Diagnostics Overview for SIMATIC S7-1200 and S7-1500

TIA Portal, SIMATIC S7-1200, SIMATIC S7-1500

https://support.industry.siemens.com/cs/ww/en/view/109752283

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Table of contents

1 Diagnostics overview

1.1 Introduction

Diagnosis is the precise determination of the cause and location of an error in a technical system. Diagnostics is the discipline or practice of diagnosis; it is a component of error management with the phases error detection, error diagnosis, error compensation and error correction.

Diagnostics reduces downtimes and thus contributes to increasing the productivity of the machine. Diagnostics supports over the entire lifecycle of a machine, from planning to operation and maintenance.

Diagnostics essentially comprises the diagnosis of all system components, the monitoring of process sequences and the diagnosis of program errors.

1.2 Use cases for diagnostics

System diagnostics (diagnosis of faults of electrical controller components)

In the SIMATIC environment, the term "system diagnostics" is used to describe the diagnostics of devices and modules. The faults can be displayed in plain text. This enables maintenance personnel to locate and rectify the error more quickly.

Faulty devices and modules can be determined through diagnostics with the user program. Thus responses to diagnostic messages can also be programmed in the user program and, as a result, undesired machine behavior can be prevented.

Machine and system diagnostics (diagnosis of faults in the production process)

Many faults in running operation of a plant are errors in the production process caused by mechanical or electrical components.

With an efficient plant-specific diagnosis of process faults and information on the location of the fault, the cause of the fault and troubleshooting information, faults can be quickly identified and rectified.

The error bits of the machine and system diagnostics can be queried in the user program, in order to stop the machine in the event of certain faults, for example.

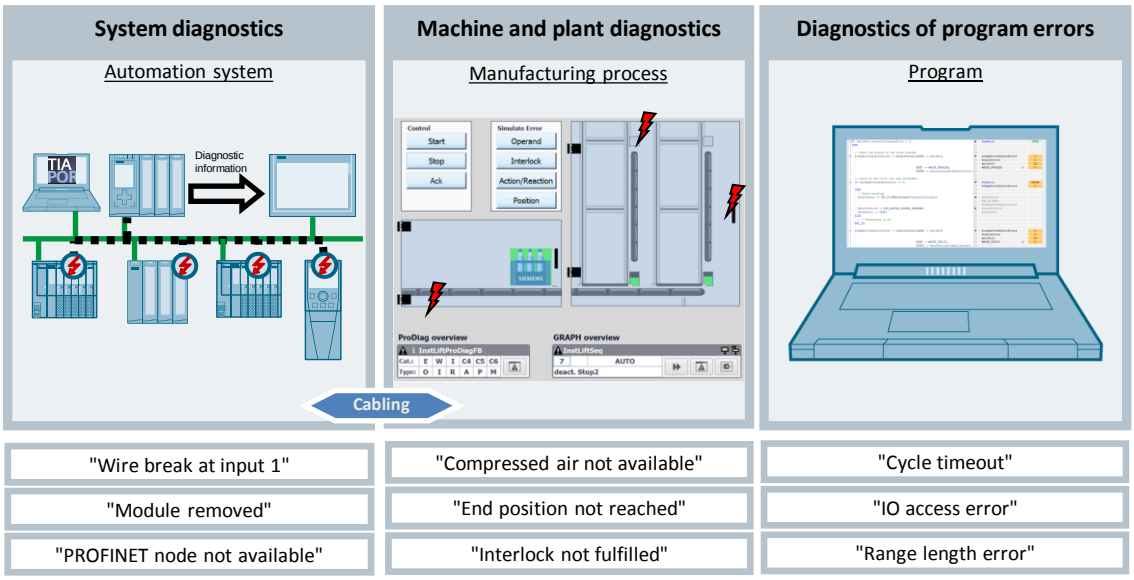
Diagnostics of program errors (analysis and elimination of programming errors)

Programming errors occur not only during commissioning, but also during operation if, for example, array limits are exceeded due to incorrect parameters.

With a development environment that offers possibilities for analyzing programs, errors in the program can be quickly localized and eliminated.

The figure below provides an overview of the use cases for diagnostics. Possible errors are listed for each use case.

Figure 1-1: Use cases for diagnostics



Objectives / advantages of diagnostics

With diagnostics you achieve the following:

- Increased availability through fast error detection and error rectification
- Reduced costs through less downtime
- Increased quality through error avoidance
- Reduced time for commissioning

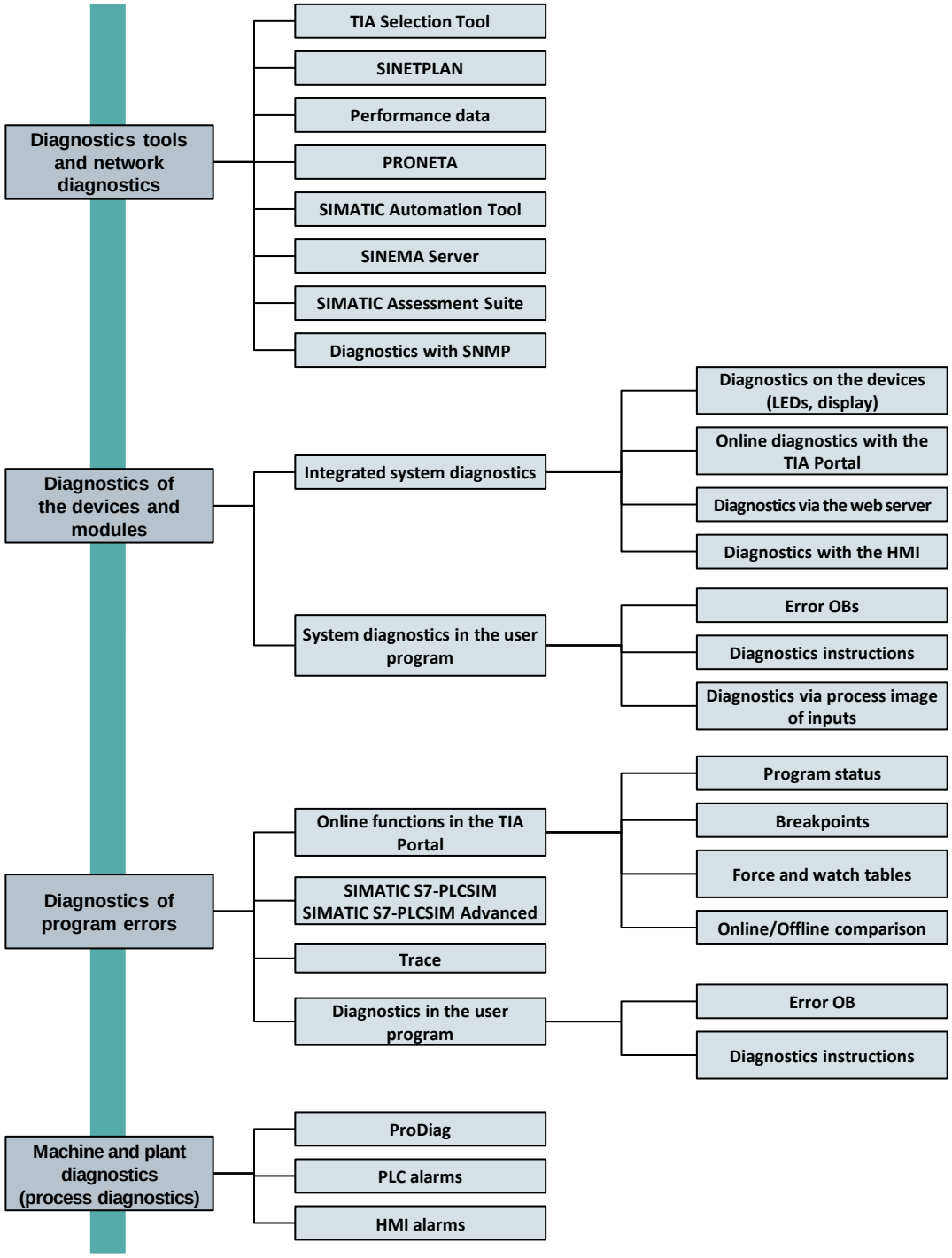
Restrictions

The diagnostic functions in this document are described using SIMATIC S7-1500 CPUs and Comfort Panels as the examples.

1.3 Diagnostics options

The figure below shows an overview of the diagnostic options depending on the use cases.

Figure 1-2: Overview of the diagnostic options



1.4 Diagnostics over the entire lifecycle

Diagnostics play an important role in the entire lifecycle of a plant. Starting in the planning stage, the suitable hardware is selected that meets the diagnostic requirements, e.g. wire break monitoring. When control cabinets are configured, the distributed I/O and its components can be checked. On the engineering side the foundation for diagnostics is planned and programmed during the commissioning phase and in operation.

The table below provides an overview of the diagnostic options over the entire lifecycle of a machine or plant.

Table 1-1: Overview of the diagnostic options over the entire lifecycle

Diagnostics options / lifecycle	Planning	Cabinet configuration	Engineering	Commis-sioning	Maintenance / operation
TIA Selection Tool	X		X		
SINETPLAN	X			X	X
Performance data	X				
PRONETA		X		X	X
SIMATIC Automation Tool				X	X
SINEMA Server				X	X
SIMATIC Assessment Suite				X	X
Diagnostics with SNMP				X	X
LED / display				X	X
TIA Portal online function			X	X	X
TIA Portal communications connections			X	X	X
TIA Portal program			X	X	X
HMI			X	X	X
Web server			X	X	X
ProDiag			X	X	X
Alarms			X	X	X
Trace			X	X	X

2 Diagnostics tools and network diagnostics

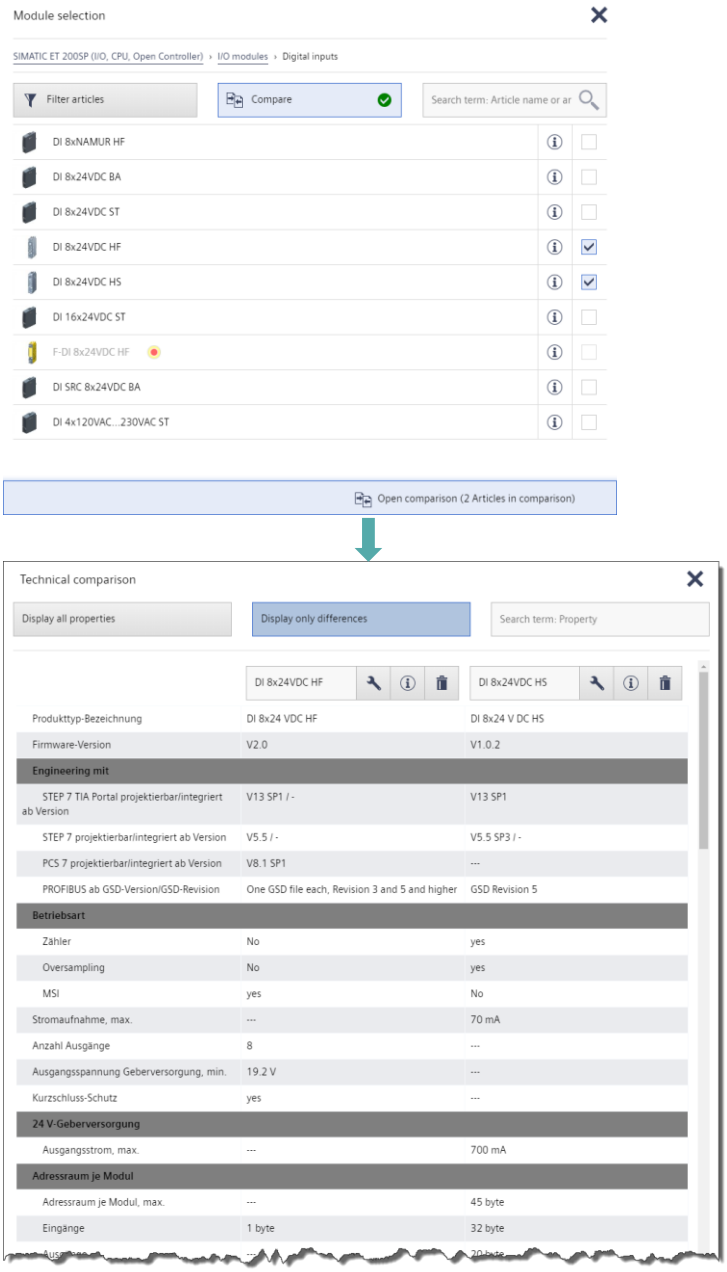
2.1 TIA Selection Tool

The free-of-charge TIA Selection Tool supports you in configuring your projects. The TIA Selection Tool is an intelligent product catalog for Siemens Industry products and offers extensive functionalities for guided preparation of hardware and software configurations.

With the TIA Selection Tool, assisted by intelligent wizards you can select, configure and order the suitable hardware for your diagnostic requirements as early as the planning phase.

The match option helps you select the module with the desired diagnostic options between modules of the same type:

Figure 2-1: Match option



The created configuration can be imported into TIA Portal and EPLAN. Thus you only have to configure the plant once.

There are two versions of the TIA Selection Tool:

- For download and execution on Windows computers (from Win 7).
- A cloud version that is launched from mobile devices, directly in the browser.

Note Additional information concerning the TIA Selection Tool is provided at https://w3.siemens.com/mcms/topics/en/simatic/tia-selection-tool

2.2 SINETPLAN – Siemens Network Planner

SINETPLAN supports you in planning and designing PROFINET networks.

The tool calculates the anticipated data traffic in the network and identifies critical sections where the network load is too high.

SINETPLAN simulates both real-time PROFINET traffic between I/O controllers and I/O devices (real-time communication) and the data traffic between standard Ethernet nodes (non-real time communication, e.g. TCP/IP data).

Thus you obtain an overview of the dynamics and capacity utilization of the planned network prior to installation and commissioning.

SINETPLAN displays critical network sections. With minimal effort you can re-plan and start the simulation again.

Through this measure you can optimize the planned network and avoid the situation that problems do not become evident until the commissioning phase or in productive operation.

This increases the availability of the production plant. Operational reliability can be increased.

Note Further information concerning SINETPLAN is provided on the product page, https://www.siemens.com/sinetplan

in the operating manual "SINETPLAN Siemens Network Planner", https://support.industry.siemens.com/cs/ww/en/view/109485570

and in the overview "Information and articles about SINETPLAN". https://support.industry.siemens.com/cs/ww/en/view/109483229

You can download SINETPLAN at the following link. https://support.industry.siemens.com/cs/ww/en/view/109739454

2.3 Performance data for communication

Even in the planning phase of a plant it is important to estimate the I/O response time in the centralized or distributed structure or the transmission time for data communication between I/O controllers for PN and DP master for PROFIBUS DP or an Industrial Ethernet network.

Note Additional information concerning performance data is provided in the application example "Performance data overview" https://support.industry.siemens.com/cs/ww/en/view/25209605

2.4 PRONETA

The PROFINET network analyzer PRONETA is a simple tool for fast analysis and configuration of PROFINET networks and for simple testing of distributed ET 200 I/O systems and other PROFINET components. It is particularly suitable for tasks involving the commissioning of PROFINET systems:

- The "network analysis" provides a fast overview of the devices connected to PROFINET. It has simple configuration options, such as setting network parameters or assigning a device name to the devices, as well as powerful mechanisms for comparing multiple topologies, for example, to compare an "ideal" topology intended for a project with the actual plant.
- Reading of I&M data: Provision of, for example the precise module designation, incl. order number and the FW / HW version of the modules
- The "I/O Test" is simple procedure for checking the I/O wiring on ET 200 PROFINET I/O systems, without the necessity for an I/O controller. The "I/O Test" makes it possible to check the wiring and document the test procedure.
- Verification and documentation of the installed modules in the I/O test protocol through unique MAC address and serial numbers.

Note

Further information concerning PRONETA is provided on the product page https://www.siemens.com/proneta

and in the application example "PRONETA Commissioning and Diagnostics Tool for PROFINET."
https://support.industry.siemens.com/cs/ww/en/view/67460624

2.5 SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to configure, operate, maintain and document TIA automation components. The SIMATIC Automation Tool works independently of a TIA Portal installation. Thus it is a perfect complement for commissioning, maintenance and service.

2.5.1 Areas of application

Commissioning

A typical example of the use of the SIMATIC Automation Tool in the commissioning phase is the automated download of controller and HMI data from TIA Portal projects and adaptation of the IP addresses with mass operations to a large number of identical control cabinets. This is usually the case for large solar parks.

Maintenance

If changes must be made in running operation, whether due to modified mechanical structures or due purely to technical programming, the SIMATIC Automation Tool enables maintenance personnel to load the changes into the CPU without TIA Portal. If production loss and downtimes play a crucial role, the last executable state can be exported with the SIMATIC Automation Tool before changes are made to the plant; this executable state can then be accessed again in the event of error.

Service / diagnostics

For service, the SIMATIC Automation Tool offers a number of functionalities to obtain a fast and easy overview of the reachable and installed automation components with the respective versions (firmware, serial number, etc.) and to archive this overview for revisions.

2.5.2 Licensing

A software license is required to use the SIMATIC Automation Tool in its full function scope.

Without a license, SIMATIC Automation Tool has the following restrictions:

- Only one procedure can be executed in one device at a time
- The API (Application Programming Interface) cannot be used for the programming of user-defined applications.
- Only one device is updated.

2.5.3 Diagnostic functions

Network

- Browse the network and create a device table with the devices accessible in the network. The device table includes CPUs, modules, HMI devices and other Siemens devices. You can save the device table in a *.sat project file or a .csv file with open text.
- Identify devices with flashing LEDs or HMI screens.

System diagnostics and system maintenance

- Back up/restore data to/from a backup file for CPUs and HMI devices.
- Display the diagnostic buffer of a CPU.
- Overall reset of the CPU memory.
- Loading service data from a CPU.
- Format the SIMATIC memory card in a CPU.
- Reset devices to factory settings
- Document and store network information in a. csv file with standard text or in a password-protected. sat file.

Note

Further information and links to the SIMATIC Automation Tool are provided on the product page
http://www.siemens.com/simatic-automation-tool

and in the "SIMATIC Automation Tool user guide".
https://support.industry.siemens.com/cs/ww/en/view/109751152

You can download the SIMATIC Automation Tool at the following link.
https://support.industry.siemens.com/cs/ww/en/view/98161300

2.6 SINEMA Server

The SINEMA Server software was specially developed for industrial applications. With the SINEMA Server software, networks in an automation environment can be analyzed and monitored using standardized diagnostics options, such as SNMP and PROFINET, for example. The collected data is stored in a long-term archive and can thus be evaluated and displayed as required. In addition, the network diagnostics that are created can be seamlessly integrated into HMI/SCADA systems (e.g. WinCC, PCS 7) via OPC and web functions. Redundant PCS 7 architectures can also be detected and displayed via SINEMA Server.

SINEMA Server provides maximum transparency in industrial networks through automatic topology recognition, constant network monitoring, as well as comprehensive diagnostics and reporting functions. Network diagnostics can be easily integrated into HMI/SCADA systems, such as WinCC, as well as third-party systems.

SINEMA Server also enables complete integration of the topology in the HMI/SCADA system via a web browser. Warnings and error messages can be transmitted via the integrated OPC interface.

Licensing

Thanks to different license sizes (50, 100, 250, 500 nodes) with SINEMA Server even smaller and larger networks can be efficiently and easily monitored. If more nodes are required, any number of them can be monitored via a central SINEMA server, for example, individual production cells can be centrally monitored by a single SINEMA Server system.

Note

Further information and links to SINEMA Server are provided on the product page,
http://www.siemens.com/sinema-server

in the operating manual "Network Management SINEMA Server",
https://support.industry.siemens.com/cs/ww/en/view/109748925

under "GettingStarted: Understanding and Using SINEMA Server V14".
https://support.industry.siemens.com/cs/ww/en/view/109746780

and in the application example "Line Integration in the Food and Beverage Industry – Network Planning and Diagnostics"
https://support.industry.siemens.com/cs/ww/en/view/109476976

2.7 SIMATIC Assessment Suite - Data Collector (SAS-DC)

The SIMATIC Assessment Suite - Data Collector (SAS-DC) - formerly known as SIMATIC Diagnostic Tool (SDT) - enables you to compile diagnostic and system information from a local system or from systems in the network, conveniently and with minimal effort. This diagnostic and system information is stored in system-specific archives.

Note Further information concerning the SIMATIC Assessment Suite is provided in the FAQ "How can you efficiently collect and diagnostics and system information"
https://support.industry.siemens.com/cs/ww/en/view/65976201

2.8 Diagnostics with SNMP

The Simple Network Management Protocol (SNMP) is a UDP/IP-based, open protocol for monitoring, control and administration of Ethernet networks. SNMP was developed to simplify management functions and to enable a transparent exchange of data between different network components. UDP/IP is a simple, connectionless and unsecured protocol of the Internet Protocol Suite.

The following management functions can be performed with SNMP:

- Monitoring of network components
- Diagnostics of network components
- Error detection and error notification
- Remote configuring of network components

Note Further information concerning SNMP is provided in the manual "SIMATIC NET Network Management Diagnostics and Project Planning with SNMP"
https://support.industry.siemens.com/cs/ww/en/view/102401112

2.9 Network and Communication diagnostics

For network and communication diagnostics further tools and functions are at your disposal.

Hinweis Further information concerning network and communication diagnostics is provided in the application example "Overview: Diagnostics Tools for SIMATIC and SCALANCE"
https://support.industry.siemens.com/cs/ww/en/view/21566216

3 Diagnostics of the devices and modules

3.1 Integrated system diagnostics

In the SIMATIC environment, the term "system diagnostics" is used to describe the diagnostics of devices and modules, e. g. distributed I/O, including modules, drives, network connections and network components.

All SIMATIC products have integrated diagnostic functions that enable faults to be detected and rectified. If diagnostics are configured, the components automatically report a fault in the event of an error and provide additional detailed information. Through integrated system diagnostics you can minimize unscheduled downtimes.

The SIMATIC automation system monitors the following states in the running plant:

- Device failure/recovery
- Insert/remove event
- Module fault
- I/O access error
- Channel error
- Parameter assignment error
- Failure of the external auxiliary voltage,
- etc.

Properties of the SIMATIC system diagnostics

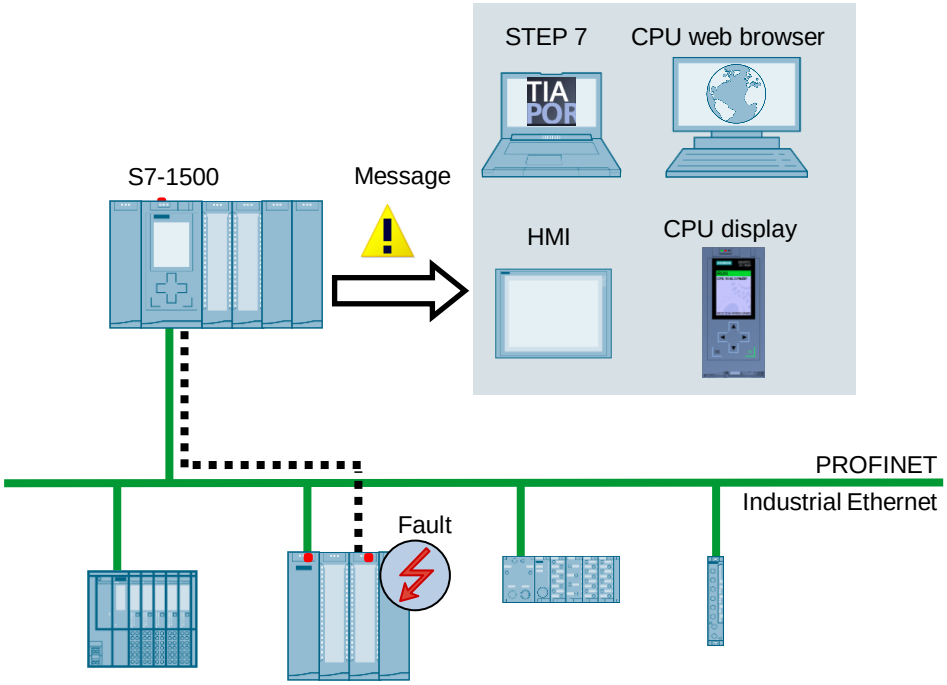
- Integrated as standard in the CPU, the devices and modules.
- System-wide, beyond bus boundaries.
- The source of the error is automatically localized.
- The cause of the fault is output automatically in plain text.

Advantages of contiguous diagnostics from the field level to the management level

The various diagnostic media provide you with a uniform view of the maintenance-relevant information for all automation components of the plant. System status (module and network status, alarms concerning system errors) are available throughout the system in a uniform presentation.

- The system diagnostics is integrated in the firmware of the CPU and works independently of the cyclic user program.
- System diagnostics is also available when the CPU is in STOP mode.
- Faults are detected and signaled to the higher-level HMI devices, the web server of the CPU, the display of the controller, S7-1500 CPU, the LED displays on the module, and to the TIA Portal.

Figure 3-1: System diagnostics



Note

Further information concerning system diagnostics is provided in the application example "System with S7-1500 and TIA Portal",
https://support.industry.siemens.com/cs/ww/en/view/68011497

in the function manual "SIMATIC S7-1500, ET 200MP, ET 200SP, ET 200AL, ET 200pro Diagnostics"
https://support.industry.siemens.com/cs/ww/en/view/59192926

and in the TIA Portal Tutorial Center in the "Diagnostics" module.
https://support.industry.siemens.com/cs/ww/en/view/106656707

3.1.1 Diagnostics on the devices

Diagnostics via LED

Most hardware components (e. g. CPU, distributed I/O, modules) provide information about their operating status and internal and external errors via their LEDs. Diagnostics though LEDs is a first resource in delimiting errors.

Diagnostics via the CPU display

Every S7-1500 CPU has a hinged front panel with a display and operating buttons. On the display of the CPU you can read out status and diagnostics information in various menus. In the "Diagnostics" menu you can directly read out the information in the diagnostics buffer or you can display queued messages. In the "Modules" menu, the module status is displayed symbolically.

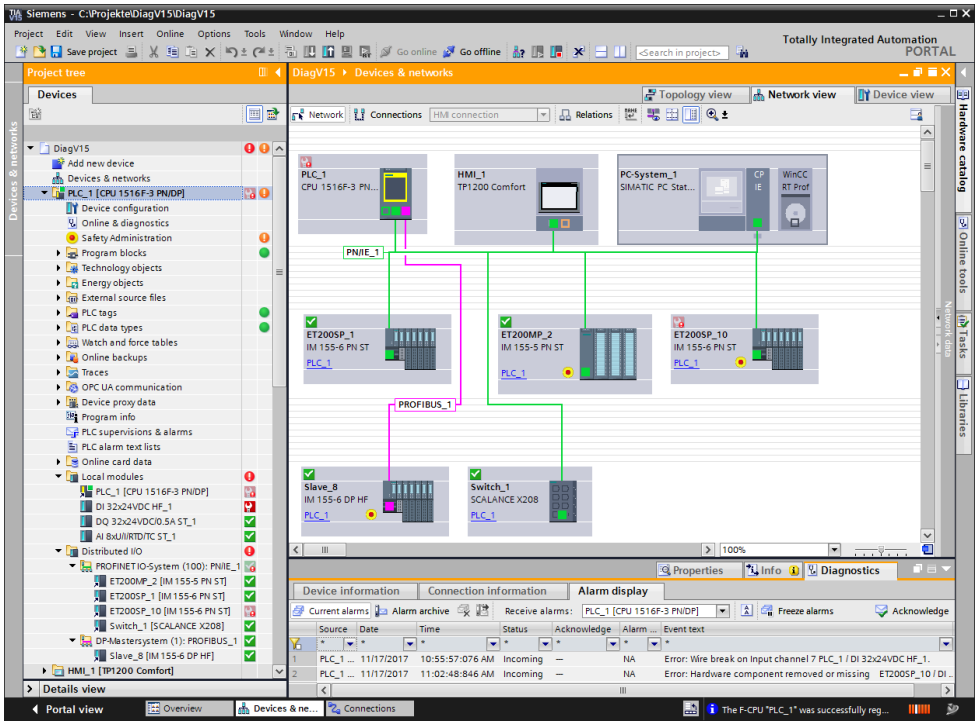
3.1.2 Online diagnosis with the TIA Portal

Symbolic presentation of the diagnostic information

When the online connection to a device is established in the TIA Portal, the diagnostic status of the device, that of its subordinate components, and if necessary its operating state are also determined. In the TIA Portal The diagnostic status is displayed symbolically in the following views:

- Project navigation
- Device view:
- Network view
- Topology view

Figure 2: Diagnostic information in the TIA Portal



Messages in the Inspector window

In the "Diagnostics" tab of the Inspector window you obtain information concerning diagnostic events of the integrated system diagnostics and the configured alarm events.

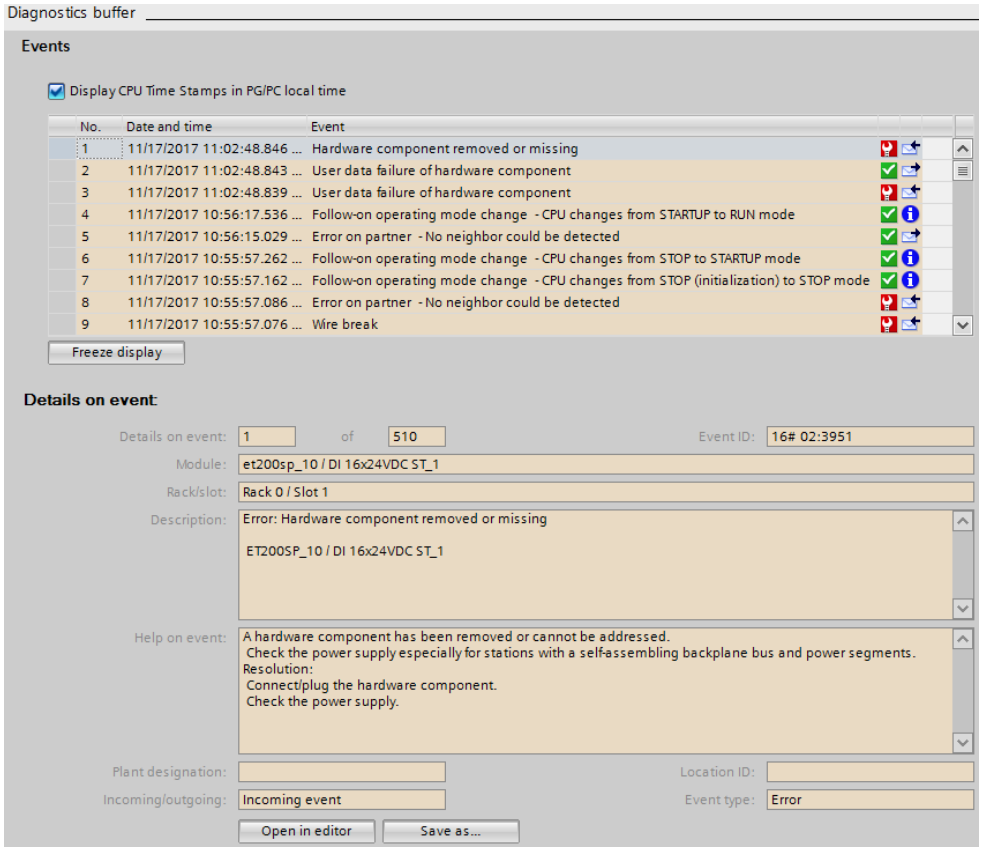
Note Messages are only shown in the "Alarm display", when

- The TIA Portal is connected to the CPU online.
- The "Receive alarms" command is activated in the context menu of the CPU.

Diagnostics buffer

In every CPU and in several other modules there is a diagnostics buffer, in which more detailed information concerning all diagnostic events is entered in the sequence of occurrence. With the TIA Portal you can read out diagnostic information from the diagnostics buffer.

Figure 3: Diagnostics buffer of a CPU



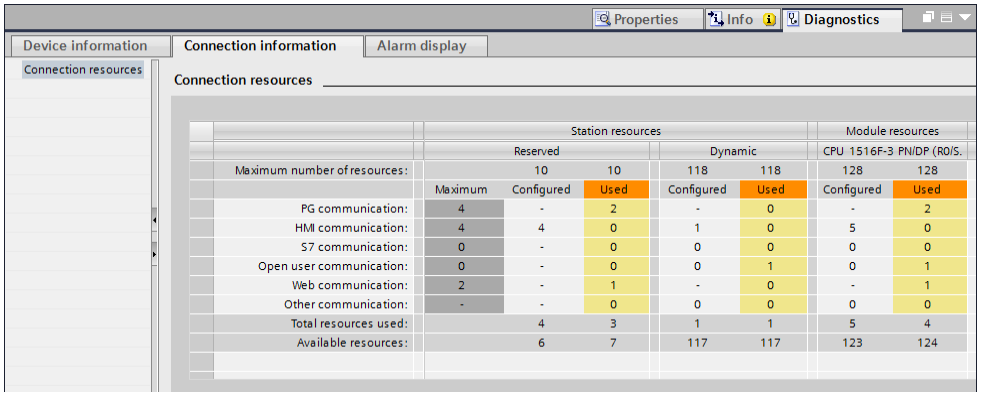
Note Further information concerning system diagnostics is provided in the application example "System Diagnostics with S7-1500 and TIA Portal" https://support.industry.siemens.com/cs/ww/en/view/68011497

Connection information of the CPU

A varying number of connection resources is available depending on the CPU type. Ultimately, the number of connection resources is authoritative for the number of usable connections of the CPU communication.

With the TIA Portal you can read the currently used connection resources of the CPU connected online in the "Diagnostics > Connection information" section of the Inspector window.

Figure 3-4: Connection information of the CPU

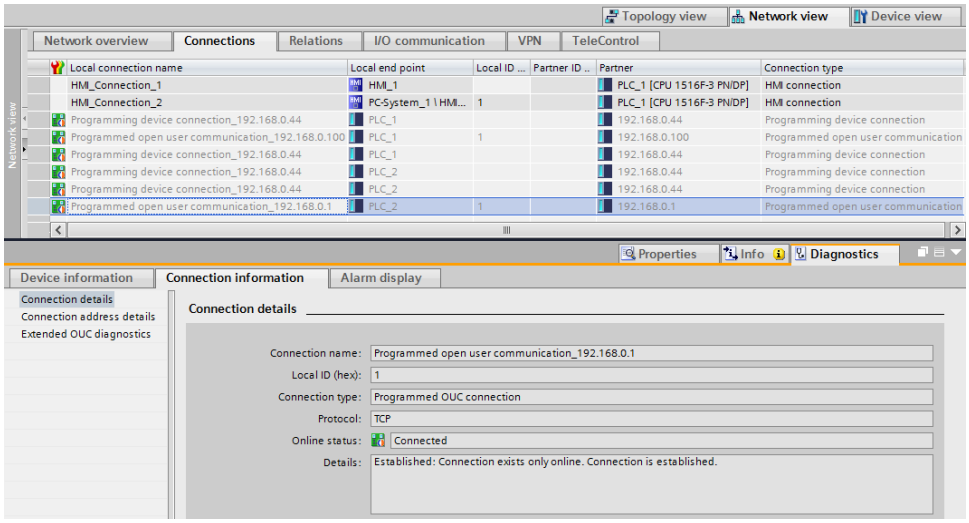


Connection table and connection information

In the Connection Table you can symbolically display the connection status of the communications connections created in the project.

Detailed information about the selected connection is displayed in the "Diagnostics > Connection information" section of the Inspector window.

Figure 3-5: Diagnostics buffer of a CPU



Note

Further information concerning connection diagnostics, is provided in the manual "SIMATIC S7-1500, ET 200MP, ET 200SP, ET 200AL, ET 200pro Communication"

https://support.industry.siemens.com/cs/ww/en/view/59192925

3.1.3 Diagnostics via the web server

With the web server of the CPU you have the option of querying the diagnostic information of the devices and modules via an Internet browser. Thus, evaluations and system diagnostics are possible from any end devices, e.g. PC or smartphone, without an installed TIA Portal.

The web server of the CPU is disabled by default. To use the functionality of the web server, the web server must first be activated in the properties of the CPU. In the user administration of the web server, you assign the access rights to the diagnostic pages to the users by activating the selection"... Query diagnostics" under Access level.

To read values in watch tables and write them to the CPU, for example, you must also configure a user with appropriate access rights in the user management of the web server.

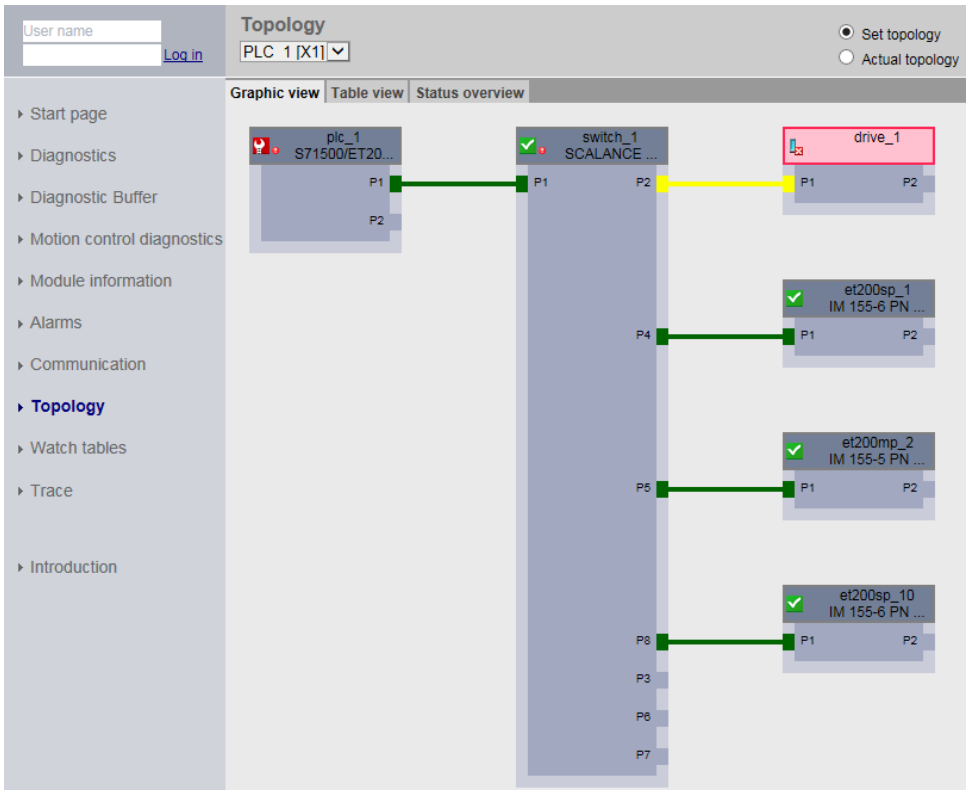
The CPU web server offers the following diagnostics options:

- Home page
- Diagnostics
  - Identification
  - Program protection
  - Memory
  - Runtime information
  - Fail-safe
- Diagnostics buffer
- Motion Control diagnostics
  - Diagnostics
  - Service overview
- Module state
- Alarms
- Communication
  - Parameter
  - Statistics
  - Connection resources
  - Connection status
- Topology
  - Graphic view
  - Table view
  - Status overview
- Watch tables
- Records (trace)

User pages can be used to create user-defined diagnostics pages.

The Figure below shows the "Topology" web page Additional web pages can be accessed via the left navigation bar.

Figure 3-6: "Topology" web page



Note

Further information concerning the web server is provided in the function manual "S7-1500, ET 200SP, ET 200pro Web Server"
https://support.industry.siemens.com/cs/ww/en/view/59193560

Further information concerning user pages is provided in the application example "Creating User-Defined Web Pages on S7-1200 / S7-1500"
https://support.industry.siemens.com/cs/ww/en/view/68011496

Information concerning analyzing of runtime behavior with user pages is provided in the application example "SIMATIC S7-1500 Profiling"
https://support.industry.siemens.com/cs/ww/en/view/109750245

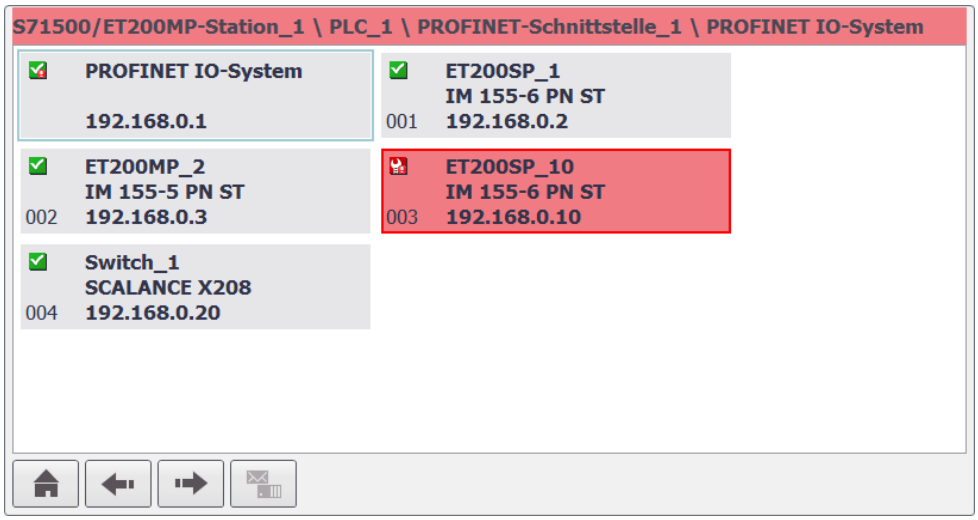
3.1.4 Diagnostics with the HMI

Various objects are available for displaying diagnostic information on the HMI.

System Diagnostics display / System Diagnostics window

The objects, "System Diagnostics display" and "System Diagnostics window" provide a diagnostics overview of the status of the available diagnostics-enabled devices in your system. In the event of a fault you navigate through the various views directly to cause of the fault in the detail view of the faulty PCB assembly.

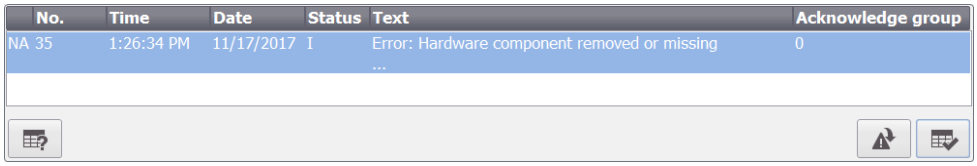
Figure 3-7: Distributed I/O view of the System Diagnostics display



Alarm display / Alarm window

The "Alarm display" and "Alarm window" objects display the alarms on the HMI device. The alarms of the integrated system diagnostics and the user-defined alarms are displayed here.

Figure 3-8: Alarm view



Note

Further information concerning system diagnostics with the HMI is provided in the application example "System Diagnostics with S7-1500 and TIA Portal" https://support.industry.siemens.com/cs/ww/en/view/68011497

Information concerning the alarms is provided in section 5.1

3.1.5 Diagnostics for SIMATIC Industrial PCs (IPCs)

SIMATIC Industrial PCs offer different additional diagnostics options.

Diagnostics information concerning temperature, fans, battery voltage, and data carriers of the IPC can be queried with the TIA Portal or with the integrated web server.

In addition, Siemens also offers other software for evaluation of the SIMATIC Industrial PCs.

SIMATIC IPC DiagBase

The SIMATIC IPC DiagBase software is pre-installed on each SIMATIC IPC. With this software you can monitor your SIMATIC IPC locally and thus detect potential system failures in good time, plan maintenance measures and thus avoid plant downtimes.

With SIMATIC IPC DiagBase you can monitor the following:

- Temperatures
- Fans
- Battery voltage
- Data storage medium

The hour meter informs you of the total system runtime.

SIMATIC IPC DiagMonitor

The SIMATIC IPC DiagMonitor includes the functionality of the SIMATIC IPC DiagBase, and of other additional features.

It enables networked monitoring of different IPCs, either from a central station or, or however all IPCs monitor each other.

With the SIMATIC IPC DiagMonitor you can monitor your plants worldwide.

If there is an event the SIMATIC IPC DiagMonitor sends emails and SMS messages.

It exchanges data with different systems via SNMP and OPC.

And thanks to its integrated web server, it allows access to data via web browser from a wide variety of devices, such as smartphones or tablets.

Note Further information concerning diagnostics for SIMATIC IPCs can be found on the product page "SIMATIC IPC DiagMonitor"
https://w3.siemens.com/mcms/pc-based-automation/en/industrial-pc/expansion_components_accessories/pc-diag-monitor/Pages/Default.aspx

and in the application example "Diagnostics of SIMATIC IPCs (with IPC DiagBase, IPC DiagMonitor, WinCC (TIA Portal) or WinCC V7)"
https://support.industry.siemens.com/cs/ww/en/view/109478242

3.2 System diagnostics in the user program of the CPU

You can configure responses to diagnostics events in the user program. For example, you can specify that your plant will be stopped when certain diagnostics events occur.

3.2.1 Error OBs for diagnostics of the devices and modules

For evaluation of error events of the devices and modules the following error OBs are available to you in STEP 7:

Table 3-1: Overview of the error OBs for diagnosis of the devices and modules

Error OB	Description
Diagnostics alarm OB (OB 82)	The operating system of the S7-1500 CPU calls the diagnostics alarm OB when a module with diagnostics capability detects a change in its diagnostics status.
Insert/remove module OB (OB 83)	The operating system of the S7-1500 CPU calls the insert/remove module OB when a configured and not deactivated module or sub-module of the distributed I/O is inserted or removed.
Rack error OB (OB 86)	The operating system of the S7-1500 CPU calls the rack error OB if a DP master system or a PROFINET I/O system or a DP slave or an I/O device fails or recovers.

The error OBs are called as interrupt in the event of error. When an interrupt is triggered, the faulty PCB assembly automatically enters diagnostics data and its start address into the start information (local variables) of the error OB.

In the user program of the error OBs, you evaluate the start information and can thus make an exact diagnosis of the error that has occurred.

Additional diagnostics data of the faulty module (on which channel the error occurred, what error is involved) can be read out using the "RALRM" instruction in the diagnostics alarm OB, for example.

Note An example of "RALRM" is provided in the FAQ "How do you implement module and channel diagnostics in the SIMATIC S7-1200/S7-1500 user program?" https://support.industry.siemens.com/cs/ww/en/view/109480387

3.2.2 Diagnostics instructions

If you want to determine the diagnostics information of a device in the user program, the following instructions are available in STEP 7:

Table 3-2: Overview of the diagnostics instructions for diagnosis of the devices and modules

Instruction	Description
RDREC	Reads data records of a component (PCB assembly or module) of a DP slave/IO device that can contain error information. RDREC works asynchronously, i.e. processing extends over several calls.
RALRM	Reads the start information of the OB when the diagnostics alarm OB (e.g. OB 82) is called and provides information on the cause of the error and location of the error.
DPNRM_DG	Reads the current diagnostics data of a DP slave (DP standard diagnosis).

Instruction	Description
RD_SINFO	Reads start information of the current OB and provides general error information.
LED	Reads the status of the module's LED.
Get_IM_Data	Reads the information & maintenance data of the CPU. Get_IM_Data works asynchronously, i.e. processing extends over several calls.
GET_NAME	Reads out the name of a PCB assembly
GetStationInfo	Reads out information of an I/O device
DeviceStates	Outputs the state of all devices of an I/O system.
ModuleStates	Outputs the state of all modules of a device.
GEN_DIAG	Generates diagnostics information To generate diagnostics information the module or sub-module is identified with the logical address.
GET_DIAG	Provides diagnostics information. To provide diagnostics information, the module or sub-module is selected.
T_DIAG	Provides diagnostics information and status information for a connection. T_DIAG works asynchronously, i.e. processing extends over several calls.

Note

Further information concerning the diagnostics instructions is provided in the system manual "STEP 7 and WinCC Engineering V15".
https://support.industry.siemens.com/cs/ww/en/view/109755202

Examples of diagnostics in the user program are provided in the application examples "Diagnostics in the User Program with S7-1500",
https://support.industry.siemens.com/cs/ww/en/view/98210758

"Diagnostics in the User Program S7-1200"
https://support.industry.siemens.com/cs/ww/en/view/109483251

and "PROFINET IO – Diagnostics Processing in the User Program".
https://support.industry.siemens.com/cs/ww/en/view/24000238

An example of "RALRM" is provided in the FAQ "How do you implement module and channel diagnostics in the SIMATIC S7-1200/S7-1500 user program?".
https://support.industry.siemens.com/cs/ww/en/view/109480387

Further information on PROFINET IO diagnostics and diagnostics data sets is provided in the programming manual "From PROFIBUS DP to PROFINET IO".
https://support.industry.siemens.com/cs/ww/en/view/19289930

Examples for AS-i diagnostics can be found in the application examples "Diagnostic block for AS-i master modules with visualization via HMI or web browser",
https://support.industry.siemens.com/cs/ww/en/view/50897766

"Diagnostic block for CM AS-i Master ST and F-CM AS-i Safety ST in ET 200SP with visualization via HMI or web browser",
https://support.industry.siemens.com/cs/ww/en/view/109479103

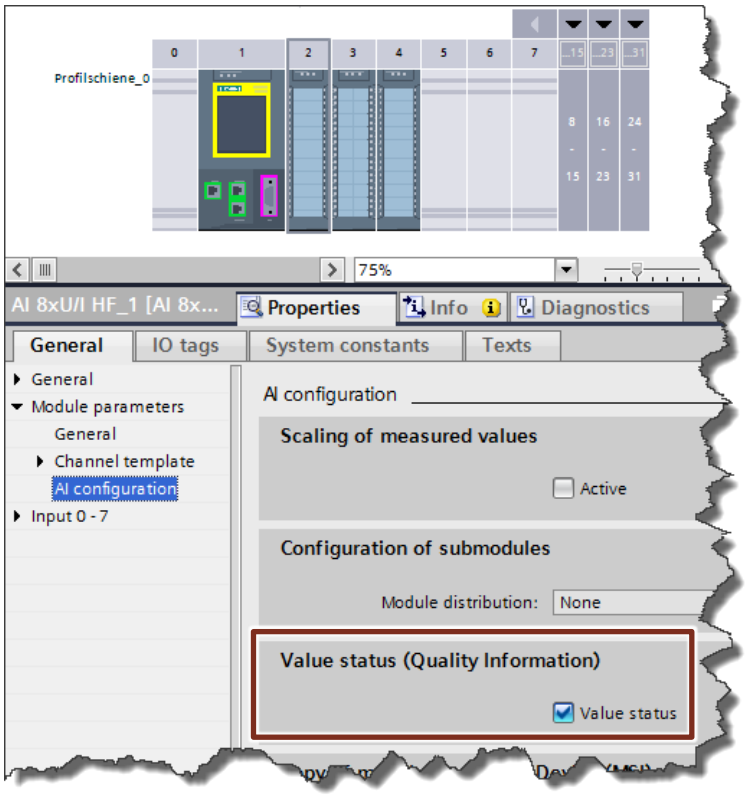
and "Diagnostic block for F-CM AS-i Safety ST in ET 200SP with visualization via HMI or web browser"
https://support.industry.siemens.com/cs/ww/en/view/109749426.

3.2.3 System diagnostics via process image of the inputs (value status)

To ensure correct processing of input and output data in the event of faults synchronously with read-in of input and output data, some modules of the SIMATIC family offer the so-called value status (QI = Quality Information) for evaluation. Detailed information on the structure is provided in the appropriate module manuals.

The diagnostics information is transmitted synchronously with the payload via the process image of the inputs. Activate the "Value status" option box in STEP 7 (see Figure 3-9) in the properties of the I/O module if you want to evaluate the value status of the channel.

Figure 3-9: Activate the value status



If you have activated the value status for an I/O module, this module provides additional information on the value status, in addition to the payload. This information is available directly in the process image of the inputs and can be evaluated with simple binary operations (see Figure 3-11) Each channel is uniquely assigned a bit in the value status. The bit in the value status indicates the validity of the value read-in in the use date.

A variable is created in the Variable Table for the value status.

Figure 3-10: Creating the variables for the value status

TagTableValueState

		Name	Data type	Address
1		valueStateCh0	Bool	%I68.0
2		valueStateCh1	Bool	%I68.1
3		valueStateCh2	Bool	%I68.2
4		valueStateCh3	Bool	%I68.3

The value status can be evaluated in the user program as follows.

Figure 3-11: Program for evaluating the value status

```
1  // Validity check of analog input value
2  IF ("valueStateCh0" = TRUE)
3  THEN
4    // Normalize value
5    #tempNormOut := NORM_X(MIN := 0, VALUE := "valueChannel0", MAX := 27648);
6    // Scale value
7    #convertValue := SCALE_X(MIN := 20.0, VALUE := #tempNormOut, MAX := 150.0);
8  ELSE
9    // Assign substitute value
10   #convertValue := #SUBST_VALUE;
11 END_IF;
```

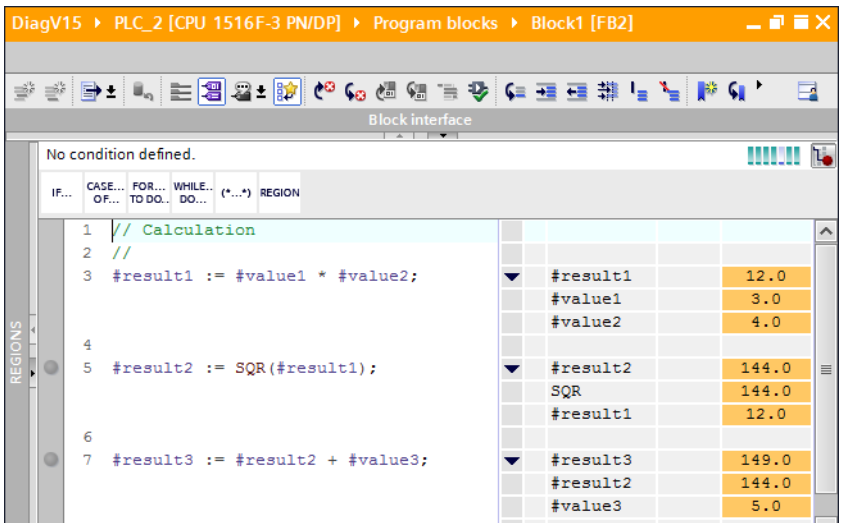
4 Diagnostics of program errors

4.1 Diagnostics with online functions in the TIA Portal

4.1.1 Program status

By monitoring the program status online, you can observe the program execution. In this process you can display the values of the individual operands and the link results (VKE) and thus find and correct logical errors in your program.

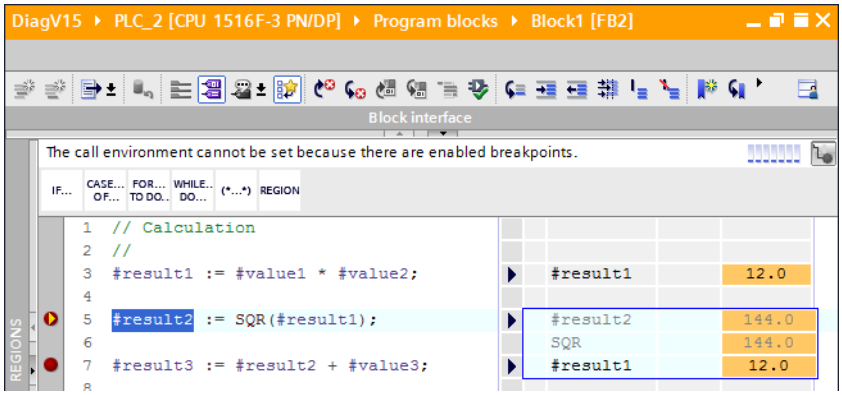
Figure 4-1: Program status



4.1.2 Breakpoints

You can test blocks that you have created in IL or SCL with breakpoints to delimit logical errors step-by-step. To do this, set breakpoints in the program code, at which program execution is stopped, i.e. at the breakpoint the CPU goes into the HOLD operating state and all outputs retain their last state. Then you can execute the program incrementally from breakpoint to breakpoint. Use of breakpoints is recommended for fast analysis before actual commissioning or during the commissioning phase.

Figure 4-2: Breakpoints



Note

During the commissioning phase in particular, ensure that all outputs retain their last state, i.e. that drives continue to run, for example.

Setting breakpoints in the standard user program results in errors in the safety program of an F-CPU, since this goes into the STOP state after the monitoring time is exceeded. Here outputs go into their configured safe state. Nevertheless if you want to use breakpoints for testing, you must first deactivate safety mode.

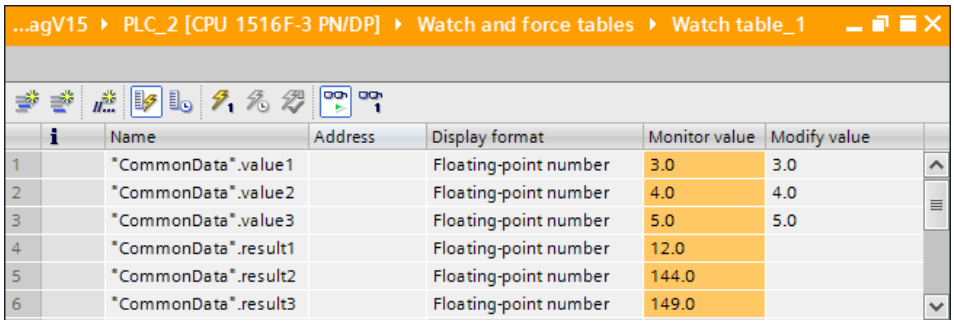
Deactivate or remove all breakpoints after a commissioning process.

4.1.3 Force and watch tables

The force table allows you to observe and force the current values of individual variables of the user program or of a CPU. When forcing, you overwrite individual variables with prescribed values. Thus, you can test your user program and run through various execution situations.

The Watch Table allows you to watch and control the current values of individual variables of the user program or a CPU. You can preassign values to individual variables for testing and thus run through different execution situations. You can also assign fixed values to the peripheral outputs of a CPU in the STOP operating state to check the wiring, for example.

Figure 4-3: Watch Table

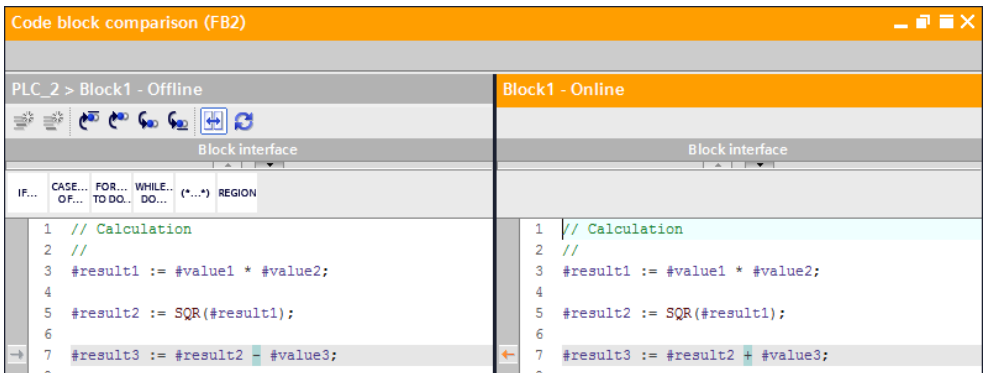


	Name	Address	Display format	Monitor value	Modify value
1	"CommonData".value1		Floating-point number	3.0	3.0
2	"CommonData".value2		Floating-point number	4.0	4.0
3	"CommonData".value3		Floating-point number	5.0	5.0
4	"CommonData".result1		Floating-point number	12.0	
5	"CommonData".result2		Floating-point number	144.0	
6	"CommonData".result3		Floating-point number	149.0	

4.1.4 Offline/Online comparison

You have the option of comparing objects of a CPU program with each other to determine possible differences. Offline/Online comparison compares the objects in the project with the objects of the appropriate online device.

Figure 4-4: Watch Table



4.2 Diagnostics in the user program

4.2.1 Error OBs for diagnostics of the user program

The following error OBs are available in STEP 7 for CPU-wide evaluation of programming errors in the user program:

Table 4-1: Overview of error OBs for diagnosis of the user program

Error OB	Description
Time error OB (OB80)	The operating system of the S7-1500 CPU calls the time error OB if one of the following errors occurs: • Exceeding the cycle time within a cycle for the first time. • The number of requests placed but not completely processed by an OB has reached the configured warning limit. • Expired time-of-day interrupt at re-entry into RUN after the CPU was in HOLD, for example. • Time-of-day interrupt skipped due to moving the time forward by more than 20 s.
Programming error OB (OB 121)	The operating system of the S7-1500 CPU calls the programming error OB if a programming error occurs while processing an instruction of the user program.
I/O access error OB (OB 122)	The operating system of the S7-1500 CPU calls the I/O access error, if an error occurs while processing an instruction of the user program at direct access to I/O data.

In the user program of the error OBs, you evaluate the start information and can thus make an exact diagnosis of the error that has occurred.

4.2.2 Instructions for runtime control error handling and reading out information

If you want to determine program errors in the user program, the following instructions are available in STEP 7:

Table 4-2: Overview of instructions for diagnosis of the user program

Instruction	Description
GET_ERROR	Queries the occurrence of errors within a program block. These are usually programming errors or access errors. The instruction stores detailed information about the first error that occurred on the "ERROR" output.
GET_ERR_ID	Queries the occurrence of errors within a block. These are usually access errors. The instruction stores the error ID of the first error that occurred on the output "ID".
RT_INFO	The "RT_INFO" instruction generates statistics at runtime of certain organization blocks of the communications or the user program. The MODE parameter is used to select what information will be output: For example, current / last cycle time, configured maximum communication load in percent
RUNTIME	Use the "Runtime measurement" instruction to measure the runtime of the entire program, individual blocks or command sequences.
GetChecksum	This instruction reads the checksum of a group of objects. Selection of the objects is determined via the "Scope" parameter.

Instruction	Description
GetSMCinfo	This instruction reads out information concerning the inserted SIMATIC memory card. The selection of the information to be read out is determined via the "Mode" parameter.
GetClockStatus	This instruction reads out the following information concerning the internal CPU clock: • Information as to whether clock synchronization via NTPServer is activated in the CPU properties. • Information as to whether one or more time synchronizations have been missed. • Information as to whether automatic adaptation to daylight saving time and standard time is activated for the properties of the CPU.

Note Information concerning analyzing runtime behavior with user pages is provided in the application example "SIMATIC S7-1500 Profiling" https://support.industry.siemens.com/cs/ww/en/view/109750245

4.3 SIMATIC S7-PLCSIM / SIMATIC S7-PLCSIM Advanced

Simulation systems can effectively support the development of programs and their subsequent productive use. In the automation world, a simulated test environment, including controller and process, shortens commissioning times and thus reduces costs.

Through early detection of programming errors and early optimization of program sections, the programs are already error-free and optimized when used on the plant. If there are program changes, it is possible to test the program before it is loaded into the plant controller.

SIMATIC S7-PLCSIM

SIMATIC S7-PLCSIM simulates a CPU for the functional test of user blocks and programs on the PG/PC. SIMATIC S7-PLCSIM executes the user program like a real controller. During program execution you can monitor and change different process values via a simple user interface. Online access and test functions of the programming tools can be performed in the same way they are performed with a real controller, with no difference.

SIMATIC S7-PLCSIM is part of the STEP 7 Professional software package or is available as a free-of-charge standalone software product.

Note Further information concerning SIMATIC S7-PLCSIM is provided in the application example "Testing and simulating HMI projects in conjunction with a SIMATIC controller and PLCSIM" https://support.industry.siemens.com/cs/ww/en/view/109748099

in the FAQ "How do you start S7-PLCSIM in STEP 7 (TIA Portal)?". https://support.industry.siemens.com/cs/ww/en/view/61931797

and in the programming and operating manual "S7-PLCSIM Online Help" https://support.industry.siemens.com/cs/ww/en/view/109741755

SIMATIC S7-PLCSIM Advanced

During the project planning and engineering phase with STEP 7 in the TIA Portal, you can perform a comprehensive function simulation with S7-PLCSIM Advanced without S7-1500 / ET 200SP hardware.

With S7-PLCSIM Advanced you integrate virtual CPUs for simulation of S7-1500 and ET 200SP controllers in a machine simulation.

The realistic test process of the STEP 7 TIA Portal program enables early fault detection and fast validation of functionality:

S7-PLCSIM Advanced also allows early operator training with the help of virtual controllers and an HMI device/an HMI simulation connected to these virtual controllers.

Note

Further information concerning SIMATIC S7-PLCSIM is provided in the application examples "Testing and simulating HMI projects in conjunction with a SIMATIC controller and PLCSIM"
https://support.industry.siemens.com/cs/ww/en/view/109748099

and "S7UnitTest: Automated testing with "SIMATIC S7-PLCSIM Advanced"
https://support.industry.siemens.com/cs/ww/en/view/109746405

in the FAQ "How do you start S7-PLCSIM in STEP 7 (TIA Portal)?".
https://support.industry.siemens.com/cs/ww/en/view/61931797

and in the function manual "SIMATIC S7-1500 S7-PLCSIM Advanced"
https://support.industry.siemens.com/cs/ww/en/view/109739153

You will find the TRIAL download under the following link.
https://support.industry.siemens.com/cs/ww/en/view/109754093

4.4 Trace function

Use the trace and logic analyzer function to record variables of a device and evaluate the recordings. Variables are, for example, drive parameters or system and user variables of a CPU.

The trace is supported by the following CPUs:

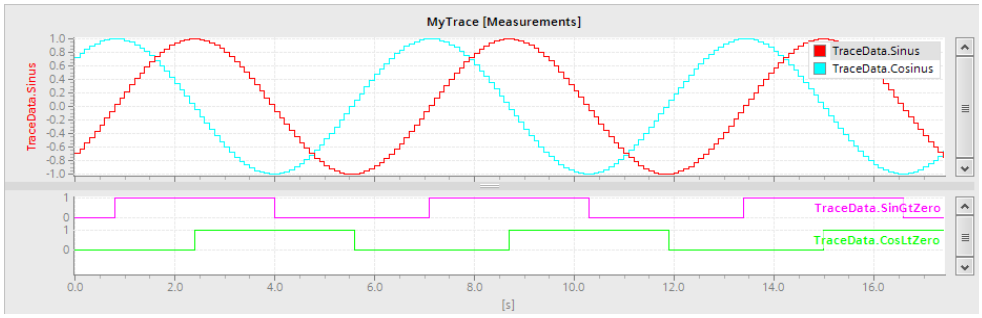
- SIMATIC S7-1200 CPUs (from firmware version V4.0)
- SIMATIC S7-1500, ET 200SP and CPU 1516pro-2 PN CPUs
- SIMATIC S7-1500 software controller

The recordings are stored and activated on the device. As soon as the trigger condition is fulfilled, the values are recorded in the controller independently of the TIA Portal. If required, the recordings can be read out with the TIA Portal and stored permanently. The TIA Portal offers a wide range of options for evaluating the measurement in the curve diagram and in the signal table.

You can also view completed measurements via the web server of the CPU

You can use the trace and logic analyzer function to observe highly dynamic processes and find errors that occur sporadically.

Figure 4-5: Trace recording



Note Further information concerning trace is provided in the manual "Using the SIMATIC/SINAMICS S7-1500, S7-1200 / S120, G120 trace and logic analyzer function"
https://support.industry.siemens.com/cs/ww/en/view/64897128

5 Machine and plant diagnostics

5.1 User-defined alarms

Messages enable the programmers to present information concerning events from the process handling in the automation system. Thus, the machine operator can quickly detect, precisely locate and rectify errors.

You can create, edit and translate event-dependent messages with assigned message texts and message attributes and output them on display devices.

Messages can be generated either directly in the user program of the CPU or in the HMI.

5.1.1 Alarm instructions in the CPU

CPU-generated alarms can be displayed on all alarm displays (HMI, web server, CPU display, TIA Portal)

The following instructions are available in STEP 7 for handling all alarms:

Table 5-1: Overview of the alarm instructions

Instruction	Description
Program_Alarm	Generates a program alarm with accompanying values.
Get_AlarmState	Outputs the alarm state of a program alarm.
Gen_UsrMsg	Generates a user diagnostic alarm, that is entered in the diagnostics buffer.
Get_Alarm	Reads out queued alarms.
Ack_Alarms	Acknowledges all alarms

Note

An example of alarm instructions is provided in the application example "Diagnostics in User Program with S7-1500" under the section "Documentation and sample project for use of alarm instructions in the TIA Portal".
https://support.industry.siemens.com/cs/ww/en/view/98210758

An example for "Get_Alarm" and "Ack_Alarms" is provided in the application example "Reading out Alarms in S7-1500 CPU using the "Get_Alarm" instruction and sending them to an Alarm System."
https://support.industry.siemens.com/cs/ww/en/view/109748168

Further information is provided in the function manual "SIMATIC S7-1500, ET 200MP, ET 200SP, ET 200AL, ET 200pro Diagnostics"
https://support.industry.siemens.com/cs/ww/en/view/59192926

5.1.2 HMI alarms

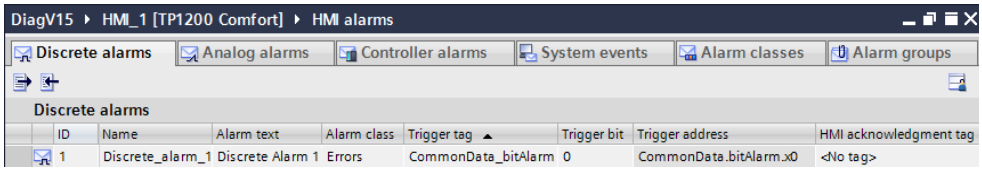
HMI alarms allow you to generate alarms directly on the HMI using HMI variables.

HMI alarms are created in tabs in the "HMI Alarms" editor and they are assigned the variables, message classes, message groups and other properties to be monitored.

Discrete alarms

A discrete alarm shows state changes in running operation. A discrete alarm is triggered at a specific value (bit) of a variable.

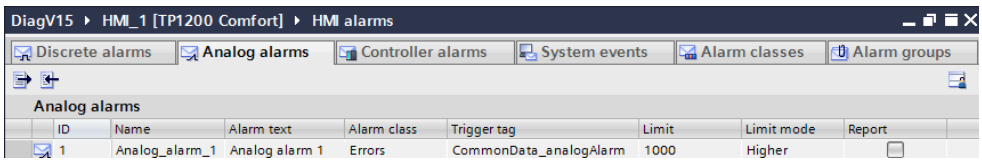
Figure 5-1: Project planning – discrete alarm



Analog alarms

An analog alarm shows limit violations of a variable in running operation. An analog alarm is triggered when a previously defined limit value is exceeded/not met.

Figure 5-2: Configuration of an analog alarm



Controller alarms (see also Alarms in the CPU)

The controller engineer creates a user-defined controller alarm in STEP 7, e.g. with the "Program_Alarm" instruction and the configuration of monitoring with ProDiag. In the controller alarm the state values of the controller can be mapped, e. g. time stamp and process values.

Controller alarms can be updated automatically on the HMI. (On the HMI device, the "Automatic update" option under "Runtime settings messages > Control messages" is activated by default for the respective connection.) After changes have been made to the controller, the HMI project planning no longer needs to be transferred.

Controller alarms will **not** be shown in the "Controller Alarms" tab. In order for controller alarms to be displayed and processed, the "Automatic update" option must be de-activated on the HMI device.

System alarms

If you open the "System alarms" tab in the "HMI alarms" editor, WinCC will request that you import or update the system alarms. System alarms can neither be deleted nor newly created. You can only edit the alarm texts in system alarms.

Alarm classes

Many alarms of varying importance occur in a plant. To make it clear to the user which alarms are most important, classify the alarms of your project into alarm classes.

The alarm class specifies the presentation of an alarm. The alarm class specifies whether and how the user must acknowledge the alarms of this alarm class.

In addition to the predefined alarm classes, user-defined alarm classes can be created.

Alarm groups

In a plant, many alarms occur from different areas and processes. The alarm group is a summary of individual alarms. You sort alarms in an alarm group according to their relatedness, for example, cause of error or source of error. If you acknowledge an alarm of this alarm group in runtime, all alarms of the alarm group are also automatically acknowledged.

Acknowledgment

To ensure that an alarm has been registered by the user of a plant, configure this alarm in such a manner that it will be displayed until the user has acknowledged it. Alarms that are critical or that indicate hazardous states in the process must be subject to acknowledgment.

Note An example of HMI alarms is provided in the application example "Configuration of Messages and Alarms in WinCC (TIA Portal)".

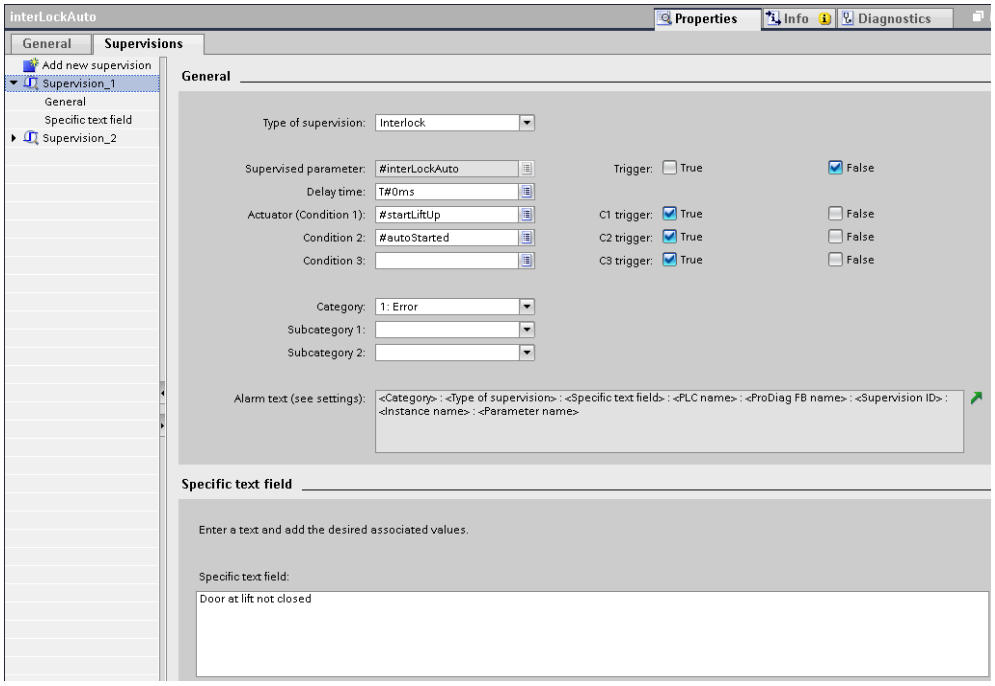
https://support.industry.siemens.com/cs/ww/en/view/62121503

5.2 Machine and plant diagnostics with ProDiag

With ProDiag you have the option of monitoring your machine or plant and intervening in the event of a fault. The monitoring alarms that you can create for different faults provide specific information on the type of monitoring, the location, and the cause of the fault. You can also provide additional rectification instructions for the determined faults. This enables you not only to detect faults, but also to identify a possible danger for a fault in advance and to take appropriate countermeasures.

With a few configuration steps you can integrate simple monitoring into your program without changing the program code. To do this, you can create a monitoring function, for example, by monitoring a Boolean operand for its signal state. As soon as the operand delivers the set signal state, a ProDiag monitoring message is output based on the configured ProDiag monitoring settings. Configuration of the monitoring functions is independent of the programming languages of the TIA Portal, since only individual operands are monitored and you do not need any additional programming sections.

Figure 5-3: Interlock monitoring

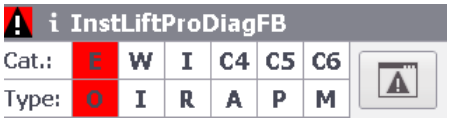


For display of the current monitoring state, the TIA Portal offers various objects that you can integrate into an HMI image.

ProDiag overview

The ProDiag overview offers an overview of the actual state of the configured monitoring. When an error occurs, the ProDiag overview displays the error type and error category.

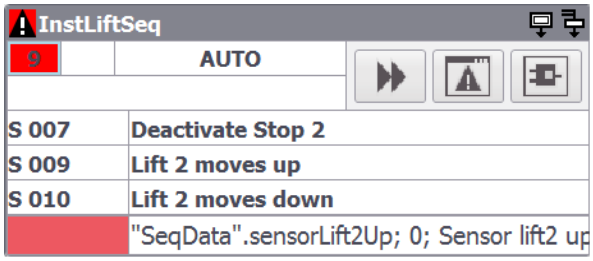
Figure 5-4: ProDiag overview



GRAPH overview

The "GRAPH overview" object shows the actual program state for the executed steps of the GRAPH sequence cascade. Errors during execution of a program are displayed directly at the corresponding step.

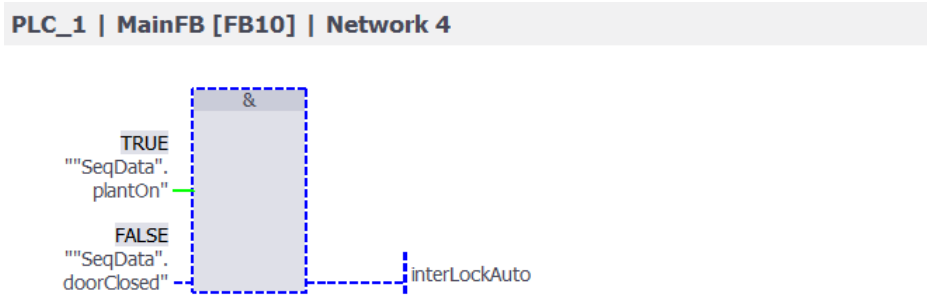
Figure 5-5: ProDiag overview



PLC code display

The PLC code display shows the PLC program section in question, of your LAD, FUP and GRAPH programs. The PLC code display is activated via a button.

Figure 5-6: PLC code display



Note An example for ProDiag is provided in the application example "Machine and Plant Diagnostics with ProDiag".
https://support.industry.siemens.com/cs/ww/en/view/109740151

6 Useful information

6.1 Remote diagnostics with teleservice

Machines and plants are increasingly operated in places that are far away from the place of manufacture. Nevertheless, plant manufacturers must be able to ensure service in the event of a fault.

Remote diagnostics via an Internet connection allows plants to be diagnosed and values to set, but also programs or data to be transmitted from anywhere in the world. Remote diagnostics make a significant contribution in saving travel and personnel costs for service deployments.

With TeleService you can centrally manage, control, and monitor distributed systems via remote connections.

6.2 Data analysis with MindSphere

Many components of a plant supply a wealth of data. This data can be stored in the cloud for further analysis.

MindSphere enables you to extensively analyze the wealth of data from the Internet of Things (IoT). The data can be used to draw conclusions about the state of the components. Thus, preventive maintenance can be carried out if required, productivity can be increased, and quality can be improved.

7 Appendix

7.1 Service and Support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks: **Fehler! Hyperlink-Referenz ungültig.**

Technical Support

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

SITRAIN – Training for Industry

We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:
www.siemens.com/sitrain

Service offer

Our range of services includes the following:

- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

You can find detailed information on our range of services in the service catalog web page:
Fehler! Hyperlink-Referenz ungültig.

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for Apple iOS, Android and Windows Phone:
Fehler! Hyperlink-Referenz ungültig.

7.2 Links and literature

Table 7-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the article page of the application example https://support.industry.siemens.com/cs/ww/en/view/109752283
\3\	System manual "STEP 7 and WinCC Engineering V15" https://support.industry.siemens.com/cs/ww/en/view/109755202
\4\	Function manual "SIMATIC S7-1500, ET 200MP, ET 200SP, ET 200AL, ET 200pro Diagnostics" https://support.industry.siemens.com/cs/ww/en/view/59192926
\5\	"SIMATIC IPC DiagMonitor" product page https://w3.siemens.com/mcms/pc-based-automation/en/industrial-pc/expansion_components_accessories/pc-diag-monitor/Pages/Default.aspx
\6\	Application example "Diagnostics of SIMATIC IPCs (with IPC DiagBase, IPC DiagMonitor, WinCC (TIA Portal) or WinCC V7)". https://support.industry.siemens.com/cs/ww/en/view/109478242
\7\	"From PROFIBUS DP to PROFINET IO" programmer guide https://support.industry.siemens.com/cs/ww/en/view/19289930
\8\	Application example "System Diagnostics with S7-1500 and TIA Portal" https://support.industry.siemens.com/cs/ww/en/view/68011497
\9\	Application example "Diagnostics in the User Program with S7-1500" https://support.industry.siemens.com/cs/ww/en/view/98210758
\10\	Application example "Diagnostics in the User Program with S7-1200" https://support.industry.siemens.com/cs/ww/en/view/109483251
\11\	Application example "PROFINET IO – Diagnostics Processing in the User Program" https://support.industry.siemens.com/cs/ww/en/view/24000238
\12\	Application example "Diagnostic Data Block for AS-i Master with Visualization via HMI or Web Browser" https://support.industry.siemens.com/cs/ww/en/view/50897766
\13\	Application example "Diagnostic data block for CM AS-i Master ST and F-CM AS-i Safety ST in ET 200SP with visualization via HMI or web browser" https://support.industry.siemens.com/cs/ww/en/view/109479103
\14\	Application example "Diagnostic data block for F-CM AS-i Safety ST in ET 200SP with visualization via HMI or web browser" https://support.industry.siemens.com/cs/ww/en/view/109749426
\15\	Function manual "S7-1500, ET 200SP, ET 200pro Web Server" https://support.industry.siemens.com/cs/ww/en/view/59193560
\16\	Application example "Creating User-Defined Web Pages for S7-1200 / S7-1500" https://support.industry.siemens.com/cs/ww/en/view/68011496
\17\	Application example "SIMATIC S7-1500 Profiling" https://support.industry.siemens.com/cs/ww/en/view/109750245
\18\	FAQ "How do you implement the module or channel diagnostics in the user program of the SIMATIC S7-1200/S7-1500?" https://support.industry.siemens.com/cs/ww/en/view/109480387
\19\	TIA Portal Tutorial Center, "Diagnostics" module https://support.industry.siemens.com/cs/ww/en/view/106656707
\20\	Information concerning the TIA Selection Tool https://w3.siemens.com/mcms/topics/en/simatic/tia-selection-tool

\21\	Product page SINETPLAN https://www.siemens.com/sinetplan
\22\	Operating manual "SINETPLAN Siemens Network Planner" https://support.industry.siemens.com/cs/ww/en/view/109485570
\23\	Overview "Information and Articles about SINETPLAN". https://support.industry.siemens.com/cs/ww/en/view/109483229
\24\	Download SINETPLAN https://support.industry.siemens.com/cs/ww/en/view/109739454
\25\	Product page PRONETA https://www.siemens.com/proneta
\26\	Application example "PRONETA Commissioning and Diagnostics Tool for PROFINET" https://support.industry.siemens.com/cs/ww/en/view/67460624
\27\	Product page SIMATIC Automation Tool http://www.siemens.com/simatic-automation-tool
\28\	User guide "SIMATIC Automation Tool" https://support.industry.siemens.com/cs/ww/en/view/109751152
\29\	Download SIMATIC Automation Tool https://support.industry.siemens.com/cs/ww/en/view/98161300
\30\	Product page SINEMA Server http://www.siemens.com/sinema-server
\31\	Operating manual "Network Management – SINEMA Server" https://support.industry.siemens.com/cs/ww/en/view/109748925
\32\	"GettingStarted: Understanding and Using SINEMA Server V14". https://support.industry.siemens.com/cs/ww/en/view/109746780
\33\	Application example "Performance Data for Communication" https://support.industry.siemens.com/cs/ww/en/view/25209605
\34\	Application example "Line Integration at the Food and Beverage Industry – Network Planning and Diagnostics" https://support.industry.siemens.com/cs/ww/en/view/109476976
\35\	Application example "Machine and Plant Diagnostics with ProDiag" https://support.industry.siemens.com/cs/ww/en/view/109740151
\36\	Application example "Reading out Alarms in S7- 1500 CPU using the "Get_Alarm" instruction and sending them to an alarm system" https://support.industry.siemens.com/cs/ww/en/view/109748168
\37\	Application example "Configuration Messages and Alarms in WinCC (TIA Portal)" https://support.industry.siemens.com/cs/ww/en/view/62121503
\38\	Application example "Testing and simulation of HMI projects in conjunction with a SIMATIC PLC and PLCSIM" https://support.industry.siemens.com/en/ww/en/view/109748099
\39\	FAQ "How do you start S7-PLCSIM in STEP 7 (TIA Portal)?" https://support.industry.siemens.com/cs/ww/en/view/61931797
\40\	Programming and operating manual "S7-PLCSIM online help" https://support.industry.siemens.com/cs/ww/en/view/109741755
\41\	Application example "Testing and simulation of HMI projects in conjunction with a SIMATIC PLC and PLCSIM" https://support.industry.siemens.com/cs/ww/en/view/109748099
\42\	Application example "S7UnitTest: Automated testing with "SIMATIC S7-PLCSIM Advanced" https://support.industry.siemens.com/cs/ww/en/view/109746405

\43\	FAQ "How do you start S7-PLCSIM in STEP 7 (TIA Portal)?" https://support.industry.siemens.com/cs/ww/en/view/61931797
\44\	Function manual "SIMATIC S7-1500 S7-PLCSIM Advanced" https://support.industry.siemens.com/cs/ww/en/view/109739153
\45\	TRIAL download SIMATIC S7-1500 S7-PLCSIM Advanced https://support.industry.siemens.com/cs/ww/en/view/109754093
\46\	Manual "SIMATIC NET Network Management Diagnostics and Project Planning with SNMP" https://support.industry.siemens.com/cs/ww/en/view/102401112
\47\	Application example "Overview: Diagnostics Tools for SIMATIC and SCALANCE" https://support.industry.siemens.com/cs/ww/en/view/21566216
\48\	FAQ "What are the differences between the Basic (BA), Standard (ST), High Feature (HF) and High Speed (HS) modules of the ET 200SP and ET 200MP?" https://support.industry.siemens.com/cs/ww/en/view/109476914
\48\	FAQ "How can you efficiently collect diagnostics and system information?" https://support.industry.siemens.com/cs/ww/en/view/65976201
\49\	Manual "SIMATIC S7-1500, ET 200MP, ET 200SP, ET 200AL, ET 200pro Communication" https://support.industry.siemens.com/cs/ww/en/view/59192925
\50\	Manual "SIMATIC/SINAMICS S7-1500, S7-1200 / S120, G120 Using the trace and logic analyzer function" https://support.industry.siemens.com/cs/ww/en/view/64897128

7.3 Change documentation

Table 7-2

Version	Date	Change
V1.0	09/2018	First version