

SIEMENS

SIMATIC

S7-1500, ET 200MP, ET 200SP, ET 200AL Diagnostics

Function Manual

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Legal information

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 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
 CAUTION
indicates that minor personal injury can result if proper precautions are not taken.
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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Preface

Purpose of the documentation

This function manual provides an overview of the diagnostics options for the automation systems S7-1500, ET 200MP, ET 200SP and ET 200AL.

The documentation covers the following:

- Illustration of the uniformity and consistency of system diagnostics
- Overview of the options for establishing system diagnostics information

Basic knowledge required

The following knowledge is required in order to understand the function manual:

- General knowledge of automation technology
- Knowledge of the industrial automation system SIMATIC
- Knowledge of working with STEP 7 and WinCC
- Knowledge about the use of Microsoft Windows operating systems

Scope of the documentation

This documentation is the basic documentation for all products of the S7-1500, ET 200MP, ET 200SP and ET 200AL systems. The product documentation is based on this documentation.

Changes compared to previous version

Changes / enhancements described in this manual, compared to the previous version (version 02/2014):

- Extension of the scope of validity to the distributed I/O system ET 200AL
- The CPUs of the product series S7-1500 and ET 200SP are collectively referred to as "CPU"

Conventions

STEP 7: We refer to "STEP 7" in this documentation as a synonym for the configuration and programming software "STEP 7 as of V12 (TIA Portal)" and subsequent versions.

This documentation contains pictures of the devices described. The figures may differ slightly from the device supplied.

You should also pay particular attention to notes such as the one shown below:

Note

A note contains important information on the product, on handling of the product and on the section of the documentation to which you should pay particular attention.

Additional support

- Information about Technical Support is available in the appendix Service & Support (Page 87).
- The technical documentation for the individual SIMATIC products and systems is available on the Internet (<http://www.siemens.com/simatic-tech-doku-portal>).
- The online catalog and the ordering system are available on the Internet (<http://mall.automation.siemens.com>).

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To stay informed about product updates as they occur, sign up for a product-specific newsletter. You can find more information on the Internet (<http://support.automation.siemens.com>).

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Documentation guide

Introduction

The documentation of the SIMATIC products has a modular structure and covers all aspects of your automation system.

The complete documentation for the S7-1500, ET 200SP, ET 200MP and ET 200AL systems consists of the respective system manuals, function manuals and product manuals.

The STEP 7 information system (online help) also supports you when configuring and programming your automation system.

Overview of the documentation on the topic "System diagnostics"

The following table lists additional documentation which supplements this description on the topic "System diagnostics".

Table 1- 1 Documentation on the topic "System diagnostics"

Topic	Documentation	Most important contents
STEP 7 (TIA Portal)	Online help for STEP 7 Professional V13	Configuring and programming with the engineering software
System description	S7-1500 Automation System (http://support.automation.siemens.com/WW/view/en/59191792)	• Application planning • Installation • Wiring • Commissioning
	ET 200SP distributed I/O system (http://support.automation.siemens.com/WW/view/en/58649293)	
	ET 200MP distributed I/O system (http://support.automation.siemens.com/WW/view/en/59193214)	
	Distributed I/O system ET 200AL (http://support.automation.siemens.com/WW/view/en/89254965)	

Topic	Documentation	Most important contents
Communication	Communication (http://support.automation.siemens.com/WW/view/en/59192925) function manual	For S7-1500, ET 200MP, ET 200SP, ET 200AL: • Interfaces for communication • Communications services • Diagnostics of communication connections
	PROFIBUS with STEP 7 V13 (http://support.automation.siemens.com/WW/view/en/59193579)	• PROFIBUS basics • PROFIBUS functions • PROFIBUS diagnostics
	PROFINET with STEP 7 V13 (http://support.automation.siemens.com/WW/view/en/49948856)	• PROFINET basics • PROFINET functions • PROFINET diagnostics
Web server	Web server (http://support.automation.siemens.com/WW/view/en/59193560) function manual	• Basics • Function • Operation • Diagnostics via web server
Modules of the S7-1500 automation system	Manuals for the S7-1500 product family (http://support.automation.siemens.com/WW/view/en/56926743)	• Interrupt, error and system messages • Technical specifications (including diagnostics functions)

SIMATIC manuals

All current manuals for the SIMATIC products are available for download free of charge on the Internet (<http://www.siemens.com/automation/service&support>).

Overview of system diagnostics

2.1 Properties of system diagnostics

Introduction

In the SIMATIC environment, diagnostics of devices and modules is collectively referred to as system diagnostics. The monitoring functions are automatically derived from the hardware configuration.

All SIMATIC products have integrated diagnostic functions that they can use to detect and remedy faults. The components automatically flag a potential fault in the operation and provide detailed information. Unscheduled standstill times can be minimized with plant-wide diagnostics.

The following states are monitored by the system in the running plant:

- Device failure
- Remove/insert fault
- Module fault
- I/O access error
- Channel fault
- Parameter assignment error
- Failure of the external auxiliary voltage

Properties of SIMATIC system diagnostics

The SIMATIC system diagnostics has the following properties:

- Integrated as standard in the hardware
- System-wide across bus limits
- Automatic localization of the error source
- Automatic output of the cause of the error in plain text
- Plant-wide diagnostics of all components
- Archiving and logging of alarms
- Configurability of alarms

Consistent diagnostics from the field level all the way to the management level

The different diagnostics media give you a uniform view of maintenance-related information of all automation components in a plant:

- System status (module and network status, alarms for system errors) are available plant-wide in a uniform display.

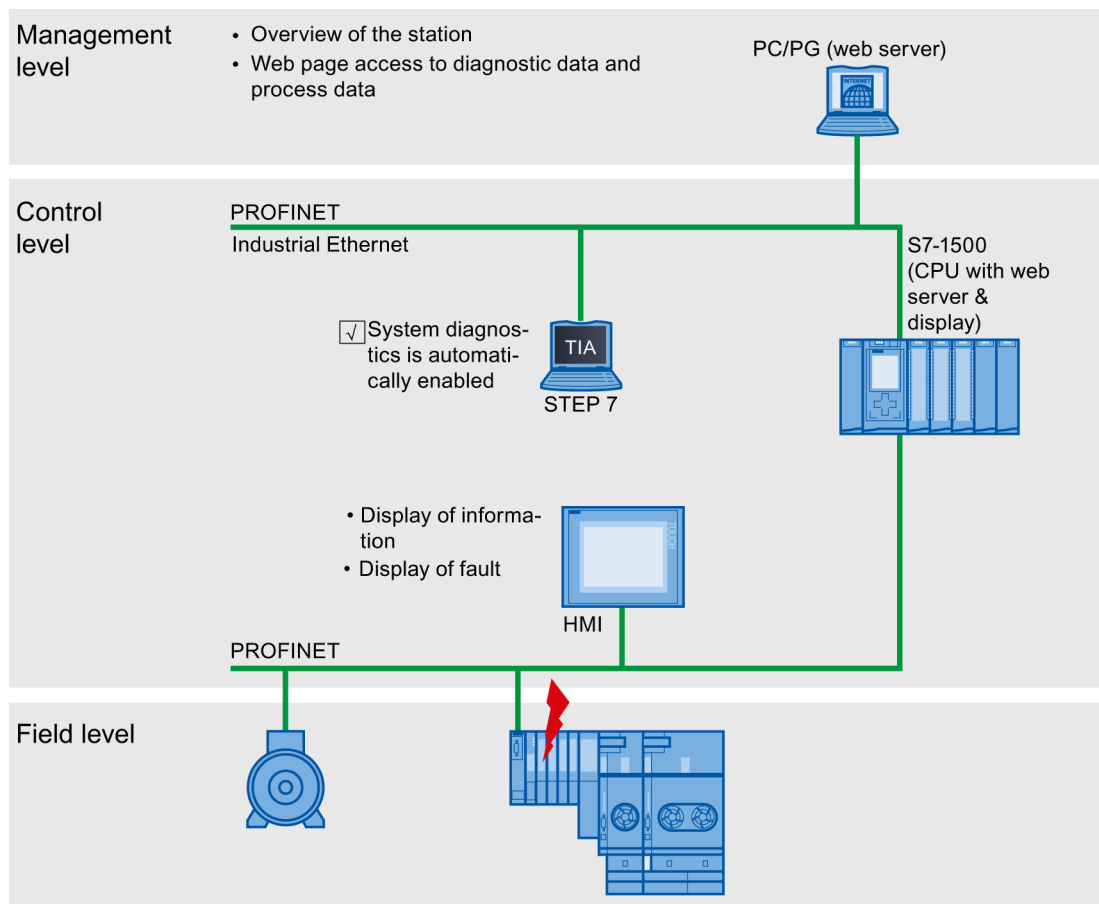


Figure 2-1 Overview of system diagnostics in a plant

2.2 Benefits of innovative system diagnostics

System diagnostics is also possible in STOP.

The system diagnostics is integrated in the firmware of the CPU and works independent of the cyclic user program. This means it is also available in the STOP CPU operating mode. Faults are detected immediately and signaled to the higher-level HMI devices, the web server and the display of the S7-1500 CPU, even in STOP mode. This makes system diagnostics consistent with the actual plant state at all times.

Uniform display concept

All clients of a system are provided with diagnostics information by a uniform mechanism. The same system diagnostics information is used regardless of the display medium.

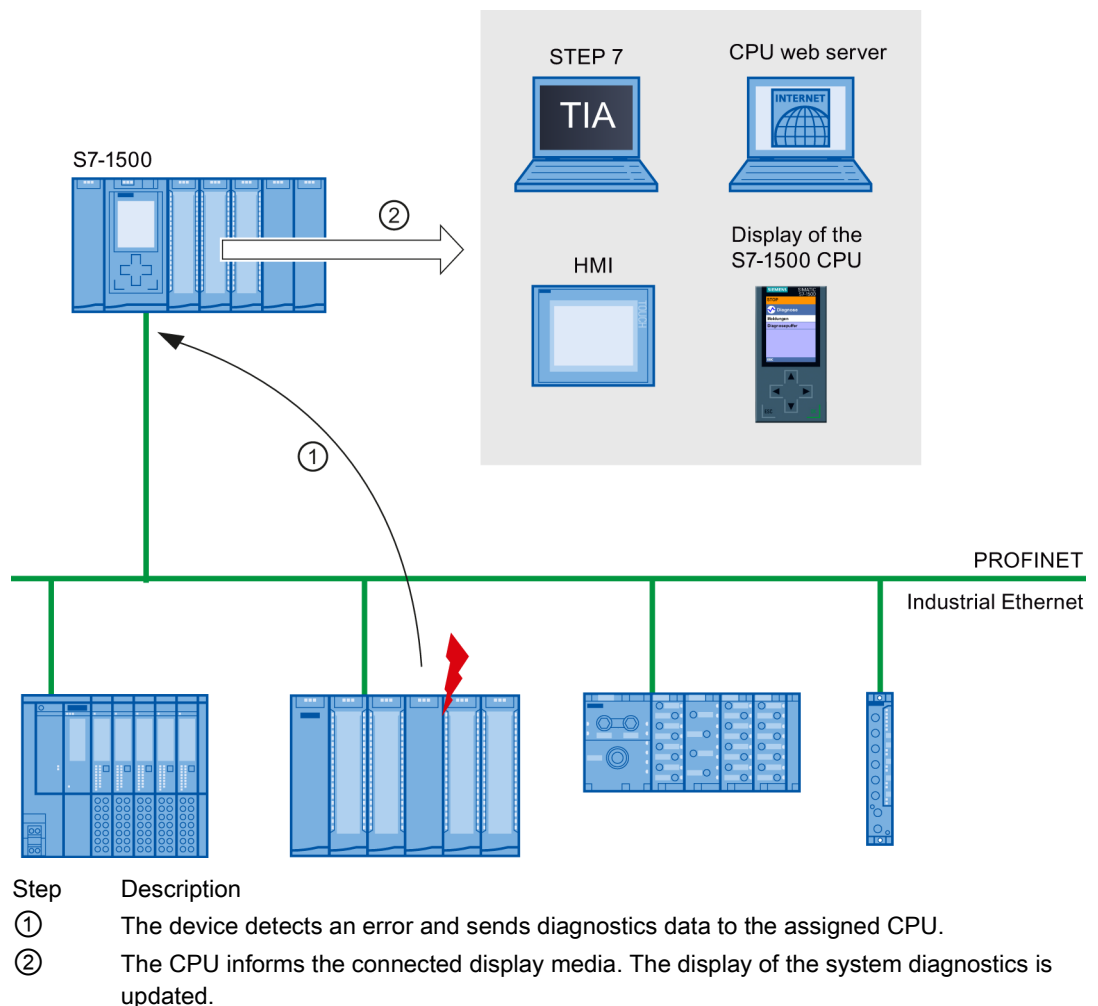


Figure 2-2 Sequence of the system diagnostics

Quick start

Introduction

The following chapters of this documentation describe the different options for establishing system diagnostics. All described options can be used independently of one another.

This chapter gives you an overview of the basic procedure to get initial diagnostics information fast.

Note

System diagnostics is generally available for the devices of the SIMATIC series.

3.1 Using the display of the CPU

The display of the S7-1500 CPU offers a fast and direct option to get diagnostics information. You can call up status information in different menus on the display.

Requirement

- A project has been created.
- The project has been downloaded to the CPU.

Determining diagnostics information using the display of the S7-1500 CPU

To determine diagnostics information using the display, follow these steps:

1. Select the "Diagnostics" menu on the display.

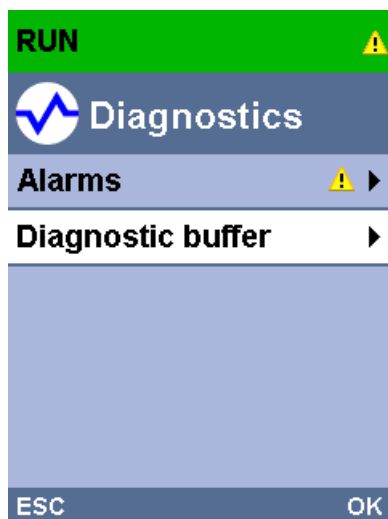


Figure 3-1 Display of the S7-1500 CPU

2. Select the "Alarms" entry from the "Diagnostics" menu.

Result

The "Alarms" entry displays the latest error information.



Figure 3-2 Display of the error message in the display of the S7-1500 CPU

Note

Automatic updating of diagnostics information

You set automatic updating of the diagnostics information under: "Display" > "DiagnosticRefresh".

Additional information

For additional information on configuring alarms, please refer to Configuring alarms for system diagnostics (Page 20).

3.2 Using STEP 7

The start using STEP 7 gives you fast access to detailed diagnostics information.

Requirements

- A project has been created.
- The project has been downloaded to the CPU.
- An error has occurred.
- The programming device must be able to establish a connection to the CPU via an interface.

Determining diagnostics information using STEP 7

To determine diagnostics information using STEP 7, follow these steps:

1. Open the respective project in STEP 7.
2. Open the portal view of STEP 7.
3. Select the "Online & Diagnostics" portal.
4. Select the "Online status" action.

The "Select device" dialog opens. The dialog is an image of the configured devices in the project.

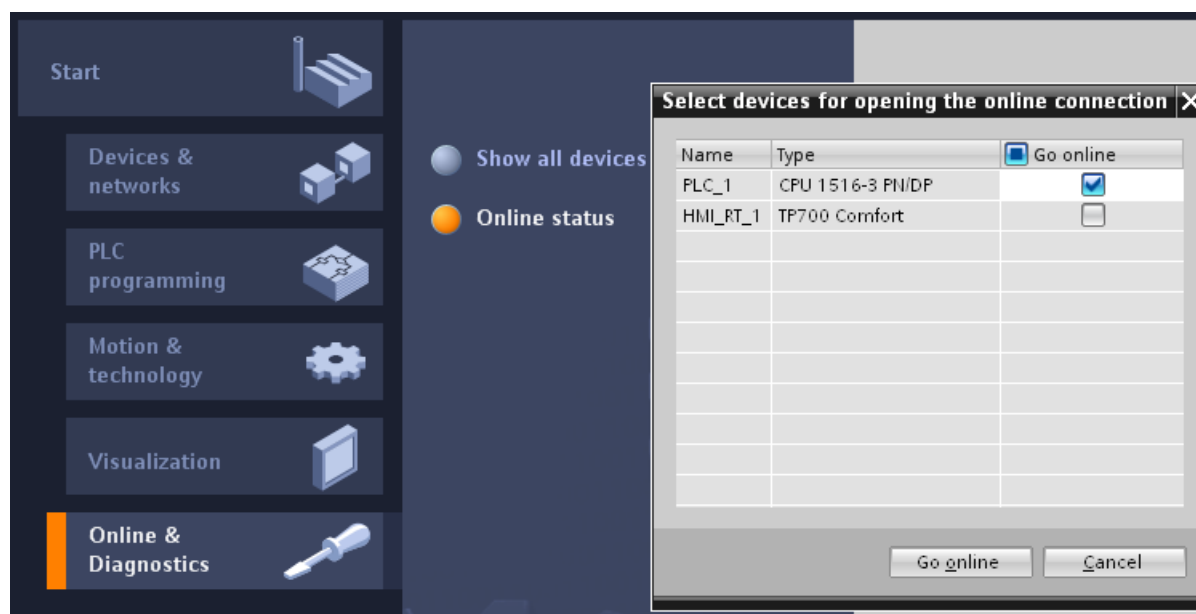


Figure 3-3 Device selection for online connection in the portal view

5. Activate the "Go online" option button for the device that you want to use to establish an online connection.
6. Click on the "Connect" button.

7. The "Go online" dialog opens.

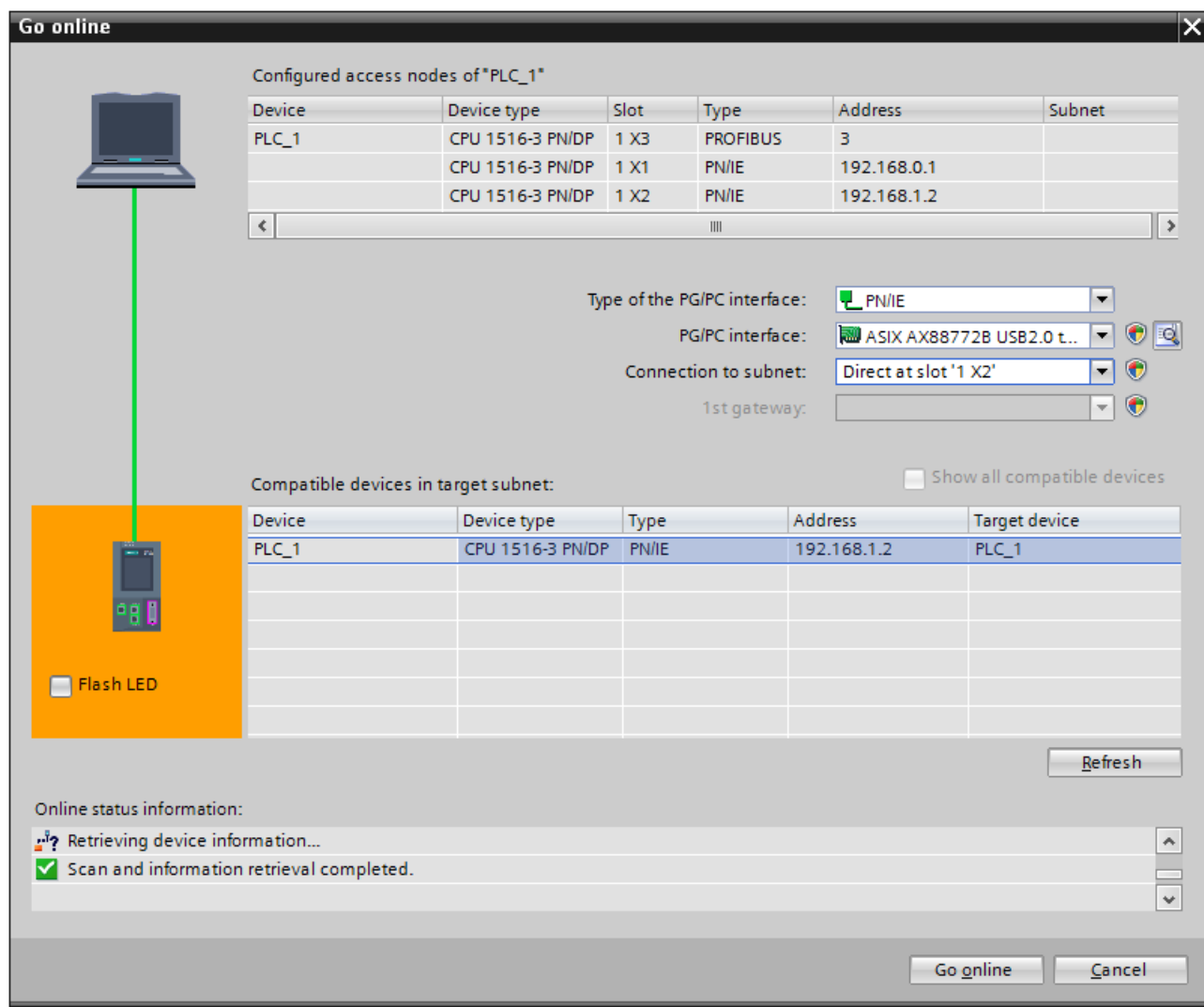


Figure 3-4 Establishing an online connection

8. Make the settings for the interface.

9. Click on the "Connect" button.

The project view of STEP 7 opens. The network view is opened in the working area.

The symbols in the project tree provide initial information about the faulty modules.

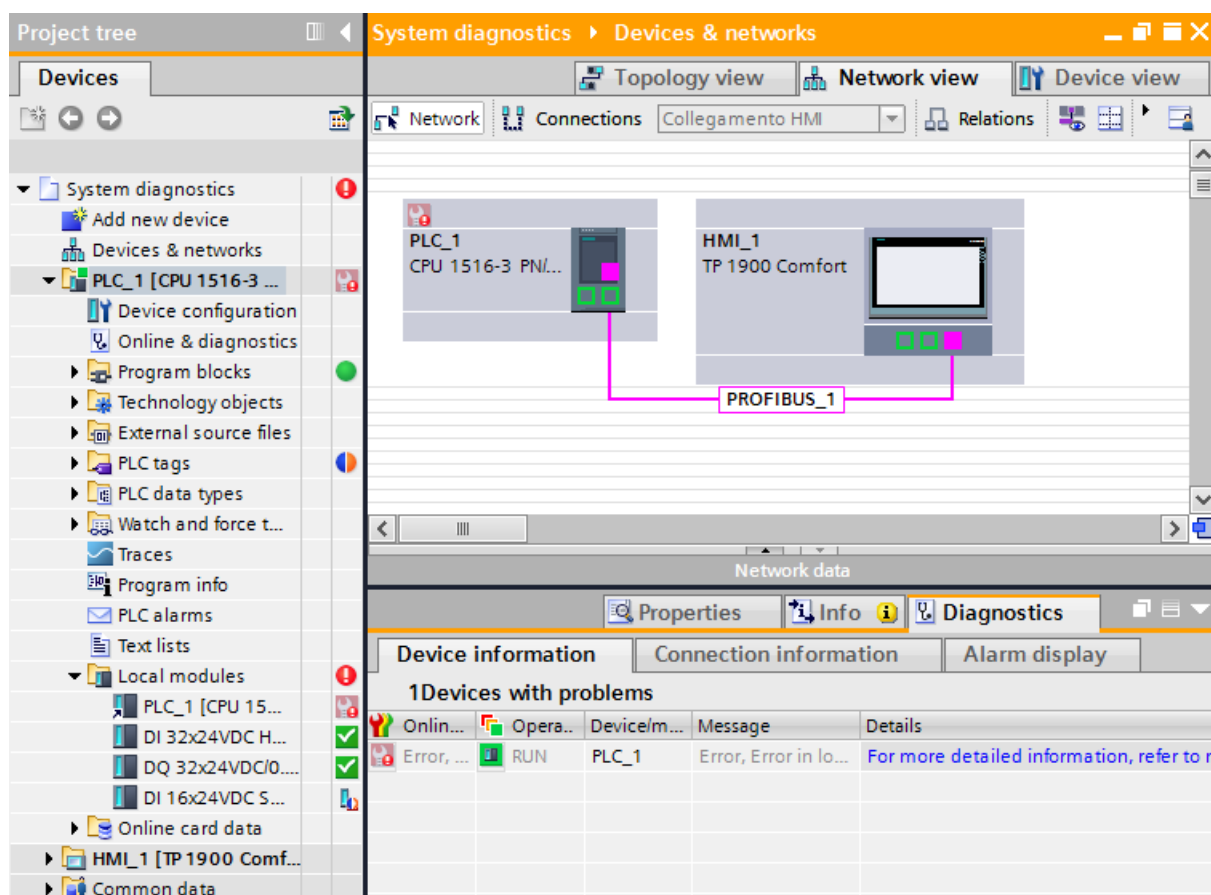


Figure 3-5 Display of the fault in network view

10. Double-click the device which displays an alarm message to access the faulty module directly. This is the CPU in the example.

The device view of the CPU is opened in the working area. In this view you can see directly in which module the error has occurred.

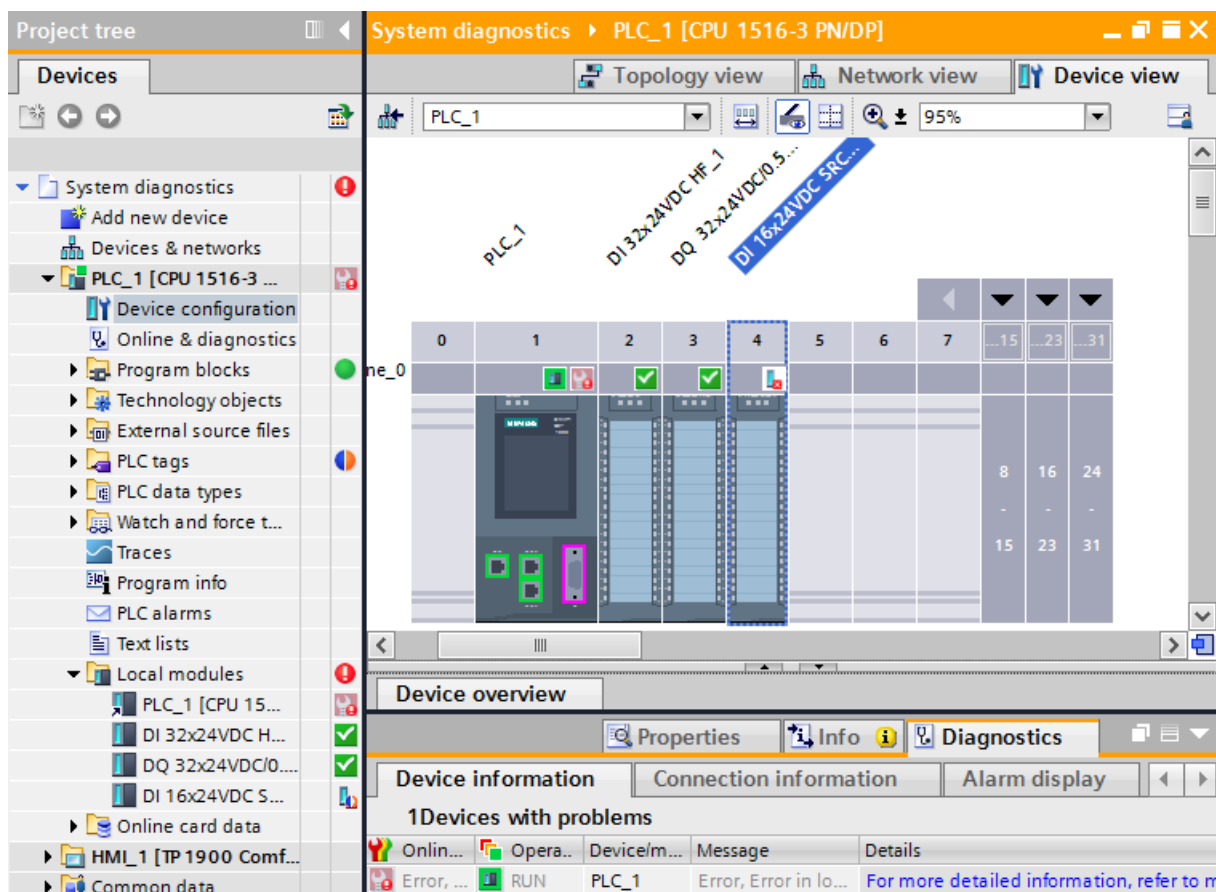


Figure 3-6 Display of the faulty module in the device view

11. Open the "Diagnostics" tab and the subordinate "Device information" tab in the Inspector window for a more detailed error description.

Result

The link in the "Details" table column takes you to the online and diagnostics view of the device and to the diagnostics buffer there, for example. It includes more information on all diagnostics events in the order in which they occurred.

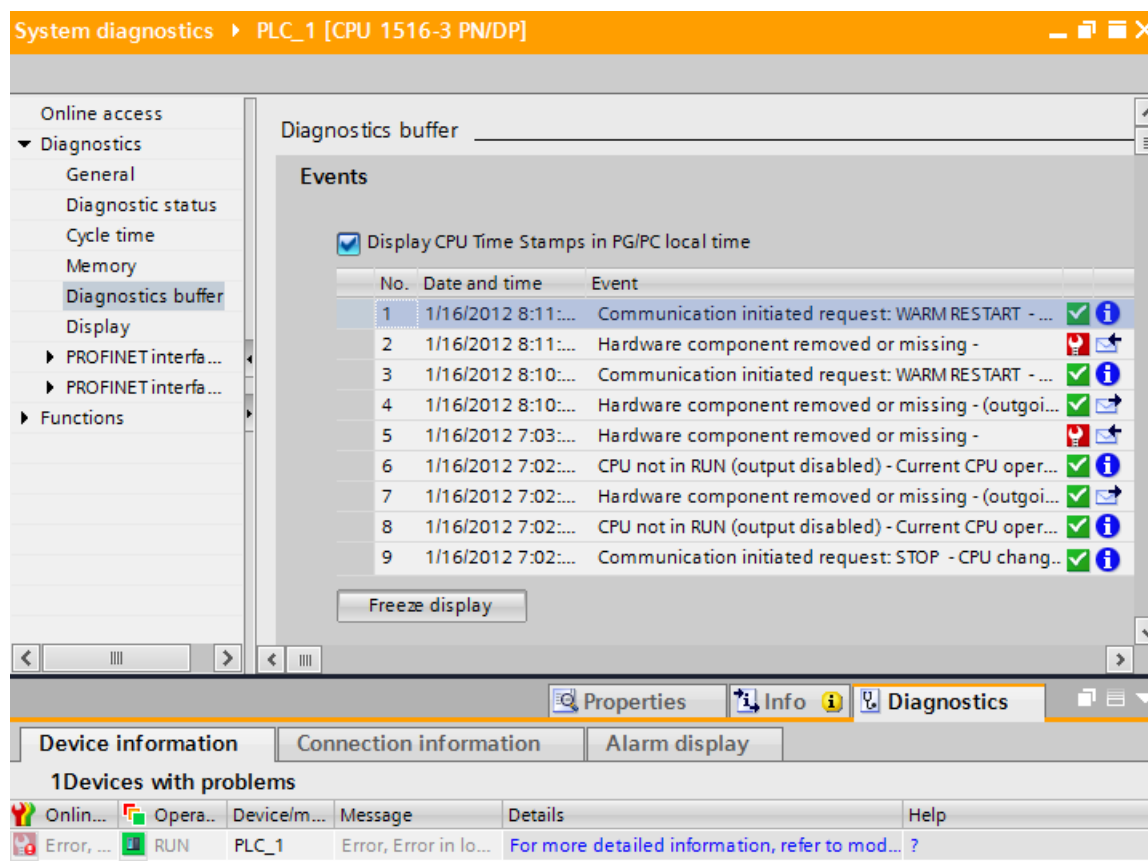


Figure 3-7 Diagnostics buffer with detailed error description

Note

Symbols and their meaning

You can find a legend with the meaning of each symbol in Explanation of diagnostics symbols (Page 26) and in the online help for STEP 7.

Setting and determining system diagnostics

Introduction

System diagnostics is generally available for the devices of the SIMATIC series.

In the properties of each individual CPU, you can specify if you want to receive alarms for system diagnostics on your display device. Alarms are provided on the display of the S7-1500 CPU, the CPU web server and the HMI device. Alarms are enabled by default. If you do not want to receive alarms for system diagnostics on your display device, you can disable the sending of alarms.

4.1 Configuring alarms for system diagnostics

Predefined message texts are available for establishing the system diagnostics.

Requirement

- You have opened STEP 7.
- You have added a CPU to the project.

Procedure

To make alarm settings for system diagnostics of the CPU in STEP 7, follow these steps:

1. Open the project view.
2. Select the CPU.
3. Open the device view.
4. Open the "Properties" tab in the Inspector window.

5. Select the "System diagnostics" entry in the "General" area navigation.

You now have access to the alarm settings. System diagnostics is enabled by default. System diagnostics cannot be disabled for the use of a CPU from the SIMATIC series.

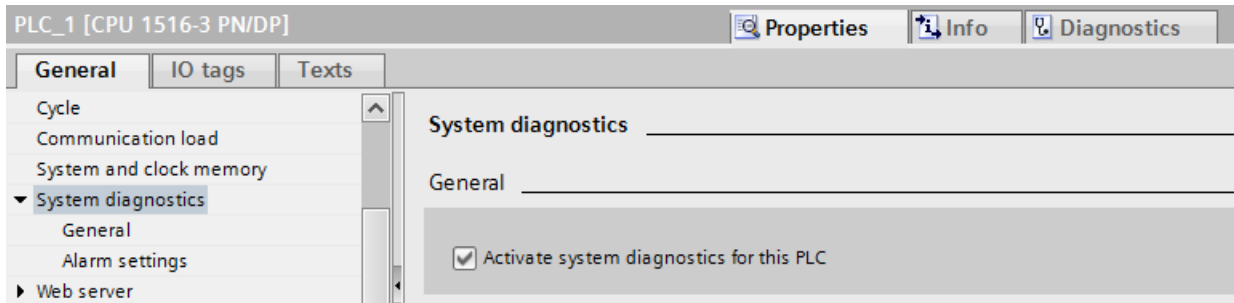


Figure 4-1 Properties of system diagnostics in STEP 7

6. In the settings, specify the alarm category that is to be displayed and if it needs to be acknowledged.

The check boxes in the "Alarm" column are enabled by default. When you disable all check boxes, the status of the HMI system diagnostics view is still updated with the "Info Report" functionality.

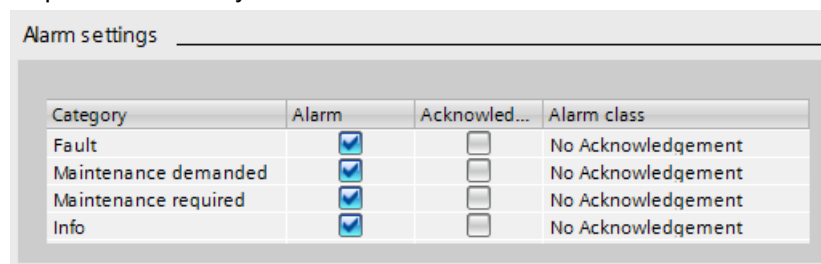


Figure 4-2 Alarm settings in STEP 7

7. Download the configuration to the CPU.

Result

You have configured the alarms for system diagnostics of the CPU in STEP 7.

The settings are saved with the project and become effective after the compiling and downloading of the hardware configuration to the involved components.

Maintenance events (maintenance demanded, maintenance required) are entered in the alarm buffer of the CPU just like any other event.

4.2 Options for displaying system diagnostics

Example

This section includes a diagnostics example to show how system diagnostics is established with the help of different display options. The example includes a S7-1500 CPU that is connected to an ET 200S distributed I/O system and an HMI Comfort Panel by means of PROFINET.

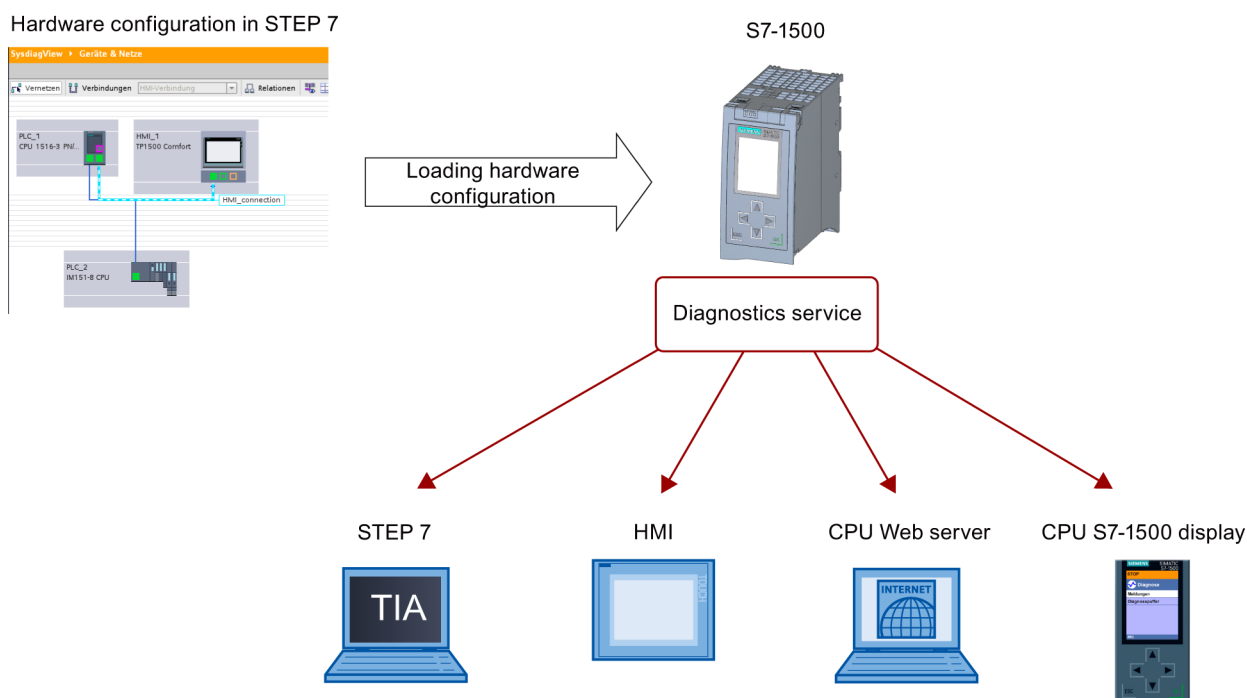


Figure 4-3 System diagnostics display options

The following sections include figures that illustrate how diagnostics information is displayed with the help of different display options.

- Using the LEDs on the hardware (Page 23)
- Local error analysis using the display of the CPU S7-1500 (Page 24)
- Using STEP 7 as of V12 (Page 26)
- Remote diagnostics using the web server (Page 44)
- Stationary system diagnostics using the HMI diagnostics view (Page 51)

4.2.1 Diagnostics information at the devices

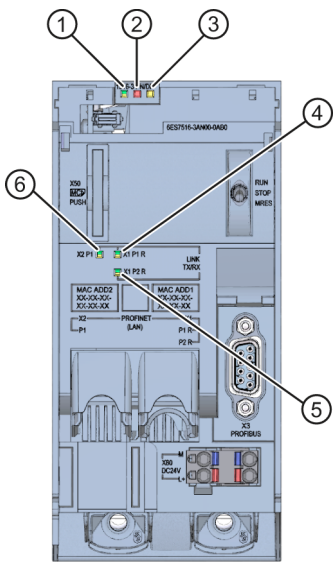
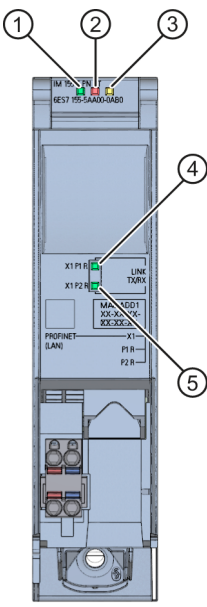
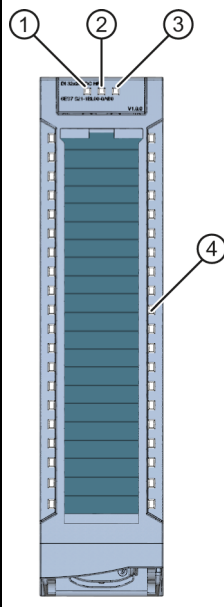
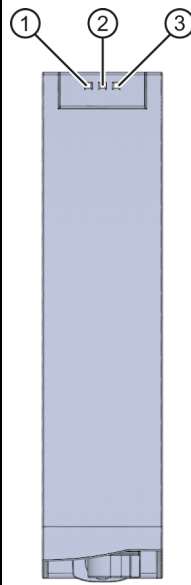
4.2.1.1 LEDs

Overview

All hardware components, such as CPUs, interface modules and modules, provide information about their operating mode as well as internal and external errors through their LEDs. Diagnostics by means of LEDs is an initial tool for error localization.

The graphics below include examples for the arrangement of LEDs on some modules.

Table 4- 1 LED displays on the modules

	CPU 1516-3 PN/DP	IM 155-5 PN ST	DI 32x24VDC HF	PS 25W 24VDC
				
①	RUN/STOP LED (two-colored LED: green/yellow)	RUN LED (two-colored LED: green/yellow)	RUN LED (single-colored LED: green)	RUN LED (single-colored LED: green)
②	ERROR LED (single-colored LED: red)	ERROR LED (single-colored LED: red)	ERROR LED (single-colored LED: red)	ERROR LED (single-colored LED: red)
③	MAINT LED (single-colored LED: yellow)	MAINT LED (single-colored LED: yellow)	without function	MAINT LED (single-colored LED: yellow)
④	X1 P1 (two-colored LED: green/yellow)	X1 P1 (single-colored LED: green)	LED CHx (two-colored LED: green/red)	
⑤	X1 P2 (two-colored LED: green/yellow)	X1 P2 (single-colored LED: green)		
⑥	X2 P1 (two-colored LED: green/yellow)			

Additional information

The meaning of the individual LED displays, their different combinations and the remedial measures resulting from them in case of errors are device-specific. The explanation can be found in the manuals of the modules.

4.2.1.2 Display of the CPU

Introduction

Each CPU in the S7-1500 automation system has a front cover with a display and operating keys. You can display status information in different menus on the display of the S7-1500 CPU. You use the operating keys to navigate through the menus.



Figure 4-4 Display - diagnostics screen

Display options

The display of the S7-1500 CPU displays the following diagnostics information:

- Information entered in the diagnostics buffer
- Alarms
- Information about network diagnostics
- Detailed device view with diagnostics symbols
- Error and alarm texts (system diagnostics alarms)
- Order number, CPU version and central I/O modules
- CPU operating mode
- Module status for central and distributed modules
- Information about the currently installed firmware

Additional information

For additional information on the topic "Functions and operation of the display of the S7-1500 CPU" see the documentation for the S7-1500 automation system (<http://support.automation.siemens.com/WW/view/en/59191792>).

4.2.2 Diagnostics information in STEP 7

4.2.2.1 Explanation of diagnostics symbols

Diagnostics symbols for modules and devices

When the online connection to a device in STEP 7 is established, the diagnostics status of the device and its lower-level components and, if applicable, the device operating mode are also determined. The following table shows the available symbols and their meaning.

Symbol	Meaning
	The connection with a CPU is being established.
	The CPU is not reachable at the set address.
	The configured CPU and the CPU actually present are of incompatible types. Example: An existing CPU 315-2 DP is incompatible with a configured CPU 1516-3 PN/DP.
	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.
	Hardware error in lower-level component: A hardware error is present in at least one lower-level hardware component. (occurs as a separate symbol only in the project tree)

Symbols for the comparison status

The diagnostics symbols can be combined at the bottom right with additional smaller symbols that indicate the result of the online/offline comparison. The following table shows the available comparison symbols and their meaning.

Symbol	Meaning
	Hardware error in lower-level component: The online and offline versions differ (only in the project tree) in at least one lower-level hardware component.
	Software error in lower-level component: The online and offline versions differ (only in the project tree) in at least one lower-level software component.
	Online and offline versions of the object are different
	Object only exists online
	Object only exists offline
	Online and offline versions of the object are the same

Operating mode symbols for CPUs and CPs

The following table shows the available symbols and their respective operating states.

Symbol	Operating mode
	RUN
	STOP
	STARTUP
	HOLD
	DEFECTIVE
	Unknown operating mode
	The configured module does not support display of the operating mode.

Event table

The following information is displayed in the table for each diagnostics event:

- Sequential number of the entry
The first entry contains the latest event.
- Date and time of the diagnostics event
If no date and time are shown, the module has no integral clock.
- Short designation of the event and, if applicable, the reaction of the CPU
- Symbol for information on incoming/outgoing status

The following table shows the available symbols and their meaning.

Symbol	Meaning
	Incoming event
	Outgoing event
	Incoming event for which there is no independent outgoing event
	User-defined diagnostics event

Additional information

For additional information on the individual symbols, please refer to the online help for STEP 7.

4.2.2.2 Accessible devices (without project)

Accessible devices

Accessible devices are all devices that are connected to a PG/PC either directly by an interface or by means of a subnet and that are switched on. These devices can display diagnostic information even without an offline project.

Requirements

- STEP 7 is open.
- The project view is open.

Result

The device is displayed in the project tree. You open the diagnostic information in the working area with a double-click on "Online & Diagnostics".

Information is available on the diagnostic status, cycle times, memory usage and the diagnostics buffer.

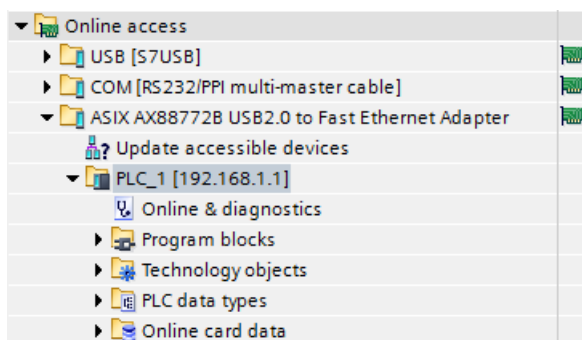


Figure 4-6 Device in the project tree

4.2.2.3 Devices & networks

Devices & networks - Go online

You can get an overview of the current state of your automation system in the device view or network view.

You implement the following tasks in the device view:

- Device configuration and parameter assignment
- Module configuration and parameter assignment

You implement the following tasks in the network view:

- Device configuration and parameter assignment
- Networking devices

Requirements

- STEP 7 is open.
- A project is open.
- The project view is open.

Procedure

To get an overview of the current state of your automation system, follow these steps:

1. Open the "Network view" in the working area.
2. Select the CPU.
3. Click the "Go online"  **Go online** button in the toolbar.

The "Go online" dialog opens.

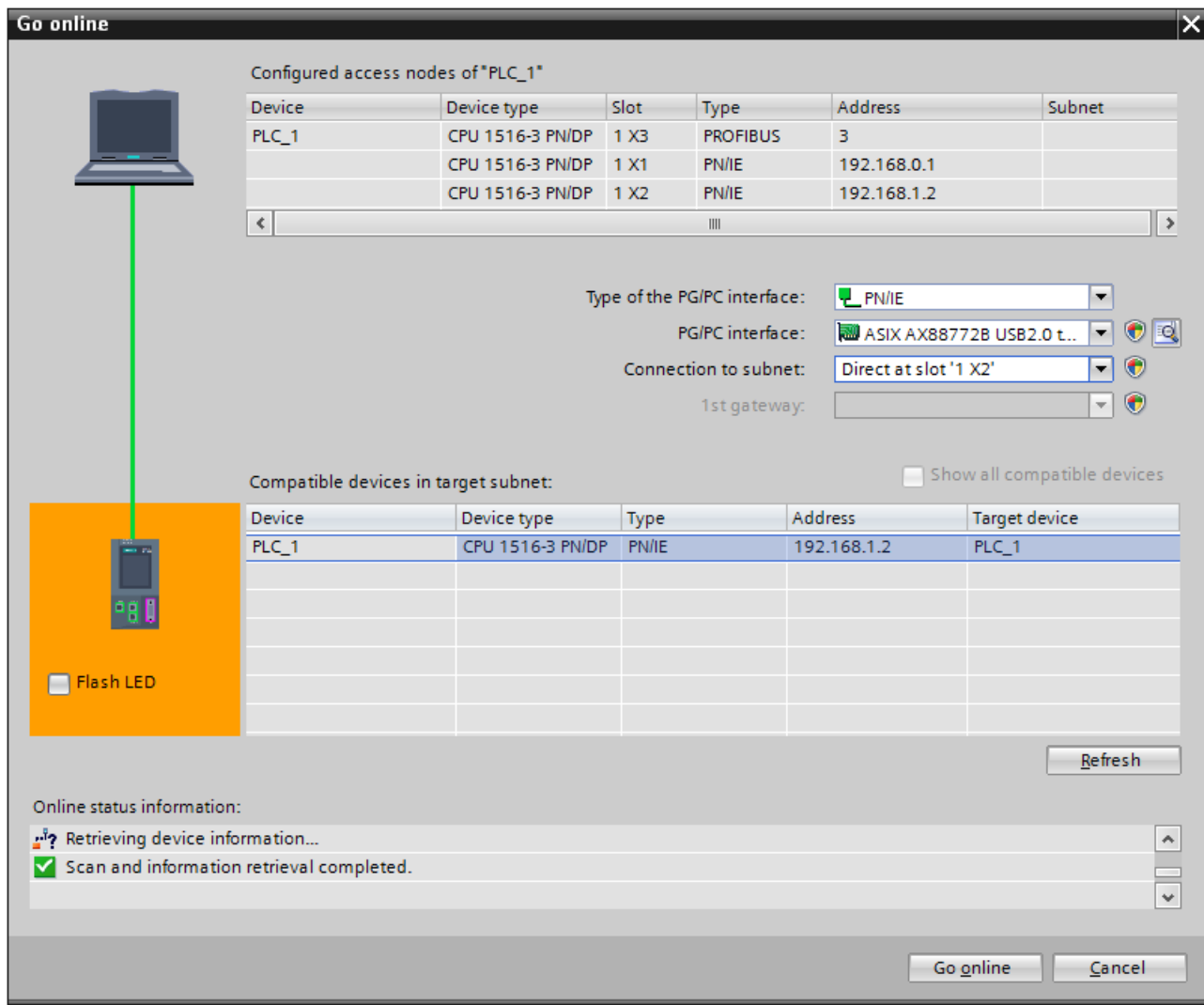


Figure 4-7 Go online

4. Make the settings for the interface.
5. Select the respective device under "Compatible devices in the target subnet".
6. Confirm the dialog with the "Connect" button.

The online mode is started.

Result

The connected devices are now displayed with diagnostic information in the network view in the working area. Here you get an overview of the current state of your automation device.

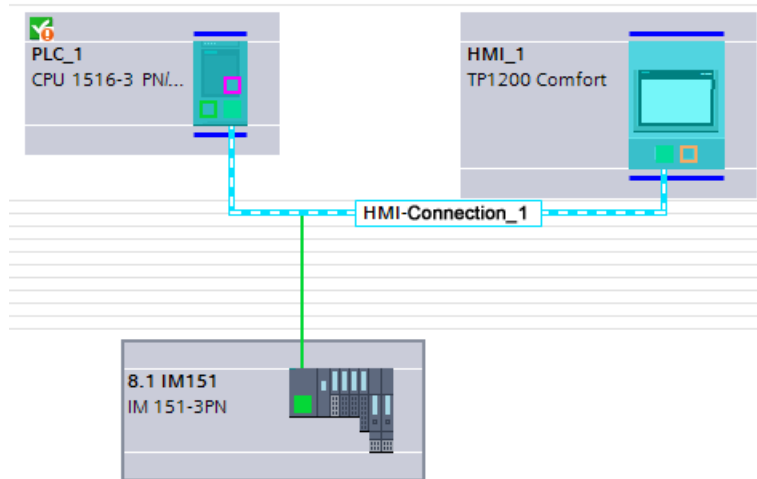


Figure 4-8 CPU with diagnostic information

You get to the "Device view" with a double-click on the device. The diagnostic information for the individual modules is displayed in this view.

Note

Symbols and their meaning

You will find a legend with the meaning of each symbol in Explanation of diagnostics symbols (Page 26) and in the online help for STEP 7.

4.2.2.4 Online & diagnostics

Online mode

In online mode there is an online connection between your PG/PC and one or several devices. Depending on the properties of a device, you are offered specific diagnostics options in online mode and certain functions.

- Diagnostics
 - General module information
 - Diagnostics status
 - Cycle time
 - Memory
 - Diagnostics buffer
 - Display
 - Interface information (e.g. IP parameter, port information)
- Functions
 - Assigning an IP address
 - Setting time and date of the CPU
 - Firmware update (e.g. for PLC, display)
 - Assigning device name
 - Reset to factory settings
 - Format memory card
 - Save service data

To establish an online connection at least one PG/PC interface must be installed that is physically connected with a device, for example, with an Ethernet cable. The current online status of a device is indicated by a symbol to the right of the device in the project tree.

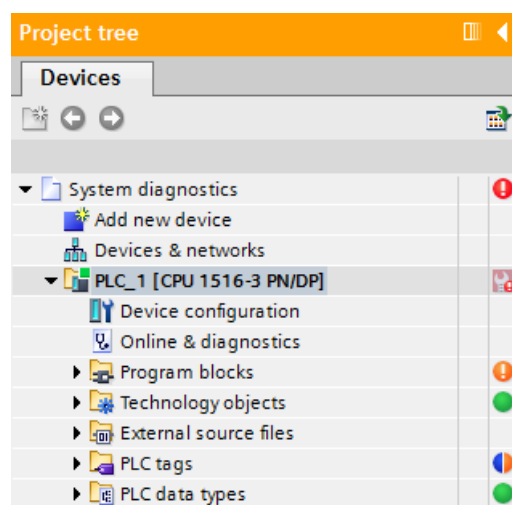


Figure 4-9 Partial view network view

Requirements

- STEP 7 is open.
- A project is open.
- The project view is open.

Procedure

To display an overview of the faulty devices, follow these steps:

1. Select the affected device folder in the project tree.
2. Select the shortcut menu command "Online & Diagnostics".

The online and diagnostics view of the module to be diagnosed is started.

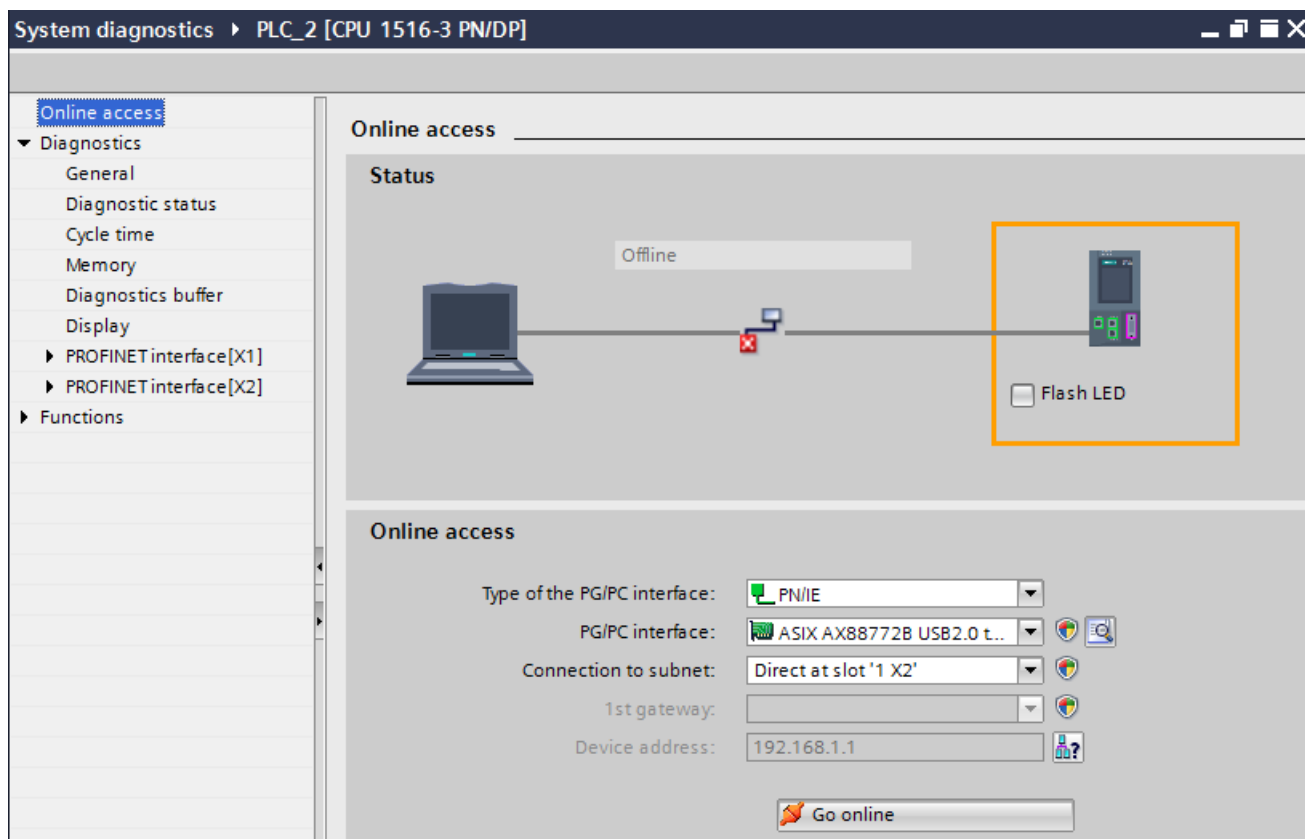


Figure 4-10 Setting online access

3. Make the settings for the interface.

Here you can change an interface access that has already been set for an online connection that was successfully established previously.

4. Click on the "Go online" button.

The online connection is established.

Result

You can find detailed diagnostics information on each device in the Inspector window, in the "Diagnostics" section of the area navigation on the "Properties" tab.

4.2.2.5 "Diagnostics" tab in the Inspector window

"Diagnostics" tab in the Inspector window

The "Diagnostics" tab of the Inspector window includes information on diagnostics events and configured alarm events.

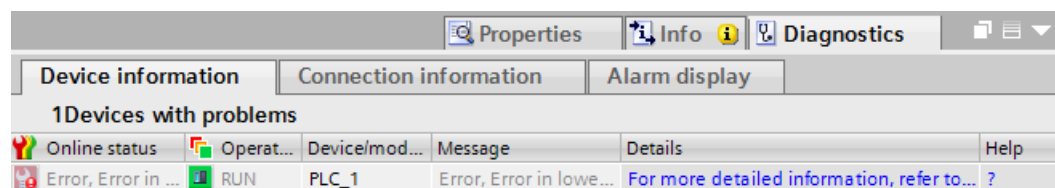


Figure 4-11 Diagnostics in the Inspector window, "Device information" tab

Note

Symbols and their meaning

You can find a legend with the meaning of each symbol in Explanation of diagnostics symbols (Page 26) and in the online help for STEP 7.

Subordinate "Device information" tab

This tab gives you an overview of faulty devices to which an online connection exists or has existed. The table provides the following diagnostics information on the faulty devices:

- Online status: includes the online status as diagnostics symbol and in words
- Operating mode: includes the operating mode as symbol and in words
- Device/module: Name of the affected device or the affected module
- Alarm: This explains the entry in the previous columns and displays an alarm, if necessary
- Details: The link opens the online and diagnostics view associated with the device or puts it in the foreground.
If the device cannot be reached, the link opens the "Go online" dialog.
- Help: The link provides additional information on the fault.

Note

Communication and access errors

Errors that occur in the user program (e.g., communication errors, access errors) are not reported in the "Diagnostics" tab of the device information. You must read out the diagnostics buffer of the CPU in the online and diagnostics view to get this information. The link in the "Details" column opens the diagnostics buffer.

Subordinate "Connection information" tab

The "Connection information" tab displays detailed diagnostics information for connections.

There will only be information on the "Connection information" tab if there is an active online connection to at least one end point of the relevant connection.

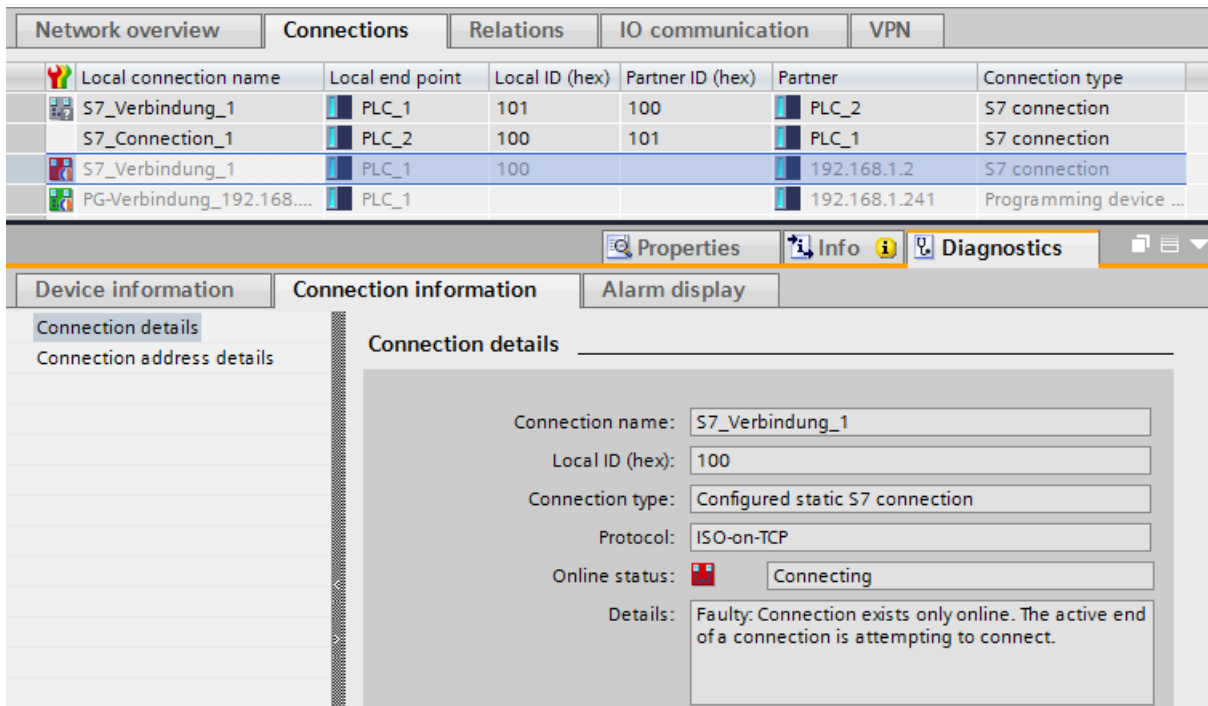


Figure 4-12 "Connection information" tab and open connection overview

If a module has been selected (network view), the tab contains the following group:

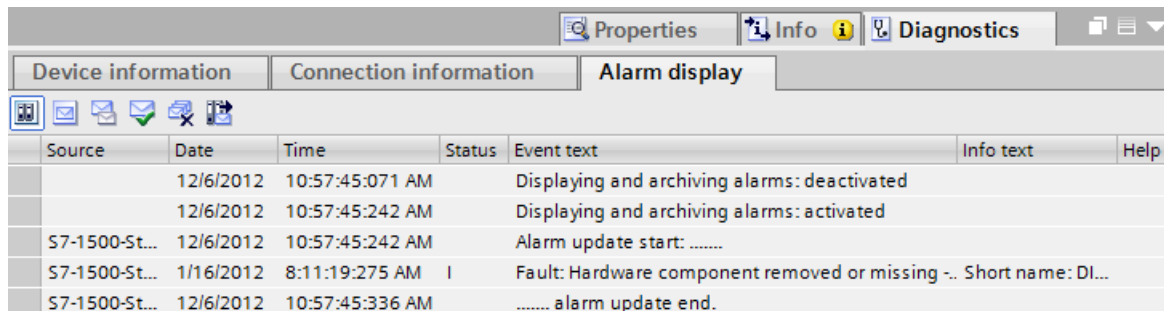
- Connection resources

If a connection has been selected (connection table), the tab contains the following groups:

- Connection details
- Address details of the connection

Subordinate "Alarm display" tab

System diagnostics alarms are output in the "Alarm display" tab.



Source	Date	Time	Status	Event text	Info text	Help
	12/6/2012	10:57:45:071 AM		Displaying and archiving alarms: deactivated		
	12/6/2012	10:57:45:242 AM		Displaying and archiving alarms: activated		
S7-1500-St...	12/6/2012	10:57:45:242 AM		Alarm update start:		
S7-1500-St...	1/16/2012	8:11:19:275 AM	I	Fault: Hardware component removed or missing -.. Short name: DI...		
S7-1500-St...	12/6/2012	10:57:45:336 AM		 alarm update end.		

Figure 4-13 "Alarm display" tab

To receive alarms in STEP 7, follow these steps:

1. Open the project view.
2. Select the required CPU in the project tree.
3. To connect online with the respective CPU, select the shortcut menu command "Go online".
4. Select the required CPU once again in the project tree and select the shortcut menu command "Receive alarms".

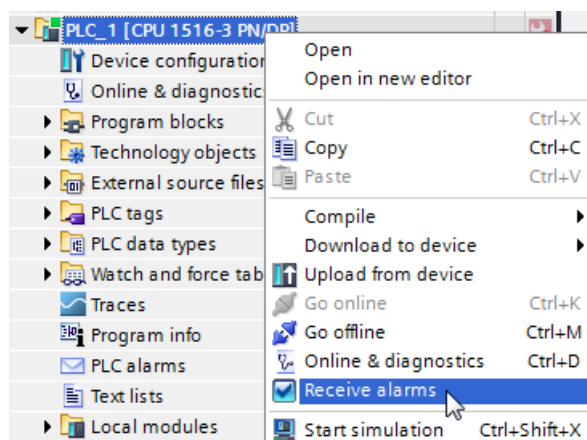


Figure 4-14 Receive alarms

5. Alarms are now displayed in the alarm display. "Archive view" is enabled by default.
6. To display the latest alarms, click the symbol "Active alarms" .

4.2.2.6 CPU diagnostics buffer

Definition

Each CPU and some other modules have their own diagnostics buffer, in which detailed information on all diagnostic events is entered in the order in which they occurred.

The CPU diagnostics buffer can be displayed on all display media (STEP 7, HMI, CPU web server and display of the CPU).

Diagnostic events

The entries available in the diagnostics buffer include:

- Internal and external errors on a module
- System errors in the CPU
- Operating mode transitions (e.g., from RUN to STOP)
- Errors in the user program
- Removal/insertion of modules

The contents of the diagnostics buffer is stored in the retentive memory in case of a memory reset of the CPU. Errors or events can be evaluated even after a longer period of time thanks to the diagnostics buffer to determine the cause of a STOP or to trace the occurrence of a single diagnostic event and to be able to assign it.

Procedure

To display the diagnostics buffer of a CPU, follow these steps:

1. Select the respective CPU.
2. Select the shortcut menu command "Online & Diagnostics".

The "Online access" view is opened in the working area.

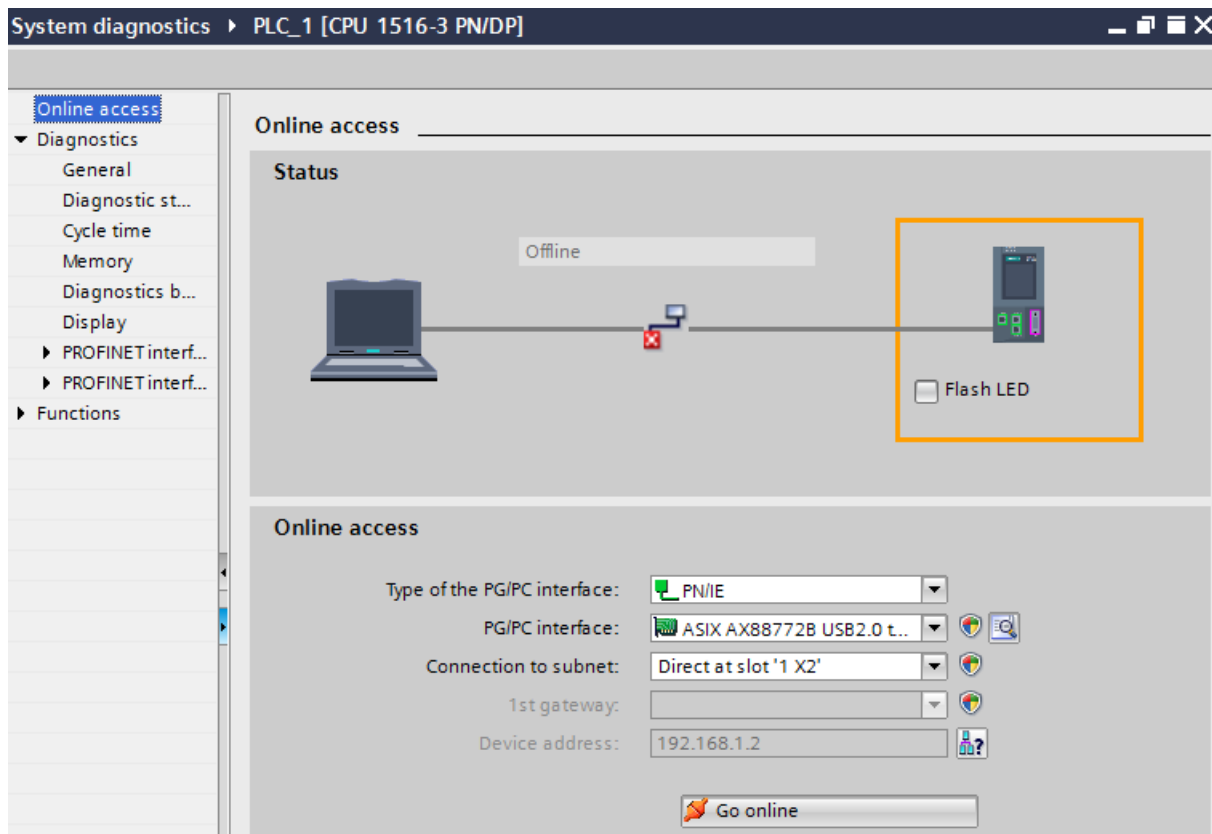


Figure 4-15 Setting up online access

3. Set the interface.

4. Click on the  Go online button.
5. Select the area "Diagnostics buffer".

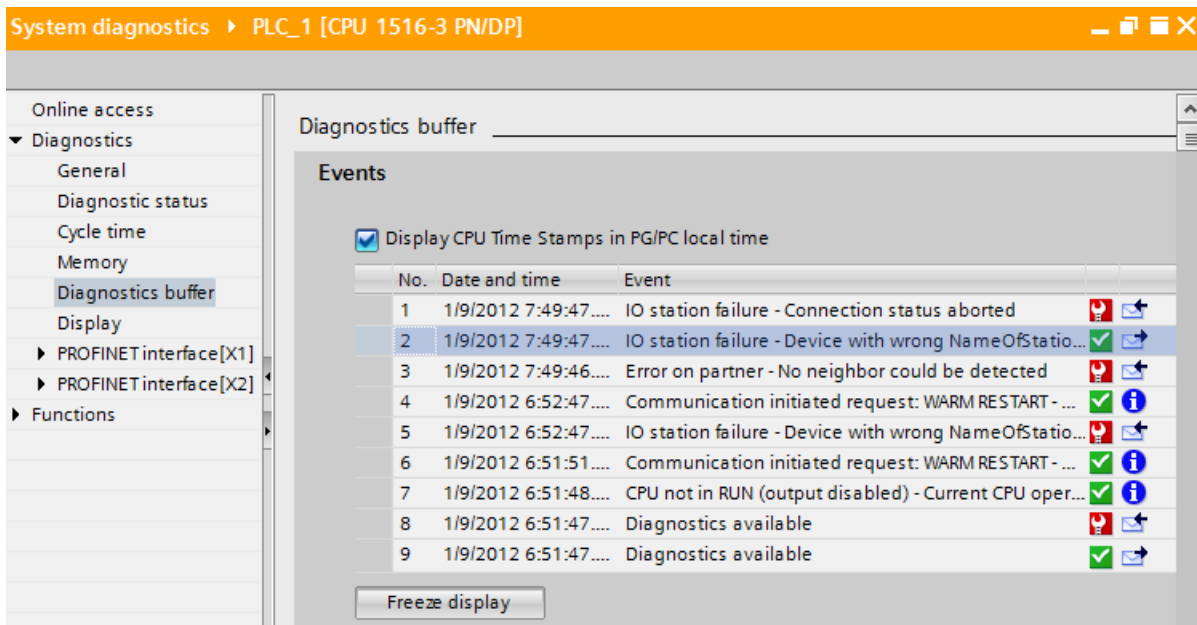


Figure 4-16 Diagnostics buffer in STEP 7

Note

Filter events

You can filter the entries in the diagnostics buffer in the settings of the "Diagnostics buffer" area to only display specific types of events. This means that specific events, such as "CPU and configuration-internal events" or "Connection diagnostics events", can be displayed separately.

4.2.2.7 "Online tools" task card

Online view in the "Online tools" task card

The following requirements must be met to display the online view of the "Online tools" task card:

- An online connection to the CPU is available.
- You have selected the CPU in the topology view, network view or device view.

The "Online tools" task card provides an overview of the CPU state, the cycle time and the memory usage.

- The "CPU Operator Panel" palette displays the current state of some LEDs and the mode switch of a CPU.
- The "Cycle time" palette displays the cycle time diagram and below it the measured cycle times as absolute values.
- The "Memory" palette contains the current memory usage of the associated CPU. The available memory is displayed in a bar diagram as well as a numerical value (percentage).

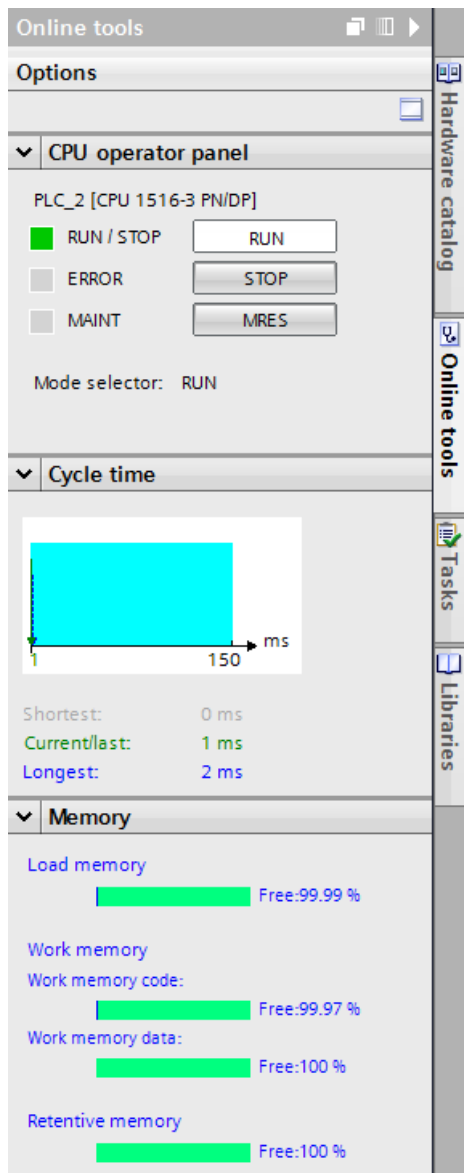


Figure 4-17 "Online tools" task card

4.2.2.8 Configuring the settings for I/O modules in STEP 7

You can also make settings for system diagnostics in STEP 7 for I/O modules. The parameters you have to configure depend on the I/O module.

The settings are optional.

Requirements

- STEP 7 is open.
- A project is open.
- The project view is open.
- A design with I/O modules has been configured.

Procedure

To make settings for system diagnostics of I/O modules in STEP 7, follow these steps:

1. Select the respective I/O module in the device view.
2. Open the "Properties" tab in the Inspector window.
3. Select the area "Inputs", for example.

You have access to the settings for system diagnostics of the I/O module. If you select "Wire break", for example, a possible wire break for the channel is flagged during operation.

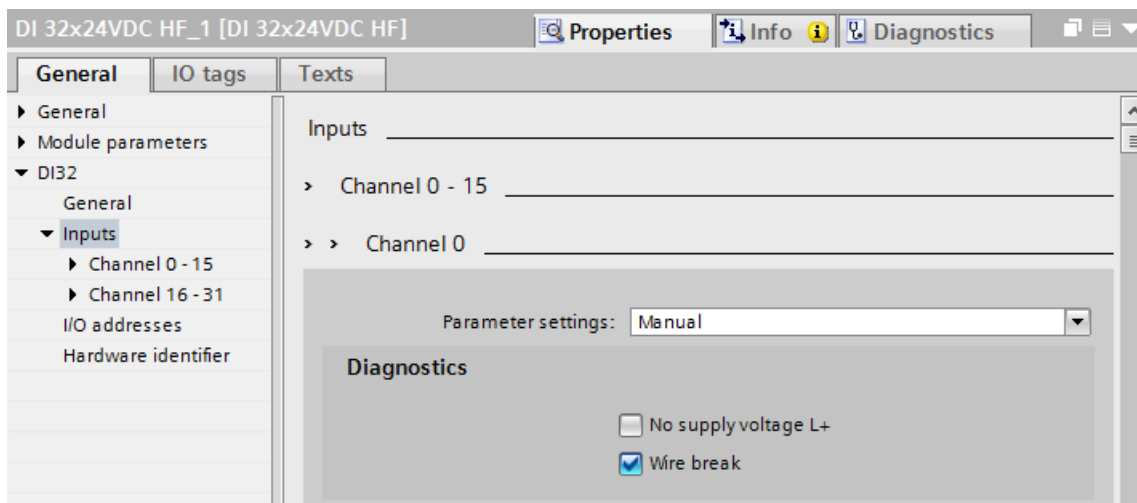


Figure 4-18 I/O setting with a digital input module

4. Save the hardware configuration.
5. Download the new hardware configuration to the CPU.

Additional information

The documentation for the respective module includes additional information on parameter assignment of I/O modules.

4.2.3 Diagnostics information using the web server

System diagnostics using the CPU web server

The CPUs of the SIMATIC series have an integrated web server and let you display the system diagnostics information by means of PROFINET. Any web client, such as PCs, multi panels or smartphones, has read-only access to module data, user program data and diagnostics data of a CPU by using an Internet browser. This means access to CPUs is possible without installed STEP 7.

The web server offers web pages with reduced complexity which have been optimized for devices with small screens and low computing power.

Using CPU 1516-3 PN/DP as an example, the following figure shows the start page of the Web server:

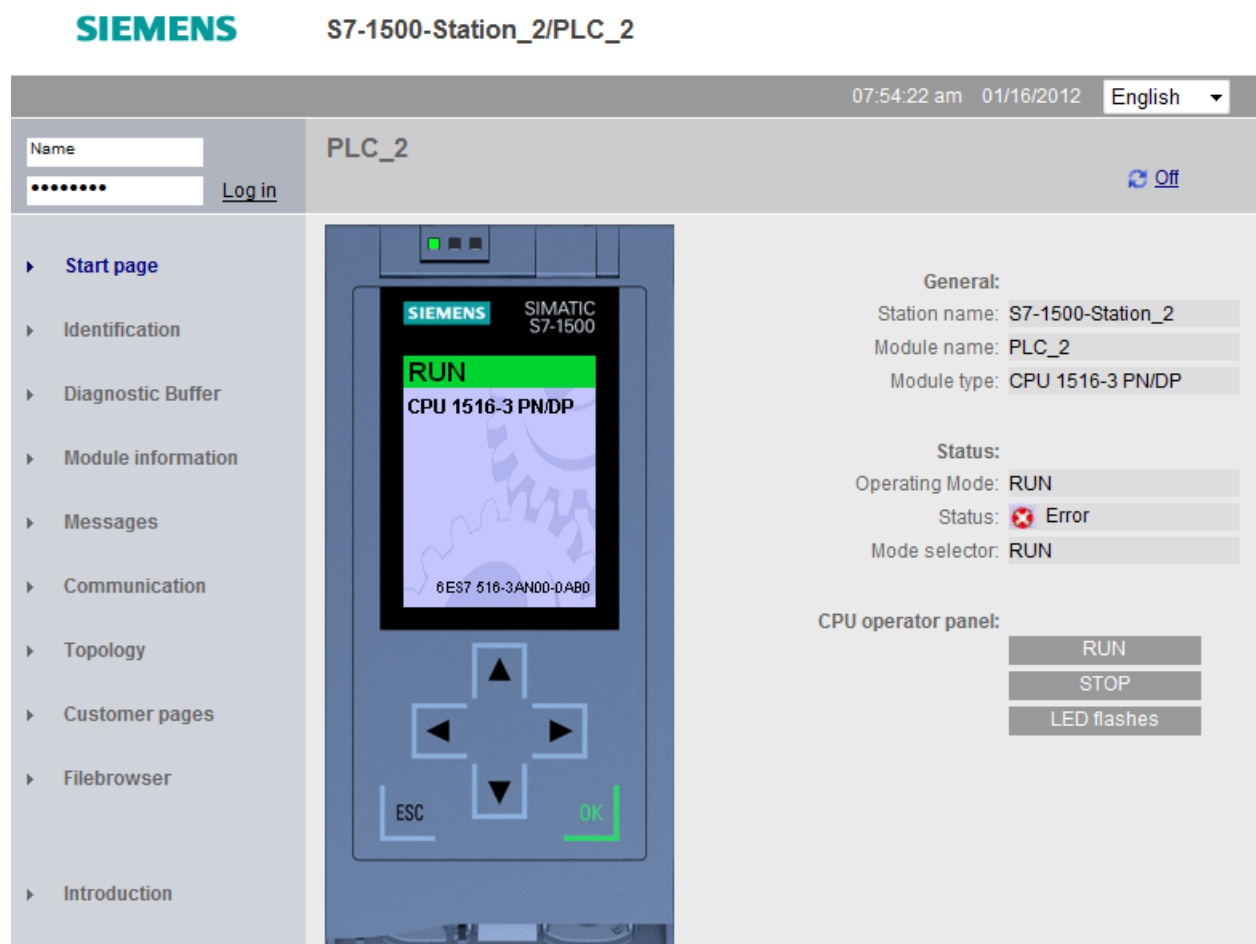


Figure 4-19 Web server, Start page

The following diagnostics options are available with the integrated web server:

- Start page with general CPU information
- Identification information
- Contents of the diagnostics buffer
- Module information
- Messages (without acknowledgment option)
- Information about communication
- Topology

Requirement

- You have opened STEP 7.
- You have added a CPU to the project.
- You have opened the project view.

Procedure

Follow these steps to access the web server:

1. Open the network view.
2. Select the CPU.
3. Open the "Properties" tab in the Inspector window.
4. Select the entry "Web server" in the "General" area navigation.

The "Web server" area is displayed.

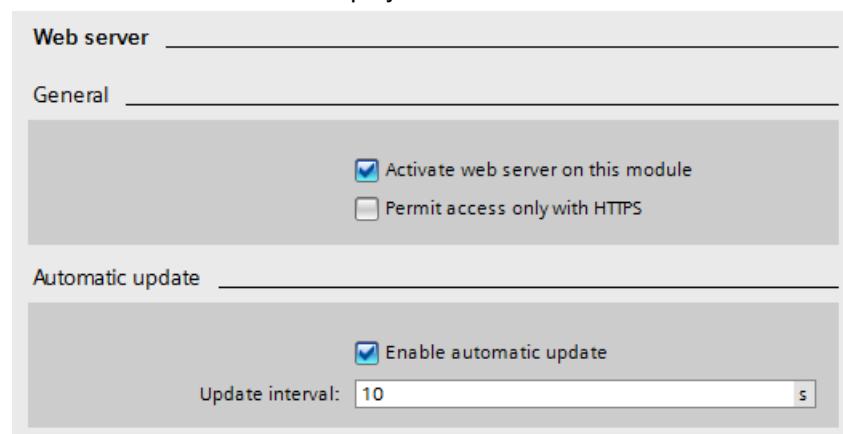


Figure 4-20 Activate the web server

5. Select the check box "Activate web server on this module".

6. Activate the web server also for each interface by which you want to access the web server. Select the respective interface. Open the "Properties" tab in the Inspector window and select the entry "Web server access" in the "General" area navigation. Select the check box "Activate web server for this interface".

Automatic updating is activated in the basic setting of a configured CPU.

7. Connect the client to a PROFINET interface of the CPU or to a communication processor (e.g., CP 1543-1).
8. Open the web browser.
9. Enter the IP address of the CPU in the "Address" field of the web browser in the following format: http://a.b.c.d or https://a.b.c.d (input example: http://192.168.3.141).
The welcome page of the Web server opens.
10. Click on the "Enter" link.

You are on the start page of the Web server.

Note

Managing access rights

In STEP 7, you can create users, define access rights and assign passwords under "Web server > User management". Users only have access to the options that are permanently linked to the access rights.

For further information on managing access rights, please refer to "Configuring the Web server" in the Web server function manual

(<http://support.automation.siemens.com/WW/view/en/59193560>).

Diagnostics option "Diagnostics buffer"

The browser displays the content of the diagnostics buffer on the "Diagnostics buffer" web page.

SIEMENS S7-1500-Station_2/PLC_2

07:53:42 am 01/16/2012 English

Name: Log in

Diagnostic Buffer

Diagnostic buffer entries 1-50

Number	Time	Date	State	Event
1	07:11:19.277 am	01/16/2012	incoming event	Communication initiated request: WARM Pending startup inhibit(s): - No startup in CPU changes from STARTUP to RUN mc
2	07:11:19.275 am	01/16/2012	incoming event	Hardware component removed or missin
3	07:10:24.730 am	01/16/2012	incoming event	Communication initiated request: WARM Pending startup inhibit(s): - No startup in CPU changes from STOP to STARTUP m
4	07:10:13.677 am	01/16/2012	outgoing event	Hardware component removed or missin
5	06:03:56.054 am	01/16/2012	incoming event	Hardware component removed or missin
6	06:02:56.211 am	01/16/2012	outgoing event	CPU not in RUN (output disabled) - Current CPU operating mode: STOP
7	06:02:50.441 am	01/16/2012	outgoing event	Hardware component removed or missin
8	06:02:50.076 am	01/16/2012	incoming event	CPU not in RUN (output disabled) - Current CPU operating mode: STOP

Details: 1 Event ID: 16# 02:400E

CPU info: Communication initiated request: WARM RESTART Pending startup inhibit(s): -
No startup inhibit set
> CPU changes from STARTUP to RUN mode
> Component: PLC_2.CPU Exec Unit_1
> Path: -
> HW_ID= 00052
> Operating mode control

Figure 4-21 Web server, "Diagnostics buffer" view

Diagnostics option "Module information"

The status of a device is indicated by the web browser with symbols and comments on the "Module information" web page.

Modules are displayed on the "Module information" web page in the "Name" column with a link. You can get to the faulty module in hierarchical order.

SIEMENS S7-1500-Station_2/PLC_2

07:52:44 am 01/16/2012 English

Name: Slot: Filter: [Filter](#)

Log in [S7-1500-Station_2 - S7-1500-Station_2](#) [Off](#)

Slot	State	Name	Order number	I address	Q address	Comment
1		PLC_2 Details	6ES7 516-3AN00-0AB0			
2		DI 32x24VDC HF_1 Details	6ES7 521-1BL00-0AB0	0		
3		DQ 32x24VDC/0.5A ST_1 Details	6ES7 522-1BL00-0AB0		0	
4		DI 16x24VDC SRC BA_1 Details	6ES7 521-1BH50-0AA0	4		

State Identification

Error: Hardware component removed or missing -

|> Component: / Profilschiene_0 / DI 16x24VDC SRC BA_1

|> Path: 0 / 0 / 4

|> HW_ID= 00260

Figure 4-22 Web server, "Module information" web page

Diagnostics option "Messages"

The web browser displays the content of the message buffer on the "Messages" web page.
The messages cannot be acknowledged on the web server.

SIEMENS S7-1500-Station_2/PLC_2

07:52:02 am 01/16/2012 English

Name: [Log in](#)

Messages MessageNr. [Filter](#)

entries 1-50 [Print](#) [Refresh](#) [Off](#)

MessageNr.	Date	Time	Message text	State	Acknowledgement
15	01/16/2012	07:11:19.275 am	Fault: Hardware component removed or missing -- S7-1500-Station_2 > Component: / Profilschiene_0 / DI 16x24VDC SRC BA_1. > Path: 0 / 0 / 4.1 HW_ID= 260	incoming	

Details on message number: 15

Short name: DI16 x DC24V SRC BA Order number: 6ES7 521-1BH50-0AA0

Incoming event

- Start page
- Identification
- Diagnostic Buffer
- Module information
- Messages**
- Communication
- Topology
- Customer pages
- Filebrowser
- Introduction

Figure 4-23 Web server, "Messages" web page

"Topology" diagnostics option

The "Topology" web page provides information on the topological configuration and status of the PROFINET devices in your PROFINET IO system.

SIEMENS S71500 Station_1/PLC_1

16:43:22 15.11.2011 English

Admin [Logout](#)

Topology [Refresh](#) [Off](#) [Print](#)

Graphic view **Table view** Status overview

Port	Status	Name	Module type	Port	Partner port	Name	Port
		CPU 1516-3PN/DP	CPU 1516-3PN/DP	port-001		SCALANCE-X-204IRT	port-001
		IM155-6PN-2	IM 155-6PN ST				
		IM155-5PN	IM 155-5PN ST				
		SCALANCE-X-204IRT	SCALANCE-X-204IRT	port-001 port-002 port-003 port-004		SCALANCE-X-204IRT cpux6-7-1xet200mp	port-004 port-002
		SCALANCE-X-208	SCALANCE-X-208				
		cpux6-7-1xet200mp		port-002		IM155-5PN	port-002

Admin [Logout](#)

- Start page
- Identification
- Diagnostics Buffer
- Module information
- Messages
- Communication
- Topology**
- Customer pages
- Filebrowser

Figure 4-24 Web server, "Topology" web page

Additional information

Additional information on the topic is available in the Web server function manual (<http://support.automation.siemens.com/WW/view/en/59193560>).

4.2.4 Diagnostics information using the HMI diagnostics view

Objects for system diagnostics

The full functionality of the HIM diagnostics view is only available with Comfort Panels and WinCC RT Advanced . Basic Panels do not support the complete range of system diagnostics functions.

Two objects are available for system diagnostics on an HMI device.

System diagnostics view

The system diagnostics view reflects the current status of all accessible devices in your plant. You navigate directly to the cause of the error and the associated device. You have access to all diagnostics-capable devices that you have configured in the STEP 7 hardware and network editor.

System diagnostics window

The system diagnostics window is an operating element and display object.

The functions of the system diagnostics window are the same as for the system diagnostics view. Because the system diagnostics window is configured in the "Global screen", you can also specify, for example, if the object can be closed in WinCC Runtime.

Note

Compatibility with Basic Panels

Only the "System diagnostics view" object is available with Basic Panels.

Basic Panels do not support the "System diagnostics window" object or the graphic symbol "System diagnostics indicator".

4.2.4.1 Configuring system diagnostics

Introduction

You add a system diagnostics view to your project to get an overview of all devices available in your plant.

The system diagnostics window offers an overview of all devices available in your plant. The system diagnostics window behaves like the system diagnostics view but is only available in the global screen.

Requirements

- At least one CPU has been set up in the project.
- An HMI device (e.g., Comfort Panel) has been set up in the project.
- CPU and the HMI device are connected with each other by an HMI connection.
- You have created a screen (for the system diagnostics view).
- The global screen is open (for the system diagnostics window).
- The Inspector window is open.

Procedure

Proceed as follows to configure the system diagnostics:

1. Double-click the "System diagnostics view" object in the "Tools" task card. The object is added to the screen.

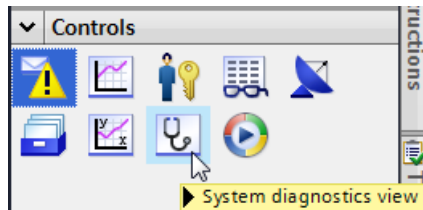


Figure 4-25 Adding a system diagnostics view

2. Select the "Properties" tab in the Inspector window.
3. Select the area "Columns".
4. Enable the columns that you require in the device view for WinCC Runtime, for example:
 - Status
 - Name
 - Operating mode
 - Slot
 - Address
5. Enable the columns that you require in the device view for WinCC Runtime, for example:
 - Status
 - Name
 - Operating mode
 - Plant designation
 - Address
6. You can change the column headers in the "Columns" area, if necessary.
7. Select the "Display" area.
8. Enable "Column settings > Columns moveable" to move the columns in WinCC Runtime.
9. To close the system diagnostics window in WinCC Runtime, select "Properties > Window > Closable" in the "Properties" tab of the Inspector window.

Result

The system diagnostics view has been added to the screen. The diagnostics status of the entire plant is displayed in the system diagnostics view in WinCC Runtime.

Diagnostic overview						
Status	Name	Operati...	Slot	Type	Order num...	Address
✓	Rack 1					
✓	PLC 1	✓			36979	
✓	CP 443-1	✓			53939	
✗	DI_1				5363	
✓	DI_2				22323	
✓	PS_1				39283	
◀ ▶						
🏠 ⬅ ➡ ✉						

Figure 4-26 System diagnostics view in the screen

The system diagnostics window has been added to the global screen. If there is an error message in the plant, the system diagnostics window responds and displays the affected device.

4.2.4.2 Different views of the HMI diagnostics view

Introduction

There are three different views available in the system diagnostics view and the system diagnostics window.

- Device view
- Details view
- Matrix view (for master/IO systems only, PROFIBUS, PROFINET)

Device view

The device view shows all the available devices of a layer in a table. Double-clicking on a device opens either the lower-level devices or the detail view. Symbols in the first column provide information about the current state of the device.

S7-1500 station_1

Status	Name	Operati...	Slot	Type	Order num...	Address
	S7-1500 statio...			S7-150...		32*
	CPU proxy_1		1	CPU 15...	6ES7 516-3...	49*
	DQ32		2	DQ32	6ES7 522-1...	258*
	DI32		3	DI32	6ES7 521-1...	259*

Navigation icons: Home, Previous, Next, Mail/Alert

Figure 4-27 Device view

Details view

The detail view gives detailed information about the selected device and any pending errors. Check whether the data is correct in the detail view.

S7-1500 station_1 \ DI32	
> Status	
> Name	DI32
> Operating state	
> Rack	0
> Slot	3
> Type	DI32
> Order number	6ES7 521-1BL00-0AB0
> Address	259*
> Plant designation	
> Location identifier	
> Manufacturer ID	SIEMENS AG
> Hardware version	97
> Profile ID	
> Specific profile data	0003
> I&M data version	1.1
> Error text	Wire break
	Help: Check the status of the connecting cables.

Figure 4-28 Details view

Matrix view

The matrix view is only available for distributed I/O systems. The matrix view shows the status of the devices of the PROFIBUS/PROFINET subnet.

- In PROFIBUS, the numbers assigned by PROFIBUS are used for identification (DP station number).
- In PROFINET, the IO devices are numbered consecutively from 1.

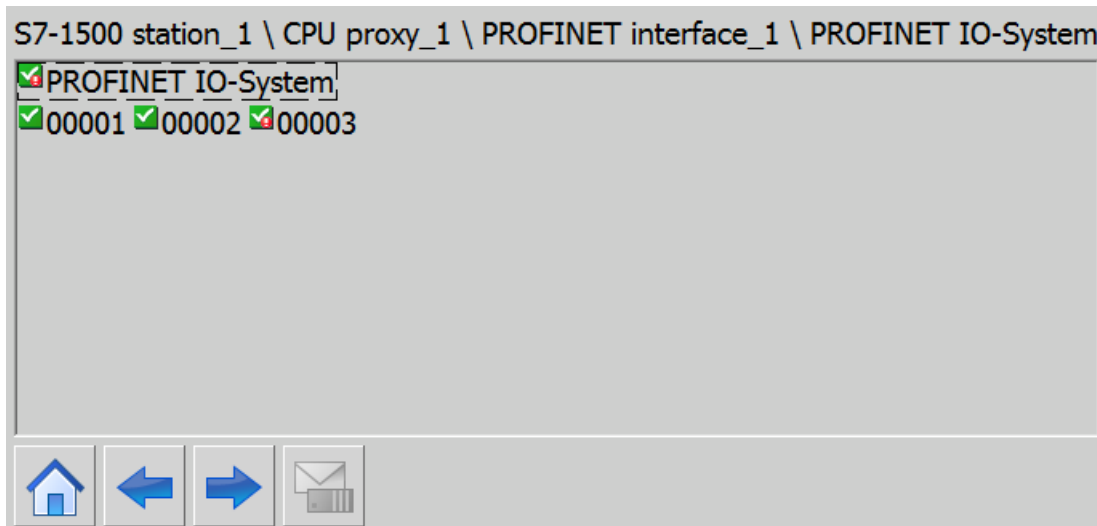


Figure 4-29 Matrix view

Navigation buttons

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.

4.2.4.3 Inserting system diagnostics indicator

Introduction

The system diagnostics indicator is a predefined graphic symbol of the library which alerts you to errors in your plant.

The library object shows two different states:

- No error
- Error

Requirements

- An HMI device (e.g., Comfort Panel) has been set up in the project.
- The "Libraries" task card is opened.
- The global library "Buttons and Switches > DiagnosticsButtons" is open.
- A screen is open.
- The system diagnostics window has been set up in the global screen.

Procedure

1. Select the "DiagnosticsIndicator" object in the library.
2. Drag-and-drop the library object to the position in the work area where you want to insert the object.

The library object is added.

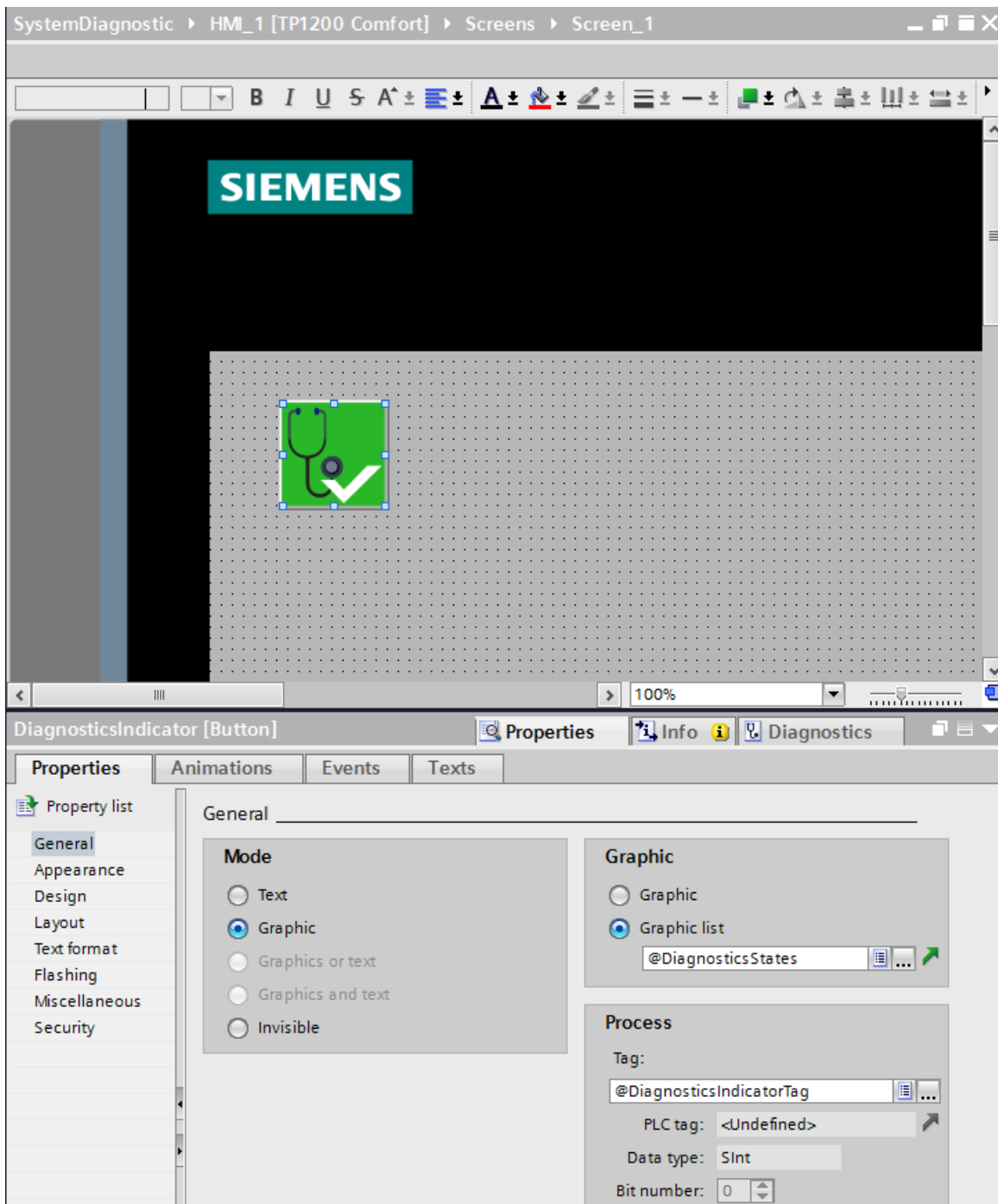


Figure 4-30 Inserting library object in the working area

3. Select the library object.
4. Open the "Events" tab in the Inspector window.

The "ShowSystemDiagnosticsWindow" is preset for the event "Click".

Result

The system diagnostics indicator has been added to the project and connected with the system diagnostics window.

The system diagnostics indicator changes its appearance if an error message is output in WinCC Runtime. The system diagnostics window opens when you click on the system diagnostics indicator. The system diagnostics window shows the detail view of the affected device.

Configuring access protection for the system diagnostics window

Configure access protection for the system diagnostics indicator to prevent unauthorized access to the system diagnostics windows.

1. Select the "DiagnosticsIndicator" object in the screen.
2. Open the "Properties" tab in the Inspector window.
3. Select an authorization in the "Security in Runtime" area.

A logon dialog opens when you click on the system diagnostics indicator in WinCC Runtime. The system diagnostics window does not open unless you have the required authorization.

4.2.4.4 Configuring button as system diagnostics indicator

Introduction

Instead of using the object "DiagnosticsIndicator" from the library, you can, for example, configure a button in "Graphic" mode to indicate errors in your plant.

Requirements

- At least one CPU has been created.
- An HMI device (e.g., Comfort Panel) has been set up in the project.
- The "Tools" task card is open.
- A bit graphics list has been created with two different graphics for the states.
- A screen is open.
- You have created a system diagnostics view.

Procedure

Follow these steps to configure a button as system diagnostics indicator:

1. Double-click the "Button" object in the "Tools" task card. A button is added to the screen.
2. Enable the "Properties" tab in the Inspector window and the "Graphic" mode in the "General" area.
3. Select the bit graphics list as graphics list.
4. Select the "Properties" tab in the Inspector window and select the tag @DiagnosticsIndicatorTag under "Tag" in the "General" area.
5. To assign a function to the button, select the "Events" tab in the Inspector window.
6. Select the "Click" event.
7. Click on "Add function" in the table.
8. Select "EnableSystemDiagnosticsView".
9. Select the system diagnostics view.

Result

You have configured an interface that reacts to error events from the CPU. The button changes when an error event occurs in Runtime.

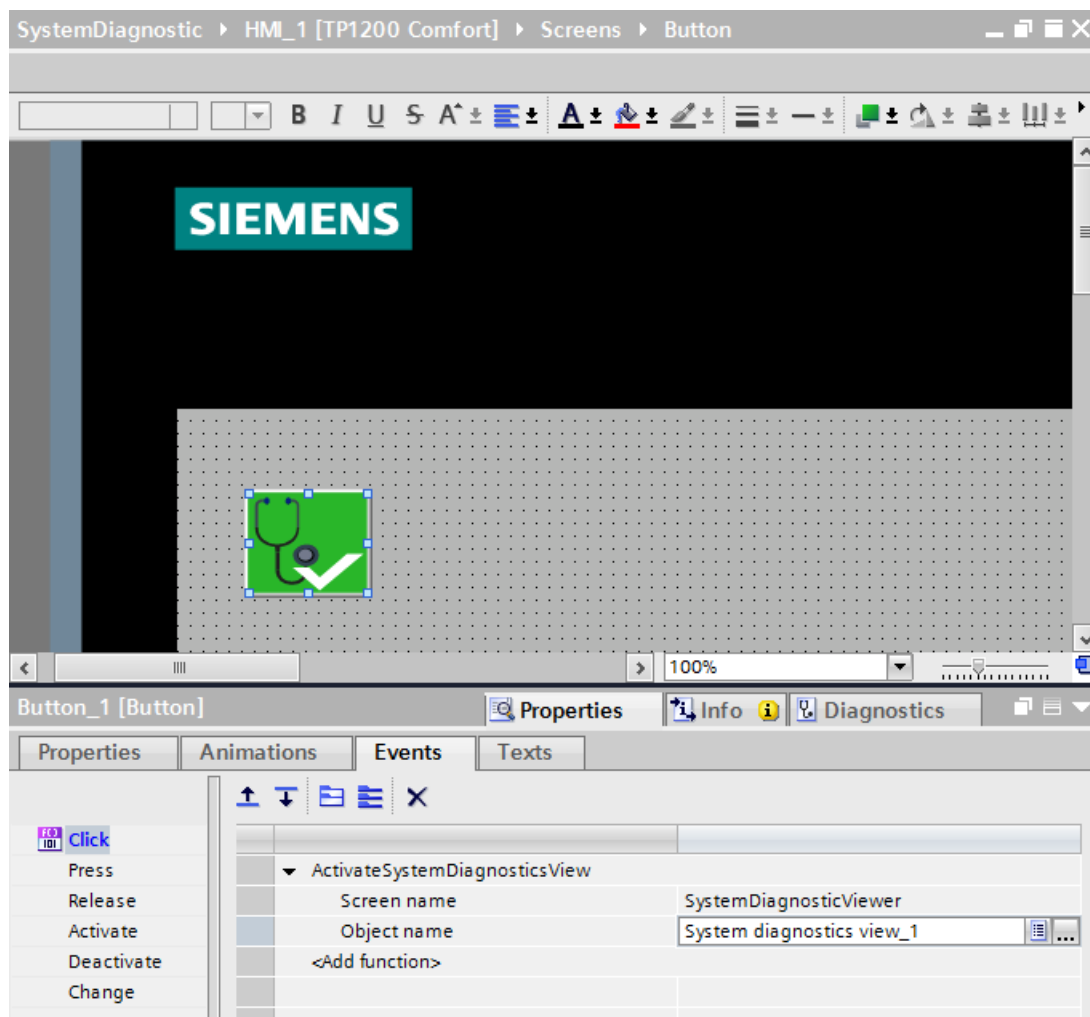


Figure 4-31 Configured button

The button has two states.

- Error
The system diagnostics view opens when you click on the button. The system diagnostics view shows the detail view of the affected device.
- No error
The system diagnostics view opens when you click on the button. The system diagnostics view shows the device view.

System diagnostics by means of the user program

5.1 Options of system diagnostics in the user program

Introduction

You can configure responses to diagnostics alarms in the user program. You can, for example, specify that your plant is stopped in case of specific diagnostics alarms.

Options of determining diagnostics in the user program

A vendor-independent structure of data records with diagnostics information applies. The following instructions are available for determining the system diagnostics of a device:

Instruction	Description
RDREC	- Includes error information on faulty modules - Works synchronously, which means processing takes place across several calls
RALRM	- Reads the start information of the OB when calling the diagnostics interrupt OB (OB 82) - Provides information on cause and location of error
DPNRM_DG	Reads the current diagnostics data of a DP slave (DP standard diagnostics)
GEN_DIAG	- Generates diagnostics information - To generate diagnostics information, the module or submodule is identified with its logical address
Gen_UsrMsg	Generates an alarm that is entered in the diagnostics buffer
GET_DIAG	- Provides diagnostics information - To provide diagnostics information, the module or submodule is selected
T_DIAG	- Provides diagnostics and status information on a connection - Works synchronously, which means processing takes place across several calls
RD_SINFO	- Reads the start information of the OB called last that has not been processed completely and the startup OB started last - Provides general error information
LED	Reads the status of the module LED
Get_IM_Data	- Reads the Information&Maintenance data of the CPU - Works synchronously, which means processing takes place across several calls
Transfer_IM_Data	Transmits the Information&Maintenance data of the CPU
DeviceStates	Outputs the state of all devices of an IO system
ModuleStates	Outputs the state of all modules of a device

Additional information

See the STEP 7 online help for additional information on the instructions for system diagnostics.

5.2 System diagnostics using process image inputs

Introduction

In addition to event-driven system diagnostics, the input and output modules of the SIMATIC series provide diagnostics information using the process image of the inputs.

The system diagnostics described in the preceding sections is made available asynchronously to the program processing. To ensure the correct processing of the input and output data in the case of faults while reading the input and output data, some modules offer the so-called value status (QI = Quality Information) for evaluation.

Requirement for evaluation of the value status

The diagnostics information about the process image of the inputs is transmitted synchronized with the user data. Select the "Value status" check box in the properties of the I/O module in STEP 7 if you want to evaluate the value status of the channel.

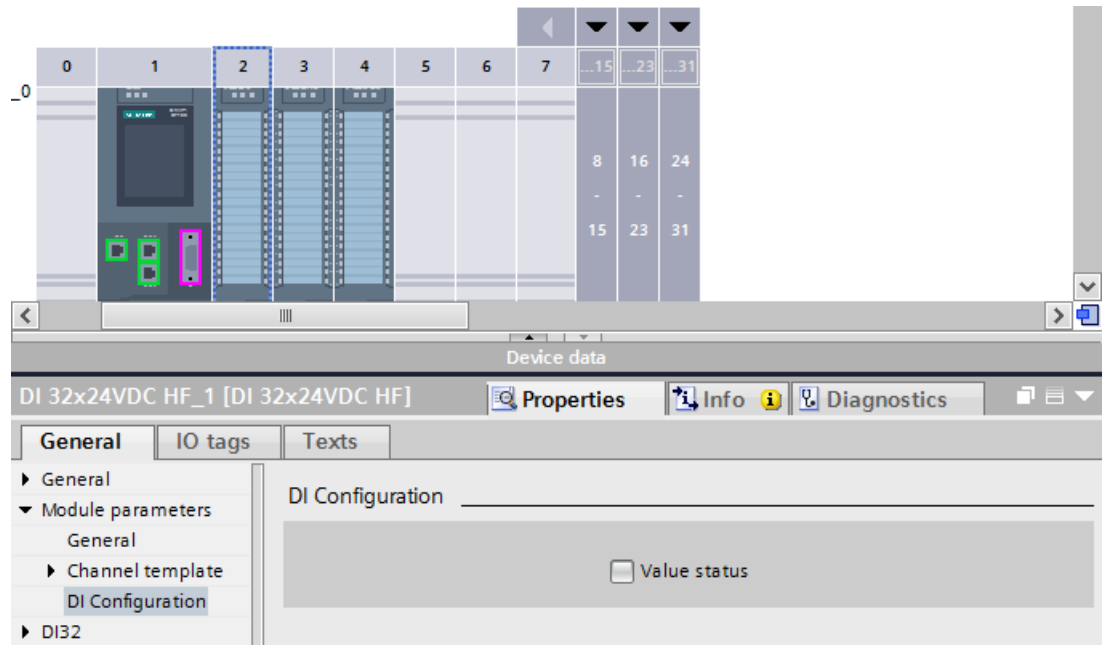


Figure 5-1 Enable value status

Evaluation of the value status

If you have enabled the value status for an I/O module, this module provides additional information on the value status in addition to the user data. This information is directly available in the process image of the inputs and can be called with simple binary operations.

Each channel is uniquely assigned one bit in the value status. The bit in the value status indicates the validity of the read-in value in the user data.

Table 5- 1 Example for evaluation of the user datum in case of a wire break for a digital input module

	Bit in user datum	Bit in value status	Value in user datum
Faulty channel	Logical 0	0	Invalid
Fault-free channel	Logical 0 (actual value)	1	Valid

Example - Evaluation of the value status for the input channel of an analog input module

The example below shows the basic evaluation of the value status for the input channel of an analog input module in the user program. The diameter of a cylinder is measured by means of a channel and its circumference is calculated.

- If the value status indicates the channel is error-free, the circumference is to be calculated.
- If the value status indicates the channel is defective, the value "0" is to be output as substitute value for the circumference.

The figure below shows the evaluation of the value status in the user program.

Perimeter					
	Name	Data type	Default value	Comment	
1	▼ Input				
2	■ Diameter	Real	0.0	Tag for analog input channel	
3	■ QualityInformation	Bool	false	Tag for QI of analog input channel	
4	▼ Output				
5	■ Perimeter	Real	0.0	Tag for result of calculation	
6	► InOut				
7	► Static				
8	► Temp				
9	▼ Constant				
10	■ PI	Real	3.14	Constant for pi	
11	■ SubstituteValue	Real	0.0	Constant for substitute value	

IF...	CASE... OF...	FOR... TO DO...	WHILE... DO...	(*...*)
-------	------------------	--------------------	-------------------	---------

```

1 IF #QualityInformation = true           //Validity check of diameter
2
3 THEN                                   //Program run, if quality information is positive
4     #Perimeter := #Diameter * #PI;      //Calculation of perimeter
5
6 ELSE                                   //Program run, if quality information is negative
7     #Perimeter := #SubstituteValue;     //Substitute value assigned to perimeter

```

Figure 5-2 Example - Evaluation of the value status in the user program

Additional information

Depending on the I/O module, the value status reserves different addresses in the process image of the inputs. The specific manual for the used module includes specific information on allocation and assignment.

Alarms

Alarms allow you to display events from processing in the automation system and to quickly detect errors, to precisely localize them and to remove them. Downtimes are significantly reduced in a plant.

Before alarms can be output, they need to be configured.

You can create, edit and compile event-dependent alarms along with their alarm texts and alarm attributes and display them on display devices.

In STEP 7, you create program alarms in the user program with the "Program_Alarm" instruction. You edit the attributes and alarm texts in the alarm editor in STEP 7.

You can output the alarm status with the "Get_AlarmState" instruction.

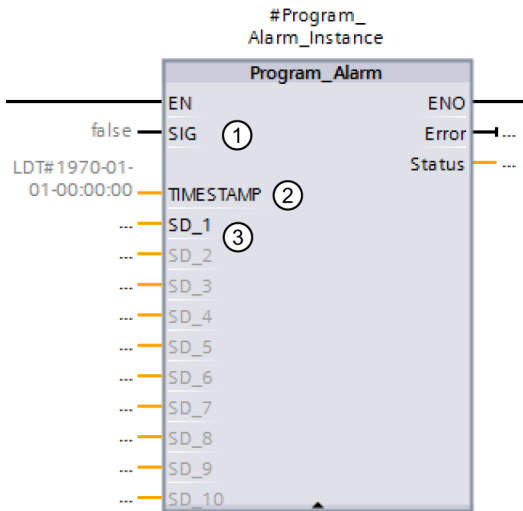
Advantages of program alarms

Compared to other alarm methods, such as HMI discrete alarms, program alarms offer the following advantages:

- Central engineering in STEP 7: You only configure a program alarm once for the CPU. The program alarm is automatically transferred from the CPU to all registered HMI devices.
- System-supported acknowledgment: The acknowledgment of a program alarm on an HMI device is automatically updated on other HMI devices by the CPU.
- Time stamping close to the event in the CPU
- Identical time stamps of the alarms on multiple HMI devices without time synchronization

6.1 Creating alarms with the "Program_Alarm" instruction

You create a program alarm in STEP 7 with the "Program_Alarm" instruction. The figure below shows the "Program_Alarm" instruction with the most important input variables.



- ① The "Program_Alarm" instruction monitors the signal at the SIG block input and generates a program alarm in case of a signal change at the SIG parameter. The instruction generates an incoming alarm when the signal changes from 0 to 1 and an outgoing program alarm if the signal changes from 1 to 0. The program alarm is triggered synchronously to program execution.
- ② The time stamp is automatically created when the alarm event occurs in the automation system and is passed along with the alarm.
- ③ You can append up to ten associated values to the program alarm at the parameters SD_i ($1 \leq i \leq 10$). The associated values are acquired at the time of the signal change at the SIG parameter and assigned to the program alarm. Associated values are used to display dynamic contents in alarms.
Example: The temperature in the tank <associated value 1> is <associated value 2> °C.
You can find more information on associated values in the STEP 7 online help.

Figure 6-1 "Program_Alarm" instruction

Note

The "Program_Alarm" instruction can only be called in a function block.

You can find more information on creating program alarms in the STEP 7 online help under "Creating and editing alarms".

6.2 Editing alarms in the alarm editor

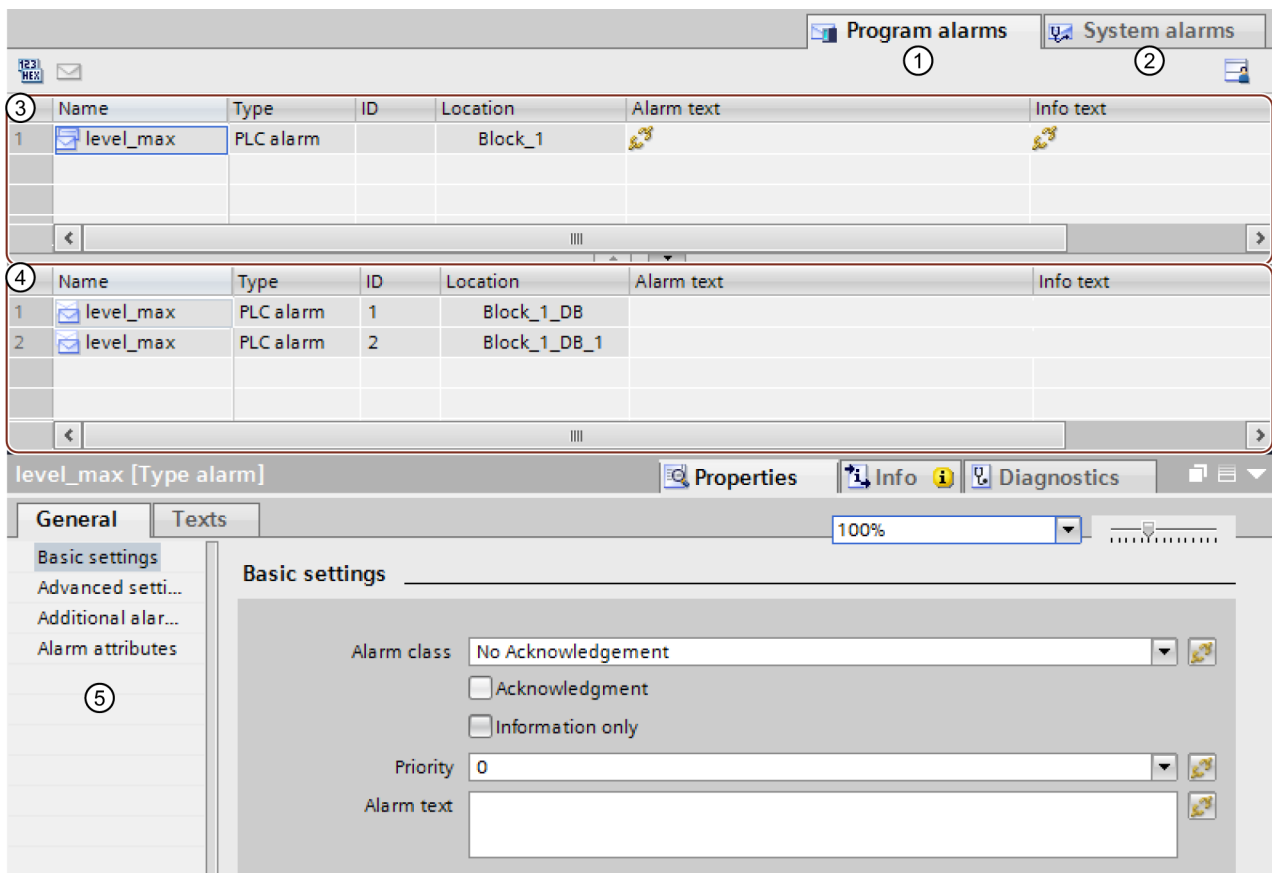
You can edit the created alarms in STEP 7 either in the program editor or in the alarm editor.

You can find more information on editing alarms in the program editor in the STEP 7 online help under "Creating and editing alarms".

Editing alarms in the alarm editor

You can edit alarm texts in the alarm editor and specify attributes such as alarm class or priority for the alarms.

The figure below shows the layout of the alarm editor.



- ① "Program alarms" tab: You can edit program alarms here.
- ② "System alarms" tab: System alarms can only be viewed but not edited. To edit these alarms, you must navigate to the device view ("Go to device" menu command), where you can modify the system diagnostics alarms in the Inspector window.
- ③ "Type alarms" area:

This is where the type alarms created in a function block with the "Program_Alarm" instruction are displayed. Type alarms serves as templates for instance alarms (④).

All the inputs you make for the type alarm are automatically included in the instance alarms derived from it.

You can find more information on type alarms in the STEP 7 online help under "Alarm types and alarms".
- ④ "Instance alarms" area:

When you assign an instance DB to the message block (for example, call in an OB, FB, FC), instance alarms are automatically generated based on the template of the type alarm and alarm numbers are assigned.

You can modify the instance alarms for specific instances.

You can find more information on instance alarms in the STEP 7 online help under "Alarm types and alarms".
- ⑤ Properties of the selected type and instance alarm in the Inspector window

Figure 6-2 Layout of the alarm editor

You can enter or modify the necessary parameters, texts and attributes in the table or in the Inspector window.

Additional information

You can find more information on texts and attributes in the STEP 7 online help under "Texts and attributes".

You can find more information on text lists in the STEP 7 online help under "Text lists for alarms".

6.3 Display of program alarms

Program alarms you create with the "Program_Alarm" instruction are automatically made available to the display devices.

You have the following options to display the alarms:

- Display of the CPU
- STEP 7
- HMI
- Web server of the CPU

User program

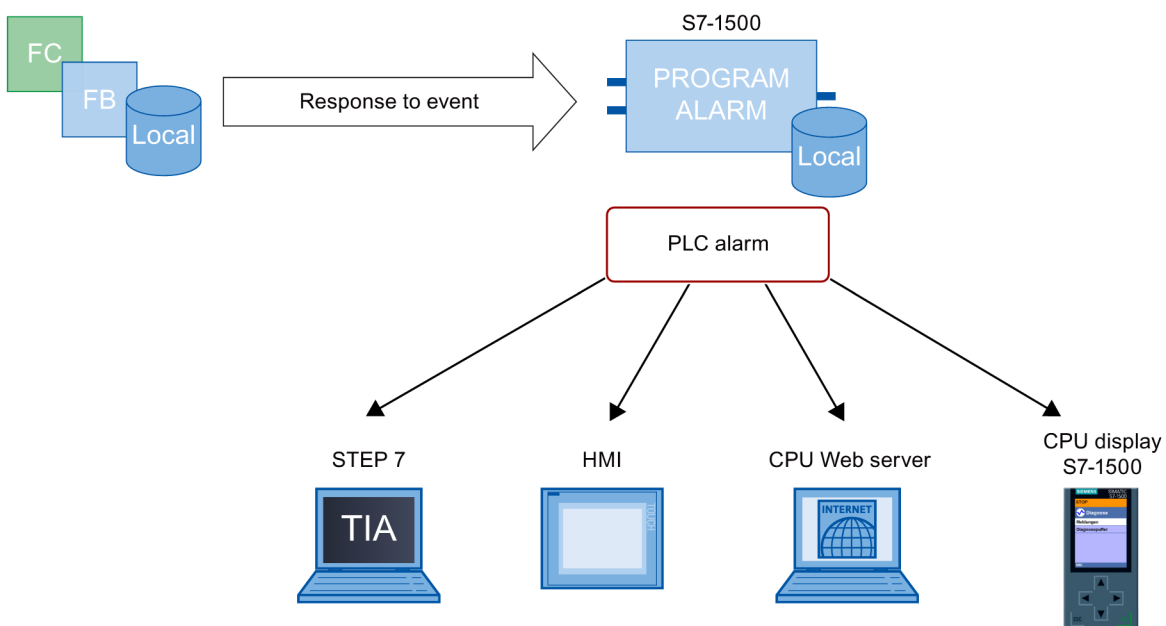


Figure 6-3 Alarms in the user program

6.4 Output of the alarm state with the "Get_AlarmState" instruction

Output of the alarm state with the "Get_AlarmState" instruction

The "Get_AlarmState" instruction outputs the alarm state of a program alarm. The output of the alarm state always refers to a program alarm that was created using the "Program_Alarm" instruction.

The program alarm is selected with the "Alarm" input parameter. Specify the instance DB of the "Program_Alarm" instruction at the "Alarm" parameter.

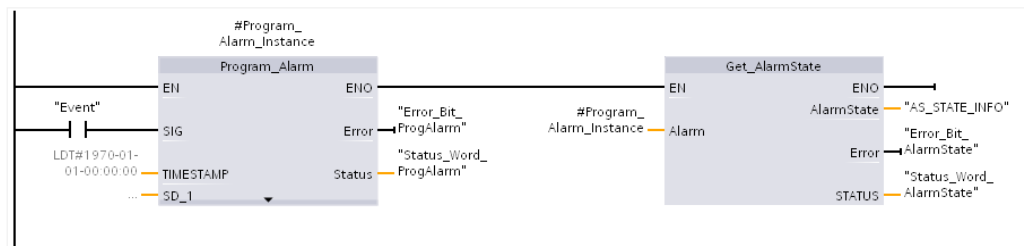


Figure 6-4 Call - Get_AlarmState

You can find additional information on evaluation of the "Get_AlarmState" instruction in the STEP 7 online help.

6.5 Example program for program alarms

6.5.1 Task

Introduction

This section describes the basic configuration of program alarms with the "Program_Alarm" instruction based on two examples. The two examples solve the same problem but use a different approach. Example 1 does not use associated values. In example 2, an associated value is assigned to the program alarm to reference a text list.

Example - Minimum/maximum fill level of a tank

A tank is filled with a liquid. The fill level is monitored by two sensors.

If the liquid in the tank drops below a minimum fill level, an alarm is output for low fill level.

If the liquid in the tank exceeds a maximum fill level, an alarm is output for high fill level.

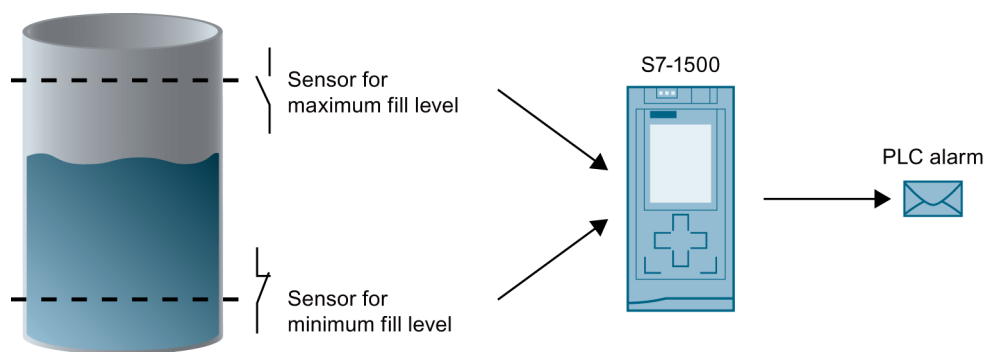


Figure 6-5 Example for fill level alarms

6.5.2 Example 1: Program alarm without associated values

Introduction

A program alarm is created for the minimum and the maximum fill level in this example.

How the example works

When the maximum fill level is exceeded in the tank, a program alarm with the alarm text for the excessive fill level is output.

When the minimum fill level is undershot in the tank, a program alarm with the alarm text indicating that the fill level is too low is output.

Steps

The following steps are necessary for this example:

- Define variables to pick up the signal
- Create function block
- Create program alarms
- Call function block
- Edit alarm text

Define variables to pick up the signal

The following table shows the variables that are used in this example. Define these variables in the standard variable table. The standard variable table is available in the project tree under "PLC variables".

Table 6- 1 Variables for fill level alarms

Name	Data type	Description
max	BOOL	Variable for maximum fill level If "max" = 1, the maximum fill level is exceeded.
min	BOOL	Variable for minimum fill level If "min" = 1, the minimum fill level is undershot.

The figure below shows the standard variable table with the defined variables "max" and "min".

	Name	Data type	Address	Retain	Visible i...	Accessible ..
1	 max	Bool	%I0.0	☐	☒	☒
2	 min	Bool	 %I0.1	☐	☒	☒
3	<Add new>			☐	☒	☒

Figure 6-6 Define variables

Create function block

To create a function block, follow these steps:

1. Open the "Program blocks" folder in project tree.
2. Double-click "Add new block".
The "Add new block" dialog opens.
3. Select the button "Function block".

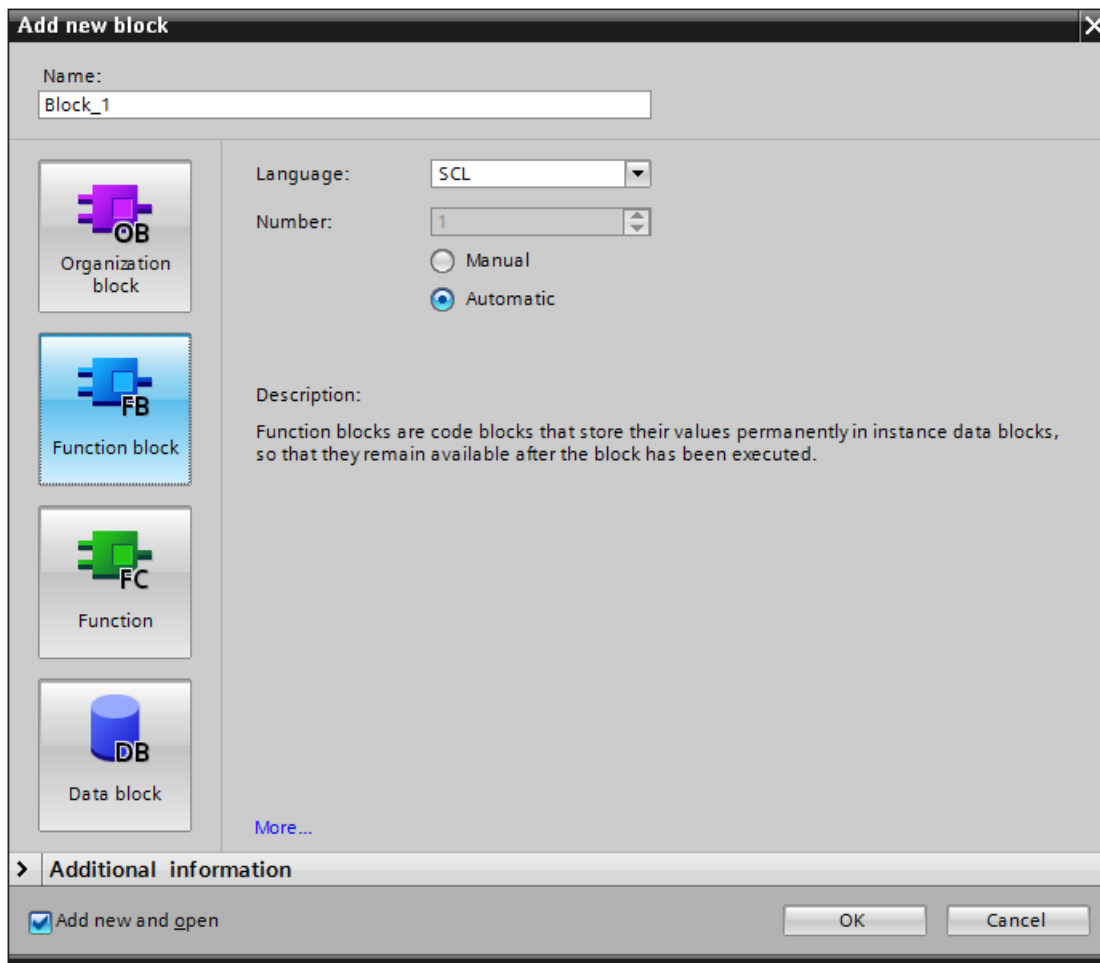


Figure 6-7 Create FB

4. Enter a name for the new block.
 5. Select the language SCL.
 6. Click on "OK" to confirm your input.
- Result: You have created a function block.

Create program alarms

To create the program alarm for the example program, follow these steps:

1. Select the created function block (FB) in the "Program blocks" folder in the project tree and double-click the function block to open it.
2. Insert the call of the "Program_Alarm" instruction in the instruction part of the function block. The "Program_Alarm" instruction is available in the "Instructions" task card under "Extended instructions" > "Alarms".

The "Call options" window opens.

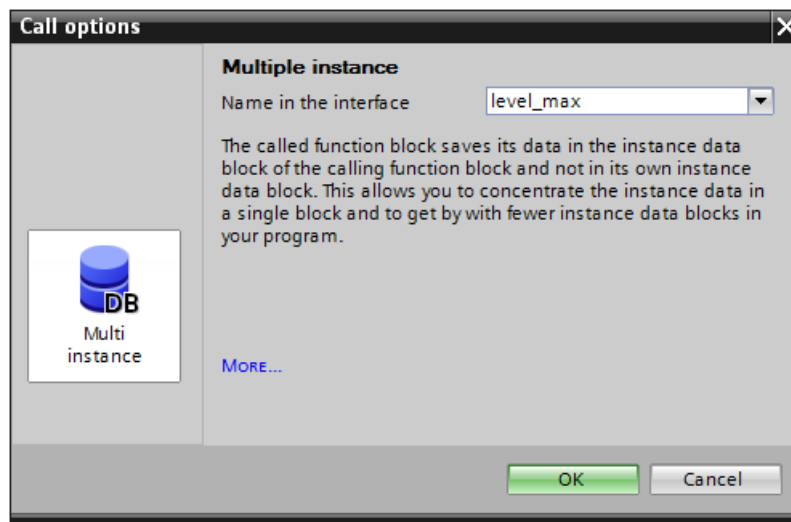


Figure 6-8 Calling PROGRAM_ALARM

3. Enter "level_max" as name and confirm the call options by clicking OK.

Result: The input variables of the "Program_Alarm" instruction are displayed in the instruction part.

4. Supply the SIG input variable of the "Program_Alarm" instruction with the variables for the maximum fill level.

```
#level_max(SIG:="max");
```

SIG: If a signal change occurs at the SIG input variable, the "Program_Alarm" instruction generates a program alarm.

5. Insert another call of the "Program_Alarm" instruction.

The "Call options" window opens.

6. Enter "level_min" as name and confirm the call options by clicking OK.

7. Result: The input variables of the "Program_Alarm" instruction are displayed in the instruction part.

8. Supply the SIG input variable of the "Program_Alarm" instruction with the variables for the minimum fill level.

```
#level_min(SIG:="min");
```

Result: You have created two type alarms.

Call function block

To call the function block in the user program, follow these steps:

1. In the "Program blocks" folder, select the cycle OB (e.g., OB1) in which you want to call the function block and open the cycle OB with a double-click.
2. Select the function block you want to call in the "Program blocks" folder.
3. Drag the function block in the instruction part of the cycle OB.
The "Call options" window opens.

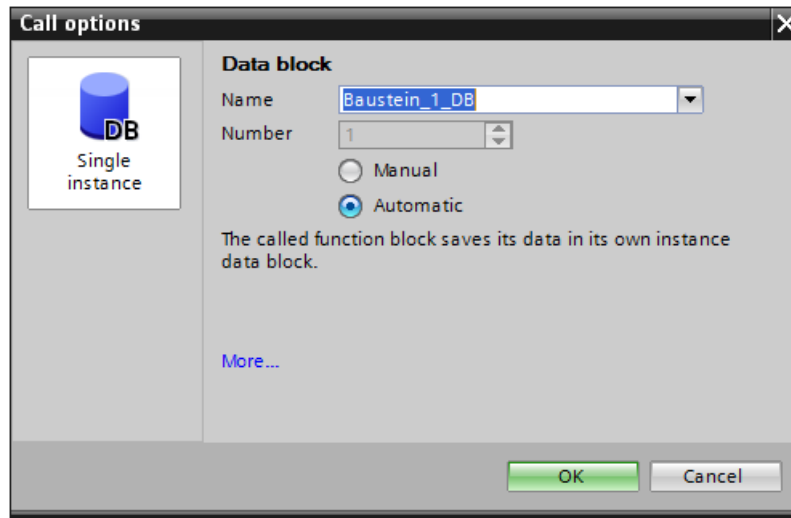


Figure 6-9 Call function block

4. Confirm the call options by clicking OK.

Result: You have called the alarm block in the user program and created an instance alarm.

Edit alarm text

To edit the alarm text, follow these steps:

1. Double-click on "PLC_Alarms" in the project tree.
The alarm editor opens.
2. Select the type alarm for the maximum fill level.
3. Enter the alarm text for the maximum fill level in the "Alarm text" column.
4. Select the type alarm for the minimum fill level.
5. Enter the alarm text for the minimum fill level in the "Alarm text" column.

Program alarms							System alarms
	Name	Type	ID	Location	Alarm text	Info text	
1	level_max	PLC alarm		Baustein_1	level too high		
2	level_min	PLC alarm		Baustein_1	level too low		
	Name	Type	ID	Location	Alarm text	Info text	
1	level_min	PLC alarm	2	Baustein_1...	level too low		

Figure 6-10 Edit alarm text

Result: You have created the alarm texts for both type alarms.

6.5.3 Example 2: Program alarm with associated value

Introduction

A shared program alarm is created for the maximum and the minimum fill level in this example. The program alarm is given an associated value. The program alarm uses the associated value to access a text list entry and outputs a separate alarm text for the minimum and the maximum fill level.

How the example works

The program alarm is output if either the minimum fill level is undershot or the maximum fill level is exceeded.

The associated value 1 of the "Program_Alarm" instruction is assigned the variable for the maximum fill level. The associated value references a text list with the entries "0" and "1".

The following scenarios are possible for output of the alarm text:

- Associated value is "0": The entry "0" of the text list with the alarm text for the undershot fill level is output.
- Associated value is "1": The entry "1" of the text list with the alarm text for the excessive fill level is output.

Steps

The following steps are necessary for this example:

- Define variables to pick up the signal
- Create function block
- Create program alarms
- Call function block
- Creating a text list
- Edit alarm text

Define variables to pick up the signal

The following table shows the variables that are used in this example. Define these variables in the standard variable table. The standard variable table is available in the project tree under "PLC variables".

Table 6- 2 Variables for fill level alarms

Name	Data type	Description
max	BOOL	Variable for maximum fill level If "max" = 1, the maximum fill level is exceeded.
min	BOOL	Variable for minimum fill level If "min" = 1, the minimum fill level is undershot.

The figure below shows the standard variable table with the defined variables "max" and "min".

	Name	Data type	Address	Retain	Visible i...	Accessible ..
1	 max	Bool	%I0.0	☐	☒	☒
2	 min	Bool	 %I0.1	☐	☒	☒
3	<Add new>			☐	☒	☒

Figure 6-11 Define variables

Create function blocks

To create a function block, follow these steps:

1. Open the "Program blocks" folder in project tree.
2. Double-click "Add new block".
The "Add new block" dialog opens.
3. Select the button "Function block".

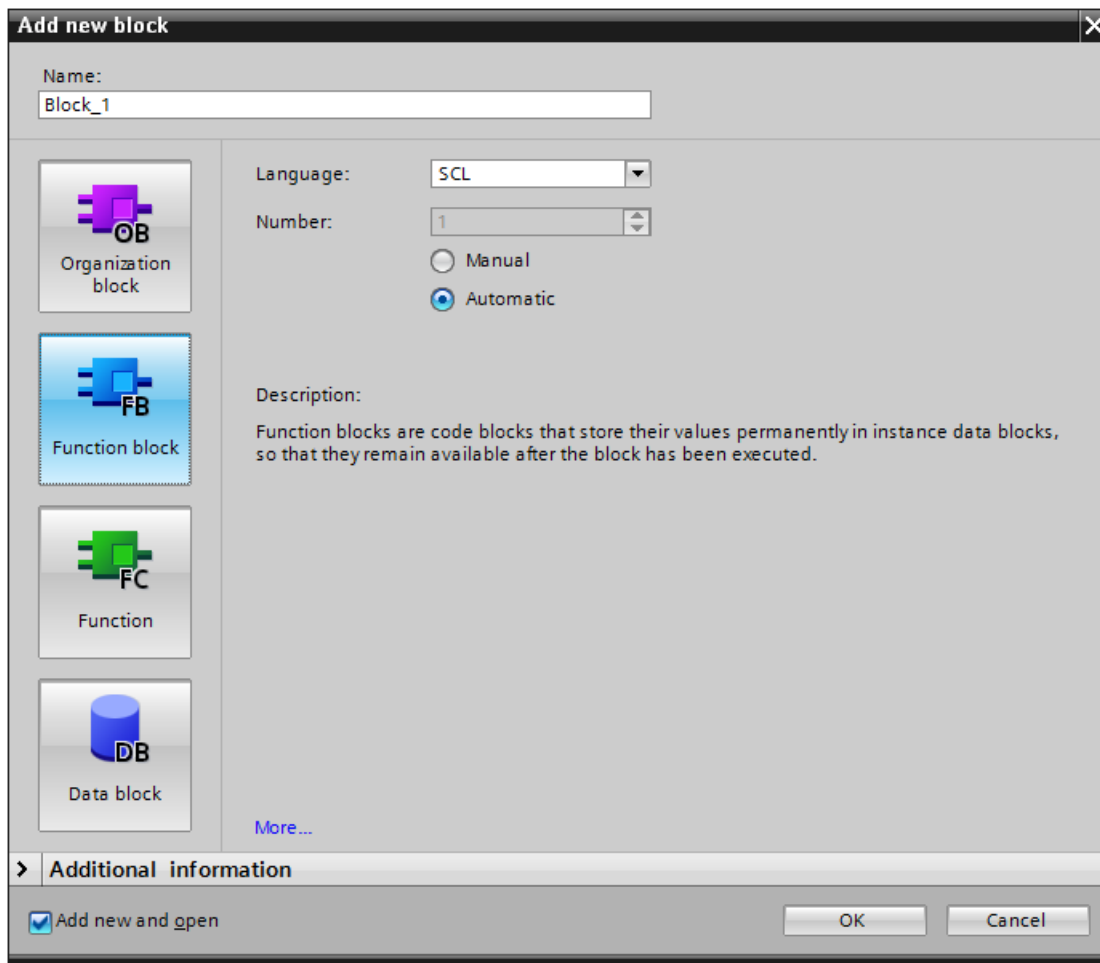


Figure 6-12 Create FB

4. Enter a name for the new block.
 5. Select the language SCL.
 6. Click on "OK" to confirm your input.
- Result: You have created a function block.

Create program alarm

To create the program alarm for the example program, follow these steps:

1. Select the created function block (FB) in the "Program blocks" folder in the project tree.
2. Insert the call of the "Program_Alarm" instruction in the instruction part of the function block. The "Program_Alarm" instruction is available in the "Instructions" task card under "Extended instructions" > "Alarms".
The "Call options" window opens.

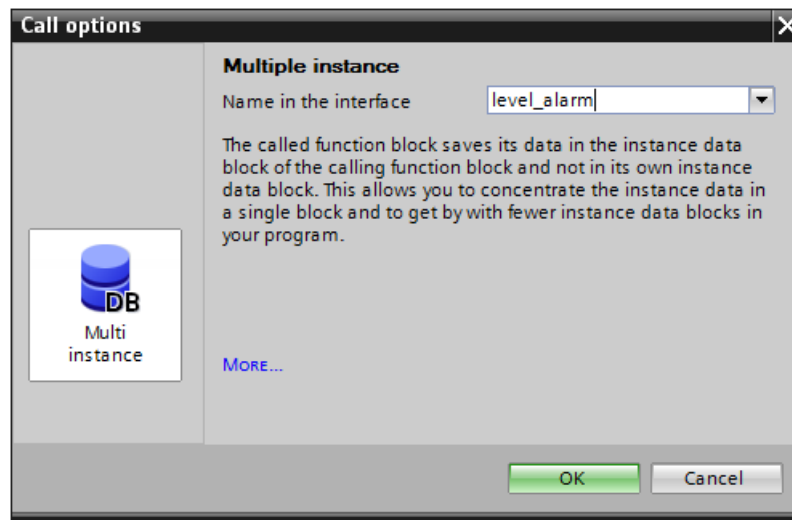


Figure 6-13 Calling PROGRAM_ALARM

3. Enter "level_alarm" as name and confirm the call options by clicking OK.
Result: The input variables of the "Program_Alarm" instruction are displayed in the instruction part.
4. Supply the SIG input variable of the "Program_Alarm" instruction with the XOR logic operation of the variables for minimum and maximum fill level and the input variable SD_1 with the variable for the maximum fill level.

```
#level_alarm(SIG:="min"XOR"max",SD_1:="max");
```

SIG: If a signal change occurs at the SIG input variable, the "Program_Alarm" instruction generates a program alarm.
SD_1: The associated value is acquired at the time of the signal change at input variable and assigned to the program alarm.

Result: You have created a type alarm.

Call function block

To call the function block in the user program, follow these steps:

1. In the "Program blocks" folder, select the cycle OB (e.g., OB1) in which you want to call the function block and open the cycle OB with a double-click.
2. Select the function block you want to call in the "Program blocks" folder.
3. Drag the function block in the instruction part of the cycle OB.
The "Call options" window opens.

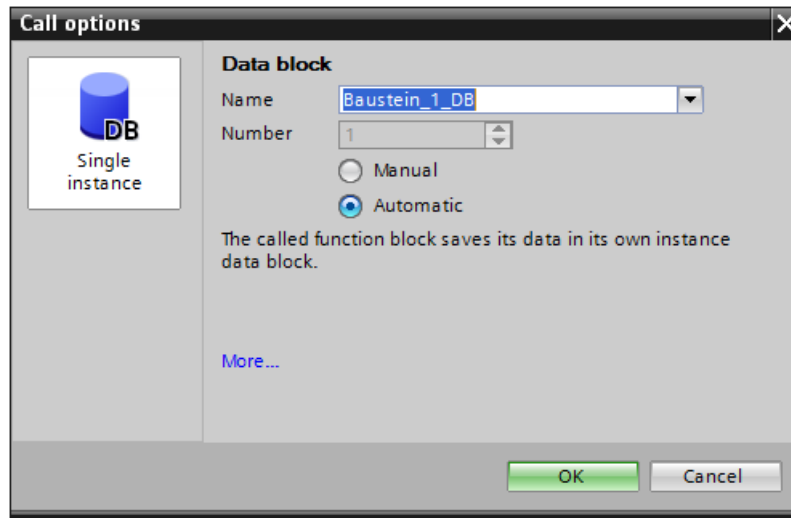


Figure 6-14 Call function block

4. Confirm the call options by clicking OK.
Result: You have called the alarm block in the user program and created an instance alarm.

Creating a text list

To create the text list for the example program, follow these steps:

1. Double-click on the "Text lists" command in the program tree.
The text list editor opens.
2. Double-click "<Add>" in the text lists area.
A new text list is added.
3. Name the text list "level_textlist".
4. Double-click "<Add>" in the text lists area of level_textlist.
A new text list entry is added in the level_textlist text list.
5. Enter the alarm text for the maximum fill level in the "Entry" column.
6. Add another entry in the text list.
7. Enter the alarm text for the minimum fill level in the "Entry" column.

Text lists			
Name	Selection	Comment	
level_textlist	Decimal		
<Add new>			

Text list entries of level_textlist			
Range from	Range to	Entry	
0	0	level too low	
1	1	level too high	
<Add new>			

Figure 6-15 Creating a text list

Result: You have created the text list for the alarm text.

Edit alarm text

To edit the alarm text for the example program, follow these steps:

1. Double-click on "PLC_Alarms" in the project tree.
The alarm editor opens.
2. Select the type alarm created for the example.
3. Click in the "Alarm text" column.
4. Open the shortcut menu and select the command "Insert dynamic parameter (text list)".

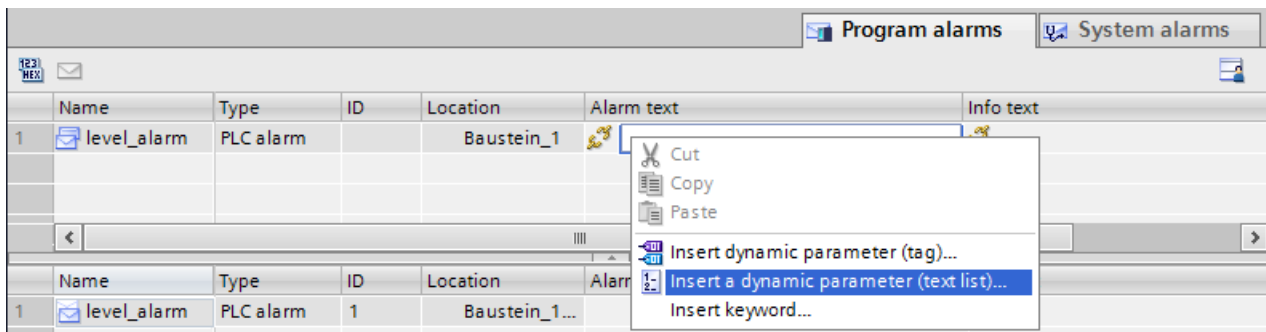


Figure 6-16 Edit alarm text

The window below opens.

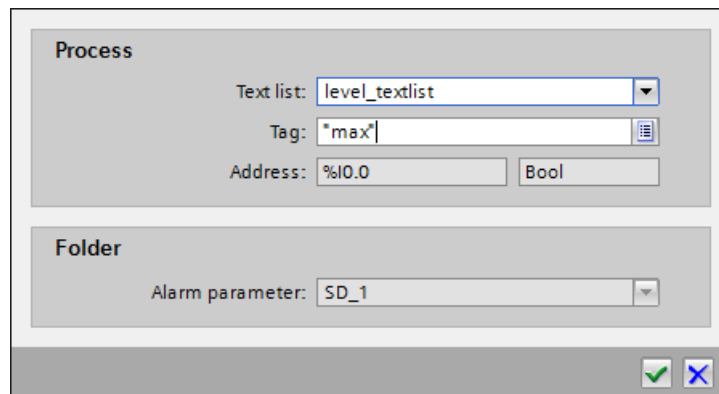


Figure 6-17 Insert dynamic parameter (text list)

5. Select the text list "level_textlist" and the variable "max". Confirm your selection by clicking "OK".

Result: You have created the alarm text for the type alarms.

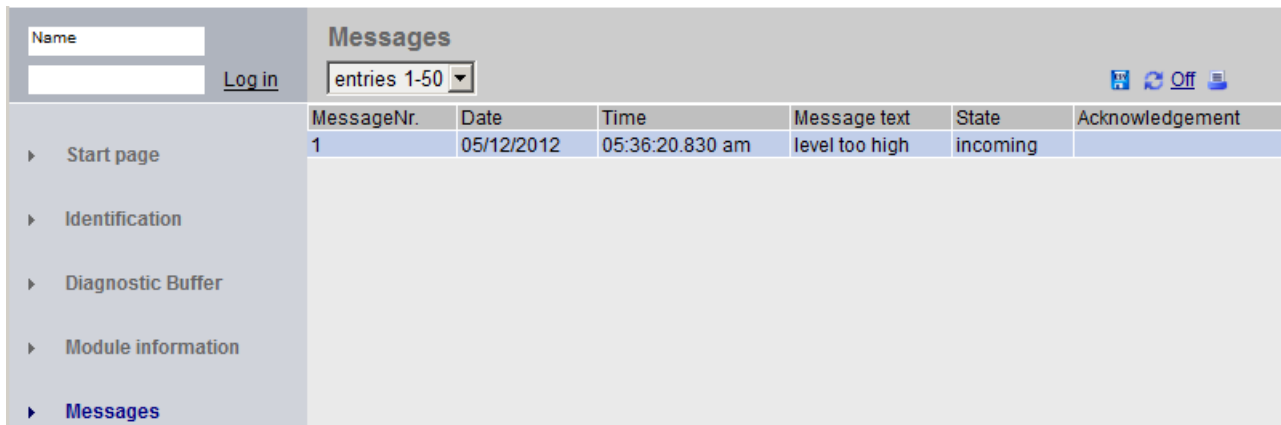
If the variable "max" (associated value 1) is 0, the message text "level too low" is output.

If the variable "max" (associated value 1) is 1, the alarm text "level too high" is output.

6.5.4 Displaying the alarm

Displaying the alarm in the Web server

The figure below shows the display of the alarm in the Web server for both examples.



MessageNr.	Date	Time	Message text	State	Acknowledgement
1	05/12/2012	05:36:20.830 am	level too high	incoming	

Figure 6-18 Displaying the alarm in the Web server

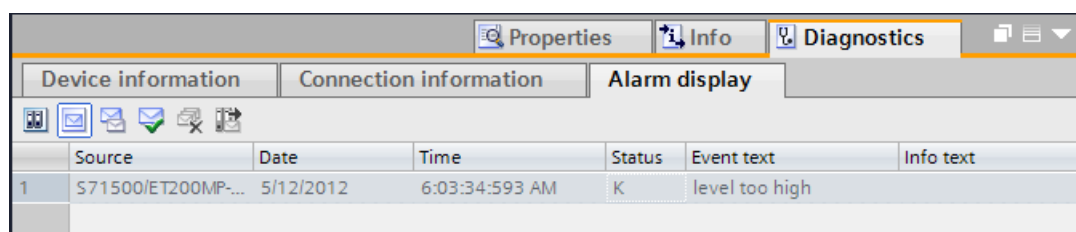
Displaying the alarm in STEP 7

Note

Displaying alarms in STEP 7

To display alarms in STEP 7, enable the option "Receive alarms" in the shortcut menu of the CPU.

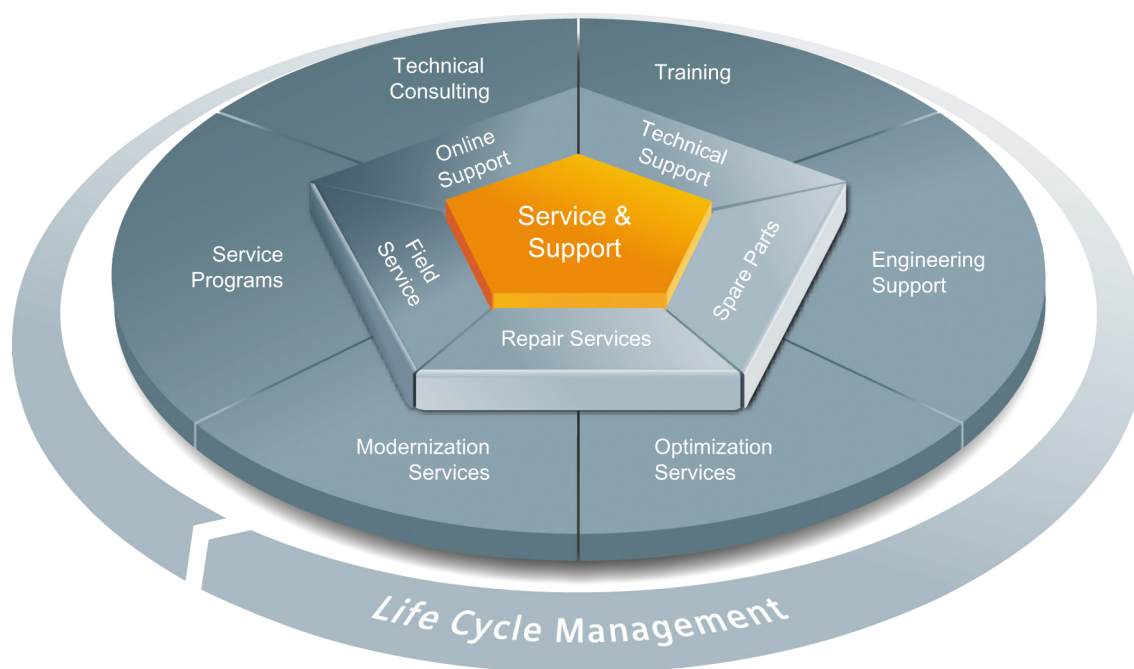
The figure below shows the display of the alarm in STEP 7 for both examples.



	Source	Date	Time	Status	Event text	Info text
1	S71500/ET200MP-...	5/12/2012	6:03:34:593 AM	K	level too high	

Figure 6-19 Display in STEP 7

Service & Support



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In every sector worldwide, plants and systems are required to operate with constantly increasing reliability. We will provide you with the support you need to prevent a standstill from occurring in the first place: with a worldwide network and optimum logistics chains.

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Our service programs are selected service packages for an automation and drives system or product group. The individual services are coordinated with each other to ensure smooth coverage of the entire life cycle and support optimum use of your products and systems.

The services of a Service Program can be flexibly adapted at any time and used separately.

Examples of service programs:

- Service contracts
- Plant IT Security Services
- Life Cycle Services for Drive Engineering
- SIMATIC PCS 7 Life Cycle Services
- SINUMERIK Manufacturing Excellence
- SIMATIC Remote Support Services

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- Reduced downtimes for increased productivity
- Optimized maintenance costs due to a tailored scope of services
- Costs that can be calculated and therefore planned
- Service reliability due to guaranteed response times and spare part delivery times
- Customer service personnel will be supported and relieved of additional tasks
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Glossary

Alarm

An message sent to the operator due to events or states of the system.

Button (WinCC)

Object in WinCC that points out faults in the plant

Channel fault

Channel-related error of an individual channel - an I/O with inputs, for example, wire break or short circuit

Device

Modules with a network connection are referred to as device. Devices are installed on racks where they can be interconnected with other modules.

Diagnostics buffer

A buffered memory area in the CPU; it stores diagnostics events in the order of their occurrence

Firmware of the CPU

In SIMATIC, a distinction is made between the firmware of the CPU and user programs.

The firmware is a software embedded in electronic devices, which means it is permanently connected with the hardware functionally. It is usually saved in a flash memory, such as EPROM, EEPROM or ROM, and cannot be replaced by the user or only with special means or functions.

User program: see glossary entry "User program"

Global screen (WinCC)

A screen that is opened in the system diagnostics window is a global screen.

HMI device

Human Machine Interface, device for visualization and control of automation processes.

HMI diagnostics view (WinCC)

The HMI diagnostics view is an object in WinCC. The HMI diagnostics view can only be used with Comfort Panels and WinCC Advanced RT.

I/O module

Device of the distributed I/O that is used as interface between the controller and the process.

Industrial Ethernet

Guideline for setting up Ethernet in an industrial environment. The main difference to the standard Ethernet is the mechanical current carrying capacity and interference immunity of the individual components.

Memory reset

Procedure to set the memories of the CPU to a defined initial state.

PLC

Programmable Logic Controller: Component of the CNC by which the machine manufacturer coordinates the interaction between the NC requirements (part program), the inputs of the machine operator and the current machine state.

PROFIBUS

Standard for fieldbus communication in automation technology.

PROFINET

Open component-based industrial communication system based on Ethernet for distributed automation systems. Communication technology promoted by the PROFIBUS Users Organization.

Subnet

Part of a network whose parameters must be synchronized with the devices (e.g., with PROFINET). It includes the bus components and all connected stations. Subnets can be linked by means of gateways, for example, to form a network.

System diagnostics

In the SIMATIC environment, diagnostics of devices and modules is collectively referred to as system diagnostics. System diagnostics is used, for example, to monitor the states of the following components in the system: Power supply, device, I/O.

System diagnostics indicator (WinCC)

The system diagnostics indicator is a predefined graphic symbol of the library which alerts you to errors in your plant and displays two states: No error, error

Topology

Structure of a network. Common structures include:

- Linear bus topology
- Ring topology
- Star topology
- Tree topology

User program

In SIMATIC, a distinction is made between user programs and the firmware of the CPU.

The user program contains all instructions, declarations and data by which a plant or process can be controlled. It is assigned to a programmable module (for example, CPU, FM) and can be structured in smaller units.

Firmware: see glossary entry "Firmware of the CPU"

Value status

The value status describes a specific signal state. The value status is constantly updated and cyclically transmitted by the field device as quality statement together with the measured value.

Web server

Software/ communication service for data exchange using Ethernet. The web server provides the documents by means of standardized transmission protocols (HTTP, HTTPS) to a web browser. Documents can be static or dynamic upon request by the web browser composed from different sources by the web server.

WinCC

Windows Control Center: a PC-based process visualization system

WinCC Runtime

Component of the basic software WinCC

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