4. Connect the network adapters of the OS partner server to the plant bus in the same way.

*4.5 Operator stations*

5. Select the WinCC application of the OS server for which you want to configure a fault-tolerant network connection.  
The connection table is displayed in the lower window pane.
6. Select the first empty row in the connection table and select the menu command **Insert > New Connection**.  
The "New Connection" dialog box opens.
7. Select the desired connection partner in the tree.
8. Select the connection type "S7 connection fault-tolerant" in the "Connection" box.
9. Activate the "Show properties before inserting" check box.  
This allows you to make settings or changes to the connection.
10. If redundant CPs for the plant bus are configured in the SIMATIC H stations, activate the check box "Enable max. CP redundancy (with 4 connection paths)" in the "Redundancy" group.
11. Click "OK" to save your entries.

## Result

The following figure shows the redundant network connection of the two OS servers to the SIMATIC H station in NetPro:



## Additional information

- Section "Network components (Page 46)"
- Section "How to configure a fault-tolerant plant bus (Page 112)"
- Online help for *STEP 7*

## 4.5.5 How to configure redundancy for OS servers on the engineering station

### Introduction

Carry out the following configuration tasks on the Engineering Station. The description for the OS server is used here.

### Validity

The procedure described in this section applies to the following servers:

- OS server
- Maintenance server

### Requirements

- The PCS 7 project is open in SIMATIC Manager.
- You configured two SIMATIC PC stations in HW Config for operation as master and standby OS servers.

### Configuring WinCC Explorer "Redundancy"

---

#### Note

Settings in steps 5 and 6: The settings are adopted automatically from the configuration in SIMATIC Manager. It may be necessary to adapt settings if projects have been copied or if you configure in a different order from the one recommended for PCS 7.

---

1. In the component view of SIMATIC Manager, select the OS in the OS server and select the menu command **Edit > Open Object**.  
The WinCC Explorer opens.
2. Select the menu command **Editor > Redundancy > Open** in WinCC Explorer.  
The "Redundancy" application opens.
3. Select the "Activate redundancy" check box.
4. In the "General" tab, select the "Default Master" check box if you want to set the OS server as the default master.

#### Note

Make sure that only one of the two OS servers is the "default master" and that this option is not selected for both of the OS servers in the "Redundancy" dialog box. Problems may otherwise occur during redundancy failover of OS clients.

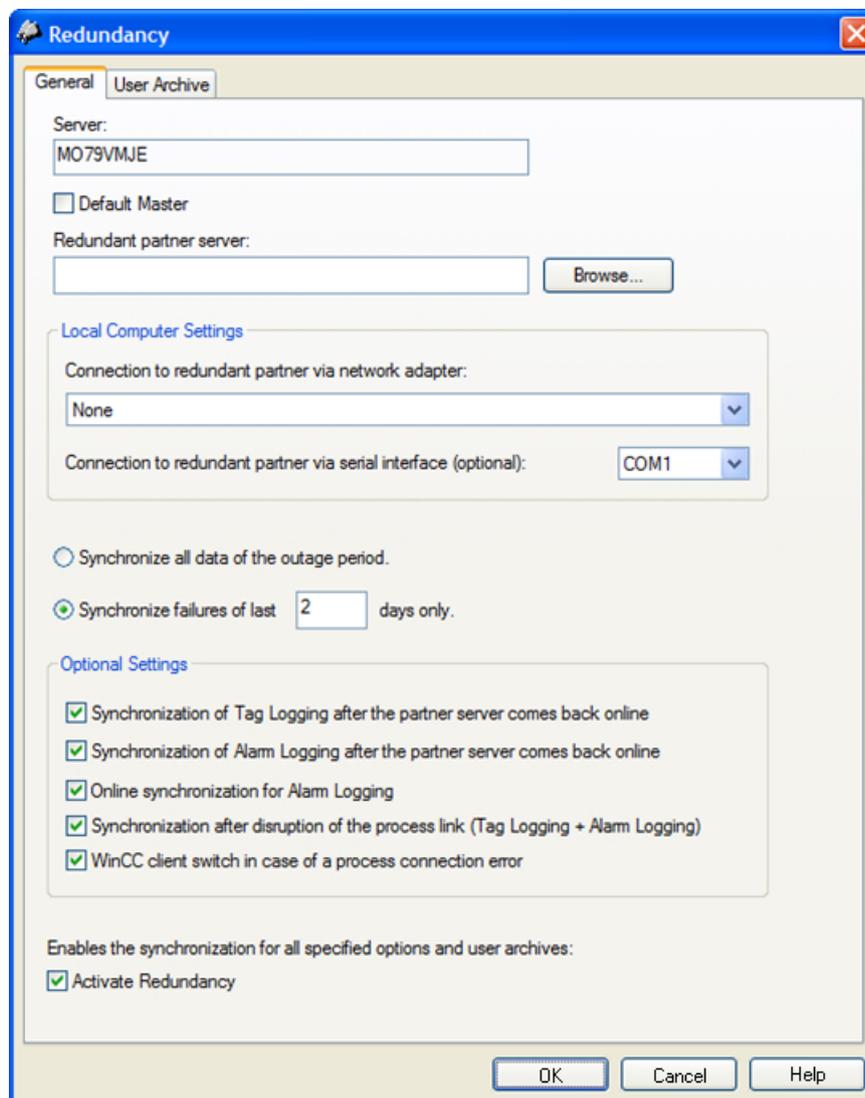
---

5. In the "Redundant Partner Server" field, enter the computer name of the redundant OS server. You can also use the "Browse" button to select an appropriate server from the network.

6. Select the following check boxes as required:
  - Synchronization of Tag Logging after the partner server comes back online
  - Synchronization of Alarm Logging after the partner server comes back online
  - Online synchronization for Alarm Logging
  - Synchronization after process connection error
  - WinCC client failover if the process connection is disrupted
7. Click "OK".

## Result

The "General" tab in the "Redundancy" dialog can be configured as follows:



### Additional information

- Online help for *WinCC*

## 4.5.6 How to set the redundancy connection for OS servers

### Introduction

You will now select the connection path for **the** redundancy connection between 2 OS servers.

You can make the following settings directly on each of the mutually redundant OS servers. The description for OS servers is used here.

### Changing the connection path

---

#### Note

When the redundancy connection is established via a serial interface, you need to reboot the PC station after changing the connection path.

---

### Validity

The procedure described in this section applies to the following servers:

- OS server
- Maintenance server

### Requirements

- The OS server and OS partner server are connected by a redundancy cable. You can use the following as the redundancy cable:
  - Network cable to additional network adapter (free onboard network adapter possible as of PCS 7 V8.0, e.g. from Bundle PC SIMATIC IPC 647C)
  - Null modem cable on the COM port
- OS server and OS partner server are installed as redundant OS servers.
- The "WinCC Redundancy" license key is available on the OS server and OS partner server.

### Procedure

1. Open the Windows Explorer on the OS server.
2. Select the folder "Simatic Shell" in the tree view
  - Windows 7/Windows Server 2008 R2:  
**Desktop > Computer > Simatic Shell**

3. Select the shortcut menu command **Redundancy Settings....**  
The "Redundancy Settings" dialog box opens.
4. Select the connection path through which the OS server pair is connected in the drop-down list.
  - For connection via RJ45 cable:  
In the "Network adapter" drop-down list, select the network adapter to which you want to attach the network cable for the redundant connection between the two PC stations of a server pair.
  - For a serial connection:  
In the "Serial port" dropdown list, select the port to which you want to attach the null-modem cable for the redundant connection between the two PC stations of a server pair: "COM1" or "COM2"

---

**Note**

**One** connection path is permitted between the two PC stations in a redundantly configured server.

---

5. Click "OK".

## 4.5.7 How to assign an S7 program to an OS

### Introduction

The AS-OS assignment of a hierarchy folder in the plant view of SIMATIC Manager results in the following in the component view:

- All CFC and SFC charts inserted in the plant view are stored in the chart folder of the assigned AS.
- All pictures and reports inserted in the plant view are stored in the folder of the assigned OS.

### Requirements

- The PCS 7 project is open in SIMATIC Manager.
- The plant view is activated.

### Procedure

1. Select the hierarchy folder for which you want to make the AS-OS assignment in the plant view.
2. Select the menu command **Edit > Object Properties** and change to the "AS-OS Assignment" tab.
3. From the "Assigned AS" list, select the S7 program that you want to assign to the selected hierarchy folder.

#### 4.5 Operator stations

4. If the lower-level objects have a different assignment and you want to have the same assignment for all lower-level objects, check the "Pass on selected assignment to Pass on all the lower-level objects" check box.

---

**Note**

The "Pass on selected assignment to all lower-level objects" check box is active if the lower-level objects have another assignment or no assignment.

---

5. From the "Assigned OS" list, select the operator station you want to assign to the selected hierarchy folder.
6. If the lower-level objects have another assignment but you prefer all lower-level objects to have the same assignment, select the "Pass on selected assignment to lower-level objects" check box.

---

**Note**

If you select "Area oriented" as the compilation mode, the OS assignment can only be changed for PH folders of the OS area level.

---

7. Click "OK".

### Result

The AS/OS assignment is selected, and the lower-level objects are passed on or not passed on according to your setting.

---

**Note**

If you have divided up the projects so that there is only one OS or one AS in a project, you cannot make an AS-OS assignment.

---

### Additional information

- Online help for the "AS-OS Assignment" tab
- Online help for PH, IEA, and PO

## 4.5.8 How to configure an OS client

### Introduction

The following section describes how to configure two OS clients, for example, that can be interconnected with a redundant pair of OS servers.

## Requirements

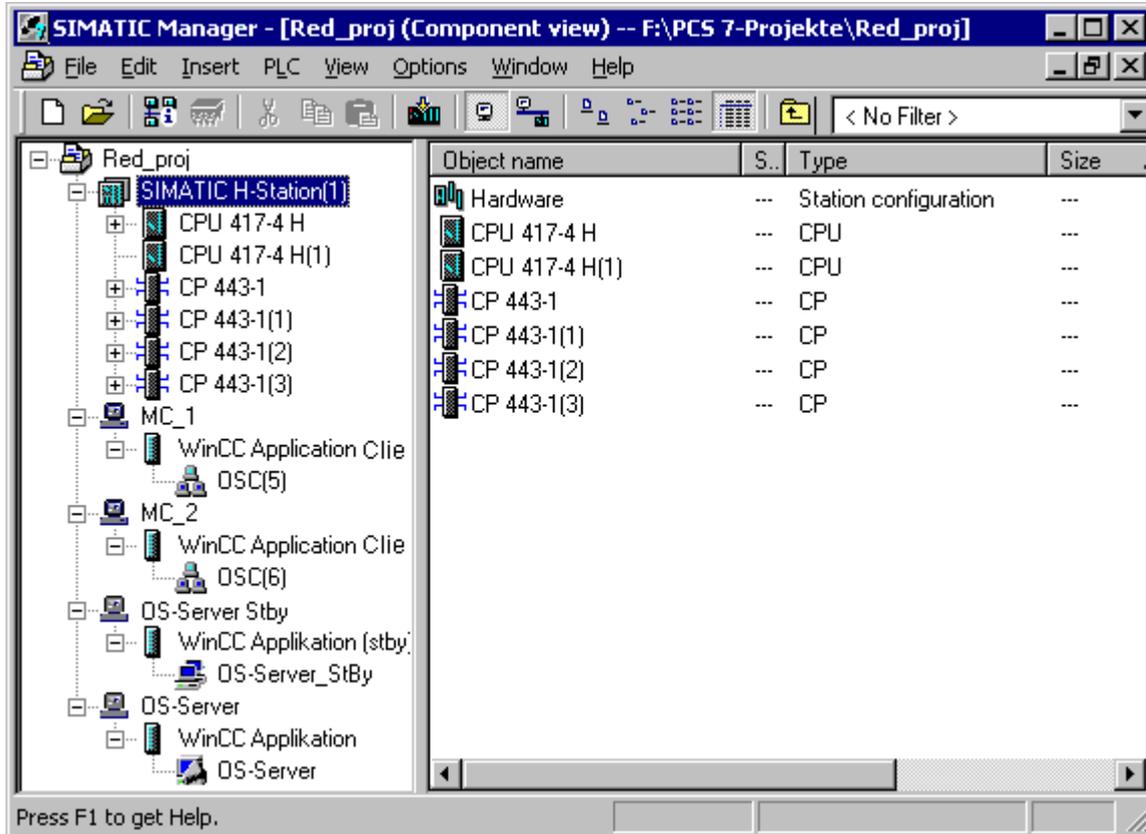
- The PCS 7 project is open in SIMATIC Manager.
- Each PC has a standard network adapter for connection to the terminal bus.

## Procedure

1. In the component view of SIMATIC Manager, select the project in which you want to configure the OS clients.
2. Select the menu command **Insert > Station > SIMATIC PC Station**.  
A new SIMATIC PC station is inserted in the selected project.
3. Select the SIMATIC PC station, select the menu command **Edit > Object Properties** and enter the desired name.
4. In the component view, select the SIMATIC PC station and double-click the "Configuration" object in the detail window.  
The hardware configuration of the SIMATIC PC station opens.
5. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
6. In the hardware catalog under "SIMATIC PC Station > HMI...", select the "WinCC application client" and insert it in the configuration table by means of drag-and-drop.
7. Select the menu command **Station > Save**.
8. Close the hardware catalog.
9. Repeat steps 2 to 8 for the second OS client.

**Result**

Your project should now correspond to the project shown in the following figure. You can change the names of the components as you wish.



**Using reference clients**

You can set up additional monitoring stations using reference clients. They use configured OS clients as a basis.

Refer to the configuration manual *Process Control System PCS 7; Operator Station for more information.*

**4.5.9 How to configure an OS client for permanent operability**

**Introduction**

A minimum of two OS clients are required for permanent operability. A preferred server is specified separately for each client, thus distributing the OS clients to the redundant OS servers. This ensures that the process is continuously available even during a failover from a faulty OS server to the redundant OS partner server.

## Requirements

- The redundant OS server pair has been configured in SIMATIC Manager.
- WinCC redundancy is configured for the OS server (master).
- The OS server (master) has been compiled such that the server data have been generated.
- Two OS clients have been configured in SIMATIC Manager.
- The server data of the OS server (master) has been assigned to the client project.

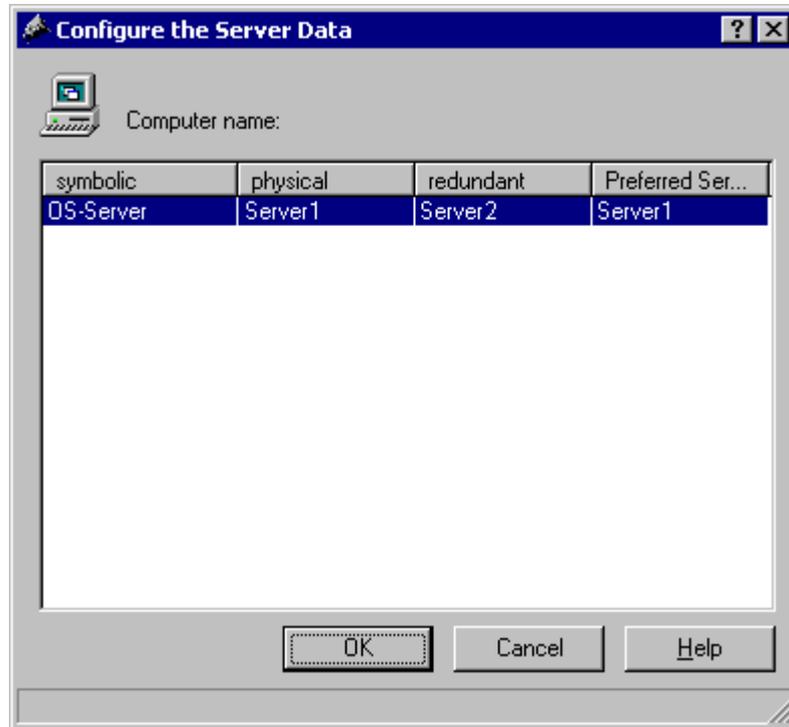
## Procedure

1. Open the WinCC project of the first OS client in the component view in SIMATIC Manager.
2. Open the "Server Data" editor in WinCC Explorer.
3. Select "Configure" command in the shortcut menu.  
The "Configure Server Data" dialog box opens.
4. Click the cell "No preferred server" in the "Preferred server" column.  
A drop-down box appears. The preferred servers available for selection depend on the redundancy configuration of the OS servers and are transferred to the OS client with the server data.
5. Select the preferred OS server for the OS client from the drop-down list box.
6. Close the dialog box.
7. Repeat steps 1 to 6 for the second OS client. Note that you must set the redundant OS partner server as the preferred server for the second OS client.
8. Select the first OS client and select the menu command **Edit > Object Properties**.  
The "Properties [name of OS]" dialog box opens.
9. Select the "Destination OS" tab.
10. Click the "Browse" button next to the "Path to target OS computer" box and enter the path to the MCP file of the OS client.  
The mcp file is generated automatically when you create the OS.
11. Repeat steps 8 to 10 for the second OS client.

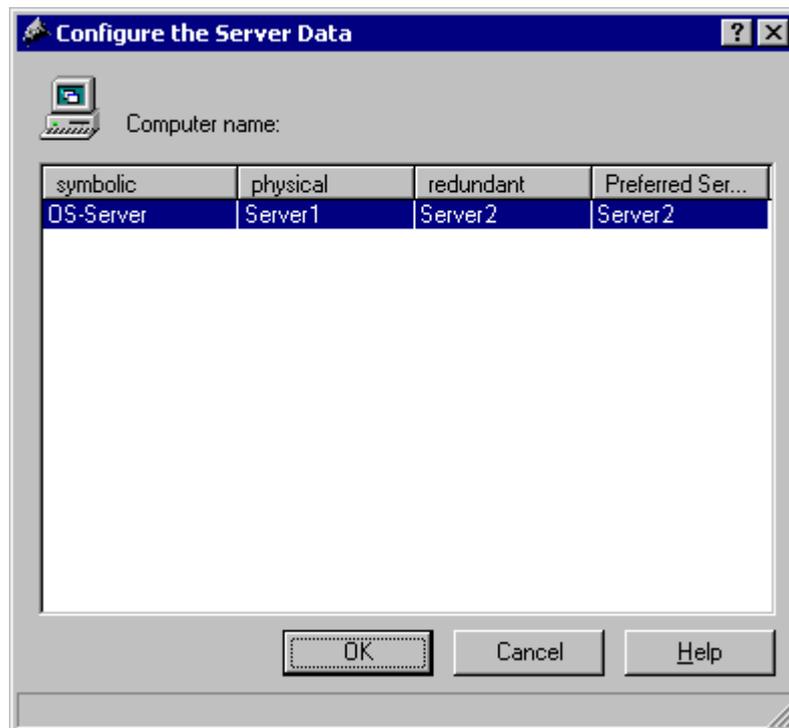
## Result

The "Configure server data" dialog boxes on both OS clients appear as follows:

- Dialog box on OS client 1:



- Dialog box on OS client 2:



## Using reference clients

You can set up additional monitoring stations using reference clients. They use configured OS clients as a basis.

## Additional information

- Online help for *WinCC*
- Configuration manual *Process Control System PCS 7; Operator Station*

## 4.5.10 How to download a SIMATIC PCS 7 project to the target systems

### Introduction

You can download a PCS 7 project that you created in SIMATIC Manager along with the components of the project (AS, OS, BATCH server/client) to the various target systems in a single step with the menu command **PLC > Compile/Download Programs**.

You can also download the various components individually to the PLCs using the menu command **PLC > Download**.

### Requirements

- All of the required SIMATIC PC stations have been configured in SIMATIC Manager.
- The master OS/standby OS assignment has been made.
- The destination paths from the ES to the individual target systems have been configured.
- The AS and all of its components (synchronization modules, CPs, etc.) have been configured.
- All network connections have been configured, saved and compiled in NetPro.
- The destination computer is already equipped with an operating system, a network connection and WinCC.
- The PCS 7 project is open in SIMATIC Manager.

### Procedure

1. Select the project in the component view of SIMATIC Manager.
2. Select the menu command **PLC > Compile and Download Objects**.  
The "Compile and Download Objects" dialog box opens.
3. Check whether all components in the project have been configured for complete compilation/downloading.
4. Click "Start".  
The compile/download operation starts.

### **Sequence when loading redundant OS servers with "Changes-only download" function**

The "Changes-only download" function of a redundant OS server is only available if both partner stations are in process mode (runtime).

For safety reasons, downloading is not performed to a redundant OS server pair at the same time:

- The OS server with the configured application "WinCC Appl. (stby)" is downloaded first.
- Once the downloading of the OS server with the configured application "WinCC Appl. (stby)" has been successfully completed, the partner station with the configured application "WinCC Appl." will be downloaded.

### **Additional information**

- Configuration manual *Process Control System PCS 7; Operator Station*
- Online help for *STEP 7*

## **4.5.11 Evaluating the "@RM\_MASTER" Redundancy Variables with Scripts**

### **Recommendation**

If you decide to evaluate the "@RM\_MASTER" tag with scripts, you should program an operator button that can deactivate this part of the scripts. This way, you will not have to change and reload scripts each time the software is updated.

## 4.6 SIMATIC BATCH Stations

### 4.6.1 Overview of configuration tasks

#### Introduction

The following sections describe how to configure redundancy for SIMATIC BATCH stations.

#### Overview of configuration tasks

You configure the redundancy functionality of the BATCH stations by performing the following steps:

Step	What?
1	Configuring the PC Stations for a redundant BATCH server pair (Page 161)
2	Configuring the PC station for a BATCH client (Page 163)
3	Setting the network adaptor for redundancy monitoring of BATCH servers (Page 165)
4	Setting redundancy of the BATCH servers (Page 166)
5	Downloading the target systems for SIMATIC BATCH (Page 167)

### 4.6.2 How to configure a BATCH server and its redundant BATCH partner server

#### Introduction

The following describes how to configure a redundant BATCH server.

In the following example, the BATCH server is connected to the fault-tolerant terminal bus.

#### Requirements

- The SIMATIC BATCH software package (BATCH Engineering) has been installed in addition to the PCS 7 software.
- The PCS 7 project is open in SIMATIC Manager.

#### Procedure

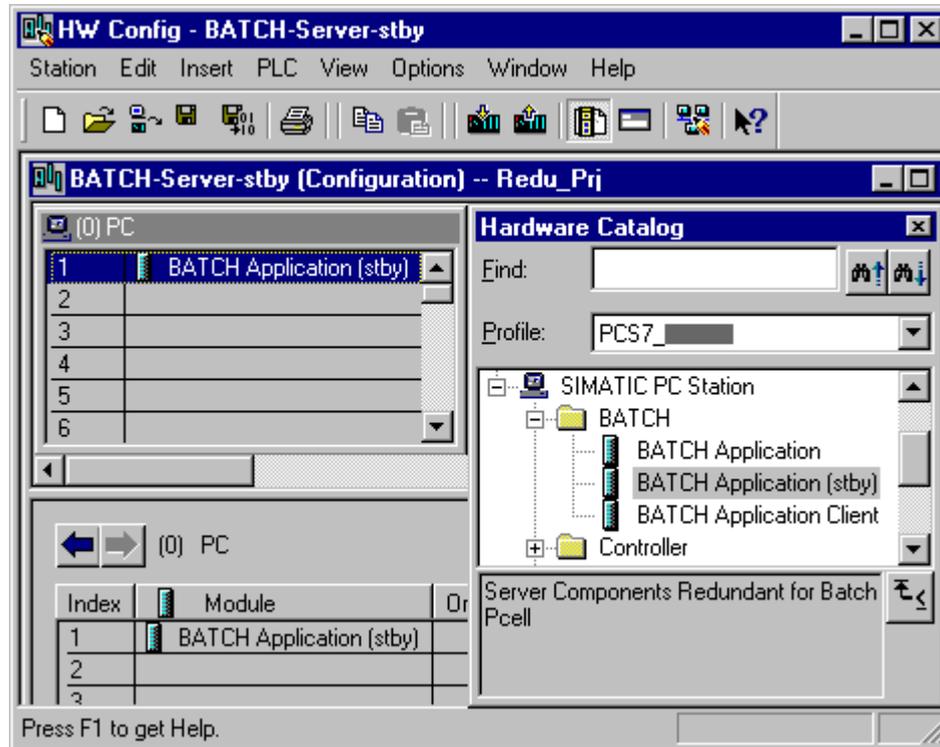
1. In the component view of SIMATIC Manager, select the project into which you want to insert the BATCH server.
2. Select the menu command **Insert > Station > SIMATIC PC Station**.  
A new SIMATIC PC station is inserted in the selected project.
3. Select the SIMATIC PC station, select the menu command **Edit > Object Properties** and enter the desired name (in the example, BATCH server).

#### 4.6 SIMATIC BATCH Stations

4. Enter the Windows name of the computer to be used as the BATCH server in the "Computer name" box.
5. In the component view, select the SIMATIC PC station and double-click the "Configuration" object in the detailed view.  
The hardware configuration of the SIMATIC PC station opens.
6. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
7. In the hardware catalog under "SIMATIC PC Station > BATCH...", select the "BATCH application" and insert it in the configuration table by means of drag-and-drop.
8. Select the menu command **File > Save**, exit HW Config and change to SIMATIC Manager.
9. In the component view of SIMATIC Manager, select the project into which you want to insert the redundant BATCH server.
10. Select the menu command **Insert > Station > SIMATIC PC Station**.  
A new SIMATIC PC station is inserted in the selected project.
11. Select the SIMATIC PC station, select the menu command **Edit > Object Properties** and enter the desired name (in the example, BATCH partner server).
12. Enter the Windows name of the computer to be used as the BATCH partner server in the "Computer name" box.
13. In the component view, select the SIMATIC PC station and double-click the "Configuration" object in the detail window.  
The hardware configuration of the SIMATIC PC station opens.
14. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
15. In the hardware catalog under "SIMATIC PC Station > BATCH...", select the "BATCH application (stby)" and insert it in the configuration table by means of drag-and-drop.
16. Select the menu command **File > Save** and exit HW Config.

## Result

The following figure shows an example configuration of a SIMATIC PC station with BATCH application (stby):



## Additional information

- Configuration manual *Process Control System PCS 7; Engineering System*, section "How to Expand a Project with Pre-Configured Stations Using the PCS 7 Wizards"
- Manual *Process Control System PCS 7; SIMATIC BATCH*

### 4.6.3 How to configure a BATCH client

#### Introduction

A BATCH client and a OS client are often run together on one SIMATIC PC station. You configure both client applications in HW Config in a SIMATIC PC station.

#### Requirements

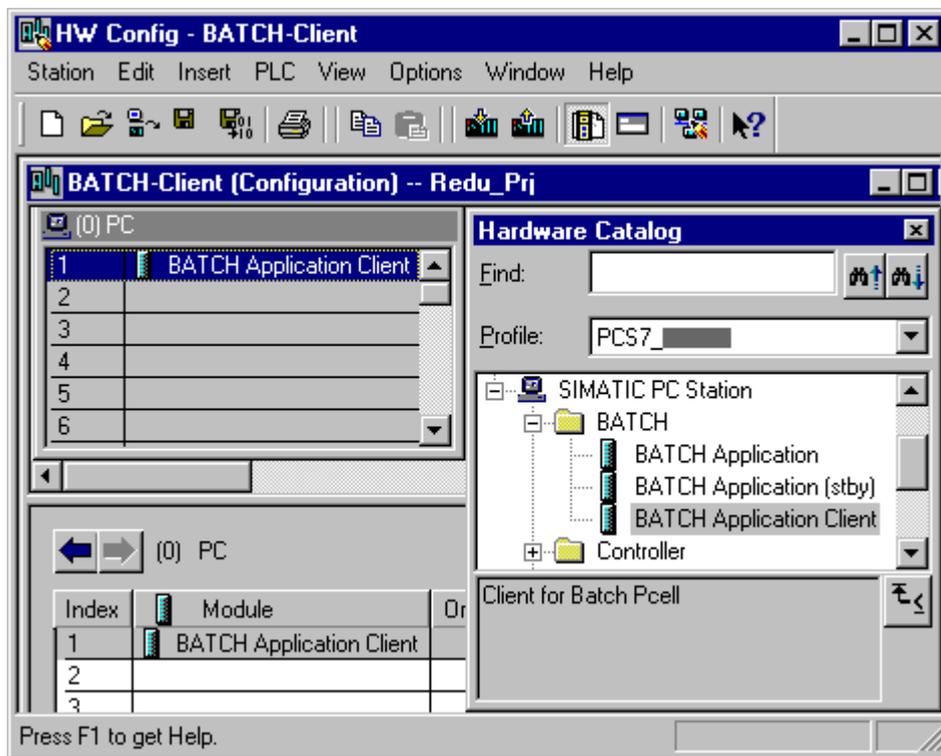
- The SIMATIC BATCH software package (BATCH Engineering) has been installed in addition to the PCS 7 software.
- The PCS 7 project is open in SIMATIC Manager.

**Procedure**

1. In the component view of SIMATIC Manager, select the project into which you want to insert the BATCH client.
2. Select the menu command **Insert > Station > SIMATIC PC Station**.  
A new SIMATIC PC station is inserted in the selected project.
3. Select the SIMATIC PC station, select the menu command **Edit > Object Properties** and enter the desired name.
4. Enter the name of the computer to be used as the BATCH client in the "Computer name" box.
5. In the component view, select the SIMATIC PC station and double-click the "Configuration" object in the detailed view.  
The hardware configuration of the SIMATIC PC station opens.
6. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
7. Under "SIMATIC PC Station > BATCH..." in the hardware catalog, select the "BATCH application client" and insert it in the configuration table by means of drag-and-drop.
8. Save your current settings and close HW Config.

**Result**

The following figure shows the SIMATIC PC station with BATCH application client configured in HW Config:



## Additional information

- Manual *Process Control System PCS 7; SIMATIC BATCH*

## 4.6.4 How to set the redundancy monitoring of BATCH servers

### Introduction

A local Ethernet network needs to be built in PCS 7 for redundancy monitoring of redundant BATCH servers.

### Requirements

- A network adapter for the local Ethernet network is available for redundancy monitoring on each BATCH server of a server pair (referred to below as the 3rd network adapter).
- All software components have been installed on the BATCH servers.

### Procedure

1. Open the dialog window "Network connections" via the **Control Panel**.
2. Select the menu command **Advanced > Advanced Settings**.
3. The terminal bus must be at the top of the list for the connections. Set the 3rd network adapter in the list under the terminal bus.
4. Deactivate the options "Client for Microsoft Networks" and "File and Printer Sharing ..." in the "Network Adapters and Bindings" tab for the 3rd network adapter
5. Click "OK".
6. In the "LAN or High-speed Internet" list of the "Network Connections" dialog box, select the 3rd network adapter and then select the menu command **File > Properties**.
7. Check the "Internet Protocol (TCP/IP)" box and deactivate all other elements.
8. Select "Internet Protocol (TCP/IP)".
9. Click "Properties".  
The "Properties of Internet Protocol (TCP/IP)" dialog box opens.
10. Set the "local" IP address in the "General" tab.

---

#### Note

Enter different IP addresses for the master server and standby server from a private subnet range (e.g., subnet 192.168.0.0) that cannot be routed to the WAN.

---

11. Click "OK".

## 4.6.5 How to configure the redundancy connection for BATCH servers on the engineering station

### Introduction

Additional tasks must be performed in the engineering and for setting up the PC stations for redundant BATCH servers:

- On the engineering station:  
Check the default engineering settings in effect
- On each BATCH server:  
Set the network adapter for redundancy monitoring

### Time needed for ending process mode of a BATCH server

The time needed for ending process mode of a BATCH server depends on the size of the SIMATIC BATCH configuration. The redundancy partner reports a fault on the BATCH server after the configured time. This time is set for redundant BATCH servers so that it is slightly longer than the time the BATCH server needs to normally end process mode in this plant.

### Requirements

- The SIMATIC BATCH software package (BATCH Engineering) has been installed in addition to the PCS 7 software.
- The PCS 7 project is open in SIMATIC Manager.
- The configuration of the server pair for BATCH server in HW Config is completed.
- A network adapter is set up for redundancy monitoring via an Ethernet connection on each BATCH server.

### Checking the configuration settings

1. Select the project in the component view of SIMATIC Manager.
2. Select the menu command **Options > SIMATIC BATCH**.  
The "Plant Data" dialog box opens.
3. Select the project in the tree view.
4. Open the "Distribution" tab. Click "Update". Check the displayed settings.
5. Open the "OS Objects" tab. Click "Update". Check the selected message OS.
6. Open the "System Response" tab. Click "Update".
7. Check the displayed settings in the "Startup response" group.  
You can find additional information about this in the manual *Process Control System PCS 7; SIMATIC BATCH*.
8. In the "Times" group, enter the required time in the "End" input box.

## Additional information

- Manual *Process Control System PCS 7; SIMATIC BATCH*

## 4.6.6 How to set the redundancy connection for BATCH servers

### Introduction

You will now select the connection path for the redundancy connection between 2 BATCH servers.

You can make the following settings directly on each of the mutually redundant BATCH servers.

---

#### Note

##### Shared server for OS and SIMATIC BATCH

The configuration for redundancy connection has to be performed only once.

---

### Requirements

- BATCH server and BATCH partner server are connected to an additional network adapter via a redundancy cable.
- BATCH server and BATCH partner server are installed as redundant BATCH servers.

### Procedure

1. Open the Windows Explorer on the BATCH server.
2. Select the folder My Computer > Simatic Shell in the tree view.
3. In the shortcut menu, select the menu command **Set Redundancy ....**  
The "Redundancy Settings" dialog box opens.
4. In the drop-down list under the "Network Adapter" group, select the network adapter through which the redundancy communication to the partner server should be established.
5. Perform steps 1 to 4 for each partner server.

## 4.6.7 How to download the target systems for SIMATIC BATCH

### Introduction

You can download a PCS 7 project that you created in SIMATIC Manager along with the components of the project (AS, OS, BATCH server/client) to the various target systems in a single step with the menu command **PLC > Compile/Download Programs**.

## Requirements

- The PCS 7 project is open in the Component view in the SIMATIC Manager.
- The SIMATIC BATCH configuration is completed.
- The Batch plant is compiled.

## Downloading via SIMATIC BATCH

1. Select the menu command **Options > SIMATIC BATCH**.  
The "Plant Data" dialog box opens.
2. Select the plant object in the tree view.
3. Click "Download".  
In the "Download from <plant>" dialog box, all PC stations for BATCH servers (single, redundant), DB servers and BATCH clients are displayed with information about their download status.
4. Click "Start".  
The plant object is downloaded.

## Additional information

- Manual *Process Control System PCS 7; SIMATIC BATCH*

## 4.7 SIMATIC Route Control stations

### 4.7.1 Overview of configuration tasks

#### Introduction

The following sections describe how to configure redundancy for SIMATIC Route Control stations.

#### Overview of configuration tasks

You configure the redundancy functionality of the SIMATIC Route Control stations by performing the following steps:

Step	What?
1	Configuring the PC stations for a redundant Route Control server pair (Page 169)
2	Configuring the PC station for a Route Control client (Page 171)
3	Creating a redundant connection between Route Control server and AS (Page 174)
4	Creating a Route Control server (Page 177)
5	Downloading the target systems for Route Control (Page 177)

### 4.7.2 How to configure a Route Control server and its redundant Route Control partner server

#### Introduction

The following describes how to configure a redundant Route Control server.

In the following example, the Route Control server is connected redundantly to the plant bus via communication processors (two CP 1623 or CP 1613 per server).

#### Requirements

- The SIMATIC Route Control software package (Route Control Engineering) has been installed in addition to the PCS 7 software.
- The PCS 7 project is open in SIMATIC Manager.

#### Procedure

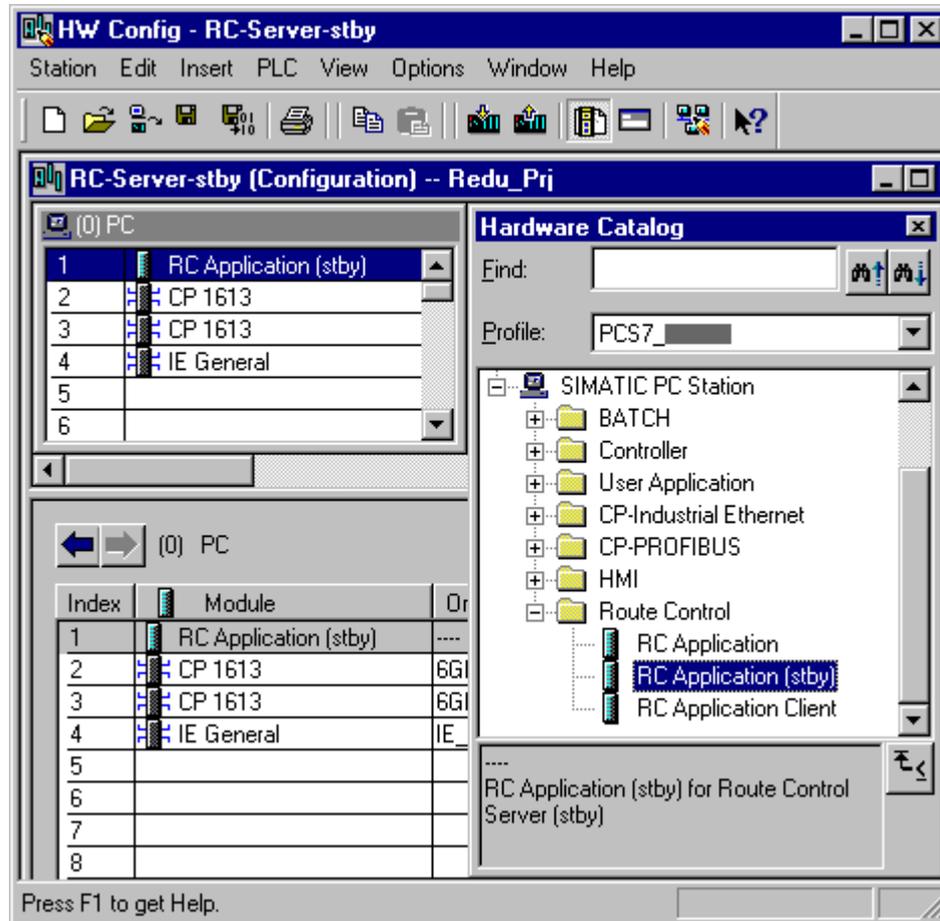
1. In the component view of SIMATIC Manager, select the project into which you want to insert the Route Control server.
2. Select the menu command **Insert > Station > SIMATIC PC Station**.  
A new SIMATIC PC station is inserted in the selected project.

*4.7 SIMATIC Route Control stations*

3. Select the SIMATIC PC station, select the menu command **Edit > Object Properties** and enter the desired name (in the example, Route Control server).
4. Enter the Windows name of the computer to be used as the Route Control server in the "Computer name" box.
5. In the component view, select the SIMATIC PC station and double-click the "Configuration" object in the detailed view.  
The hardware configuration of the SIMATIC PC station opens.
6. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
7. In the "SIMATIC PC Station > Route Control ..." folder of the hardware catalog, select "RC application" and insert it in the configuration table by means of drag-and-drop.
8. In the "SIMATIC PC Station > CP Industrial Ethernet" folder of the hardware catalog, select the communication processor and drag it to the PC station.  
The "Properties - Ethernet Interface" dialog box opens.
9. Set the required address on the bus for the CP.  
Select the "Set MAC address/Use ISO protocol" check box and click "OK".
10. Repeat steps 8 and 9 for the second communication processor.
11. Select the menu command **File > Save**, exit HW Config and change to SIMATIC Manager.
12. In the component view of SIMATIC Manager, select the project into which you want to insert the redundant Route Control server.
13. Select the menu command **Insert > Station > SIMATIC PC Station**.  
A new SIMATIC PC station is inserted in the selected project.
14. Select the SIMATIC PC station, select the menu command **Edit > Object Properties** and enter the desired name (in the example, Route Control partner server).
15. Enter the Windows name of the computer to be used as the Route Control partner server in the "Computer name" box.
16. In the component view, select the SIMATIC PC station and double-click the "Configuration" object in the detail window.  
The hardware configuration of the SIMATIC PC station opens.
17. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
18. Under "SIMATIC PC Station > Route Control ..." in the hardware catalog, select "RC application (stby)" and insert it in the configuration table by means of drag-and-drop.
19. If redundant communication processors are installed for each PC station, repeat steps 8 and 9 for the second communication processor.
20. Select the menu command **File > Save** and exit HW Config.

## Result

The following figure shows an example configuration of a SIMATIC PC station with Route Control application (stby):



## Additional information

- Configuration manual *Process Control System PCS 7; Engineering System*, section "How to Expand a Project with Pre-Configured Stations Using the PCS 7 Wizards"
- Manual *Process Control System PCS 7; SIMATIC Route Control*

### 4.7.3 How to configure a Route Control client

#### Introduction

Below you find out how to configure a redundant Route Control client in HW Config.

## Requirements

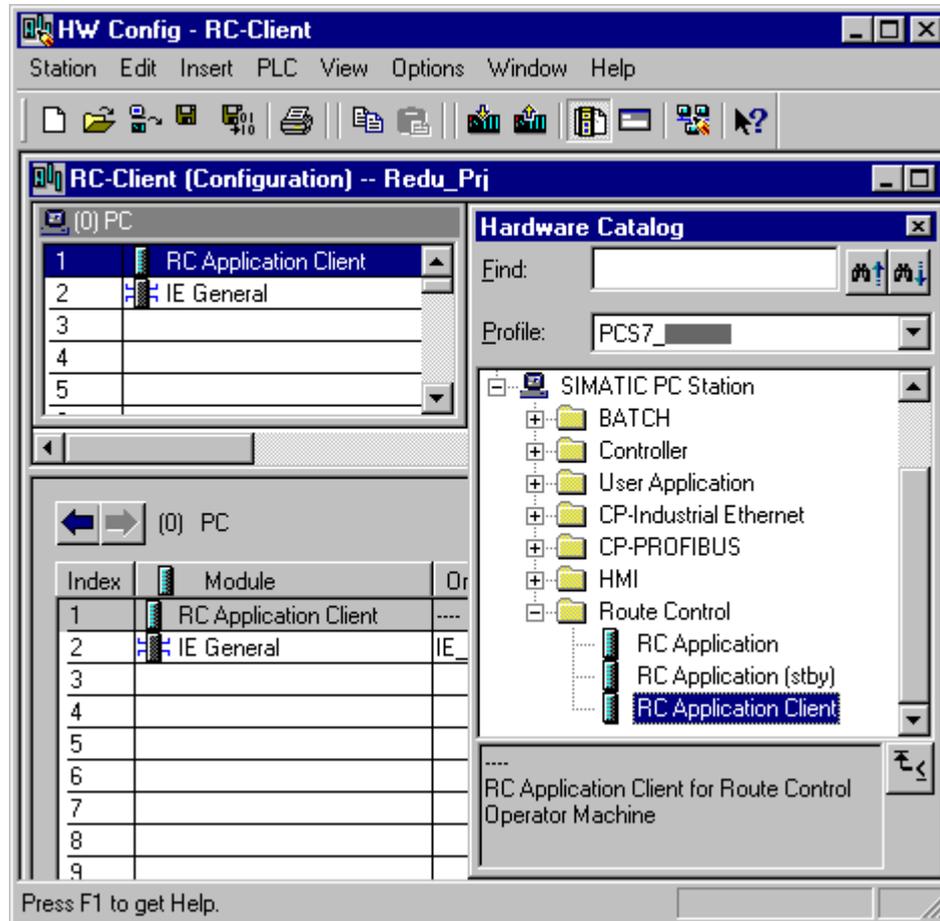
- The SIMATIC Route Control software package (Route Control Engineering) has been installed in addition to the PCS 7 software.
- The PCS 7 project is open in SIMATIC Manager.

## Procedure

1. In the component view of SIMATIC Manager, select the project into which you want to insert the Route Control client.
2. Select the menu command **Insert > Station > SIMATIC PC Station**.  
A new SIMATIC PC station is inserted in the selected project.
3. Select the SIMATIC PC station, select the menu command **Edit > Object Properties** and enter the desired name.
4. Enter the name of the computer to be used as the Route Control client in the "Computer name" box.
5. In the component view, select the SIMATIC PC station and double-click the "Configuration" object in the detailed view.  
The hardware configuration of the SIMATIC PC station opens.
6. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
7. Under "SIMATIC PC Station > Route Control ..." in the hardware catalog, select "RC application client" and insert it in the configuration table by means of drag-and-drop.
8. Save your current settings and close HW Config.

## Result

The following figure shows the SIMATIC PC station with Route Control application client (RC application client) configured in HW Config:



### Shared client for OS and Route Control

If a Route Control client and OS client are operated together on a SIMATIC PC station, configure both client applications in HW Config in one SIMATIC PC station.

### Additional information

- Manual *Process Control System PCS 7; SIMATIC Route Control*

## 4.7.4 How to configure a redundant connection between a Route Control server and AS

### Introduction

The redundant connections between the Route Control server and the AS are created in NetPro using SIMATIC Route Control wizards.

### Requirements

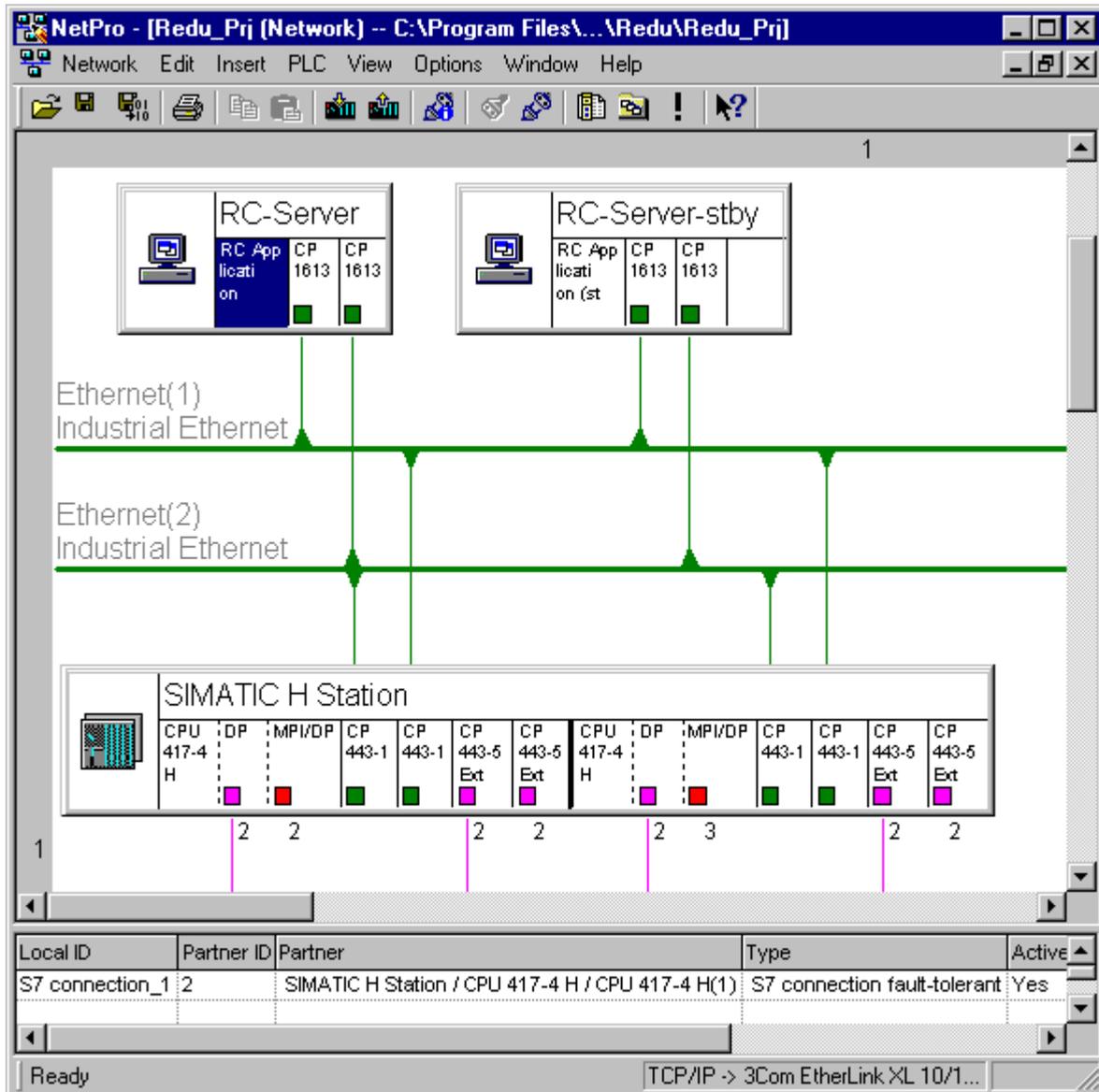
- The PCS 7 project is open in SIMATIC Manager.
- The AS is connected to the plant bus in NetPro.
- The plant bus has been configured.
- Two SIMATIC PC stations have been configured in HW Config as a Route Control server and Route Control partner server with network adapters.

### Procedure

1. In the SIMATIC Manager, select the menu command **Options > SIMATIC Route Control > Wizard**.
2. In the "Introduction" dialog box of the wizard, click "Next".  
The "What do you want to do?" dialog box opens.
3. In the "Generate S7 connections" group, activate the check box "AS-Server connection information". Click "Next".
4. Make the settings according to the plant configuration.  
The Route Control wizard automatically creates a fault-tolerant connection when a fault-tolerant system is the connection partner.
5. When the Route Control server and SIMATIC H station are each connected to the plant bus with 2 network adapters, the following additional steps need to be performed:
  - Open NetPro in SIMATIC Manager with the menu command **Options > Configure Network**.
  - Select the Route Control application of the Route Control server for which you want to configure a fault-tolerant network connection.  
The connection table is displayed in the lower window pane.
  - Select the connection to the SIMATIC H station in the connection table.
  - Select the menu command **Edit > Object properties**.  
The "Properties... S7 connection" dialog box opens.
  - Select the "General" tab.
  - To use 4-way redundancy, activate the check box "Enable max. CP redundancy (with 4 connection paths)".
  - Click "OK".

## Result

The following figure shows the redundant network connection to the automation system for both Route Control servers in NetPro. The example plant is configured with a redundant fault-tolerant plant bus. Each PC station and each CPU is connected to the plant bus with 2 network adapters:



## Additional information

- Section "How to configure a fault-tolerant plant bus (Page 112)"
- You can find information about the Route Control wizards in the manual *Process Control System PCS 7; SIMATIC Route Control*.
- Online help for *STEP 7*

## 4.7.5 How to set the redundancy connection for Route Control servers

### Introduction

You will now select the connection path for the redundancy connection between two Route Control servers.

You can make the following settings directly on each of the mutually redundant Route Control servers.

### Changing the connection path

---

#### Note

When the redundancy connection is established via a serial interface, you need to reboot the PC station after changing the connection path.

---

### Validity

The procedure described in this section applies to Route Control servers.

### Requirements

- The Route Control server and Route Control partner server are connected by a redundancy cable.  
You can use the following as the redundancy cable:
  - Null modem cable on the COM port
  - Network cable on an additional network adapter
- Route Control server and Route Control partner server are installed as redundant Route Control servers.

### Procedure

1. Open the Windows Explorer on the Route Control server.
2. Select the folder My Computer > Simatic Shell in the tree view.
3. In the shortcut menu, select the menu command **Set Redundancy ....**  
The "Redundancy Settings" dialog box opens.

4. Select the connection path through which the Route Control server pair is connected in the drop-down list.
  - For connection via RJ45 cable:  
In the "Network adapter" drop-down list, select the network adapter to which you want to attach the network cable for the redundant connection between the two PC stations of a server pair.
  - For a serial connection:  
In the "Serial port" drop-down list, select the port to which you want to attach the null-modem cable for the redundant connection between the two PC stations of a server pair: "COM1" or "COM2"
5. Click "OK".

## 4.7.6 How to set the redundancy of the Route Control servers

### Introduction

You only have to configure the PC stations in the SIMATIC Manager for redundant Route Control servers.

In the object properties of the PC station, the computer name must be configured or "Computer name identical to PC station name" the check box must be activated.

### Additional information

- Section "How to configure a Route Control server and its redundant Route Control partner server (Page 169)"

## 4.7.7 How to download the target systems for Route Control

### Introduction

For Route Control plants with redundant Route Control servers, you should always download the Route Control configuration to the Route Control server and the Route Control clients.

### Additional information

- You can find information about downloading the Route Control server in the manual *Process Control System PCS 7; SIMATIC Route Control*.
- You can find information about downloading the configuration to the Route Control client in the manual *Process Control System PCS 7; SIMATIC Route Control*.

## 4.8 Archive servers (Process Historian and Information Server)

### 4.8.1 How to configure a Process Historian and its redundant partner server

#### Introduction

This section describes the individual steps involved in creating the Process Historian and its redundant partner server.

In the following example, the two Process Historians of the server pair are connected redundantly to the terminal bus.

#### Requirements

- The PCS 7 project is open in SIMATIC Manager.
- Each PC has two network adapters for connection to the terminal bus.

#### Procedure

---

##### Note

Steps 1 to 8 of this procedure have already been performed if a Process Historian was created in the project.

---

1. In the component view of the SIMATIC Manager, select the project into which you want to insert the Process Historian.
2. Select the menu command **Insert > Station > SIMATIC PC Station**.  
A new SIMATIC PC station is inserted in the selected project.
3. Select the SIMATIC PC station, select the menu command **Edit > Object Properties** and enter the desired name (in the example: Archive 1).
4. Enter the Windows name of the computer to be used as Process Historian in the "Computer name" box.
5. In the component view, select the SIMATIC PC station and double-click the "Configuration" object in the detailed view.  
The hardware configuration of the SIMATIC PC station opens.
6. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
7. In the hardware catalog under "SIMATIC PC Station > Archive", select the "Process Historian Appl." and insert it in the configuration table by means of drag-and-drop.
8. Select the menu command **Station > Save and compile**, exit HW Config and change to SIMATIC Manager.
9. In the component view of SIMATIC Manager, select the project where you want to insert the redundant operator station.

10. Select the menu command **Insert > Station > SIMATIC PC Station**.  
A new SIMATIC PC station is inserted in the selected project.
11. Select the SIMATIC PC station, select the menu command **Edit > Object Properties** and enter the desired name (in the example: Archive 2).
12. Enter the Windows name of the computer to be used as the Process Historian partner server in the "Computer name" box.
13. In the component view, select the SIMATIC PC station and double-click the "Configuration" object in the detail window.  
The hardware configuration of the SIMATIC PC station opens.
14. If the hardware catalog is not visible, select the menu command **View > Catalog**.  
The hardware catalog opens.
15. In the hardware catalog under "SIMATIC PC Station > Archive", select the "Process Historian Appl. (stby)" and insert it in the configuration table by means of drag-and-drop.
16. Select the menu command **Station > Save and compile** and exit HW Config.

#### **Additional information**

- Configuration manual *Process Control System PCS 7; Engineering System*; section "How to Expand a Project with Pre-Configured Stations Using the PCS 7 Wizards"
- Online help for *STEP 7*



# Component Replacement and Plant Changes

## 5.1 Failure and replacement of bus components

### 5.1.1 Replacement of SIMATIC components in runtime

#### Continuous operation

A crucial factor for continuous operation of fault-tolerant process control systems is the replacement of faulty or failed components in runtime. Replacement of defective components is only possible if fault-tolerant components are used. The redundant components continue to operate and supply the function until the replacement is made. The system is no longer fault-tolerant in this condition.

#### Which components can be replaced in central controllers?

The following components in a **redundantly configured automation system** can be replaced in runtime:

- Central processing units (e.g., CPU 417-4H)
- Power supply modules (e.g., PS 405, PS 407)
- Communication modules
- Synchronization modules and fiber-optic cables
- Interface modules (e.g., IM 460, IM 461)

#### Which components of the distributed I/O can be replaced?

The following components in a **redundantly configured distributed I/O system** can be replaced in runtime:

- DP master (CPU or CP in the AS)
- DP slaves (for example, ET 200M, ET 200iSP)
- Redundant interface modules (for example, IM 153-2 and IM 152-1)
- Input/output modules
- PROFIBUS DP cables

#### Additional information

You can find detailed, step-by-step instructions on the procedure for replacing components in runtime in the manual *Automation System S7-400H; Fault-tolerant Systems*.

The following table is an overview of the descriptions:

For the procedure used to replace components ...	.... refer to the manual <i>Automation System S7-400H; Fault-tolerant Systems</i> in section ...
Central racks	Failure and replacement of a CPU (redundant CPU)
	Failure and replacement of a power supply module
	Failure and replacement of a communication processor
	Failure and replacement of a synchronization module or FO cable
	Failure and replacement of an IM 460 and IM 461 interface module
Distributed I/O	Failure and replacement of distributed I/O components
	Failure and replacement of an input/output or function module
	Failure and replacement of a PROFIBUS DP master
	Failure and replacement of a redundant PROFIBUS DP interface module
	Failure and replacement of a PROFIBUS DP slave
	Failure and replacement of PROFIBUS DP cables

**Note**

**After every component replacement**

Make sure that all systems are free from faults and that the H-system is operating redundantly and without errors.

## 5.1.2 Replacement of bus components in runtime

### Introduction

The information in this section relates to the following bus components

- Bus cable
- Switches, hubs, bridges

### Failure and replacement of bus components

Components of a bus system (plant bus, terminal bus, PROFIBUS) can be replaced when there is no risk of accidentally affecting other components as a result of the replacement.

Before making a replacement, the following aspects must be taken into consideration:

- Bus topology (for example ring structure, spur lines, redundancy connections, disrupted bus cable)
- Connection of the bus system to "master systems":
  - The assignment of clients to servers
  - The connection to time master systems
  - The connection to domain controllers
  - For PCS 7 OS: The setting of preferred servers
- Other disrupted components

### Recommended procedure

If a bus component is partially functional, we recommend the following procedure:

- If repairs are necessary, first replace the defective bus cable.
- Insert a new bus component into the existing system before you remove the old bus component completely.
- Avoid the occurrence of double faults.
- Replace the connection to the connected components in series (not at the same time).

## 5.1.3 Replacement of operator stations in runtime

### Replacement of operator stations

When replacing operator stations, a distinction must be made between:

- Replacing an OS server
- Replacing an OS client

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#### Note

Information on updating operator stations with redundant OS servers in runtime can be found in "guidelines on updating a redundant OS in runtime (Page 208)".

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### Requirements

- The new PC contains the same hardware components.
- An image of the PCs to be replaced is used for the installation.
- The name of the replaced PC is used for the new PC.
- The same IP address is used for the new PC.
- The MAC address is adapted in the project.

### Replacing an OS server

Follow the steps below to replace an OS server:

Step	What?
1	Switch OS clients over to the server that will be remaining in operation.
2	Deactivate and replace the OS server,
3	Check the network addresses and download the configuration data.
4	On the engineering station: Download OS server data (and automatic redundancy update).
5	Start WinCC.
6	Activate process mode.
7	Activate or switch over assigned OS clients.

### Replacing an OS client

Follow the steps below to replace an OS client:

Step	What?
1	Deactivate process mode.
2	Deactivate and replace the OS client.
3	Check the network addresses and download the configuration data.
4	On the engineering station: Download target system (OS client).
5	Activate process mode.

### Changing to a new PCS 7 version

You can find information on how to convert all operator stations of a redundant system to a new PCS 7 version in the manual *Process Control System PCS 7; Software Update without Utilization of New Functions*

## 5.1.4 Replacement of BATCH stations in runtime

### Replacement of BATCH stations

When replacing BATCH stations, a distinction must be made between:

- Replacing a BATCH server
- Replacing a BATCH client

### Requirements

- The new PC contains the same hardware components.
- An image of the PCs to be replaced is used for the installation.
- The name of the replaced PC is used for the new PC.

- The same IP address is used for the new PC.
- The MAC address is adapted in the project.

### Replacing the BATCH server

Follow the steps below to replace a BATCH server:

Step	What?
1	Replace the BATCH server.
2	On the engineering station: Open the BATCH configuration dialog, select PCell, download BATCH server.
3	Start the BATCH server (BATCH server starts up as standby server).

### Replacing the BATCH client

Follow the steps below to replace a BATCH client:

Step	What?
1	Close the BATCH Control Center.
2	Replace the BATCH client.
3	On the engineering station: Open the BATCH configuration dialog, select PCell, download BATCH client.
4	Open the BATCH Control Center.

## 5.1.5 Replacement of Route Control stations in runtime

### Replacement of Route Control stations

When replacing Route Control stations, a distinction must be made between:

- Replacing a Route Control server
- Replacing a Route Control client

### Requirements

- The new PC contains the same hardware components.
- An image of the PCs to be replaced is used for the installation.
- The name of the replaced PC is used for the new PC.
- The same IP address is used for the new PC.
- The MAC address is adapted in the project.

### Replace the Route Control server.

Follow the steps below to replace a Route Control server:

Step	What?
1	Replace the Route Control server.
2	On the engineering station: Open Route Control Engineering and download the Route Control server
3	Start Route Control (Route Control starts as standby server).
4	Update the Route Control servers using the Route Control Center, so that both Route Control servers operate with the same database.

### Replacing the Route Control client

Follow the steps below to replace a Route Control client:

Step	What?
1	Close the Route Control Center.
2	Replacing the Route Control client.
3	On the engineering station: Download Route Control client from the SIMATIC Manager or Route Control Engineering.
4	Open the Route Control Center.

## 5.2 Plant changes in runtime

### Plant changes in runtime

In addition to the options for replacing failed components in runtime as described in the section titled "Failure and replacement of components during operation", the CPU (41x-xH) also supports a **system modification without interrupting the running program**.

### Requirements

- The relevant hardware components are suitable for insertion and removal under voltage.
- The H system with CPU is available. Firmware versions:
  - CPU 412-3H, 414-4H or 417-4H as of firmware version V2.0.0
  - CPU xxx-5H PN/DP (xxx = 410; 412; 414; 416; 417) as of firmware version V6.0.0

### Use cases for plant changes

A plant change in which the hardware of the plant is changes occurs in the following cases:

- Hardware components of a fault-tolerant system are removed.
- Hardware components of a fault-tolerant system are added.
- Hardware components of a fault-tolerant system are replaced by non-identical components.

Plant modification always requires a software modification. Configuration changes are made in HW Config and downloaded to the CPU. The modified hardware is physically replaced, removed or added.

Similar to the events that occur when components are replaced, when the system is modified in runtime, the functions of the modified components are taken over by the corresponding redundant components. The running program is not interrupted.

### Which components can be changed?

changes	Possible modifications
Changes in the CPU	<ul style="list-style-type: none"> <li>• Editing CPU Parameters</li> <li>• Changes to the memory components of the CPU</li> </ul>
Adding for removing modules in central racks	<ul style="list-style-type: none"> <li>• Communication modules</li> <li>• Interface modules (for example, IM 460, IM 461), in de-energized state only</li> </ul>

5.2 Plant changes in runtime

changes	Possible modifications
Adding or removing modules components in distributed I/O modules	<ul style="list-style-type: none"> <li>• DP slaves with redundant interface modules (for example, ET 200M, DP/PA Link, Y Link)</li> <li>• Non-redundant DP slaves in any DP master system</li> <li>• Modules in modular DP slaves</li> <li>• DP/PA Coupler</li> <li>• PA devices (process automation)</li> <li>• FF devices</li> <li>• Use of a free channel or reassignment of a utilized channel on an existing module</li> </ul>
Changing the parameters settings for a module	<ul style="list-style-type: none"> <li>• Editing parameters</li> </ul>

**Additional information**

You can find detailed, step-by-step instructions on the procedure for plant changes in runtime in the manual *Automation System S7-400H; Fault-tolerant Systems*.

**Note**

Note the following information:

- The procedures described for PCS 7 can be found in the *Automation System S7-400H; Fault-tolerant Systems* manual, "Modifying the System During Operation" section.
- Make sure that all systems are free from faults and that the H-system is operating redundantly and without errors after any modification to the plant.
- If you violate one or more rules in this procedure, the fault-tolerant system may respond in ways that restrict its availability, up to and including failure of the entire process control system.

The following table is an overview of the descriptions. The procedures described for making changes in runtime assume that the system is designed redundantly and that your aim is to achieve this again.

For the procedure used to replace components ...	....refer to the manual <i>Automation System S7-400H; Fault-tolerant Systems</i> in section ...
Components	Adding Components in PCS 7
	Removing Components in PCS 7
	Changes to the memory components of the CPU
Parameter	Editing CPU Parameters
	Changing the parameters settings for a module

# Failure, Switchover and Return of Fault-tolerant Components

# 6

## 6.1 I/O

### 6.1.1 Failure of redundant interface modules

#### Functionality

Interface modules can be configured redundantly in the distributed I/O device (ET 200M, ET 200iSP). The interface modules provide the interface to the automation system through the PROFIBUS DP. When there are two interface modules, in other words, the system has been configured with "Redundancy", if one of the two modules fails, the other interface module takes over the automation process without interruption.

#### Failure

If the active interface module fails, there is a bumpless failover to the redundant interface module. In the failover, the master identification changes from the failed interface module to the interface module that is now active.

If the redundant interface module fails, the master identification does not change.

#### Hot restart

When the failed interface module restarts, the redundant interface module keeps the master identification. The master identification changes back to the now replaced or repaired module only if the redundant interface module fails.

### 6.1.2 Failure of redundant I/O modules

#### Functionality

As soon as an error occurs in one of the redundantly configured modules, there is a bumpless failover to the second module, which then takes over the signal processing.

## Failure scenarios

The following faults may occur in a module:

- Hardware or power failure in the module
- Detected signal interference (e.g. wire break, discrepancy)
- Fault on the assigned bus line to an interface module

The driver blocks detect a disturbance:

- At the input signals:  
The disturbed input module or, when channel selectivity is configured, the disturbed channel is passivated and only the signal of the redundant modules is evaluated. A module or channel is passivated when the function blocks can no longer access the respective module or channel.
- At analog output modules:  
Only analog output modules with power outputs can be operated redundantly (0 to 20 mA, 4 to 20 mA). The value to be output is halved and each module outputs one half of the value. If one module fails, the redundant module outputs the entire value.

## Discrepancy with input modules

A discrepancy error at the input value occurs when there is a non-tolerated difference between the input values after the configured discrepancy time has expired. The following parameters should be set to configure the discrepancy:

- For digital input modules:
  - Discrepancy time (maximum allowed time that the redundant input signals can differ)
- For analog input modules:
  - Tolerance window (configured by the percent of the end value of the measuring range)  
Two analog values are the same if they are within the tolerance window.
  - Discrepancy time (maximum allowed time that the redundant input signals are outside the tolerance windows)
  - Value applied  
The value applied is one of the two analog input values that is transferred in the user program.

With discrepancy, information is entered in the diagnostics buffer and a corresponding message is generated.

## Depassivation

Passivated modules or, when channel selectivity is configured, passivated channels are depassivated with the following events:

- When the H system starts up
- When operating state of the H system changes to "Redundant"
- Following a system modification in runtime
- Following depassivation via the maintenance station

- Following a prompt from the user program via an acknowledgement signal, for example, on an OS with a "Depassivation" button at the block
- After pulling/plugging a module
- Following a diagnostic interrupt (e.g. wire break, measured value)

#### **Additional information**

- Online Help for *STEP 7*
- Manual *Automation System S7-400H; Fault-tolerant Systems*
- Manual *Process Control System PCS 7; PCS 7 OS Process Control*

## 6.2 Automation system

### 6.2.1 Failure of the master CPU

#### Functionality

The initial situation is that the S7-400H is in "Redundant" system mode. The processing of the user program is synchronized on both CPUs of the H system and, for example, CPU0 is the master CPU and CPU1 is the backup CPU. Event-driven synchronization ensures that the backup CPU will always continue processing without interruption if the master CPU fails.

#### Example: Failure of the master CPU

If CPU0 fails, for example, the following LEDs light up on CPU1:

- REDF = Redundancy loss
- IFM1F = Interface fault interface module 1  
This indicates the first fiber-optic cable of the synchronization line.
- IFM2F = Interface fault interface module 2  
This indicates the second fiber-optic cable of the synchronization line.

The H system switches to "Solo" system mode. CPU1 ensures uninterrupted processing of the user program. CPU1 is now the master CPU. The H system is no longer in "Redundant" system mode.

#### Example: Reintegration of the failed master CPU

When the failed CPU0 is reintegrated, it does not become the master CPU. The master CPU automatically performs the link-up and update of the reintegrated CPU0. Both processes are necessary in order to check and synchronize the data in the memory of the master CPU and the backup CPU. CPU0 then goes to RUN mode. Now the system is once again in "Redundant" mode.

### 6.2.2 Failure of a fiber-optic cable

#### Requirements for the example

- The S7-400H is in "Redundant" system mode in the starting scenario.
- The CPU in Rack 0 is the Master CPU and the CPU in Rack 1 is the backup CPU.
- The mode selectors of both CPUs are set to RUN.

**Example: Failure of a fiber-optic cable**

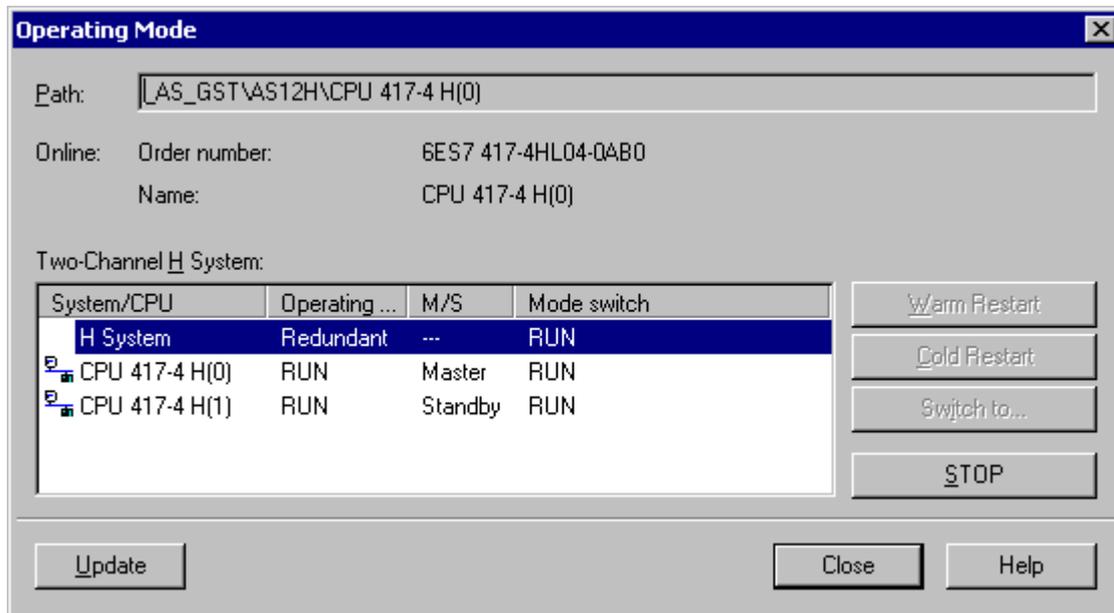
If a fiber-optic cable fails, the REDF LED and the IFM1F or IFM2F LED light up on the two CPUs depending on the location of the fiber-optic cable failure. The H system goes to "Solo" system mode and the user program continues to be processed by the master CPU used up to this point (CPU0).

**Example: Reintegration of the CPU in rack 1**

Once the defective fiber-optic cable has been replaced and connected to both CPUs, you must restart the backup CPU that is in STOP mode, i.e., CPU in Rack 1.

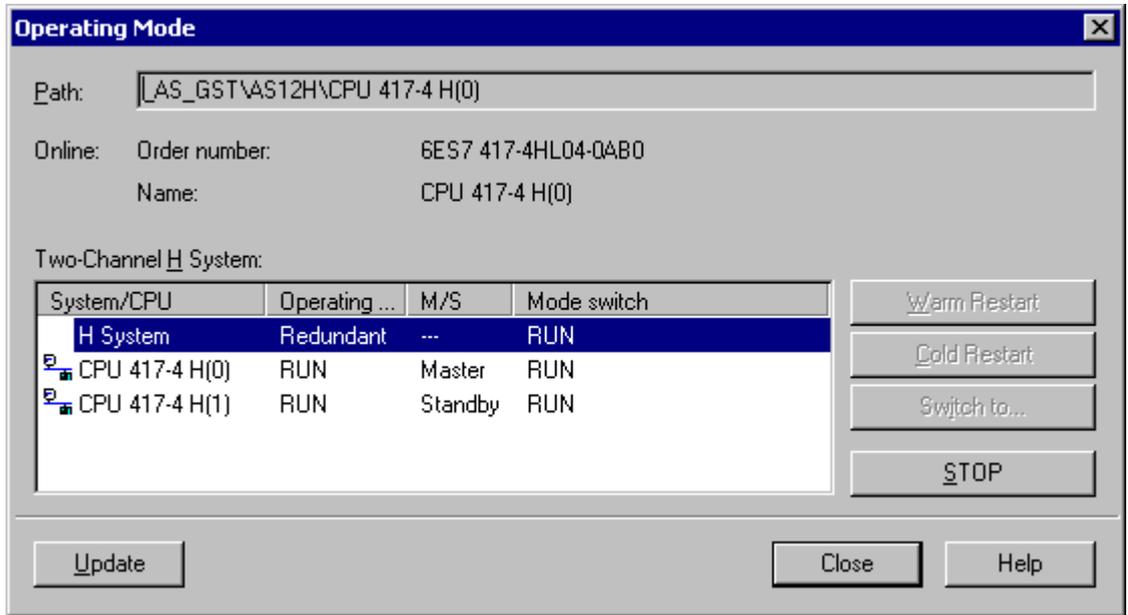
There are several options available to you:

- You have access to the automation system:  
Turn the key switch on the failed CPU from its current position to STOP back to the setting (RUN).
- You have an Ethernet connection to the H system:  
In the "Operating Mode" dialog box, restart the CPU in Rack 1, which is in STOP mode.
  - Open the PCS 7 project on an ES, click the "Online" icon in the task bar of SIMATIC Manager and select a CPU in the right window pane.
  - Open the shortcut menu with a right click and open the "Operating Mode" dialog box with the menu command **PLC > Operating Mode**.
  - Select the CPU in Rack 1 and click "Warm restart".  
The CPU in Rack 1 links up again and performs an update. The system is then in "Redundant" mode again.



Result

When the CPU in Rack 1 is back online, the "Operating mode" dialog box appears as follows:



## 6.3 Communication

### 6.3.1 Failure of redundant bus components

#### Functionality

As soon as a fault occurs on a transmission path, the second transmission path takes over and forwards the signals.

#### Failure scenarios

The following problems can occur on a bus component:

- Defective bus component (e.g., CP, coupler, AFD, AFS, cable)
- Problem on a bus line (e.g., overload, wire break)

#### Additional information

- Manual *SIMATIC Net Twisted Pair and Fiber-Optic Networks*
- Manual *SIMATIC Net PROFIBUS Networks*
- Manual *SIMATIC; Communication with SIMATIC*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-200*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-300*
- Operating instructions *SIMATIC NET; Industrial Ethernet Switches SCALANCE X-400*

## 6.4 OS server

### 6.4.1 Failure, failover and restarting of redundant OS servers

#### Introduction

This section describes the criteria by which the master/standby identification of an OS server changes. Examples are given to illustrate how the system reacts to failures.

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#### Note

Information on updating operator stations with redundant OS servers in runtime can be found in "guidelines on updating a redundant OS in runtime (Page 208)".

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#### Fault scenarios

- The project is not activated on the redundant OS partner server.
- The network connection from the OS server to the redundant OS partner is disrupted.
- The network connection to the OS clients is disrupted.
- The process connection to the AS is disrupted.
- The PC station is not operating correctly.

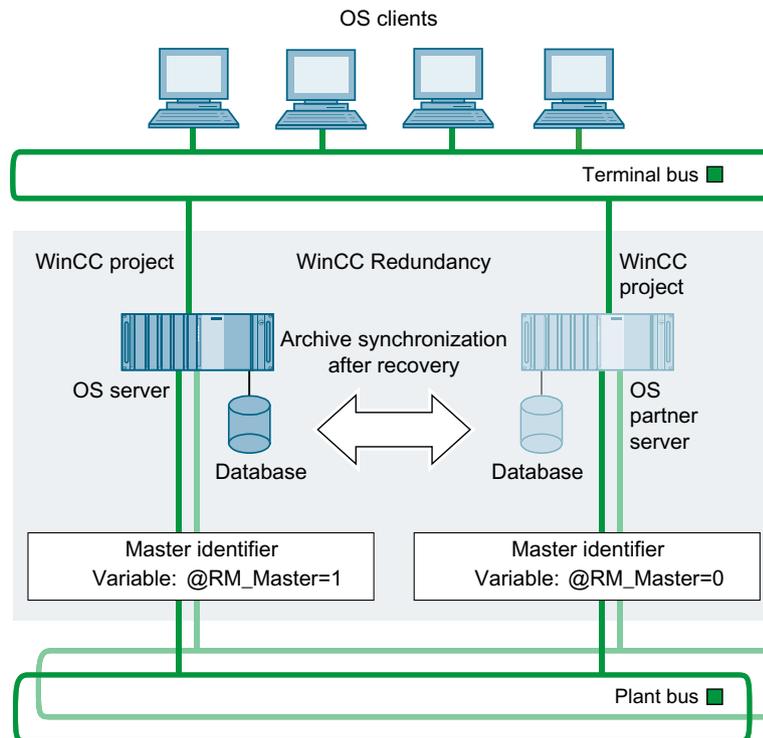
#### Reaction of WinCC redundancy to possible faults

WinCC redundancy can react to faults, errors or error messages in the following ways:

- By saving events and the time they occurred
- By synchronizing the archives of the process data (Tag Logging) and message data (Alarm Logging) with the archive data of the active OS server when a failed OS server is recovered.
- By changing the system tags "@RM\_MASTER" and "@RM\_MASTER\_NAME" according to the situation.
- By automatically interconnecting the OS clients with the preferred server or with the available OS server with master identification. The "@RM\_SERVER\_NAME" tag indicates for an OS client the OS server to which this OS client is currently connected.
- By generating process control messages in the message list.

The fault scenarios listed above and the resulting reactions by WinCC Redundancy are described in the following.

## Example configuration



## Startup of an OS server pair

The following applies, in general: An OS server pair consists of the OS server and its OS partner server. The two PCs are configured with WinCC Redundancy in a redundant grouping.

When the OS server pair starts up, WinCC Redundancy first checks which of the two OS servers is to be assigned the master identification. This depends on which OS server starts up first.

- If one OS partner server is active already when the other comes online, the second OS server receives the standby identification.
- If no other OS server is active when an OS server starts up, it is assigned the master identification.

The internal WinCC tag `@RM_MASTER` is set to identify the master OS server. The internal WinCC tag `@RM_MASTER` is reset to identify the standby OS server.

The `"@RM_MASTER_NAME"` tag contains the name of the OS server, for example, "Server 1". You can display this tag, for example, in an I/O field of a Graphics Designer picture. Other applications or scripts can also evaluate these tags. The `"@RM_MASTER"` tag can also be changed.

### WinCC project is deactivated

A functionally equivalent WinCC project is activated on both OS servers. If the WinCC project is deactivated on OS Server 1 (master identification), WinCC Redundancy triggers the following reactions:

- OS Server 2 (standby identification) saves the time of the failure (date and time of day) of OS Server 1 (master identification).
- OS Server 2 reports the failure of OS Server 1 with a process control message in the process control list.
- OS Server 2 now takes over the role of the master by setting the @RM\_MASTER tag. The @RM\_MASTER\_NAME tag is changed accordingly.
- If the WinCC project is activated again on OS Server 1, OS Server 1 is set as the standby and the @RM\_MASTER tag is reset. The @RM\_MASTER\_NAME tags are changed accordingly.

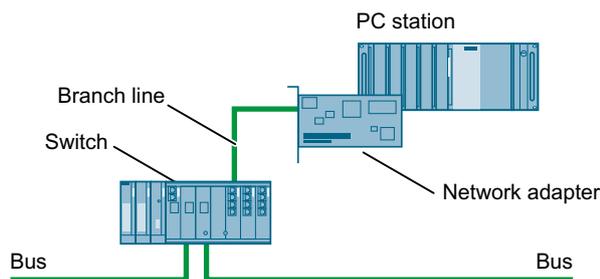
Gaps in the archive data occur on OS Server 1 during the time it is inactive. As soon as OS Server 1 returns, the gaps in the data are remedied by the following measures:

- OS Server 2 saves the date and the time of day, marking the return of OS Server 1.
- OS Server 2 reports the return of OS Server 1 with a process control message in the message list.
- The data gaps in the message, process data and user archives of OS Server 1 are filled by the data from the OS Server 2 memory. Conditions: The options "Synchronization of Tag Logging after the partner server comes back online" and "Synchronization of Alarm Logging after the partner server comes back online" must be enabled in the "Redundancy" dialog box for this.
- The @RM\_MASTER tags remain unchanged in both servers:
  - OS Server 2 keeps the master identification.
  - The @RM\_MASTER tag remains set.
  - The @RM\_MASTER tag for OS Server 1 is reset.

### Disrupted network connection to the OS partner server

A disrupted network connection is only detected in the redundancy scheme when:

- There is a fault in the spur line.
- There is a defective connector or network adapter.
- A PC station is identified as faulty.



The terminal bus as a whole and the communication between the AS and OS servers remains unaffected.

Both OS servers are started and begin processing an activated WinCC project. If a disruption in the network connection to the OS partner server occurs in this situation, WinCC Redundancy reacts as follows:

- Both OS servers save the date and time of day of the failure.
- Both OS servers report the failure with a process control message in the message list.
- If the disrupted OS server is a master, the master/standby identification changes.

During the connection failure no online synchronization for alarm logging, operation messages and user archives can be performed between the two OS servers. As soon as the connection is restored, this is remedied by following actions:

- Both OS servers save the date and time of day of the restored connection.
- Both OS servers report the return with a process control message in the message list.
- Data from the alarm logging, tag logging and the user archives accumulated during the connection failure are transmitted to the returning OS server.
- The @RM\_MASTER and @RM\_MASTER\_NAME tags remain unchanged in both servers.

### Disrupted network connection between the OS client the OS server

An OS server and the OS client connected to it are processing an activated WinCC project. A redundant OS partner server has been configured for the OS server in WinCC Redundancy. The OS server is defined as the preferred server for the OS client. A disrupted network connection to the OS server may result from a cable break in the spur line from the network to the OS server. The terminal bus as a whole remains unaffected.

If a connection failure occurs between the OS client and the OS server, WinCC Redundancy triggers the following reactions:

- The OS client is not switched over from the failed OS server to its redundant OS partner server because the OS server is not available.
- When the failed OS server is available once again to the OS client, the OS client automatically switches back to its preferred server.

### Disrupted network connection to the AS

If a fault occurs on the plant bus connection between the OS server and the AS, WinCC Redundancy reacts as follows:

- The disruption of the plant bus connection is reported to the OS partner server.
- The OS partner server receives the message that the OS server has failed.
- The OS partner server saves the date and the time of day of the OS server failure.
- An OS client is automatically switched over from the failed OS server to its redundant OS partner server. Condition: The "WinCC client switch in case of a process connection error" option must be selected in the "Redundancy" dialog box for this.

When the process connection to the OS server is restored, the missing data in the archive of the OS server is updated by the procedure described below. Condition: The "Synchronization

## 6.4 OS server

after process connection error" option must be selected in the "General" tab of the "Redundancy" dialog box for this.

- The OS partner server saves the date and the time of day marking the return of the OS server.
- The data gaps in the archives of the failed OS server are updated by the data from the memory of the OS partner server. The process data of all automation systems (even those that have not failed) are synchronized.
- When the process connection is restored, this is announced by a process control message in the message list.

### PC station identified as faulty

In PCS 7, the PC stations are preset in such a way that the network adapters are automatically deactivated when a PC station is identified as faulty. Depending on the Autostart settings, a manual reboot is required or an automatic reboot of the server is triggered.

---

#### Note

##### Terminate process mode on redundant systems

If the process mode of the PC station is to be terminated manually and the redundancy partner of the PC station is not available, a corresponding message points out this situation. In this case, you can cancel the process for terminating process mode. These actions are logged.

---

### Additional information

- Online help for *WinCC*

## 6.5 BATCH Server

### 6.5.1 Reaction of BATCH servers to failure

#### Functionality

BATCH applications and any configured WinCC applications are active on BATCH servers. A BATCH client visualizes the batch data of the BATCH server to which it is connected.

#### Failure of the master BATCH server

If the master BATCH server fails, for example, due to an operating system failure or an application error, the standby BATCH server detects that the master is no longer available based on redundancy mechanisms and takes over the master role. The BATCH clients are then automatically switched over from the master BATCH server to the standby BATCH server.

The running BATCH program is automatically resumed after the failover to the redundant BATCH server. The BATCH program status is synchronized between the active BATCH server and the AS. You have to manually trigger the BATCH program to continue if communication errors have occurred.

In a replication solution, the databases on the master BATCH server and the standby BATCH server are continually synchronized. If the BATCH servers switch over, the new active BATCH server always has access to the latest BATCH data.

---

#### Note

##### Data reliability

During the failover from the failed BATCH server to its redundant BATCH server, no automation process data are visualized on a BATCH client. Operator inputs are also lost during this brief period.

---

#### PC station identified as faulty

Additional information on this is available in the section "Failure, failover and restarting of redundant OS servers (Page 196)".

#### Additional information

- Manual *Process Control System PCS 7; SIMATIC BATCH*

## 6.6 Route Control server

### 6.6.1 Reaction of Route Control servers to failure

#### Functionality

Route Control applications and any configured WinCC applications are active on Route Control servers. A Route Control client visualizes the route list of the Route Control server to which it is interconnected.

#### Failure of the master Route Control server

If the master Route Control server fails, for example, due to failure of the operating system or failure in an application, the standby Route Control server recognizes that the master is no longer available based on redundancy mechanisms and takes over the role of master. The new master automatically assumes all control functions of the running route control program, even of routes already requested. The visualization continues, since the Route Control clients automatically switch to the new master.

The status is synchronized between the active Route Control server and the AS. If communication errors occurred, the Route Control program can only be continued manually.

---

#### Note

##### Data reliability

During the failover from the failed Route Control server to its redundant Route Control server, no data from the automation process is visualized on a Route Control client. Operator inputs during this failover time are neither accepted nor executed.

Operation of a route via a Route Control faceplate from a PCS 7 OS is possible during redundancy failover of a Route Control server, if there is a communications connection between PCS 7 OS and the automation system.

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### Activating process mode of Route Control servers

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#### Note

Please note that you need to activate process mode for redundant Route control servers one after the other. One of the two Route Control servers will take on the property of Master server, depending on the configuration.

---

#### PC station identified as faulty

Additional information on this is available in the section "Failure, failover and restarting of redundant OS servers (Page 196)".

**Additional information**

- Manual *Process Control System PCS 7; SIMATIC Route Control*

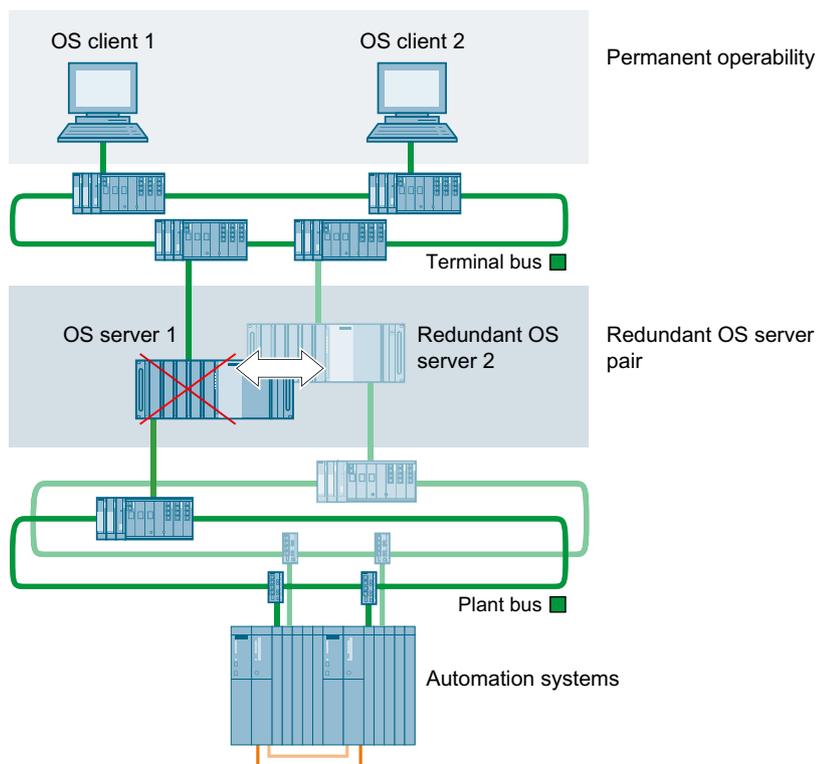
## 6.7 OS clients

### 6.7.1 Failover reactions of OS clients with permanent operability

#### Functionality

If the network for the configured OS server is interrupted, the process values on the OS clients are no longer updated. After successful failover to the partner server, the process can be operated again on all assigned OS clients. Other OS clients interconnected with the redundant OS partner server are not affected by this. The plant operator can therefore switch to these OS clients, if needed.

#### Example configuration



#### Permanent operability

If OS Server 1 fails, OS Client 1 is connected to redundant OS Server 2. The identity of the redundant partner server of OS Server 1 comes from the downloaded server data on the OS client. OS Client 1 is not available during the failover to redundant OS Server 2. However, if redundant OS Server 2 is specified as the preferred server for OS Client 2, you can continue to operate the plant during the failover from the failed OS Server 1 to redundant OS Server 2.

Once OS Server 1 becomes available again, OS Client 1 is connected to the returning OS Server 1 because it is the configured preferred server.

Permanent operability is restored after the failover is complete. OS Client 1 is not available for the duration of the failover to OS Server 1. OS Client 2 remains operable.

The status of the "@RM\_Master" redundancy tag does not apply to the OS client with preferred server configuration. The @RM\_SERVER\_NAME tag indicates the OS server to which this OS client is currently connected.

---

**Note**

Information on updating operator stations with redundant OS servers in runtime can be found in "guidelines on updating a redundant OS in runtime (Page 208)".

---

### Reaction of an OS client without a preferred server

If no "preferred server" is configured for the OS client in the "Configure Server Data" dialog box, the OS client connects to the OS server of a redundancy configuration for which the "@RM\_Master" redundancy tag is set.

If the active OS server fails, its redundant OS partner server becomes the master server. You can recognize which of the two redundant OS servers is currently acting as the master server by the status of "@RM\_Master" redundancy tag. You can trigger a manual switchover by setting or resetting this tag. All OS clients then connect to the "new" master server.

### Failover criteria of the OS client

The following faults trigger an OS client failover. It is not relevant here whether or not a preferred server has been configured.

- The network connection to the redundant OS server is disrupted.
- The redundant OS server fails, e.g., due to power loss.
- The WinCC project of the redundant OS server is deactivated.
- A disruption of the network connection between OS server and AS, when the option "WinCC client switch in case of a process connection error" is selected in the "Redundancy" dialog box.

### Additional information

- Online help for *WinCC*

## **6.8 BATCH clients**

### **6.8.1 Failover reactions of BATCH clients**

#### **Functionality**

If the master BATCH server fails, the BATCH clients automatically switch to the redundant BATCH server.

#### **Reactions during failover**

During a failover, a message window is displayed on the screen of the BATCH client indicating the failover. The BATCH client cannot be operated during this time. The message window closes and the BATCH client can be operated only when the failover from the failed BATCH server to the redundant BATCH server is complete.

#### **Additional information**

- Manual *Process Control System PCS 7; SIMATIC BATCH*

## 6.9 Route Control clients

### 6.9.1 Failover reaction of Route Control clients

#### Functionality

If the master Route Control server fails, the Route Control clients are automatically switched over to the redundant Route Control server.

#### Reactions during failover

During a failover, a message window is displayed on the screen of the Route Control client indicating the failover. The Route Control client cannot be operated during this time. The message window closes and the Route Control client can be operated again only when the failover from the failed Route Control server to the redundant Route Control server is complete.

---

#### Note

The route can be controlled from a Route Control faceplate during the switchover of a Route Control server.

---

#### Additional information

- Manual *Process Control System PCS 7; SIMATIC Route Control*

## 6.10 Guidelines for updating a redundant OS in runtime

### 6.10.1 Introduction

#### Introduction

Below, you will find guidelines for updating a redundant OS in runtime. This means that the operation of the PCS 7 system is not disrupted, the AS does not change to STOP mode and the automation process can continue to be operated and monitored.

#### Requirements

- The redundant OS is made up of the following components:
  - Redundant OS server
  - OS clients
- The PCS 7 version is at least PCS 7 V7.1.3.

#### Information on updating the PC stations and project data

You can find information on updating the PC stations and project data in the *Process Control System PCS 7; Software Update without Utilization of the New Functions* documentation.

#### Rules

 <b>CAUTION</b>
--

Make sure that you keep to the described order to avoid disrupting operation of the PCS 7 system.
---

---

#### Note

Perform the steps described from Phase 1 to Phase 5 without extended interruptions because the redundancy is not available during the update.

---

#### Note

##### Updating the maintenance station

Process mode on the maintenance client must be deactivated prior to updating the project on the ES.

The maintenance server must be the last server to be updated.

---

## Checking time synchronization

To avoid any jumps in time (UTC/local standard time) when "updating redundant systems in runtime", check the time synchronization of the OS in the updated PCS 7 project on the ES:

1. Open SIMATIC Manager.
2. Select the OS in the component view.
3. Select the menu command **Edit > Open Object**.  
WinCC Explorer opens.
4. Click the "Computer" object in the tree view.
5. Select the menu command **Edit > Properties**.  
The "Computer Properties" dialog box opens.
6. Select the "Parameters" tab.
7. In the "PLC Clock Setting" group, activate the "PLC is set to coordinated universal time (UTC)" check box.

## Objectives of the update

- The automation system remains uninterrupted in RUN mode.
- The process remains controllable at all times.

## Sequence of the Update

Updating involves five phases:

Phase	Action
Phase 1	Updating Server_2 (Page 214)
Phase 2	Updating the OS clients interconnected with Server_2 (Page 217)
Phase 3	Downloading the connections, gateways and changes to the AS (Page 219)
Phase 4	Updating the OS clients interconnected with Server_1 (Page 220)
Phase 5	Updating Server_1 (Page 222)

6.10 Guidelines for updating a redundant OS in runtime

The procedure described below must be repeated for all client-server relationships in the system, as appropriate.

- If you have several redundant servers, first update only the clients interconnected with the standby server that has already been updated or that has been defined as the preferred server for these clients.
- Then update the clients that are interconnected with the master server or that have defined it as their preferred server.

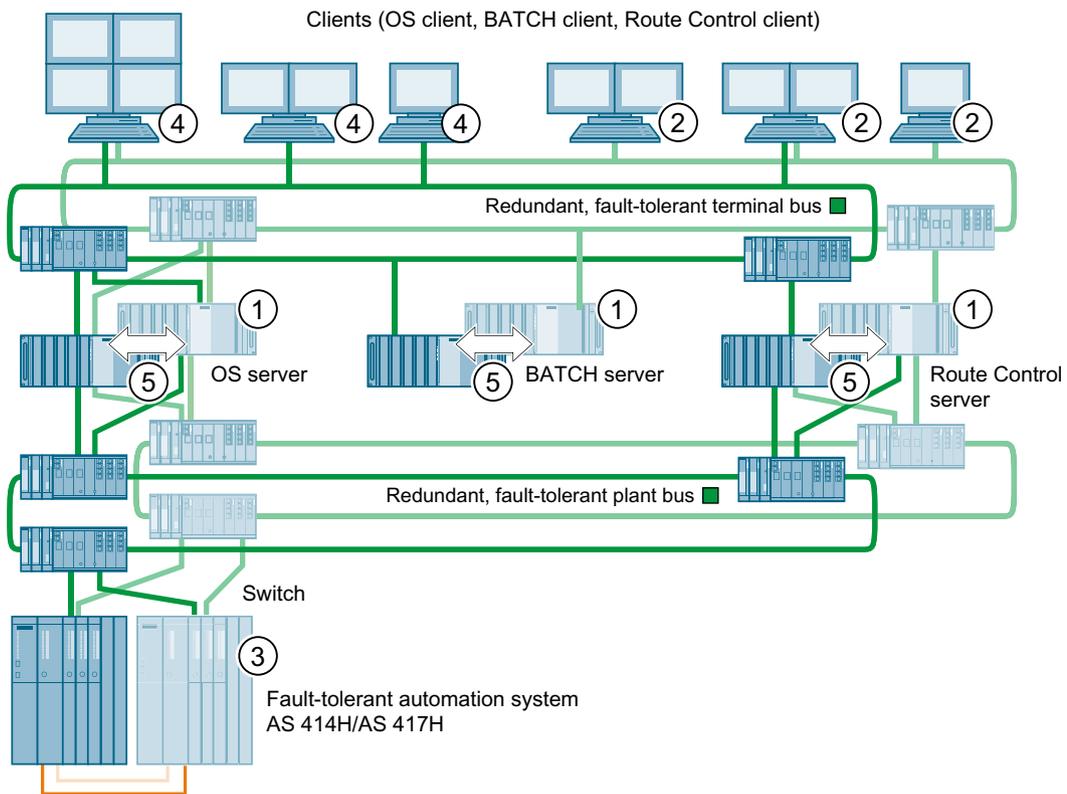


Figure 6-1 The numbering shows the sequence for the update.

### 6.10.2 Overview of the required tasks

#### Introduction

You update the redundant OS in runtime in five phases. Each phase is broken down into individual steps.

The section shows you an overview of the steps required in the five phases. You will find more detailed instructions for each phase in the following sections.

### Initial situation

- Server\_1 is master server.
- Server\_2 is standby server.
- Client\_1 is connected to Server\_1 because this server is configured as its preferred server. Client\_1 represents all OS clients connected to Server\_1.
- Client\_2 is connected to Server\_2 because this server is configured as its preferred server. Client\_2 represents all OS clients connected to Server\_2.

### Requirements

- Process Mode of the Maintenance Client was ended before the ES was updated.
- The update of the PCS 7 project for the ES is complete.
- If the Maintenance Station is used, SIMATIC PDM is installed on the ES.
- All the settings for the configured mode have been made. The configuration data has been loaded onto the ES from NetPro.
- If you want to use encrypted communication after the software update: "Encrypted communication" is activated for the ES with migration mode. You can find information about this in the documentation *Process Control System PCS 7; PCS 7 PC Configuration*.
- All OS servers and all OS clients are running with PCS 7 V7.1.3. or higher.

### Overview of the required tasks

<b>NOTICE</b>
<b>Interrupted redundancy</b>
Perform the steps described from Phase 1 to Phase 5 without extended interruptions because the redundancy is not available during the update.

6.10 Guidelines for updating a redundant OS in runtime

Phase	Step
<p>Phase 1: Updating Server_2</p>	<ol style="list-style-type: none"> <li>1. Server_2: Deactivate and exit WinCC</li> <li>2. Server_2: Back up the PCS 7 project Back up the operating system and the PCS 7 software installation</li> <li>3. Server_2: Install or update the operating system, PCS 7 Installation "OS server"</li> <li>4. Server_2: If you want to use secure communication after the software update: Activate "Secure communication" with migration mode. You can find information about this in the documentation <i>Process Control System PCS 7; PCS 7 PC Configuration</i>.</li> <li>5. ES: Download OS connection data and target system</li> <li>6. Server_2: Start WinCC</li> <li>7. Server_2: Check and save the "Redundancy" dialog box</li> <li>8. Server_2: Check and save the "Time Synchronization" dialog box</li> <li>9. Client_2: Deactivate process mode and exit WinCC</li> <li>10. If a Process Historian is present in the project, make sure:                         <ul style="list-style-type: none"> <li>– The Process Historian is in "Active" state.</li> <li>– "PH-Ready Configuration" is executed at Server_2.</li> </ul> </li> <li>11. Server_2: Activate WinCC Runtime</li> <li>12. Other redundant OS server pairs: Carry out Phase 1: Steps 1 to 9</li> </ol>
<p>Phase 2: Update the OS clients that are interconnected on Server_2</p>	<ol style="list-style-type: none"> <li>1. Client_2: Back up the PCS 7 project Back up the operating system and of the PCS 7 software installation</li> <li>2. Client_2: Install or update the operating system, PCS 7 Installation "OS client"</li> <li>3. Client_2: If you want to use secure communication after the software update: Activate "Secure communication" with migration mode. You can find information about this in the documentation <i>Process Control System PCS 7; PCS 7 PC Configuration</i>.</li> <li>4. ES: Download to OS target system</li> <li>5. Client_2: Activate</li> </ol>
<p>Phase 3: Downloading the connections, gateways, and changes to the AS</p>	<ol style="list-style-type: none"> <li>1. ES: Download connections and gateways from NetPro to the AS</li> <li>2. ES: Download CFC charts to the AS</li> </ol>

Phase	Step
Phase 4: Update the OS clients that are interconnected on Server_1	<ol style="list-style-type: none"> <li>1. Client_1: Deactivate and exit WinCC</li> <li>2. Client_1: Back up the PCS 7 project Back up the operating system and the PCS 7 software installation</li> <li>3. Client_1: Install or update the operating system, PCS 7 Installation "OS client"</li> <li>4. Client_1: If you want to use secure communication after the software update: Activate "Secure communication" with migration mode. You can find information about this in the documentation <i>Process Control System PCS 7; PCS 7 PC Configuration</i>.</li> <li>5. ES: Download of OS target system</li> <li>6. Client_1: Select the operability of the clients</li> </ol>
Phase 5: Updating Server_1	<ol style="list-style-type: none"> <li>1. Server_1: Deactivate and exit WinCC</li> <li>2. Client_1: Activate</li> <li>3. Server_1: Back up the PCS 7 project Back up the operating system and the PCS 7 software installation</li> <li>4. Server_1: Install or update the operating system, PCS 7 Installation "OS server"</li> <li>5. Server_1: If you want to use secure communication after the software update: Activate "Secure communication" with migration mode. You can find information about this in the documentation <i>Process Control System PCS 7; PCS 7 PC Configuration</i>.</li> <li>6. ES: Download OS connection data and OS target system</li> <li>7. Server_1: Start WinCC</li> <li>8. Server_1: Check and save the "Redundancy" dialog box</li> <li>9. Server_1: Check and save the "Time Synchronization" dialog box</li> <li>10. If a Process Historian is present in the project, make sure: "PH-Ready Configuration" is executed at Server_1.</li> <li>11. Server_1: Activate WinCC process mode</li> <li>12. Other redundant OS server pairs: Carry out Phase 5: Steps 1 to 9</li> <li>13. ES: Start SIMATIC PDM</li> </ol>

## Result

When you have completed all the steps, your system has the following status:

- Updated Server\_1 is standby server.
- Updated Server\_2 is master server.
- Updated Client\_1 is connected to its preferred server Server\_1.
- Updated Client\_2 is connected to its preferred server Server\_2.

The updating of your redundant operator stations is complete.

---

**Note**

**Encrypted communication**

If you have used encrypted communication, it is activated in migration mode for all PC stations in the system. Use encrypted communication in migration mode only as a temporary solution.

Deactivate migration mode in the entire system. You can find information about this in the documentation *Process Control System PCS 7; PCS 7 PC Configuration*.

---

### 6.10.3 Phase 1: Updating Server\_2

#### Introduction

In the first phase, you update redundant Server\_2. In this way, you avoid an unnecessary failover for OS clients that have no preferred server configured.

You can find additional information about redundancy synchronization in *WinCC Information System > Configurations > Redundant Systems*.

During the steps involved in Phase 1, your system continues to work with only one server. The system remains controllable from the OS clients that have not yet been updated. If this server fails, the automation system can no longer be controlled.

<b>NOTICE</b>
---------------

<b>Interrupted redundancy</b>
-------------------------------

Perform the steps without extended interruptions because the redundancy is not available during the update.
---

#### Initial situation before phase 1

- Server\_1 is master server.
- Server\_2 is standby server.
- Client\_1 is connected to Server\_1.
- Client\_2 is connected to Server\_2 because this server is configured as its preferred server.

#### Requirements

- The PCS 7 project you are updating has already been updated on the ES.
- When using an archive server:
  - Synchronization of the archive must be complete to ensure that the process data (RT data) is consistent.

## Procedure - Phase 1

Note that you will need to work alternately on Server\_1 and Server\_2.

### Phase 1 / 1. Server\_2: Deactivate and exit WinCC

- Deactivate WinCC Runtime and exit WinCC on the standby Server\_2.  
The system reacts as follows:
  - Client\_1 remains interconnected with Server\_1.
  - Client\_2, which has Server\_2 configured as the preferred server, changes over to Server\_1.
  - Server\_1 detects a failure due to Server\_2 being deactivated. If you have configured system messages, Server\_1 generates a process control message to this effect.

### Phase 1 / 2. Server\_2: Backup of the PCS 7 project; backup of the operating system and of the PCS 7 software installation

- Back up your previous operating system, the previous PCS 7 software installation and your current PCS 7 project as a fallback strategy.

### Phase 1 / 3. Server\_2: Installation or update of the operating system, PCS 7 Installation "OS server"

- Install or update the operating system (you can find information about this in the manual *Process Control System PCS 7; PCS 7 PC Configuration*).  
An OS server can only run on a server operating system which has been released for PCS 7. You can find additional information on this in the *Process control system PCS 7; PCS 7 Readme* documentation.
- Install the necessary PCS 7 components.  
In the "Program Packages" dialog of the PCS 7 Setup, select the "OS Server" check box or, if the OS is to swap out data to the Process Historian, the "OS-Server for Process Historian" check box.
- Make the necessary settings.

Note that Windows administration of PCs should be performed by a Windows administrator. You can find a detailed description of the PCS 7 installation and the required PCS 7-specific settings for PC stations in the manual *Process Control System PCS 7; PCS 7 PC Configuration*.

**Phase 1 / 4. Server\_2:** If you want to use encrypted communication after the software update: Activate "Encrypted communication" with migration mode. You can find information about this in the documentation *Process Control System PCS 7; PCS 7 PC Configuration*.

### Phase 1 / 5. ES: Download OS connection data and OS target system

- Open *NetPro* and download the connection data from the ES to Server\_2.
- Right-click on the OS to be transferred in the open PCS 7 project below the WinCC application. Select the menu command **PLC > Download to Current Project > Selected Station** in the shortcut menu.  
This starts the transfer from the ES to Server\_2.

### Phase 1 / 6. Server\_2: Start WinCC

- Start WinCC on Server\_2.

**Phase 1 / 7. Server\_2: Check and save the "Redundancy" dialog box**

- Open the "Redundancy" editor and check the settings in the dialog box. Click "OK" to exit the dialog box even if you have made no changes.

**Phase 1 / 8. Server\_2: Check and save the "Time Synchronization" dialog box**

- Open the "Time Synchronization" editor and check the settings in the dialog box. Click "OK" to exit the dialog box even if you have made no changes.

**Phase 1 / 9. Client\_2: Deactivate process mode and exit WinCC**

- Deactivate the process mode on all clients where Server\_2 is set up as preferred server.

---

**Note**

In WinCC Explorer (Server data), you can activate Server\_1 for operation as preferred server for Client\_2 within the phases 1 and 2. This setting retains operability of the clients.

---

**Phase 1 / 10. Server\_2: Activate WinCC Runtime**

- Activate WinCC Runtime on Server\_2.  
The system reacts as follows:
  - There is no server failover. Depending on the configuration, the activated Server\_2 becomes the standby or master server.
  - All OS clients still receive their visualization data from OS server Server\_1, which has not yet been updated.

**Phase 1 / 11. Other redundant OS server pairs: Repeat steps 1 to 10**

- If you are using more than one redundant OS server pair, you must first update standby server Server\_2 for each.
- Carry out the Phase 1 steps 1 through 10 for each Server\_2.

---

**Note**

**Migration of the central archive server (CAS) on the Process Historian**

You can find more information about this in the "WinCC Classic Information System".

---

**Result after Phase 1**

- Server\_2 is updated and not connected to any OS clients.
- Server\_1 is the master server in the PCS 7 project being updated.
- Server\_2 can be either master or standby, depending on the configuration.
- The archives will be synchronized between Server\_1 and Server\_2.
- Client\_1 is connected to Server\_1.
- Client\_2 is either deactivated or interconnected with Server\_1 after you have changed the preferred server setting. Client\_2 cannot access the upgraded Server\_2 as the preferred server.

## 6.10.4 Phase 2: Updating OS clients interconnected with Server\_2

### Introduction

In Phase 2, you update the OS clients that were interconnected with Server\_2.

The system can be controlled at all times using Client\_1, which is interconnected with the not-yet-updated Server\_1.

The same PCS 7 version is running on the active OS server Server\_1 and on Client\_1. Mixed operation between OS clients and OS servers of different PCS 7 versions is not possible.

Archive data and messages that have accrued on OS server Server\_1 during the update process are available on both OS servers. Synchronization of the archives is complete with the following message: "REDRT: <Name of the OS server> complete".



#### CAUTION

##### Interrupted redundancy

Perform the steps without extended interruptions because the redundancy is not available during the update.

### Initial situation before phase 2

- Server\_1 is master server in the PCS 7 project.
- The updated Server\_2 is standby server in the updated PCS 7 project.
- Client\_1 is connected to Server\_1.
- Client\_2 is either deactivated or interconnected with Server\_1 after you have changed the preferred server setting. Client\_2 cannot access the upgraded Server\_2 as the preferred server.

### Requirement

The PCS 7 project you are updating has already been updated on the ES.

### Procedure - Phase 2

#### Phase 2 / step 1. Client\_2: Backup of the PCS 7 project, of the operating system and of the PCS 7 software installation

- Back up your previous operating system, the previous PCS 7 software installation and your current PCS 7 project as a fallback strategy.

**Phase 2 / 2. Client\_2: Installation of the operating system, PCS 7 Installation "OS client"**

- Install or update the operating system (you can find information about this in the manual *Process Control System PCS 7; PCS 7 PC Configuration*).  
An OS client runs only on an operating system that has been released for PCS 7. You can find additional information on this in the *Process Control System PCS 7; PCS 7 Readme* documentation.
- Install the necessary PCS 7 components.  
In the PCS 7 Setup, select the "OS Client" check box in the "Program Packages" dialog box.
- Make the necessary settings.

Note that Windows administration of PC stations should be performed by a Windows administrator. You can find a detailed description of the PCS 7 installation and the required PCS 7-specific settings for PC stations in the manual *Process Control System PCS 7; PCS 7 PC Configuration*.

**Phase 2 / 3. Client\_2:** If you want to use encrypted communication after the software update: Activate "Encrypted communication" with migration mode. You can find information about this in the documentation *Process Control System PCS 7; PCS 7 PC Configuration*.

**Phase 2 / 4. ES: Download to OS target system**

- Right-click on the OS to be transferred in the open PCS 7 project below the WinCC application. Select the menu command **PLC > Download** in the shortcut menu. This downloads the project for Client\_2 from the ES to the relevant OS.

**Phase 2 / 5. Client\_2: Activate**

- Start WinCC on Client\_2.
- Activate WinCC Runtime.

**The system reacts as follows:**

- Client\_2 connects with the upgraded Server\_2.

**Result after Phase 2**

- Server\_1 is master server in the PCS 7 project.
- The updated Server\_2 is standby server in the updated PCS 7 project.
- Client\_1 is connected to Server\_1.
- Updated Client\_2 is connected to its preferred server Server\_2.
- The system can be controlled from all OS clients.

---

**Note**

**Maintenance client**

If Server\_2 is the maintenance server (last OS server pair to be updated in the project), then the maintenance client (Client\_2) can be started.

Maintenance client accesses to intelligent field devices are only possible after completion of the software update.

---

## 6.10.5 Phase 3: Downloading the connections, gateways and changes to the AS

### Introduction

In Phase 3, connections, gateways and CFC charts are downloaded to the AS from NetPro by downloading changes only.

### Initial situation before phase 3

- Server\_1 is master server in the PCS 7 project.
- The updated Server\_2 is standby server in the updated PCS 7 project.
- Client\_1 is connected to Server\_1.
- Updated Client\_2 is connected to its preferred server Server\_2.
- The system can be controlled from all OS clients.

### Requirements

- The PCS 7 project you are updating has already been updated on the ES.
- Configuration of the automation systems ready for download. All AS are compiled.

### Procedure - Phase 3

#### Phase 3 / 1. ES: Transfer NetPro connection data and gateways to the AS

- Open NetPro and select your AS. Select the menu command **PLC > Download to Current Project > Connections and Gateways**.
- Select the CPU you want to download to in the "Select Target Module" dialog box and exit the dialog box by clicking "OK".

#### Phase 3 / 2. ES: Download CFC charts to the AS

If there was no download to the AS during the project update, you will now need to download to the AS.

- Select an AS in SIMATIC Manager.
- Select the menu command **CPU > Download**.
- Select the "Changes only" check box.

---

#### Note

If you select the "Include user data blocks" check box, the user data blocks on the AS are overwritten. You can find additional information in the online help for the "S7 Download" dialog box.

---

- Close the dialog box by clicking "OK".

Repeat the steps for downloading to the AS for each AS in the project.

**The system reacts as follows:**

- The system can be controlled and monitored from all clients.

**Result after Phase 3**

- Server\_1 is master server in the PCS 7 project.
- The updated Server\_2 is standby server in the updated PCS 7 project.
- Client\_1 is connected to Server\_1.
- Updated Client\_2 is connected to its preferred server Server\_2.
- The system can be controlled from all OS clients.

**6.10.6 Phase 4: Updating the OS clients interconnected with Server\_1**

**Introduction**

In Phase 4, you update the OS clients that are interconnected with Server\_1.

The system can be controlled at all times using Client\_2, which is interconnected with Server\_2.

 <b>CAUTION</b>
<b>Interrupted redundancy</b>
Perform the steps without extended interruptions because the redundancy is not available during the update.

**Initial situation before phase 4**

- Server\_1 is master server in the PCS 7 project.
- The updated Server\_2 is standby server in the updated PCS 7 project.
- Client\_1 is connected to Server\_1.
- Updated Client\_2 is connected to its preferred server Server\_2.
- The system can be controlled from all OS clients.

**Requirement**

The PCS 7 project you are updating has already been updated on the ES.

**Procedure - Phase 4**

**Phase 4 / 1. Client\_1: Deactivate and exit WinCC**

- Deactivate WinCC Runtime and exit WinCC on OS Client\_1.

**Phase 4 / 2. Client\_1: Backup of the PCS 7 project, of the operating system and of the PCS 7 software installation**

- Back up your previous operating system, the previous PCS 7 software installation and your current PCS 7 project as a fallback strategy.

**Phase 4 / 3. Client\_1: Installation or update of the operating system, PCS 7 Installation "OS client"**

- Install or update the operating system (you can find information about this in the manual *Process Control System PCS 7; PCS 7 PC Configuration*).  
An OS client runs only on an operating system that has been released for PCS 7. You can find additional information on this in the *Process Control System PCS 7; PCS 7 Readme* documentation.
- Install the necessary PCS 7 components.  
In the PCS 7 Setup, select the "OS Client" check box in the "Program Packages" dialog box.
- Make the necessary settings.

Note that Windows administration of PCs should be performed by a Windows administrator. You can find a detailed description of the PCS 7 installation and the required PCS 7-specific settings for PC stations in the manual *Process Control System PCS 7; PCS 7 PC Configuration*.

**Phase 4 / 4. Client\_1:** If you want to use encrypted communication after the software update: Activate "Encrypted communication" with migration mode. You can find information about this in the documentation *Process Control System PCS 7; PCS 7 PC Configuration*.

**Phase 4 / 5. ES: Download to OS target system**

- Right-click on the OS to be transferred in the open PCS 7 project below the WinCC application.
- Select the menu command **PLC > Download** in the shortcut menu. This downloads the project for OS Client\_1 from the ES to the relevant OS.

**Phase 4 / 6. Client\_1: Select the operability of the clients**

Options:

- If all clients should remain operable, set the preferred server for Client\_1 to Server\_2. Client\_1 is operable after you have completed Phase 4. After having updated Server\_1 in Phase 5, change the server setting for Client\_1 to preferred server = Server\_1.
- If you do not need Client\_1 to be operable during the software update, the preferred server for Client\_1 does not have to be changed.

**The system reacts as follows:**

- Client\_1 is connected to Server\_2 or deactivated.

**Result after Phase 4**

- Server\_1 is master server in the PCS 7 project.
- The updated Server\_2 is standby server in the updated PCS 7 project.

- Client\_1 is updated (deactivated or connected to Server\_2).
- OS Client\_2 is interconnected with its preferred Server\_2.

## 6.10.7 Phase 5: Updating Server\_2

### Introduction

While you perform the steps in phase 5, your system runs only with Server\_2. The system remains controllable from the OS clients that were updated in phases 2 and 4.



#### CAUTION

##### Interrupted redundancy

Perform the steps without extended interruptions because the redundancy is not available during the update.

### Initial situation before phase 5

- Server\_1 is master server in the PCS 7 project.
- The updated Server\_2 is standby server in the updated PCS 7 project.
- Client\_1 is updated (deactivated or connected to Server\_2).
- OS Client\_2 is interconnected with its preferred Server\_2.

### Requirements

- The PCS 7 project you are updating has already been updated on the ES.
- Archive synchronization is complete.
  - Message: "REDRT: <Name of the OS server> complete".
  - Using a Process Historian:  
The data from the circular archive of OS server 1 is transferred or migrated to Process Historian.  
You can find more information on this in the *SIMATIC; Process Historian Installation Notes* documentation.
- Make sure that at least one updated OS client is interconnected with Server\_2.  
If no OS client is interconnected with Server\_2, your system cannot be operated while you are updating Server\_1.

## Procedure - Phase 5

### Phase 5 / 1. Server\_1: Deactivate and exit WinCC

- Deactivate WinCC Runtime on Server\_1.
- Exit WinCC on Server\_1.
- Updated Server\_2 is master server.

### Phase 5 / 2. Client\_1: Setting the preferred server

- If the preferred server for Client\_1 is set to Server\_2, carry out the following steps:
  - Close WinCC Runtime on Client\_1.
  - Set the preferred server for Client\_1 to Server\_1.
  - Start WinCC on OS Client\_1.
- Activate WinCC Runtime.

### Phase 5 / 3. Server\_1: Backup of the PCS 7 project, of the operating system and of the PCS 7 software installation

- Back up your previous operating system, the previous PCS 7 software installation and your current PCS 7 project as a fallback strategy.

### Phase 5 / 4. Server\_1: Installation or update of the operating system, PCS 7 Installation "OS server"

- Install or update the operating system (you can find information about this in the manual *Process Control System PCS 7; PCS 7 PC Configuration*).  
An OS server can only run on a server operating system which has been released for PCS 7. You can find additional information on this in the *Process control system PCS 7; PCS 7 Readme* documentation.
- Install the necessary PCS 7 components.  
In the "Program Packages" dialog of the PCS 7 Setup, select the "OS Server" check box or, if the OS is to swap out data to the Process Historian, the "OS-Server for Process Historian" check box.
- Make the necessary settings.

Note that Windows administration of PCs should be performed by a Windows administrator. You can find a detailed description of the PCS 7 installation and the required PCS 7-specific settings for PC stations in the manual *Process Control System PCS 7; PCS 7 PC Configuration*.

**Phase 5 / 5. Server\_1:** If you want to use encrypted communication after the software update: Activate "Encrypted communication" with migration mode. You can find information about this in the documentation *Process Control System PCS 7; PCS 7 PC Configuration*.

### Phase 5 / 6. ES: Download OS connection data and OS target system

- Open NetPro and download the connection data from the ES to Server\_1.
- Right-click on the OS to be transferred in the open PCS 7 project below the WinCC application. Select the menu command **PLC > Download** in the shortcut menu. This starts the transfer from the ES to Server\_1.

### Phase 5 / 7. Server\_1: Start WinCC

- Start WinCC on Server\_1.

**Phase 5 / 8. Server\_1: Check and save the "Redundancy" dialog box**

- Open the "Redundancy" editor and check the settings in the dialog box. Click "OK" to exit the dialog box even if you have made no changes.

**Phase 5 / 9. Server\_1: Check and save the "Time Synchronization" dialog box**

- Open the "Time Synchronization" editor and check the settings in the dialog box. Click "OK" to exit the dialog box even if you have made no changes.

**Phase 5 / 10. Server\_1: Activate WinCC Runtime**

- Activate WinCC Runtime on Server\_1.

**Phase 5 / 11. Carry out Phase 5: Steps 1 to 10**

If you are using more than one redundant OS server pair, repeat steps of Phase 5 / step 1 through 10 for each Server\_1.

**Phase 5 / 12. ES: Starting SIMATIC PDM**

Start the SIMATIC PDM on the ES, if installed.

**The system reacts as follows:**

- Server\_1 becomes standby server.

**Result after Phase 5**

- Updated Server\_1 is standby server.
- Updated Server\_2 is master server.
- Updated Client\_1 is connected to its preferred server Server\_1.
- Updated Client\_2 is connected to its preferred server Server\_2.

The updating of your redundant operator stations is complete.

Maintenance client accesses to intelligent field devices are possible when the PDM server has been started on the engineering station.

**NOTICE**

**Archive data**

When using a Process Historian, only the latest archive data from the operator stations is available.

Archive data from swapped out archives and archive data from a previously used central archive server may need to be migrated.

**Note**

**Encrypted communication**

If you have used encrypted communication, it is activated in migration mode for all PC stations in the system. Use encrypted communication in migration mode only as a temporary solution.

Deactivate migration mode in the entire system. You can find information about this in the documentation *Process Control System PCS 7; PCS 7 PC Configuration*.

---

## **6.11 Guide to updating a redundant BATCH server in runtime**

### **6.11.1 Software update (migration)**

Information is available in the SIMATIC BATCH product documentation:

- Operating Manual *SIMATIC Process Control System PCS 7; SIMATIC BATCH*; section "Software update (Migration)."

## 6.12 Guide to updating a redundant Route Control server in runtime

### 6.12.1 Updating a redundant Route Control server in runtime

For servers and single-station systems which are used for OS and Route Control, please observe the following information.

#### Requirement

- The Route Control project on the engineering station has been updated.
- Note the phases in section "Guidelines for updating a redundant OS in runtime (Page 208)".

#### Note

##### Backing up the log files

Back up the log files before replacing or reinstalling a computer, at the latest. You can find the configured storage path via the Route Control Engineering (list for route log in the path: Project Settings > Runtime Parameters > Routes Log > Values for Server and Standby).

#### Procedure

Execute the following steps on the servers, note the sequence and the states on each PC station.

	Default Master <sup>(1)</sup>	Default Standby <sup>(1)</sup>
1.	V7.x SPx <sup>(2)</sup> – Runtime	V7.x SPx <sup>(2)</sup> – Runtime
2.	V7.x SPx <sup>(2)</sup> – Runtime	Exit Runtime Execute an update installation on the "Default Standby Server" and the Engineering Station.
3.	V7.x SPx <sup>(2)</sup> – Runtime	Update the database to the new version and download it (you may have to update and download the WinCC project)
4.	V7.x SPx <sup>(2)</sup> – Runtime Do not update the current server (default master)!	Start the RC server (and also WinCC Runtime, if needed) and perform the update (the default standby server must be selected on a client with a new version in the RC Center using the menu command <b>Program &gt; Server Selection</b> )
5.	The default master continues to operate as standby server	Activate the default standby This RC server becomes the master (new version – Runtime) <ul style="list-style-type: none"> <li>• RC clients with V7.x SPx <sup>(2)</sup> report errors because connection to an RC server of another version is not possible.</li> <li>• RC clients with the new version connect to the RC server</li> <li>• All running routes will be processed with the new RC server.</li> </ul>
6.	Exit RC server	New version – Runtime
7.	Execute an update installation on the default master.	New version – Runtime
<b>The next step involves changing the master role.</b>		

6.12 Guide to updating a redundant Route Control server in runtime

	Default Master <sup>(1)</sup>	Default Standby <sup>(1)</sup>
8.	Start RC server (or WinCC Runtime) – starts as standby (you may have to update the project)	New version – Runtime The database is read.
9.	New version – Runtime (standby)	New version – Runtime

<sup>(1)</sup> : Default master or standby refers to the current state of the server pair before the software update in runtime. Any redundancy switching is not necessary.

<sup>(2)</sup> : V7.x. SPx means Route Control V7.0 or V7.1, possibly with Service Pack.

**Additional information**

- Programming and Operating Manual *SIMATIC Process Control System PCS 7; SIMATIC Route Control*; section "Software update."

# Diagnostics

Information is available in the manual *Process Control System PCS 7; Service Support and Diagnostics*.

## 7.1 Advanced self-diagnostics of communication connections

PCS 7 features advanced self-diagnostics for redundant software systems (servers). If this diagnostics routine detects an internal fault, and in the event that the redundant partner server is fully functioning, all communication connections on the server affected by the fault are disconnected (terminal and plant bus).

The affected server is then restarted automatically.

### Requirements

- Use of a PCS 7 OS (multi-station) redundant system, SIMATIC BATCH and SIMATIC Route Control.
- The following settings have been made on the server systems:
  - Automatic Windows logon (not relevant for servers in WinCC service mode)
  - Automatic start of the PCS 7 server applications

### Procedure

1. Go to the Windows Start menu and open the "Run" dialog box.
2. Enter the following in the input field:  
gpedit.msc  
The "Local Group Policy Editor" dialog box opens.
3. In the tree view, select the folder **Local Computer Policy > Computer Configuration > Administrative Templates > System**.
4. Double-click the "Display Shutdown Event Tracker" object in the detail view.  
The "Display Shutdown Event Tracker" dialog box opens.
5. Select the "Deactivated" option button.
6. Click "OK".

---

#### Note

Before a PCS 7 server application is exited, an availability check is carried out on the relevant redundant partner server. If the partner server is not fully functional, the user is informed of this status and can proceed accordingly.

The availability check is only carried out in service mode if a user is logged on.

---

### Additional information

You can find more information in the corresponding documentation and readme files on:

- PCS 7 OS
- SIMATIC BATCH
- SIMATIC Route Control
- SIMATIC NET



## 7.2 State of redundant operator stations in diagnostic pictures

When using a Maintenance Station, the block icons show the redundancy state of the redundant OS servers in the diagnostic area. You can find information on the block icons displayed for redundant components in the documentation *Process Control System PCS 7; Maintenance Station*.

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