

SIEMENS



Application Example • 08/2016

Setup of a Ring Topology Based on “MRP”

SCALANCE X, SIMATIC S7



<https://support.industry.siemens.com/cs/ww/en/view/109739614>

Warranty and Liability

Note

The Application Examples are not binding and do not claim to be complete with regard to configuration, equipment or any contingencies. The Application Examples do not represent customer-specific solutions. They are only intended to provide support for typical applications. You are responsible for the correct operation of the described products. These Application Examples do not relieve you of the responsibility of safely and professionally using, installing, operating and servicing equipment. When using these Application Examples, you recognize that we cannot be made liable for any damage/claims beyond the liability clause described. We reserve the right to make changes to these Application Examples at any time and without prior notice. If there are any deviations between the recommendations provided in this Application Example and other Siemens publications – e. g. catalogs – the contents of the other documents shall have priority.

We do not accept any liability for the information contained in this document. Any claims against us – based on whatever legal reason – resulting from the use of the examples, information, programs, engineering and performance data etc., described in this Application Example shall be excluded. Such an exclusion shall not apply in the case of mandatory liability, e.g. under the German Product Liability Act (“Produkthaftungsgesetz”), in case of intent, gross negligence, or injury of life, body or health, guarantee for the quality of a product, fraudulent concealment of a deficiency or breach of fundamental contractual obligations (“wesentliche Vertragspflichten”). The compensation for damages due to a breach of a fundamental contractual obligation is, however, limited to the foreseeable damage, typical for the type of contract, except in the event of intent or gross negligence or injury to life, body or health. The above provisions do not imply a change of the burden of proof to your detriment.

Any form of duplication or distribution of these Application Examples or excerpts hereof is prohibited without the expressed consent of Siemens AG.

Security information

Siemens provides products and solutions with Industrial Security functions that support the secure operation of plants, systems, machines and networks.

In order to secure plants, systems, machines and networks against cyber threats it is necessary to implement (and to maintain continuously) a holistic, state-of-the-art Industrial Security concept. With this in mind, Siemens' products and solutions are only part of such a concept.

It is the customer's responsibility to prevent unauthorized access to the customer's plants, systems, machines and networks. Systems, machines and components should only be connected to the company's network or the Internet, when and insofar as this is required and the appropriate protective measures (for example, use of firewalls and network segmentation) have been taken.

In addition, Siemens' recommendations regarding appropriate protective action should be followed. For more information on Industrial Security, visit <http://www.siemens.com/industrialsecurity>.

Siemens' products and solutions undergo continuous development to make them even more secure. Siemens strongly recommends to perform updates as they become available and to use only the latest product versions. Using versions that are out of date or no longer supported can increase the risk of cyber threats.

In order to always be informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at <http://www.siemens.com/industrialsecurity>.

Table of Contents

Warranty and Liability	2
1 Introduction	4
1.1 Overview.....	4
1.2 Mode of operation	6
1.2.1 “Media Redundancy Protocol”	6
1.2.2 Requirements / boundary conditions.....	8
1.3 Components used	10
2 Engineering	11
2.1 Hardware setup	11
2.2 Configuration	12
2.2.1 Preparation	12
2.2.2 Creating a TIA Portal project.....	13
2.2.3 Configuring MRP	16
2.2.4 Creating a test scenario	18
2.2.5 Loading modules	19
2.3 Commissioning.....	20
2.4 Test.....	21
2.5 Diagnostics	23
2.5.1 Web Based Management.....	23
2.5.2 TIA Portal	23
3 Appendix	26
3.1 Siemens services	26
3.2 Links and literature	27
3.3 Change documentation	27

1 Introduction

1.1 Overview

Requirement

The enhanced level of automation of industrial plants in order to raise productivity and quality increases the dependency on the availability of automation systems at the same time.

Failure of an automation system can cause high costs due to production failure and downtime caused by, for example, the failure of a CPU or of the network connection, e. g. due to wire break.

For this reason, fault tolerance is an important basic requirement, be it for factory and process automation or for energy supply.

Measure

To increase availability, industrial communication networks are designed with redundant physical connection paths between the network nodes.

For this, specific media redundancy protocols ensure a loop-free network topology as well as the detection of communication interruptions.

Benefits

A redundant network structure offers the following benefits:

- The redundant structure significantly increases plant and machine availability since the failure of individual devices has no influence on the communication.
- Required maintenance and repair work can be carried out without any time pressure, because the plant does not need to be shut down.
- In the event of a network error, fast network diagnosis is possible and troubleshooting is accelerated.
- In case of a failure, the costs due to production standstill are reduced.

Ring topology as a solution approach

In industry, a ring topology is chosen very often in order to implement the items mentioned above.

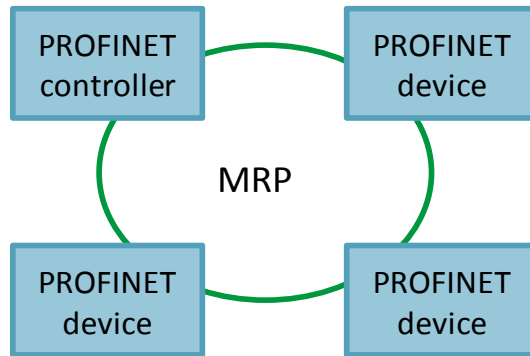
It offers a number of advantages:

- Fast detection of a network error and reconfiguration of the network,
- Can be implemented for small and very large networks,
- Cost-effective due to reduced wiring involved,
- Clear and simply structured wiring,
- Plant can be expanded during operation,
- Standardized protocol ensures compatibility of devices from different manufacturers.

Application implementation

This application example shows the functioning of the “Media Redundancy Protocol” (MRP). MRP is a redundancy protocol intended to increase the network availability in ring topologies and ensures loop-free communication in PROFINET networks.

Figure 1-1



Possible application

The redundancy solution used in this application example is particularly suited for the networking of controllers and control systems at the control level for industry and process automation.

Media redundancy forms part of PROFINET and is integrated into all PROFINET-capable field, control or network components. Thus, MRP is a manufacturer-independent protocol and can be used easily without any additional costs.

Thanks to the MRP protocol, it is possible to detect and to reconfigure a defective ring within 200 ms (for up to 50 nodes).

Note

Within an MRP ring, devices of different manufacturers can be used. All devices must support the MRP protocol in compliance with IEC 62439.

1.2 Mode of operation

1.2.1 “Media Redundancy Protocol”

Setting up the ring topology

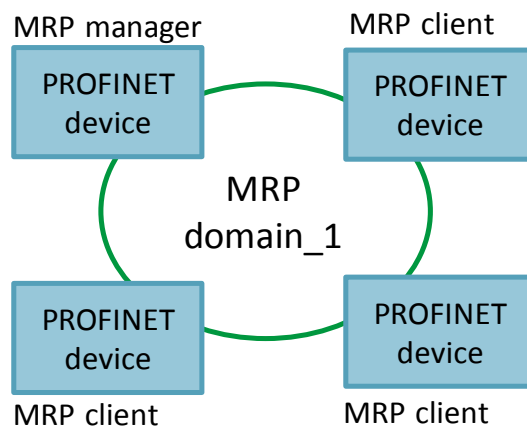
The connection of the free ends of a linear network topology to form a ring is decisive for ring redundancy. This can be implemented both via external PROFINET-capable switches and directly via the integrated PROFINET interfaces of programmable controllers.

Thus, each ring node requires a switch (integrated into the module) with two ring ports connected to the ring.

One ring node assumes the role of the redundancy manager. All other devices in the ring are redundancy clients.

All PROFINET devices being part of this redundant network form a so-called “MRP domain”.

Figure 1-2



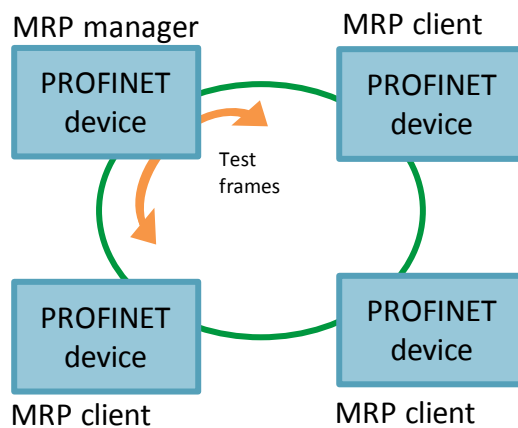
The selection and definition of the ring ports, the assignment of the MRP domain as well as the role that shall be assumed by the device in the ring are specified when configuring the corresponding device.

Note The MRP role can be selected independently of the PROFINET mode.

Function description

It is the task of the redundancy manager to monitor and control the ring with regard to network errors. For this, it sends test frames both from ring port 1 and ring port 2. These test frames pass the ring in both directions until they arrive at the redundancy manager's other ring port. In the error-free state, the redundancy manager blocks the network traffic on one of its ring ports (except for the test frames). Thus, the physical ring structure at the logical level for normal network traffic is converted back to a linear structure and loops are avoided.

Figure 1-3



However, if there is no test frame, a network error has occurred. The ring might be interrupted e. g. due to a failure of a connection between two devices or of a device in the ring.

In this case, the redundancy manager connects through its blocked port. Via this substitute path, a functioning connection between all remaining devices is restored in form of a linear network topology.

If the ring is being closed, the MRP manager will maintain the status of its port now being active. This means that the active port (after switchover) will remain active and the second ring port will be blocked.

Table 1-1

Port status	Before switchover	After switchover
active	P1	P2
blocked	P2	P1

Reconfiguration time

The time between a ring interruption and restoring a redundant path is referred to as reconfiguration time. For MRP, this is a maximum time of 200 ms.

Note

The higher-level application must be able to cope with an interruption of 200 ms. For PROFINET, the watchdog time has to be selected correspondingly as > 200 ms.

1.2.2 Requirements / boundary conditions

The following shall apply to the use of this redundancy protocol:

Usable devices

The "MRP" method works in compliance with the Media Redundancy Protocol (MRP) specified in the IEC 61158 Type 10 "PROFINET" standard.

The ring must consist only of devices supporting this function. These are, for example, the following devices:

- IE switches of the SCALANCE X product family:
 - X-200 as of firmware version V4.0
 - X-200IRT as of firmware version V4.0
 - X-300 as of firmware version V3.0
 - X-400 as of firmware version V3.0
 - X-500 as of firmware version V3.0
- SIMATIC-S7-PROFINET devices with integrated IE switch (at least 2 ports)
- Other MRP devices in compliance with IEC 61158 Type 10 "PROFINET" from other manufacturers

Tip

You can use the TIA Selection Tool to filter products for features as well. Thus, you can quickly find appropriate products for your use case.
<http://siemens.com/tia-selection-tool>

Installation guidelines

The following conditions are required for smooth operation with the media redundancy method MRP:

- All ring nodes must support MRP and must have enabled the MRP protocol.
- Connections within the ring must be made via the configured ring ports.
- The maximum number of ring nodes is 50. Otherwise, reconfiguration times of > 200 ms might occur.
- All devices connected within the ring topology must be part of the same redundancy domain. A device cannot be part of several redundancy domains.
- All devices in the ring must be set to "MRP Client", "MRP Manager (Auto)/Client" or "Automatic Redundancy Detection". All devices in the ring must be set to "MRP Client", "MRP Manager (Auto)/Client" or "Automatic Redundancy Detection".
- All partner ports within the ring must have the same settings.

Note

"Automatic Redundancy Detection" is the default setting in SCALANCE modules and therefore two ring ports are always active. However with this setting it cannot be made sure, which module is ring manager at the moment. For diagnostic, this can be an obstacle.

On all SCALANCE modules which are not part of the ring, the setting "Automatic Redundancy Detection" must be deactivated.

Boundary conditions

Please observe the following boundary conditions if you want to use MRP in parallel with other protocols or functions

Table 1-2

Constellation	Condition
MRP and Realtime (RT)	RT mode is possible when using MRP.
MRP and IRT	IRT mode together with MRP is not possible.
MRP and TCP/IP (TSEND, HTTP, ...)	TCP/IP communication together with MRP is possible, as lost data packages are sent repeatedly, if required.
MRP and prioritized startup	<p>If you configure MRP in a ring, you will not be able to use the "prioritized startup" function in the devices involved in PROFINET applications.</p> <p>If you want to use the "prioritized startup" function, you have to disable MRP in the configuration (thus, the device must not be part of the ring).</p>
MRP in PROFINET devices with more than two ports	If you operate a PROFINET device with more than two ports in a ring, you should set a sync boundary for the ports that are not part of the ring. Setting a sync boundary defines a limitation for a sync domain. Sync frames that are transferred for synchronization of nodes within a sync domain will not be forwarded.

1.3 Components used

In this application example, the ring is demonstrated by means of the following products:

Software packages

This solution requires the software package STEP 7 Professional V13 SP1 Update 7.

Install this software on a PC/PG.

Required devices/components:

Use the following components for the configuration:

- 1x CPU 1511 (as of FW V1.5) (MLFB: 6ES7511-1AK00-0AB0) with a SIMATIC memory card,
- 1x ET 200SP, IM155-6PN ST (MLFB: 6ES7155-6AU00-0BN0),
- 1x ET 200SP, DQ 4X24VDC/2A ST (MLFB: 6ES7132-6BD20-0BA0),
- 2x SCALANCE XB208 (MLFB: 6GK5208-0BA00-2AB2),
- a 24V power supply with cable connector and terminal block plug,
- DIN rail with mounting material for the S7-1500 and ET 200SP,
- 1x PC on which the “STEP 7 Professional V13 SP 1” configuration tool and a web browser are installed,
- the necessary network cables, TP cables (twisted pair) according to the IE FC RJ45 standard for Industrial Ethernet.

Note

To make sure that no old configurations and certificates are stored in the modules, reset the modules to the factory settings. In the configuration below, it is assumed that the modules are in this state.

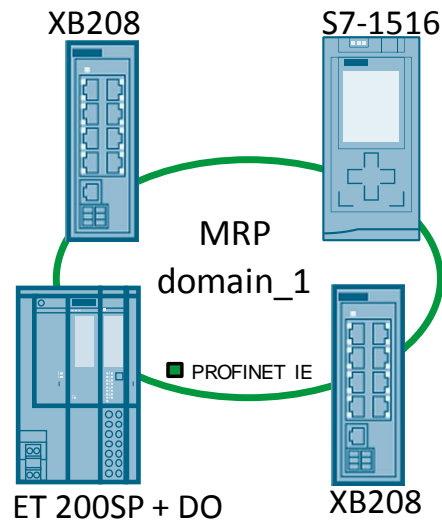
2 Engineering

2.1 Hardware setup

Overview

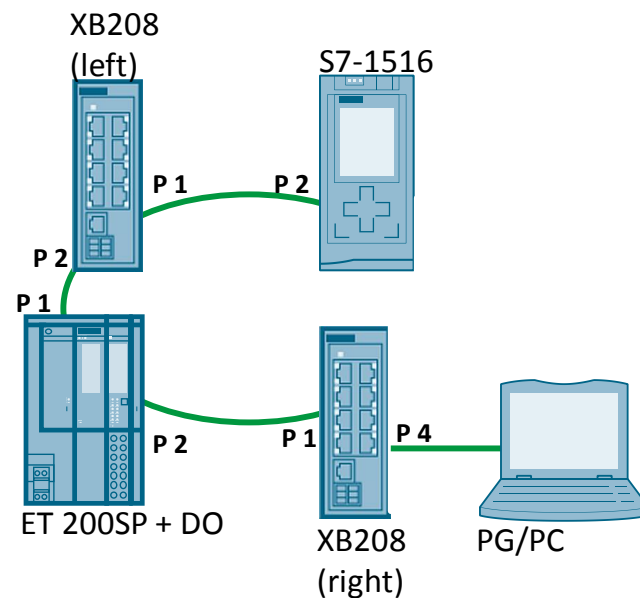
The figure below shows the components and their networking for setting up the application example.

Figure 2-1



Networking

Connect the modules to each other as follows:



Note

Close the ring after configuration only. Otherwise, there might be unwanted reactions in the network due to frame loops occurring.

2.2 Configuration

2.2.1 Preparation

Assigning roles

In order to set up a functional redundancy without any errors, it is important to assign a defined role to each module.

The table below shows which role is assumed by each module and which ports are used.

Table 2-1

Module	PROFINET mode	MRP role	Ring ports
XB208 (left)	Device	MRP manager	Port 1 Port 2
ET 200SP	Device	MRP client	Port 1 Port 2
XB208 (right)	Device	MRP client	Port 1 Port 2
S7-1511	Controller	MRP client	Port 1 Port 2

IP addresses

The modules involved are configured exclusively via TIA Portal.

To load the project data into the modules, it is useful to first change their IP address as shown in [Table 2-2](#). The STEP 7 function "Edit Ethernet Node..." or the Primary Setup Tool (PST) are suitable for assigning the IP address ("Accessible nodes..."). The PST is available for download free of charge (see [chapter 3.2](#)).

Table 2-2

Module	IP address	Subnet mask
XB208 (left)	192.168.0.1	255.255.255.0
S7-1511	192.168.0.2	
XB208 (right)	192.168.0.3	
ET 200SP	192.168.0.4	
PG/PC	192.168.0.250	

2.2.2 Creating a TIA Portal project

Hardware configuration

Use the TIA V13 configuration software to create a new project. Create a hardware configuration with the S7 devices and SCALANCE X modules you are using.

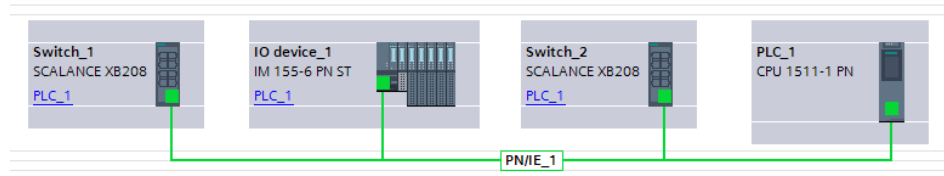
Configuring the interfaces

Configure the interfaces of all modules according to the specifications listed in [Table 2-2](#). Network the interfaces of the CPU, the ET 200SP and of the two SCALANCE X switches.

Assign the S7-1511 to the other modules as IO controller.

Result:

All modules are configured and networked in the project.



Creating the topology

Though the topology is not a prerequisite for the correct functioning of MRP, it facilitates troubleshooting in case of a failure.

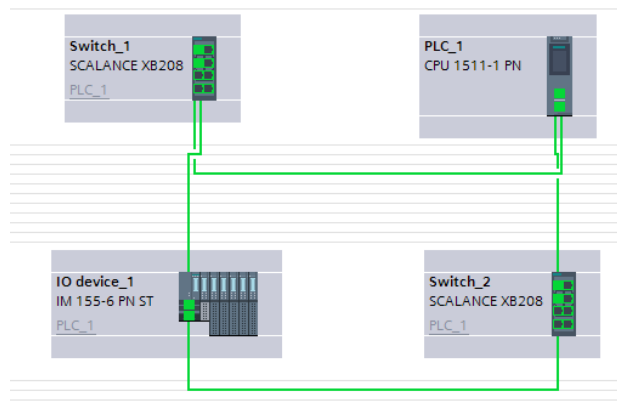
In the topology view of TIA Portal, connect the modules to each other as follows:

Table 2-3

Module		Partner	
XB208 (left)	Port 2	ET 200SP	Port 1
ET 200SP	Port 2	XB208 (right)	Port 1
XB208 (right)	Port 2	S7-1511	Port 1
S7-1511	Port 2	XB208 (left)	Port 1

Result:

In the project, all modules are joined in a topology.



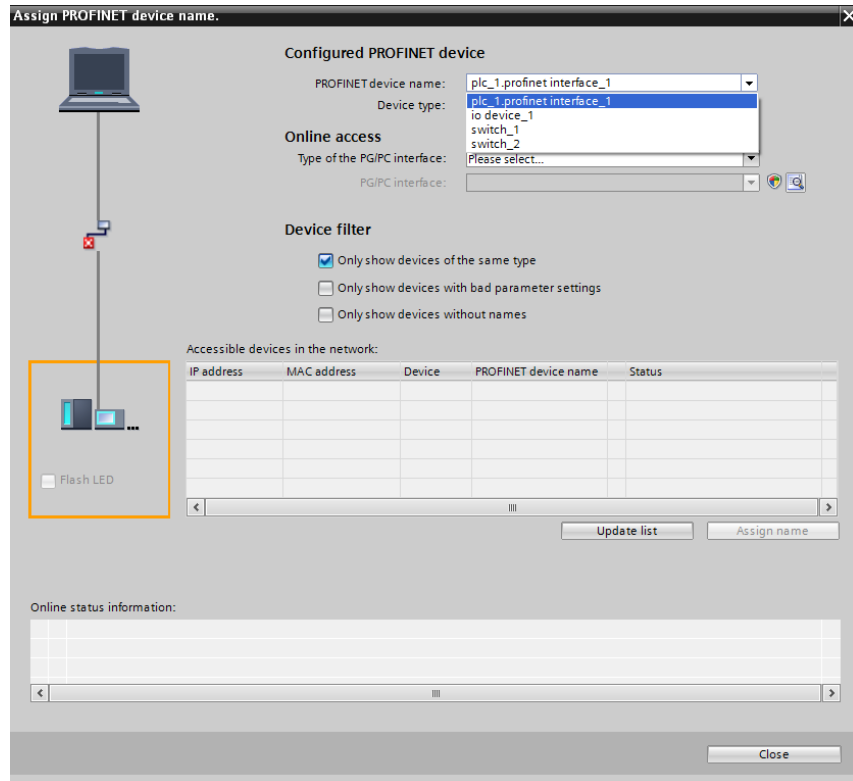
Assigning device names

All PROFINET devices need a device name.

Via the TIA function “Assign device name”, you can assign this name to the corresponding module. To use the function, go to the network view, select the PROFINET line and open the context menu.

Assign the respective device names to all PROFINET devices via this dialog.

Figure 2-2



© Siemens AG 2016 All rights reserved

Note

A detailed description and assistance regarding the use of TIA functions is available in the TIA online help.

Adjusting the update time

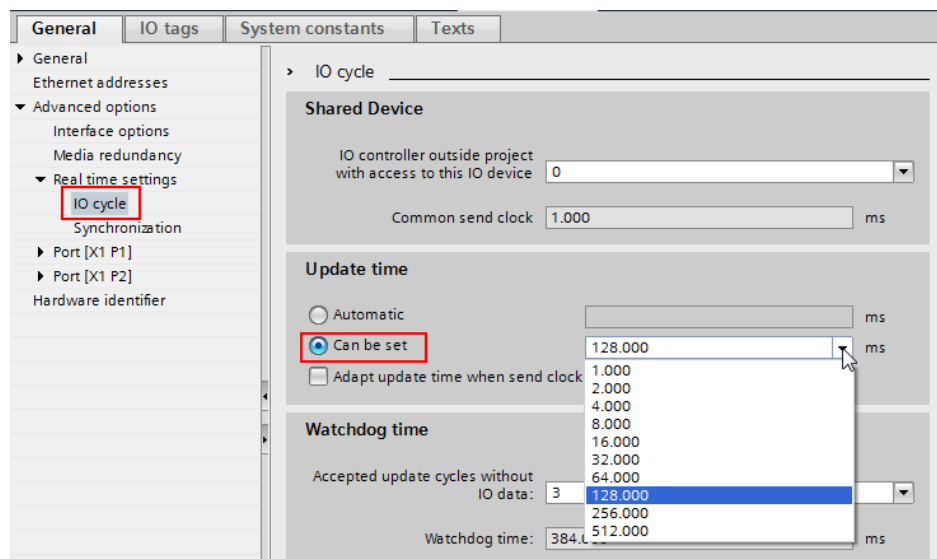
The reconfiguration time for MRP is 200 ms. Accordingly, a watchdog time of > 200 ms has to be selected for the PROFINET communication. The watchdog time is not configured directly, but as a number of accepted update cycles without IO data.

The update cycle can be configured separately for any IO device.

In the default setting, STEP 7 calculates the update time automatically for any IO device of the PROFINET IO system. In order not have the update time calculated automatically, you can change the setting.

Proceed as follows:

1. In the network view of in the device view, select the PROFINET interface of the IO device.
2. The properties are displayed in the inspector window. Under “Advanced options > Real time settings > IO cycle”, go to the “Update time” section.
3. Select “Can be set” to define the update time and enter the desired time. The watch dog time must be higher 200ms in summary. This can be reached by increasing the update time or the accepted update cycles without IO data.



4. This changes the update time for all PROFINET IO devices.

2.2.3 Configuring MRP

Overview

This chapter focuses on the configuration of the MRP ring and comprises the following configuration steps:

- Setting the role within the ring
- Defining the ring ports used.

Opening the TIA Portal project

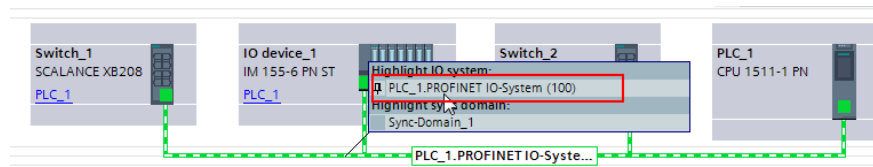
Open the TIA project created in the last chapter and go to the network view.

Setting up a ring redundancy

The “MRP” redundancy can be configured in the properties of the PROFINET IO system.

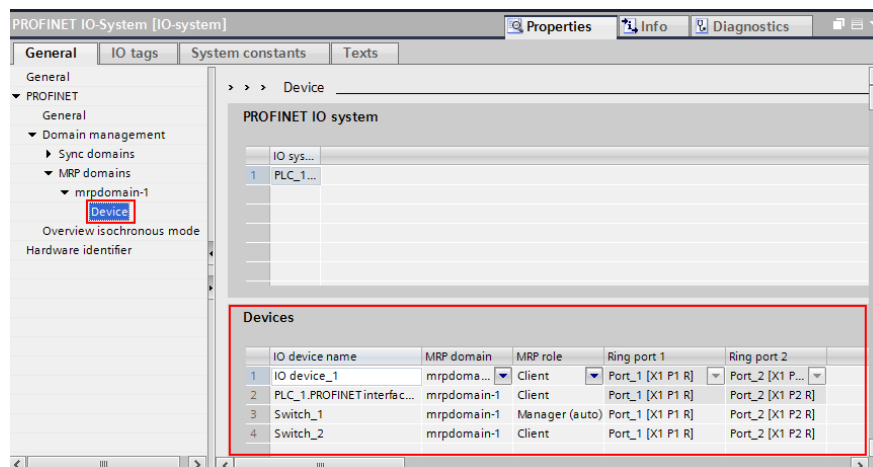
Proceed as follows:

1. To get to the configuration options of the PROFINET IO system, move the mouse cursor to the subnet.
2. Select and highlight the PROFINET connection in the “Highlight IO system” dialog that opens.



The PROFINET IO system is displayed as a dashed line.

3. Click on the PROFINET IO system and navigate to the “PROFINET > Domain management > MRP domains”. Here, you can define which MRP domain shall be the default one, change the names of all domains and control redundancy roles and ring ports.



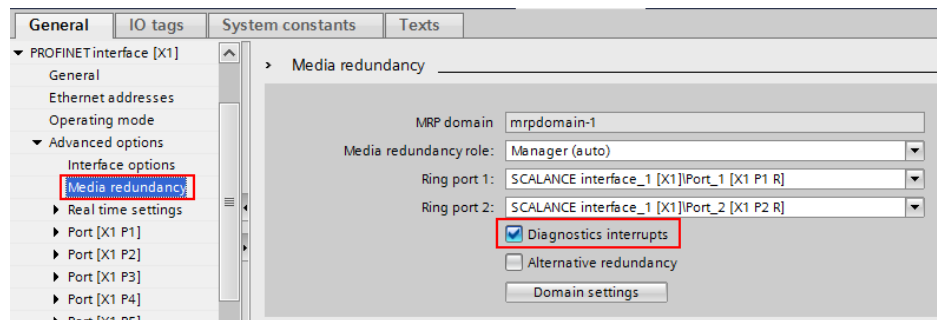
- Set the parameters according to the specifications listed in Table 2-1.

	IO device name	MRP domain	MRP role	Ring port 1	Ring port 2
1	IO device_1	mrpdoma...	Client	Port_1 [X1 P1 R]	Port_2 [X1 P...
2	PLC_1.PROFINET interfac...	mrpdomain-1	Client	Port_1 [X1 P1 R]	Port_2 [X1 P2 R]
3	Switch_1	mrpdomain-1	Manager (auto)	Port_1 [X1 P1 R]	Port_2 [X1 P2 R]
4	Switch_2	mrpdomain-1	Client	Port_1 [X1 P1 R]	Port_2 [X1 P2 R]

Enabling diagnostics interrupts

To be able to determine the status of the MRP ring via the user program of the CPU (e. g. via the diagnostics OB 82), the diagnostics interrupt in the modules must be enabled.

- In the network view of in the device view, select the PROFINET interface of the IO device.
- The properties are displayed in the inspector window. Under “Advanced options > Media redundancy”, enable the “Diagnostics interrupts” function.



- Like this, enable the diagnostics interrupt of the other MRP nodes as well.
- Compile and save the TIA project.

2.2.4 Creating a test scenario

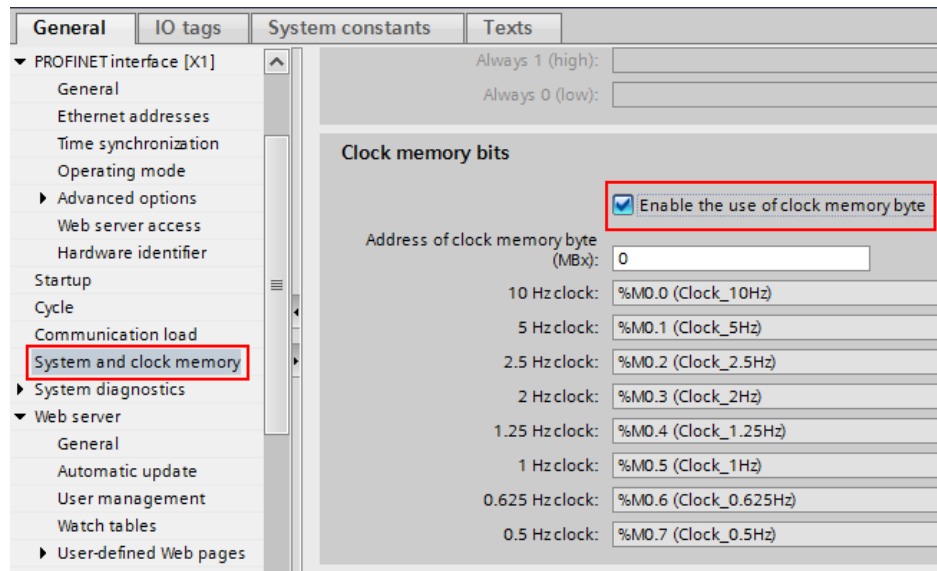
Description

To demonstrate the functionality of MRP, a simple flashing light is implemented as test scenario at the ET 200SP and triggered by the clock memory bit in the S7-CPU.

Enabling the clock memory bit

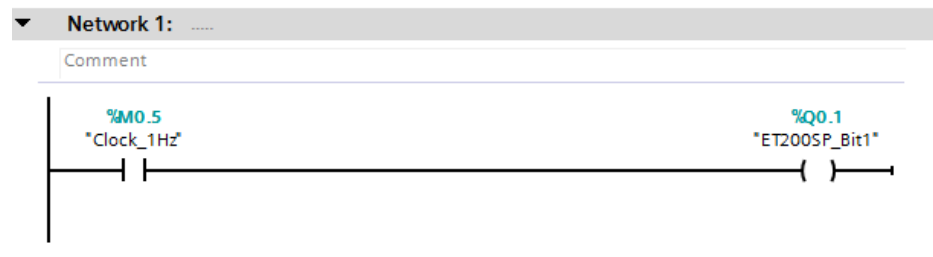
To enable the clock memory bit, proceed as follows:

1. In the project tree, open the device view of the CPU.
2. In the inspector window, go to the properties and then to "System and clock memory". Enable the clock memory bit.



Assigning a bit

To connect the clock memory bit with an output bit of the ET 200SP, open the "Main" block (OB1) of the CPU and add the following assignment to network that is still free:



As an address for the assignment, use an output bit of your ET 200SP.

2.2.5 Loading modules

All modules are loaded via TIA Portal.

However, the SCALANCE modules can only be loaded if no PROFINET relation has been built yet between them and the CPU.

For this reason, go to the project tree, select the module in the following order and load its project data.

1. SCALANCE XB208 (left)
2. SCALANCE XB208 (right)
3. CPU S7-1511

Note If loading of the SCALANCE modules is not possible due to an already existing PROFINET relation, transitionally disconnect the network connection between the SCALANCE X208 and the CPU.

Note For loading the project data into the SCALANCE modules, the HTTPS protocol is used. For this, TIA Portal requires the login data of the SCALANCE module. In the default setting, the user name and the password is "admin".

Click on the "Finish" button if the loading process has been completed without any errors.

Result:

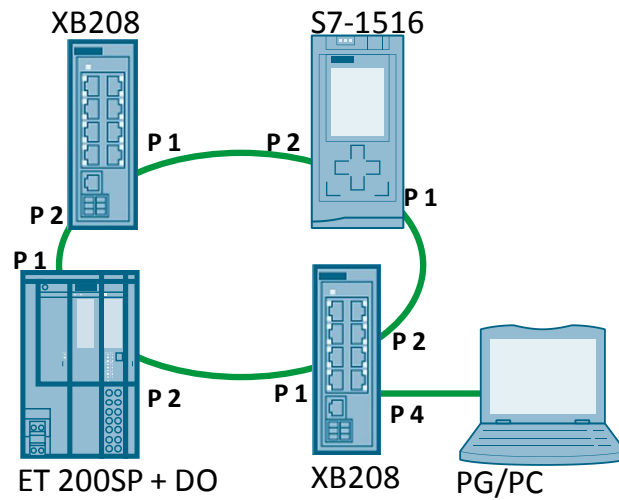
The modules automatically restart and the loaded configuration is activated.

If a module signals an error, try to find the cause by means of TIA Portal diagnostics and eliminate the error.

2.3 Commissioning

After configuration has been completed, the ring can be closed. Set up a ring topology as follows:

Figure 2-3



For the ring topology, the nodes are connected via the configured ring ports (port 1 and port 2).

2.4 Test

Error-free state

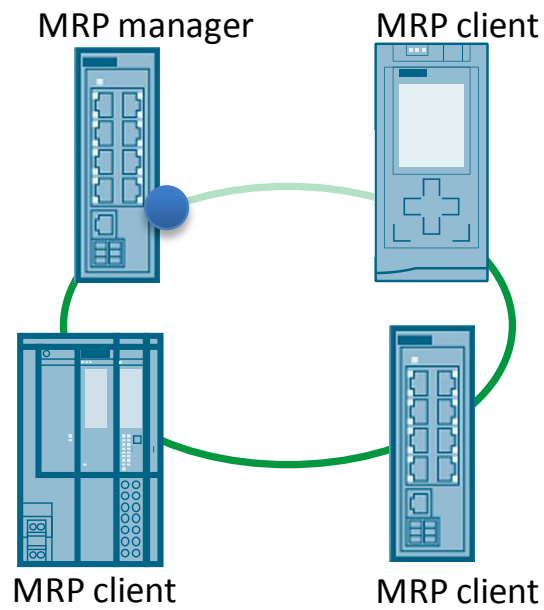
After having completed configuration and commissioning, you have set up a loop-free ring.

The MRP manager blocks one of its ring ports and gives the ring a linear structure.

The bit at the DO of the ET 200SP flashes cyclically.

The following figure shows the topology in an error-free state:

Figure 2-4



Error in the ring

To test the ring redundancy, provoke a ring switchover by dragging an (unblocked) connection (e. g. between SCALANCE XB208 and ET 200SP).

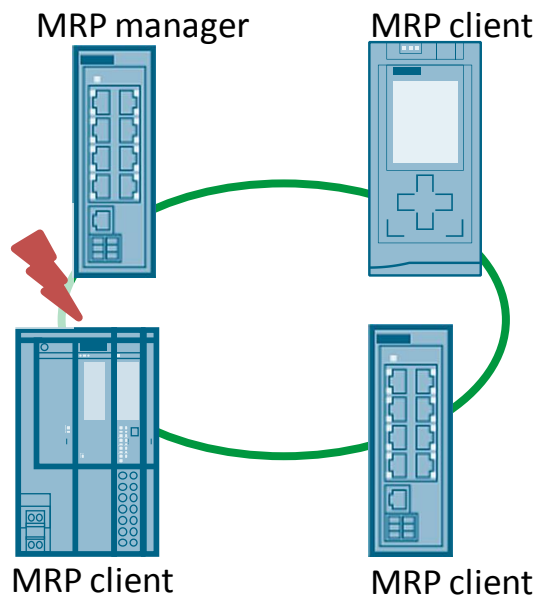
The redundancy manager detects the fault in the ring due to a failure of the test frames. It enables its previously blocked ring port and thus compensates the fault in the ring.

The flashing light continues to run cyclically.

Due to the adjustment of the update time in the IO devices, the brief interruption (reconfiguration time) does not involve a fault in the PROFINET communication.

The following figure shows the topology in case of a fault:

Figure 2-5



2.5 Diagnostics

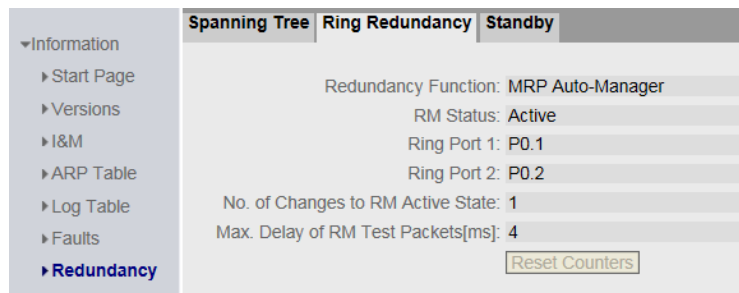
2.5.1 Web Based Management

Information about the status of the device with regard to ring redundancy is available in the Web Based Management of the SCALANCE X modules.

Go to the menu “Information” > “Redundancy” and then to the “Ring Redundancy” tab.

Here, you will find information on

- the role of the device within the ring,
- whether the ring is free of errors (the redundancy manager has opened the ring at its ring ports) or not (the redundancy manager connects through the connection between its ring ports),
- the ring ports used,
- the number of ring interruptions in case of a fault.



2.5.2 TIA Portal

Online access

The diagnostics in TIA Portal requires online access to the module to be diagnosed.

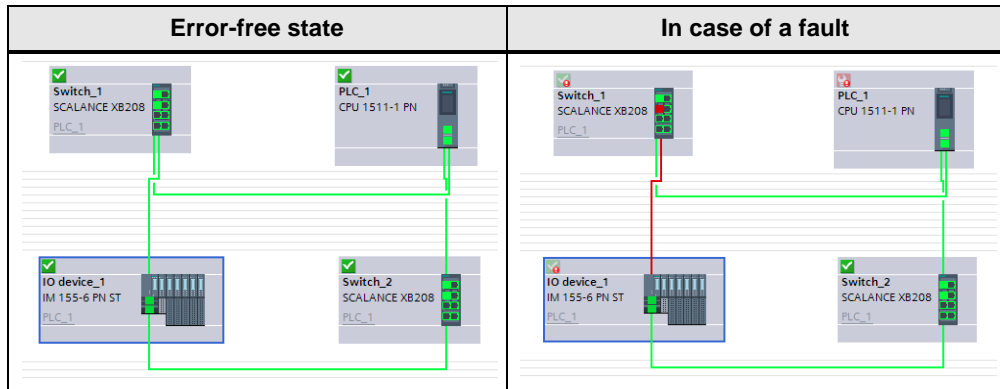
You can start the online and diagnostics view of a module to be diagnosed from the following screens:

- Overview
- Project tree
- Device view
- Network view
- Topology view

Topology

By defining the physical interconnection of the Ethernet ports in the topology view, the diagnostics status of the ports can be displayed graphically.

The following screenshot shows the topology of the configured MRP ring in the error-free state and in case of a fault:



Module diagnostics

When the online connection to a device is established, its diagnostics status will be determined and displayed via icons.

Switch_1 [SCALANCE XB208]		
Device configuration		
Online & diagnostics		
Switch_1 [SCALANCE XB208]		
Switch_2 [SCALANCE XB208]		✓
Device configuration		
Online & diagnostics		
Switch_2 [SCALANCE XB208]		✓

Moreover, you will get diagnostic information in plain text such as e. g. information on the MRP ring status:

MRP > Switch_1 [SCALANCE XB208]

Online access											
Diagnostics											
General											
Diagnostic status											
PROFINET interface [X1]											
IO controller											
Ethernet address											
Ports											
Communication diagn...											
PROFINET IO diagnostics											
Domain											
Sync domain											
MRP domain	<table border="1"> <tr> <td>Name:</td> <td>mrpdomain-1</td> </tr> <tr> <td>Role:</td> <td>Manager</td> </tr> <tr> <td>Ring port 1:</td> <td>Port 1 (X1P1)</td> </tr> <tr> <td>Ring port 2:</td> <td>Port 2 (X1P2)</td> </tr> <tr> <td>MRP ring status:</td> <td>Open</td> </tr> </table>	Name:	mrpdomain-1	Role:	Manager	Ring port 1:	Port 1 (X1P1)	Ring port 2:	Port 2 (X1P2)	MRP ring status:	Open
Name:	mrpdomain-1										
Role:	Manager										
Ring port 1:	Port 1 (X1P1)										
Ring port 2:	Port 2 (X1P2)										
MRP ring status:	Open										
Functions											
Assign IP address											
Assign name											
Reset to factory settings											
Identification											

User program

In the user program, there are two options to read out the MRP ring status:

1. By reading the data record 8050 (MrpInstanceReal) via the “RDREC” instruction from the redundancy manager
2. By using the diagnostic OB 82.

Note

Detailed instructions for this are available in the FAQ with entry ID 109483240.
(<https://support.industry.siemens.com/cs/ww/en/view/109483240>)

3 Appendix

3.1 Siemens services

Industry Online Support

You have questions or need support?

Siemens Industry Online Support offers access to our entire service and support know-how as well as to our services.

Siemens Industry Online Support is the central web address for information on our products, solutions and services.

Product information, manuals, downloads, FAQs and application examples – all information is accessible with just a few mouse clicks at

<https://support.industry.siemens.com/> .

Technical Support

Siemens Industry's Technical Support offers quick and competent support regarding all technical queries with numerous tailor-made offers – from basic support to individual support contracts.

Please address your requests to the Technical Support via the web form:

www.siemens.com/industry/supportrequest .

Service offer

Our service offer comprises i. a. the following services:

- Product Training
- Plant Data Services
- Spare Parts Services
- Repair Services
- Field & Maintenance Services
- Retrofit & Modernization Services
- Service Programs & Agreements

Detailed information on our service offer is available in the Service Catalog:

<https://support.industry.siemens.com/cs/sc>

Industry Online Support app

Thanks to the "Siemens Industry Online Support" app, you will get optimum support even when you are on the move. The app is available for Apple iOS, Android and Windows Phone.

<https://support.industry.siemens.com/cs/de/en/sc/2067>

3.2 Links and literature

Table 3-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Download page of this entry https://support.industry.siemens.com/cs/ww/en/view/109739614
\3\	SCALANCE XB-200 – Operating Instructions https://support.industry.siemens.com/cs/ww/en/view/109476747
\4\	SCALANCE XB-200 Web Based Management – Configuration Manual https://support.industry.siemens.com/cs/ww/en/view/109476752
5\	SITRAIN courses on Siemens Industrial Networks Education – Certification Program https://sitrain.com
\6\	Primary Setup Tool https://support.industry.siemens.com/cs/ww/en/view/19440762

3.3 Change documentation

Table 3-2

Version	Date	Modifications
V1.0	08/2016	First version