System Diagnostics with S7-1500 and TIA Portal

STEP 7 V12, WinCC V12

Application Description• May 2013

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SIMATIC
S7-1500 System Diagnostics

System Diagnostics with S7-1500 and TIA Portal

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Preface

Purpose of the Application

The present application shows different diagnostics possibilities for the S7-1500 automation system.

Core topics of this application

The following main points are discussed in this application:

- Uniformity and consistency of the integrated systems diagnostics.
- Overview of the possibilities of detecting system diagnostics information.

Advantages

- **Integrated system diagnostics**
  The integrated system diagnostics ensure full transparency of the system status. The system diagnostics are generated automatically.
- **Uniform display concept**
  The system diagnostics information is displayed as a uniform clear text information in the CPU display, TIA Portal, HMI and the web server itself for messages of the drives.
- **Channel granular display concept**
  In case of failure, the respective channel can be detected and classified quickly.

Benefit

- Reduced downtimes and increased system availability thanks to an exact visual allocation in case of failures.
- Efficient failure analysis due to a uniform display concept.
- Servicing possible without a current project, due to a complete project upload including symbols.

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1 Task

1.1 Overview

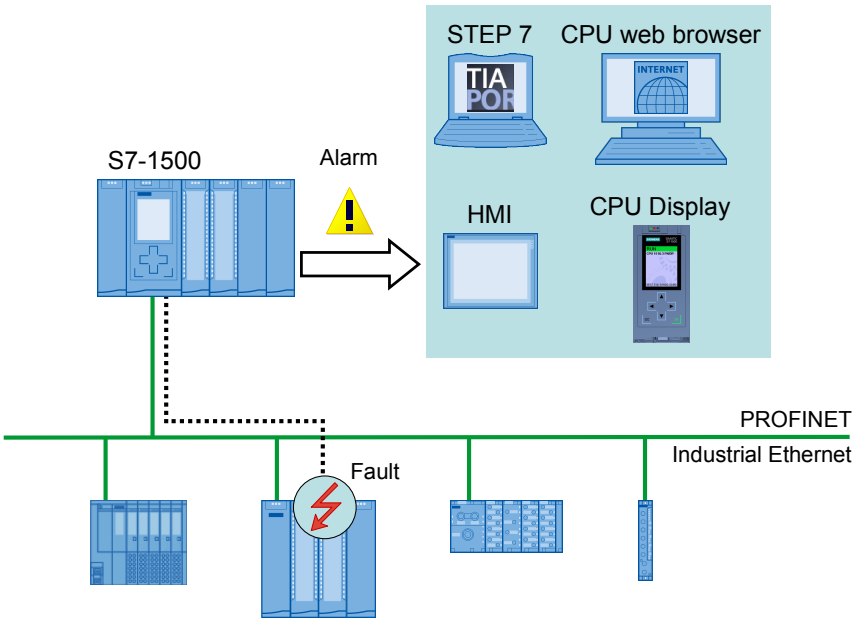
Introduction

In the automation technology, diagnostics of devices, modules and networks is gaining importance. Diagnostics over the whole system can minimize downtimes. In the SIMATIC environment the complete diagnostics are summarized as system diagnostics.

Overview of the automation task

The figure below provides an overview of the automation task.

Figures 1-1 Overview of the automation task



Description of the automation problem

The automation task consists of monitoring a PROFINET IO peripheral system with various network components. The possibility of an individual diagnosis of the components and a detailed diagnosis of the complete system should be guaranteed. The priority is on the collection and display of the diagnostic information.

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1.2 Requirements

Requirements of the automation task

- Configuration and setting possibilities of the devices and modules
- Evaluation and display of the diagnostic data in the engineering tool
- Evaluation and display of the diagnostic data directly in the controller
- Display of the diagnosis data in an operating panel
- Website access to diagnostic data
- Diagnostics of the topology (combining the devices in a network)
- Consistency of the system diagnostics

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2 Solution

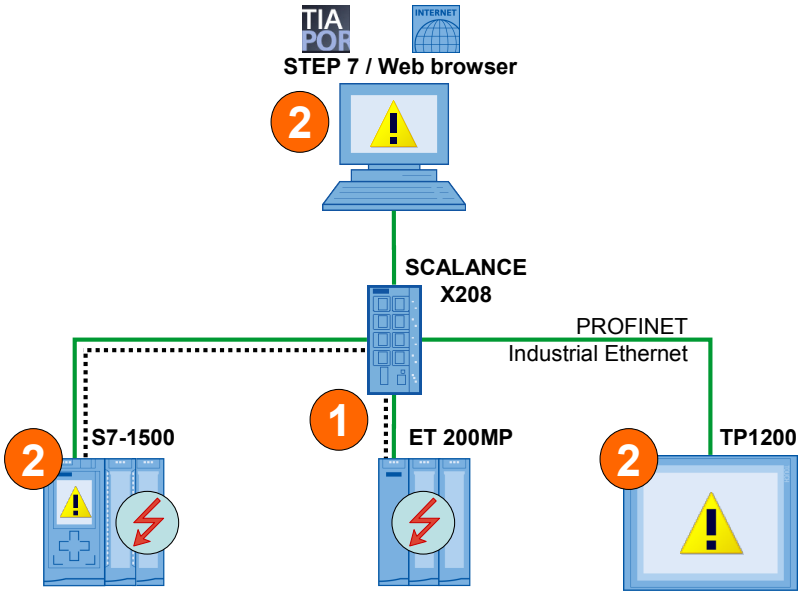
2.1 Solution Overview

Uniform display concept

The integrated system diagnostics of S7-1500 offer the following functions:

- All clients of a system are supplied with diagnostic information through a uniform mechanism.
- Independent of the display medium, the same system diagnostic information is used.
- System diagnostics are also possible in STOP.

Figure 2-1 Overview overall solution



1. The device detects a fault and sends diagnostic data to the assigned CPU.
2. The CPU informs the connected display media. The display of the system diagnostics is refreshed.

Delimitation

- This application does not contain a complete discussion of all diagnostic possibilities provided by S7-1500.
- The programmed code does not cover every possible fault. The extension of the present code by the user is therefore possible and necessary.

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Required knowledge

Basic knowledge for the following issues is assumed:

- Microsoft Windows 7
- STEP 7 V12
- WinCC V12
- STEP 7 module architecture and programming
- PROFINET IO

2.2 Description of the core functionality

Consistent system diagnostics

In addition to the status display of the devices with LEDs, the diagnostic data are also sent to the assigned CPU. The CPU reports the faults to the following diagnostic media:

- TIA Portal
- CPU web server
- CPU display
- HMI devices

The diagnostic information is supplied in a uniform display form all over the system.

Diagnostic possibilities

In the application the possibilities for system diagnostic information is demonstrated with the example of a missing supply voltage L+ at the module DQ32.

The diagnosis of the topology is demonstrated with the faulty interconnection of the ports.

The diagnosis with the user program is described with the example of a missing supply voltage L+ in the module DI32 of an IO-device.

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2.3 Hardware and software components used

The application was set up with the following components:

Hardware components

Table 2-1

Component	No.	Order number	Note
PM 1507 LC	1	6EP1332-4BA00	Alternatively, a different power supply can also be used.
CPU 1516-3 PN/DP	1	6ES7 516-3AN00-0AB0	Alternatively, a different CPU S7-1500 can also be used.
SIMATIC memory card	1	6ES7954-8LF00-0AA0	24 MB
DI32	2	6ES7 521-1BL00-0AB0	Diagnostics can be configured
DQ32	2	6ES7 522-1BL00-0AB0	Diagnostics can be configured
IM 155-5 PN ST	1	6ES7 155-3AN00-0AB0	-
SCALANCE X208	1	6GK5 208-0BA10-2AA3	-
TP1200 Comfort	1	6AV2124-0MC01-0AX0	-
PG/PC with an Ethernet interface	1	-	Customary PC with operating system Windows
IE FC TP STANDARD CABLE	1	6XV1840-2AH10	IE connection Minimum order quantity 20m
RJ45 connector	8	6GK1901-1BB10-2AA0	Can be finished

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Standard software components

Table 2-2

Component	No.	Order number	Note
SIMATIC STEP 7 V12	1	6ES7822-1A.02-..	
SIMATIC WinCC V12	1	6AV210.-....2-0	

Sample files and projects

The following list includes all files and projects used in this example.

Table 2-3

Component	Note
68011497_S7-1500_Diagnose_CODE_v10.zip	<This zip file contains the STEP 7 project.>
68011497_S7-1500_Diagnose_DOKU_v10_en.pdf	This document.

2.4 Alternative solutions

SCALANCE

As an alternative to SCALANCE X208, a different SCALANCE with topology-support (LLDP), such as SCALANCE XF208, can be used.

CPU S7-1500

As an alternative to CPU 1516-3 PN/DP, a different CPU S7-1500 can be used.

HMI

As an alternative to the operating panel TP1200 Comfort, a different operating panel can be used.

Note If one of the above devices is replaced by an alternative, the hardware configuration must also be adapted.

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3 Basics

Basics for the system diagnosis

In the SIMATIC environment the diagnostics of devices and modules are summarized in the expression system diagnostics. The monitoring functions are automatically derived from the hardware configuration.

All the SIMATIC products refer to integrated diagnostic functions with which you can detect and repair faults. The components automatically report operational faults and supply additional detailed information. Diagnostics over the whole system can minimize downtimes.

In the running system, the following states are monitored by the system:

- Failure of a device
- Pull out/push in fault
- Module fault
- Periphery access fault
- Channel fault
- Configuration fault
- No supply voltage L+
- Broken wire
- Short circuit to ground

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System diagnostics are also possible in STOP

The system diagnostics are integrated in the firmware of the CPU S7-1500 and works independently from cyclic user programs. Therefore it is also available in the CPU operating mode STOP. Any faults are detected immediately and reported to the higher-level HMI devices, the web server, the display of the CPU S7-1500, the LED displays in the module concerned and in the TIA Portal even in the operating mode STOP. Therefore, the system diagnostics are always synchronous with the actual system status.

Uniform diagnostic and display concept

All the connected diagnostic display media are supplied with the same system diagnostic information by a uniform mechanism.

Diagnostics in different languages

The display of the system diagnostics is available in several languages:

- German
- English
- French
- Spanish
- Italian
- Chinese

4 Core Topics of this Application

4.1 Diagnostics with LEDs

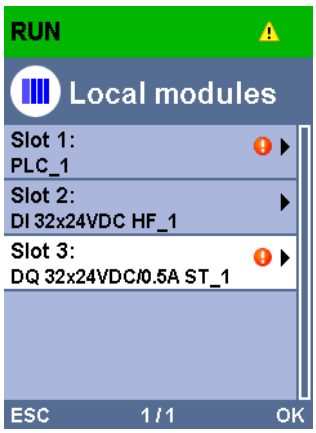
Most of the modules of the SIMATIC family have an LED status and fault display in the housing. Depending on the status and/or fault one or more LEDs light up. The meaning of individual LEDs or the combination of several LEDs is different for every module.

Note Please find more information about the meaning of the LED display in the manual of the respective module.

4.2 Diagnostics with the display in the CPU S7-1500

The S7-1500 display provides a large variety of diagnostic possibilities. In the menu “Diagnostics” you can directly read out the information in the diagnostic buffer or have the pending diagnostics messages displayed. In the menu ”Module”, the module status is displayed symbolically.

Figure 4-1 Diagnostics message in the display of the CPU



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4.3 Diagnostics in the TIA Portal I

4.3.1 Diagnostics of the hardware in the device and network view

In addition to the diagnostics in the hardware, STEP 7 provides the “Online” view. When the online connection to a device, is built up, its diagnostics status and the diagnostics status of its subordinate component, if any, is also determined. If there is a fault or an error in a module and if there is diagnostic information, the status of the faulty module is displayed by means of diagnostic symbols.

Diagnostic symbols

Diagnostic symbols make trouble-shooting easier. If a module has no faults, a green symbol for “no fault” is displayed. But if there is a fault event, the respective symbol for this kind of fault is displayed.

Please find a description of the diagnostic symbols for modules and devices and their meaning in the TIA Portal V12 online help.

Figure 4-2 Diagnostic symbols for modules and devices

Examples See also History Extra

Displaying diagnostics status and comparison status using icons

Diagnostics icons for modules and devices

The following table shows the available icons and their respective meaning.

Icon	Meaning
	The connection with a CPU is currently being established.
	The CPU is not reachable at the set address.
	The configured CPU and the CPU actually present are of incompatible types.
	On establishment of the online connection to a protected CPU, the password dialog was terminated without specification of the correct password.
	No fault
	Maintenance required
	Maintenance demanded
	Error
	The module or device is deactivated.
	The module or the device cannot be reached from the CPU (valid for modules and devices below a CPU).
	Diagnostics data are not available because the current online configuration data differ from the offline configuration data.
	The configured module or device and the module or device actually present are incompatible (valid for modules or devices under a CPU).
	The configured module does not support display of the diagnostics status (valid for modules under a CPU).
	The connection is established, but the module status has not yet been determined or is unknown.
	The configured module does not support display of the diagnostics status.
	Hardware error in lower-level component: A hardware error is present in at least one lower-level hardware component. (occurs as a separate icon only in the project tree)

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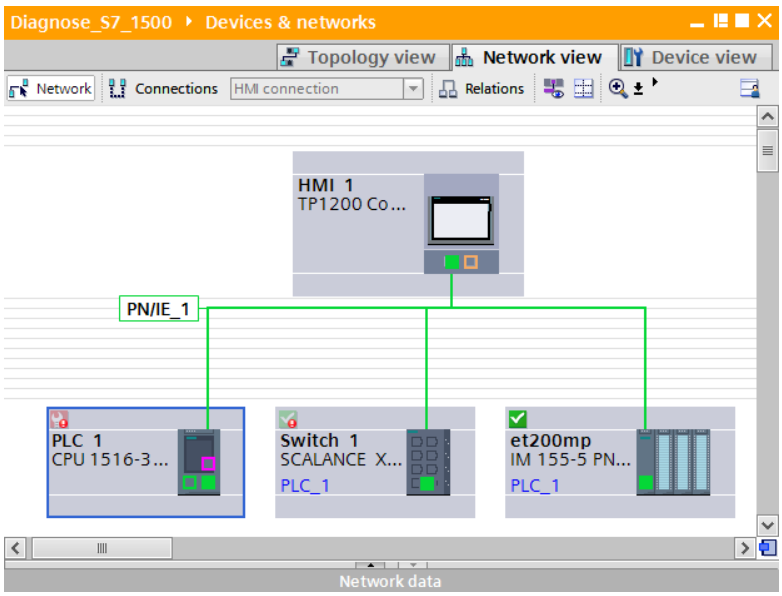
Diagnostic information in the network view

In the network view, the status of the devices connected online is displayed symbolically. The network view provides an overview of the current status of the devices and of your system. Double-click on the device to go to the device view.

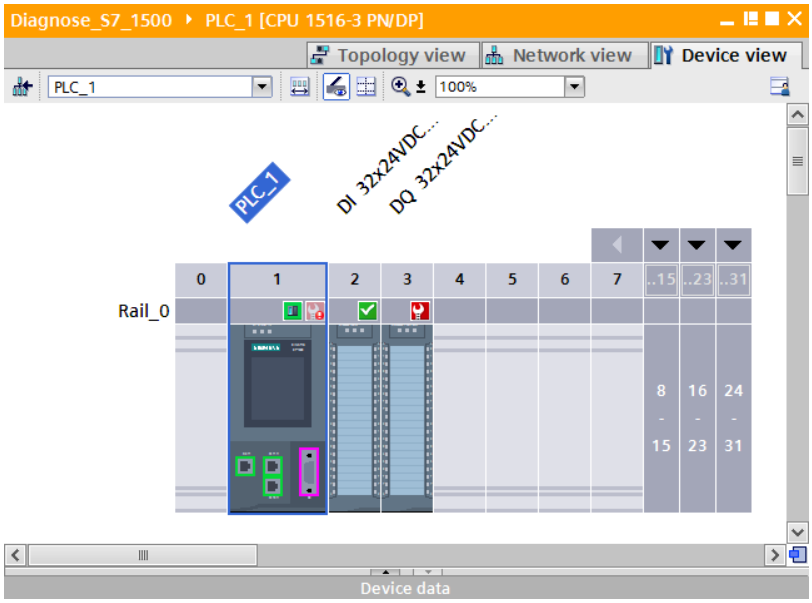
Figure 4-3 Diagnostic information in the network view



Diagnostic information in the device view

In the device view, the status of the devices connected online, is displayed symbolically. The device view provides an overview of the current status of the devices and of your system. Double-click on the diagnostic symbol of a module to go to the diagnostics view of a module directly.

Figure 4-4 Diagnostic information in the network view



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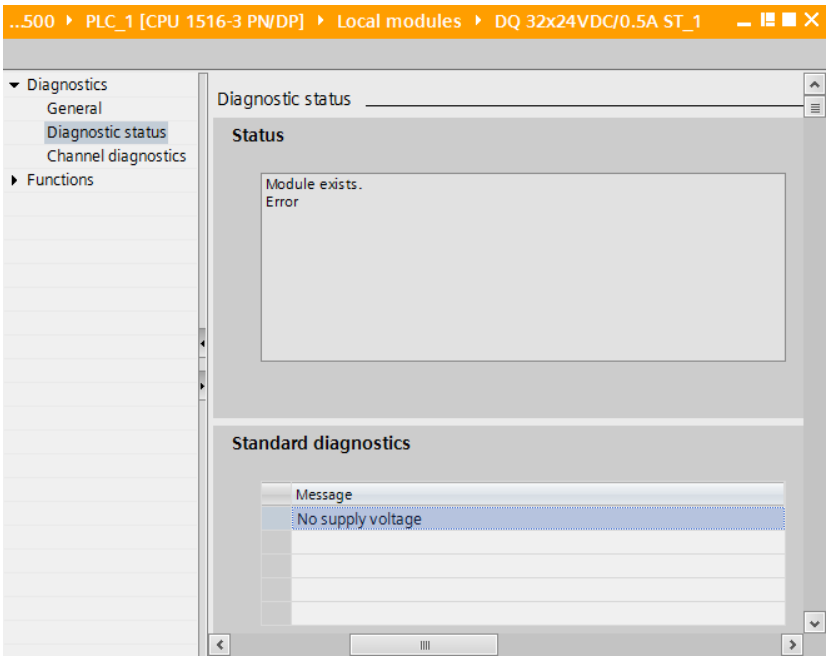
Diagnostic information in the diagnose view

The diagnose status of a module is displayed in the folder “Diagnostics > Diagnostic status”. The “Diagnostic status” is divided into the windows:

- **Status (Status)**
  Here, the status is displayed from the view of the CPU and the difference between configured and connected modules is displayed.
- **Standard diagnostics**
  In this window, the fault of the module is displayed.

Figure 4-5 Diagnostic information in the diagnostics view



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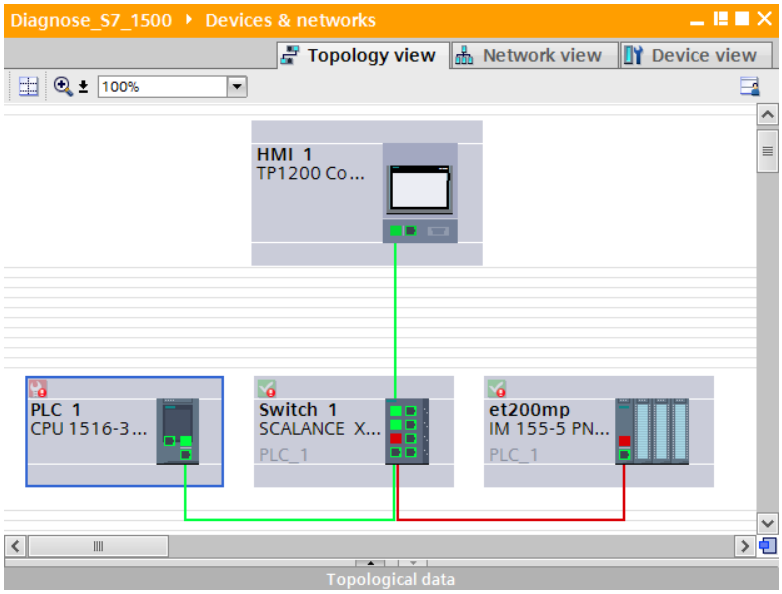
4.3.2 Diagnostics in the topology view

The online topology offers following diagnostic possibilities:

- The status of the devices is displayed symbolically.
- Faults of the subordinate components are displayed by additional diagnose symbols in the right lower corner of the device diagnose symbols.
- The states of the ports are displayed in different colors.
- The status of the line between two ports is displayed in color.

Figure 4-6 Diagnostics in the topology view



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4.3.3 Diagnosis in the project navigation

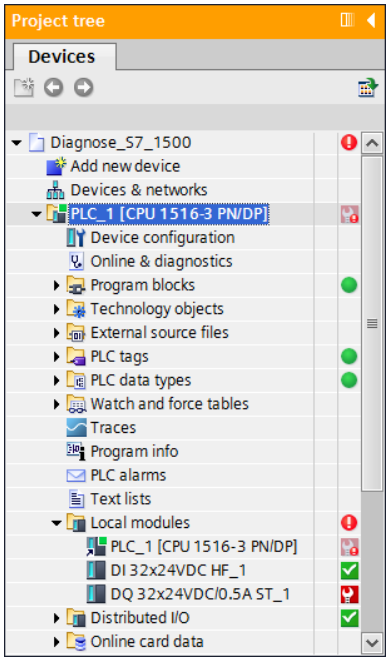
With the project navigation you have a quick and easy access to all the components in your project. If there is an online connection to a device, the following diagnostic status is automatically displayed symbolically in your project navigation.

- The status of the devices is displayed symbolically.
- Faults of the subordinate components are displayed by additional diagnose symbols in the right lower corner of the device diagnose symbols.
- For hardware components with their own operating modes, the operating mode is displayed in color in the right top corner of the hardware symbol.

Double-click on the diagnostic symbol of the respective hardware component to go to the diagnostics view of a component directly.

You can also start the function “Online & diagnostics” of the device (PLC_1) directly from the project navigation.

Figure 4-7 Diagnostics in the project navigation



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4.3.4 Diagnostics in the inspection window

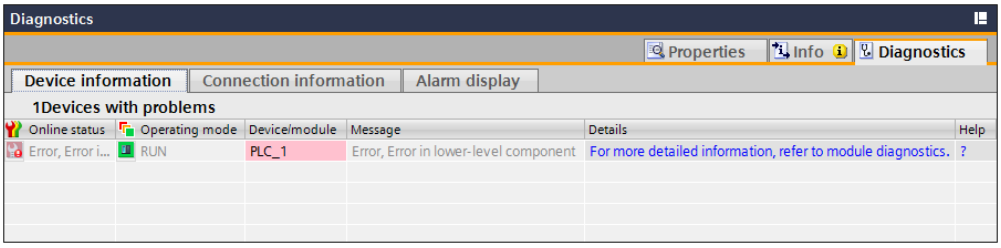
In the tab “Diagnostics” of the inspection window, you get diagnostic information in the following subordinate tabs in form of a table.

Tab “Device-information”

In the “Device information” tab, the following information of the devices connected online are displayed.

- Online status
- Operating mode
- Device/module
- Message
- Details: contains a link to the diagnostics view of the device
- Help: contains a link to the online help for more information about the message

Figure 4-8 Device Information tab



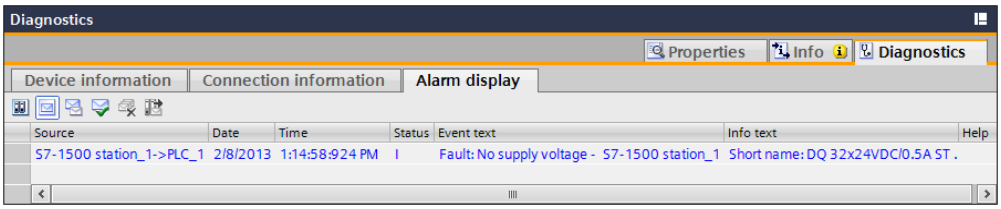
Tab “Connection information”

The “Connection information” tab provides an overview of the connection resources of the device.

Tab “Alarm display”

In the “Alarm display” tab the event texts of the devices are listed with Source, Date, Time, Status, Event text, Info text and Help. The Status displays whether it is a coming, going or acknowledged alarm.

Figure 4-9 Alarm display tab



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4.4 Diagnostics with the web server

With the web server you have the possibility of monitoring the CPU via the Internet or the corporate Intranet. Evaluations and system diagnostics over great distances and from anywhere where there is an Internet access, become possible.

In addition to general information, the web server of the CPU offers the following diagnostics:

- Start page
- Diagnostic buffer
- Module information
- Messages
- Topology

Start page

On the website “Start page”, the representation of the CPU with LEDs shows the current status of the CPU. The “Status” window contains information about the operating mode and the status of the CPU.

Figure 4-10 Start page website

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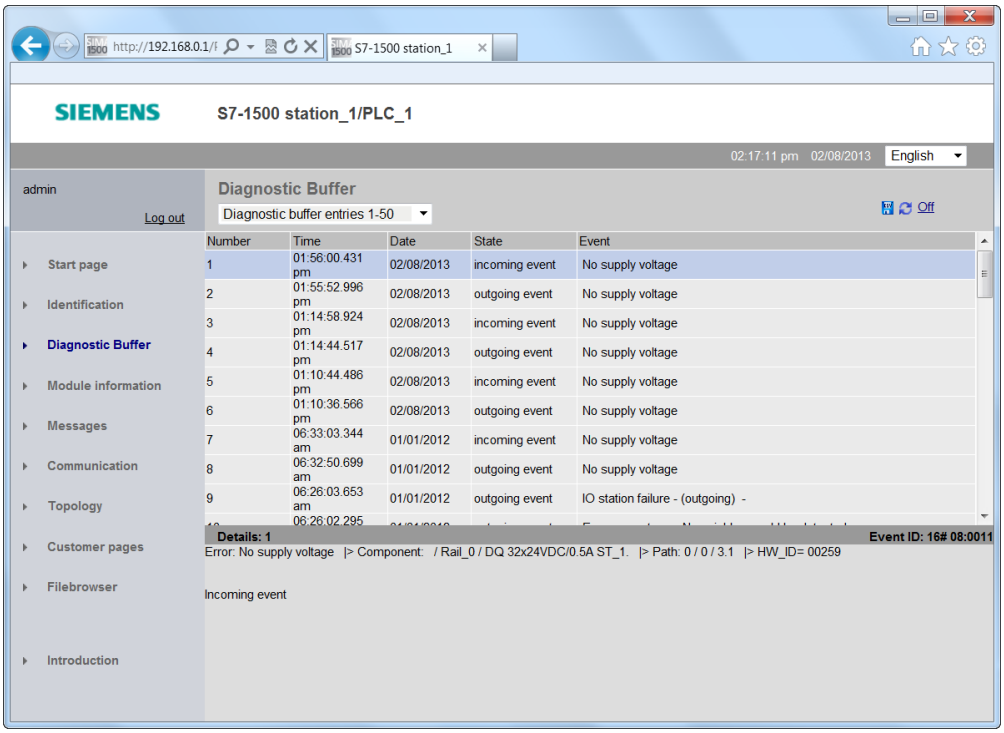
Diagnostic buffer

You can read out the entries in the diagnostic buffer without an engineering tool from the website “Diagnostic buffer”. In the “Details” window, the detailed information of a selected event is displayed.

Figure 4-11 Diagnostic buffer website



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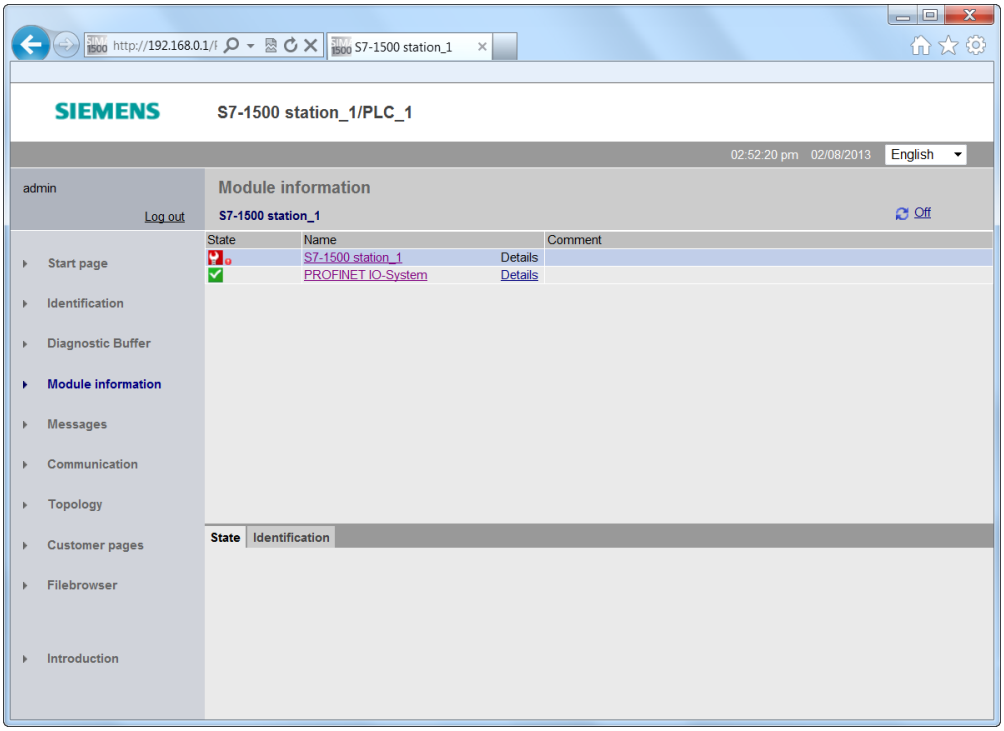
Module information

The website “Module information” displays symbols to show whether the components of a station are OK or whether there is a fault. Click to the links of the components to navigate to the detailed information about the fault. The display of the module levels above the table is taken into account. With this link, you can go directly to the higher module level.

Figure 4-12 Module information website



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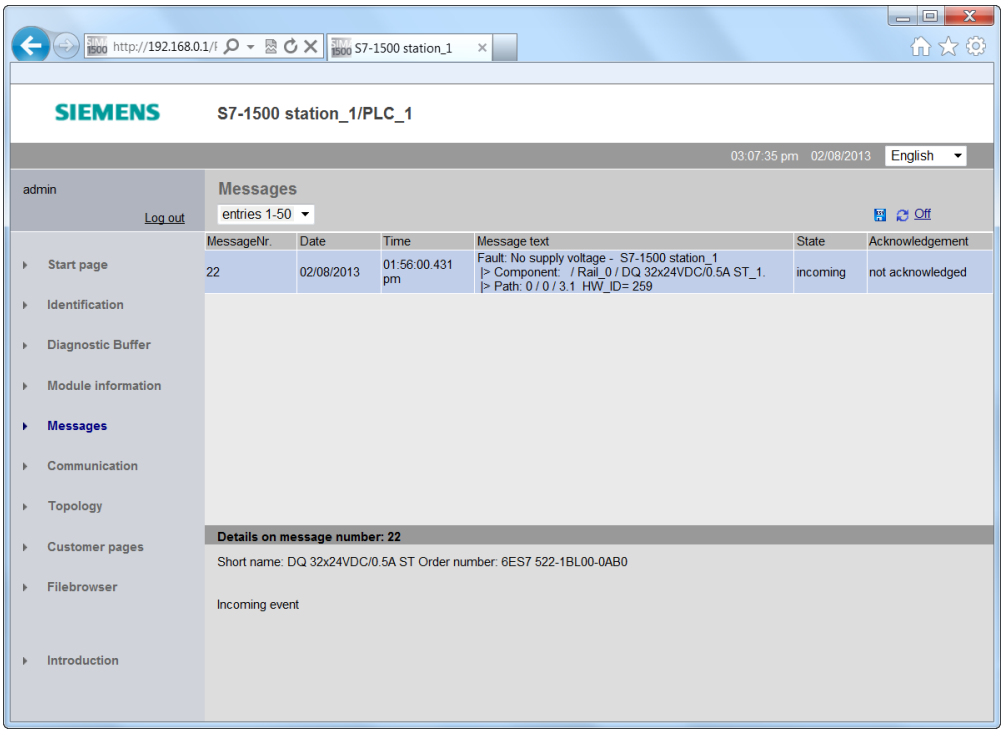
Messages

Current messages are displayed chronologically in the website “Messages”. The window “Details on message number” provides you with detailed information about the selected message.

Figure 4-13 Message website



Topology

The website “Topology” provides you with information about the topology and the status of the PROFINET devices in your system.

The following views are available:

- Graphic view
- Table view
- Status view

Topology “Graphic view”

In the graphic view, you can choose between the “Set topology” and the “Actual topology”. If a topology is configured, the status of the connections is displayed in colors in the “Set topology” as follows:

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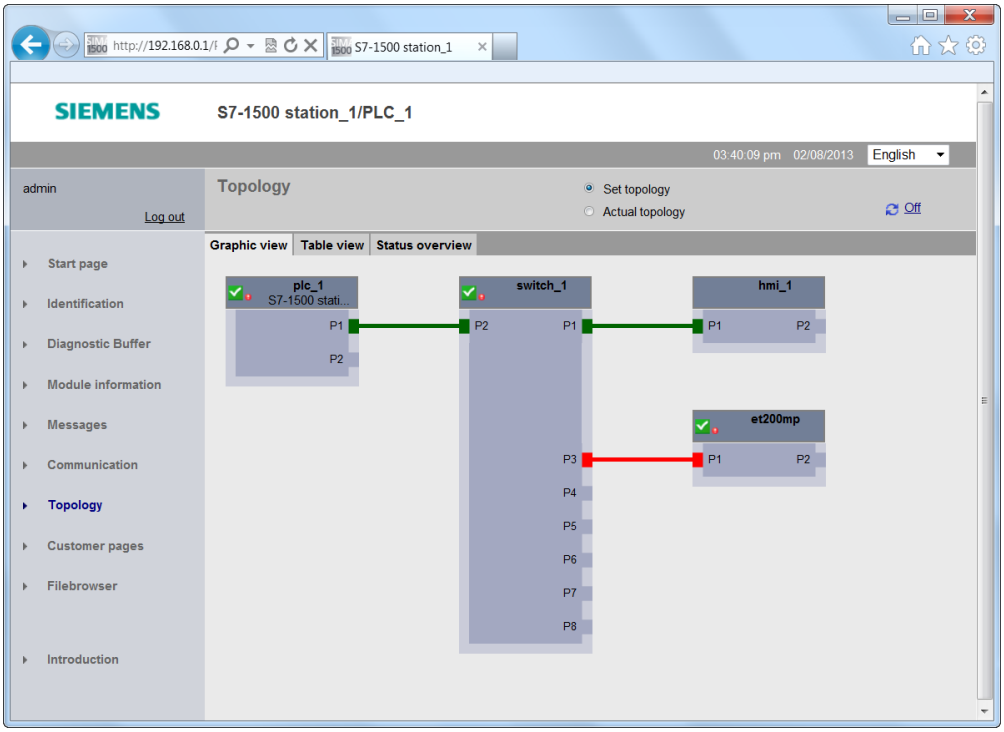
Table 4-1

Color of the connection	Status of the connection
green	The actual connection matches the configured one.
yellow	Diagnostics of the connection are not possible, for example because there is no connection.
red	The actual connection does not match the configured connection, for example because the ports were exchanged.

In the “Actual topology”, the actual topology is determined. The connections are displayed in green.

Figures 4-14 Topology website - graphic view



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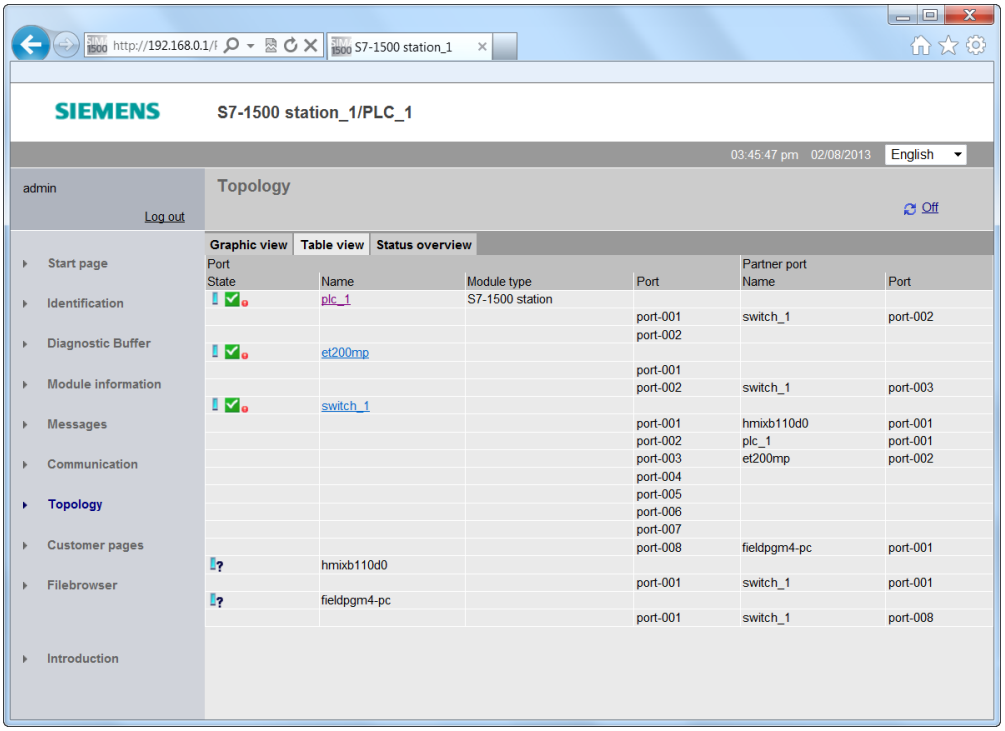
Topology “Table view”

The “Table view” only shows the “Actual topology”. In the first column of the table the status of the port and the module status are displayed symbolically.

Figures 4-15 Topology website - table view



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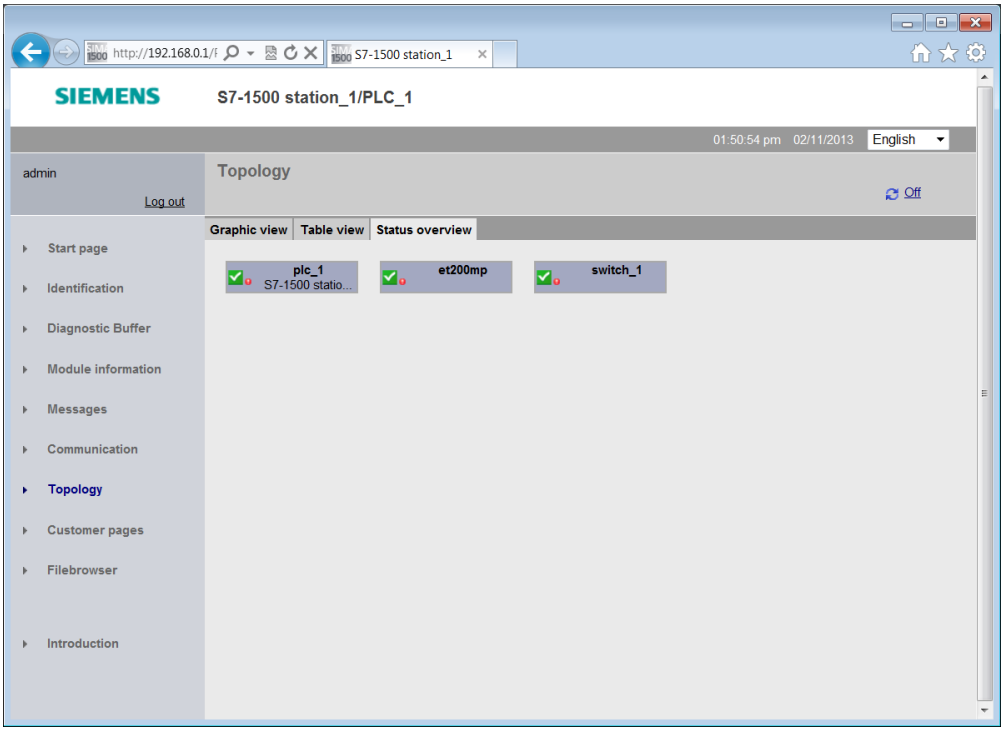
Topology “Status overview”

In the “Status overview”, the module status of the PROFINET devices is displayed with symbols. You get a quick overview of the faulty modules.

Figures 4-16 Topology website - status view



Note The two websites “Topology” and “Module information” are linked. When you click on the head of a configured module in one of the topology views, you go to this module in the “Module information” website immediately.

Note For further information about website, please refer to S7-1500 Web server Function Manual.

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4.5 Diagnostics with the system diagnostics display in the HMI

4.5.1 Basics

For displaying diagnostic information in the HMI, the TIA Portal provides two complete objects for a quick localization of the fault. These objects are only available on Comfort Panels.

System diagnostics display

The system diagnostics display provide you with a diagnostic overview of the status of all available devices in your system that can be diagnosed. In case of a fault, please navigate through the different views directly to the cause of the fault in the detailed view of the faulty module.

System diagnostics window

The window “System diagnostics” is not substantially different from the “System diagnostics display”. The “System diagnostics window” can only be configured in the Global View. Therefore, there is an extra “window” area in the properties. Here you can choose whether the window can be closed.

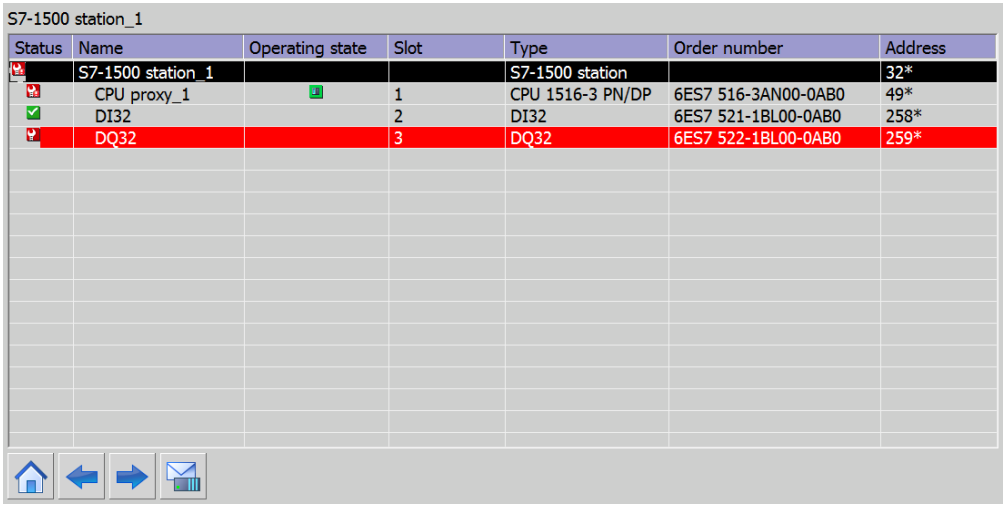
4.5.2 Views of the system diagnostics

The diagnostics information is displayed in the system diagnostics display and in the system diagnostics window in different views.

Device view

In the device view, the status of all available devices of one level are displayed.

Figure 4-17 Device view of the system diagnostics display



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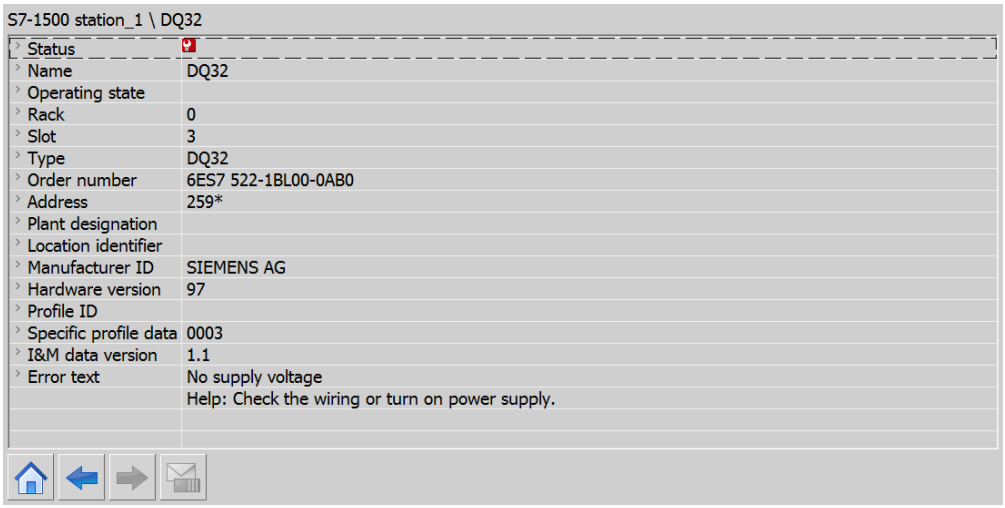
Detailed view

In the detailed view, the diagnostics information of the selected device is displayed. In addition to general data you will find a description of the fault and possible remedies here.

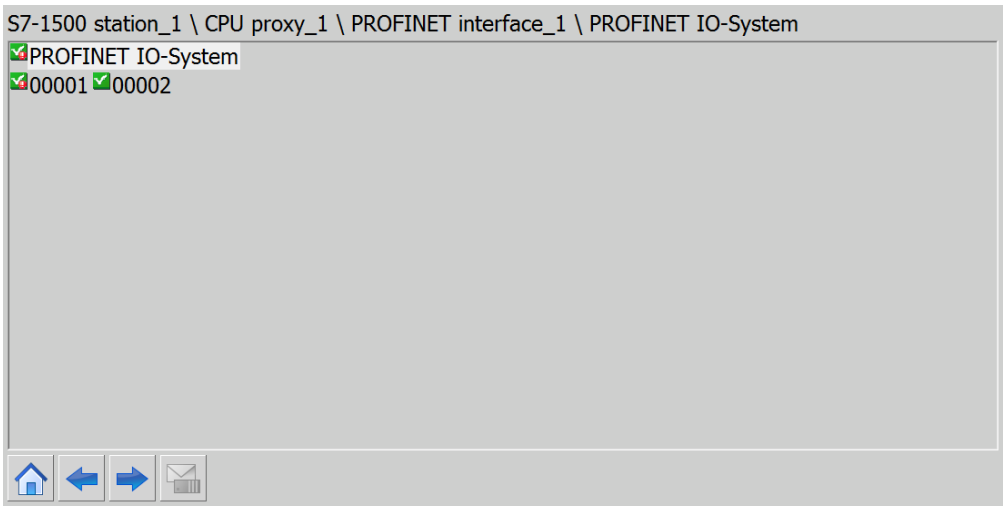
Figure 4-18 Detailed view of the system diagnostics



Matrix view

The matrix view only pops up if you have configured a PROFIBUS_DP or PROFINET IO master system in your system. The matrix view shows the status of the devices in the master system.

Figure 4-19 Matrix view of the system diagnostics



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Navigation buttons

With the navigation buttons you can navigate through the systems diagnosis.

Figure 4-20 Navigation buttons in the system diagnostics

Button	Function
	Opens the lower-level devices or the detail view if there are no lower-level devices.
	Opens the higher-level device or the device view if there is no higher-level device.
	Opens the device view.

4.5.3 System diagnostics indicator

The system diagnostics indicator is a graphical object in a global library. The object is inserted in a picture or a picture template and connected to the system diagnostics window. The system diagnostics indicator changes its graphic when there is a fault in the system. With a click on the system diagnostics indicator, the system diagnostics window opens up. The detailed view of the faulty device is automatically displayed.

Figure 4-21 Graphics of the system diagnostics indicator

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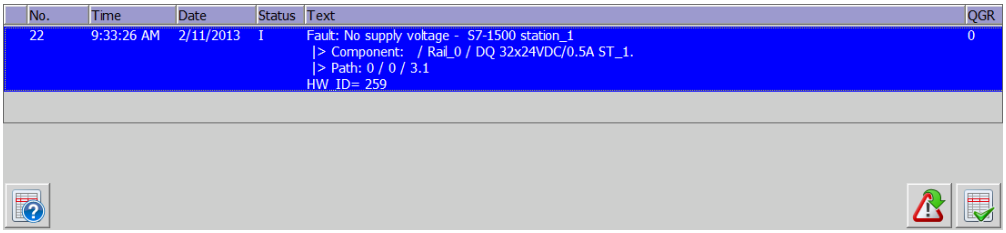
4.6 Diagnostics with alarm view / alarm window in the HMI

With the objects “Alarm view” and/or “Alarm window”, the TIA Portal offers you more possibilities of displaying diagnostics information in the HMI.

Alarm view

The object “Alarm view” shows you the diagnostics information as alarms in the operating panel, if you selected the respective alarm states and alarm classes. Depending on the configuration, different columns with information about a message are displayed in the “alarm view”.

Figure 4-22 Alarm view in the HMI



Alarm window

The object “Alarm window” is not substantially different from the “Alarm view”. The “Alarm window” can only be configured in the Global View. Therefore, there is an extra “Mode” area in the properties. For example, you can set whether the “Alarm window” is to pop up automatically for every new message.

Alarm indicator

The “Alarm indicator” is a graphic symbol that indicates pending alarms or messages that have to be acknowledged, depending on the configuration. The “Alarm indicator” can have two states:

- Flashing: At least one alarm that has to be acknowledged is pending.
- Static: At least one of the acknowledged alarm has not yet been sent. The number indicated means the number of alarms still pending.

The “Alarm indicator” can only be configured in the Global View.

Depending on the configuration, an alarm window opens up when the alarm indicator is used. The alarm indicator can only be operated with a mouse or the touch screen.

Figure 4-23 Alarm indicator

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4.7 System diagnostics with the user program

In the user program you can configure reactions to certain diagnostic messages. With the integrated diagnostics instructions in the TIA Portal, you read out the system diagnostics information from the faulty modules. With the information, you can define to stop the system if certain faults occur, for example.

You can send the system diagnostics information read out to a higher-level station for further evaluation.

Diagnostics instructions

For the determination of the system diagnostics information in the user program, the following instructions are available in STEP 7.

Table 4-2

Instruction	Description
RD_SINFO	Read out start information of the current OBs
LED	Read LED status
GET_NAME	Read out the name of the module
DeviceStates	Read the module status information of an IO system
ModuleStates	Read the module status information of a module
GEN_DIAG	Generate diagnostics information
GET_DIAG	Read diagnostics information
RDREC	Read data set. The STATUS output parameter contains error information.
RALRM	Receive alarm. The STATUS output parameter contains error information.
DPNRM_DG	Read diagnostics data of a DP slave
T_DIAG	Check connection

Note For more detailed information about the instructions, please refer to the TIA Portal V12 Online Help.

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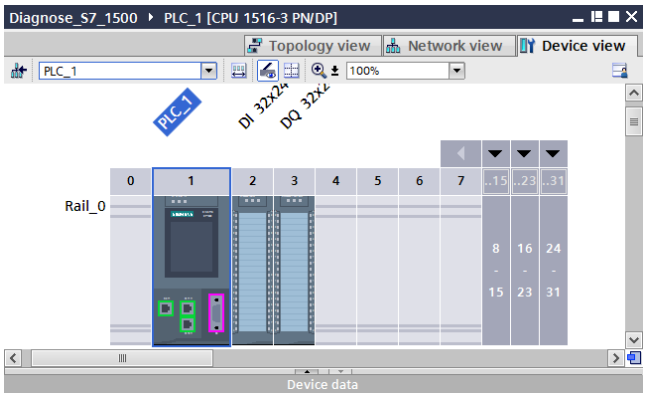
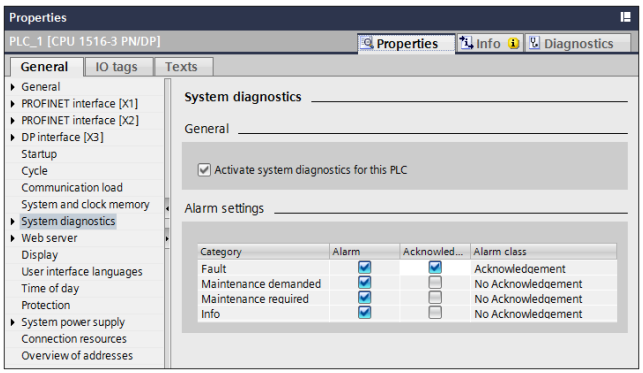
5 Configuration and Settings

5.1 Configuration of the systems diagnostics

The system diagnostics cannot be deactivated for S7-1500. In the “Messages” window you can define which message categories are to be put out and whether they have to be acknowledged. Please proceed as follows:

Table 5-1

No.	Action	Remark
1.	In the device view, of “PLC_1”, please double-click on “Device Configuration” in the project navigation.	
2.	Click on “System diagnostics” in the inspector window of the “PLC_1”, under “Properties > General”.	
3.	In the field “Alarm Settings”, please select the categories to be displayed.	
4.	Activate “Acknowledgement” for the alarm category “Fault”. “Alarm class” now changes from “No Acknowledgement” to “Acknowledgement”, and cannot be changed.	

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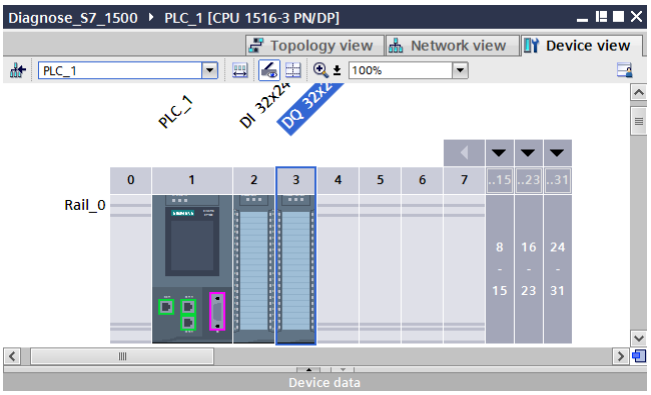
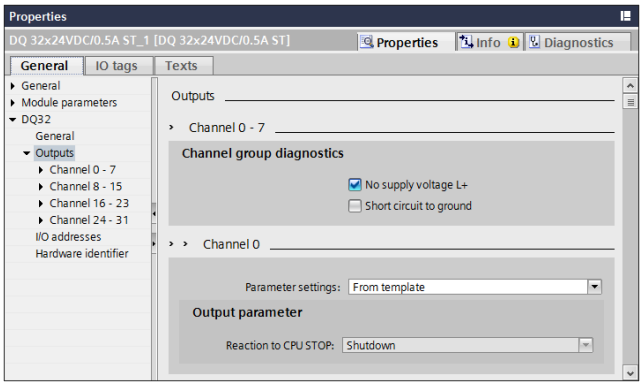
5.2 Configure diagnostic settings of the module DQ32

You can release the module-specific diagnostic settings for every module separately. For displaying the missing supply voltage L+ in the module DQ32, please proceed as follows:

Table 5-2

No.	Action	Remark
1.	In the device view, of “PLC_1”, please double-click on “Device Configuration” in the project navigation.	
2.	Select the module “DQ32” in the device view.	
3.	Click on “DQ32 > Outputs” in the inspector window under “Properties > General”.	
4.	Activate the option box “no supply voltage L+”	

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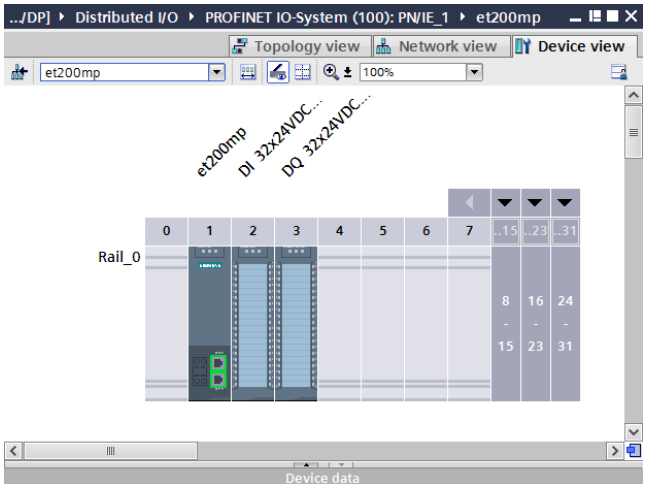
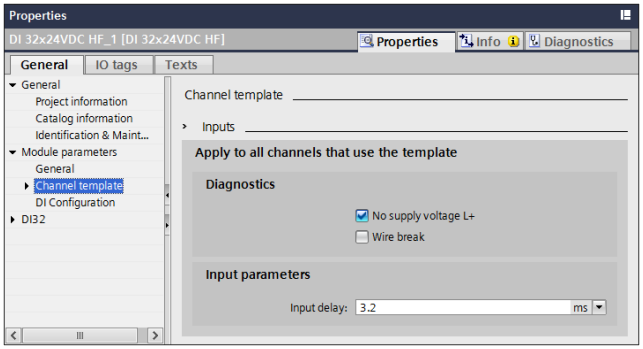
5.3 Configure diagnostic settings of the module DI32

You can release the module-specific diagnostic settings for every module separately. For displaying the missing supply voltage L+ in the module DI32 of the IO device “et200mp”, please proceed as follows:

Table 5-3

No.	Action	Remark
1.	The device view is still open. In the device list, select “et200mp”.	
2.	Select the module “DI32” in the device view.	
3.	In the inspector window under “Properties > General > Module Parameters”, click on “Channel template”.	
4.	Activate the option box “no supply voltage L+”	

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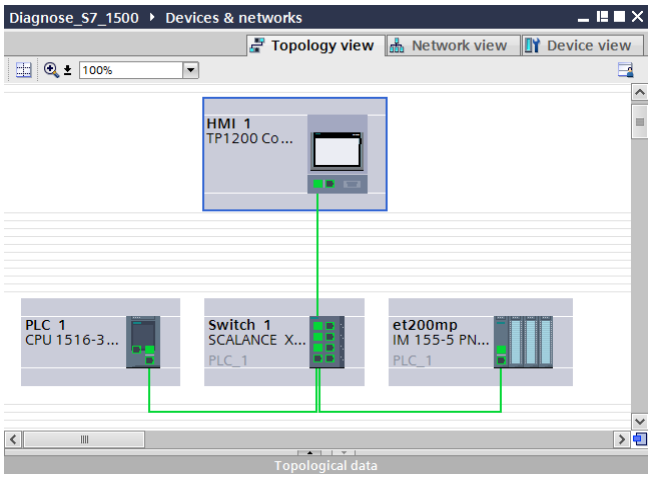
5.4 Configure topology

For displaying the faulty interconnection of the ports in our example, the topology must be configured. Please proceed as follows:

Table 5-4

No.	Action	Remark
1.	Open the device and network editor with a double click on “Devices & networks” in the project navigation.	
2.	Change to the graphic view of the topology view.	
3.	Click on port 1 of “TP1200” with the left mouse button. Move the mouse cursor while keeping the mouse button pressed to Port 1 of “SCALANCE X208”. Release the mouse button.	
4.	Now interconnect port 1 of “PLC_1” with port 2 of “SCALANCE X208” in the same way.	
5.	Now interconnect port 1 of “et200mp” with port 3 of “SCALANCE X208” in the same way.	

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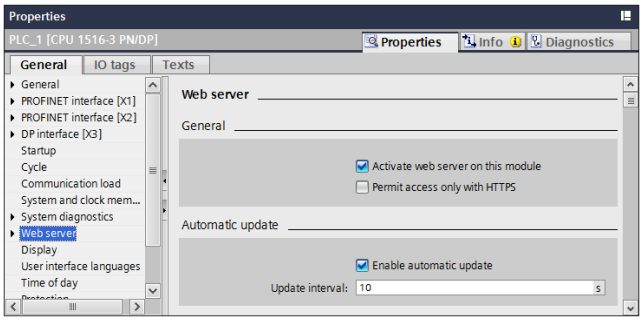
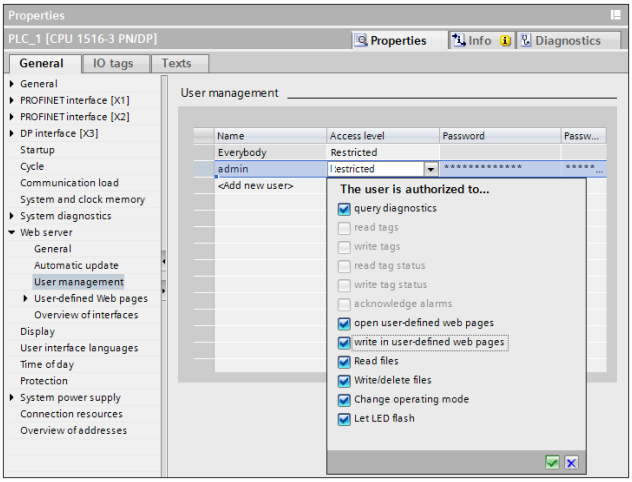
5.5 Configure the web server of the CPU

The web server of the CPU allows for system diagnostics via PROFINET IO. For this, the web server must be activated in the following way:

Table 5-5

No.	Action	Remark
1.	In the device view, of “PLC_1”, please double-click on “Device Configuration” in the project navigation.	
2.	Click on “Web server” in the inspector window of the “PLC_1”, under “Properties > General”.	
3.	Activate the option box “Activate web server on this module”.	
4.	Create a new user “admin” with the password “s7”. Give all the authorizations to the user.	

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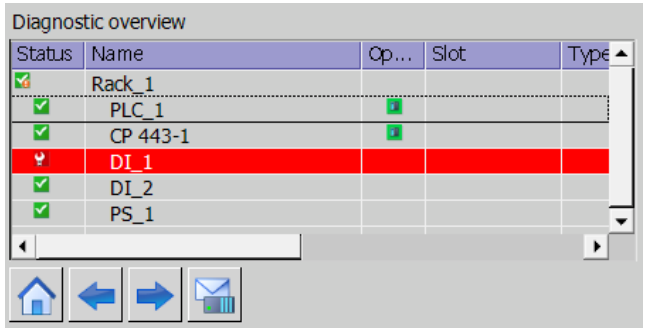
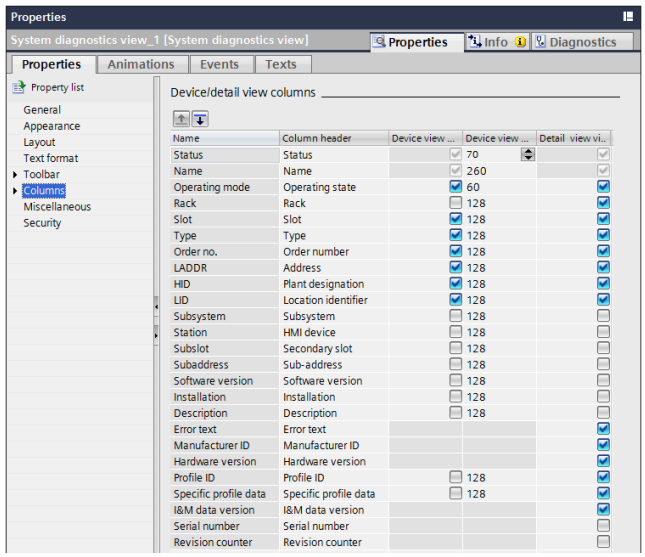
5.6 Configure system diagnostics display in the HMI

For displaying the diagnostic information in the HMI, the complete control system “diagnostics display” is available in the TIA Portal. The following table shows you how to insert the control into your HMI configuration.

Table 5-6

No.	Action	Remark
1.	Open the screen “Diagnostics” from the project navigation under “HMI_1 > Screens > 001_Application”.	
2.	Open the TaskCard “Toolbox”.	
3.	Drag the Control “Systems Diagnostics View” to the screen.	
4.	Adapt the size of the control to the screen.	
5.	Click on “Columns” in the inspector window under “Properties > Properties”.	
6.	Activate the columns you want to display in the device/detailed view.	

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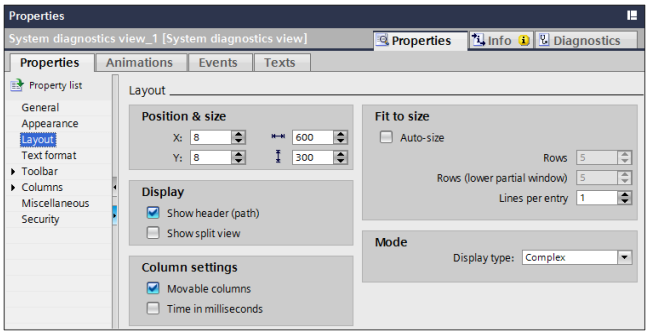
5.6 Configure system diagnostics display in the HMI

No.	Action	Remark
7.	Activate the columns you want to display in the diagnostic buffer detail view.	
8.	Click on “Layout” in the inspector window under “Properties > Properties”.	
9.	Activate “Show split view” if you wish to display the device and detailed views at the same time, or deactivate “Show split view” if you only wish to display one view.	

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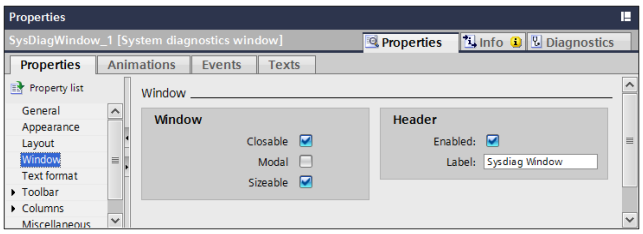
5.7 Configure system diagnostics display in the HMI

For displaying the diagnostic information in the HMI, the complete control system “diagnostics display” is available in the TIA Portal. The following table shows you how to insert the control into your HMI configuration.

Table 5-7

No.	Action	Remark
1.	Open the “Global Screen” from the project navigation under “HMI_1 > Screen management”.	
2.	Open the TaskCard “Toolbox”.	
3.	Drag the Control “Systems Diagnostics View” to the Global screen.	
4.	Configure the “System Diagnostic Screen” like a “System Diagnostic View” (see chapter 5.6 Configure system diagnostics display in the HMI).	
5.	Click on “Window” in the inspector window under “Properties > Properties”.	
6.	Activate the window properties “Closable” and “Sizeable”.	

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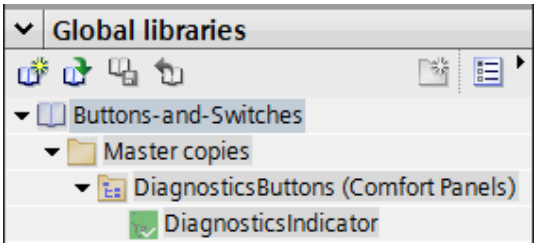
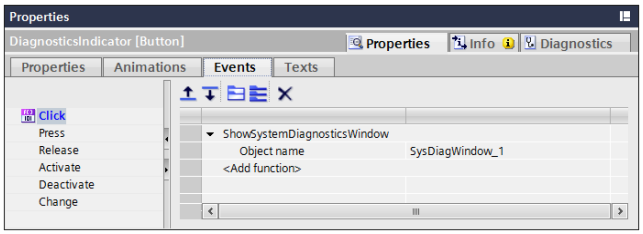
5.8 Configure system diagnostics indicator

The “System diagnostics indicator” is for displaying troubles in the HMI. If you want to be able to use the “System Diagnostic Indicator”, a “system diagnostic window” must have been configured in the global screen.

Table 5-8

No.	Action	Remark
1.	Open the screen “DiagnosticsOverview” from the project navigation under “HMI_1 > Screens > 001_Application”.	
2.	Open the TaskCard “Toolbox > Libraries > Global Libraries”.	
3.	Open the folder “Buttons-and-Switches > Master copies > DiagnosticsButtons”.	
4.	Drag and drop the object “DiagnosticsIndicator” to the place in the screen where you want it to be.	
5.	Click on “Click” in the inspector window under “Properties > Events”.	
6.	Now select the system diagnostic window “SysDiagWindow_1” from the global screen for the pre-set system function “ShowSystemDiagnostics Window”.	

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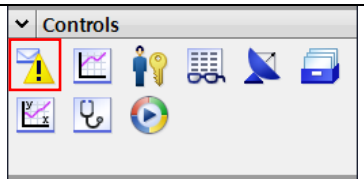
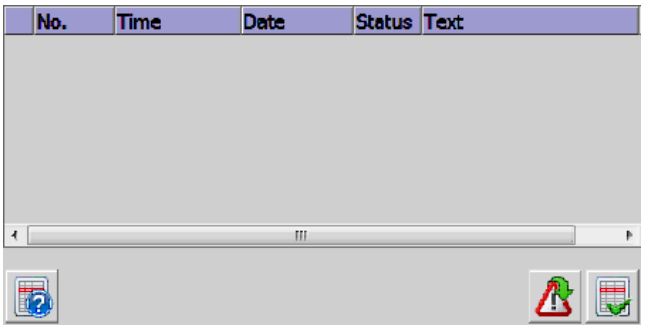
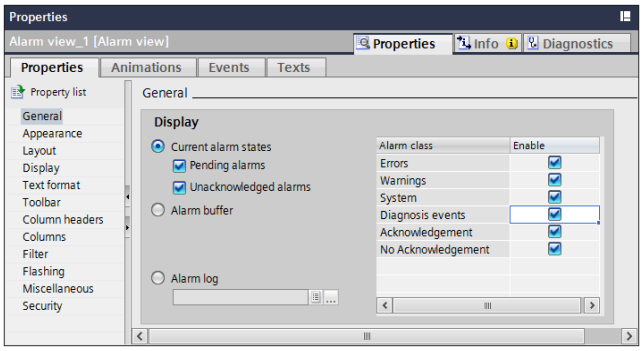
5.9 Configure the alarm view

The “Alarm view” is for displaying troubles in the HMI. The following table shows you how to insert the pre-defined control “Alarm view” into your HMI configuration.

Table 5-9

No.	Action	Remark
1.	Open the screen “Alarms” from the project navigation under “HMI_1 > Screens > 001_Application”.	
2.	Open the TaskCard “Toolbox”.	
3.	Drag the Control “Alarm View” to the screen.	
4.	Adapt the size of the control to the screen.	
5.	Click on “General” in the inspector window under “Properties > Properties”.	
6.	Under “Display > Current alarm states”, activate the “Pending alarms” and “Unacknowledged alarms”.	
7.	Activate the alarm classes “Acknowledgement” and “No acknowledgement”. Both alarm classes were set automatically during the configuration of the “Alarm Settings” (see chapter 5.1 Configuration of the systems diagnostics).	

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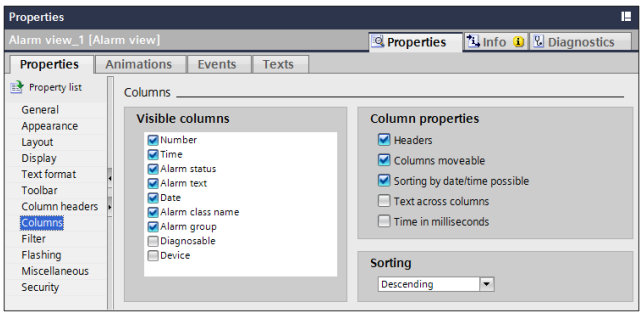
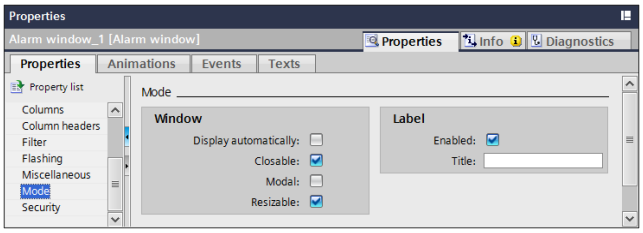
No.	Action	Remark
8.	Click on “Columns” in the inspector window under “Properties > Properties”.	
9.	Under “Visible columns” select the columns you wish to be output in “Alarm view”.	

5.10 Configure the alarm window

The “Alarm window” is mainly configured like the “Alarm view”. The following table shows you how to insert the pre-defined control “Alarm window” into your HMI configuration.

Table 5-10

No.	Action	Remark
1.	Open the “Global Screen” from the project navigation under “HMI_1 > Screen management”.	
2.	Open the TaskCard “Toolbox”.	
3.	Drag the Control “Alarm View” to the global screen.	
4.	Configure the “Alarm window” like an “Alarm view” (see chapter 5.9 Configure the alarm view).	
5.	Click on “Mode” in the inspector window under “Properties > Properties”.	
6.	Deactivate the window - properties “Display automatically” and activate the window properties “Closable” and “Resizable”.	

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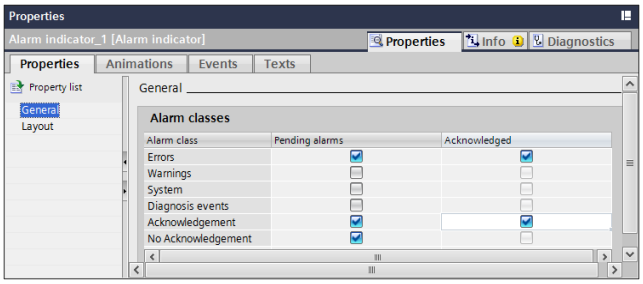
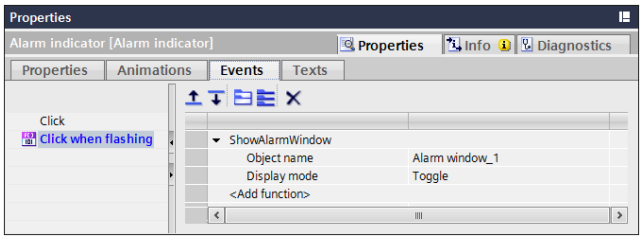
5.11 Configure the alarm indicator

The “Alarm indicator” indicates pending alarms in the HMI. If you want to be able to use the “Alarm indicator”, an “Alarm window” must have been configured in the global screen.

Table 5-11

No.	Action	Remark
1.	Open the “Global Screen” from the project navigation under “HMI_1 > Screen management”.	
2.	Open the TaskCard “Toolbox”.	
3.	Drag and drop the control “Alarm indicator” to the place in the screen where you want it to be.	
4.	Select the alarm classes you wish to be displayed by the alarm indicator in the inspector window under “Properties > Properties > General”. In the column “Pending alarms” activate the alarm classes “Errors”, “Acknowledgment” and “No acknowledgment”. In the column “Acknowledged”, activate the alarm classes “Errors” and “Acknowledgment”.	
5.	Click on “Click when flashing” in the inspector window under “Properties > Events”. The function list opens up.	
6.	Click on the first line of the function list and choose the system function “ShowAlarmWindow” under “Alarms”.	
7.	Under “Object name” please select the alarm window “Alarm window_1”.	

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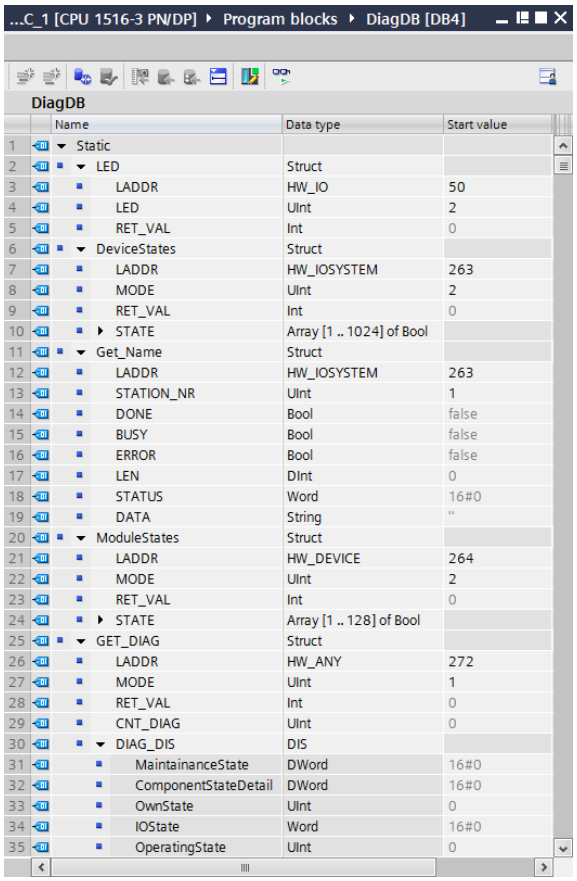
5.12 Configure system diagnostics with user programs

For the system diagnostics in user programs, complete instructions are available in the TIA Portal. For more detailed information about the instructions, please refer to the TIA Portal V12 Online Help. The use of several applications in the user program is described below.

No further evaluation of the System Diagnostics information will be described in this example.

In this application the parameter structure of the individual diagnostic instructions is displayed in the data block “DiagDB” (see Figure 5-1). The parameters of the instructions are not linked to the variables of the data block.

Figure 5-1 Data block “DiagDB”



	Name	Data type	Start value
1	Static		
2	LED	Struct	
3	LADDR	HW_IO	50
4	LED	UInt	2
5	RET_VAL	Int	0
6	DeviceStates	Struct	
7	LADDR	HW_IOSYSTEM	263
8	MODE	UInt	2
9	RET_VAL	Int	0
10	STATE	Array [1 .. 1024] of Bool	
11	Get_Name	Struct	
12	LADDR	HW_IOSYSTEM	263
13	STATION_NR	UInt	1
14	DONE	Bool	false
15	BUSY	Bool	false
16	ERROR	Bool	false
17	LEN	DInt	0
18	STATUS	Word	16#0
19	DATA	String	''
20	ModuleStates	Struct	
21	LADDR	HW_DEVICE	264
22	MODE	UInt	2
23	RET_VAL	Int	0
24	STATE	Array [1 .. 128] of Bool	
25	GET_DIAG	Struct	
26	LADDR	HW_ANY	272
27	MODE	UInt	1
28	RET_VAL	Int	0
29	CNT_DIAG	UInt	0
30	DIAG_DIS	DIS	
31	MaintainanceState	DWord	16#0
32	ComponentStateDetail	DWord	16#0
33	OwnState	UInt	0
34	IOState	Word	16#0
35	OperatingState	UInt	0

Please find the value and/or the symbolic name of the respective parameters “LADDR” (HW-ID) in the tab “System constants” of the “Default tag table” (see Figure 5-2).

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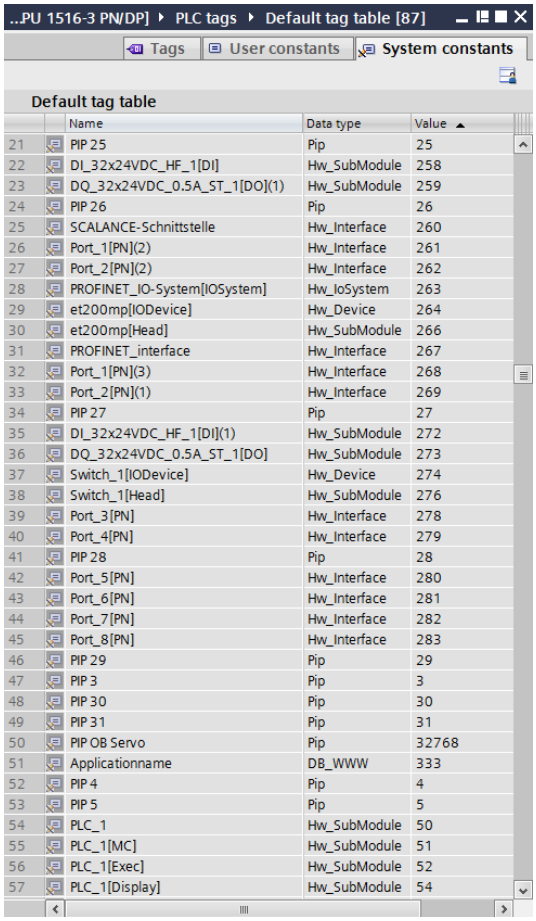
Figure 5-2 System constants



	Name	Data type	Value
21	PIP 25	Pip	25
22	DI_32x24VDC_HF_1[DI]	Hw_SubModule	258
23	DQ_32x24VDC_0.5A_ST_1[DO](1)	Hw_SubModule	259
24	PIP 26	Pip	26
25	SCALANCE-Schnittstelle	Hw_Interface	260
26	Port_1[PN](2)	Hw_Interface	261
27	Port_2[PN](2)	Hw_Interface	262
28	PROFINET_IO-System[IOSystem]	Hw_IoSystem	263
29	et200mp[IODevice]	Hw_Device	264
30	et200mp[Head]	Hw_SubModule	266
31	PROFINET_interface	Hw_Interface	267
32	Port_1[PN](3)	Hw_Interface	268
33	Port_2[PN](1)	Hw_Interface	269
34	PIP 27	Pip	27
35	DI_32x24VDC_HF_1[DI](1)	Hw_SubModule	272
36	DQ_32x24VDC_0.5A_ST_1[DO]	Hw_SubModule	273
37	Switch_1[IODevice]	Hw_Device	274
38	Switch_1[Head]	Hw_SubModule	276
39	Port_3[PN]	Hw_Interface	278
40	Port_4[PN]	Hw_Interface	279
41	PIP 28	Pip	28
42	Port_5[PN]	Hw_Interface	280
43	Port_6[PN]	Hw_Interface	281
44	Port_7[PN]	Hw_Interface	282
45	Port_8[PN]	Hw_Interface	283
46	PIP 29	Pip	29
47	PIP 3	Pip	3
48	PIP 30	Pip	30
49	PIP 31	Pip	31
50	PIP OB Servo	Pip	32768
51	Applicationname	DB_WWW	333
52	PIP 4	Pip	4
53	PIP 5	Pip	5
54	PLC_1	Hw_SubModule	50
55	PLC_1[MC]	Hw_SubModule	51
56	PLC_1[Exec]	Hw_SubModule	52
57	PLC_1[Display]	Hw_SubModule	54

Note Assign the symbolic names of the variable table and the variables of the data block to the parameters of the instructions per drag & drop.

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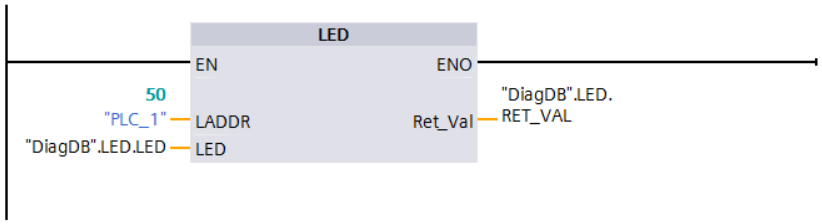
5.12.1 Instruction “LED”

With the instruction “LED”, you can read out the status of a certain module LED. The following example shows you that your status of the ERROR-LED (parameter LED = 2) of the “PLC_1”.

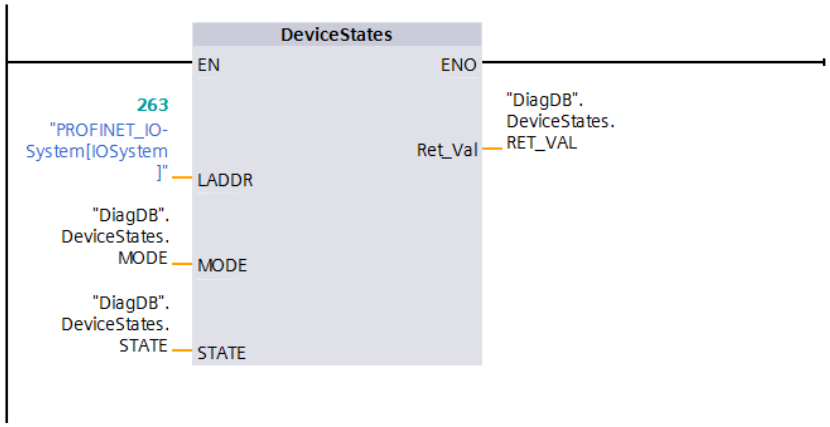
Figure 5-3 Instruction LED



5.12.2 Instruction “Device States”

With the instruction “Device States” you put out the status of the modules of an I/O system (PROFIBUS DP or PROFINET IO). The following example detects the trouble modules (Parameter MODE =“) of the “PROFINET_IO_Systems.”

Figure 5-4 Instruction DeviceStates



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5.12.3 Instruction “GET_NAME”

With the instruction “GET_NAME” you can read out the device name of, let's say a faulty module of an IO system (PROFIBUS DP or PROFINET IO) for example. The following example determines the device names of the module with the “Device Number” “1”. Please find the “Device number” in the network view under “Properties of the module (see Figure 5-5). The “Device number” “1” is assigned in the data block “DiagDB” of the variable “STATION_NR”.

Figure 5-5 Device number

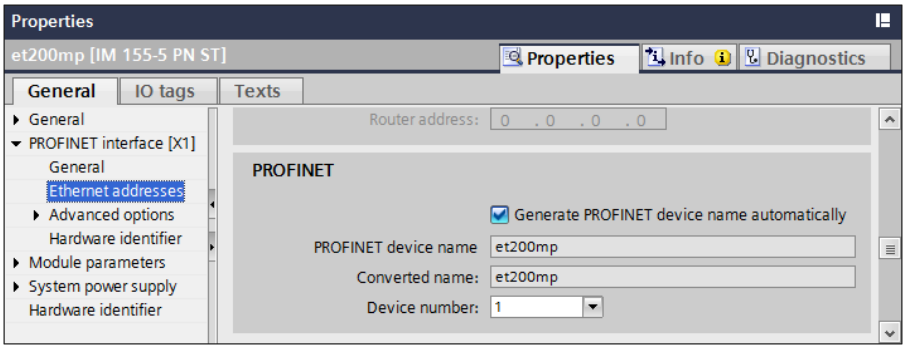
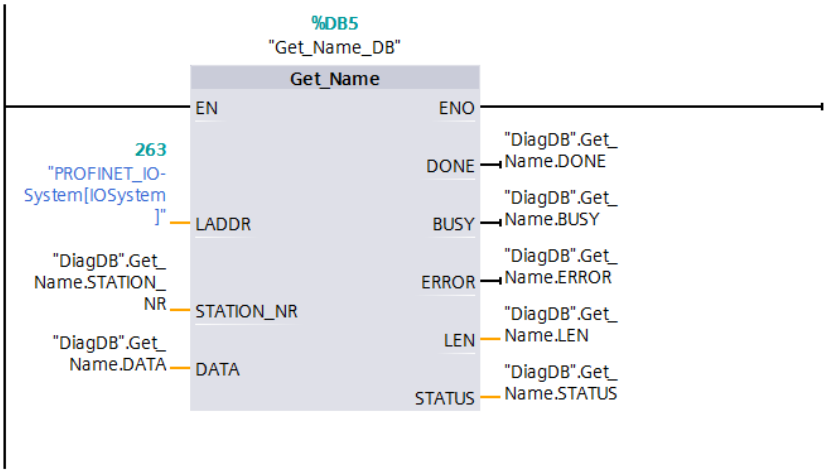


Figure 5-6 Instruction GET_NAME



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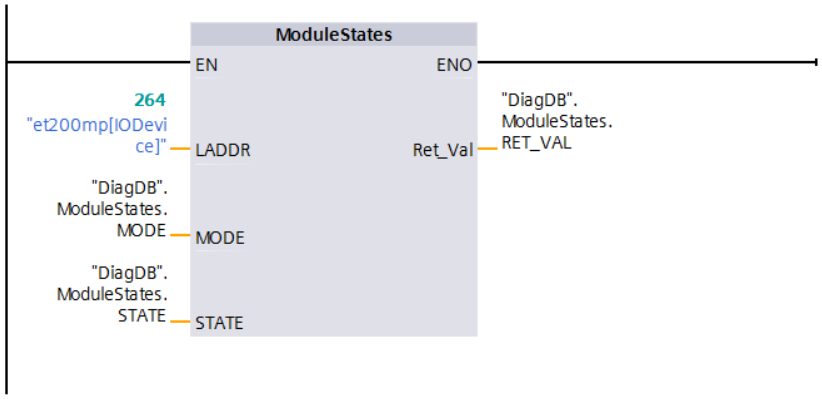
5.12.4 Instruction “ModuleStates”

With the instruction “ModuleStates” you can read out the module state of a module. The following example detects the trouble modules (Parameter MODE =2) of the IO device “et200mp”.

Figure 5-7 Instruction ModuleStates

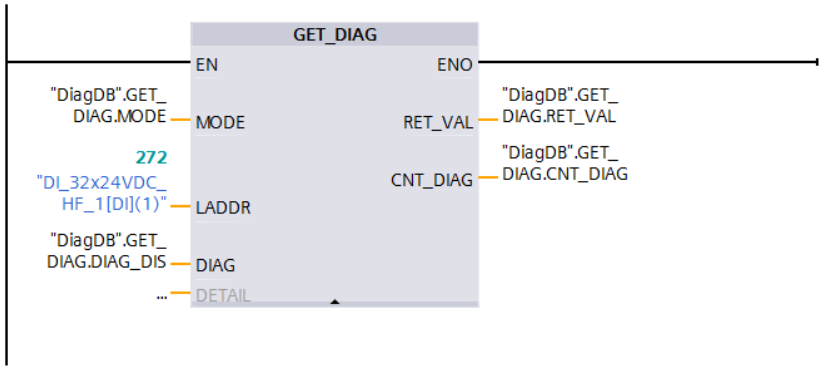


5.12.5 Inspection “GET_DIAG”

With the instruction “GET_DIAG” you can read out the diagnose information of a module. In the following example the diagnostic status of the DI module “DI32x24VDC_HF_1” is put out according to the structure “DIS” (Parameter MODE = 1) in the parameter “DIAG”.

Note The structure “DIS” is already integrated in TIA Portal and does not need to be created. However, variables with the data type “DIS” can only be defined in the block interface or in data blocks (see Figure 5-1).

Figure 5-8 Instruction GET_DIAG



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6 Installation

This chapter describes the hardware and software components to be installed. The description and manuals and delivery information supplied with the respective products must always be observed.

6.1 Hardware installation

The hardware components are listed in chapter 2.3 Hardware and software components used. For setting up the hardware, please proceed according to the following table:

NOTICE	**Only switch on the voltage supply after the last step.**

Table 6-1

No.	Action	Remark
1	Insert the SIMATIC Memory Card into the Memory Card Slot of the CPU 1516-3 PN DP. Assemble the following modules of the CPU 1516-3 PN/DP in the following order. 1. PM 1507 LC 2. CPU 1516-3 PN/DP 3. DI32 4. DQ32	
2	Assemble the following modules of the ET 200MP in the following order: 1. IM 155-5 PN ST 2. DI32 3. DQ32	
3	Attach the Panel TP1200 Comfort.	
4	Attach the switch SCALANCE X208.	
5	Supply all the necessary voltage points of the devices and modules with 24 V from the power module.	
6	Set up the voltage supply of the power supply with AC 230V.	AC 230V Please remove the cold device plug with the ground line and cable lugs
7	Connect the CPU, the ET 200MP, the Panel TP1200 Comfort and your PG/PC to the switch SCALANCE as described in the following screen Figure 6-1.	

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The figure below shows the interconnection of the devices.

Figure 6-1 Network of the devices

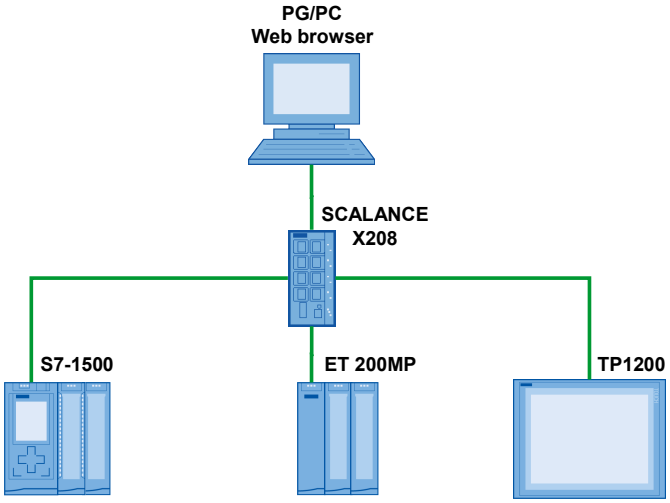

Table 6-2

SCALANCE X208	Device / port
Port 1	TP1200 Comfort / Port 1
Port 2	CPU 1516-3 PN/DP / Port 1
Port 3	ET 200MP / Port 1
Port 4	PG/PC with a web browser / depending on the device

Note The assembly regulations for SIMATIC S7 and SIMATIC NET have to be observed.

6.2 Software installation

Table 6-3

No.	Action	Remark
1	Install STEP 7 V12	
2	Install a web browser on the PG/PC, e.g. Firefox or Internet Explorer, with which you want to access the website of the CPU.	

6.3 Installation of the application software

This chapter describes the steps for the installation of the example code.

Table 6-4

No.	Action	Remark
1	Unzip the file “68011497_S7-1500_Diagnose_CODE_v10.zip” into your project list.	

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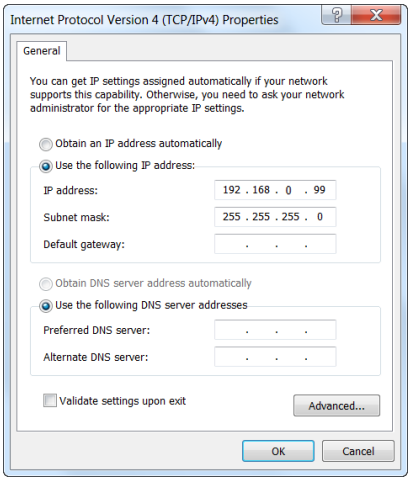
7 Starting the Application

7.1 Preparation

Table 7-1

No.	Action	Remark
1	First make sure that the IP address of the PC/PC interface is located in the same subnet as the IP addresses of the PROFINET devices.	

7.2 Commissioning

Assign the names and IP addresses of the PROFINET users

The following table gives you an overview of the PROFINET device names and IP addresses.

Table 7-2

Device	Device name	IP address
CPU 1516-3 PN/DP	plc_1	192.168.0.1
ET 200 SP IM155-5 PN ST	et200mp	192.168.0.2
Panel TP1200 Comfort	hmi_1	192.168.0.3
Switch SCALANCE X208	Switch _1	192.168.0.4

To ensure the PROFINET functionality, all the net users need unique names, which are identical in the device and in the configuration of the S7-CPU. For assigning these names and the IP addresses, please carry out the following instructions:

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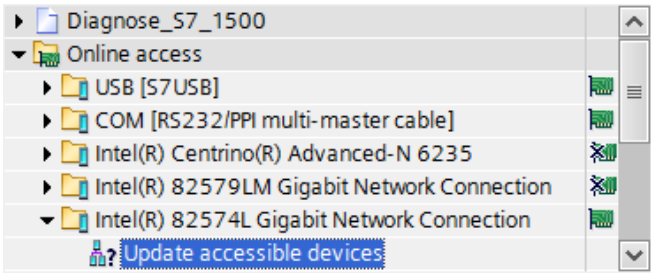
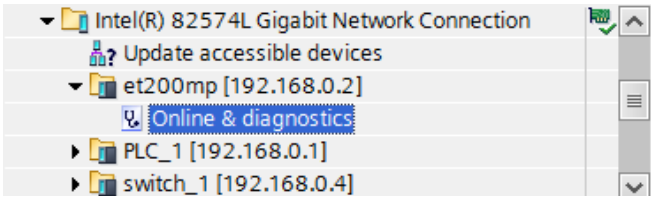
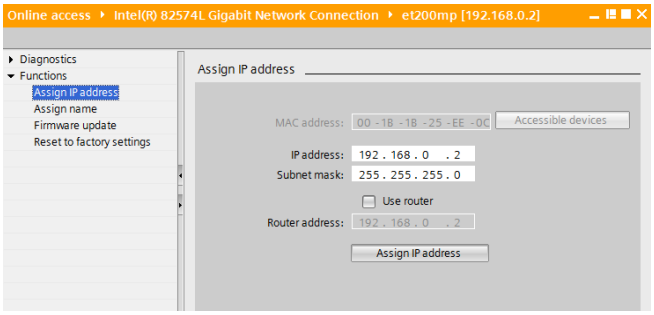
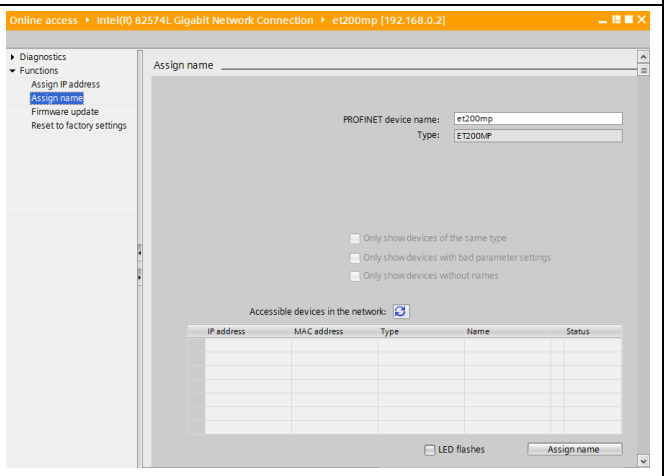
Table 7-3

No.	Action	Remark
1	Start SIMATIC STEP 7 V12	
2	Select the interface to which your devices are connected in the project navigation under “Online access”.	
3	Double-click on “Update accessible devices” to start the search for users.	
4	The users which were found will be listed in the project navigation. Open the diagnostic screen with a double-click on “Online &Diagnostics” of a user.	
5	In the folder “Functions”, select the group “Assign IP address”. Enter the IP address according to Table 7-2 and the corresponding subnet screen and assign them to the device with the button “Assign IP address”.	
6	In the folder “Functions”, select the group “Assign name”. Enter the PROFINET device name according to Table 7-2 and assign it to the device with the button “Assign name”.	

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No.	Action	Remark
7	Carry out items 4 to 5 for the CPU 1516-3 PN/DP. Please note: The device name is assigned during the download of the configuration into the CPU.	
8	Carry out items 4 to 6 for the SCALANCE X208.	
9	Set the IP address and the device name of the operating device according to Table 7-2 in the control panel of the operating device. Please refer to the respective manual of the operating device for the exact procedure.	

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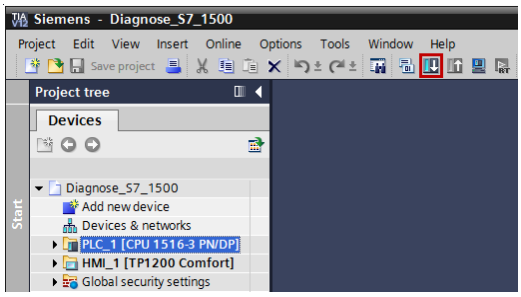
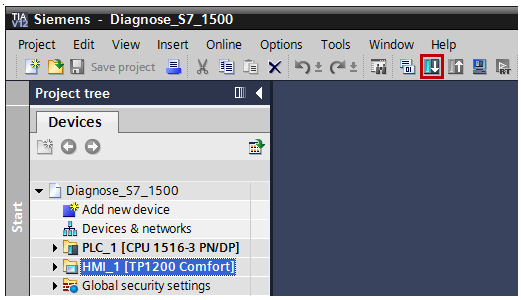
Load the STEP 7 project into the CPU

Table 7-4

No.	Action	Remark
1	Start SIMATIC STEP 7 V12	
2	Open the project in SIMATIC STEP 7 V12.	
3	Select S7-1500 in the project navigation.	
4	Click on the button “Download to device”. Select the PG/PC interface with which the PLC is connected to the PG. Load the complete project into the CPU.	

Load the WinCC project into the HMI

Table 7-5

No.	Action	Remark
1	Select the operating device TP1200 Comfort in the project navigation.	
4	Click on the button “Download to device”. If necessary, select the PG/PC interface. Load the complete WinCC project into the operating device. Please note: When selecting the PG/PC interface, please ensure the correct transfer settings in the operating device.	

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8 Operating the Application

8.1 Diagnostics with LEDs

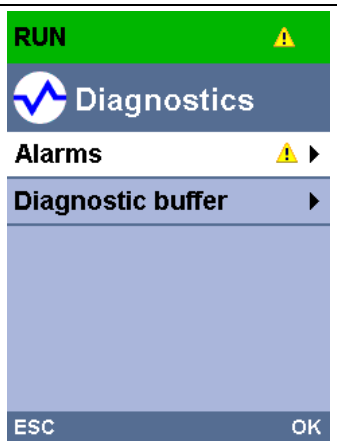
The missing supply voltage L+ in the module DQ32 is displayed by a flashing red LED in the module and in the CPU.

8.2 Diagnostics with the display in the CPU S7-1500

The S7-1500 display has a large variety of diagnostic possibilities. The missing supply voltage L+ in the module DQ32 is displayed in various places in the display.

8.2.1 Diagnostics menu: Alarms

Table 8-1

No.	Action	Remark
1.	Navigate to the “Diagnostics” menu with the arrow buttons and open it with the “OK” button.	
2.	Select “Alarms” and open it with the “OK” button.	

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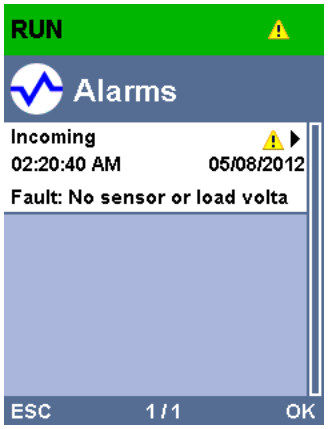
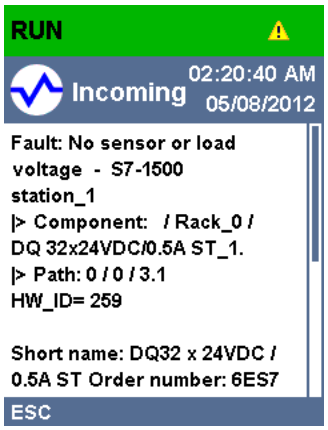
No.	Action	Remark
3.	Select the alarm and open the message details with “OK”.	
4.	Check the message.	

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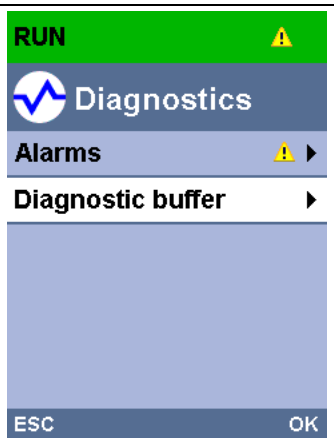
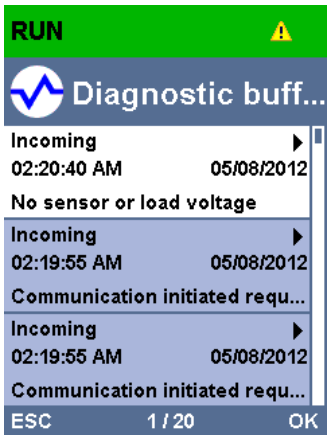
8.2.2 Diagnostics menu: Diagnostic buffer

Table 8-2

No.	Action	Remark
1.	Navigate to the “Diagnostics” menu with the arrow buttons and open it with the “OK” button.	
2.	Select “Diagnostic buffer” and open it with the “OK” button.	
3.	Select the alarm and open the message details with “OK”.	

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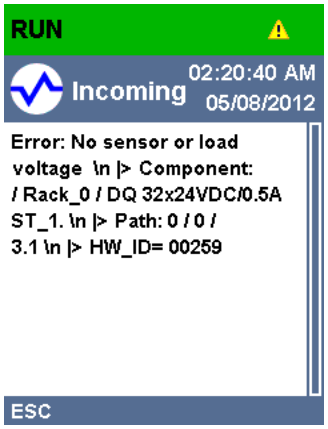
No.	Action	Remark
4.	Check the message in the diagnostic buffer.	

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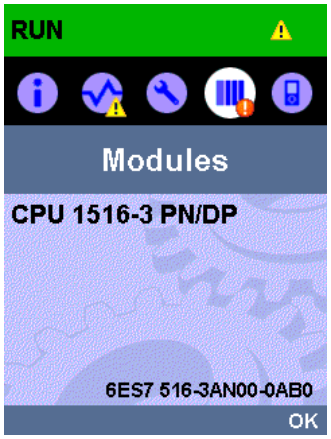
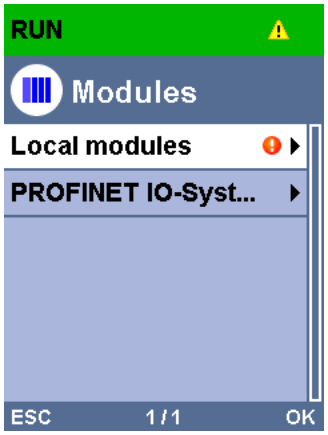
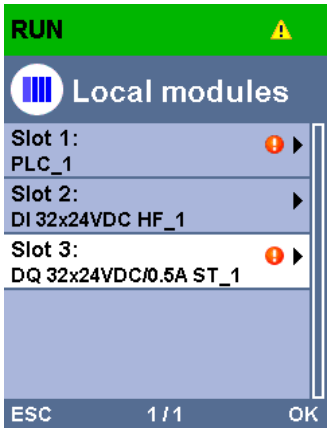
8.2.3 The “Modules” menu

Table 8-3

No.	Action	Remark
1.	Navigate to the “Modules” menu with the arrow buttons and open it with the “OK” button.	
2.	Select “Local modules” and open it with the “OK” button.	
3.	Select the missing module DQ32 on “Slot3” and open the status with “OK”.	

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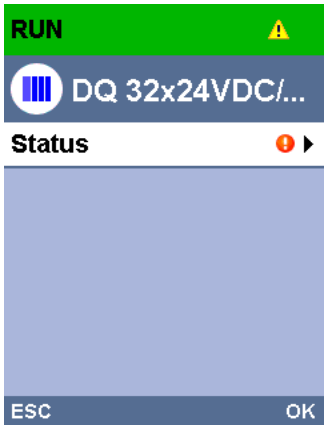
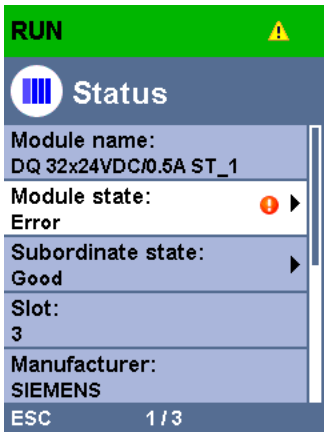
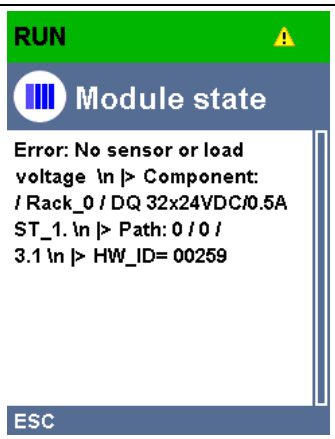
No.	Action	Remark
4.	Select “Status” and open it with the “OK” button.	
5.	Select the “Module state” and open the message details with “OK”.	
6.	Check the message.	

Note Quit the currently selected menu by hitting the “ESC” button.

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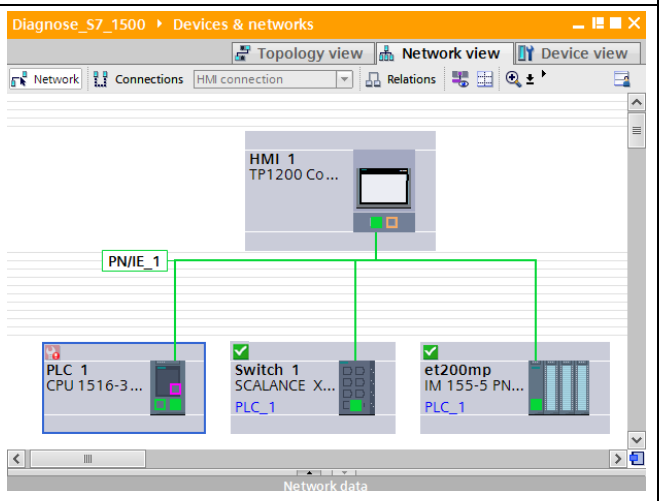
8.3 Diagnostics in the TIA Portal

8.3.1 Diagnostics of the hardware in the device and network view

For the diagnostics of the missing supply voltage L+ in the module DQ32 in the device and network view, please proceed as follows:

Diagnostic information in the network view

Table 8-4

No.	Action	Remark
1.	Open the device and network editor with a double click on “Devices & networks” in the project navigation.	
2.	Select the “PLC_1” in the network view.	
3.	In the toolbar, click the “Connect online” button.	When a connection is first established, the dialog “Connect online” opens up. Select the PG/PC interface with which the PLC is connected to the PG/PC and click on “Connect”.
4.	In the network view, the diagnostic symbol “Fault” is displayed at “PLC_1”. The additional diagnostic symbol in the lower right hand corner of the diagnostic symbol indicates that a fault has occurred in a lower-level component.	

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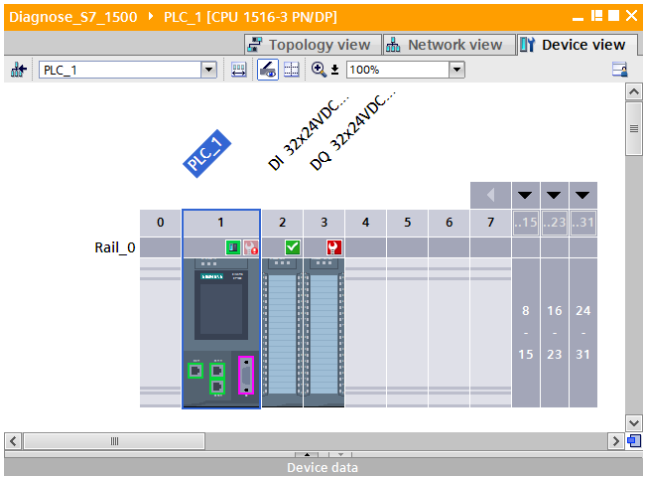
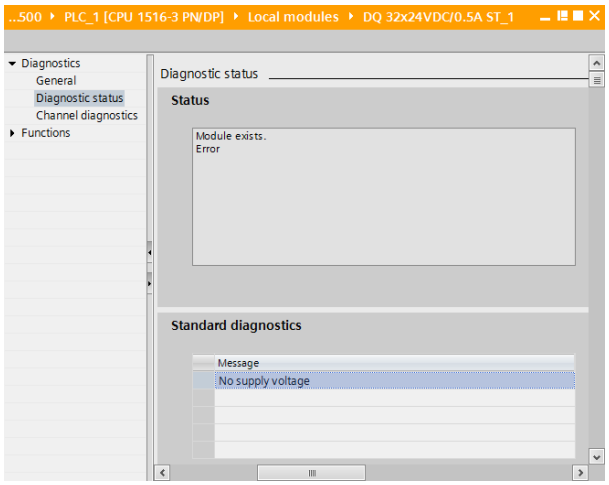
Diagnostic information in the device view

Table 8-5

No.	Action	Remark
5.	Double-click on the device “PLC_1”. The online device view opens up. For every hardware component, the corresponding diagnostic symbol is displayed. Therefore, the faulty module can be detected immediately in the display.	

Diagnostic information in the diagnostics view

Table 8-6

No.	Action	Remark
6.	Double-click on the diagnostic symbol of the module “DQ32”. The diagnostics view of the module is displayed.	
7.	Open the folder “Diagnostics > Diagnostic status”. The diagnostic message is displayed in the window “Standard diagnostics”.	

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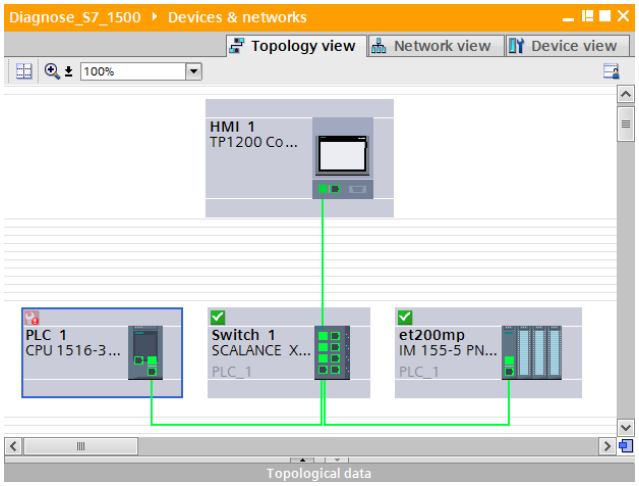
8.3.2 Diagnosis in the topology view

Fault scenario: Missing supply voltage

For the diagnostics of the missing supply voltage L+ in the module DQ32 in the topology view, please proceed as follows:

Table 8-7

No.	Action	Remark
1.	The online connection to PLC_1 has already been established. Change to the topology view of the device and network editor. In the topology view, the diagnostic symbol “Fault” is displayed at “PLC_1”. The additional diagnostic symbol in the lower right hand corner of the diagnostic symbol indicates that a fault has occurred in a lower-level component.	
2.	Double-click on the device to change the device view, see Diagnostic information in the device view.	

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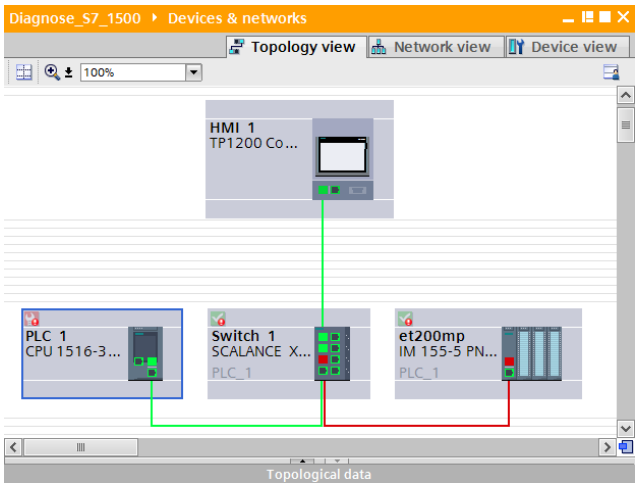
Fault scenario: Faulty interconnection of the port

For this fault scenario, remove the Ethernet cable from port 1 of the ET 200MP and insert it into port 2 of the ET 200MP.

For the diagnostics of the faulty interconnection in the topology view, please proceed as follows

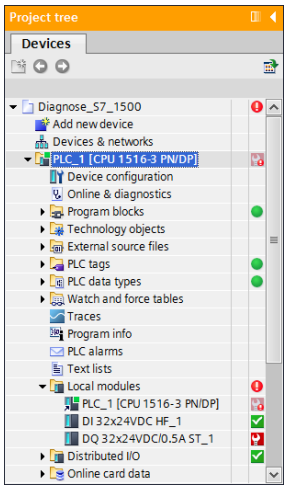
Table 8-8

No.	Action	Remark
1.	The online connection to PLC_1 has already been established. Change to the topology view of the device and network editor. In the topology view, the diagnostic symbol “Fault” is displayed at “PLC_1” and faults in the lower-level component are displayed at “Switch_1” and “et200mp”. The faulty interconnection and the respective port at “Switch_1” and “et200mp” are displayed in red.	

8.3.3 Diagnosis in the project navigation

For the diagnostics of the missing supply voltage L+ in the module DQ32 in the device and network view, please proceed as follows:

Table 8-9

No.	Action	Remark
1.	The online connection to PLC_1 has already been established. Go to the project navigation. In the project navigation, view, the diagnostic symbol “Fault” is displayed at “PLC_1”. The additional diagnostic symbol in the lower right hand corner of the diagnostic symbol indicates that a fault has occurred in a lower-level component.	
2.	Open the “PLC_1” folder. The symbol for the fault in lower-level components is displayed in the folder “Local modules”.	

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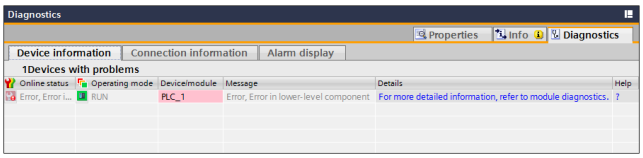
No.	Action	Remark
3.	Open the folder “Local modules”. In the module “DQ32”, the diagnostic symbol “Fault” is displayed.	
4.	Double-click on the module “DQ32 to go to the device view, see Diagnostic information in the device view.	
5.	Double-click on the diagnostic symbol of a module to go to the diagnostics view of a module, see Diagnostic information in the diagnostics view.	

8.3.4 Diagnostics in the inspection window

For the diagnostics of the missing supply voltage L+ in the module DQ32 in the inspector window, please proceed as follows:

“Device information” tab

Table 8-10

No.	Action	Remark
1.	The online connection to PLC_1 has already been established. Change to the inspector window.	
2.	Open the “Diagnostics” tab.	
3.	Open the lower-level tag “Device information”. The “Online status” shows you that a fault has occurred in a lower-level component. The “Device/module” “PLC_1” has the “operating mode” “RUN”. Click on the link under “Details” to go to the diagnostics view of a module. Click on the link under “Help” to receive online help and further information about the message.	

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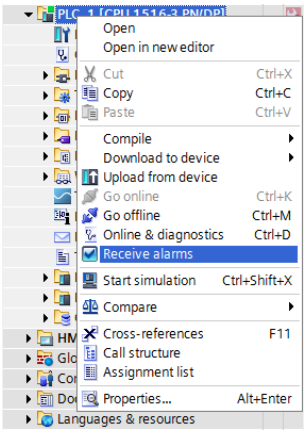
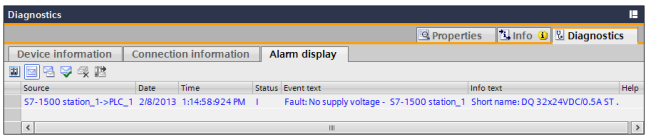
“Alarm display” tab

Table 8-11

No.	Action	Remark
1.	The online connection to PLC_1 has already been established.	
2.	Click on “PLC_1” in the project navigation with the right mouse button. The context menu opens up.	
3.	Activate “Receive alarms” in the context menu.	
4.	Go to the inspector window and open the tab “Diagnostics > Alarm display”.	
5.	Click on the symbol “Active alarms”. The alarm about the faulty module “DQ32” is displayed with the source, date and time. The status “I” indicates that it is a coming alarm.	

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8.4 Diagnostics with the web server

For the diagnostics of the missing supply voltage L+ in the module DQ32 with the web server, please proceed as follows:

Login at the web server / website “Start page”

Table 8-12

No.	Action	Remark
1.	Open the web browser, for example the Internet Explorer.	
2.	Enter IP address of “PLC_1” as address, for example http://192.168.0.1. The intro page opens up.	
3.	Click “ENTER”. The start page of “PLC_1” opens up.	
4.	Enter the name “admin” and the password “s7”. Then click on “Log in”. The complete start page of “PLC_1” opens up. The pending fault is displayed at the status LED and in the box “Status”.	

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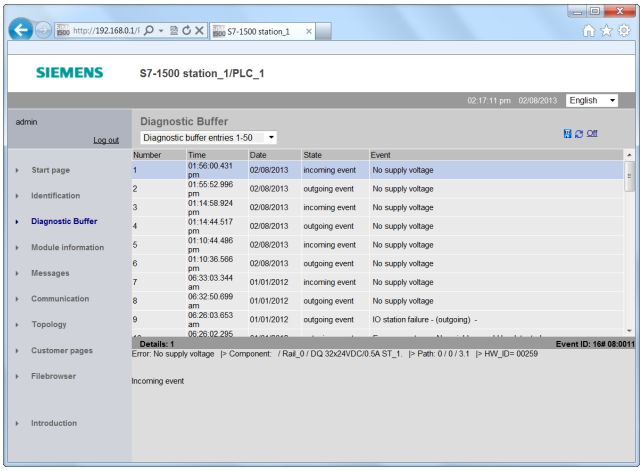
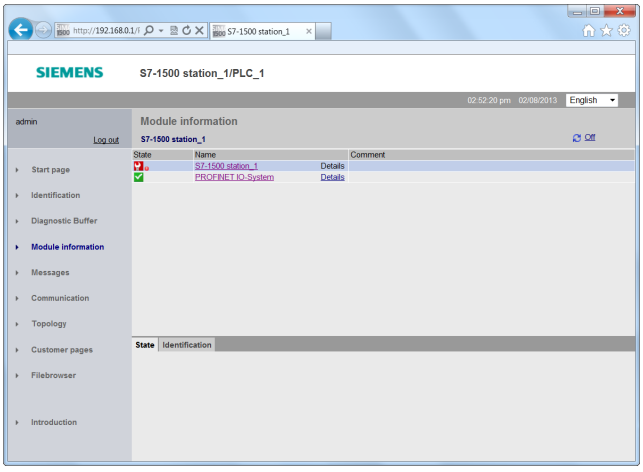
Website “Diagnostic buffer”

Table 8-13

No.	Action	Remark
1.	Click on “Diagnostic Buffer” to open the website.	
2.	Select the alarm “No supply voltage”. Under “Details” you get more diagnostic information about the alarm.	

Website “Module information”

Table 8-14

No.	Action	Remark
1.	Click on “Module information” to open the website. In “S7-1500-station_1”, the diagnostic symbol “Fault” is displayed. The additional diagnostic symbol in the lower right hand corner of the diagnostic symbol indicates that a fault has occurred in a lower-level component.	
2.	Click on the link “S7-1500-station_1” to get an overview of the status of the local modules. In the faulty module “DQ32”, the diagnostic symbol “Fault” is displayed.	

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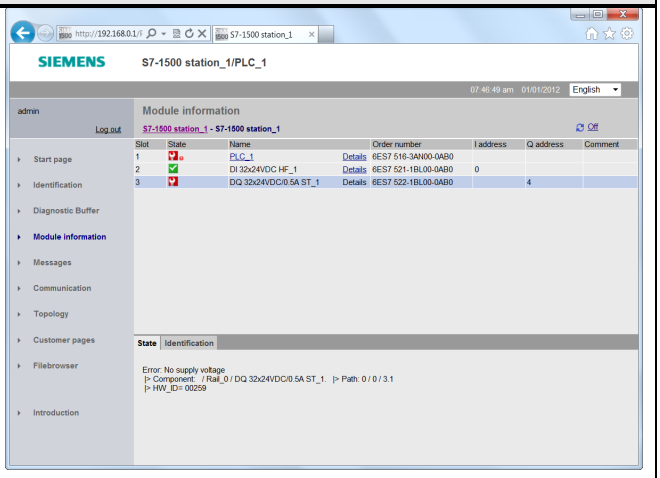
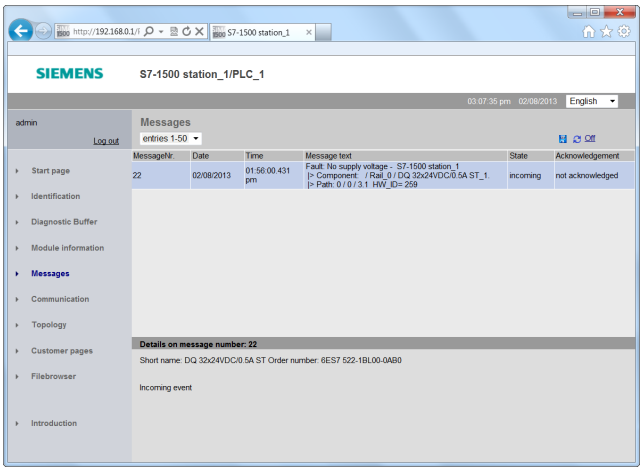
No.	Action	Remark
3.	Click on the link “Details” of the module “DQ32”. Under “Status” you get more diagnostic information about the alarm.	

Website “Messages”

Table 8-15

No.	Action	Remark
1.	Click on “Messages” to open the website.	
2.	Select the message “Fault: No supply voltage…” Under “Details” you get more diagnostic information about the alarm.	

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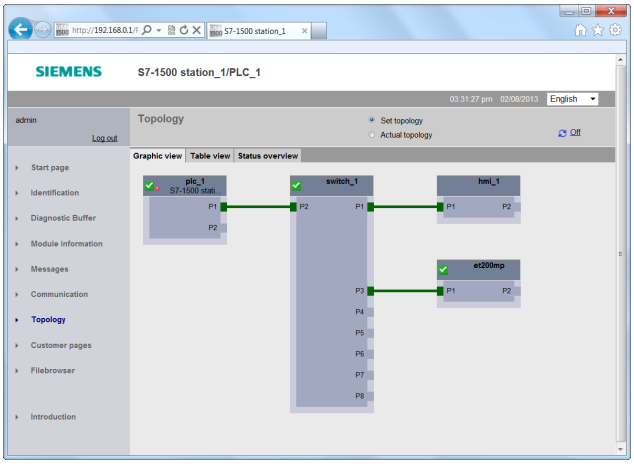
Website “Topology”

1st fault scenario: Missing supply voltage

For the diagnostics of the missing supply voltage L+ in the module DQ32 in the device and network view, please proceed as follows:

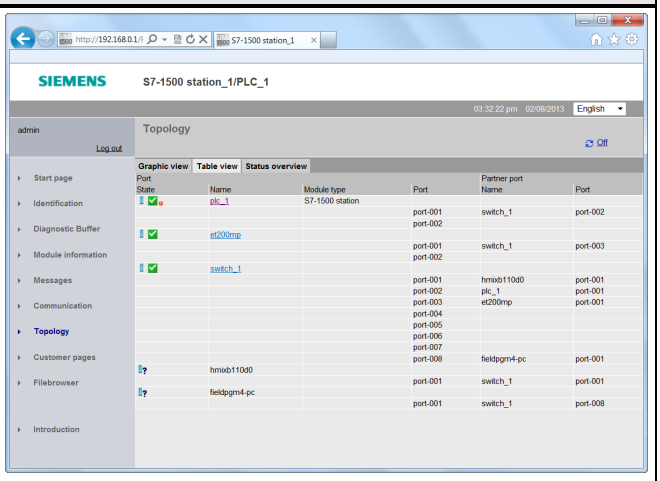
Topology “Graphic view”

Table 8-16

No.	Action	Remark
1.	Click on “Topology” to open the website. The “Graphic view” of the “Set topology” is displayed. The orange diagnostic symbol at “plc_1” shows you that a fault has occurred in a lower-level component.	
2.	With a click on “plc_1” you can call the website “module information”.	

Topology “Table view”

Table 8-17

No.	Action	Remark
1.	Click on “Table view” in the website “Topology” to have a table view displayed in the actual topology. The orange diagnostic symbol at “plc_1” shows you that a fault has occurred in a lower-level component.	
2.	With a click on “plc_1” you can call the website “module information”.	

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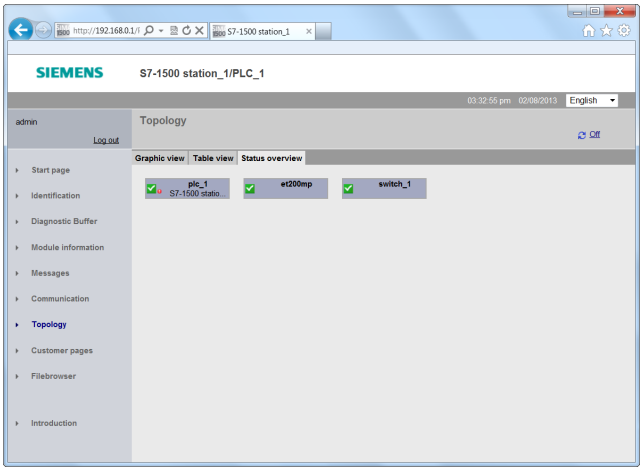
Topology “Status overview”

Table 8-18

No.	Action	Remark
1.	Click on “Status overview” in the website “Topology” The orange diagnostic symbol at “plc_1” shows you that a fault has occurred in a lower-level component.	
2.	With a click on “plc_1” you can call the website “module information”.	

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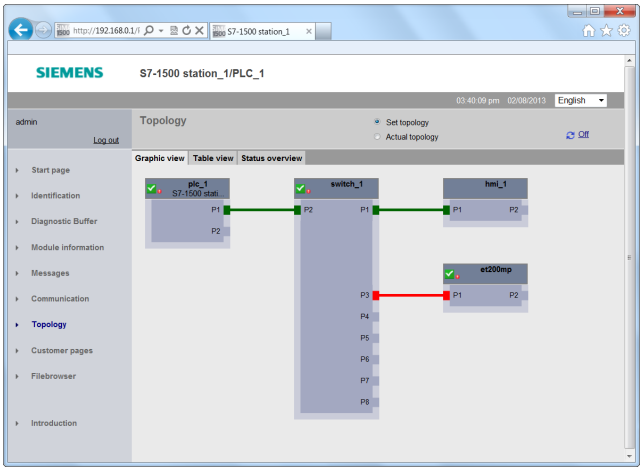
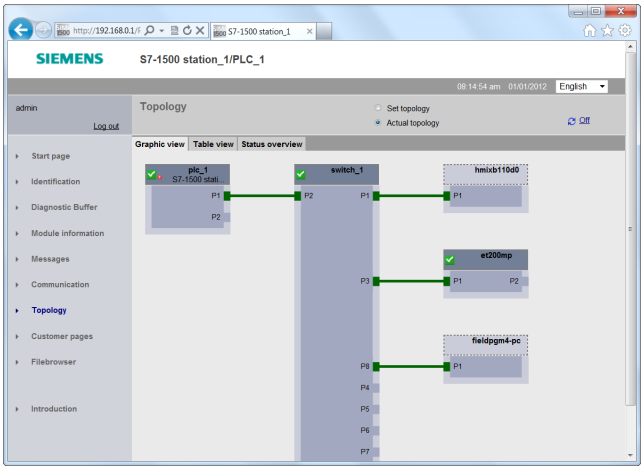
2nd fault scenario: Faulty interconnection of the port

For this fault scenario, remove the Ethernet cable from port 1of the ET 200MP and insert it into port 2 of the ET 200MP.

Topology “Graphic view”

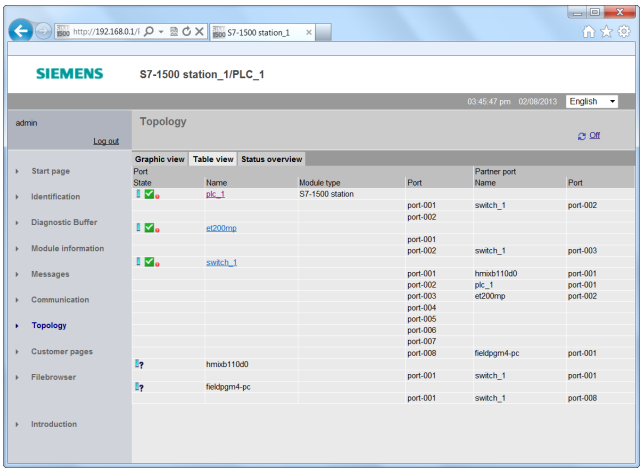
Table 8-19

No.	Action	Remark
1.	Click on “Topology” to open the website. The “Graphic view” of the configured “Set topology” is displayed. The orange diagnostic symbol at the devices shows you that a fault has occurred in a lower-level component. The missing connection is displayed in red.	

No.	Action	Remark
2.	Click on “Actual topology” to display the actual inter-connection of the ports.	

Topology “Table view”

Table 8-20

No.	Action	Remark
1.	Click on “Table view” in the website “Topology” to have a table view displayed in the actual topology. The orange diagnostic symbol at the devices shows you that a fault has occurred in a lower-level component. The actual interconnection of the ports is displayed in a table.	

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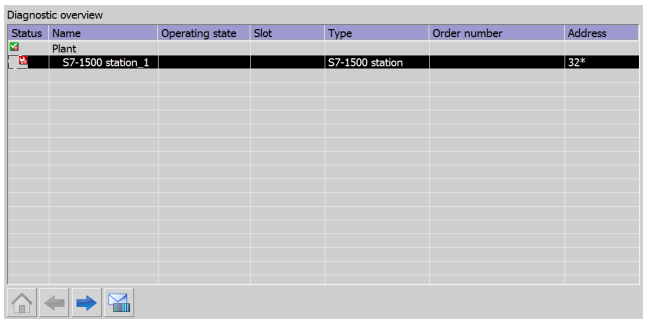
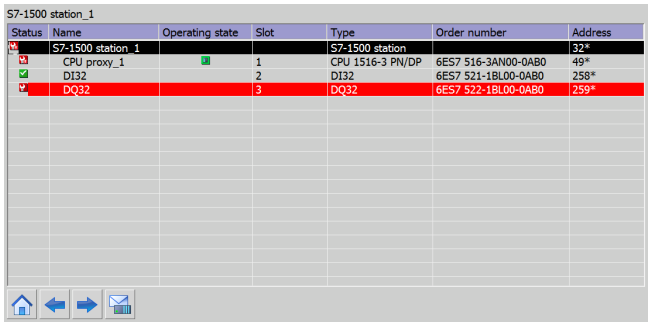
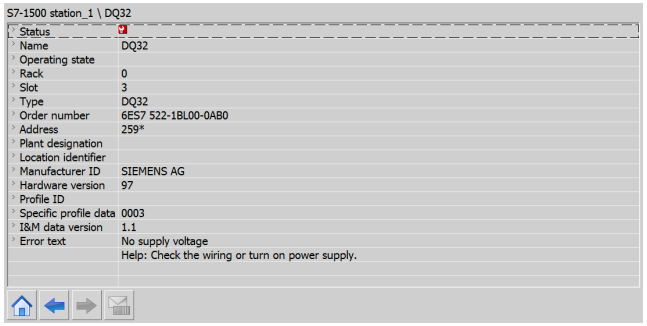
8.5 Diagnostics with the system diagnostics display in the HMI

For the diagnostics of the missing supply voltage L+ in the module DQ32 in the system diagnostics view, please proceed as follows:

Table 8-21

No.	Action	Remark
1.	Open “Diagnostics” by clicking on the button.	
2.	The additional diagnostic symbol in the lower right hand corner of the diagnostic symbol at “S7-1500-Station_1” indicates that a fault has occurred in a lower-level component. Double-click on “S7-1500-Station_1” to go to the device view.	
3.	In the device view you get an overview of the status of the local modules. In the faulty module “DQ32”, the diagnostic symbol “Fault” is displayed. Double-click on “DQ32” to go to the detailed view.	
4.	The detailed view shows you the cause of the fault and possible remedies.	

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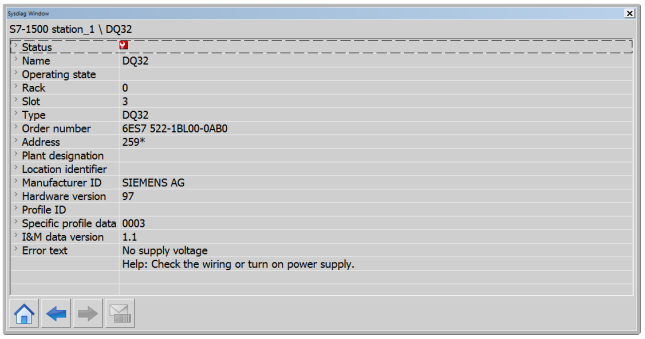
8.6 Diagnostics with the system diagnostics indicator and the system diagnostics window in the HMI

For the diagnostics of the missing supply voltage L+ in the module DQ32 with the system diagnostics indicator in the operating device, please proceed as follows:

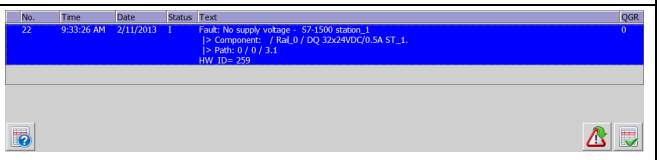
Table 8-22

No.	Action	Remark
1.	If a fault occurs, the button of the system diagnostics indicator changes its status from green (no fault) to red (fault). Click on the button of the system diagnostics indicator. The system diagnostics window opens in the detailed view of the faulty module “DQ32”.	
2.	The detailed view shows you the cause of the fault and possible remedies.	

8.7 Diagnostics with alarm view in the HMI

For the diagnostics of the missing supply voltage L+ in the module DQ32 in the system diagnostics view, please proceed as follows:

Table 8-23

No.	Action	Remark
1.	Open the “Alarms” screen by clicking on the respective button.	
2.	The alarm about the faulty module “DQ32” is displayed with the source, date and time.	

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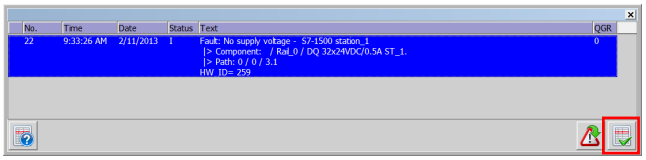
8.8 Diagnostics with alarm indicator and alarm window in the HMI

For the diagnostics of the missing supply voltage L+ in the module DQ32 with the alarm indicator and the alarm window in the operating device, please proceed as follows:

Table 8-24

No.	Action	Remark
1.	In case of a fault, the alarm indicator is displayed. The alarm indicator flashes, since the alarm must still be acknowledged. The number indicates the number of pending alarms. Click on the button of the alarm indicator. The alarm window opens up.	
2.	The alarm about the faulty module “DQ32” is displayed with the source, date and time.	
3.	Acknowledge the alarm by clicking on the “Acknowledge” button. The status of the alarm changes from “I” (incoming) to “IA” (incoming and acknowledged). The alarm indicator stops flashing.	

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8.9 System diagnostics with the user program

The system diagnostics with the user program is only described as to the principle. The individual evaluation of the system diagnostic information of the diagnostic blocks has to be programmed by the user.

The meaning of the system diagnostic information of the respective diagnostics blocks are described with the example of a missing supply voltage L+ in the module DI32 of the IO device “et200mp”. Please refer to the data block “DiagDB” in the online overview for system diagnostics information´.

8.9.1 Diagnostic information “LED”

The parameter “Ret_Val” of the instruction “LED” puts out the status “4” of the CPU ERROR LED. Please find the description of the parameter “Ret_Val” in the TIA Portal V12 online help. “LED Status 4 = color 1 flashes with 2Hz”

This means that the ERROR LED flashes red and that an error has occurred.

Figure 8-1 Diagnostic information LED

LED	Struct		
LADDR	HW_IO	50	16#0032
LED	UInt	2	2
RET_VAL	Int	0	4

8.9.2 Diagnostic information “DeviceStates”

With the parameter STATE, the status of the module selected by means of the parameter MODE is put out. The status information is put in form of a bit character string. The bit “0” of the bit character string contains the status information for all modules of an I/O system.

- Bit 0 = 0: No error encountered for any module.
- Bit 0 = 1: An error occurred for at least one module.

Bits “1” to “128” (PROFIBUS DP) or “1024” (PROFINET IO) indicate the status of the respective modules selected by the mode. In this example, the status was set to Bit 1. For MODE = 2 (error in the module), this means that an error occurred in the module with the “Device number” “1”.

Figure 8-2 Diagnostic information DeviceStates

DeviceStates	Struct		
LADDR	HW_IOSYSTEM	263	16#0107
MODE	UInt	2	2
RET_VAL	Int	0	0
STATE	Array [1 .. 1024] of Bool		
STATE[1]	Bool	false	TRUE
STATE[2]	Bool	false	TRUE
STATE[3]	Bool	false	FALSE
STATE[4]	Bool	false	FALSE

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8.9.3 Diagnostic information “GET_NAME”

The device number of the module with the device number “1” (see Figure 5-5 Device number) is “et200mp”.

Figure 8-3 Diagnostic information GET_NAME

Get_Name	Struct		
LADDR	HW_IOSYSTEM	263	16#0107
STATION_NR	UInt	1	1
DONE	Bool	false	TRUE
BUSY	Bool	false	FALSE
ERROR	Bool	false	FALSE
LEN	DInt	0	7
STATUS	Word	16#0	16#0000
DATA	String	''	'et200mp'

8.9.4 Diagnostic information “ModuleStates”

With the parameter STATE, the status of the module selected by means of the parameter MODE is put out. The status information is put in form of a bit character string. The bit “0” of the bit character string contains the status information for all modules.

- Bit 0 = 0 No error encountered for any module.
- Bit 0 = 1 An error occurred for at least one module.

The status of the ET 200MP interface module occupies bits “1” and “2”. Bits “3” to “128” indicate the status of the module of ET 200MP selected with Mode. In this example, the status was set to Bit 3. For MODE = 2 (error in the module), this means that an error occurred in the first module (“DI32x24VDC_HF_1”).

Figure 8-4 Diagnostic information ModuleStates

ModuleStates	Struct		
LADDR	HW_DEVICE	264	16#0108
MODE	UInt	2	2
RET_VAL	Int	0	0
STATE	Array [1 .. 128] of Bool		
STATE[1]	Bool	false	TRUE
STATE[2]	Bool	false	FALSE
STATE[3]	Bool	false	FALSE
STATE[4]	Bool	false	TRUE
STATE[5]	Bool	false	FALSE
STATE[6]	Bool	false	FALSE

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8.9.5 Diagnostic information “GET_DIAG”

In the following example the diagnostic status of the DI module “DI32x24VDC_HF_1” is put out according to the structure “DIS” (Parameter MODE = 1) in the parameter “DIAG”. For the meaning of the individual parameter values of the structure “DIS”, please refer to the TIA Portal V12 online help. You will receive the following diagnostic information:

Table 8-25

Parameters	Value	Meaning
MaintenanceState	7	Error
ComponentStateDetail	Bit 6 = 1	Error in at least one channel or one component
OwnState	4	Error
IOState	Bit 4 = 1	Error
OperatingState	0	-

Figure 8-5 Diagnostic information GET_DIAG

GET_DIAG	Struct		
LADDR	HW_ANY	272	16#0110
MODE	UInt	1	1
RET_VAL	Int	0	0
CNT_DIAG	UInt	0	0
DIAG_DIS	DIS		
MaintainanceState	DWord	16#0	16#0000_0007
ComponentStateDetail	DWord	16#0	16#0000_8040
OwnState	UInt	0	4
IOState	Word	16#0	16#0010
OperatingState	UInt	0	0

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9 Related literature

9.1 Bibliography

This table offers you a variety of pertinent literature.

Table 9-1

	Subject	Title
/1/	STEP7 SIMATIC S7-1200	Automating with SIMATIC S7-1200 Author: Hans Berger Published by: Publicis Publishing ISBN-10: 3895784036 ISBN-13: 9783895784033

9.2 Internet link specifications

This table offers you a selection of links to more detailed information.

Table 9-2

	Subject	Title
/1/	Link to this document	http://support.automation.siemens.com/WW/view/en/68011497
/2/	Siemens Industry Online Support	http://support.automation.siemens.com
/3/	S7-1500, ET 200MP, ET 200SP System diagnostics Function manual	http://support.automation.siemens.com/WW/view/en/59192926
/4/	S7- System Manual	http://support.automation.siemens.com/WW/view/en/59191792
/5/	S7-1500 Web server function manual	http://support.automation.siemens.com/WW/view/en/59193560
/6/	Industrial Ethernet Switches SCALANCE X-200 Operating Manual	http://support.automation.siemens.com/WW/view/en/63203633

10 History

Table 10-1

Version	Date	Modifications
V1.0	05/2013	First version

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