Network and Communication diagnostics

SCALANCE, SIMATIC

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1 Introduction

1.1 Overview

Reason
The availability of plants is one of the most important goals of any plant operator. An integrated diagnostic concept is necessary to guarantee the availability of a plant.

With an integrated diagnostic concept, malfunctions can be detected at an early stage and their cause can be localized. This can minimize failures in the plant.

There are numerous different diagnostic procedures in automation technology. The following questions therefore arise for the user in the search for an optimal diagnostic option:

- What solutions are there?
- How do the solutions differ?

Motivation
This document gives you an overview of the options available for diagnosing a SIMATIC controller or a SCALANCE network device, networks and communication.

Structure documentation
The documentation is divided in two parts: It begins with a general part. Here you will find general information on diagnosis and a rough overview of the common diagnostic options.

The general part is followed by a description of selected diagnostic tools. Each diagnostic tool has its own section. You will receive a short description of the diagnostic tool and answers to the following questions:

- WHEN or WHY can you use this diagnostic tool?
- What is the result of the diagnosis?
- Where can you find this diagnostic tool?
- WHAT are the advantages and added value?

If you would like to know more about the diagnostic tool described, you will find a link to the corresponding article in Siemens Industry Online Support in each section.
1.2 Integrated diagnostics concept:

SIMATIC S7-1500

In the SIMATIC S7-1500 automation system, integrated diagnostics are consistent across all automation levels. All SIMATIC products have integrated diagnostic functions with which you can efficiently analyze and localize errors. This shortens commissioning times and minimizes downtimes in production.

Note

Further information concerning diagnostics with SIMATIC S7-1500 is provided in the application example "Diagnostics Overview for SIMATIC S7-1200 and S7-1500".


SCALANCE

Thanks to their wide range of functions, the switches meet the requirements of a sustainable, industry-oriented Industrial Ethernet switch. The wide range of redundancy options, the multifaceted configuration and diagnostic options and the wide selection of variants enable the automation engineer to implement his desired network concept with SCALANCE switches.

Various diagnostic tools - centralized as well as local - also help you to keep downtimes as infrequent as possible. SCALANCE is characterized by a separate LED field for the hardware structure. There, the diagnostic LEDs can be identified at a glance, even when all the cables are plugged in. Port status, the status of the device via signaling contact as well as the status of the redundancy manager are clearly displayed here. As far as software is concerned, configuration is supported not only by the text-based CLI interface, but also by a web server in which settings can be made intuitively.
Diagnostics and diagnostic format

The following figure shows at which level and in which form you can diagnose modules.

Figure 1-1
Overview of the diagnostic tools

The following table lists the diagnostic tools that are covered in this overview document. Use the link in the right-hand column of the table to jump straight to the corresponding chapter.

Table 1-1

<table>
<thead>
<tr>
<th>Diagnostic tools</th>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display of the CPU</td>
<td>View diagnostics buffer und module status. Detect errors.</td>
<td>Chapter 3.1.1</td>
</tr>
<tr>
<td>LED</td>
<td>First aid for containing errors using an on-site analysis of the condition of the module.</td>
<td>Chapter 3.1.2, Chapter 3.2.1</td>
</tr>
<tr>
<td>System diagnostics</td>
<td>Evaluate information. Display text-based messages.</td>
<td>Chapter 3.1.3</td>
</tr>
<tr>
<td>System diagnostics in the user program</td>
<td>Configuring reactions to diagnostic messages.</td>
<td>Chapter 3.1.4</td>
</tr>
<tr>
<td>LOG file / system messages</td>
<td>View diagnostic messages in plain text and recognize errors.</td>
<td>Chapter 3.2.2</td>
</tr>
<tr>
<td>Web Based Management</td>
<td>Read internal errors. Detect overload situations. Monitoring the ring condition. View standby status. Check for module overheating.</td>
<td>Chapter 3.2.3</td>
</tr>
<tr>
<td>Cable tester</td>
<td>Check copper wires for faults.</td>
<td>Chapter 3.2.4</td>
</tr>
<tr>
<td>Cable tester</td>
<td>Detect interference in an optical transmission path.</td>
<td>Chapter 3.2.5</td>
</tr>
<tr>
<td>FMP Diagnostics</td>
<td>Detect power loss in an optical transmission path.</td>
<td>Chapter 3.2.6</td>
</tr>
<tr>
<td>Loop detection</td>
<td>Detect network loops.</td>
<td>Chapter 3.2.7</td>
</tr>
<tr>
<td>Signal recorder</td>
<td>Check connection quality in a WLAN.</td>
<td>Chapter 3.2.8</td>
</tr>
<tr>
<td>Spectrum analyzer</td>
<td>Check the radio channel for interference.</td>
<td>Chapter 3.2.9</td>
</tr>
<tr>
<td>Port mirroring</td>
<td>Record data traffic.</td>
<td>Chapter 3.2.10</td>
</tr>
<tr>
<td>Wireshark</td>
<td>Record and evaluate network communication on a local interface.</td>
<td>Chapter 4.1</td>
</tr>
<tr>
<td>Remote capture</td>
<td>Record and evaluate network communication across the entire network.</td>
<td>Chapter 4.2</td>
</tr>
<tr>
<td>SIMATIC Assessment Suite</td>
<td>Gather diagnostic and system information.</td>
<td>Chapter 4.3</td>
</tr>
<tr>
<td>PRONETA</td>
<td>Analyzing and configuring the PROFINET network.</td>
<td>Chapter 4.4</td>
</tr>
<tr>
<td>Symbolic status display of the modules</td>
<td>Display operating status and output relevant information on pending errors in the system.</td>
<td>Chapter 2.1</td>
</tr>
<tr>
<td>Diagnosis of communication connections</td>
<td>View the status of the communication connections.</td>
<td>Chapter 2.2</td>
</tr>
<tr>
<td>SNMP</td>
<td>Monitor network components, detect errors, and report errors.</td>
<td>Chapter 5.1</td>
</tr>
<tr>
<td>RMON</td>
<td>Collect and store statistical data in a network device for proactive monitoring and diagnosis.</td>
<td>Chapter 5.2</td>
</tr>
<tr>
<td>Ping</td>
<td>Check IP endpoint for accessibility.</td>
<td>Chapter 5.3</td>
</tr>
</tbody>
</table>
### Classification of diagnostic tools

The following figure shows how the diagnostic tools are to be classified in the automation pyramid:

**Figure 1-2**

<table>
<thead>
<tr>
<th>Control level</th>
<th>Management level</th>
<th>Operations management level</th>
<th>Network management</th>
</tr>
</thead>
<tbody>
<tr>
<td>On the CPU display</td>
<td>FMP Diagnostics</td>
<td>Signal recorder</td>
<td>Wired Diagnostics</td>
</tr>
<tr>
<td>LED display</td>
<td>Cable tester</td>
<td>Log table</td>
<td>Spectrum analyzer</td>
</tr>
<tr>
<td>User program</td>
<td>Web Based Management</td>
<td>Ping</td>
<td>Loop detection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRONETA</td>
<td>System diagnostics</td>
</tr>
</tbody>
</table>

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2 Diagnostics in TIA Portal

TIA portal offers extensive possibilities of diagnostics. The application example describes only the possibilities for network and communication diagnostics.

Note
Further information concerning diagnostics with TIA Portal is provided in the application example "Diagnostics Overview for SIMATIC S7-1200 and S7-1500".

2.1 Symbolic status display of the modules

Description
When you establish an online connection to a module, the system also determines its diagnosis status and, if necessary, that of its subordinate components. If the module has an operating status, this is also determined. The diagnostic status and operating status are displayed with icons in the TIA portal.

What do you see?
If you have established an online connection, you will see additional diagnostic icons for the diagnostic status and operating status.

The following table shows a selection of the diagnostic symbols:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td>No fault</td>
</tr>
<tr>
<td>✅</td>
<td>Maintenance required</td>
</tr>
<tr>
<td>🔴</td>
<td>Maintenance request</td>
</tr>
<tr>
<td>🔴</td>
<td>Error</td>
</tr>
<tr>
<td>🚦</td>
<td>The module or the device is deactivated.</td>
</tr>
<tr>
<td>🚧</td>
<td>The module or the device is not accessible from the CPU (valid for modules and devices below a CPU).</td>
</tr>
<tr>
<td>🚧</td>
<td>The functionality of the module or submodule is not available.</td>
</tr>
<tr>
<td>🚧</td>
<td>The connection is established, but the state of the module is currently being determined or is unknown.</td>
</tr>
</tbody>
</table>

Where can you find this?
If you have set up an online connection, you can find the icons for the diagnosis status and operational status in all views in the TIA Portal. These include:

- Device overview
- Network view
- Topology
- Project navigation

The corresponding diagnostic symbol is displayed for each hardware component. For hardware components with their own operating status, the operating status symbol is also displayed.
Further information

For more information on the symbolic status display, see

- in the "SIMATIC STEP 7 Basic/Professional V15 and SIMATIC WinCC V15" > Section 11 "Editing Devices and Networks" > Chapter 2.1 "Hardware Diagnostics":

- in the FAQ "How can you use the online and diagnostic view in the TIA Portal to diagnose the decentralized periphery and subordinate modules":

- In the application example "System Diagnostics with S7-1500 and TIA Portal".

- In the FAQ "Why are the modules in the STEP 7 (TIA Portal) online view marked as different, although they are identical?"

- In the FAQ "How can you use the online and diagnostic view in the TIA Portal to diagnose the decentralized periphery and subordinate modules?"
2.2 Diagnostics of communication connections

Description

The TIA Portal provides you with a connection table. In the connection table, you can display the details of all communication connections created in the project or of selected communication connections.

If you have established an online connection to a module (CPU or CP) that is involved in one or more communication services, the connection diagnosis is started.

Diagnostic icons for the connection status are now added to the properties of the offline listed communication connections in the connection table.

In addition, the connection table now also contains entries for all communication connections that only exist online, e.g. connections for instructions for open user communication, PG and OP connections, connections for web server access.

What do you see?

If you have established an online connection, you will see additional diagnostic symbols for the communication connections in the connection table.

The following table shows the diagnostic icons for communication connections:

Table 2-2

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Connection established</td>
</tr>
<tr>
<td></td>
<td>Connection is not established or is being</td>
</tr>
<tr>
<td></td>
<td>established.</td>
</tr>
<tr>
<td></td>
<td>Connection not available</td>
</tr>
</tbody>
</table>

Where can you find this?

You can find the connection table in the tabular area of the network view.

Further information

Further information on connection diagnostics can be found in the “SIMATIC STEP 7 Basic/Professional V15 and SIMATIC WinCC V15” manual > Section 11 “Edit Devices and Networks” > Chapter 2.2 “Diagnosing Connections”: https://support.industry.siemens.com/cs/ww/en/view/109755202
3 Diagnostics on the device

SIMATIC and SCALANCE have useful on-board equipment for the diagnosis and optimization of industrial networks. This chapter describes the diagnostic tools that the devices themselves come with.

3.1 Diagnostics with SIMATIC

The application example describes only the possibilities for network and communication diagnostics.

Note

Further information concerning diagnostics on the device is provided in the application example "Diagnostics Overview for SIMATIC S7-1200 and S7-1500". https://support.industry.siemens.com/cs/ww/en/view/109752283

3.1.1 Display view CPU

Description

The S7-1500 CPUs have a display with control buttons. You can use the display for the following purposes:

- Read out the status information for the configured modules.
- Diagnosis
- Adjust CPU settings.

What do you see?

There are two main menu items in the CPU display that are relevant for diagnostics:

- "Diagnostics" menu
- Menu "Module"

The "Diagnostics" menu contains:

- The display of diagnostic messages.
- The display of alarms.

The "Modules" menu contains information on the central and decentralized modules used in your configuration.

What are the advantages?

If you use the display of the CPU, you have the following advantages:

- Shorter downtimes of the system due to diagnostic messages in plain text.
- Reading of the diagnostic buffer and the module status directly on site. No PG / PC is required.

When do you use it?

You can use the display of the CPU at any time, even during operation of the system. In the event of service, system downtime is minimized by quick access to the diagnostic messages.
3 Diagnostics on the device

Further information

For more information about the display of the CPU, see:

- In the "PROFINET with STEP 7 V15" operating manual https://support.industry.siemens.com/cs/ww/en/view/49948856
- In the "SIMATIC S7-1500, ET 200MP, ET 200SP, ET 200AL, ET 200pro Diagnostics" function manual: https://support.industry.siemens.com/cs/ww/en/view/59192926

3.1.2 Status LED on the module

Description

Most SIMATIC modules have an LED display on the housing for status and error indication. Depending on the status and error, one or more LEDs light up. Diagnosis by LEDs is first aid for containing errors. To further limit the error, you will usually evaluate the display of the module status in STEP 7 or the diagnostic buffer of the CPU.

What do you see?

The S7-1500, ET 200MP, ET 200SP and ET 200AL systems have LEDs to indicate the status and errors.

The "RUN" LED indicates the operating status.

If there is an error in the system, the "ERROR" LED lights up red.

The S7-1500, ET 200MP, ET 200SP and ET 200AL systems support the diagnostic concept and maintenance concept in PROFINET IO in order to recognize and eliminate potential faults at an early stage. As soon as network components need to be checked or replaced, the "MAINT" LED signals this to the user via a yellow flashing light.

With the ET 200SP decentralized peripheral system, you can also determine the information on the cause of the error via the LED error display. After an announcement by means of a flashing signal, the error type and then the error location and error code are displayed.

What are the advantages?

When you evaluate the LEDs of the module, you have the following advantages:

- You can see the condition of your system directly on site. No PG / PC is required.
- Shorter downtimes of the plant. In the event of a fault or maintenance, you can take immediate action to correct the fault or the cause of the maintenance request.
- You can identify and eliminate potential faults at an early stage.

When do you use it?

You can evaluate the LEDs of the CPU at any time, even during operation of the system.

If your CPU is not accessible, you can also view the status of the LEDs via the "Online & Diagnostics" function of TIA Portal.
Where can you find this?
The LEDs for the operating status of the CPU are located on the front above the operating panel.
The "RX/TX" LED is located at the interface connections. On the S7-1500 CPU, you will find this LED under the control panel with the display.

Further information
A detailed description of all LEDs of the modules with error causes and remedial measures can be found in the respective module documentation.

3.1.3 System diagnostics
Description
Hardware components and third-party devices can trigger a system reaction if a system error occurs and provide information on the system error that has occurred.
System diagnostics offers you a convenient way of evaluating this information for S7-1500 CPUs and displaying it in the form of text-based messages.
System diagnostics is an integral part of STEP 7 and does not require an additional license. The system diagnosis of the S7-1500 CPUs is activated by default. You do not need to make any further settings here.

What do you see?
The system diagnosis displays all relevant information on pending errors in the system. This information is automatically packed into text messages.
The database of all messages is the diagnostic buffer in the CPU. The diagnostic buffer is designed as a ring buffer: The most recent event is in the diagnosis buffer on the first line. An entry consists of a time stamp and the event text.
A new entry is triggered by the following events, among others:
- Internal and external errors in one module
- System error in the CPU
- Operating state transitions
- User program error
- Removal and insertion of modules
- Security events
The following security events (event types) each lead to an entry in the diagnosis buffer:
- Go online
- Manipulation of communication data, the data on SIMATIC Memory Card, the firmware update file detected.
- A changed protection level (access protection) is loaded into the CPU.
- Password legitimization restricted or released.
- Online access denied because the number of simultaneous accesses was exceeded.
- Timeout due to inactivity of an existing online connection.
- Logging on to the Web server.
- A backup of the CPU is created.
- The CPU project planning is restored.
What are the advantages?

If you use the system diagnosis, you have the following added value:

- Programming the system diagnosis is not necessary.
- Errors can be localized quickly.
- The system diagnostics is automatically updated when the hardware configuration changes.
- Transparent status messages for controllers, peripherals, and drives (motion control messages).
- System diagnostics are activated by default for the SIMATIC S7-1500 CPU and are also available in the “STOP” operating state.
- Errors or events can still be evaluated by the diagnostic buffer even after a long time in order to determine the cause of a STOP or to be able to trace and assign the occurrence of individual diagnostic events.
- You can make settings for the system diagnosis, for example, a confirmation requirement for the message.

When do you use it?

As soon as the system diagnosis has received the information on the system error that has occurred from the module, the messages are made available to the user in text form.

You can view the system error messages at any time, even during system operation.

Where can you find this?

You can view the system diagnosis messages in the following places:

- In the "Diagnostics" tab of the TIA Portal Inspector window.
- On the web server of the CPU
- On the CPU's own display
- In the diagnostic buffer of the CPU
- Using the “System Diagnostics Display” tool on a HMI visualization.

Further information

For more information on integrated system diagnostics, see:

- In the “SIMATIC STEP 7 Basic/Professional V15 and SIMATIC WinCC V15” manual > Section 11 "Editing devices and networks" > Chapter 2.4 “System diagnostics for S7-1500 PLCs (S7-1500)":
- In the “SIMATIC STEP 7 Basic/Professional V15 and SIMATIC WinCC V15” manual > Section 11 "Editing Devices and Networks“ > Chapter 2.1 ”Hardware Diagnostics“:
- In the “SIMATIC S7-1500, ET 200MP, ET 200SP, ET 200AL, ET 200pro Diagnostics” function manual:
- In the application example "System Diagnostics with S7-1500 and TIA Portal".
3.1.4 System diagnostics in the user program

Description

A manufacturer-independent structure for data records with diagnostic information applies. A manufacturer-independent structure for data records with diagnostic information applies.

The instructions in the TIA module library and the library from Siemens Industry Online Support make it easier for you to read the information from the data sets.

What do you get?

The following instructions are available to help you determine the system diagnostics of a device:

Table 3-1

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDREC</td>
<td>The instruction reads data records of a component of a DP slave / IO device, which can contain error information.</td>
</tr>
<tr>
<td>RALAM</td>
<td>When the diagnostic alarm OB (OB 82) is called, the instruction reads the start information of the OB and provides information on the cause and location of the error.</td>
</tr>
<tr>
<td>DPNRM_DG</td>
<td>The instruction reads the current diagnostic data of a DP slave (DP standard diagnosis).</td>
</tr>
<tr>
<td>GEN_DIAG</td>
<td>The instruction generates diagnostic information.</td>
</tr>
<tr>
<td>Gen_UsrMsg</td>
<td>The instruction generates a message that is entered in the diagnosis buffer.</td>
</tr>
<tr>
<td>GET_DIAG</td>
<td>The instruction provides diagnostic information.</td>
</tr>
<tr>
<td>GTE_NAME</td>
<td>The instruction reads out the name of an IO device</td>
</tr>
<tr>
<td>T_DIAG</td>
<td>This instruction provides diagnostic and status information for a connection.</td>
</tr>
<tr>
<td>RD_SINFO</td>
<td>The instruction reads the start information of the OB that was last called up and not yet processed completely, and of the startup OB that was last called. The instruction provides general error information</td>
</tr>
<tr>
<td>LED</td>
<td>The instruction reads the status of the LED of the module.</td>
</tr>
<tr>
<td>Get_IM_Data</td>
<td>The instruction reads the Information &amp; Maintenance data of the CPU.</td>
</tr>
<tr>
<td>Transfer_IM_Data</td>
<td>The instruction transmits Information &amp; Maintenance data to the CPU.</td>
</tr>
<tr>
<td>DeviceStates</td>
<td>This instruction outputs the status of all devices of an IO system.</td>
</tr>
<tr>
<td>ModuleStates</td>
<td>This instruction outputs the status of all modules of a device.</td>
</tr>
</tbody>
</table>

In the Siemens Industry Online Support you will also find a module library for PROFINET data sets.
3 Diagnostics on the device

You can execute the following functions with these library modules:

- Reading the device information:
  - Information about the interface, e.g. IP and MAC address
  - Information about the device interface, e.g. status, medium, name
  - Information about the link status of the interfaces, e.g. link down, link up
  - Information about the role of the device in MRP, e.g. client, manager
  - Information on port statistics, e.g. number of bytes received
- Reading the MRP status
- Modification of the parameters of an analog input module of the ET 200SP at runtime, e.g. for deactivating and activating the channel diagnostics.

Where can you find this?

You can find the instructions for diagnosis in the TIA function module library You can find the module library for PROFINET data records in the Siemens Industry Online Support under the entry ID: 109753067.


What are the advantages?

If you use the system diagnosis in the user program, then you have the following advantages:

- You can define the program technology yourself as to how your system should react to certain diagnostic messages.
- You can process and visualize the diagnostic messages according to your own specifications.
- You do not need to know the structure of the diagnosis data records.

When do you use it?

You can call the instructions and the library modules at any time in the user program and evaluate the result.

Note

Some instructions work asynchronously, that is, they are processed over several sessions.
Further information

For more information about the instructions for system diagnostics, see:

- Online Help to STEP 7
- In the manual "SIMATIC STEP 7 Basic/Professional V15 and SIMATIC WinCC V15":
- In the "SIMATIC S7-1500, ET 200MP, ET 200SP, ET 200AL, ET 200pro Diagnostics" function manual:
- In the programming manual "From PROFIBUS DP to PROFINET IO":
- In the "PROFINET with STEP 7 V15" operating manual:
- In the application example "Diagnostics in the user program with S7-1500":
- In the FAQ "How do you implement the module or channel diagnostics in the user program of the SIMATIC S7-1200/S7-1500?":
3.2 Diagnostics with SCALANCE

3.2.1 LED display

Description
All managed SCALANCE X devices have an LED display on the housing for status and error indication. Depending on the status and error, one or more LEDs light up. Diagnosis by LEDs is first aid for containing errors.

What do you see?
To indicate the status and error, most SCALANCE X devices have the following LEDs:
- LED "F": Display of the error status
- LED "RM": Display of the "Redundancy Manager" function
- LED "SB": Displaying the "Standby" function
- LED "DM": Display of the display mode
- LED "L1/L2": Display of the power supply
- LED "P": Port status display. The number depends on the device.

<table>
<thead>
<tr>
<th>LED</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>The LED &quot;F&quot; indicates the error status of the device.</td>
</tr>
<tr>
<td>RM</td>
<td>The &quot;RM&quot; LED indicates whether the device is a redundancy manager and</td>
</tr>
<tr>
<td></td>
<td>whether the ring is operating without errors.</td>
</tr>
<tr>
<td>SB</td>
<td>The &quot;SB&quot; LED indicates the status of the standby function.</td>
</tr>
<tr>
<td>DM</td>
<td>The LEDs &quot;DM1&quot; and &quot;DM2&quot; indicate which display mode is set.</td>
</tr>
<tr>
<td></td>
<td>The LEDs &quot;L1&quot;, &quot;L2&quot; and the port LEDs display different information</td>
</tr>
<tr>
<td></td>
<td>depending on the display mode set.</td>
</tr>
<tr>
<td>L1 / L2</td>
<td>The LEDs &quot;L1&quot; and &quot;L2&quot; indicate whether the power supply L1 / L2 is</td>
</tr>
<tr>
<td></td>
<td>connected. The meaning of the &quot;L1&quot; and &quot;L2&quot; LEDs depends on the set</td>
</tr>
<tr>
<td></td>
<td>display mode.</td>
</tr>
<tr>
<td>P</td>
<td>The port LEDs &quot;P1&quot;, &quot;P2&quot;, etc., display information on the corresponding</td>
</tr>
<tr>
<td></td>
<td>ports. The meaning of LED &quot;P&quot; depends on the set display mode.</td>
</tr>
</tbody>
</table>

What are the advantages?
When you evaluate the LEDs of the module, you have the following advantages:
- You can see the condition of your system directly on site. No PG / PC is required.
- Shorter downtimes of the plant. In the event of a fault or maintenance, you can take immediate action to correct the fault or the cause of the maintenance request.
- You can identify and eliminate potential faults at an early stage.

When do you use it?
You can evaluate the LEDs of the SCALANCE at any time, even during operation of the system.
Depending on the installation location, however, direct access to the device is not always possible. For this reason, Web Based Management offers a simulation display for the light emitting diodes. Unused ports are shown as grey LEDs.
3 Diagnostics on the device

Where can you find this?
You will find the LEDs on the front of the SCALANCE housing. The arrangement of the LEDs depends on the device.

Further information
A detailed description of all LEDs and corrective measures can be found in the respective SCALANCE documentation.

3.2.2 Log table

Description
SCALANCE allows you to log events that occur, some of which you can define yourself.
The contents of the event log table are retained even after the power is turned off.

What do you see in the log table?
You can define which system events are to appear in the log table in Web Based Management (WBM) or via the Command Line Interface (CLI).
You can generate an entry in the log table for the following system events:
- Cold start, warm start
- Link Change
- Authentication error
- RMON alarm
- Switching the power supply
- Changes in the spanning tree, MRP / HRP ring status or error status
- Loop detection
- Diagnostics alarms
- Status change Standby, 802.1X port authentication or PoE
- Secure NTP

What are the advantages?
With the log table, you have the following added value:
- The entries in the log table are generated automatically.
- The events are readable in plain text. The errors can be localized quickly.
- All system events can be read in at a central location.
- Errors or events can still be evaluated by the log table even after a long time in order to determine the cause of an error or to be able to trace and assign the occurrence of individual diagnostic events.

When do you use it?
You can theoretically view the log table in SCALANCE at any time. If SCALANCE signals an error, e.g. via the error LED, it makes sense to look in the log table. All events are displayed in text form in the log table.

Where can you find this?
You can find the log table in Web Based Management.
3 Diagnostics on the device

Further information
A detailed description of the log table can be found in the corresponding configuration manual for SCALANCE.

3.2.3 Web Based Management

Description
Each managed SCALANCE has an integrated web server for Web Based Management (WBM). You can configure the device using Web Based Management, but you can also read diagnostic and status information.

What do you see in Web Based Management?
Which diagnostic and status information you can read from the Web Based Management of SCALANCE depends on the SCALANCE used.
The diagnostic and status information of the SCALANCE XC-200 are selected as examples in this section. In the "Information" menu, you will find numerous menu items that provide you with the following diagnostic and status information:
- Internal error
- State of the redundancy protocols, e.g. whether the ring is open.
- Statistics counter of Ethernet telegrams to detect overload situations.
- Temperature values of the switch and connected devices to detect an overheating prematurely.
- Security settings

The following table explains the menu items and their contents in detail:

<table>
<thead>
<tr>
<th>Menu</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error</td>
<td>If an error occurs, the error is displayed on this page. Errors are indicated on the device by the red error LED illuminating. Internal errors of the device and errors that you have configured are reported.</td>
</tr>
<tr>
<td>Redundancy</td>
<td>The page is divided into several tabs and displays the current information and states of the redundancy protocols.</td>
</tr>
<tr>
<td></td>
<td>• Register Spanning Tree: Here you can see current information and the settings of the root bridge.</td>
</tr>
<tr>
<td></td>
<td>• “Redundancy” tab: Among other things, here you will see:</td>
</tr>
<tr>
<td></td>
<td>- The device redundancy function.</td>
</tr>
<tr>
<td></td>
<td>- The state (open/closed) of the ring.</td>
</tr>
<tr>
<td></td>
<td>- The configured ring ports.</td>
</tr>
<tr>
<td></td>
<td>• Standby: Among other things, here you will see:</td>
</tr>
<tr>
<td></td>
<td>- Standby ports</td>
</tr>
<tr>
<td></td>
<td>- Standby function.</td>
</tr>
<tr>
<td></td>
<td>- The status (active / passive) of the standby port.</td>
</tr>
<tr>
<td></td>
<td>• Link check: Here, you can see:</td>
</tr>
<tr>
<td></td>
<td>- The ports on which you can enable Link Check</td>
</tr>
<tr>
<td></td>
<td>- The current status</td>
</tr>
<tr>
<td></td>
<td>- The statistics of sent and received link check telegrams of the monitored connections</td>
</tr>
<tr>
<td>Ethernet statistics</td>
<td>The switch keeps an internal statistics counter with which it counts the number of received data packets for each port.</td>
</tr>
</tbody>
</table>
3 Diagnostics on the device

<table>
<thead>
<tr>
<th>Menu</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td>This page displays the temperature values of internal and external modules of the device. The modules are only displayed if they provide temperature information. If the temperature value falls below or exceeds the displayed threshold values, the status changes accordingly. You can configure that you are informed by a message.</td>
</tr>
<tr>
<td>Security</td>
<td>This page displays the security settings and local user accounts.</td>
</tr>
</tbody>
</table>

What are the advantages?

If you use Web Based Management, you have the following advantages:

- You only need a web browser to monitor the status of your module and your network. No special software is required on the PC.
- You can log on to Web Based Management at any time of day and from anywhere in the world via the company network or a corresponding dial-in option.
- You will find all the necessary information in the event of a fault clearly arranged and easy to grasp.
- To use Web Based Management, you must log on to the device. It is not possible for unauthorized users to gain access to the device.

When do you use it?

If sporadic problems occur in your network, the cause may be an overload situation, for example. Fast and simple diagnostics are possible with Web Based Management and Ethernet statistics. The information from the Ethernet statistics gives you an overview of data traffic and any network problems that may occur.

If you have designed your network redundantly and a fault occurs, communication is still ensured by the redundant connection. However, communication is only possible as long as the redundant connection is intact. You can use Web Based Management to monitor redundancy in your network and react if redundancy is no longer guaranteed in the event of a fault.

You can use Web Based Management to view the current operating temperature of your module. If the module is in a critical temperature range, you can be informed and react accordingly.

Where can you find this?

To open the Web Based Management of SCALANCE, enter the IP address or the URL of the device in the address field of the Internet browser. If a connection to the device exists, the login page of Web Based Management (WBM) appears.

Further information

A detailed description of Web Based Management can be found in the corresponding configuration manual for SCALANCE.
3.2.4 Cable tester for copper cables

Description
You can use cable testers to find errors at the cabling level. Nearly all the managed SCALANCE X devices offer an integrated cable tester for copper cables. With the cable tester, each individual Ethernet port can perform independent fault diagnosis on the cable. This test is performed without the cable being disconnected, a cable tester connected and a loopback module installed at the other end.

What will you learn from this test?
If you use the integrated cable tester, you can locate short circuits and line interruptions to within a few meters. You can view the test result in Web Based Management.

As a test result you get the following statements:
- The status of the line, e.g. "Short circuit", "OK".
- The distance to the open cable end, cable break or short circuit in meters.

Note
The test is only allowed if no data connection is established on the port to be tested. If there is a data connection on the port to be tested, the connection is briefly interrupted.

What are the advantages?
If you use the integrated cable tester, you do not need any additional software or hardware. The cable tester is integrated in the SCALANCE.

When do you use it?
If you detect faults in the network, the cause of the fault may also be on the physical layer.

A disturbance in the network can manifest itself as follows:
- Defective performance
- Incorrect date packages
- Sporadic interruptions
- Complete breakdown

You can use the integrated cable tester to diagnose and eliminate errors at the cabling level.

Where can you find this?
You will find the integrated cable tester in the Web Based Management of SCALANCE.

Further information
Further information on the cable tester can be found in the corresponding SCALANCE X configuration manual.
3 Diagnostics on the device

3.2.5 Cable tester for optical fibers

Description

If transmission errors occur with optical lines, it is not obvious what caused the problem. The problem can be the transmitter, the receiver or the transmission path.

In many cases SCALANCE can help you with the diagnosis. The plug-in transceivers provide valuable information for troubleshooting.

With the SFP diagnosis integrated in the SCALANCE, you carry out an independent fault diagnosis for each individual SFP port. This test is performed without a cable being disconnected, a cable tester connected and a loopback installed at the other end.

What will you learn from this test?

If you use the SFP, SFP+, SCP or STP plug-in transceivers, the plug-in transceivers provide you with important information. You can read this information with the integrated SFP diagnosis.

The SFP diagnosis provides you with the current operating data, the lower limit and the upper limit for each plug-in transceiver.

The current operating data consists of the following values:

- The nominal bit rate of the SFP port.
- The port temperature.
- The voltage applied to the port.
- The power supplied to a device on this port.
- The reception and transmission power of the port.

You can read the result of the SFP diagnosis in Web Based Management. If you compare the current operating data with the permissible limits, you can determine whether you should rather check the lines and connectors or the transceivers in the event of a fault in an optical transmission path. The operating temperature of the plug-in transceiver can be an important indication of thermal problems of the network component.

What are the advantages?

If you use SFP diagnosis in the event of interference in an optical transmission path, you have the following advantages:

- You do not need any additional software or hardware. SFP diagnosis is integrated in SCALANCE.
- You can limit the error. If the current operating data of the plug-in transceiver are within the normal range, then the cause of the error could be in the line.

When do you use it?

If you detect faults in the network, the cause of the fault may also be on the physical layer.

A malfunction can manifest itself as follows:

- Defective performance
- Incorrect date packages
- Sporadic interruptions
- Complete breakdown

You can use the integrated SFP diagnostics to diagnose and limit faults at the cabling level for optical fibers.
3 Diagnostics on the device

Where can you find this?
You can find the integrated SFP diagnosis in the Web Based Management of SCALANCE.

Further information
For more information on SFP diagnostics, refer to the corresponding SCALANCE X configuration manual.

3.2.6 FMP diagnostics

Description
To monitor an optical path, you can use the Fiber Monitoring Protocol (FMP). This function continually monitors the transmission and reception power of an optical port. An alarm is triggered as soon as the temperature falls below the limit values.

What you will receive with the FMP diagnostics:
Fiber monitoring allows you to monitor reception power and power loss on optical links between two switches.
If the value of the received power or the amount of the power drop exceeds or falls below the set limit values, an event is triggered. You can set limits in two steps for messages with the severity levels "Warning" and "Critical".

What are the advantages?
If you use FMP diagnosis, you have the following advantages:
• You do not need any additional software or hardware. FMP diagnosis is integrated in SCALANCE X.
• You can continually monitor your optical path and detect fiber breaks or fiber degradation at an early stage.

When do you use it?
If you detect faults in the network, the cause of the fault may also be on the physical layer.
A malfunction can manifest itself as follows:
• Defective performance
• Incorrect date packages
• Sporadic interruptions
• Complete breakdown
You can use the integrated FMP diagnostics to detect errors on an optical path at an early stage and to be warned of deviations.

Where can you find this?
If your SCALANCE X device supports FMP diagnostics, you can find the integrated FMP diagnostics in the Web Based Management of SCALANCE X.

Further information
For more information on FMP diagnostics, refer to the corresponding SCALANCE X configuration manual.
3 Diagnostics on the device

3.2.7 Loop detection

Description

A loop is an error in the network structure. In most situations, a network loop causes the network to come to a complete standstill because the network is overloaded by the high flood of multicast and broadcast packets. Due to the high network load, the diagnosis is also severely impeded.

"Loop Detection" is a proprietary protocol from SIEMENS that resolves local loops in a network. To resolve network loops, the function specifically switches off ports of a switch on which a loop has been detected.

What will you learn from the "Loop Detection"?

You can use the "Loop Detection" function in Web Based Management to specify the ports for which loop detection is to be activated. You also specify how the port should react when a remote loop occurs. The following options are available for selection:

- No action: A loop has no effect on the port.
- Deactivate: The port is blocked.

When a port is blocked in the SCALANCE X, the corresponding "P" LED flashes on the device housing.

You will also see a corresponding entry in the log table.

Note

The "Loop Detection" function is not a redundancy protocol. Ports that have been blocked by this function must be reactivated manually using the switch's Web Based Management.

What are the advantages?

If you use the "Loop Detection" function, you can find and correct the error more quickly.

When do you use it?

You can use the "Loop Detection" function to protect your network from local and remote loops.

Note

"Loop Detection" is a proprietary protocol from SIEMENS and is only supported by SCALANCE devices.

To detect loops, test frames are sent from the switches. The test frames create an additional network load.

Where can you find this?

You can find the "Loop Detection" function in the Web Based Management of SCALANCE X.

Further information

For further information on the "Loop Detection" function, refer to the corresponding configuration manual for SCALANCE X.
3.2.8 Signal recorder

Description

The SCALANCE W components have an integrated signal recorder. The signal recorder records the signal strength of the access point and other connection data on the IWLAN client side. The signal recorder is a helpful tool for obtaining initial information about the connection quality and the illumination of a system, as well as for finding possible optimization possibilities.

The "Signal recorder" function is only available in client mode.

What do you see with the signal recorder?

You can use the signal recorder to record the effective useful signal between the access point and the client. This data helps you to find the areas with insufficient useful signal.

You can view the measurement result in Web Based Management.

In Web Based Management, the measurement result is divided into two areas:

- The "Client" section shows the measurement of the client.
- The "Access Point" area represents the measurement of the access point to which the client is currently connected.

Both areas contain two figures each with further information, e.g. signal strength, noise floor, and roaming.

What are the advantages?

If you use the signal recorder, you have the following advantages:

- With the signal recorder you can obtain initial information about the connection quality and the illumination of a system.
- You can save the measurement results as a PDF file. The PDF file contains a graphical representation of the course of the effective useful signal in dBm and the course of the data rate in Mbps.

When do you use it?

You use the signal recorder when planning your WLAN channel.

In order to obtain a meaningful recording of the signal, it is necessary to plan the signal recorder recording in advance. Among other things, the following questions need to be clarified:

- Is it a static or a mobile application?
- Where can the IWLAN clients be located in the system?
- Which critical points (shielding, sources of interference,...) are in the system?
- Is the system already in full operation during the test run (from a technical radio point of view)?

The signal recorder can be used particularly advantageously if the client is moving along a fixed path.

Where can you find this?

You can find the integrated signal recorder in Web Based Management for SCALANCE W.
3 Diagnostics on the device

Further information
For more information on the signal recorder, see:
- In the configuration manual for SCALANCE W.
- In the FAQ "What information can you obtain from the signal recorder of the SCALANCE W components?" https://support.industry.siemens.com/cs/ww/en/view/109470655

3.2.9 Spectrum analyzer

Description
When designing a WLAN system in industry, an interference-free channel is a basic requirement for robust communication.

If you have interference in your WLAN, the cause may be that other systems besides the WLAN devices also transmit on the same frequency as your WLAN. You can use the spectrum analyzer analysis tool to detect errors or analyze problems. The spectrum analyzer is used to acquire and display a signal in the frequency domain.

The SCALANCE W access points with V5.2 firmware have an integrated spectrum analyzer.

What do you see with the spectrum analyzer?
If you use the integrated spectrum analyzer, you can recognize and display electromagnetic signals of a frequency range. You can measure the strength of all signals in the vicinity of the access point. You can view the measurement result in Web Based Management.

The measured values of the spectrum analysis are recorded in three output windows:
- The maximum values, the current values and the average values of the received signal strength in dBm are displayed in the "Realtime" output window. This helps you to diagnose malfunctions at different positions.
- In the "Spectrogram" output window, the time course is displayed in the form of a waterfall diagram of the first display. The spectrogram displays the received signals in a complete system.
- The output window "Density Chart" shows the percentage signal strength depending on the dBm value.

What are the advantages?
If you use the integrated spectrum analyzer, you have the following advantages:
- You can use spectrum analysis to identify the causes and effects of WLAN interference.
- If you want to evaluate the result of the spectrum analysis, you can save the absolute dBm values of the last recording as a CSV file.

When do you use it?
You use the spectrum analyzer when planning your WLAN channel. With the spectrum analyzer you can determine whether the channel is free or disturbed by other systems.

Note
If you activate the spectrum analyzer, all connected clients lose connection to the access point as long as the signal analyzer is running.
Where can you find this?
You can find the integrated spectrum analyzer in the Web Based Management of the SCALANCE W Access Point.

Further information
You can find further information about the spectrum analyzer:
- In the configuration manual for SCALANCE W.
- In the FAQ "What information does the spectrum analyzer of a SCALANCE W Access Point provide?"

3.2.10 Port mirroring

Description
If you want to record network traffic on an Ethernet hub, you can use your analyzer to hang on any port on the hub. The hub forwards all incoming data frames to all ports.

A switch, on the other hand, forwards a data packet only to the port where the target device is located. To record traffic from a switch port, the analyzer should be plugged into the port to which the target device is already connected. The problem is that only one device can hang on a switch port. To solve this problem, all managed SCALANCE X devices have the "Port Mirroring" function.

With port mirroring, all traffic that passes through one switch port is mirrored to another switch port. This allows the target device to remain connected to the original port and the analysis device, e.g. a PC with Wireshark, is connected to the monitor port.

What do you see during the port mirroring?
The "Port Mirroring" function maps the data traffic of one port (mirror port) to another port (monitor port). You can then analyze the data traffic at the monitor port without feedback.

You can make the following settings for each mirror port:
- The incoming and outgoing data traffic is copied.
- Only incoming traffic is copied.
- Only outgoing traffic is copied.

Note
If your switch is VLAN-enabled, the monitor port should not be used in any VLAN. Mark the monitor port in all VLANs with ",".

What are the advantages?
If you use the "Port Mirroring" function, you can record and analyze the data traffic that passes through a switch port using an analysis tool.

When do you use it?
If you want to record and analyze the data traffic or the network load at a specific switch port with an analysis tool, then use the "Port Mirroring" function.
Where can you find this?

You can find the "Port Mirroring" function in the Web Based Management of SCALANCE X.
In Web Based Management, you can select the original port and the mirror port. The mirror port is only used for analysis purposes at times.

Further information

For more information on the "Port Mirroring" function, refer to the corresponding SCALANCE X configuration manual.
4 Diagnostics with external tools

If the cause of an error cannot be clearly determined with the on-board means of the module, external tools can help you in your search.

4.1 Wireshark

Description

Wireshark is a network analyzer and is installed on a PC. With this tool, you record network packets that are sent to and received by any local interface over a period of time. You can analyze and evaluate the recording via a graphical interface.

Wireshark has powerful filter functions. The filters are mainly used to limit the expected data volume and analysis to the ports or protocols to be examined.

What do you see with the "Wireshark"?

Wireshark records all data traffic on a local interface of your choice. The recording appears in a graphical interface. You can follow the recording live there. To ensure an optimal overview, the scanned packets are displayed in different colors depending on the protocol.

If you select a specific package in the recording, the selected package is displayed in more detail in Wireshark.

Wireshark's graphical interface consists of several areas. The most important areas are:

- In the "Filter Bar" you can define filter rules which type of traffic should be shown or hidden in the packet list.
- The "Package List" shows the live recording of the imported data packages. In addition to consecutive numbering, a time stamp relative to the beginning of the recording, the source and the destination address, the protocol to which the respective packet belongs is displayed here.
- In the "Package Details" section, the selected package is broken down into its components and analyzed.
- In the "Bytes" area, you see the package in its raw form as a hex and ASCII dump.

What are the advantages?

If you use the Wireshark tool, you have the following advantages:

- You can conveniently record and analyze the entire data traffic.
- You can optionally specify when the recording is to be automatically ended and how the data is to be recorded.
- Wireshark offers you the possibility to set filters, e.g. network protocol, source and destination address or TCP port. If you set a filter, the data collection that must be evaluated later remains manageable.
- Wireshark offers a wide range of analysis and statistics functions.
- You can save the recording in a file and give it to a specialist for evaluation, for example.

When do you use it?

Use the Wireshark tool to detect network and security problems. Recording the data packets can be useful when troubleshooting or evaluating the communication content.
4 Diagnostics with external tools

You can also use Wireshark to test the function of a software, e.g. if you want to know whether the activated encryption works.

Wireshark is almost indispensable if you want to know which devices in your network are sending and receiving data. The network analyzer logs and analyzes all data traffic. This enables you to determine whether an IP address unknown to you is causing interference or is communicating without permission.

**Note**

Before using Wireshark for network analysis, check whether the use of the tool is allowed in the network environment or whether data protection regulations have to be considered.

Intercepting connections and storing, using or passing on the data read along may be punishable under certain circumstances.

**Where can you find this?**

The Wireshark analysis tool is open-source software and can be downloaded free of charge from the Internet.

**Further information**

Further information about the Wireshark tool can be found on the homepage [https://www.wireshark.org/](https://www.wireshark.org/)
4.2 Remote capture

Description
Wireshark allows you to record network traffic on the local interface. With the function "Remote Capture" Wireshark can also read data traffic from remote interfaces.

The SCALANCE W devices support the "Remote Capture" function from firmware V6.1 (CLI) and from V6.2 (WBM and CLI). You can use the Remote Capture function to record network traffic from remote interfaces at the access point using Wireshark.

What do you see with the "Remote Capture"?
If you have activated the "Remote Capture" function in SCALANCE, the remote interface can be integrated into Wireshark. Wireshark records the data traffic flowing through the interface over a period of time. You can then view the contents of the frames from the recording or filter them according to specific contents.

What are the advantages?
If you use the "Remote Capture" function, you have the following advantages:
- You can use the Remote Capture function to record network traffic from remote interfaces at the access point using Wireshark.
- You can also activate the function at several interfaces simultaneously.
- No special hardware, e.g. a TAP, or certain tools, e.g. AirPCap, is required.
- The SCALANCE W Client can be located at a remote location.

When do you use it?
To analyze transmission errors or the network load at remote interfaces at the access point, use the "Remote Capture" function.

Note
If the "All Traffic" option is activated at the access point, all connected clients lose the connection to the access point as long as the recording is running.

Note
Before using Wireshark for network analysis, check whether the use of the tool is allowed in the network environment or whether data protection regulations have to be considered.

Intercepting connections and storing, using or passing on the data read along may be punishable under certain circumstances.

Where can you find this?
To enable Wireshark to record network data from the remote SCALANCE W, you must activate the Remote Capture function in SCALANCE W via the Command Line Interface or Web Based Management and configure a Remote Capture interface in Wireshark.
Further information

For more information on the Remote Capture function, see:
- In the configuration manual for SCALANCE W.
- In the FAQ "How can you record network traffic on the SCALANCE W with Wireshark?"

4.3 SIMATIC Assessment Suite

Description

The "SIMATIC Assessment Suite" tool enables you to collect diagnostic and system information for service, support and maintenance from a local system or from systems in the network. This diagnostic and system information is stored in system-specific archives.

What do you learn with the SIMATIC Assessment Suite?

If you want to read the log files of the installed SIMATIC software from a computer, you can use the "SIMATIC Assessment Suite" tool. The tool collects the LOG files of the installed software and archives the collected information in a ZIP format.

What are the advantages?

If you use the "SIMATIC Assessment Suite" tool for diagnostics, you have the following advantages:
- Collect a wide range of diagnostic and system information.
- Collect with one "click". The time-consuming, manual collection of diagnostic and system information per system is no longer necessary.
- No installation required.
- Once created, configurations can be saved and reused.
- Configurations can be passed on.
- Diagnostic and system information of all configured systems is available centrally on one computer after one run.

Where can you find this?

You can find the tool under the following article:
4.4 PRONETA

Description
The PROFINET network analyzer PRONETA is a simple tool for fast analysis and configuration of PROFINET networks and for simple testing of decentralized ET 200 peripheral systems and other components. It is particularly suitable for basic tasks for commissioning PROFINET systems.

What do you learn with PRONETA?
PRONETA is divided into two parts and consists of the following components:

- Network analysis
- I/O test

The "network analysis" gives you an overview of the devices connected to PROFINET.

The "network analysis" has simple configuration options. For example, you can set the network parameters of a device or assign the network names to the devices. However, "network analysis" also has powerful mechanisms for comparing several network topologies.

You can use the "I/O test" to test the I/O wiring of a system with numerous decentralized peripheral devices. The "I/O test" checks the wiring and automatically generates a protocol of the test procedure. You can export this log for documentation purposes.

What are the advantages?
If you use the "PRONETA" tool, you have the following advantages:

- Free download from the SIEMENS support websites.
- Allows configuration of networks in early project phases before a CPU is installed in the network.
- No additional hardware or software required.
- No installation required.
- Support of PROFINET devices from all manufacturers.
- I/O test that supports numerous SIMATIC ET 200 peripheral modules.
- Support of project files from STEP 7 V5.4, 5.5 and 5.6.

Where can you find this?
You can find the tool under the following article:
Diagnostics with network protocols

The advent of "intelligent devices" has changed the diagnostic strategy, as Managed Devices provide a wealth of information about standard protocols, e.g. SNMP, communication quality or topology. These can be actively read out from the devices network-wide at runtime. Powerful tools are available for this.

5.1 SNMP

Description

The Simple Network Management Protocol (SNMP) is a UDP/IP-based, open protocol based on the client/server model.

SNMP allows you to monitor and control network components such as routers or switches from a central station. SNMP distinguishes between an SNMP agent (client function) and an SNMP manager (server function).

The role of an SNMP agent can usually be assumed by any network device to be managed, e.g. routers, switches. The role of the SNMP manager is usually assumed by a universal, centrally accessible computer in the network.

An important component of SNMP is the Management Information Base (MIB). All SNMP agents have a large number of variables, the SNMP objects. All SNMP objects of an agent are collected in its MIB and logically structured. The SNMP objects provide information about the status of the own resource, e.g. IP address, firmware version, or can be described with new parameters, e.g. configuration parameters.

Each SNMP-enabled network component is delivered with a collection of standard MIBs. If component-specific, non-standardized data is required for network monitoring, then these special SNMP objects can be described in the "Private MIB" of the manufacturer.

You achieve this with SNMP?

SNMP offers read and write access. With the read access you have the possibility to query the value of an SNMP object from the SNMP agent. With the write access you describe an SNMP object in the SNMP agent with a new value.

These two types of access enable you to perform the following management functions with SNMP:

- Monitor network components.
- Diagnose network components.
- Detect and inform of errors.
- Remote configuration of network components.

There are the following ways to read or write to an SNMP agent using SNMP:

- You can connect to the SNMP agent using SNMP manager software (also called MIB browser). You can then browse through the MIB and read and write values. To browse through the MIB objects, the private MIB of the SNMP agent must be imported into the MIB browser.
- There are numerous SNMP management systems that support you with these management functions, e.g. SINEMA Server. After installation and configuration, the system works autonomously.
- To make a CPU SNMP-enabled, you can use the SNMP components from Siemens Industry Online Support. These modules simulate the SNMP protocol and take on the role of the SNMP manager.
What are the advantages?

If you use SNMP, you have the following advantages:

- SNMP is an open protocol supported by many manufacturers.
- The SNMP protocol is widely used in Ethernet networks.
- Many different network components are supported, e.g. switches, routers, and controllers.
- The standardized MIBs and SNMP access mechanisms allow heterogeneous networks to be optimally monitored and controlled.
- With SNMP, event-driven communication via traps is also possible. This means there is little network load due to SNMP communication.
- Common SNMP management systems help you to diagnose and optimize networks.

When do you use it?

To manage and control networks and their components, you can use SNMP. These include, for example, the following areas of application:

- Detect individual network components
- Reconfigure devices by changing SNMP objects.
- Determine the entire network topology.
- Identify significant problem situations.
- Alert and alarm management.
- Network analysis and monitoring.
- Edit errors.
- Distribute software (installation and configuration).
- Modify network topology.

Common SNMP management systems, e.g. SINEMA Server, help you to diagnose and optimize networks. The SINEMA Server software was specially developed for industrial applications. With SINEMA Server you can analyze and monitor networks in an automation environment. The recorded data is stored in a long-term archive and can therefore be evaluated and displayed as required.

Note

Only use the secure variant SNMP v3 and change the insecure variant SNMP v1/2 at least to "ReadOnly" in the configuration of the switch.

Where can you find this?

SNMP is implemented in all SIMATIC modules and managed SIMATIC NET devices.

For some SIMATIC NET devices, you must explicitly enable SNMP communication during project planning.

Managed SCALANCE devices have a private MIB. If you want to use the Private MIB file independently of the device, e.g. if you want to open the MIB file with an MIB browser, you must first save the file outside the SCALANCE. You can download and save the Private MIB via the Web Based Management of SCALANCE.
Further information

For more information about SNMP, see:

- In the configuration manual for SCALANCE X
- In the diagnostic manual "SIMATIC NET": Network Management Diagnostics and Project Planning with SNMP
- In the FAQ "How can I find examples, explanations and further information about SNMP and the SIMATIC NET SNMP OPC server?"
- In the FAQ "MIB (Management Information Base) at SNMP"
- In the FAQ "Downloading the Private MIB (Management Information Base) V4.2 and SNMP OPC Profile V1.3 and the PROFINET GSDML File V2.2 for SCALANCE W-700"
- FAQ "The automationMIB version V02.00.00.02 is now available for download".
- In the application example "Monitoring and control of a network with a SIMATIC S7-PN CPU using SNMP"
- In the application example "GettingStarted: Understand and use SINEMA Server V14"

The SNMP Management System "SINEMA Server" can be found in Siemens Industry Online Support at
5.2 RMON

Description

SNMP lacks the ability to analyze communication relationships, e.g. communication partners, protocols used, and data streams. Remote Monitoring (RMON) is an adequate solution for better evaluating the status of a network, e.g. load, logical errors, log errors, and archiving the corresponding information.

RMON is one of the most important extensions of SNMP management. The RMON MIB is an extension of the SNMP MIB and defines the most important indicators for Ethernet networks. This supports comprehensive error diagnostics and statistics functions that enable the network operator to monitor network performance and make network expansions as easy as possible.

You can read the RMON data from an SNMP agent from an SNMP manager via SNMP.

What do you learn with RMON?

RMON is a tool for data collection. RMON collects all Ethernet diagnostic data in the device, prepares it and makes it available in the form of tables. To organize the abundance of data, the RMON-MIB is divided into nine groups:

- The statistics group contains information about usage and error statistics. The number of packets sent, packet size, broadcasts, multicasts, network errors and collisions are recorded.
- In the history group, trend analyses of usage are created based on information from the statistics group.
- In the alarm group, the user can configure alarms for each managed device. Separate alarm levels can be set for the values recorded by the RMON agent.
- In the event group, rising and falling threshold values can be recorded and triggered for each event accordingly.
- The host group consists of a statistics table based on the MAC addresses. There are counters for broadcast, multicast and error packets as well as for the number of bytes.
- The HostTopN group contains ordered host statistics.
- In the traffic matrix group, the user and error information is displayed in matrix form in relation to a send and receive address.
- The Filter group gives the network administrator tools to set filters to select certain packages on the network.
- The Packet Capture Group is an extension of the filter group and allows a flexible definition of trace buffers that are filled according to the currently set filters.

The SCALANCE devices support the RMON groups "Statistics" and "History". For each port, you can specify whether statistical data is to be collected and, if so, how many samples in which interval.

You can view the RMON history in the Web Based Management of SCALANCE.
What are the advantages?

If you use RMON, you have the following advantages:

- RMON is based on SNMP and is supported by many manufacturers.
- You can collect statistical data in network-compatible devices and store it in databases.
- RMON includes network performance data in all 7 layers of the OSI model.
- RMON configurations can be used just as advantageously in routed site LANs as in LAN-WAN networks.

When do you use it?

The diagnostic data, e.g. port-related load curves, enable you to detect and eliminate problems in the network at an early stage.

The RMON History group represents a possibility to read out historical data from the switch after a fault. In this group, counting processes are registered, which can give conclusions about the use in a certain time interval and for certain data types.

In Web Based Management of SCALANCE, you can activate RMON for individual ports.

Where can you find this?

RMON is implemented in all managed SCALANCE X devices.

Further information

Further information on RMON can be found in the configuration manual for SCALANCE X.
5 Diagnostics with network protocols

5.3 Ping

Description
You can use the ping command to test the function of a network connection.
By default, Ping sends four packets to the specified device and lists the answers with a small statistic.
The program is usually executed as a console command.

What do you learn from the ping?
You can use the ping to check whether a device is accessible in a network. Ping sends an ICMP packet to the destination address of the device to be checked (echo request). The receiver must, if it supports the protocol, send back a reply (echo reply).
The tool measures the time between echo request and echo reply and displays the time span as output.
If the destination device is not reachable, the message "Network unreachable" or "Host unreachable" is displayed as the response.

Note
It cannot be concluded from a missing response that the remote station is unreachable because some devices, such as the firewall, are configured to ignore and discard ICMP packets.

What are the advantages?
When you use the Ping tool, you have the following advantages:
• You can easily check the network connection.
• The ping command is simple and requires no special administrative knowledge.
• The ping command can be operated via a console.

When do you use it?
With the ping test you can check the connection to a web page, your local network or another network device.
After you have connected a network device to your network, it is helpful if you check with a PC and the Ping tool whether the network device is accessible in the network.
If you do not receive a response from the target device, there may be an error in the network connection.

Where can you find this?
The program is included in the scope of delivery of every common operating system.
6 Appendix

6.1 Service and Support

Industry Online Support
Do you have any questions or need assistance?
Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.
The Industry Online Support is the central address for information about our products, solutions and services.
Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks:
https://support.industry.siemens.com

Technical Support
The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers – ranging from basic support to individual support contracts. Please send queries to Technical Support via Web form:
www.siemens.com/industry/supportrequest

SITRAIN – Training for Industry
We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that’s tailored to the customer’s specific needs.
For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:
www.siemens.com/sitrain

Service offer
Our range of services includes the following:
- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts
You can find detailed information on our range of services in the service catalog web page:
https://support.industry.siemens.com/cs/sc

Industry Online Support App
You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for Apple iOS, Android and Windows Phone:
https://support.industry.siemens.com/cs/ww/en/sc/2067
6.2 Links and Literature

Table 6-1

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<tr>
<td>\1\</td>
<td>Siemens Industry Online Support</td>
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<td><a href="https://support.industry.siemens.com">https://support.industry.siemens.com</a></td>
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<tr>
<td>\2\</td>
<td>Link to the article page of the application example</td>
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<tr>
<td>\3\</td>
<td>Application example &quot;Diagnostics Overview for SIMATIC S7-1200 and S7-1500&quot;.</td>
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6.3 Change documentation

Table 6-2

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<td>First version</td>
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<tr>
<td>V2.0</td>
<td>08/2018</td>
<td>Update completely.</td>
</tr>
<tr>
<td>V2.1</td>
<td>11/2018</td>
<td>Title adapted. Chapter &quot;Online Tools task card&quot; and &quot;Real-time trace&quot; deleted. Notes added.</td>
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