

SIEMENS

SIMATIC HMI

ProAgent/PC and ProAgent/MP

Printout of the Online Help

Safety Guidelines

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are marked as follows according to the level of danger:



Danger

indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



Warning

indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Caution

used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Caution

used without safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

Attention

indicates that unwanted events or status can occur if the relevant information is not observed.

Note

draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

Only qualified personnel should be allowed to install and work with this software. Qualified personnel within the meaning of the safety notices of this documentation are persons capable of giving due consideration to safety engineering standards when using this software on systems.

Correct Usage

Note the following:



Warning

The equipment may be used only for the applications stipulated in the catalog and in the technical description and only in conjunction with other equipment and components recommended or approved by Siemens.

Startup must not take place until it is established that the machine, which is to accommodate this component, is in conformity with the guideline 98/37 ECC.

Faultless and safe operation of the product presupposes proper transportation, proper storage, erection and installation as well as careful operation and maintenance.

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We have checked the content of this publication for compliance with the described hard and software. However, discrepancies cannot be excluded, with the result that we assume no guarantee for total compliance. The information in this publication is checked regularly, and any necessary corrections are included in the following editions. We would be grateful for any suggestions for improvement.

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Preface

Purpose

This document provides important information covering all ProAgent topics:

- You will be introduced to process diagnostics.
- You will learn how a diagnostic report is displayed on the operator panel.
- Requirements for the configuration of your project.
- How to configure process diagnostics and the diagnostics screens.
- A detailed reference.

Documentation

- *ProAgent/PC and ProAgent/MP User Manual (this document)*
The printed version of this User Manual is supplied with *ProAgent/PC and ProAgent/MP*. It addresses systems engineers who want to configure system-specific process diagnostics for error detection and troubleshooting routines.
- *Installation guide*
The Installation Guide is supplied in a printed version. It addresses system administrators who want to install the ProTool CS configuration software on a PC.
- *ProTool User Manual*
The User Manual is supplied in a printed version and addresses development engineers. It contains configuration basics, details on configurable objects as well as samples.

Notation

Different font formats simplify orientation within the text:

- "Messages" dialog box Names of dialog boxes, fields and buttons are shown in quotation marks.
- "System" > "ProAgent" Menu items are shown in quotation marks. Successive submenus/options are separated by arrows. The complete route to the menu option in question is always shown.

History of the documentation

The different releases of the User's Guide describe the following software versions:

Issue 12/99	ProTool Version 5.2 ProAgent Version 5.2
Release 07/00	ProTool Version 5.2 + SP2 ProAgent Version 5.2 + SP2
Issue 12/01	ProTool Version 6.0 ProAgent Version 6.0

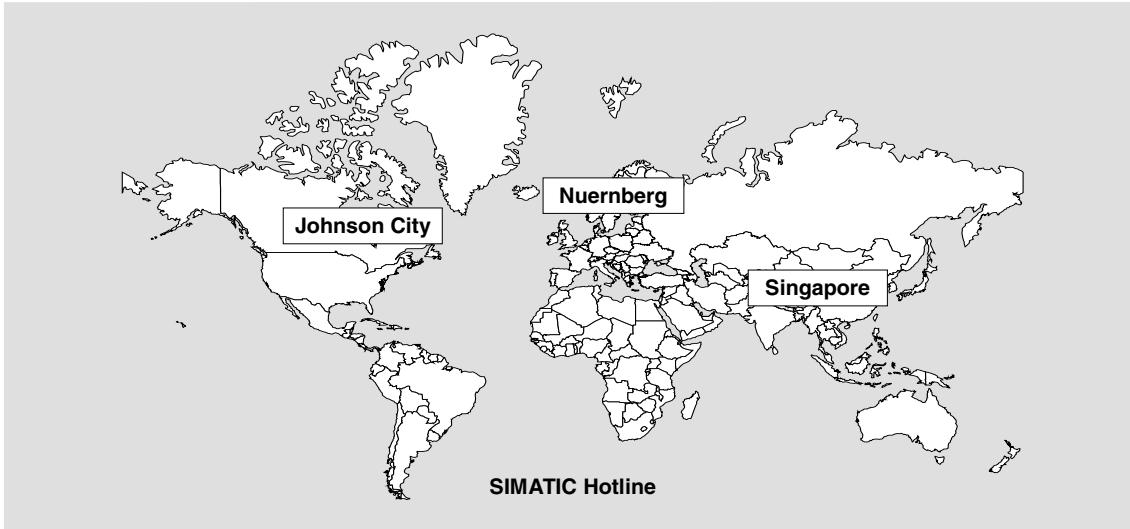
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Other support

In the case of technical queries, please contact the Siemens representatives in the subsidiaries and branches responsible for your area.

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- General information on SIMATIC products is available on the Internet under <http://www.ad.siemens.de/simatic>
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 - <http://www.ad.siemens.de/simatic-cs> or
 - on the Bulletin Board System (BBS) in Nuremberg (SIMATIC Customer Support Mailbox), dial-in number +49 (911) 895-7100. Dial in to the Mailbox using a modem up to V.34 (28.8 kbps) with the parameters set to:
 - 8,N,1,ANSI.
 - You can also dial in per ISDN (x.75, 64 kbps).
- You can find your local partner for Automation & Drives in our Partner Database on the Internet under
 - <http://www3.ad.siemens.de/partner/search.asp>

Up-to-date information on ProTool

- You can obtain general information on ProTool on the Internet URL
 - http://www1.ad.siemens.de/hmi/html_00/products/software/pro_tool/index.htm or
 - http://www1.ad.siemens.de/hmi/html_76/products/software/pro_tool/index.htm (English).
- The ProTool Online Support with information on FAQs (Frequently Asked Questions), spare parts as well as Tips & Tricks is also found on the [Internet](#). Available downloads are, for example, Firmware Updates, Service Packs or helpful applications.

SIMATIC HMI-documentation

This manual is part of the SIMATIC HMI documentation. The table below shows where to find what information.

Documentation	Target Group	Content
ProTool configuring Windows-based systems User's Guide	Programmers	Furnishes information about working with the configuration software. It contains information about installation, basic principles of configuring, detailed description of configurable objects and functions. This document applies to Windows-based systems.
ProTool Online Help	Programmers	Provides information on the configuration computer during a ProTool session. The Online Help contains context-sensitive Help detailed instructions and examples detailed information all the information contained in the User's Guide
ProTool/Pro Runtime User's Guide	Commissioning technicians, users	Describes how to install the ProTool/Pro RT visualization software and commissioning and operation of the software on Windows-based systems.
ProAgent for OP User's Guide ProAgent/MP and ProAgent/PC User's Guide	Programmers	Furnishes the following information about the ProAgent option pack (process diagnostics): configuring installation-specific process diagnostics, locating process faults, identifying the causes of and eliminating faults, adapting the ready-made diagnostic screens supplied to suit your own requirements.

Contents

1	Guide to the documentation	1-1
1.1	Notation	1-2
1.2	Abbreviations	1-3
1.3	Online support	1-4
1.3.1	Working with ProTool online Help	1-6
1.3.2	Working with direct Help	1-9
1.4	ProTool for the whole SIMATIC HMI device family	1-10
1.4.1	ProTool for Windows-based systems	1-11
1.4.2	ProTool for graphical displays	1-13
1.4.3	ProTool for text-based displays	1-14
2	Introduction	2-1
2.1	What process diagnostics can achieve	2-2
2.2	Important Terms	2-5
2.3	How a process diagnostics is Carried Out	2-6
2.4	How a process diagnostics is configured	2-8
2.5	Before You Start	2-11
3	Display on the operating unit	3-1
3.1	How to activate diagnostics	3-2
3.2	What are the individual diagnostic screens used for?	3-3
3.3	How the diagnostic screens are linked to one another	3-9
3.4	Structure of the diagnostic screens	3-10
3.5	Scope and function of the global key set	3-12
3.6	Message Screen	3-13
3.6.1	What you see on the Message Screen	3-14
3.6.2	Keys in the Message Screen	3-16
3.6.3	How to work with the Message Screen	3-17
3.7	Overview Screen	3-19
3.7.1	What you see in the Overview Screen	3-21
3.7.2	Keys in the Overview Screen	3-25
3.7.3	How to work with the Overview Screen	3-27
3.7.4	Hierarchical units on the Overview Screen	3-30
3.7.5	Changing the display mode	3-31
3.7.6	Changing operating mode	3-32
3.8	Detail Screen	3-33
3.8.1	Structure of the Detail Screen	3-36
3.8.2	Information on the unit in the Detail Screen	3-38
3.8.3	Displaying the element as a symbol list	3-41
3.8.4	Displaying element in STL	3-42
3.8.5	Element displayed in LAD	3-44
3.8.6	Keys in the Detail Screen	3-46
3.8.7	How to work with the Detail Screen	3-48
3.8.8	Switching between partial and full view	3-52
3.8.9	Switching between initial values and current status	3-53
3.8.10	Changing fault or transition	3-54
3.8.11	Enhanced options with S7-PDIAG	3-56
3.9	Movement Screen	3-63
3.9.1	What you see on the Movement Screen	3-66

3.9.2	Keys in the Movement Screen	3-70
3.9.3	How to work with the Movement Screen	3-72
3.9.4	Hierarchical units on the Movement Screen.....	3-75
3.10	Step Sequence Screen.....	3-76
3.10.1	What you see on the Step Sequence Screen	3-77
3.10.2	Keys in the Step Sequence Screen.....	3-79
3.10.3	How to work with the Step Sequence Screen	3-80
4	Requirements of the configuration	4-1
4.1	Basic requirements of the PLC program	4-2
4.2	Shared database with STEP7	4-5
4.3	Upgrading existing projects	4-9
4.3.1	Requirements when upgrading	4-10
4.3.2	Steps involved in upgrading a configuration to include process diagnostics.....	4-11
5	Steps in the configuration of a diagnostics	5-1
5.1	Incorporating the diagnostic screens.....	5-3
5.2	Modifications during the commissioning of an S7-PDIAG project.....	5-6
5.3	Linking the diagnostic screens	5-8
5.3.1	How to make the Diagnostic Start Screen the Start Screen of your project.....	5-9
5.3.2	How to open the Diagnostic Start Screen in your project.....	5-10
5.3.3	How to open a Diagnostic Screen of your choice in your project.....	5-12
5.4	How to select units for diagnostics and device ID	5-14
5.5	How to select the display classes for diagnostics	5-18
5.6	How to compile and download a diagnosable project	5-21
5.7	How to port a diagnosable project to a computer without STEP7.....	5-23
6	Configuring diagnostic screens in detail	6-1
6.1	Customize diagnostic screens or create own screens?	6-2
6.2	Internal structure of the diagnostic screens.....	6-3
6.3	Customizing standard screens	6-5
6.4	Creating your own diagnostic screens	6-6
6.5	Linking diagnostic screens	6-8
6.6	Working with password levels	6-9
6.7	Multi-lingual projects.....	6-10
6.8	Operation of movements	6-11
6.9	Example: More than one diagnostic display in a screen	6-13
6.10	Customizing and configuring ProAgent screen objects.....	6-14
6.10.1	What is a message view?	6-15
6.10.2	What is an overview display?	6-17
6.10.3	What is a detail view?	6-18
6.10.4	What is a movement display?.....	6-20
6.10.5	What is a step sequence display?	6-22
6.10.6	Introduction to configuring ProAgent screen objects.....	6-23
6.11	Using ProAgent functions.....	6-29
6.11.1	ProAgent functions for selecting diagnostic screens.....	6-30
6.11.2	ProAgent functions for an overview display	6-32
6.11.3	ProAgent functions for a detail view	6-35
6.11.4	ProAgent functions for a movement display.....	6-37
6.11.5	ProAgent function for displaying the movement list	6-39
6.11.6	ProAgent functions for a step sequence display	6-40

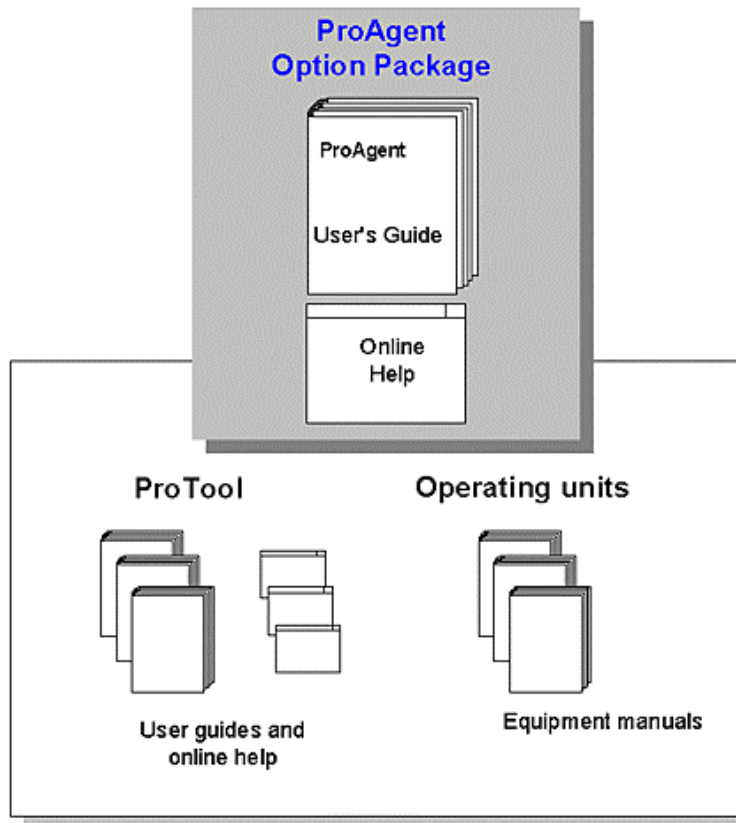
7	Reference	7-1
7.1	System messages	7-2
7.2	Functions (overview)	7-4
7.2.1	Assign movements (function)	7-6
7.2.2	Detail: Change fault (function)	7-7
7.2.3	Detail: Change transition (function)	7-8
7.2.4	Detail status (function)	7-9
7.2.5	Detail: Switch display mode (function)	7-10
7.2.6	Disable Step sequence (function)	7-11
7.2.7	Message View: Evaluate error (function)	7-12
7.2.8	Movement hierarchy (function)	7-14
7.2.9	Movement symbolic names (function)	7-15
7.2.10	Overview Acknowledge unit (function)	7-16
7.2.11	Overview Fault mode (function)	7-17
7.2.12	Overview Operating modes (function)	7-18
7.2.13	Overview Subordinate units (function)	7-19
7.2.14	Overview Superior units (function)	7-20
7.2.15	ProAgent: Evaluate fault (function)	7-21
7.2.16	ProAgent movement list (function)	7-23
7.2.17	ProAgent: Restore screen (function)	7-24
7.2.18	ProAgent: Save screen (function)	7-25
7.2.19	ProAgent: Select unit (function)	7-26
7.2.20	Reduced detail (function)	7-27
7.2.21	Reset Step Sequence (function)	7-28
7.2.22	Reset Step (function)	7-29
7.2.23	Set Step (function)	7-30
7.2.24	Start movement (function)	7-31
7.2.25	Step Sequence mode (function)	7-32
7.2.26	Stop movement (function)	7-33
8	Configuration procedures in STEP7 for process diagnostics	8-1
8.1	Configuring ALARM_S messages	8-2
8.2	Displaying the result of criteria analysis in the message text	8-7
8.3	Target position modes in the S7-PDIAG Movement Screen	8-9
8.4	Special aspects of S7 CPUs	8-11
9	Estimating Memory Requirement	9-1
9.1	System limits on diagnostics for ProAgent/MP	9-2
9.2	System limits on diagnostics for ProAgent/PC	9-4

1 Guide to the documentation

ProAgent option pack

There are a number of manuals and Online Help systems relating to ProTool and the various types of operating unit.

The diagram below illustrates the position of the ProAgent documentation within the overall documentation structure.



Position within the information environment

The tools for programming the PLCs under STEP7 have their own documentation which is not included in the above diagram.

Whereas with ProTool the configuration software and devices are described separately from each other, the User's Guide and Online Help for ProAgent explain both the configuration and operation on the devices.

The Online Help and User's Guide are identical to a large extent. However, detailed descriptions of individual dialog box elements and a reference section of all functions and error messages are available only in the Online Help.

1.1 Notation

Character formats

There are a number of character formats used in this manual to assist reader orientation.

Output	Words in typewriter font signify input and output as it appears on the screen of the PC/PU or on the display of the operating unit.
F1	The names of keys on the operating unit are shown in upper case letters.
"System" > "ProAgent"	Menu items are shown in quotation marks. Successive submenus/options are separated by arrows. The complete route to the menu option in question is always shown.
"Messages" dialog box	Names of dialog boxes, fields and buttons are shown in quotation marks.

1.2 Abbreviations

Meanings of abbreviations

The meanings of the abbreviations used in this documentation are as follows:

STL	Statement list
EM	Event message
CPU	Central processing unit
CS	Configuration system
DB	Data block
FB	Function block
FC	Function
HMI	Human machine interface
LAD	Ladder diagram
MP	Multi panel
MPI	Multipoint interface
OB	Organization block
OP	Operator panel
PC	Personal computer
PU	Programming unit
RT	Runtime
AM	Alarm message
PLC	Programmable logic controller
TP	Touch panels
UDT	User defined data type
RLO	Result of logical operation

1.3 Online support

ProTool online information

ProTool supports you in your work with wide-ranging and flexible Help information. Depending on the current situation and your personal requirement for information, decide whether you want detailed background information, specific instructions on what to do, examples or merely a brief note on how a control element functions.

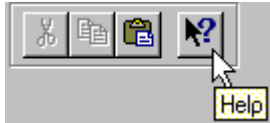
Information on the status bar

The status bar is the bar at the bottom border of the ProTool window. It contains general and editor-specific information. General information includes, for example, the operating unit you have set and the current editing language. Editor-specific information relates, for example, to details concerning area pointers in the message editor, on the current screen area in the screen editor or on the selected report in the editor for headers and footers.

The status bar also displays information on menu commands and buttons on the toolbars.

Information on menu commands and buttons

You obtain brief information on menu commands and buttons on the toolbar by holding the mouse pointer over the corresponding element (refer to the figure). At the same time, a brief description of the function is displayed on the status bar.



The ProTool information system

The ProTool information system provides access to the whole range of ProTool documentation at all times while you are configuring. It contains the following component:

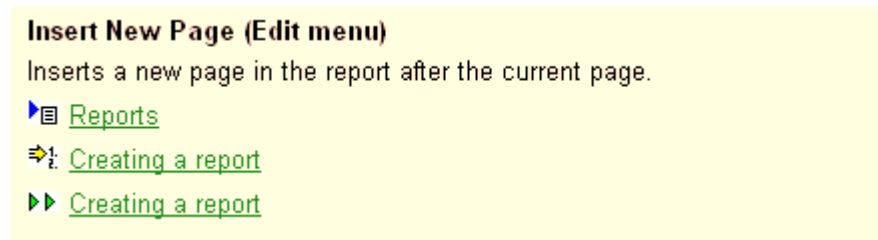
- Complete documentation for ProTool, for all device classes
- Documentation for option packs, add-ons and drivers, to the extent installed
- Access to different pdf documents that are supplied with ProTool
- The "Release Notes"
- More user manuals such as "Getting Started".

The ProTool information system contains two sections: in the navigation section on the left side, several tabs feature access options to the Help topics. The subject section, on the right, displays the different Help topics.




You open the ProTool information system from the Start bar of the PC: "Start" > "SIMATIC" > "ProTool CS 6.0" > "ProTool Information System".

ProTool direct Help

ProTool direct Help contains detailed information about buttons, icons, windows and dialog boxes in ProTool. When you select direct Help, a Help window opens. The figure shows an example.



In the Help window you can call on further Help from the ProTool information system, should you require more information. ProTool presents you with the following types of information:

-  Background and background information
With this you select background information about a topic - for example, definitions and concepts.
-  Guidance
With this you retrieve specific instructions on what to do.
-  Examples
Use this to open application examples and sample cases.

1.3.1 Working with ProTool online Help

Opening online Help

Menu command "?" > "Help Topics"	"Contents" tab: On this tab you can see the graphic contents of the online documentation. They show all the available topics, sorted into categories.
From direct Help	You go directly in one step from direct Help to the topic.

Tabs in navigation section

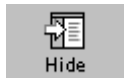
The navigation section is located in the left of online Help. Your tabs provide you with access options for the Help topics:

- "Contents": Contains a hierarchical overview of all Help topics that you retrieve directly from here.
- "Index": Here you can search through indexed terms for Help topics and display the topics you find.
- "Find": Here you can perform a full-text search in the documentation and display in Help the topics containing the search term
- "Favorites": Here you can store topics which you will always need. You can then select them without having to search for them first.

Navigating with the mouse

After opening online Help, you have the following options with the featured buttons:

Buttons at top



Hide

Click this button to hide the navigation section of the information system with its "Contents", "Index" and "Find" tabs. The information system will then take up less space on the screen.



Show

When the navigation area is hidden, you can display it again by clicking this button.

If the navigation section is hidden, the contents display is not updated upon a change of topics.



Previous

Click this button to scroll back to the previous page.



Next

Click this button to scroll forward to the next page.



Glossary

Click this button to open the glossary.

The "Download File" window appears. Select "File" from your present location to open the glossary in a separate window.

Navigation on the "Contents" tab



Click this button to view the lower-levels in the hierarchy



of a book.

Double-click on the illustrated button to open a Help topic and simultaneously display the lower levels in the hierarchy.



Double-click the symbol illustrated to open a Help topic.

Navigation on a Help page

Basics

Click this button to retrieve more information about a topic, such as definitions and concepts or details.

Instructions

Click this button to open step-by-step instructions on what to do.

Example

Click this button to retrieve application examples and sample cases. Instructions on what to do contain specific values.

Navigating with the keyboard

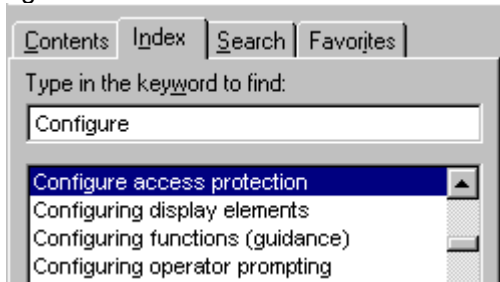
You have the same navigation options when working with the keyboard as you have with the mouse.

ALT + RIGHT	Scroll forward one page.
ALT + LEFT	Scroll back one page.
LEFT	Move the scroll bar in the active window to left.
RIGHT	Move the scroll bar in the active window to right.
UP	Move the scroll bar up in the active window.
DOWN	Move the scroll bar down in the active window.
CTRL + TAB	Switch from one tab to another (Contents, Index, Find and Favorites).
Arrow keys	Navigate in Contents.
ENTER	View a topic you have selected on one of the tabs in the navigation section.
	Trigger a previously selected button.
F6	Toggle between the navigation section and the subject section.
TAB	Switch between the buttons in the subject section.

Full-text search on the "Find" tab

On the "Find" tab, there are various options for making your search as efficient as possible:

- Use quotation marks to search for compound expressions such as "configure graphic".
- Use asterisks if you are not certain about the precise wording; for example, the query *messages information retrieves event messages, process messages, etc.
- The last search terms you entered are saved in a list and can be retrieved again.








- Click the arrow next to the input field to make your search more specific with operands; for example, "graphic" AND "configure".
- Search in result: If you select the "Search Previous Results" check box after a search operation, you can search the pages found with a new term to define your search strategy more precisely. Make sure that you deselect the check box before performing the next global search.
- Sort your search results by clicking the "Title" or "Position" button of the results list. Title: Search results are sorted in alphabetical order. Position: This function is very useful when you are searching in the ProTool Information System. You can then sort your results by hits in Help for Windows-based devices, text-based devices, graphics devices, ProSave etc.
- Select the "Look in title only" check box if you only want to search in the titles of the different topics and not perform a full-text search.

1.3.2 Working with direct Help

Press F1 to open

When configuring, you can open direct Help at all times by pressing "F1".

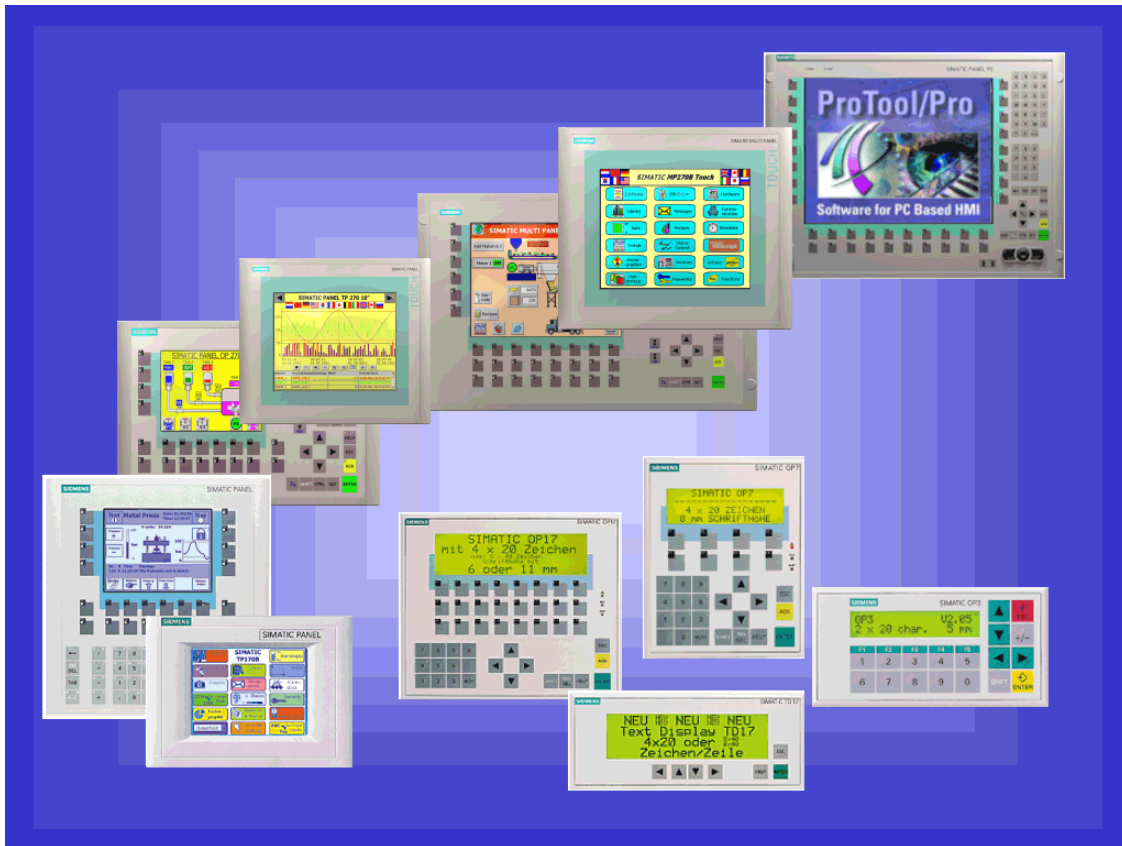
Open by clicking a button

Procedure:	
1	<p>Open direct Help by clicking one of the following buttons:</p> <p> On the ProTool toolbar to obtain help with buttons, icons and windows in ProTool.</p> <p> On the title bar of an open dialog box to obtain help for this dialog box. The mouse pointer is transformed into a question mark.</p>
2	<p>Click the dialog element on which you require help.</p> <p>Direct Help opens.</p>
3	<p>Use the colored navigation aids in direct Help to go to the ProTool information system and obtain further information, step-by-step instructions or examples.</p> <p>Depending on the icon, you obtain the following types of information:</p> <ul style="list-style-type: none">  Basics  Instructions  Examples

1.4 ProTool for the whole SIMATIC HMI device family

The SIMATIC HMI device family

The SIMATIC HMI device family is a complete family of text displays, operator panels, touch panels and Windows-based systems for efficient machine operation and monitoring. The performance and convenience of the devices are finely tuned to suit the individual demands made of them.



SIMATIC HMI operating units

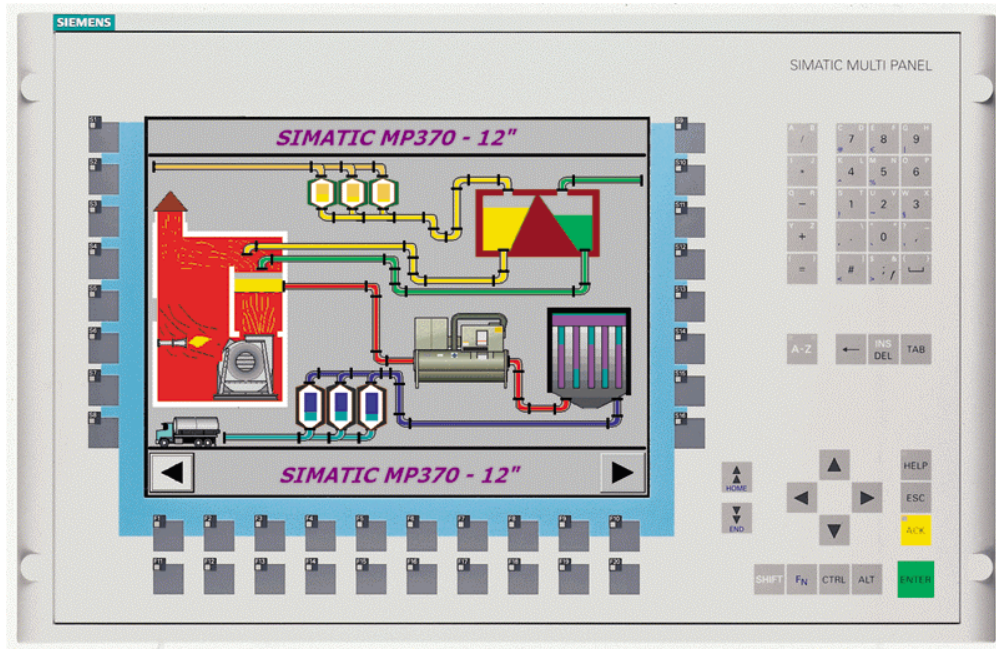
The great advantage is that you configure all the devices with the same configuration software.

1.4.1 ProTool for Windows-based systems

Devices

The "ProTool - Configuring Windows-Based Systems" documentation tells you how to configure the following devices:

- Panels
 - TP 170A
 - TP 170B
 - TP 170B Color
 - TP 270 (6" and 10")
 - OP 170B
 - OP 270 (6" and 10")
- Multi Panels
 - MP 270B
 - MP 270
 - MP 270 TOUCH
 - MP 370
 - MP 370 TOUCH
- Panel PCs
 - FI 25
 - FI 45
 - PC 670 10"
 - PC 670 12"
 - PC 670 15"
 - PC 670 12" TOUCH
 - PC 670 15" TOUCH
 - PC 870 12"
 - PC 870 15"
 - PC 870 15" TOUCH
 - PC IL 70 12" TOUCH
 - PC IL 70 15" TOUCH
- SINUMERIK Panels
 - OP 010
 - OP 012
 - OP 015
- SIMOTION Panels
- PC



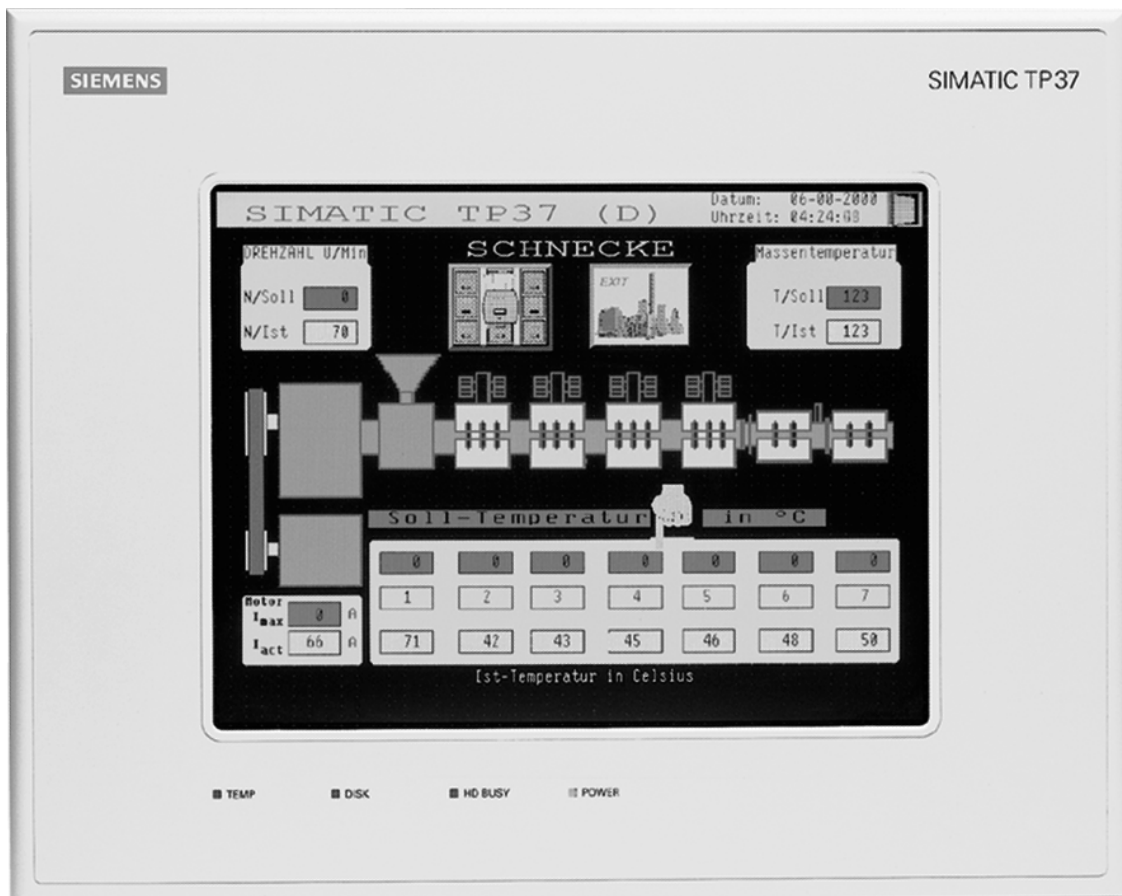
Example: MP 370

1.4.2 ProTool for graphical displays

Devices

The "ProTool - Configuring Graphics Displays" documentation tells you how to configure the following operating units:

- Graphics-oriented operator panels
 - OP 27
 - OP 37
- Touch panels
 - TP 27-6
 - TP 27-10
 - TP 37
- C7 devices
 - C7-626 (OP 25 with integrated S7-CPU)



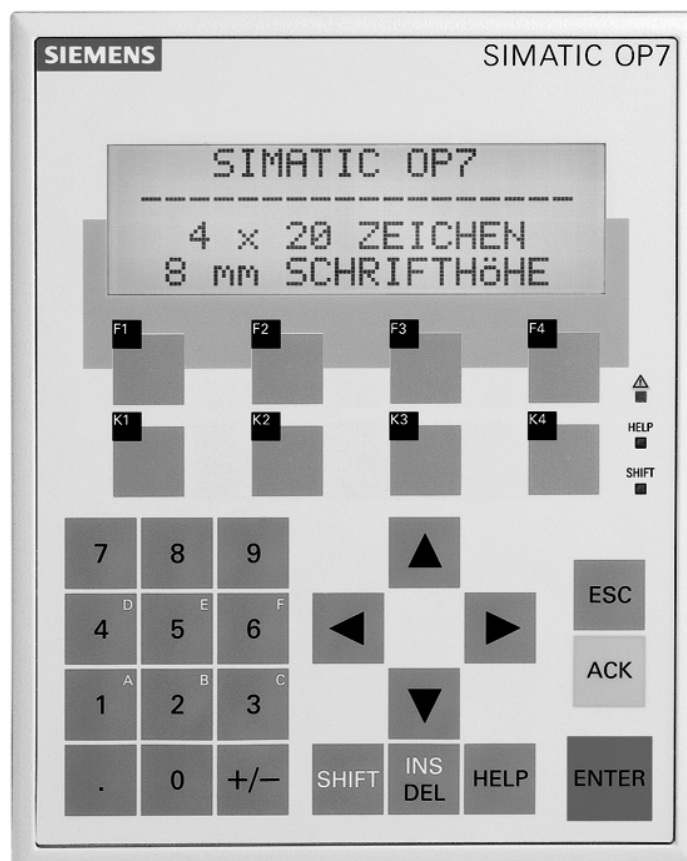
Example: TP 37

1.4.3 ProTool for text-based displays

Devices

The "ProTool - Configuring Text-Based Displays" documentation tells you how to configure the following operating units:

- Text-oriented operator panels
 - OP 3
 - OP 7
 - OP 17
- Text displays – TD17
- C7 devices
 - C7-621 (OP 3 with integrated S7-CPU)
 - C7-623 (OP 5 with integrated S7-CPU)
 - C7-624 (OP 15 with integrated S7-CPU)
 - C7-633 (OP 7 with integrated S7-CPU)
 - C7-634 (OP 17 with integrated S7-CPU)



Example: OP 7

2 Introduction

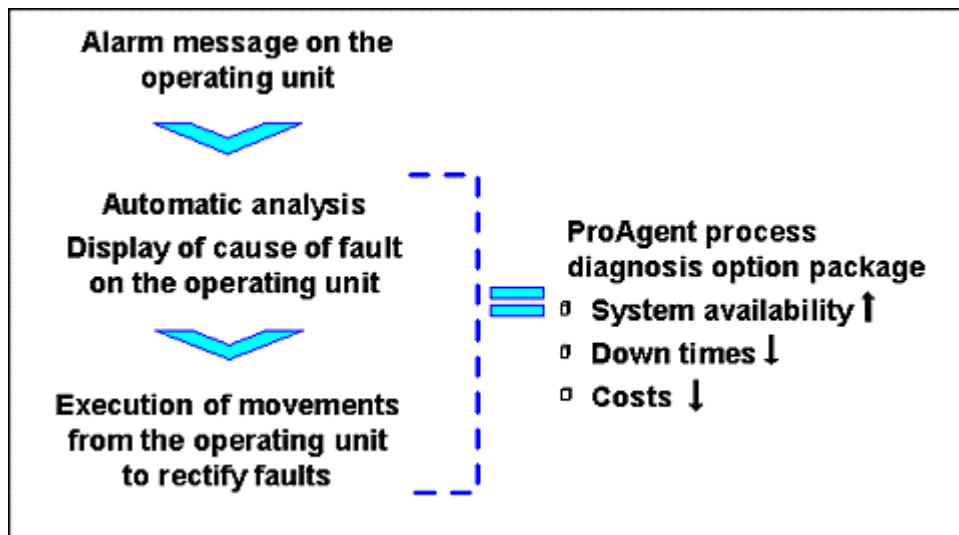
This section explains the benefits of process diagnostics and shows you how to locate a fault on the operating unit and rectify it. An overview shows the steps required for configuration and where the interfaces between STEP7, ProTool and ProAgent are.

This section also explains a number of important terms that are frequently encountered in the context of process diagnostics.

2.1 What process diagnostics can achieve

System environment

When you use SIMATIC S7 controllers you can configure a powerful process diagnostics system. It will help you to rapidly identify potential problems and to eliminate them. In that way, you will be able to increase the availability of your installation, reduce downtimes and bring down costs.



Sequence and benefits of process diagnostics

Operating units supported

The following operating units can be used for process diagnostics:

ProAgent package	Operating units supported
ProAgent/MP	OP270, TP270, MP270 MP270 Touch, MP270B, MP270B Touch, MP370, MP370 Touch
ProAgent/PC	All Panel PCs (except FI25), Standard PC

Avoiding problems

Many problems can be avoided from the outset

The flexibility of the process diagnostics system enables potential problems in the process sequence to be identified before they actually occur. A worn tool, for example, is normally signaled by an increase in the forces involved. The process diagnostics system can monitor these forces and initiate replacement of the tool at the appropriate time.

Identifying problems

The message system draws your attention to faults

The SIMATIC operating units allow you to visualize installations, that is, display them, and to control them with ease. A powerful message system draws your attention to faults in the process.

An error message appears on the operating unit as an indication.

Rectifying problems

Situation-relevant information assists you in locating the fault

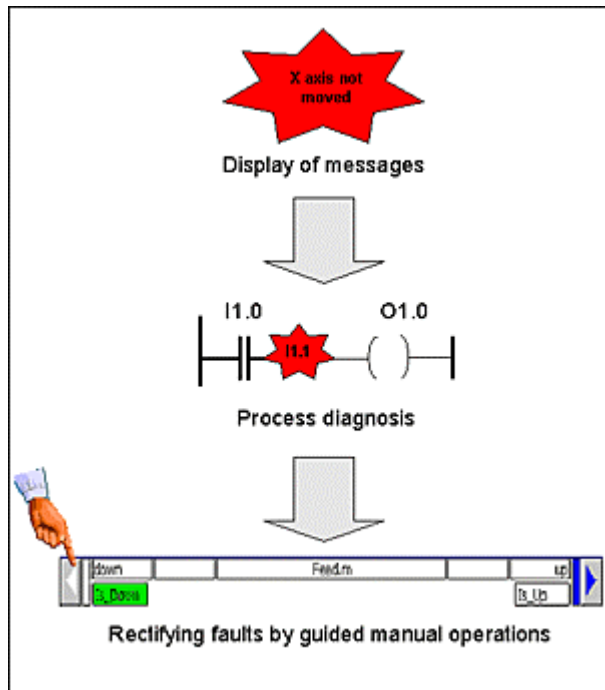
When problems occur in the process sequence, you can easily retrace the faults to the units from which they originate. To do so, you can examine on the operating unit the logical operation results in the statement list or ladder diagram. You don't have to connect up a PU. And the fault can be located just as quickly.

You can quickly remedy the problem

You can selectively initiate movements on the operating unit to remedy the problem.

If a number of installation components have been damaged, this is indicated on the operating unit and you can initiate simultaneous repair of the individual components.

And that means that your installation will be ready for operation again as quickly as possible.



Message, diagnostics, assistance with fault rectification

Reducing costs

Early identification and elimination of faults

- increases installation availability
- reduces down times
- and thus ultimately reduces costs

2.2 Important Terms

Units

In S7-PDIAG a unit is a block, in S7-GRAPH it is a sequence of steps; in S7-HiGraph it is a status graph.

Units are objects of the process diagnostics that are monitored with the aid of error definitions. There can be several error definitions for each unit. Units can be physical objects in the process (e.g. a press or die) which in turn can incorporate movements (e.g. forward/backwards, up/down).

Units are logical hierarchical criteria and structure the view of the process. They may store data that is shared by all hierarchically subordinate objects. Hierarchically subordinate objects can in turn be other units or movements, for example.

Each unit can incorporate one or more actions.

Actions

Actions are components of a unit. Their purpose within the process is to control a single actuator.

In program terms, an action is

- a network in a LAD/CSF/STL program
- a step in a S7-GRAPH program
- a status in a S7HiGraph program

Transitions

A transition describes a condition for progressing from one step to the next within a sequence of steps.

Transitions exist only in S7-GRAPH and S7HiGraph.

Movements

Movements are defined in S7-PDIAG and S7-HiGraph by using the UDT "Movement" within a block.

Each movement can be executed in two directions, e.g. in/out, open/close, up/down, forward/backwards. ProAgent allows up to 16 target positions of a movement to be displayed.

2.3 How a process diagnostics is Carried Out

Diagnostic Screens

For the process diagnostics various additional standard diagnostic screens (diagnostic screens for short) are supplied. Those screens are linked to one another by keys.

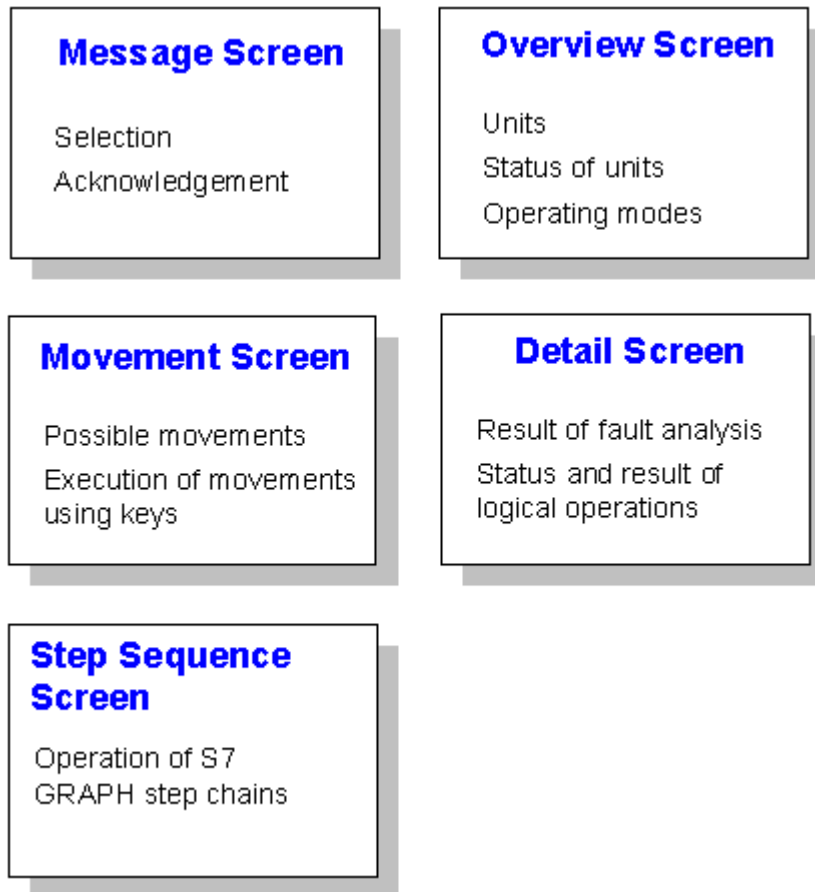
For the operator on the operating unit, process diagnostics is simple in view of these diagnostic screens:

When a fault occurs, an alarm message appears on the Message Screen or in the message window on the operating unit.

By identifying this alarm message by an asterisk (*), the operator sees that the malfunction is capable of being diagnosed - in other words, it indicates that he can trace the cause of the fault on the operating unit.

At the press of a button, the operator can switch either to an Overview Screen, a Movement Screen or a Detail Screen.

- On the "Overview Screen", all the units of the system are displayed together with their subunits. This shows the operator at a glance the current operating mode and condition of each individual unit.
- The "Movement Screen" provides quick assistance with rectifying faults. You can see at a glance which movements are blocked and those which can still be executed. It can be used to initiate movements by individual units by means of keys.
- The "Detail Screen" shows the results of the fault analysis automatically instigated from the operating unit. To do this, a simple symbol list, a detailed statement list (STL) or a ladder diagram (LAD) is shown in the display with the corresponding section of the STEP 7 program code. At the same time, the status bits of the operands and all the logic operation results can be displayed. Signals that have caused a fault are highlighted. You can quickly trace the cause of an error in this manner.
- The "Step Sequence Screen" can be used to set or reset individual steps in the selected S7-GRAPH sequence of steps.



The Different Diagnostic Screens

Standardization

The user interface on the operating unit is standardized so that operation follows a uniform pattern for all installations and components.

A detailed description of the individual diagnostic screens is given under the topic "Display on the Operating Unit".

2.4 How a process diagnostics is configured

System concept

ProAgent is a universal system concept and designed for optimum interaction between STEP7, STEP7 option packages and the operating unit configuration program, ProTool.

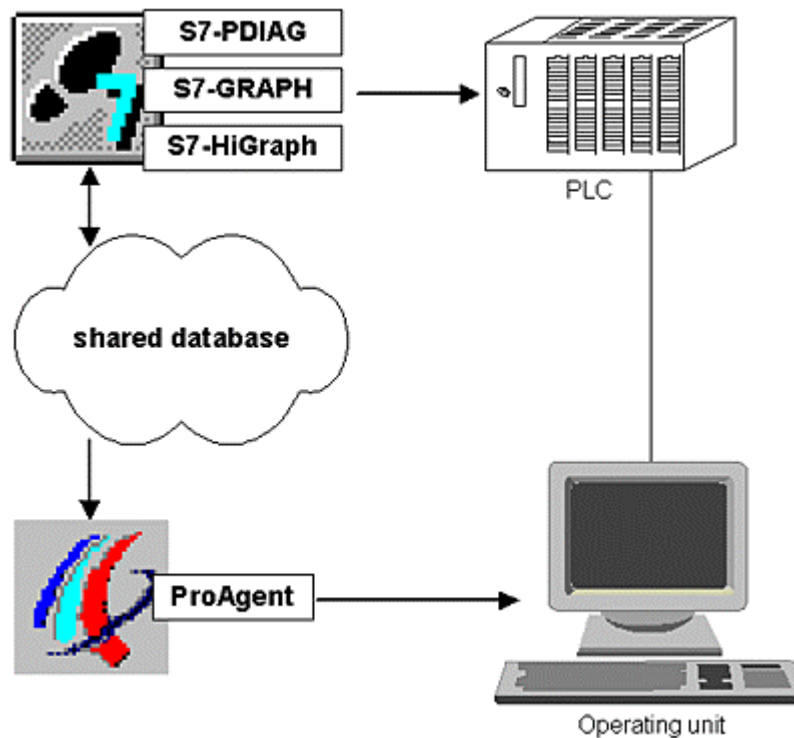
Configuring the process diagnostics is quick and simple to perform. It makes no difference whether you integrate process diagnostics into a new project to be created or into an existing project.

Subtasks

Just as when configuring an installation, there are two main subtasks involved in implementing a process diagnostics:

1. Programming the PLC
2. Configuring the operating unit

ProAgent, like ProTool, is used for the second step only, i.e. configuring the operating units.



Configuring process diagnostics

Programming the PLC

Depending on the programming language you are using for the PLC, the preparations for the process diagnostics will differ as follows:

- If you are using S7-GRAPH or S7-HiGraph, your programs are automatically capable of diagnostics.
- If you are programming in LAD/CSF/STL, you need the S7-PDIAG option package. S7-PDIAG creates additional modules for monitoring your process for the purposes of fault detection. This is mostly done automatically.

Thanks to the global nature of S7 process diagnostics, you can also work with different programming languages within the same system – entirely as circumstances demand. You can also detect and locate process faults in "mixed" sequential and logic control systems.

Common database as interface

When translating the PLC program, the STEP7 option packages store all the data required for the process diagnostics in a shared database.

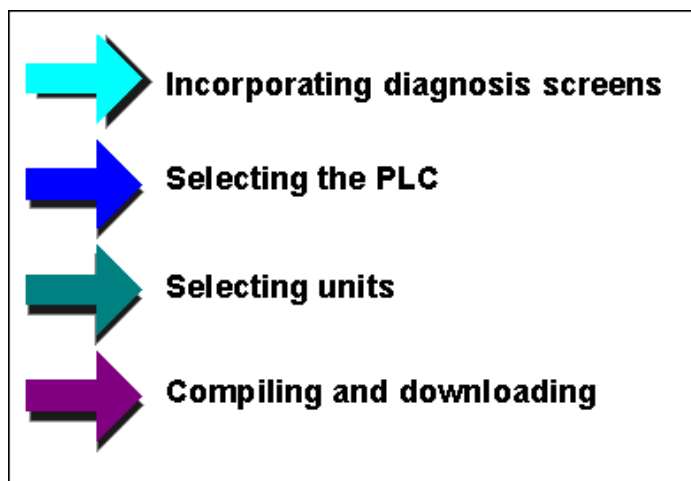
ProTool then accesses that database when the operating unit is configured during the next stage.

Configuring the operating unit

Once the STEP7 program has been created, the process diagnostics can be configured for the operating unit. It is only at this stage that the ProTool option package ProAgent comes into play.

It goes without saying that you do not need to repeat any of the entries already made in STEP7. All relevant information has been stored in the shared database that ProTool now accesses.

This is what makes the process of configuration in ProTool so quick and easy to complete. All you have to do is



Configuring the operating unit for process diagnostics

The first step involves adopting the standard diagnostic screens supplied with ProAgent.

The screens are now fully ready. If, in certain situations, you should nevertheless wish to modify any of the screens to suit your own particular requirements, that presents no problem.

You then select the PLC to which the operating unit is connected.

Next, you select the units of your S7 PLC for which you wish to set up a process diagnostics. Making that selection is simple: ProTool compiles a list from the shared database and all you need to do is click the relevant units.

You can also specify using various display classes which messages are to be displayed on the operating unit.

Finally, you simply compile and transfer your project as usual.

2.5 Before You Start

Requirements

ProAgent is integrated in ProTool and the remainder of the S7 environment and consequently is only one of the components involved in creating a process diagnostics. ProAgent, like ProTool, is used only for configuring the operating unit and not the PLC.

In order to be able to configure a process diagnostics, certain basic requirements must be met. They can be summarized as follows:

- ProTool must be installed as an integral component in STEP7.
- ProAgent must be installed.
- The PLC must have been programmed previously. You can use LAD/CSF/STL and S7-PDIAG or S7GRAPH or S7HiGraph for this. You can also use these packages in parallel on a single PLC.
- If the PLC has been programmed in LAD/FUP/STL, additional error detection blocks must have been created using the option package S7-PDIAG. Error detection must have been activated.
- The PLC program must have already been compiled.

3 Display on the operating unit

Introduction

When you configure process diagnostics, a number of additional diagnostic screens are integrated into the configuration. The contents of the screens can be adapted dynamically to the technological units of the installation.

Standardization

The entire user interface has been standardized, so that all installations and sections of installations are controlled along uniform lines.

Diagnostic Screens

The following individual diagnostic screens are integrated:

- The Diagnostic Start Screen, as the point of entry and distribution for the diagnostic functions.
- The Message Screen, in which the diagnosable messages can be selected and processed
- The Overview Screen, in which the operator can see at a glance which operating mode the individual units are in.
- The Movement Screen for quick rectification of an error.
- The Step Sequence Screen, in which you can run individual steps manually, reinitialize sequences of steps and adjust these to match the program
- The Detail Screen, which shows the result of the error analysis which is performed automatically by ProAgent.

3.1 How to activate diagnostics

Diagnosable messages

You are already familiar from ProTool with the option available for working with message lines and message windows: depending on the configuration, alarm messages are either displayed in a message line or in an alarm message window.

The message line and alarm messages window are still used – even if a process diagnostics has been configured using ProTool and ProAgent. However, diagnosable messages are now identified by an asterisk * in front of the message number.

You can only carry out a diagnostics for that type of message.

Nr.	Zeit	Zustand	Text	QGR
* 11	18:44:29	KO	Interlock Clamp open	0
* 10	19:30:35	KQ	S7GRAPH Supervision Fault: FB10, DB10, S2	0

Structure of an alarm message

Diagnostic Start Screen

The way in which you start the diagnostics depends on the project concerned. In the simplest case, there is a key that is used to activate the Diagnostic Start Screen. From there you can then move to other diagnostic screens as required.

Other routes

Your project may also provide specific keys for moving directly to individual diagnostic screens.

You then start the diagnostics from those screens, bypassing the Diagnostic Start Screen.

Message acknowledgement

ALARM-S messages requiring acknowledgement can be acknowledged in the message view with "ACK". If the alarm message belongs to an acknowledgement group, when it is acknowledged, all other alarm messages in that group are acknowledged at the same time, as normal.

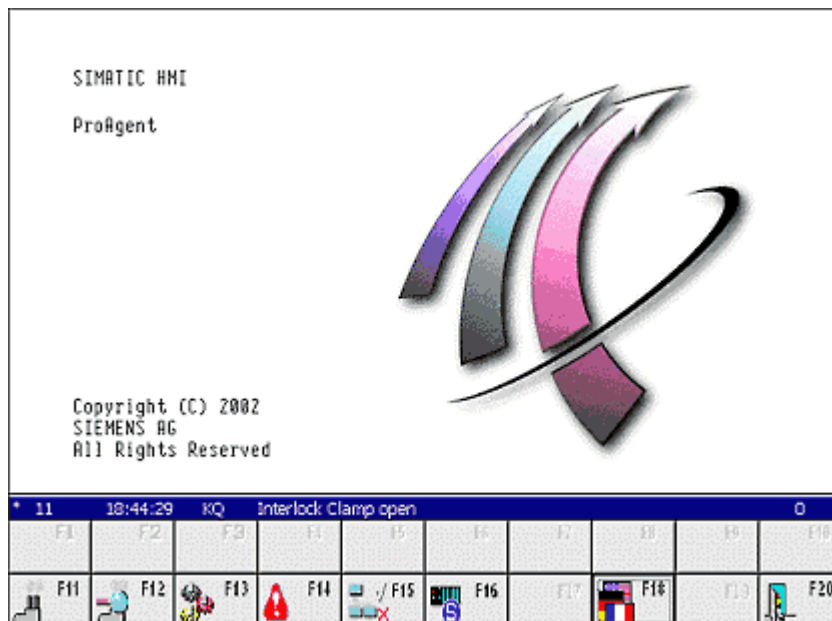
3.2 What are the individual diagnostic screens used for?

process diagnostics

For process diagnostics some additional standard diagnostic screens can be integrated into the configuration. The process diagnostics is performed from those screens.

All diagnostic screens are standardized to a large degree and differ in only minor details from one operating unit to another. The illustrations below show examples of diagnostic screens as they appear on a PC.

Diagnostic Start Screen

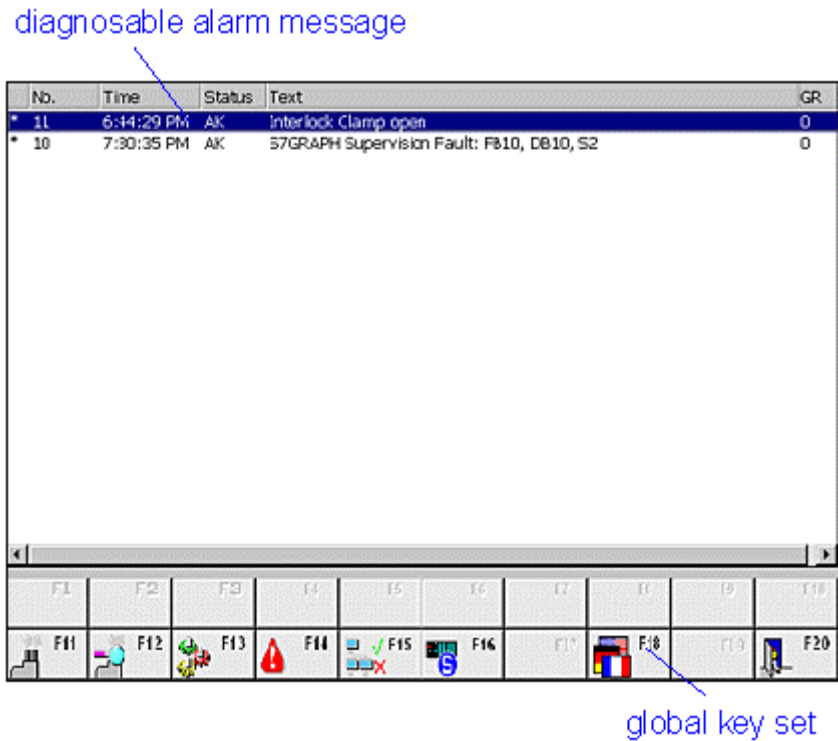


Diagnostic Start Screen (as shown on PC)

The Diagnostic Start Screen forms the point of entry and distribution for the diagnostic functions. From there, you can move to the Message Screen and the Overview Screen where you can obtain an initial overview of pending error messages.

Whether or not the Diagnostic Start Screen is actually used depends on the particular configuration concerned.

Message Screen



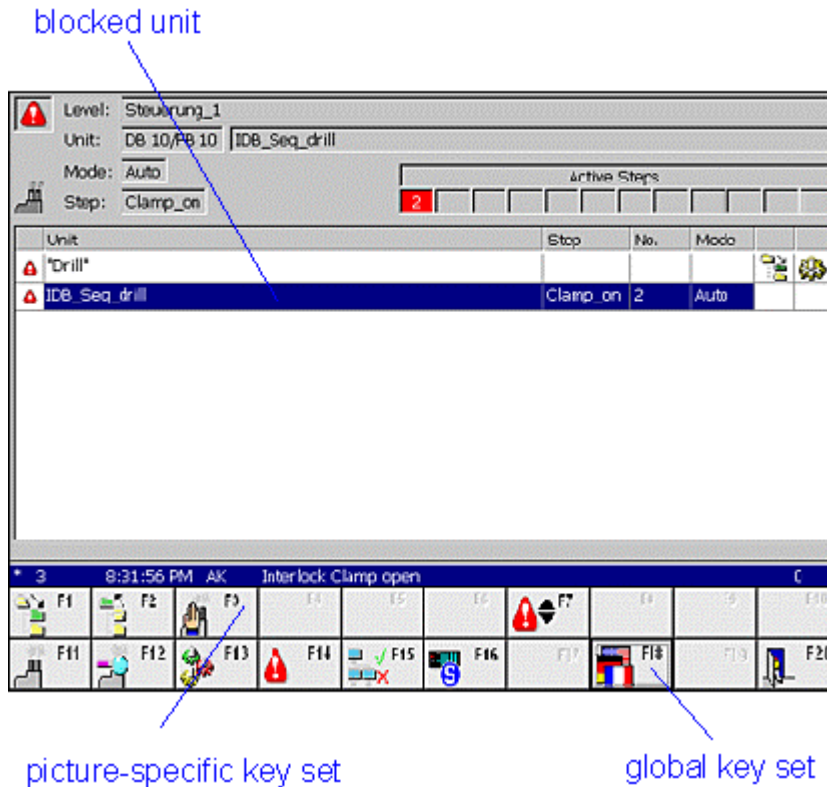
Message Screen (example on PC)

Like the Diagnostic Start Screen, the Message Screen also often serves as the point of entry into the diagnostics. Its structure is similar to that of the conventional alarm message page except that additional keys are provided for selecting other diagnostic screens.

Diagnosable messages are identified by an asterisk * in front of the message number. You can carry out a process diagnostics for those messages only.

A detailed description of the Message Screen can be found in the section entitled "Message Screen".

Overview Screen



Overview Screen (example on PC)

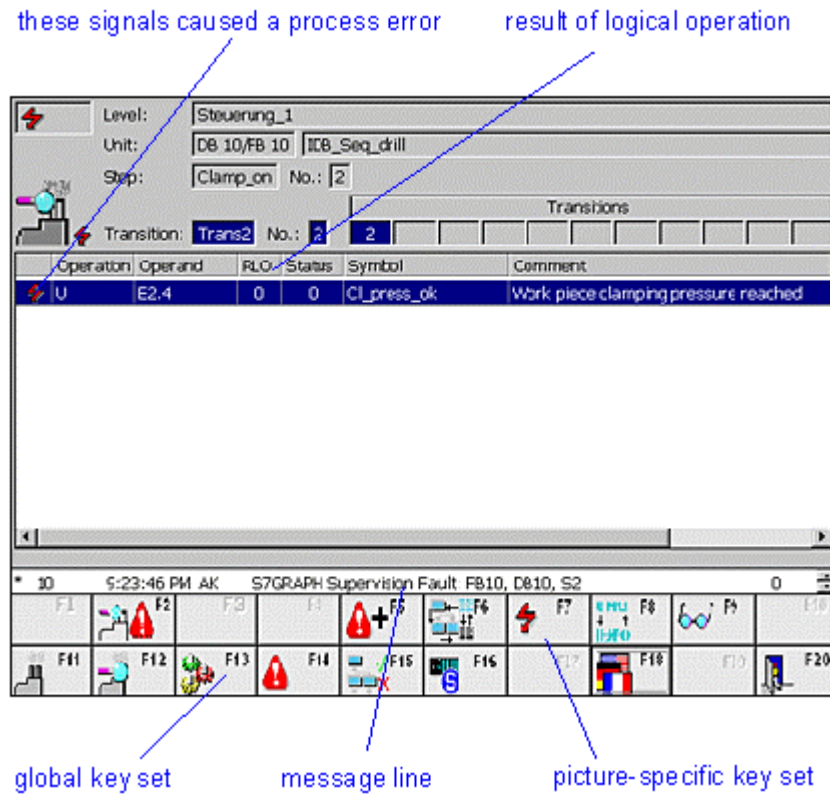
The Overview Screen shows all the units present in your system.

This shows you at a glance the current operating mode and condition of each individual unit. Blocked units are identified as such. Once a fault has been rectified, the marker disappears again.

If your system has units that were programmed in S7-GRAPH, you can set or reset each step in the sequence in Step Sequence mode.

A detailed description of the Overview Screen can be found in the section entitled "Overview Screen".

Detail Screen



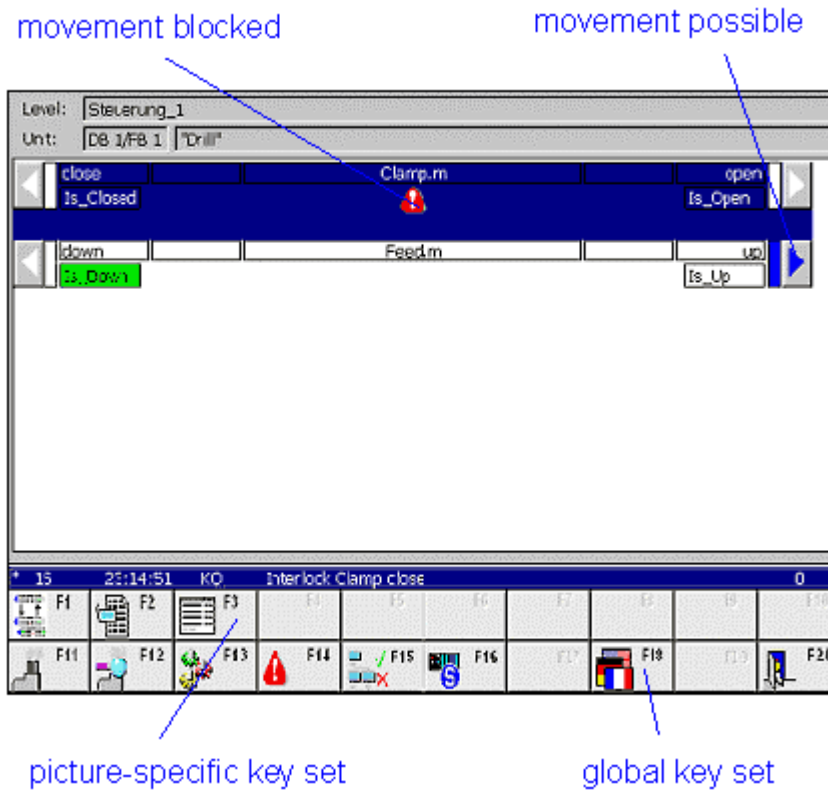
Detail Screen: Symbol list mode (as shown on PC)

The process diagnostics analyzes which signals in the PLC program have led to an error message. The Detail Screen shows the results of that analysis. This means that you can not only see that a fault has occurred, you are immediately shown what has caused it as well.

The Detail Screen shows the corresponding section of STEP7 program code as a symbol list, in STL or in LAD. In parallel with this, in STL and LAD view the status bits of the operands and all the logical operation results are specified. Signals that have caused an alarm message are highlighted.

A detailed description of the Detail Screen can be found in the section entitled "Detail Screen".

Movement Screen



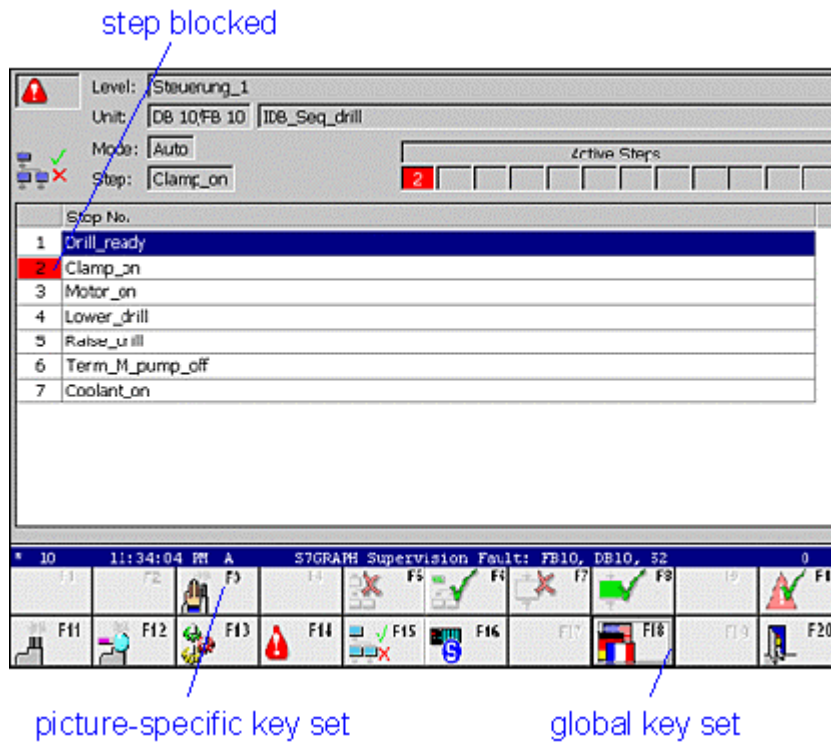
Movement Screen (as shown on PC)

The Movement Screen provides assistance with rectifying faults. You can use the keys at the sides to initiate specific movements on individual units.

The symbols shown tell you at a glance whether a movement is active and in which target position it is located.

A detailed description of the Movement Screen will be found in the section entitled "Movement Screen".

Step Sequence Screen



Step Sequence Screen (example on PC)

The Step Sequence Screen displays a list of all the steps in the step sequence. Steps with faults and active steps are indicated by specific colors. From here you can initialize the sequence of steps or activate individual steps, for example.

A detailed description of the Step Sequence Screen is given in the section entitled "Step Sequence Screen".

3.3 How the diagnostic screens are linked to one another

Five diagnostic screens

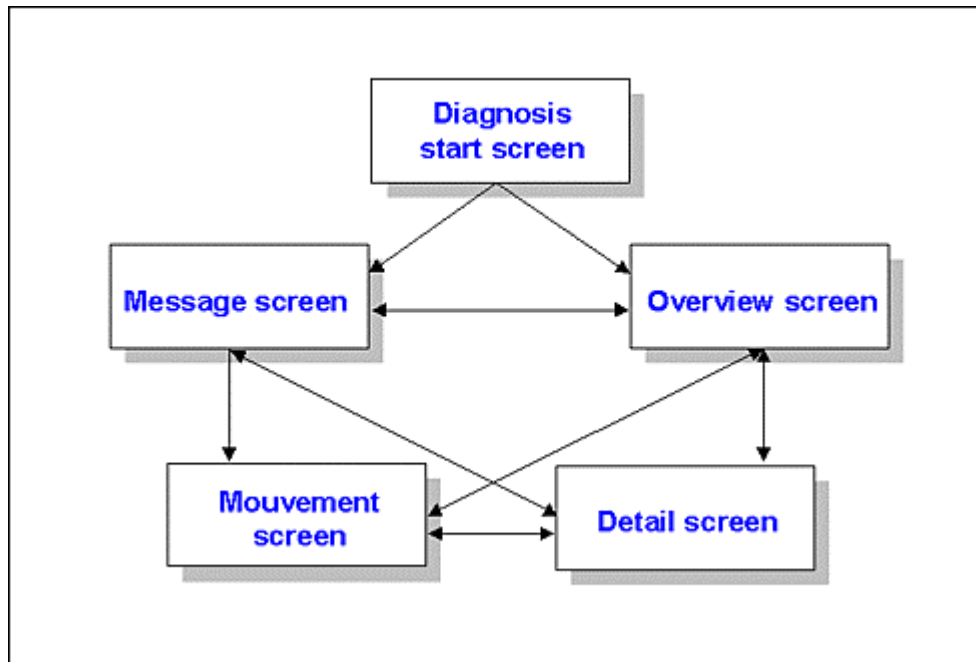
The five Diagnostic Screens Message Screen, Overview Screen, Detail Screen, Step Sequence Screen and Movement Screen are interconnected via keys from the global key set, enabling you to switch back and forth between individual screens.

One Diagnostic Start Screen

There is also a Diagnostic Start Screen, which often serves as the point of entry into the diagnostics (see "How to activate diagnostics").

Links

The diagram below shows the ways in which you can navigate between the screens:



Possible navigation routes between the diagnostic screens

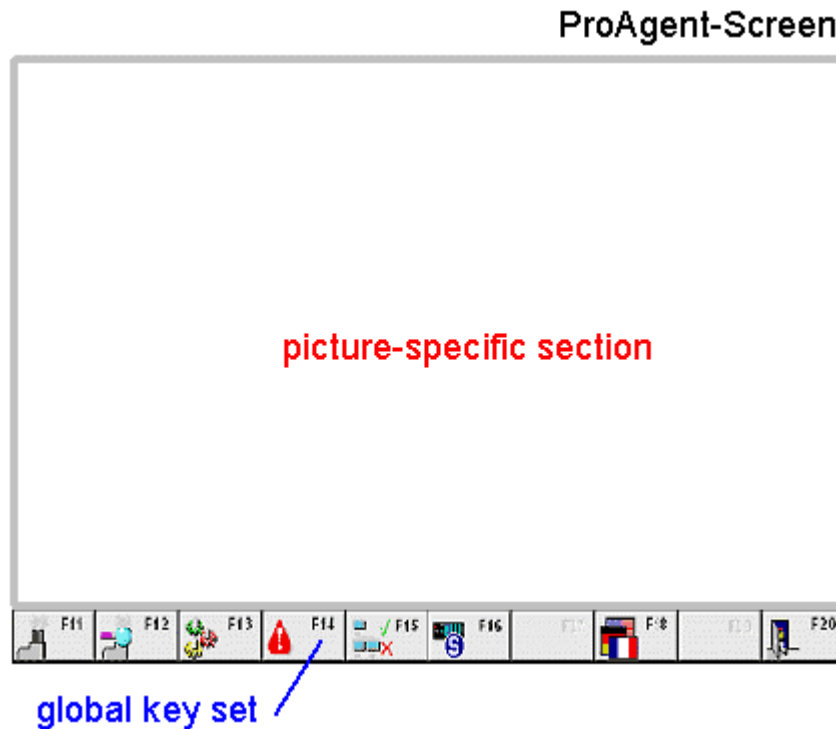
The point of entry to the diagnostics is normally provided by the Diagnostic Start Screen, the Message Screen or the Overview Screen. You can access any of the other diagnostic screens from the Message Screen and the Overview Screen.

Your particular configuration may differ from this arrangement of links. If your project provides the means, you may also be able to move directly to specific diagnostic screens from other system screens.

3.4 Structure of the diagnostic screens

General aspects

All the diagnostic screens – except the Start Screen – are structured in three parts: a part specific to each diagnostic screen is sandwiched between a global screen header and a global key set. Above the keys is a message line displaying the oldest alarm message.



Sections of the diagnostic screens

Clear partitioning of diagnostic screens into one screen-specific and two global sections make sure you can quickly find your bearings when running the different screens.

Global screen header

The date and time are always displayed in all diagnostic screens.

Global key set

In addition to a number of screen-specific keys, you can also use various global screen keys in all diagnostic screens.

On the Multi Panel and the OP270 there are fewer function keys than on other operating units. In the corresponding Diagnostic Screens, therefore, the functions of the global key set and the screen-specific key functions are incorporated into a single row of keys.









The topic "Scope and function of the global key set" explains in detail which keys are available in each case and the function each one performs.

3.5 Scope and function of the global key set

Global Key Set

In addition to a number of screen-specific keys, you can also use various global screen keys in all diagnostic screens.

The Multi Panel, the OP270 and the TP270 have only a limited number of programmable keys. Some of the functions of the global key set therefore have to be executed using other keys on these devices or are not available.

Key or button	Designation	Function
	Overview Screen	Use this key to call up the Overview Screen.
	Detail Screen	Use this key to call up the Detail Screen.
	Movement Screen	You use this key to open the Movement Screen.
	Message Screen	You use this key to open the Message Screen.
	Step Sequence Screen	You use this key to open the Step Sequence Screen.
	Status/Control	Use this key to call up a screen with a "Status/Control Variable" field. This enables you to monitor and control the operands of the relevant PLC program in a variables table. Detailed information on Status/Control can be found in the "Runtime Manual".
	Language	Use this key to switch language where a multilingual project has been compiled.
	Back	You use this key to return to the Diagnostic Start Screen. If you wish to change this, you must use the appropriate functions (see "ProAgent functions for selecting Diagnostic Screens").

Global keys

3.6 Message Screen

The purpose of the Message Screen

No.	Time	Status	Text	GR
* 11	6:44:29 PM	AK	Interlock: Clamp open	0
* 10	7:30:35 PM	AK	S7GRAPH Supervision Fault: FB10, DB10, S2	0

The screenshot shows a window titled 'Message Screen' with a list of messages and a row of function keys (F1-F20) at the bottom. The messages are as follows:

No.	Time	Status	Text	GR
* 11	6:44:29 PM	AK	Interlock: Clamp open	0
* 10	7:30:35 PM	AK	S7GRAPH Supervision Fault: FB10, DB10, S2	0

The function keys at the bottom are labeled F1 through F20, each with a small icon representing a different diagnostic screen or function.

Message Screen (example on PC)

The Message Screen displays all pending process messages. The messages are listed on the screen in chronological order.

The Message Screen frequently serves as the entry point to diagnostics. On it, you can observe whether faults occur and which faults those are and you can then switch to any of the other diagnostic screens as required.

Additional functions compared to the message page

The Message Screen is structured in a very similar way to a normal message page. However, it provides some additional information and functions.

This enables you to see by a glance at an asterisk next to the message number which messages are diagnosable. You can then carry out a process diagnostics for those messages.

You can select a specific message and use keys to call up other context-sensitive diagnostic screens such as:

- The Detail Screen: this screen shows an excerpt from the program code that caused the selected alarm message.
- The Overview Screen: this screen shows an overview of the various units in your system.

3.6.1 What you see on the Message Screen

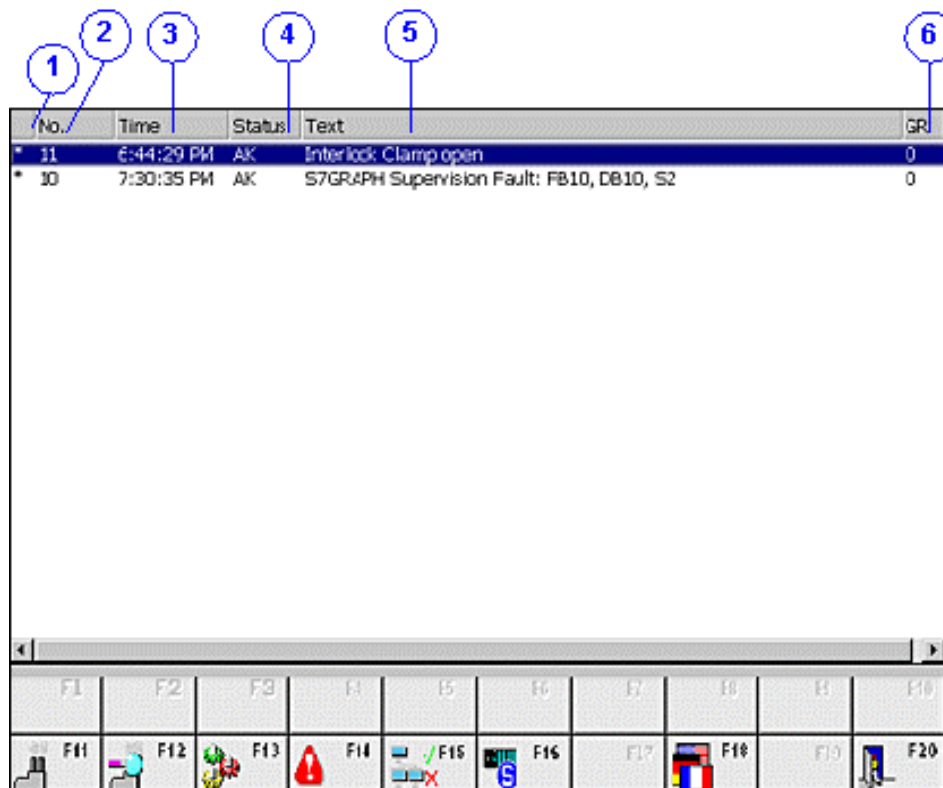
Familiar layout

Basically, the layout of the Message Screen is the same as the normal message pages you are familiar with from the standard functionality.

Additional functions

Compared with the normal way in which messages are displayed, however, there are a few minor changes.

The important feature is the identification of diagnosable messages by means of an asterisk "*" at the beginning.



Message Screen (example on PC)

(1) An asterisk is displayed here if the message displayed is diagnosable. For this type of message only, you can call up the Overview Screen, the Detail Screen, the Movement Screen or the Step Sequence Screen.

(2) The message number is shown here.

(3) Here you can see the time of the arriving event.

(4) The date of the arriving event is displayed here.

(5) Here you can see the message status:

A: message arrived

D: message departed

A: message acknowledged

(6) Here you can see the message text configured with STEP7.

Displaying the result of criteria analysis in the message text

The message text can also display the operands that gave rise to the fault. In this way the system operator obtains the most important information about the system fault in the message window itself or in the message line without having to switch to the Diagnostic Screens.

When the faulty operands are displayed in the message text, they are archived together with their last accompanying process value when the message is archived.








For the faulty operands to be displayed and archived, appropriate dummy entries must be inserted in the ALARM_S message text. For more information about this topic see "Displaying the result of criteria analysis in the message text" .

3.6.2 Keys in the Message Screen

Use

The number of keys/buttons configured in the Message Screen is limited by the number of keys/buttons available on the unit. However, if necessary you can program other functions on these keys/buttons or on supplementary buttons.

You can use the following keys on the Message Screen:

Key or button	Designation	Function
	Overview Screen	You use this key to open the Overview Screen. You must have selected a diagnosable message first.
	Detail Screen	You use this key to open the Detail Screen. You must have selected a diagnosable message first.
	Movement Screen	You use this key to open the Movement Screen. You must have selected a diagnosable message first.
	Step Sequence Screen	You use this key to open the Step Sequence Screen. You must have selected a sequence of steps first.
	Status/control	Use this key to call up a screen with a "Status/control" field. This enables you to monitor and control the operands of the relevant PLC program.
	Language	Use this key to switch language where a multilingual project has been compiled.
	Back	You use this key to return to the Diagnostic Start Screen. If you wish to change this, you must use the appropriate functions (see "ProAgent functions for selecting Diagnostic Screens").

Keys in the Message Screen

3.6.3 How to work with the Message Screen

What you need to do

This section gives a general outline of how to use the Message Screen in practice.

Aims

You have opened the Message Screen in order to obtain an overview of the pending alarm messages. You wish to carry out a process diagnostics for specific messages.

No.	Time	Status	Text	GR
* 11	6:44:29 PM	AK	Interlock: Clamp open	0
* 10	7:30:35 PM	AK	S7GRAPH Supervision Fault: FB10, DB10, S2	0

The screenshot shows a window titled 'Message Screen' with a scrollable list of messages. Below the list is a function key bar with 20 keys labeled F1 through F20. Each key has a small icon representing a different function or status.

Message Screen (example on PC)

Selecting a message

Before performing process diagnostics for a specific alarm message, select the message concerned. To do this, click the message concerned with the mouse or move the selection bar with the arrow keys to the corresponding point.

Before changing to the Diagnostic Screen concerned, call the function `ProAgent_Evaluate_Fault` in order to make a note of the unit, movement and criteria analysis associated with the message for the purpose of process diagnostics.

If a number of messages are displayed in different screen areas and no message has the focus, the message in the screen area with the highest priority is selected. If a number of message displays are shown, function `ProAgent_Evaluate_Fault` selects the message display in the following order of priority:

1. Message display with focus (dotted rectangle)
2. Alarm message window
3. Message line
4. Message display in the fixed window
5. Message display in the basic screen

Switching to the Overview Screen



To obtain an overview of which units of your system are affected by the faults, use this key to switch to the Overview Screen. From there, you can subsequently move on to the Movement Screen in order to manually execute individual movements for a specific unit.

Switching to the Detail Screen



Once you have selected the required message, you can press this key to switch to the Detail Screen. This shows you a list of the signals responsible for triggering the alarm message.

Switching to the Movement Screen



Once you have selected a message you can use this key to switch directly to the Movement Screen, i.e. without having to use the "indirect route" via the Overview Screen. The Movement Screen shows all movements for the units where there are faults and allows you to execute those movements directly as well.

Switching to the Step Sequence Screen



If you have selected a message based on an S7-GRAPH step sequence, you can use the "Sequence" key to switch directly to the Step Sequence Screen. There you can search for specific steps and enable or disable one or more steps in the step sequence.

Exiting the Message Screen

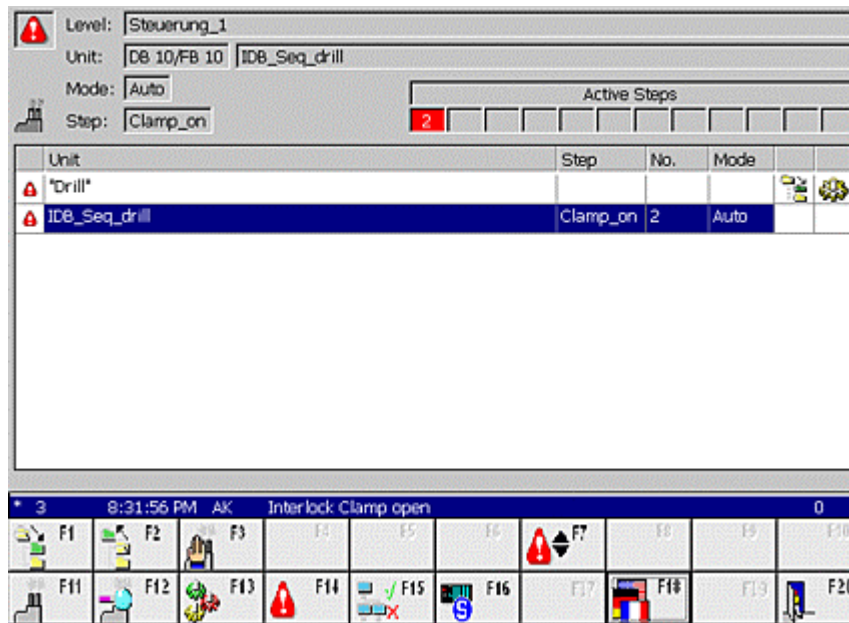
You can switch directly from the Detail Screen to the other diagnostic screens or also exit diagnostics:



switches to the Diagnostic Start Screen

3.7 Overview Screen

The purpose of the Overview Screen



Overview Screen (example on PC)

The Overview Screen shows all the diagnosable units in your system.

It gives you the following information about each unit:

- whether it has a fault
- if programmed accordingly, which operating mode you are in (e.g. manual or automatic mode)
- whether there are subordinate or superior units
- whether a movement exists for it
- in the case of S7-GRAPH sequences, which step in the sequence of steps is currently active
- in the case of S7-HiGraph units, which status is currently active.

If there are faults on more than one unit, you can see on which one the fault first occurred. In that way, you can tell immediately where the actual cause lies and which faults are consequential errors.

Functions

You can select a unit from the list and, if programmed accordingly, set its operating mode. For example, you can switch from Automatic to Manual mode in order to be able to rectify a fault manually.

Once you have selected a unit, you can analyze it in more detail on the Detail Screen and then switch to the Movement Screen to execute individual movements manually in order to rectify the fault.

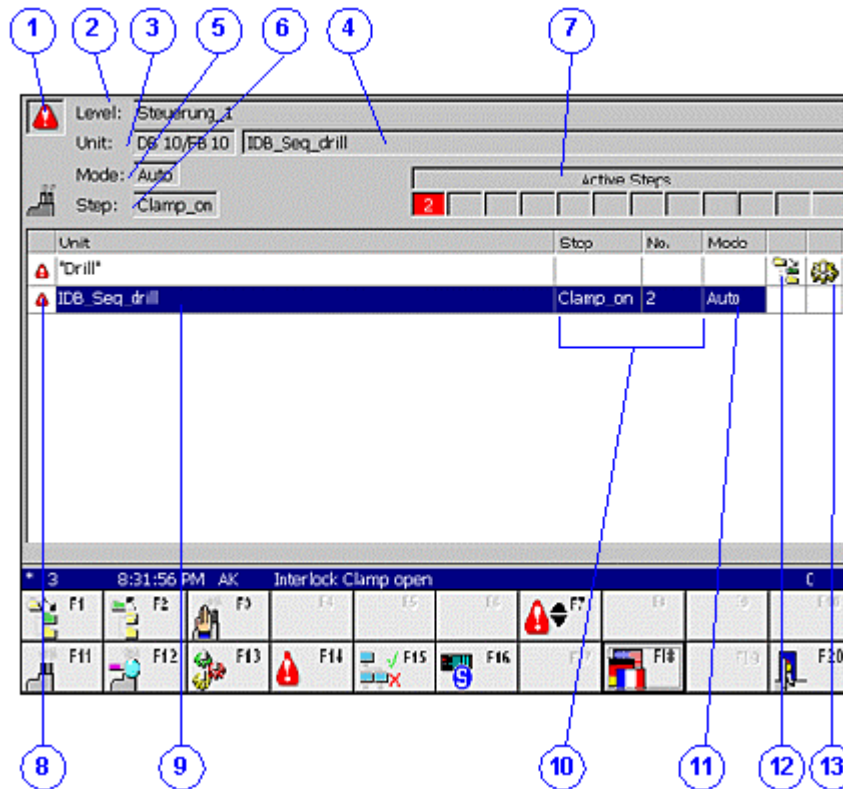
If you have selected a unit that was programmed using S7-GRAPH, you can use the Step Sequence Screen to search for specific steps and to activate or deactivate individual steps or the entire sequence.

3.7.1 What you see in the Overview Screen

General layout

Like all the diagnostic screens, the Overview Screen has a standardized layout. There are only minor differences between the various types of operating units.

The illustration below shows an example of the Standard Overview Screen as it appears on a PC.



Overview Screen (example on PC)

Display mode

(1) The top left field gives you information on the display mode:



The "Warning triangle" symbol is displayed here if only the blocked units are displayed. If this symbol is not shown then all the units are displayed (see "Changing the display mode").

Information on the selected unit

The top section of the display shows detailed information relating to the unit selected by the cursor.

(2) The "Level" field displays the PLC assigned to the unit and the complete hierarchical path.

(3) The "Unit No." field tells you the block type (FB/FC and DB) and the block number of the selected unit.

(4) The complete name of the unit appears in the "Unit" box. This name depends on the programming of the PLC:

- If the unit was programmed in "S7-PDIAG", this is the symbol of the block or, if this does not exist, an absolute name.
- If the unit was programmed in "S7-GRAPH", this is a sequence name.
- If the unit was programmed with S7-HiGraph, this is the name of a group of graphs or a status graph of lower rank.

(5) The current mode of the unit is displayed in the "Operating mode" box. You can change modes with the "Operating mode" key.


If no operating mode is defined in the STEP7 program, or if display of the operating mode is suppressed, then the field will be empty. In this case, you cannot set the operating mode.

The content of the lowest line in the display is dependent on the programming of the PLC:

If the unit was programmed in "S7-PDIAG", this line is not displayed.

If the unit was programmed in "S7-GRAPH", the following will be displayed:

(6) The "Step" field shows the name of the first active step.

(7) The numbers of the active steps appear in these boxes. The numbers of the steps with faults always appear first reading from left to right. They are shown in red. If there are more active steps than can be displayed, the following icon is shown: .

If the unit was programmed with "S7-HiGraph" and a corresponding process connection was created, the following will be displayed:

(6) The "Status" field shows the name of the first active status.

(7) This field displays the number of the active status.

Overview of units

The center section of the display shows a table of all diagnosable units in your system. The order in which they are displayed depends on the attributes that you gave the units when programming them (e.g. in S7-PDIAG in the "Properties > Units" dialog box). The Overview Screen in ProAgent is structured in accordance with the attributes "belongs to screen" (screen number) and "position in screen" (position number):

- Units with the same screen number are arranged according to position number.
- If they also have the same position number, units are sorted into alphabetical order by name.
- Units for which no screen number and position number have been set appear in alphabetical order at the end of the list.

(8) Displayed in the left of the table is the current status of a unit:



The "Warning triangle" symbol indicates that a unit is blocked. The unit on which the fault occurred first is identified by a flashing icon.. This indicates to you that this fault is not a secondary fault.



The "Connection errored" symbol indicates that connection to the PLC is errored or an addressing error has occurred.



The "Inconsistency alert" symbol indicates that the data for this network has changed in the STEP7 configuration. In a criteria analysis the network data is read by ProAgent directly from the PLC.



The "Consistency error" symbol indicates that the data for this network is not consistent with the STEP7 database. Regenerate your project before continuing.

(9) The "Unit" box indicates the name of a unit stored in the PLC program. This is:

- the symbol of a module or an absolute designator if the unit was programmed in "S7-PDIAG"
- a sequence name if the unit was programmed in "S7-GRAPH"
- if programmed with "S7-HiGraph", the name of a status graph.

(10) The content of the next two boxes depends on how the unit was programmed:

- if "S7-PDIAG" is used, nothing is displayed
- if "S7-GRAPH" is used, the "Step name" is displayed and the "No." box shows the number of the active step.
- if "S7-HiGraph" is used, the "Status name" is displayed and the "No." box shows the number of the active status.

(11) In the "Mode" column you can see which operating mode is currently set for that unit. You can change modes with the "Operating mode" key.

If no operating mode is defined in the STEP7 program, or if display of the operating mode is suppressed, then the box will be empty. In this case, you cannot change the operating mode. For information on disabling the operating mode display, please refer to "ProAgent functions for an overview display"

(12) To the right of the "Mode" column you can see whether there is a higher-level or lower-level unit available for the unit concerned:



This icon refers to a subordinate unit.

This icon refers to a superior unit.

This symbol indicates that there is a lower-level unit and a higher-level unit.

(13) On the far right you can see whether there is a movement for the unit concerned:



If there is a movement for the unit then the "Movement" icon is displayed. You can then switch to the Movement Screen using the "Movements" key.












(14) Here you can scroll up and down in the list of units by clicking the mouse if more units are present than can all be displayed in the list at the same time.


3.7.2 Keys in the Overview Screen

Use

The number of keys/buttons configured in the Overview Screen is limited by the number of keys/buttons available on the unit. However, if necessary you can program other functions on these keys/buttons or on supplementary buttons.

You can use the following keys on the Overview Screen:

Key / Button	Designation	Function
	Switch overview screen	Use this key to switch between the two overview screens on the OP270 with a 6" display. The overview screen had to be spread over two screens on this operating unit for reasons of space.
 "Enter"	Down one level	Use this key to switch to a lower-level hierarchical unit.
 "Backspace"	Up one level	Use this key to switch to a higher-level hierarchical unit.
	Operating modes	Use this key to change the operating mode of the selected unit. The operating modes that are possible depend on how the unit has been programmed.
	all/blocked	Use this key to toggle the display mode between display of all units and display of units with faults only.
	Detail Screen	Use this key to call up the Detail Screen.
	Movement Screen	You use this key to open the Movement Screen.
	Message Screen	Use this key to call up the Message Screen.
	Step Sequence Screen	You use this key to open the Step Sequence Screen.
	Status/control	Use this key to call up a screen with a "Status/control" field. This enables you to monitor and control the operands of the relevant PLC program.
	Language	Use this key to switch language where a multilingual project has been compiled.

Key / Button	Designation	Function
	Back	You use this key to return to the Diagnostic Start Screen. If you wish to change this, you must use the appropriate functions (see "ProAgent functions for selecting Diagnostic Screens").

Keys in the Overview Screen

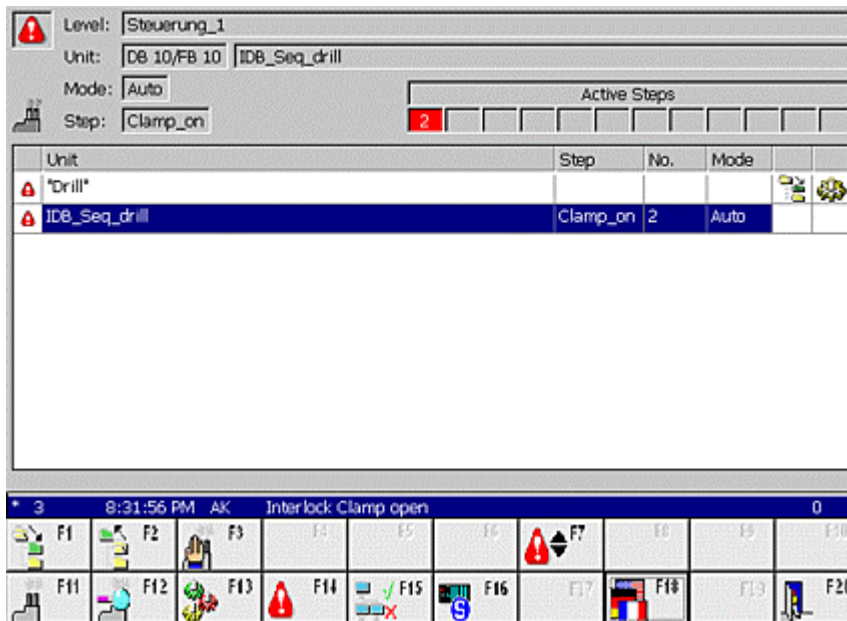
3.7.3 How to work with the Overview Screen

What you need to do

This chapter gives a general outline of how to use the Overview Screen most effectively in practice.

Aims

You have opened the Overview Screen to see on which units of your system there are faults. You want to see which unit caused the problem and what triggered it. Finally, you want to be able to move specific system components in order to rectify the fault.



Overview Screen (example on PC)

On which units are there faults?



First of all, you want to be able to see on which units there are faults. You can use the cursor keys to move the cursor through the list. All blocked units are marked by the "Warning triangle" symbol.

To see only those units with faults, use the "All / errored" key to switch display mode. Those units that are not blocked are then no longer displayed, and you can move directly between the blocked units with the highlight.

This setting will remain until you restart ProTool Runtime mode or change the display mode back to all units by pressing the relevant key.

On which unit did a fault occur first?

The unit on which a fault occurred first is identified by a flashing "Warning triangle" icon. There is a very strong possibility that the cause of the fault is to be found here and that the other faults are consequential on the original fault.

The unit with the oldest fault

When determining which unit had the oldest fault, the priority of the associated message is taken into consideration.

If you want to be certain that the unit with the oldest fault will always flash in the Overview Screen, do not use different priority levels for messages. To find out how to assign priority levels to messages, please refer to the topic "Configuring Alarm_S Messages".

Information about the unit

You select the unit with the flashing warning triangle. In the top section of the screen you can now see detailed information about that unit, i.e. the block type and the block number, text assigned to the unit, the operating mode currently set and step numbers/status numbers of the active steps (see "What you see in the Overview Screen").

Detailed analysis



If the cause of the fault is not obvious, you will want to investigate the fault more thoroughly in order to see which logical operation results in the program code triggered the error message. Use this key to open the Detail Screen.

Changing to manual mode

If you know what has caused the fault, you will naturally want to rectify it as quickly as possible so that the system can be started up again. To that end, you can execute specific movements on particular units in manual mode.

To change the operating mode, select the unit on which you wish to carry out a movement.



Use the "Operating modes" key to open a corresponding selection list.

Executing movements



Once you have selected the unit or subunit that you wish to move and have set the correct operating mode, use the this key to switch to the Movement Screen.

Opening the Step Sequence Screen



If you have selected a unit that was programmed in S7-GRAPH, you can use the "Sequence" key to switch direct to the Step Sequence Screen. There you can search for specific steps and enable or disable one or more steps in the step sequence.



If the "Movements" symbol is displayed on the right of a sequence, then the sequence was assigned a movement unit in S7-GRAPH (see "Basic requirements of the PLC program"). The assigned movement unit will be treated in the Overview Screen as part of a sequence and will not be shown as a separate unit. You can switch to the Movement Screen using the "Movements" key.

Exiting the Overview Screen



You use this key to return to the Diagnostic Start Screen.



Or you can use this key to switch to the Message Screen. There you can watch whether other faults occur.

3.7.4 Hierarchical units on the Overview Screen

Hierarchical Units

When programming a PLC it is possible – depending on the programming language used – to define a hierarchy of the units. Thus in the case of S7-PDIAG a unit can be equated with a module which as a rule also represents a process unit. By virtue of the multi-instance concept of STEP7, a unit can also contain other units.

As soon as at least one subunit has a fault, the immediately superior unit is also marked as having a fault. The marker is thus passed on from one level to the next right up to the highest hierarchical level.

Note

When the PLC is programmed in S7-GRAPH, there are no hierarchical units.

Identifying hierarchical units

In this way you can tell whether there are any more hierarchical layers associated with a unit.



If there are only subordinate units related to a particular unit, this icon is shown to the right of the relevant unit.



If there are only superior units related to a particular unit, this icon is shown to the right of the relevant unit.



This symbol indicates that there are a lower-level unit and a higher-level unit for a given unit.

Changing hierarchical level

To switch between hierarchical levels you must first select the unit for which you want to see the subordinate or superior units. The "Down one level" key shows you the subordinate units and the "Up one level" key shows you the superior unit.

When you move down a hierarchical level, only the subordinate units of the selected unit are shown.

When you move up a hierarchical level, all units on that level are once again displayed.

3.7.5 Changing the display mode

Display modes

You can determine whether all the units are to be shown in the Overview Screen or only those with faults.



To change back to the other display mode, press the "All / errored" key.

When to use which mode

Restricting the display to units with faults only is particularly useful if your system has a large number of individual units. If, however, you wish to select a unit without a fault (e.g. to execute a movement), you must switch back to the display mode showing all units.

How to tell which mode is active

The display mode that is active at any particular time is indicated by a graphical symbol in the top left display field as follows:

- The "Warning triangle" symbol is displayed if only the blocked units are displayed.
- The icon does not appear if you can see and select all units, both units with and without faults.

3.7.6 Changing operating mode

Aims

If you know what has caused the fault, you will naturally want to rectify it as quickly as possible so that the system can be started up again. To that end, you can execute specific movements on particular units in manual mode, for example.

Note

Whether it is necessary or possible to switch to manual mode or to another mode prior to triggering manual movements depends on your PLC program.

To change the operating mode you must first select the unit on which you wish to change the operating mode. If the unit does not belong to the unit level displayed you must first change unit level.



Use the "Operating modes" key to open a selection list.

Here you can select the operating mode in question using the mouse or the cursor keys.



Once you have selected the unit or subunit that you wish to move and have set the correct operating mode, use this key to switch to the Movement Screen and execute the required movement.

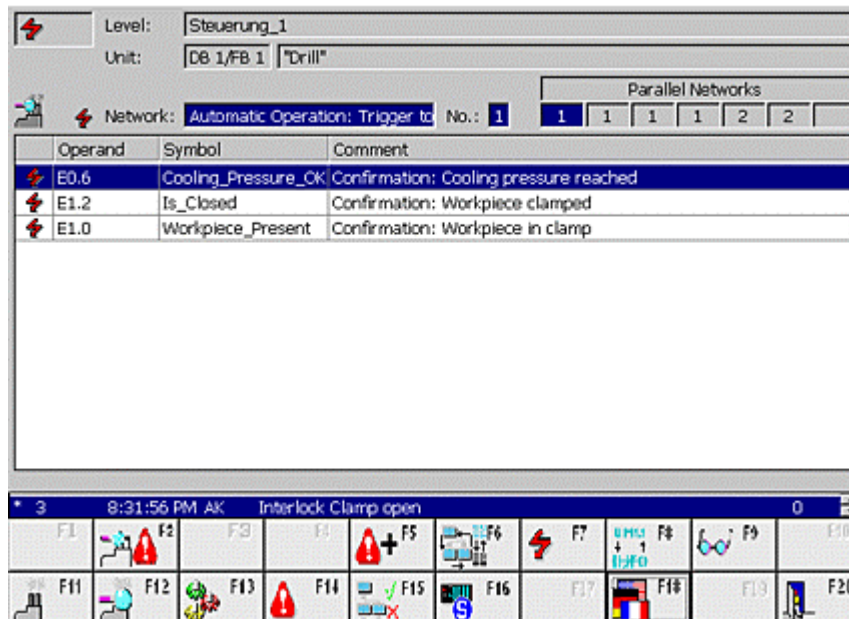
3.8 Detail Screen

The purpose of the Detail Screen

Retracing an error to the relevant points in the program code is referred to as analysis of criteria. The Detail Screen shows the results of the analysis of criteria.

Symbol list, STL or LAD

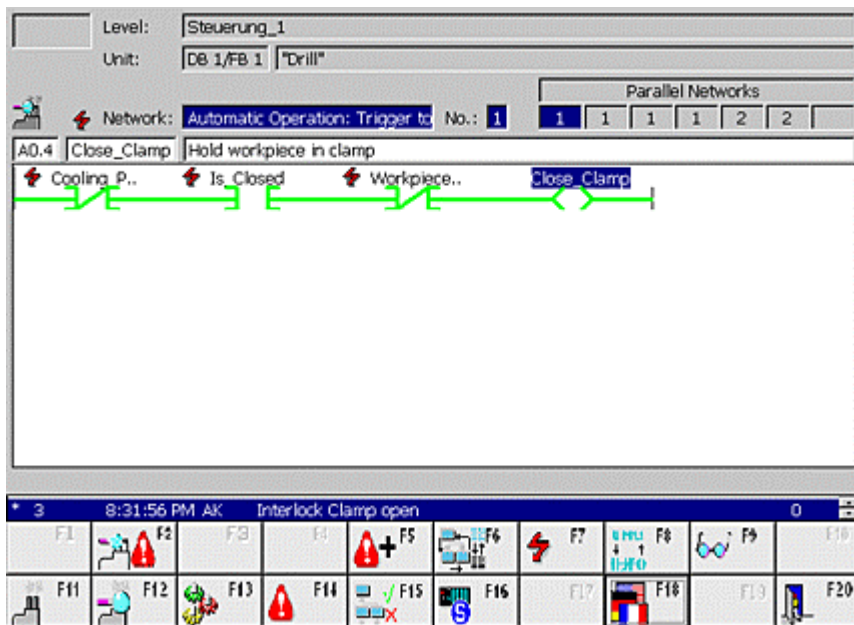
Depending on the configuration, the diagnostic result is first shown either in a clear symbol list, in a detailed statement list (STL) or as a ladder diagram (LAD). You can switch between the display modes easily using keys.



Detail Screen (symbol list mode as shown on PC)

Level: Steuerung_1		Unit: DB 1/FB 1 "Drill"		Parallel Networks				
Network: Automatic Operation: Trigger to		No.:	1	1	1	1	2	2
Operation	Operand	RLO	Status	Symbol	Comment			
UN	E0.6	1	0	Cooling_Pressure_OK	Confirmation: Cooling pressure reached			
U	E1.2	1	1	Is_Closed	Confirmation: Workpiece clamped			
UN	E1.0	1	0	Workpiece_Present	Confirmation: Workpiece in clamp			
=	A0.4	1	1	Close_Clamp	Hold workpiece in clamp			

Detail Screen (example of STL variant on PC)



Detail Screen (LAD format as shown on PC)

The LAD display format does not allow all commands to be represented, however. The following can be shown:

U op, UN op, U(, O op, ON op, O(, O,), NOT, = op, S op, R op, Label

(op=operand; label only at start of network, U corresponds to A in IEC display mode)

If a command which cannot be represented in LAD format needs to be displayed, a system message appears. You can then use a key to switch to symbol list display mode and from there to STL display mode.

Note

When using non-binary operands and signal-edge operations within a diagnostic network, ProAgent is unable to perform criteria analysis. This results in blank Detail Screens.

Program excerpt

The display of the STEP 7 program code lists the points in the PLC program which triggered a process fault. This should not be confused with a programming error.

Instead, the occurrence of a process fault has brought about a specific condition, the incidence of which the process is monitored for. That condition is characteristic of a system fault. That's why the monitoring was programmed like this.

Since the process diagnostics system can monitor a whole range of conditions and mutual interdependencies can also be defined, it is of course of interest to see which signals have led to the issue of an alarm message.

From this information you can derive what is causing the alarm and how it may be rectified in the shortest possible time.

Additional information

In addition to the program code, you can also view operands, symbols and remarks. At the same time, you are shown the status of the operands and all results of logical operations.

All signals whose conditions have contributed to the alarm message are identified. In that way you can see at a glance which conditions have led to the issue of an alarm message.

3.8.1 Structure of the Detail Screen

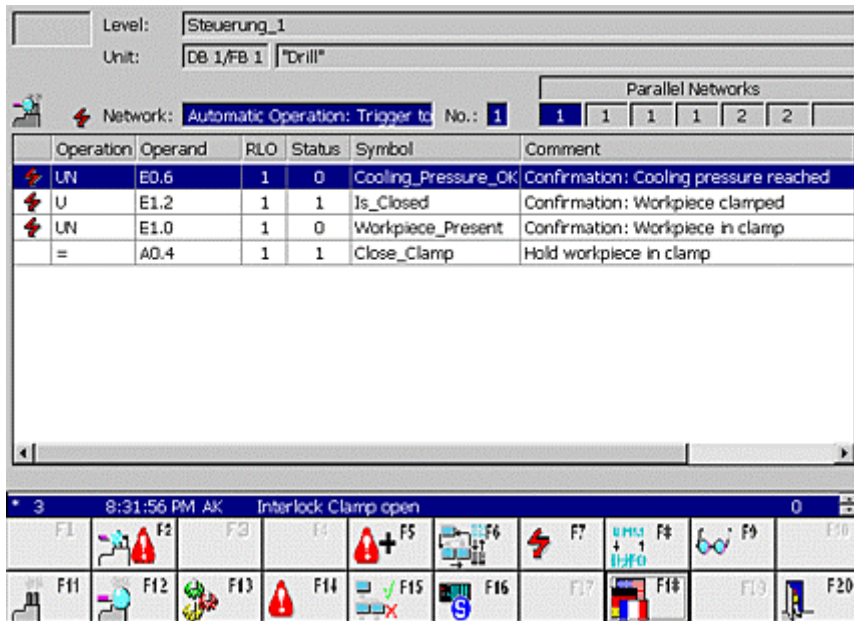
Faults displayed

The faults displayed when the Detail Screen is opened depend on the point from which it was called up:

- If you have called up the Detail Screen from the Message Screen (or from the message page/message window) you will first have had to select a message there. The Detail Screen then shows the fault which triggered the message you have selected on the Message Screen.
- If you have called up the Detail Screen from the Overview Screen you will have first had to select a unit. In the Detail Screen you can now see the oldest fault for this unit.

General layout

Like all the diagnostic screens, the Detail Screen has a standardized layout. There are only minor differences between the various types of operating unit.



Detail Screen (example of STL variant on PC)

The top section of the Detail Screen contains detailed information about the unit in which the process fault has occurred.

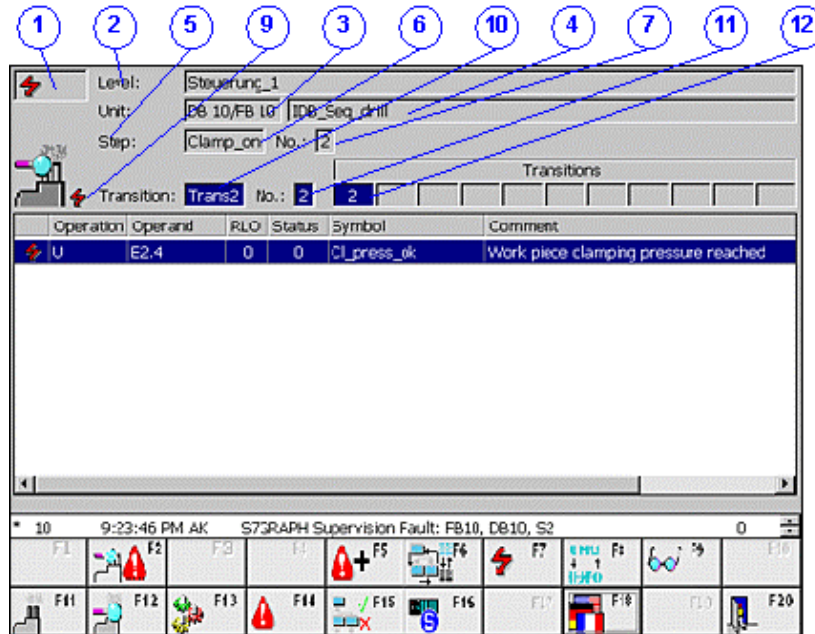
The corresponding element is shown in the middle. The illustration shows an example of the Detail Screen in STL format as it appears on a PC. For an illustration and description of the symbol list mode please refer to "Displaying the element as a symbol list", and for an illustration of the LAD format see the section headed "Displaying element in LAD".

The bottom part of the screen contains a message line showing the oldest alarm message and the global and screen-specific key set.

3.8.2 Information on the unit in the Detail Screen







Overview

The top section of the Detail Screen contains detailed information about the unit in which the process fault has occurred.



Detail Screen (as shown on the S7-GRAPH unit on a PC)

(1) At the top left, you obtain information on the display mode:


-  The "lightning flash" symbol appears if partial view is active - this lists only those instructions and/or switches that have not been performed (see "Switching between partial and full view").
-  The symbol is struck through if there are no faults and thus no element is displayed.
-  The "Spectacles" symbol appears if the current status bits are displayed rather than the status bits at the time of occurrence of the fault (initial values) (see "Switching between initial values and current status").
-  The "Connection errored" symbol indicates that connection to the PLC is errored or an addressing error has occurred.
-  The "Inconsistency alert" symbol is displayed if the data for this network has changed in the STEP7 configuration. In a criteria analysis the network data is read by ProAgent directly from the PLC. For further information please refer to "Changes during commissioning".
-  The "Consistency error" symbol indicates that the data for this network is not consistent with the STEP7 database. Regenerate your project before continuing.

- (2) The "Level" field displays the PLC assigned to the unit and the complete hierarchical path.
- (3) The "Unit no." field tells you the block type (FB/FC and DB) and the block number of the selected unit.
- (4) The "Unit" box displays the name of the unit you selected.

The displays and contents of the following fields depend on the programming of the unit:

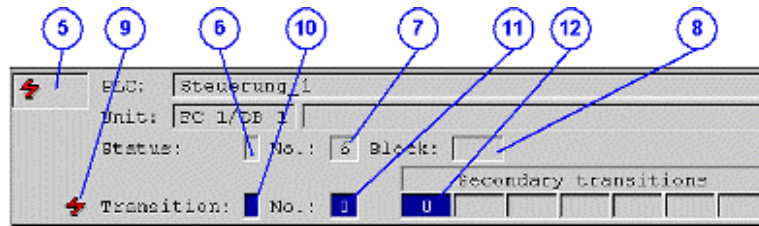
Programming in S7-GRAPH:

If the unit was programmed in S7-GRAPH you will have two lines of information on the faulty step and/or the blocked transition.

- (5) The "Lightning flash" symbol appears here if the currently displayed step is blocked.
 - (6) The "Step" field displays the step name.
 - (7) The number of this step is displayed in the "No." box.
 - (8) The "Block" field shows the block type (FB/FC and DB).
 - (9) The "Lightning flash" symbol appears here if the currently displayed transition is blocked.
 - (10) You can see the transition name in the "Transition" box.
 - (11) The "No." box displays the number of this transition.
 - (12) The "Subsequent transitions of selected step" box lists the user numbers of the subsequent transitions currently possible for the step selected. The selected transition is highlighted here. If more subsequent transitions are possible than can be displayed then this field will also contain the symbol: .
- If a transition with a fault is displayed here as the unit then parallel transitions are displayed here.

Programmed in S7-HiGraph:

If the unit was programmed in S7-HiGraph you will have two lines of information on the faulty status and/or the blocked transition.

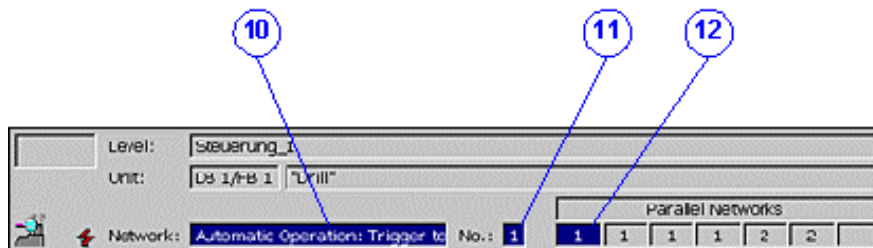


- (5) The "Lightning flash" icon appears here if the currently displayed status is faulty.
- (6) The "Status" field shows the name of the status.
- (7) The number of this status is displayed in the "No." box.
- (8) The "Block" field shows the block type (FB/FC and DB).
- (9) The "Lightning flash" symbol appears here if the currently displayed transition is blocked.
- (10) You can see the transition name in the "Transition" box.
- (11) The "No." box displays the number of this transition.
- (12) The "Subsequent transitions of selected status" box lists the user numbers of the subsequent transitions currently possible for the status selected. The selected transition is highlighted here. If more subsequent transitions are possible than can be displayed then this field will also contain the symbol:

If a transition with a fault is displayed here as the unit then the elements of the transitions can be seen here.

Programmed in S7–HiGraph:

If the unit was programmed with S7–PDIAG, you will see only one more information line.



- (10) The "Network" field displays the name of the selected network.
- (11) The "No." box displays the number of the network you selected.
- (12) The "Parallel networks" field lists the existing networks for the selected unit. The selected network is highlighted here. If more networks exist than can be displayed then this field will also contain the symbol:

Representation of the element

The center section of the screen shows an excerpt from the STEP7 program code for the element with the fault. You can choose between display as a symbol list and display in STL or LAD.

3.8.3 Displaying the element as a symbol list

Overview

In the symbol list view of the STEP7 program code the middle part of the Detail Screen shows only the signals which resulted in an alarm message being triggered. This gives you a quick overview of the faults that have occurred:

Operand	Symbol	Comment
⚡ E0.6	Cooling_Pressure_OK	Confirmation: Cooling pressure reached
⚡ E1.2	Is_Closed	Confirmation: Workpiece clamped
⚡ E1.0	Workpiece_Present	Confirmation: Workpiece in clamp

Detail Screen: displaying the element as a symbol list

The following elements are displayed:

- (1) The "Lightning flash" symbol appears here because the signal shown next to it has contributed to an alarm message.
- (2) "Signal": The different operands are displayed here. If German is set as the language on the operating unit then SIMATIC view will be used. If not, the operands will be shown in IEC view.
- (3) "Symbolism": lists the symbol of the signal in accordance with the text or graphic list in STEP7.

In the case of tags within DBs, only the symbolism is displayed if a symbolic identifier has been stored in the text or graphic list. If no symbol was generated then the operating unit shows the absolute address of the tags.

- (4) Comment: displays a comment on the signal in question, if this was stored in STEP7 in the text or graphic list.

3.8.4 Displaying element in STL

Overview

In the STL view of the STEP7 program code the middle part of the Detail Screen highlights only the instructions which resulted in an alarm message being triggered:

Operation	Operand	RLO	Status	Symbol	Comment
U	E2.4	0	0	CI_press_ok	Work piece clamping pressure reached

Detail Screen: Element displayed in STL

The following elements are displayed:

(1) The "Lightning flash" symbol appears here if the adjacent signal has contributed to an alarm message.

When partial view is active, these are the only switches displayed (see "Switching between partial and full view").

(2) "Operator": If German is set as the language on the operating unit, the operators will be shown in SIMATIC view. If not, IEC view will be used.

(3) "Signal": The different operands are displayed here. Here too, the display depends on whether SIMATIC or IEC display mode is set.

(4) "RLO": The associated result of logic operation appears here.

(5) "Status": The status of the operands appears here. The information displayed relates either to the values at the time of occurrence of the fault (initial values) or the current status (see "Switching between initial values and current status").

(6) "Symbolism": Lists the symbol of the signal in accordance with the text or graphic list in STEP7.

(7) "Comment": Displays a comment on the signal in question in accordance with the symbol table in STEP7.

Note

The SIMATIC or IEC display mode setting for operations and operands in the Detail Screen is imported from STEP7.

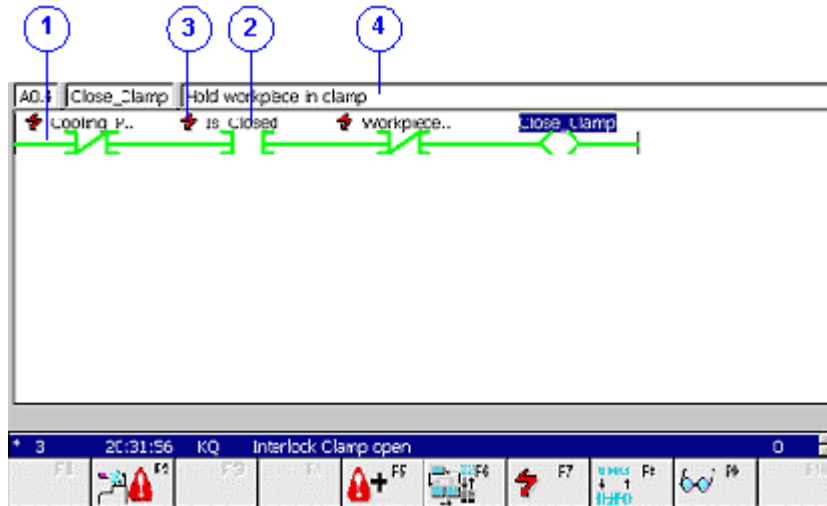
Expanded display in the Detail Screen

The program code displayed is not always totally identical with the program code that has been entered in STEP7. In order to keep the section of program code displayed as meaningful as possible, the view in the Detail Screen also takes into account the expanded display possibilities of the elements.

3.8.5 Element displayed in LAD

Overview

In the LAD view of the STEP7 program code the middle part of the Detail Screen highlights only the instructions with the "Lightning flash" icon which resulted in an alarm message being triggered:



Displaying element in LAD

Specifically, you are shown the following:

(1) The switches: A switched contact is shown by a continuous green line and a non-switched contact by a broken blue line.

The information displayed relates either to the status at the time of occurrence of the fault (initial values) or the current status (see "Switching between initial values and current status").

(2) Absolute operand: If German is set as the language on the operating unit, the operands will be shown in SIMATIC view. If not, IEC view will be used.

(3) The "Lightning flash" symbol indicates that the switch to the right has contributed to an alarm message.

When partial view is active, these are the only switches displayed (see "Switching between partial and full view").

(4) An additional text line showing the absolute identifier, the symbol and the comment for the selected operands.

In the case of tags within DBs, only the symbolism is displayed if a symbolic identifier has been stored in the text or graphic list. If no symbol was generated then the operating unit shows the absolute address of the tags.

You can change from one operand to another with the mouse or arrow keys. The text displayed then changes accordingly.

Note

Parenthesized expressions cannot be displayed LAD. If supplementary NOT operations are included in the network, it is not possible to display the signal flow with the aid of status colors.

Expanded display in the Detail Screen







The program code displayed is not always totally identical with the program code that has been entered in STEP7. In order to keep the section of program code displayed as meaningful as possible, the view in the Detail Screen also takes into account the expanded display possibilities of the elements.










3.8.6 Keys in the Detail Screen

Use

The number of keys/buttons configured in the Detail Screen is limited by the number of keys/buttons available on the unit. However, if necessary you can program other functions on these keys/buttons or on supplementary buttons.

You can use the following keys on the Detail Screen:

Key / button	Designation	Function
 	<p>Up / down</p> <p>Left / right</p>	<p>The directions in which you can browse will depend on the type of display. Small arrows indicate the directions in which you can move the cursor:</p> <p>If there are more lines than can be shown on the display at once, you can scroll up or down in text or graphic list or STL display mode.</p> <p>In LAD display mode you can move the cursor through the element displayed in all directions.</p> <p>If you move the highlight beyond the visible display the screen is scrolled accordingly and reconstructed.</p>
	Analyze fault	Use this key in the Detail Screen to launch criteria analysis for the currently selected message.
	next error	You use this key to change to the next error of the unit or subunit.
	more output	<p>You use this key to change within an error.</p> <p>S7-GRAPH: the change takes place consecutively to all transitions and then to the locking condition for the step (see "Changing fault or transition").</p> <p>In the event of a locking error you change first to the locking condition of the step, then to the first transition.</p> <p>S7-HiGraph: depending on the error selected, you change either to the subsequent transition of a status or to the transitions leading to a status.</p> <p>S7-PDIAG: in the case of multiple assignments to a monitored operand the change is to the next network containing an assignment to that operand.</p>
	all / faulty operands	<p>This key is used to toggle between full and partial view of the criteria (see "Switching between partial and full view").</p> <p>In the partial view, only those criteria that have led to a fault are displayed.</p> <p>This key is not active in symbol list display mode.</p>

Key / button	Designation	Function
	List / STL / LAD	You can use this key to switch between symbol list, STL and LAD display modes.
	Initial value / current status	This key is used to determine what status and therefore which logical operation results are shown, i.e. the values at the time of occurrence of the fault (initial values) or the current values (see "Switching between Initial values and current status"). In S7-HiGraph only initial values can be displayed.
	Overview Screen	You use this key to open the Overview Screen.
	Movement Screen	You use this key to open the Movement Screen.
	Message Screen	You use this key to open the Message Screen.
	Step Sequence Screen	You use this key to open the Step Sequence Screen.
	Status/control	Use this key to call up a screen with a "Status/control" field. This enables you to monitor and control the operands of the relevant PLC program.
	Language	This key can be used to switch language where a multilingual project has been compiled.
	Back	You use this key to return to the Diagnostic Start Screen. If you wish to change this, you must use the appropriate functions (see "ProAgent functions for Selecting Diagnostic Screens").

Keys in the Detail Screen

3.8.7 How to work with the Detail Screen

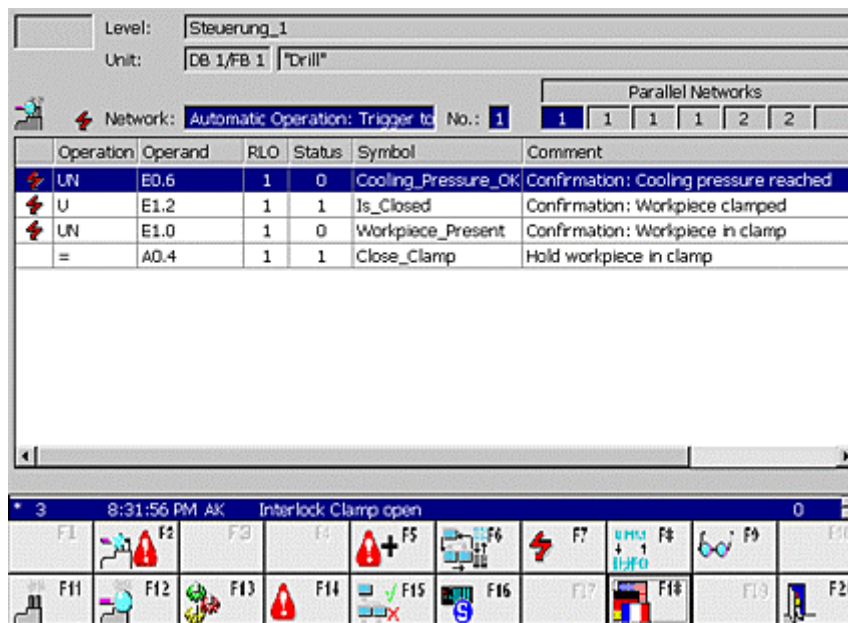
What you need to do

This chapter gives a general outline of how to use the Detail Screen in practice.

Aims

You have opened the Detail Screen in order to see which signals in the PLC program have resulted in a particular alarm message. By doing so you can tell which monitoring routine triggered the error message and accordingly where the fault is to be found.

The center section of the screen shows an excerpt from the program code for the elements with the fault. The elements which have led to an alarm message are highlighted.



Detail Screen (example of STL variant on PC)

Which unit?

The top two lines of the display show you to which unit the excerpt from the program code shown belongs. Here you can see the text assigned to the unit in STEP7.

Which expression?

The following lines vary depending on the programming language in which the unit specified above was programmed:

- If the unit was programmed in S7-PDIAG then the relevant network is shown. In the case of multiple assignments, the other possible networks for the unit selected are shown to the right of this.
- If the unit was programmed in S7-GRAPH, the number of the active step and the assigned text are displayed. The following line then provides information on the transitions.
- If the unit was programmed in S7-HiGraph the number of the active status and the text assigned appears here. The following line then provides information on the transitions.




Which transition?

If the unit for which the program code is being displayed was programmed in S7-GRAPH or S7-HiGraph then the third line shows which transitions belong to the step shown. The transition to which the displayed program code belongs is marked.

Symbol list, STL or LAD

If you prefer STL or LAD display modes you can switch from symbol list display mode to STL display mode at any time using the "List/STL/LAD" key. If you activate this key again you will switch to LAD display mode. Pressing the key again will take you back to symbol list display mode.

Getting information from symbol list display mode

Operand	Symbol	Comment
 E0.6	Cooling_Pressure_OK	Confirmation: Cooling pressure reached
 E1.2	Is_Closed	Confirmation: Workpiece clamped
 E1.0	Workpiece_Present	Confirmation: Workpiece in clamp

The symbol list shows only signals with a fault, together with the associated icons and comments.

This gives you an overview of the essential information on the faults that exist so that you can analyze the cause of the fault quickly.

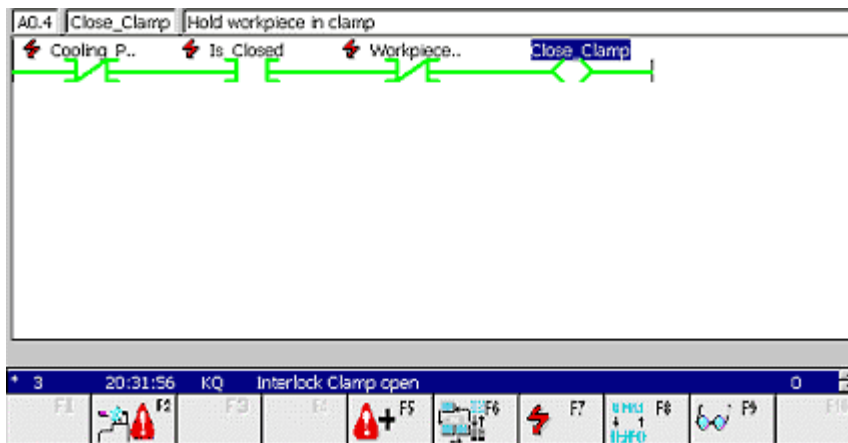
Getting information from STL display mode

Operation	Operand	VKE	Status	Symbol	Kommentar
UN	E0.6	1	0	Cooling_Pressure_Ck	Confirmation: Cooling pressure reached
U	E1.2	1	1	Is_Closed	Confirmation: Workpiece clamped
UN	E1.0	1	0	Workpiece_Present	Confirmation: Workpiece in clamp
=	A0.4	1	1	Close_Clamp	Hold workpiece in clamp

The statement list shows the individual operators and icons, status bits, logical operation results, symbols and remarks. All statements that have led to an alarm message being triggered are marked with a "lightning flash" symbol.

This means you can see right away where your fault monitoring system gave the alarm. If you examine the instructions concerned, you will quickly be able to locate the cause of the fault. The logical operation results will help you in that regard.

Getting information from LAD display mode



The ladder diagram shows the individual switches and operands. As in the Step7 LAD/STL/CSF editor, the status is indicated by the color of the switch lines:

- enabled switches are represented by continuous green lines
- disabled switches are represented by broken blue lines

The line above the ladder diagram shows the symbols and comments for the operands selected.

With this information, you can ascertain just as easily as in STL display mode at what point your fault monitoring system gave the alarm and how the fault occurred.

More elements



You use this key to change to the next error - in other words, to the next fault action of the unit.



Use this key to switch within the fault to the next transition or to other elements affected.

For further details please refer to "Changing fault or transition".

Modifying the view options

You can adapt the type of display to your requirements:



If you want to be able to view all signals, i.e. including those that have not led to a fault, press this key (see "Toggling between partial and full view")

This key is not active in symbol list view.



If you wish, you can have the current status bits displayed instead of the status bits at the time the error occurred (initial values). To do this, press this key (see "Switching between initial values and current status").

Criteria analysis for the selected message

The lower section of the Detail Screen displays the current messages. For each of these messages you can have a criteria analysis displayed right there in the Detail Screen.



Select the message for which you wish to carry out a criteria analysis and use this key.

The criteria analysis for the message concerned is then displayed for you.

For further information on the topic `ProAgent_Evaluate_Fault` please refer to "ProAgent functions for selecting Diagnostic Screens".

Exiting the Detail Screen

You can switch directly from the Detail Screen to the other diagnostic screens or also exit diagnostics:



switches to the Overview Screen



switches to the Movement Screen



switches to the Step Sequence Screen



switches to the Message Screen



switches to the Diagnostic Start Screen

3.8.8 Switching between partial and full view

The option

On the Detail Screen in STL or LAD display mode you can choose whether you want to:

- view all instructions of an element displayed (= full view)
- or whether you only want to see statements that have caused the monitored signal to be put in the wrong status (= partial view)



To toggle between the two states, press the "All/faulty operands" key. In partial view the "Lightning flash" icon is displayed in the top left next to the "PLC" field.



The symbol is struck through if there are no faults and thus no element is displayed.

Partial view is particularly useful if you want to be able to quickly locate the critical statements that have resulted in the issue of an alarm message.

On the Detail Screen in symbol list display mode the "All/faulty operands" key is not active, since here only faulty units are shown irrespective.

3.8.9 Switching between initial values and current status

Note

On S7-HiGraph units, only initial values can be shown.

Initial values

By default, those status bits displayed are those which were valid at the moment at which the fault monitoring system first detected the process fault. For that reason those values are also referred to as initial values. They remain until the next fault occurs.

These values are also the basis on which the logical operation results (RLOs) are founded.

In the case of sequences of steps the status is only shown if the corresponding step is active.

Current status

As an alternative to the initial values you can also query the current status. Viewing the current status allows you to monitor online what effect corrective measures have on the condition of the system.

If you have set the display mode to symbol list mode or partial view (see "Switching Between Partial and Full View") you can see right away if the fault has been put right. In that case, no more signals are displayed on the screen.

Toggling



To toggle between the initial values and the current status, press the "Initial values/current status" key. When the current status is displayed, the "Spectacles" symbol appears top left next to the "Unit level" box.

3.8.10 Changing fault or transition

Change fault

A unit may have more than one fault at the same time. You can then use the keys to go on to the next fault for this unit.



To change to the next error on the same unit or subunit use the "Next fault" key.

The display of the elements in the top part of the screen will be modified accordingly (see "Information about the unit in the Detail Screen").

Change transition

Sometimes the cause of a fault cannot be established at first glance:

On S7-PDIAG units, only one network is ever shown on the Detail Screen. However, the cause of the fault may be located in more than one network.

On S7-GRAPH units, the locking condition of the step or individual transitions may trigger an error message.

On S7-HiGraph units, a monitoring timeout or individual transitions of a status graph may give rise to an error message.



The "Next element" key takes you to the next element within a fault:

On S7-PDIAG units you move from one participating network to the next.

On S7-GRAPH units that report a locking error you switch from the locking condition of the step to the first transition and then to all further transitions.

On S7-GRAPH units that report a monitoring error you switch from one transition to the next.

On S7-HiGraph units all the subsequent transitions are shown consecutively in the event of a monitoring timeout.

In the case of a status error the transition that led to the fault state is shown.

The display of the elements in the top part of the screen will be modified accordingly (see "Information about the Unit in the Detail Screen").

Multiple assignment of monitored operands

With "Multiple assignments" to a monitored operand, the cause of the error may also reside in different networks.



You can use the "Next element" key to switch between the networks affected.

You can tell which network is currently being displayed from the information in the top part of the Detail Screen. However, the block number displayed on the first line remains as it is.

3.8.11 Enhanced options with S7-PDIAG

Program code displayed

The program code displayed is not always totally identical with the program code that has been entered in STEP 7. To keep the excerpt from the program code as informative as possible, the enhanced options of programming with S7-PDIAG are also taken into account in the Detail Screen. This affects auxiliary networks, jump commands, multiple assignments and exclusion operands.

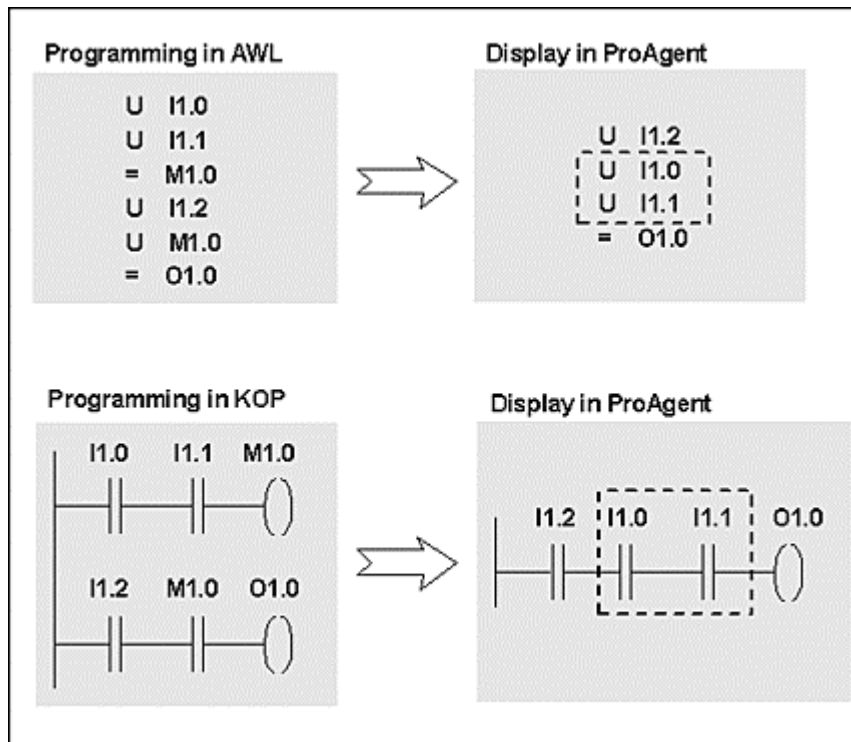
3.8.11.1 Auxiliary networks

Overview

The program code displayed is not always totally identical with the program code that has been entered in STEP7. To provide you with an excerpt that is as meaningful as possible, ProAgent displays the networks created in S7-PDIAG.

For example, the complete assignment may be used instead of a flag. This enables you to trace a signal back to the peripheral more easily.

Reference networks are shown in symbol list, STL and LAD display modes of the Detail Screen.



Reference network in STL and LAD

Comparative operations

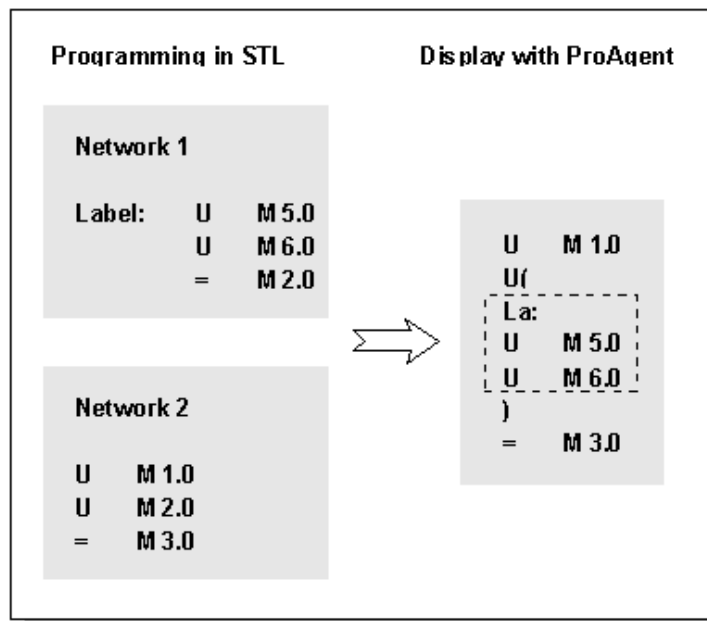
Comparative operations and non-binary operands within a diagnostic network in STEP7 result in blank Detail Screens.

3.8.11.2 Branch instructions

Overview

ProAgent's criteria analysis is in a position to resolve even complex PLC programs with labels and display them on the operating unit.

The display in STL is such that all code parts that can be evaluated become visible.



Resolving branch instructions

Labels external to the start of a network

In the LAD display mode of the Detail Screen, display is possible only if the label is at the start of the network. In STL display mode display is always possible, but in the case of labels the display device sets the initial query. The following statement is the basically treated like the start of a network.



Caution

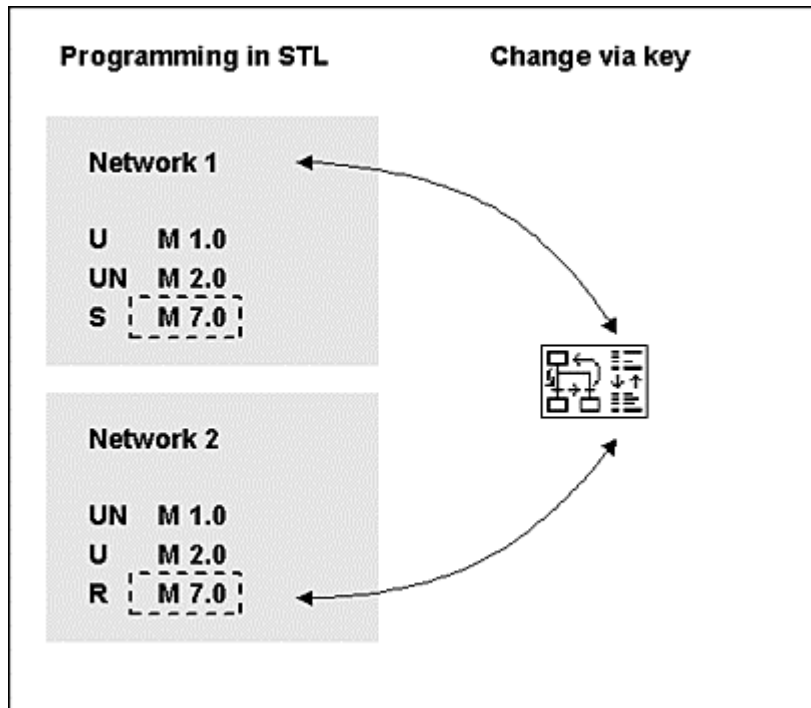
When using labels in monitored networks, it is not always possible to determine with certainty in the Detail Screen which operands are giving rise to the fault. Labels or branch instructions should therefore not be used in monitored networks.

Parenthesized expressions cannot be displayed LAD. It is therefore not possible to display the signal flow with the aid of status colors if supplementary NOT operations are included in the network.

3.8.11.3 Multiple assignments

Overview

If your PLC program performs multiple assignments to a monitored operand - for example, with SET/RESET or even with a direct assignment - you can switch between all the networks affected in the Detail Screen at the press of a key.



Multiple assignment of monitored operand M 7.0

You can tell which network is currently being displayed from the information in the top part of the Detail Screen.

3.8.11.4 Exclusion operands

Requirements

Exclusion operands can be defined only for units that have been suitably programmed in S7-PDIAG.

In the case of S7–HiGraph units the exclusion operands are created automatically.

What are exclusion operands?

The criteria analysis treats all operands equally. This may result in subnetworks being identified as failed which strictly speaking are contributory to the cause of the error from a logical point of view; but with additional knowledge they can be excluded as being contributors to the cause of the error.

One example is the different system operating modes which, by definition, can never occur simultaneously on a unit, or individual operands for different product versions which similarly cannot be produced simultaneously.

For this reason S7-PDIAG features the option of defining exclusion operands in a text or graphic list. In the case of S7–HiGraph units the exclusion operands are created automatically.

If exclusion operands have been created, then ProAgent only selects symbols in the network as failed

- where the exclusion operand is linked with U and recorded with a value of 1, or
- where the exclusion operand is linked with UN and recorded with a value of 0.

Reverse logic of inclusion operands:

If the exclusion operand is linked with UN and if the exclusion operand has the value 1, the operands of the associated partial networks are not identified as being in error.

Note

Exclusion operands should always be programmed at the start of a partial network. Otherwise, in certain circumstances too many failed operands are displayed in the Detail Screen.

Example

The following example shows operand monitoring of A 1.0 to state "0" with modes "Auto" and "Manual":

Without excusion operands			
		RLO	Status
U	#Auto	1	1
⚡	U I 0.0	0	0
⚡	O	0	1
⚡	U #Manual	0	0
⚡	U I 0.1	0	0
⚡	= O 1.0	0	0

↓

Exclusion operands			
		RLO	Status
U	#Auto	1	1
⚡	U I 0.0	0	0
	O	0	1
	U #Manual	0	0
	U I 0.1	0	0
⚡	= O 1.0	0	0

Example of exclusion operands

From a strictly logical point of view, the marking of the faulty lines in the upper section of the program is correct. However, the subnetwork processing in "Manual" operating mode cannot be a cause of faults by definition, since the system is already in "Auto" operating mode and cannot be in another operating mode at the same time.

Taking this additional knowledge into account, a considerably clearer error identification is shown in the lower section of the program.

Display by ProAgent

Due to the definition of the exclusion operands in S7-PDIAG, fewer lines are identified as contributing to the error in the Detail Screen.



You can use the "All/errored operands" key to toggle between partial and full view as usual (see "Switching between partial and full view"):

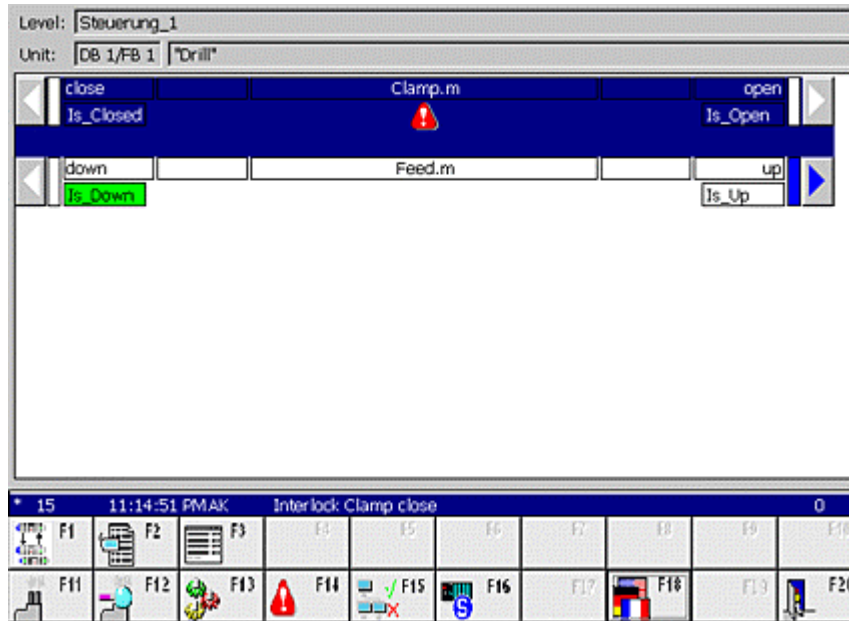
With partial view, correspondingly fewer lines are displayed.

With full view, all the lines can still be seen, but fewer lines are identified by the "lightning flash" symbol as being contributory factors.

In either case, visibility is distinctly improved and analysis is facilitated.

3.9 Movement Screen

The purpose of the Movement Screen



Movement Screen (example on PC)

The Movement Screen helps you when rectifying a fault or operating the installation. It allows you to execute specific movements for individual units manually by means of keys. For example, you could move the die of a stamping press back to its starting position before removing a jammed workpiece.

Each movement can be executed in two directions, e.g. in/out, open/close, up/down, forward/backwards.

Note

With programming with S7-GRAPH, movements cannot be defined. However, in S7-GRAPH you can assign movements from S7-PDIAG to a unit.

Blocked movements

If a movement has a fault and therefore cannot be executed, you can recognize this in the Movement Screen from the "Warning triangle" symbol.

Sequence in the Movement Screen

The sequence of movements in ProAgent's Movement Screen is the sequence established when the movement concerned was configured in S7-PDIAG's Movement Screen. The sequence of movements can be defined only inside a unit.

Target positions

The Movement Screen also shows which target positions have already been passed. This means that on a stamping press, for example, you could see what the current position of the die is. If the movement has a fault you can see at what point it is blocked.

Requirements

A PLC must have been suitably programmed in order that movements can be executed from the operating unit. The UDT "Movement" (UDT2) must be used and appropriately wired up. More detailed information on programming movements is provided in the S7-PDIAG manual.

Using direct keys

In the OP/TP/MP270 and MP370 you can use direct DP keys to operate your system, or in the case of Panel PCs you can use the direct keys module. You use the direct keys to set bits in the I/O area of the SIMATIC S7 directly from the operating unit.

Direct keys enable you to implement operating actions quickly without any communication-related delay. They are essential, for example, in typing mode.

Note

When using direct keys the functions `Start_Movement` and `Stop_Movement` should be removed from the Movement Screen.

Defining the device ID

If the same movement is controlled from several operating units, you must use the expanded UDT "Movement" (UDT2), so that the operating unit can make use of the movement unambiguously via the device ID in the UDT2.

The device ID identifies the operating unit by means of a unique number. In ProTool select "System" > "ProAgent" and assign each operating unit a unique number as its device ID.



Caution

In order to scroll from one movement to the next in the movement display, please note the following: after scrolling the movements and intending to handle further movements, the operator must wait until the display indicates that these movements can be used.

A movement can be used if the "Left" and "Right" buttons are displayed next to it.



If the operator scrolls the movements and then immediately tries to handle another movement, there are a few moments during which it is possible to be still handling the movement that was previously displayed at the same position. This is dependent on the time required to run through the messages and reset the previous movement bit.

3.9.1 What you see on the Movement Screen

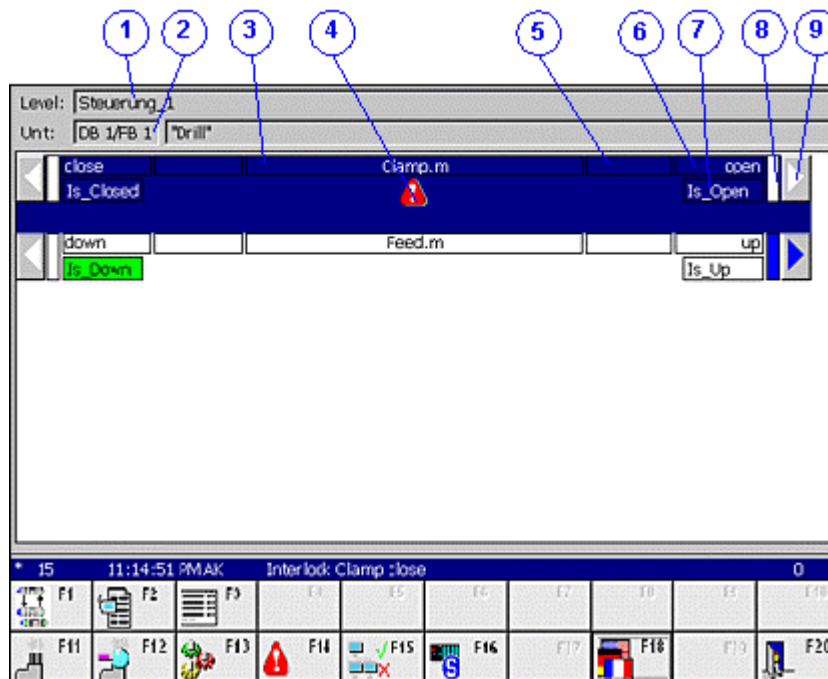
Function

The Movement Screen shows a list of all the movements configured for a unit and their subordinate hierarchy levels.

General layout

Like all the diagnostic screens, the Movement Screen has a standard layout. There are only minor differences between the various types of operating unit.

The following illustration shows an example of the Movement Screen on a PC.



Movement Screen (example on PC)

Information on the display mode

The top left field gives you information on the display mode:



The "Warning triangle" symbol indicates that a unit is blocked. The unit on which the fault occurred first is identified by a flashing icon.. This indicates to you that this fault is not a secondary fault.



The "Connection errorred" symbol indicates that connection to the PLC is errorred or an addressing error has occurred.



The "Inconsistency alert" symbol indicates that the data for this network has changed in the STEP7 configuration. In a criteria analysis the network data is read by ProAgent directly from the PLC.



The "Consistency error" symbol indicates that the data for this network is not consistent with the STEP7 database. Regenerate your project before continuing.

Information about the unit

The first line shows information about the selected unit. The selected unit is that unit of your system for which the movements are displayed further down the screen.

Which unit is the selected unit depends on where the Movement Screen was activated from.

- If you activated the Movement Screen from the Message Screen, the selected unit is determined by the alarm message that was highlighted by the cursor on exiting. The unit to which that alarm message is attributable becomes the selected unit on the Movement Screen.
- If you activated the Movement Screen from the Overview Screen, the selected unit is the unit that was highlighted by the cursor when the Overview Screen was quit.
- If you opened the Movement Screen from the overview list of movements then the unit selected is the unit to which the movement highlighted on exiting the overview list belongs.

Specifically, the information about the selected unit is made up of the following details:

- (1) The full name of the unit is shown in this field.
- (2) In this field you are given details of the block type and the block number of the unit selected.

List of movements

Below the information on the selected unit is a display of the movements.

The individual movements are arranged underneath each other.

The order of the display depends on the attributes that the units in S7-PDIAG contained in the "Properties" > "Units" dialog box. The Movement Screen in ProAgent is built in accordance with the attributes "Belongs to screen" and "Position in screen". If no default values are specified at that stage, or if individual positions are assigned twice over (including on several CPUs), the order is alphabetic.

Each movement can be executed in two directions, e.g. in/out, open/close, up/down, forward/backwards. One direction of movement is symbolized by the left side of the screen and the other by the right side.

The two keys immediately to the left and right of the representation of the relevant movement are assigned to each movement. These keys are used to execute the movements.

Each movement line is made up of the following elements:

(3) This shows you what movements are involved. The text was assigned to the movement when configuring the unit (variable name of the movement). Only the last two parts of the variable name, separated by ".", are shown.

(4) If the movement is blocked, a blocking ID appears in the form of a warning triangle.

If the connection to the PLC is disrupted or an address error occurs then the "Faulty connection" symbol is displayed.

(5) Here the output from which the movement is controlled is displayed. Use the "Icon / absolute" key to switch between the icon display and absolute display of the output if corresponding attributes were stored during programming in S7-PDIAG under "Controlled operand direction 1" and "Controlled operand direction 2".

(6) This shows you which direction of movement is symbolized by which side of the screen. This movement is executed when you press the adjacent key or the corresponding traversing key.

(7) Here you are shown a symbolic representation of various target positions. In addition, an explanatory text is displayed for each target position if this was configured.

A target position corresponds to a specific movement (e.g. a specific belt position, a specific angle of rotation etc.). There can be several target positions for a movement.

- If a target position has not yet been reached it is shown as an outline.
- If a target position has been reached, it is shown against the configured background color (default: green).

(8) While a movement is being executed the rectangle next to the button that you can use to initiate the movement is blue.

(9) If you are using a PC as the operating unit then the triangle in the margin is designed as a command button. You can click it with the mouse or press the function key indicated. On all other operating units it refers to the corresponding soft key.

The triangle also indicates to you whether or not a movement can be executed:

- if the movement can be executed, the triangle is displayed in blue
- if the movement cannot be executed because it is blocked or locked by an interlock (e.g. the last target position has already been reached), the triangle is displayed simply as an outline.

Target position modes in the S7-PDIAG Movement Screen

From S7-PDIAG V5.0 HF3 and higher you can use the S7-PDIAG Movement Screen to configure different display modes for the selected movement to all target positions. The target positions of movements are displayed in ProAgent's Movement Screen in accordance with the configured S7-PDIAG display modes.

Different functions can be performed at a given target position:

- multilingual text,
- absolute or symbolic names of address references, or
- decimal numbers.









For detailed information on displaying target positions please refer to "Target position modes in the S7-PDIAG Movement Screen".




3.9.2 Keys in the Movement Screen

Use

The number of keys/buttons configured in the Movement Screen is limited by the number of keys/buttons available on the unit. However, if necessary you can program other functions on these keys/buttons or on supplementary buttons.

You can use the following keys on the Movement Screen:

Key / button	Designation	Function
 Ctrl F1 to Ctrl F12 (PC)	Side command buttons Soft keys	You use these keys to trigger the individual movements. A movement can only be executed if the triangle symbol has a blue background. If the symbol is displayed simply as an outline, the movement cannot be executed. A movement is driven for the whole time you keep the key pressed. If execution of the movement is successful, the square next to the triangle symbol is likewise highlighted blue.
	Subunits	This key is used to specify whether only the movements of the selected (superior) unit are displayed or all movements of subordinate units as well (see "Hierarchical units on the Movement Screen"). The (top-level) unit is the unit in this instance which was selected in the screen from which the Movement Screen was called.
	Symbol / absolute	Use this key to switch the display of the outputs between symbolic and absolute representation that are driven by the movements. The corresponding attributes must have been stored during programming in S7-PDIAG.
	Movement list	Use this key to call up the movements list in order to select further movements.
	Overview Screen	Use this key to call up the Overview Screen.
	Detail Screen	Use this key to call up the Detail Screen.
	Message Screen	You use this key to open the Message Screen.
	Step Sequence Screen	You use this key to open the Step Sequence Screen.

Key / button	Designation	Function
	Status/control	Use this key to call up a screen with a "Status/control" field. This enables you to monitor and control the operands of the relevant PLC program.
	Language	This key can be used to switch language where a multilingual project has been compiled.
	Back	You use this key to return to the Diagnostic Start Screen. If you wish to change this, you must use the appropriate functions (see "ProAgent functions for selecting Diagnostic Screens").

Keys in the Movement Screen

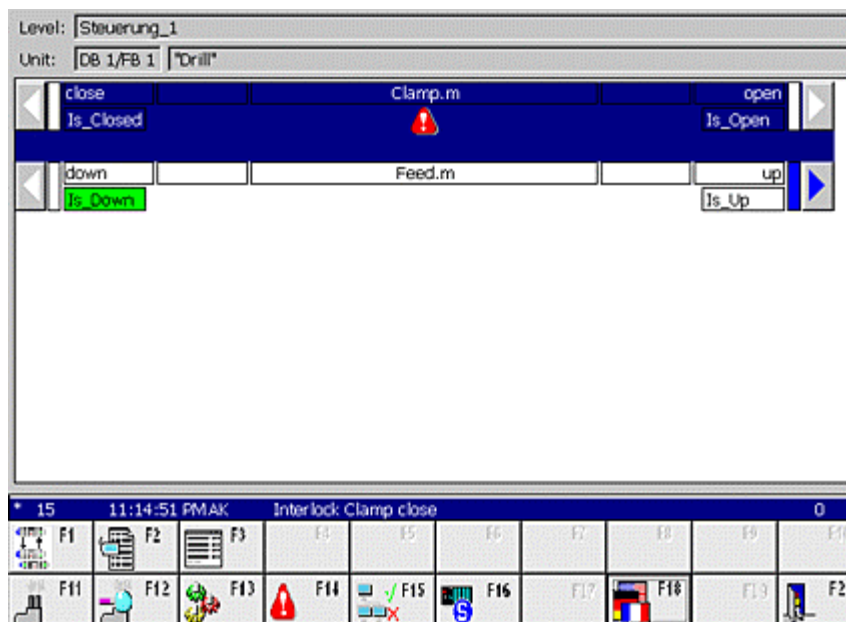
3.9.3 How to work with the Movement Screen

What you need to do

This chapter gives a general outline of how to use the Movement Screen most effectively in practice.

Aims

You want to remove a block and to do so, you wish to initiate some movements on the blocked unit manually. You also want to see which movements are blocked.



Movement Screen (example on PC)

Which unit?

The header of the display tells you that you are in the right unit since only the movements belonging to this unit are displayed.

Which movements?

The rest of the screen lists all the available movements one below the other on separate lines. You can scroll the list up or down if there are more possible movements than can be shown on the screen at once. Small arrows in the top left corner indicate other movements.



If a unit also has hierarchically subordinate units, you can use this key to view the movements of those subunits as well (see "Hierarchical units on the Movement Screen").



If you wish to initiate a movement that is not currently shown you can use this key to call up a list of all the movements. Here you can quickly select the desired movement and call up the associated Movement Screen.

Which faults?



You recognize that a movement is blocked by the fact that the "warning triangle" symbol appears in the center of the line under the name of the movement.



Triangle symbols at either end of each line show you whether a movement can be carried out in a particular direction:



A triangle with a blue background indicates that this movement is available in the direction concerned.

If the triangle symbol is displayed simply as an outline, the movement in the specified direction cannot be executed.



Caution

If a movement cannot be triggered, this does not mean that it is blocked. It may be that specific interlocks have been stored in the PLC program or a movement has already reached its extremity.

Executing a movement

You have now found the movement that you wish to execute and established that it is not blocked and can be executed.

To trigger the movement:

- On an operating unit (OP/TP/MP, Panel PC), use the key or button to which the relevant triangle symbol is pointing (that is, to the left or right next to the display).
- On a PC, press the function keys for the corresponding triangle symbol (e.g. "Ctrl F1").
- If your operating unit has a mouse or touch panel, click or press the corresponding triangle symbol.

Note

Do not switch between the keyboard and the mouse when operating the movements.

Tracking a movement

While the movement is being executed the rectangle next to the triangle symbol with a blue background is also blue.

As soon as a particular target position is reached, the corresponding target position symbol changes its appearance as follows:

- white rectangle: target position not yet reached
- green rectangle: target position reached or exceeded

Exiting the Movement Screen

You can switch directly from the Movement Screen to the other diagnostic screens or also exit diagnostics:



switches to the Overview Screen



switches to the Detail Screen



switches to the Message Screen



switches to the Diagnostic Start Screen

3.9.4 Hierarchical units on the Movement Screen

Hierarchical units

When programming a PLC it is possible – depending on the programming language used – to define a hierarchy of individual units. Thus in the case of S7-PDIAG a unit can be equated with a module which as a rule also represents a process unit. By virtue of the multi-instance concept of STEP a unit can also contain other units.

Display

The Movement Screen always shows all movements for a specific unit of your system. Which unit this is depends on where the Movement Screen was activated from (see "What you see in the Movement Screen").

If there are a number of hierarchical levels between the units of a system, the Movement Screen initially shows only the movements for the current unit.

If you wish to trigger movements of lower-level units, you have to switch the display.

Changing display mode



To view the movements of lower-level units as well, press the "Subunits" key.

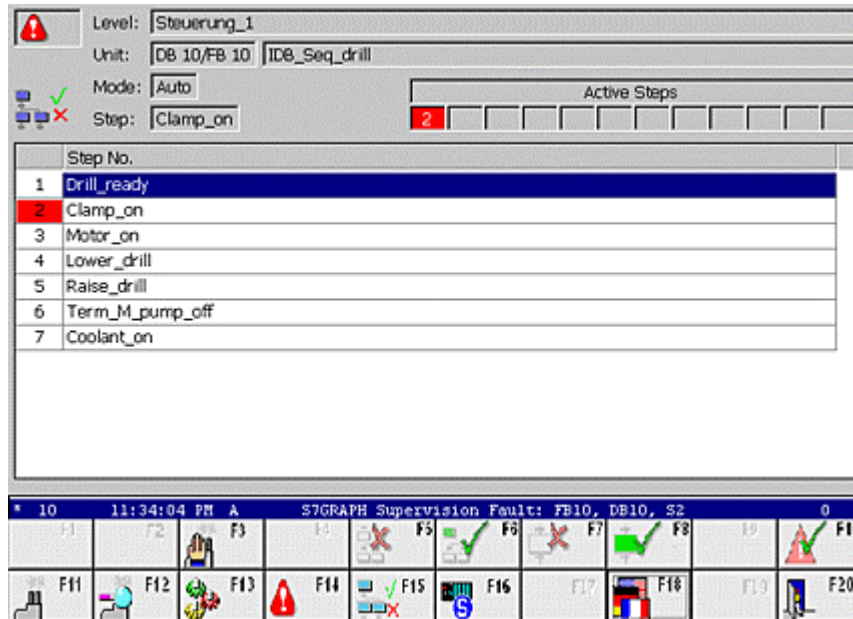
After the display mode has been changed, all movements of subordinate units are shown.

To hide the movements for subordinate units again, press the same key again.

3.10 Step Sequence Screen

What is the Step Sequence Screen used for?

The Step Sequence Screen helps you to rectify faults in an S7-Graph sequence of steps.



Step Sequence Screen (example on PC)

The Step Sequence Screen displays information on the unit (name, current step with number and name) that was selected on the diagnostic screen from which you opened the Step Sequence Screen.

Functions

In the Step Sequence Screen you can

- select specific individual steps manually in order to activate or deactivate them,
- reinitialize the sequence of steps or clear it



Warning

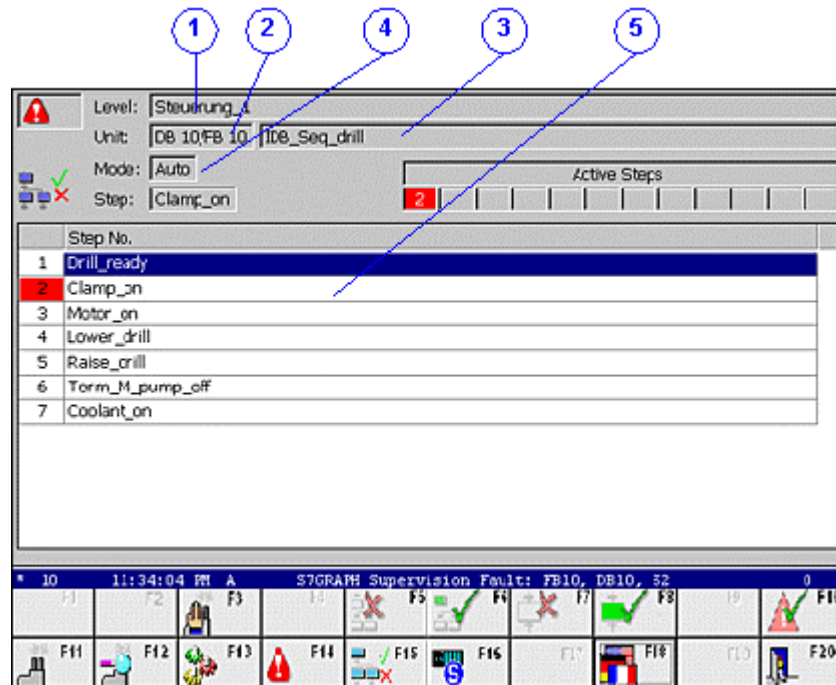
Manually activating and deactivating steps can give rise to inconsistent states of the step sequence or system.

3.10.1 What you see on the Step Sequence Screen

Standardized layout

Like all the diagnostic screens, the Step Screen has a standardized layout. There are only slight variations between the displays on the various operating units.

The following illustration shows an example of the Step Sequence Screen on a PC.



Step Sequence Screen (example on PC)

Information on the display mode

The top left field gives you information on the display mode:



The "Warning triangle" symbol indicates that a unit is blocked. The unit on which the fault occurred first is identified by a flashing icon.. This indicates to you that this fault is not a secondary fault.



The "Connection errored" symbol indicates that connection to the PLC is errored or an addressing error has occurred.



The "Inconsistency alert" symbol indicates that the data for this network has changed in the STEP7 configuration. In a criteria analysis the network data is read by ProAgent directly from the PLC.



The "Consistency error" symbol indicates that the data for this network is not consistent with the STEP7 database. Regenerate your project before continuing.

Information on the selected unit

In the upper area of the display you obtain detailed information on the unit selected in the diagnostic screen from which the Step Sequence Screen was opened.

- (1) The "Level" field displays the PLC assigned to the unit and the complete hierarchical path.
- (2) The "Unit no." field tells you the block type (FC or DB) and the block number of the selected unit.
- (3) The sequence name appears in the "Unit" box.
- (4) The current mode of the unit is displayed in the "Operating mode" box.

Representation of the sequence of steps

The central area of the Step Sequence Screen displays the individual steps in the sequence selected.








(5) Here you can see a list of all the steps in the sequence selected. The step name and step number are displayed for all the steps. You can tell the status of a step from its color:

- green = active
- red = disturbed

3.10.2 Keys in the Step Sequence Screen

Use

You can use the following keys on the Step Sequence Screen:

Symbol	Designation	Function
	Operating modes	You can use this key to change the operating mode of the selected unit: automatic mode, manual mode, typing mode.
	Deactivate sequence	You use this key to deactivate all the steps in the step sequence. No further steps will be executed.
	Initialize sequence	You use this key to start the step sequence with the initial steps defined.
	Disable step	With this key you deactivate the selected step. To do this, you must be in "Manual mode".
	Enable step	With this key you activate the selected step. To do this, you must be in "Manual mode".
	Acknowledge sequence	You use this key to acknowledge a monitoring fault that has arisen during operation (supervision condition met).
		The keys in the global key set.

Keys in the Step Sequence Screen

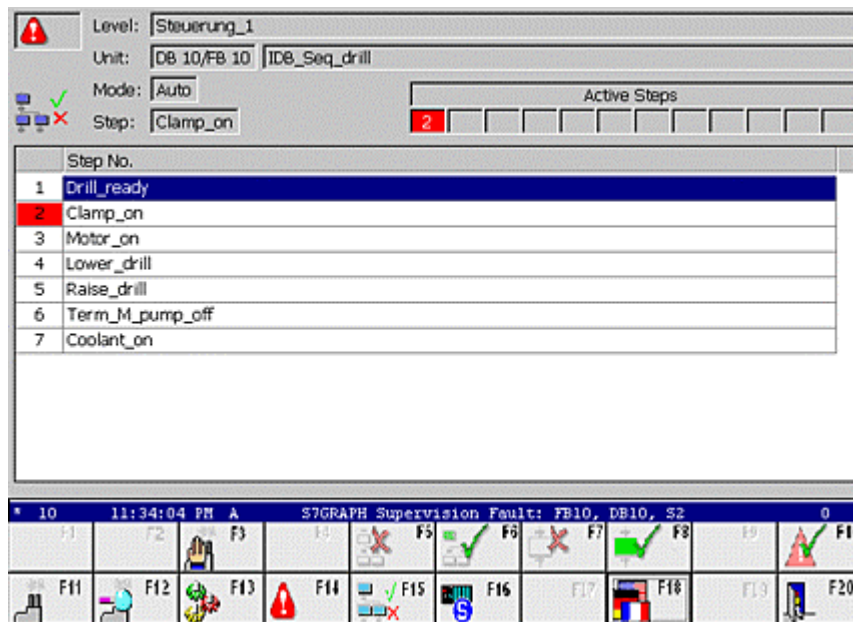
3.10.3 How to work with the Step Sequence Screen

What you need to do

This chapter gives a general outline of how to use the Step Sequence Screen most effectively in practice.

Aims

You want to eliminate a fault by activating steps in the sequence on which the unit with the fault is based. You have opened the Step Sequence Screen to enable or disable one or more steps in the sequence.



Step Sequence Screen (example on PC)



Warning

Manually activating and deactivating steps can give rise to inconsistent states of the step sequence or system.

Which unit?

In the "Unit" box, check that you are in the right sequence as only the steps associated with this sequence are displayed.

Which steps?

A list of all the available steps is displayed in the center part of the screen. You will see the step number and step name for each step. Select the step you want with the arrow keys or the mouse.

Executing individual steps

If the sequence of steps is in "Manual" mode, you can activate individual steps irrespective of whether the transition is satisfied.



With this key you activate the individual step selected.



Use this key to deactivate the individual step selected.

Step sequence mode

On the Step Sequence Screen you can also activate or deactivate the entire sequence of steps.



If you press the "Initialize" key, you will restart the entire sequence of steps with the initial steps defined.



If you press the "Disable" key, you will deactivate all the steps in the sequence. No further steps will be executed.

Exiting the Step Sequence Screen

You can switch directly from the Step Sequence Screen to the other diagnostic screens or also exit diagnostics:



switches to the Overview Screen



switches to the Detail Screen



switches to the Movement Screen



switches to the Message Screen



switches to the Diagnostic Start Screen

4 Requirements of the configuration

This chapter tells you about the requirements that have to be fulfilled when programming the PLC so that process diagnostics can be included in a project.

It describes in detail the various steps that need to be taken in order to include process diagnostics in a ProTool project.

The chapter also shows you how you can upgrade an existing project to include process diagnostics.

4.1 Basic requirements of the PLC program

Requirements

For a process diagnostics, both the PLC and the operating unit must be configured. ProTool and ProAgent can only be used for configuring the operating unit.

Note

As a basic requirement, ProTool plus ProAgent requires a diagnosable PLC program.

Programming language

The PLC is programmed either in STEP7 (STL or LAD), S7-GRAPH or S7-HiGraph.

- If you are using LAD/CSF/STL, you will need the S7-PDIAG options pack. S7-PDIAG allows you to extend the PLC program so that individual signals such as for the status of inputs, outputs, markers, etc. are monitored.
- If you are using S7-GRAPH or S7-HiGraph Version 5 or higher, you do not need an additional option pack. The PLC programs are automatically diagnosable.
You will likewise need the S7-PDIAG options package only if you want to trigger movements for S7-GRAPH units.

The procedure for programming the PLC and the particular aspects to be considered when doing so are explained in the "Documentation for S7-PDIAG", for "S7-GRAPH" and/or for "S7-HiGraph".

Points to bear in mind

The PLC program must operate without errors.

When working with S7-PDIAG make sure that:

- the fault detection FB is invoked in OB1
- the program contains no loops, as the fault detection FB is invoked only once per cycle
- fault detection has been activated for the individual fault monitoring routines
- initial value acquisition has been activated for the individual fault monitoring routines if you want to use the Detail Screen
- the UDT "Movement" (UDT2) has been used if you want to use the Movement Screen. The UDT "Movement" (UDT2) creates a standardized interface with the Movement Screen

If you are working with S7-GRAPH or S7-HiGraph ensure that diagnostic data compilation is enabled.

Make quite sure that the language settings of the PLC program and the ProTool project are in agreement:

- If you are working with more than one language, the languages to be selected and configured in ProTool must have been configured in the PLC program
- If you are working in one language only, the same language must have been used in the PLC program as is to be used to configure the operating unit
- The PLC program must have been compiled.

What you must remember when using S7-PDIAG

If you are working with S7-PDIAG, bear the following points in mind:

- The function block for fault detection in OB1 must be called.
- The program must not contain a loop, since the function block for fault detection is only called once per cycle.
- Error detection must be activated in S7-PDIAG for the different monitoring routines.
- Initial value detection has to be activated for the different monitoring routines if you wish to perform a criteria analysis on the Detail Screen.
- The UDT "Movement" must be used if you want to use the "Movement Screen". The UDT "Movement" sets up a standardized interface to the Movement Screen.
- If several units may display the same movements, they must use the UDT "Movement" expanded by the HMI_ID (UDT2).

What you must remember when using S7-GRAPH

If you are working with S7-GRAPH, bear the following points in mind:

- Under "Extra" > "Block settings" > "process diagnostics" you can assign an FB/DB pair to a sequence of steps. In ProAgent, this unit of movement (the FB/DB pair) will be handled in the Overview Screen as part of a sequence and will not be shown as a separate unit.



Instead, the "Movements" symbol will appear next to the assigned unit.

- The error handling and the criteria analysis for ALARM_S messages of the movement unit continue to be active. You can move back and forth to the movement unit at the sequence.

Message procedure ALARM_S

If you are using ProAgent, then the ALARM_S message procedure is already preset in ProTool. Configuration of messages in STEP7 involves two types of message:

- Alarm messages and
- Event messages

For further information on ALARM_S please refer to the manual "ProTool for Windows-based systems".

Message text

As part of the process of programming the PLC you define the text of messages that will subsequently appear on the operating unit as alarm messages. In other words, the text of diagnosable messages is not entered in the message editor in ProTool as would normally be the case, but in STEP7. The advantage of this is that you can use the messages on different display units but only have to enter them once.

For an overview of the general procedure as for example in the case of S7-PDIAG, please refer to the topic "How to configure ALARM_S messages".

Dummy entries in message texts

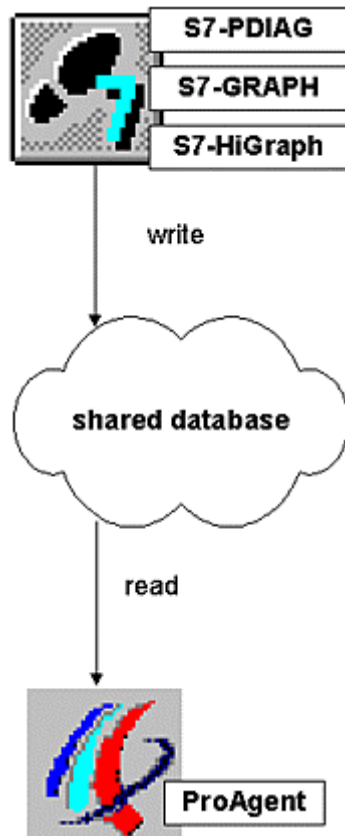
By inserting dummy entries into the ALARM_S message text you can also have the message text display the symbols and remarks relating to the operands that led to the fault. In this way the system operator obtains the most important information about the system fault in the message window itself or in the message line without having to switch to the Diagnostic Screens.

For more detailed information on the topic of showing the result of criteria analysis in a message text, please refer to "Displaying the result of criteria analysis in the message text".

4.2 Shared database with STEP7

Accessing the database

STEP7 and its optional packages store all the data required for process diagnostics in a shared database.



Shared database

ProTool accesses the required information about the PLCs present from that database, i.e.

- Which units are diagnosable?
- which signals are monitored for which states
- which message texts have been defined?

Updating the database

Always compile the monitoring blocks before starting configuration in ProAgent after modifying the PLC program.

Note

The database is not updated if you make changes in STEP7 without subsequently retranslating the monitoring blocks. ProTool will then not have access to the latest data!

During commissioning, in the event of minor changes in S7-PDIAG you can apply the data relevant to diagnostics direct to the CPU. You then do not have to recompile your ProAgent project for the time being.

Content requirements

At certain times, ProTool places specific "minimum requirements" on the data stored in the database.

It is always preferable, of course, if the PLC program is already complete and fully tested. In practice, however, this will not always be the case and you may want to be working on the PLC program and the operating unit configuration at the same time.

The table below shows which data is absolutely necessary at which point. A description of the individual steps can be found in the section called "Overview of configuration steps in ProTool"

Configuration stage	Requirements
Incorporating the diagnostic screens	System planning (ProTool/STEP7)
Linking the diagnostic screens	System planning (ProTool/STEP7)
Selecting the units	Defining the fault monitoring routines (STEP7) Translated fault monitoring blocks (STEP7)
Compiling and downloading	Final translated PLC program (STEP7)

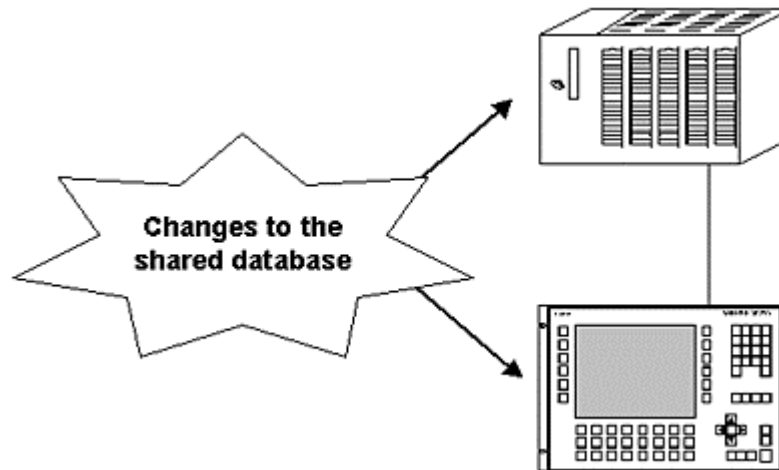
Minimum database requirements

Data consistency

PLCs and operating units exchange data during operation but not their programs. As the programmer, you are responsible for ensuring that the latest version of the relevant program is used on each device.

If, therefore, changes are made to the PLC program at some later date, you must also recompile and re-download the operating unit configuration so that there are no inconsistencies between devices.

When compiling the operating unit configuration, the stored messages and diagnostic data are imported from the database shared with STEP7.



Interdependencies

Faster compilation with S7-PDIAG V.5.0

If you are using S7-PDIAG version 5.0 or higher, only the messages and diagnostic data that is not in agreement with the status of the operating unit configuration is imported from the database. This accelerates compilation markedly.

If the configuration is already at the same status as the shared database, the project does not need to be compiled and the system will not therefore offer this option. In this case a message will be displayed accordingly.

Tip

You can further reduce the compilation time by judiciously arranging units into groups in S7-PDIAG. When doing so, consider how the groups are allocated to the operating units. If changes are made to the S7-PDIAG configuration you only have to recompile and re-download the operating unit configurations affected by the S7-PDIAG changes (see also "Selecting the units").

Activating data synchronization

By choosing "File" > "Compile" you can go to the "Compilation settings" dialog box and select which data in the database shared with STEP7 is to be synchronized, i.e. reimported if necessary when compiling. Normally synchronization with the complete database should remain selected. In that case you can be sure that the most up-to-date data is always made available to the operating unit.

Note

In order to speed up the compilation process or if you deliberately wish to continue working with old STEP7 data, you can deactivate synchronization. In that case, however, you are responsible yourself for ensuring that the compiled data is kept up to date as required.

Forcing compilation (S7-PDIAG version 5.0 or higher)

When compiling the ProTool/ProAgent project, ProAgent synchronizes only the diagnostic data which has changed. In the event of difficulty, you can force complete synchronization or compilation of the diagnostic data. To do this you must first carry out a full compilation of all units in S7-PDIAG (menu command "process diagnostics" > "Compile all"). You can then recompile your configuration in ProTool.

4.3 Upgrading existing projects

This chapter tells you about the requirements that have to be fulfilled when programming the PLC so that process diagnostics can be included in a project.

The chapter also shows you how you can upgrade an existing project to include process diagnostics.

4.3.1 Requirements when upgrading

Basic requirements of the PLC program

As a basic requirement, ProTool plus ProAgent requires a diagnosable PLC program. And the same is true whether you are creating a new project or upgrading an existing project to include process diagnostics.

For an overview of these requirements please refer to the topic "Requirements of the PLC Program"

Requirements of the project

There are no particular requirements placed on the ProTool project being upgraded.

One basic requirement for upgrading with ProAgent, however, is that the operating unit being configured must be a diagnosable operating unit or a PC.

Your project can include more than one PLC including ones which do not meet the requirements for process diagnostics. In that case, however, those PLCs will not be capable of diagnostics.

You can also integrate various different diagnosable PLCs in your project and even program them in different languages according to the particular requirements e.g. one PLC in STL using S7-PDIAG and another in S7-GRAPH.

Uniform design

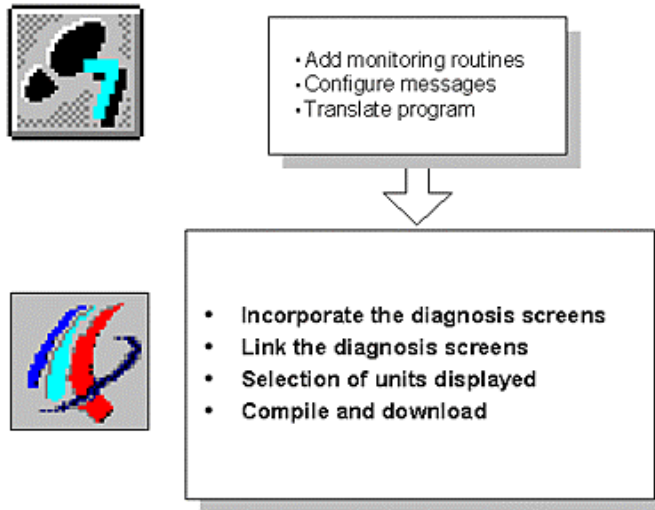
Information on how you can modify the diagnostic screens so that they are visually in harmony with the rest of your system configuration is also given under the heading "Modifying the diagnostic screens".

4.3.2 Steps involved in upgrading a configuration to include process diagnostics

Overview

Upgrading an existing project to include process diagnostics is not significantly different from the process of creating a new project with diagnostic capability.

The diagram below shows the steps required in chronological order:



Configuration steps involved in upgrading a configuration to include process diagnostics

Tip

A special list of the steps needed to upgrade a project to diagnosable status can be found under the heading "Overview of configuration steps in ProTool".

Requirements of the PLC program

As universal system tools, ProTool and ProAgent are closely compatible with the STEP7 software.

An overview of the minimum requirements which the PLC program must fulfill so that you can define a process diagnostics in ProTool can be found under the heading "Requirements of PLC program and project when upgrading".

In order that you do not have to define the same data more than once, the system uses a common database as an interface. As a general rule, therefore, the PLC program should already exist and have been translated before you start working in ProTool.

A list of which steps should have been completed in STEP7 and at what point is given in the section "Shared database with STEP7".

Configuration steps in ProTool

The process of configuration in ProTool requires only a few operations as follows.

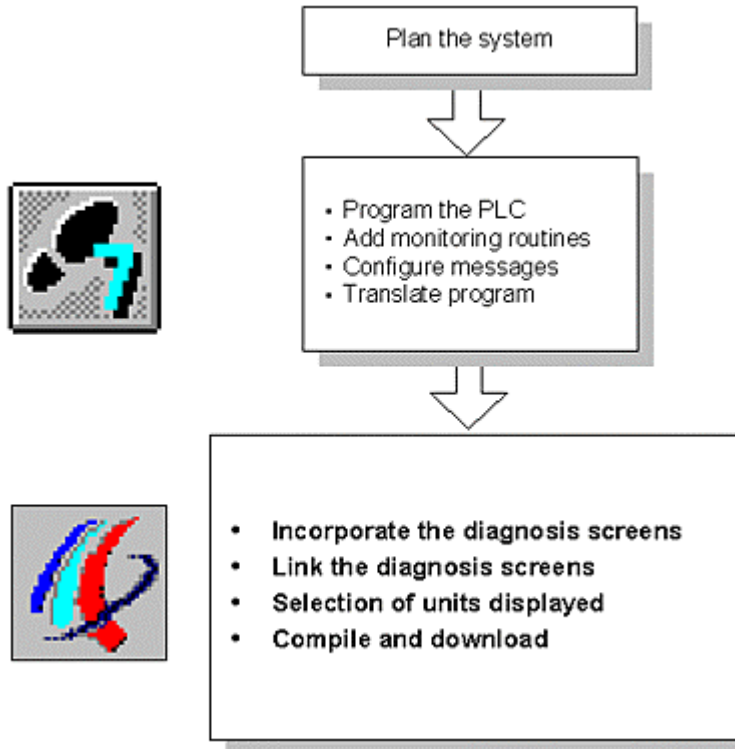
The list below outlines the special considerations when upgrading an existing project.

1. Incorporating the diagnostic screens
To begin with you copy the supplied standard diagnostic screens into your project. This can be done easily via the clipboard.
2. Linking the diagnostic screens
You have to create a means of accessing the diagnostic screens from the existing screens. Normally, a function for selecting the Diagnostic Start Screen is entirely adequate. Conversely, you must provide a means of returning from the diagnostic screens to your own screens. The simplest way of doing this is to configure an appropriate screen selection function on the Diagnostic Start Screen. The remaining steps are the same as for creating a new project, i.e.:
3. Selecting the units
4. Compiling and downloading

5 Steps in the configuration of a diagnostics

Overview

The diagram below shows the chronological sequence of all steps to be completed when configuring a process diagnostics.



Configuration steps for a process diagnostics

Tip

For a special list of the steps needed when upgrading an existing configuration, please refer to the topic "Overview of the steps required when upgrading".

Requirements of the PLC program

As universal system tools, ProTool and ProAgent are closely compatible with the STEP7 software.

A breakdown of the minimum requirements to be satisfied by the PLC program is given in the section "Requirements of the PLC program".

In order that you do not have to define the same data more than once, the system uses a common database as an interface. As a general rule, therefore, the PLC program should already exist and have been translated before you start working in ProTool.

A list of which steps should have been completed in STEP7 and at what point is given in the section "Shared database with STEP7".

Configuration steps in ProTool

The process of configuration in ProTool requires only a few operations as follows:

	Procedure
1	<p>Incorporating the diagnostic screens</p> <p>To begin with you import the supplied standard diagnostic screens into your project. You can copy individual diagnostic screens or the complete standard project for your operating unit easily using the clipboard or using the Drag & Drop method.</p>
2	<p>Linking the diagnostic screens</p> <p>In order to be able to activate the diagnostic screens once they have been incorporated, you must assign one or more keys the appropriate screen selection function(s).</p> <p>To switch back to your system screens from the Diagnostic Screens use the function <code>ProAgent_Save_Screen</code> (see "ProAgent functions for selecting Diagnostic Screens").</p>
3	<p>Selecting the units</p> <p>This next step involves selecting the units of your system for which you wish to be able to carry out a process diagnostics.</p>
4	<p>Select display classes (optional)</p> <p>Finally, you can specify that alarm messages of particular display classes are to be displayed.</p>
5	<p>Compiling and downloading</p> <p>Once configuration is complete, compilation and transfer to the operating unit is carried out as usual.</p>

5.1 Incorporating the diagnostic screens

Integrated operation

You use ProAgent to configure a device for operation and monitoring. Its central function, therefore, is to provide the operator with an easy-to-use interface by means of which it is possible to identify process faults at a glance and rectify them quickly.

Note

ProAgent requires that ProTool has been installed integral with STEP7. If you have only been using ProTool as a stand-alone product up to now, please first consult your "ProTool User's Guide" for details of working with integrated operation.

Ready-to-use diagnostic screens

When ProAgent is installed, a STEP7 project with all the ProAgent standard configurations is stored in the ProTool directory under `Standard\PROAGENT`. This includes ProAgent standard configurations for the following devices:

File name	Suitable for the devices
ProAgentOP270	OP270
ProAgentMP270B	MP270B
ProAgentMP370	MP370
ProAgentFI45	FI45
ProAgentPC670low	PC670, screen resolution: 640x480
ProAgentPC670medium	PC670, screen resolution: 800x600
ProAgentPC670high	PC670, screen resolution: 1024x768
ProAgentPCmedium	PC, screen resolution: 800x600
ProAgentPChigh	PC, screen resolution: 1024x768

Names of STEP7 projects

These projects contain ready-to-use diagnostic screens for the different operating units. They need only to be incorporated into your configuration.

Since ProAgent is used in many different countries around the world, the standard diagnostic screens supplied have been given English names as follows:

Name	Diagnostic screen
ZP_PROAGENT	Diagnostic Start Screen
ZP_ALARM	Message Screen
ZP_DETAIL	Detail Screen
ZP_MOTION	Movement Screen
ZP_STEP	Step Sequence Screen
ZP_UNIT	Overview Screen

Names of the diagnostic screens

Note

All the standard configurations are configured with the setting "Full screen". You can change this setting using the menu option "System" > "Settings".

Converting for other operating units

If you use an operating unit for which no standard ProAgent configuration exists, you can convert the appropriate standard ProAgent project in ProTool in other operating units:

Standard project	Source unit	Target units
ProAgentOP270_6	OP 270 - 6"	TP 270 - 6"
ProAgentMP270B	MP 270B	MP 270, MP 270B - 10" TOUCH, TP 270 - 10", OP 270 - 10"
ProAgentMP370	MP 370	MP 370 TOUCH
ProAgentPC670low	PC 670 - 10"	PC 640 * 480
ProAgentPC670medium	PC 670 - 12"	PC 670 - 12" TOUCH, PC 870 - 12", PC IL 70 - 12" TOUCH
ProAgentPC670high	PC 670 - 15"	PC 670 - 15" TOUCH, PC 870 - 15" TOUCH, PC IL 70 - 15" TOUCH
ProAgentFI45	FI45	PC 670 - 15", PC 670 - 15" TOUCH, PC 870 - 15", PC 870 - 15" TOUCH

Conversion options

Copying the diagnostic screens

From the project for your operating unit copy the required diagnostic screens to your own project via the clipboard.

To do this you must first open your own project and the ProAgent standard project for your operating unit in parallel. The standard project is in the ProTool directory under Standard\ProAgent.

You can then select the screens you want in the project window of the ProAgent standard project and insert them in your own project using the menu commands "Edit" > "Copy" and "Edit" > "Paste".

The diagnostic screens are now available for use in your project. All the necessary functions have been copied along with the screens.

Note

In Simatic Manager you can also copy the complete ProAgent standard project for your operating unit if you want to use all the screens in the standard project.

Continuing configuration

You can now continue with the process of configuration as normal. But do not forget to configure a screen change from your system screens to the new diagnostic screens and back again (refer to "Linking the diagnostic screens").

Easy to adapt

It goes without saying that you can also modify or add to the diagnostic screens supplied and thus seamlessly integrate them in your systems. Important information on this subject can be found in the section "Modifying the diagnostic screens".

5.2 Modifications during the commissioning of an S7-PDIAG project

Copy network data relevant to diagnostics to PLC

In S7-PDIAG version 5.0 or higher, network data relevant to diagnostics can be stored direct in the PLC. If you activate this mode in S7-PDIAG (menu command "Tools" > "Settings" > "Compile", check box "Copy network data relevant to diagnostics to PLC" active), you can see minor changes in the monitored network right away in the ProAgent Detail Screen.

The ProAgent project does not have to be recompiled for this. This can save you a lot of time, particularly during the commissioning phase.

Note

Prior to final commissioning of the modified S7-PDIAG project you should carry out a final compilation of the ProAgent project to ensure correct functioning of the operating unit.

When should you select "Copy network data relevant to diagnostics to PLC"?

Testing the following changes in the S7-PDIAG configuration does not require recompilation in ProAgent:

- adding or removing operands in monitored networks
- changing the network logic or the operators in monitored networks
- changing the monitoring time

In these cases it is sufficient to recompile your S7-PDIAG configuration and reload the CPU. The operating unit then reads the modified operands, operators or monitoring times direct from the CPU. Synchronization with the STEP7 database is not required for this data.

Limitations

If "Copy network data relevant to diagnostics to PLC" is selected, the following data can then only be read from the common STEP7 database and is therefore not displayed or not up to date:

- symbols and remarks for newly added operands
- modified symbols and remarks for existing operands
- modified message texts

This data is only displayed correctly after compilation and download of the ProTool project.



In the Overview and Detail Screens, the S7-PDIAG units are flagged with the "Inconsistency alert" symbol when their network data has been read straight from the CPU if it is not possible to display all symbols, remarks and network names correctly.

If new monitors have been added in your S7-PDIAG configuration, again you must compile in ProAgent as usual.

Further information on "Copy network data relevant to diagnostics to PLC" can be found in the "Documentation on S7-PDIAG".

5.3 Linking the diagnostic screens

Principle

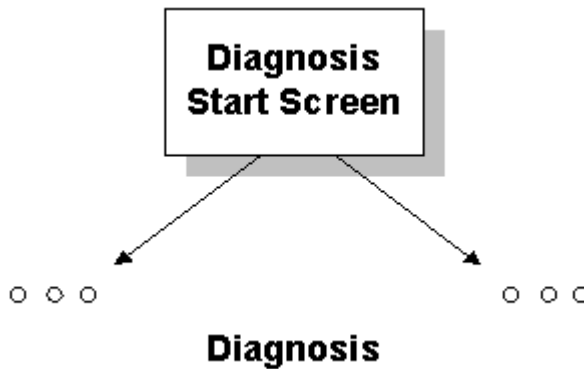
Once you have incorporated the diagnostic screens, you then have to make them accessible to the operator. Diagnostic screens can be linked in a number of ways, depending what type your project is:

- Your project is intended for process diagnostics only. It contains diagnostic screens only and no other system screens. In this case your project should start during program runtime using the Diagnostic Start Screen supplied.
- Your project contains both diagnostic screens and system-specific screens. In such cases, it is useful to make one of those screens the start screen or to create a general start screen.
- You would prefer not to start process diagnostics with the aid of a start screen but rather by using a diagnostic screen (e.g. the Detail Screen directly). In this case you must define in your configuration which unit you want to be displayed in the diagnostic screen.
- This section tells you how to proceed with the different linking methods.

5.3.1 How to make the Diagnostic Start Screen the Start Screen of your project

Use

Once you have incorporated the diagnostic screens, you then have to make them accessible to the operator. In the simplest case your project can be used solely for process diagnostics, i.e. it contains only diagnostic screens and no other system screens. Your project should therefore start with the Diagnostic Start Screen.



Use of diagnostic screens only

Procedure

The diagnostic screens are already interlinked (see "How the diagnostic screens are linked to one another").

All you have to do is to make the Diagnostic Start Screen the start screen of your project as follows:

Procedure	
1	Select the "Screens" object type in the ProTool project window.
2	Click the object ZP_PROAGENT with the right mouse button. This is the Diagnostic Start Screen.
3	Choose "Properties" from the shortcut menu.
4	On the "General" tab in the dialog box that opens, select the "Start Screen" check box.

The Diagnostic Start Screen is overlaid on the operating unit automatically after the project has been started in ProTool RT. And from that point you can access all the other diagnostic screens one after the other by means of keys.

5.3.2 How to open the Diagnostic Start Screen in your project

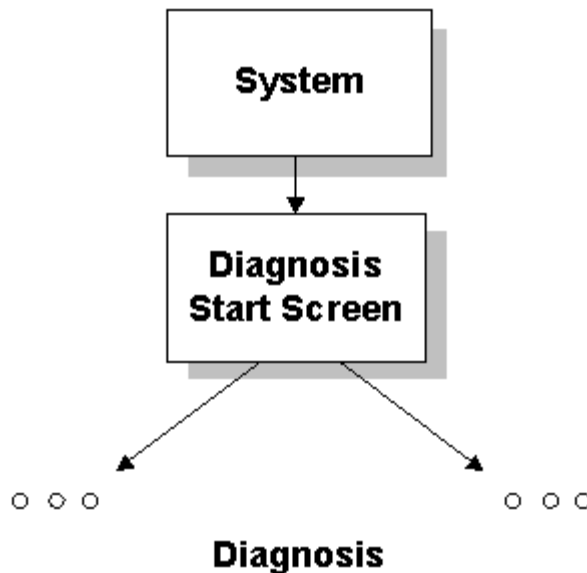
Use

Normally, your project will contain other system-specific screens in addition to the diagnostic screens. In such cases, it is useful to make one of those screens the start screen or to create a general start screen.

From that point you can then control your system in the normal way. In addition, you configure a key which can be used to start the diagnostic package as you would a subroutine. The key in question activates the Diagnostic Start Screen from where you can then access all other diagnostic screens.

Advantage: the project is very easy to create and maintain. Operation is largely separate from operation of the system.


Disadvantage: the indirect route to the diagnostic functions via the Diagnostic Start Screen is not as straightforward from the operator's point of view as direct selection of the diagnostic screens.



Access to diagnostic functions via Diagnostic Start Screen

Procedure

Configure a screen selection function for the Diagnostic Start Screen as follows:

Procedure	
1	<p>In your system screen, first configure the function <code>Select screen</code> with the parameter <code>ZP_PROAGENT</code> by assigning it to a key.</p> <p>When, subsequently, the key concerned is pressed, it opens the Diagnostic Start Screen from where all other diagnostic screens can be accessed by means of keys.</p> <p>You must also make sure that you provide a means of returning from the Diagnostic Start Screen to your own system screens.</p>
2	<p>Configure the function <code>Select screen</code> by assigning it to a key in the Diagnostic Start Screen and as parameter define the name of the system screen that you want to switch back to when diagnostics has ended.</p>
	<p>You can use the symbol <code>ZP_ESC</code> as the icon.</p>

5.3.3 How to open a Diagnostic Screen of your choice in your project

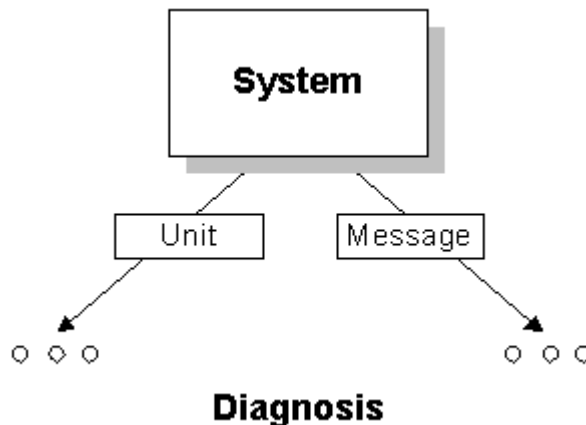
Function

You can bypass the Diagnostic Start Screen by calling the Message Screen or the Overview Screen direct from any other screen in your project.

From the Message Screen or the Overview Screen you can then go to the Detail Screen, the Step Sequence Screen or the Movement Screen.

Which unit will be displayed together with the associated diagnostic data when you call the Detail, Step Sequence or Movement Screen depends on the configuration in the calling screen:

- If you configure the function `ProAgent_Evaluate_Fault` onto a key, the operator must have selected a diagnosable alarm message in the Message Screen, message window or message line before calling the diagnostic screen.
- If you configure the function `ProAgent_Select_Unit` onto a key, the operator receives information about a specific unit.



Direct access to individual diagnostic screens

Call via the diagnosable alarm ,message

Aim

The operator has selected a diagnosable alarm message. He wants to be able to call a diagnostic screen from a screen of your project and find information about the unit associated with the alarm message selected.

Procedure

Procedure	
1	If you want to assign a button open the screen from which you want to go to one of the Diagnostic Screens.
2	Click the key that is to be used for selecting the screen.

	Procedure
3	First configure the function by assigning it to the <code>ProAgent: Save</code> screen key. As the event, use the default setting (Press key). Configuring the function ensures that you will return correctly from the diagnostic screen to your system screen.
4	Configure to the same key and the same event as the next function "ProAgent Analyze fault". This function "must" be executed before the screen is selected. As the event, use the default setting (Press key).
5	Next configure the function <code>Select</code> screen. Here too, you should use the default setting (Press key) as the result. Specify the following parameters: the screen name <code>ZP_ALARM</code> if you wish to activate the Message Screen the screen name <code>ZP_UNIT</code> if you want to activate the Overview Screen the screen name <code>ZP_DETAIL</code> if you wish to activate the Detail Screen the screen name <code>ZP_MOTION</code> if you want to activate the Movement Screen the screen name <code>ZP_STEPS</code> if you want to activate the Step Sequence Screen

The diagnostic screen concerned can now be accessed directly using the key configured.



This key takes the operator back to the system screen from which the diagnostics was opened.

Call via a unit

By using the function `ProAgent select unit` you can specify the DB/FB number to select a unit and switch to the desired diagnostic screen.

Further information on the topic ""ProAgent select unit"" can be found in the reference section for ProAgent functions.

Aim:

The operator wants to be able to call a diagnostic screen from a screen of your project and find information about a specific unit.

Procedure:

	Procedure
1	Execute steps 1 through 3 as described in "Call via an alarm message".
2	Configure to the same key and the same event as the next function "ProAgent_Select_Unit". As the event, use the default setting (Press key). Specify the unit directly by means of its DB/FB number or dynamically with the aid of a tag via the PLC.

If you change to the Detail Screen, the criteria analysis for the oldest alarm on the selected unit is automatically displayed.

5.4 How to select units for diagnostics and device ID

Clarity through careful selection

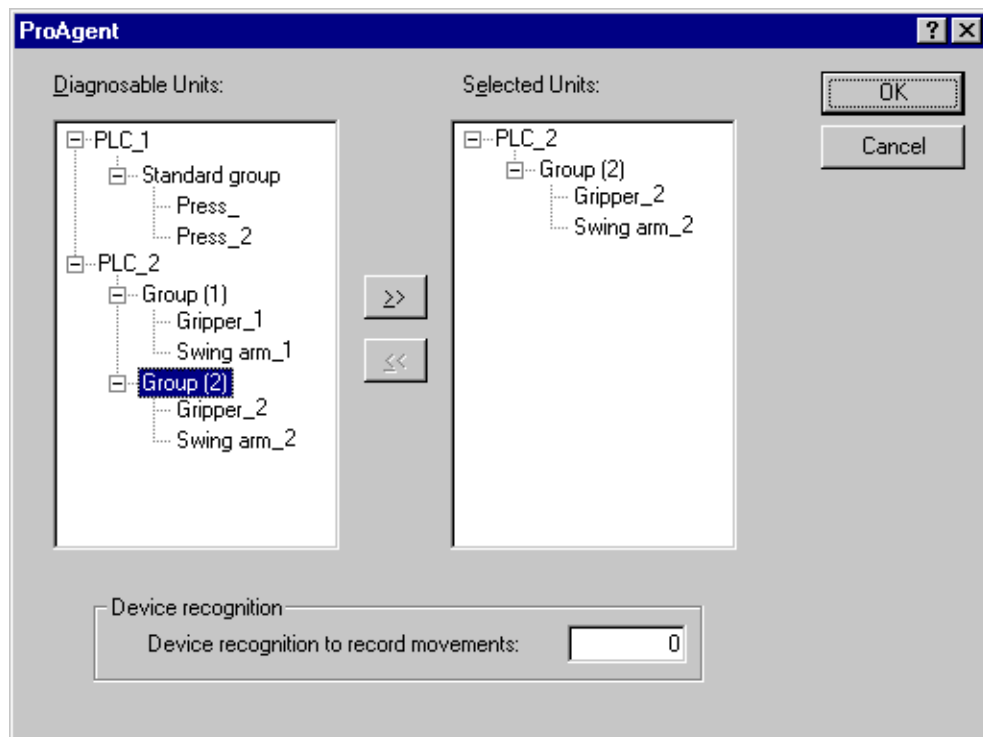
In ProTool you can define specifically which PLCs, groups and units you want to monitor from a particular operating unit. It may be, for example, that your system has more than one operating unit. In that case, you would naturally only want to carry out diagnoses on each operating unit for the units actually operated by the operating unit in question.

Note

To avoid the operating units reciprocally blocking the movements when you initiate a movement from the Movement Screen, always monitor a unit with movements on one operating unit only.

System > ProAgent

You specify the units that are to be included in the process diagnostics by choosing the menu option "System" > "ProAgent". A two-column selection box allows you to specify the units you want to include.



Units for diagnostics

Only those units that are diagnosable are offered for selection, i.e. which were programmed accordingly in S7-PDIAG, S7-GRAPH or S7-HiGraph.

Note

ProTool obtains the information it requires from the database it shares with STEP7. Should you not find a certain diagnosable unit on the list that you might expect to find, recompile the PLC program (see "Shared database with STEP7"). If you change the name of a PLC, that name will be displayed instead of the name used in STEP7.

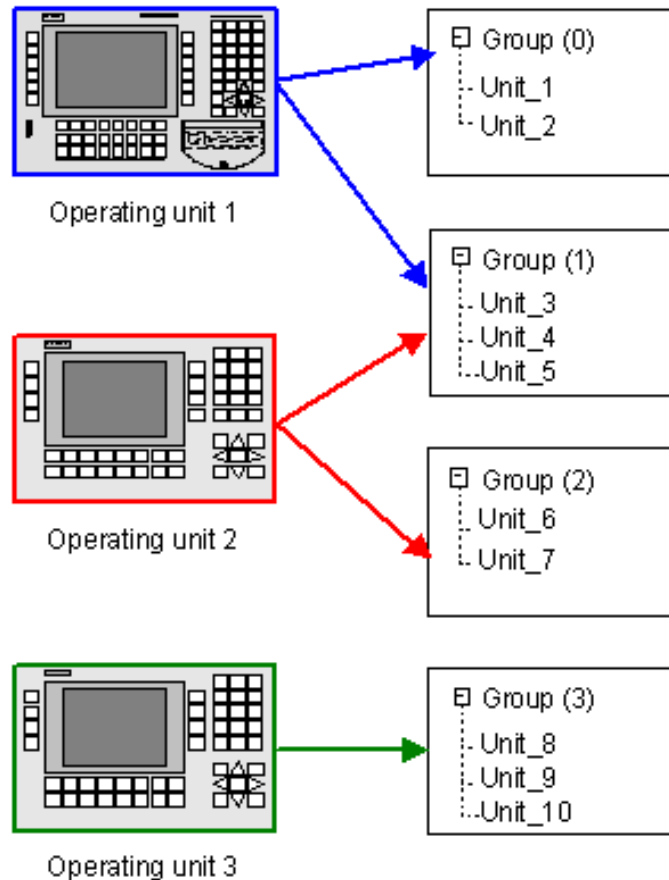
The tree structure shown corresponds to the hierarchy that results from the PLC program concerned. If you are using S7-PDIAG version 5.0 or higher, you can combine the individual units to form groups. These groups are also displayed during unit selection in ProTool.

Combining units to form groups (S7-PDIAG V. 5.0 or higher)

With S7-PDIAG version 5.0 or higher, you can combine the individual units within a PLC to form groups.

If you set up these groups judiciously, you can reduce the compilation and download times in ProTool.

If changes are made to the S7-PDIAG configuration you only have to recompile and re-download the operating unit configurations that serve and monitor the changed groups.

Example*Assignment of operating units to various groups*

With the system configuration illustrated, in the event of changes affecting units in group (0) you only have to recompile and re-download the configuration for operating unit 1. The other configurations are unaffected by the change. They cannot therefore be recompiled.

Selecting groups or units

To select a group or a unit for diagnostics:

Procedure	
1	In the "Diagnosable units" box, select the group or unit you wish to include in the diagnostics. By clicking "+" or "-" you can view or hide information on the individual units and groups.
2	Click the ">>" button. The selected group or unit then appears in the list of selected units. The selected units are diagnosable during operation, i.e. messages concerning the selected units are displayed on the operating unit.

Note

Only select units for diagnostics if you are actually using diagnostics, that is, if you actually want to be able to configure Diagnostic Screens or use ProAgent functions. Otherwise you will be using system resources on the operating unit unnecessarily.

Removing groups or units

To remove a group or unit from the list of selected units:

	Procedure
1	In the "Selected units" box, select the group or unit you wish to remove.
2	Click the "<<" button. The group or unit then disappears from the list of selected units. process diagnostics can then not be performed on that unit during operation.

Enter the device ID

The device ID enables you to assign a unique number to a display unit. The device ID is needed for allocating movements.

To enter the device ID, in ProTool select "System" > "ProAgent" and assign each operating unit a unique number as its device ID.

So that the device ID can be utilized, it is necessary to use the UDT "Movement" expanded by the device ID (UDT2), supplied with effect from S7-PDIAG V5.0 HF3 and higher. This is important if the same movements can be displayed on more than one operating unit at once.

The expanded UDT "Movement" (UDT2) is described in the "S7-PDIAG Manual" for Version 5.0 HF3 and higher.

5.5 How to select the display classes for diagnostics

Note

You need only select display classes if in addition to the messages selected via the units you also want to display ALARM_S messages of certain display classes.

Otherwise you can skip this section.

Message procedure ALARM_S

process diagnostics requires the ALARM_S message number process. Only units that use ALARM_S can be diagnosed.

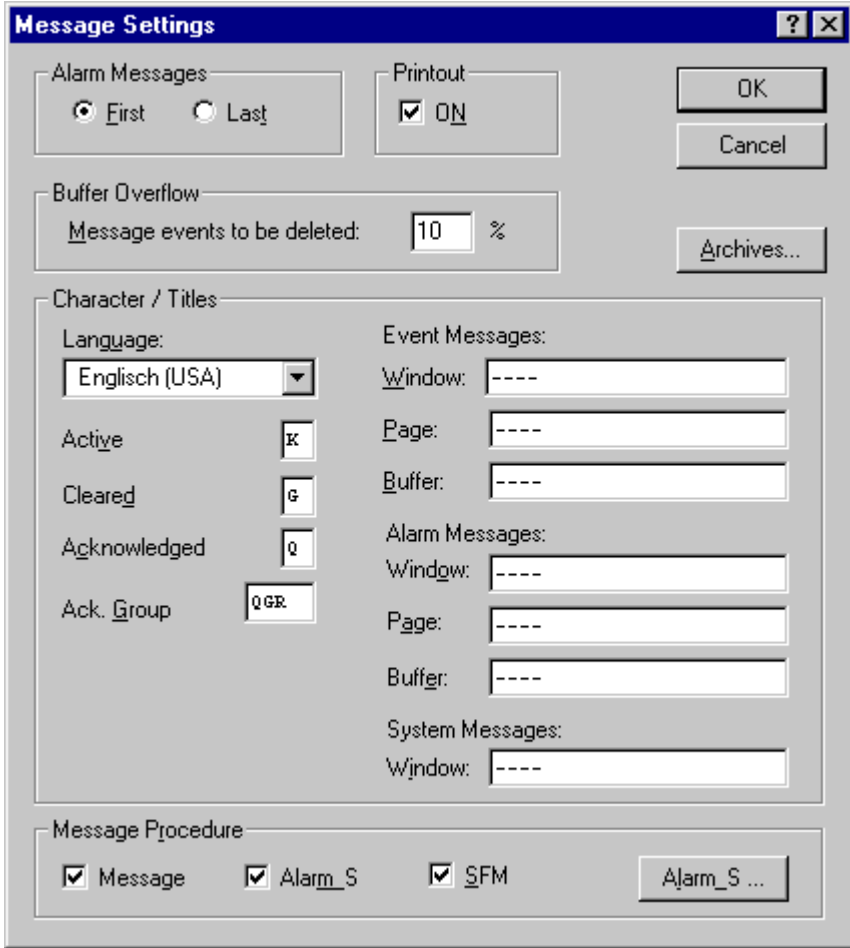
Detailed information on ALARM_S can be found in the "ProTool documentation" under the heading "Message processing".

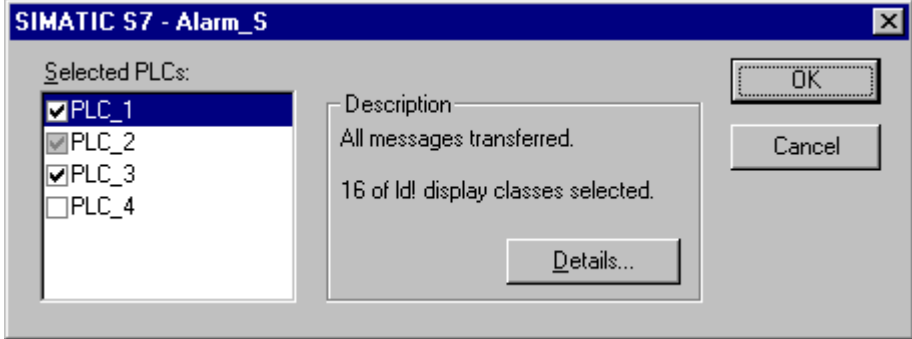
If you are using ProAgent, then the ALARM_S message procedure is already preset in ProTool. All messages relating to the units you have selected for your diagnostics are automatically displayed.

The display classes allow you to specify which additional messages are to be displayed on the operating unit.

The display classes were defined when configuring the PLC in STEP7. This involves specifying for each message the display class to which it belongs.

Selecting display classes

Procedure	
1	<p>Choose the menu option "System" > "Messages" > "Settings". The Message settings dialog box opens.</p>  <p>"Message settings" dialog box</p>

Procedure	
2	<p>Click the "Alarm_S" button to select individual display classes.</p> <p>The "SIMATIC S7 messages" dialog box opens. The left hand column of the dialog box shows a list of all the PLCs in your system.</p>  <p>"SIMATIC S7 messages" dialog box</p>
3	<p>For each PLC, specify which messages are to be displayed on the operating unit:</p> <p>In order not to display messages on the operating unit, deselect the check box on the left next to the PLC.</p> <p>In order to display all messages on the operating unit, select the check box on the left next to the PLC.</p> <p>To display only a selection of messages of very specific display classes on the operating unit select the desired PLC, click the Details button and make a selection in the Display classes dialog box. The check box to the left of the name of the PLC then appears with a gray background.</p>

During operation of the system, only those messages that belong to a selected display class will then appear on the operating unit.

5.6 How to compile and download a diagnosable project

Familiar sequence

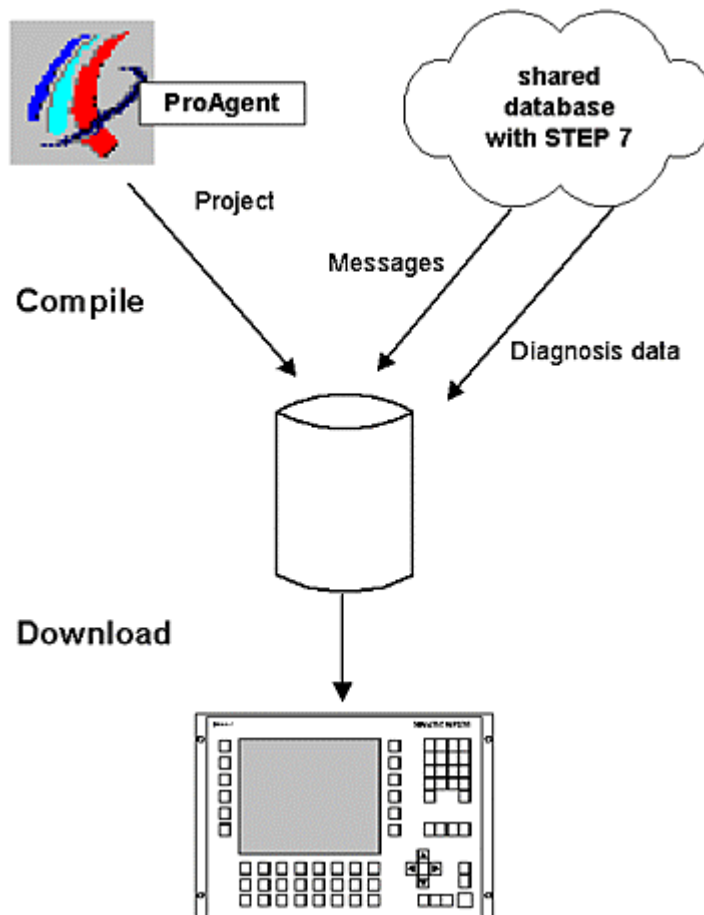
Compiling and downloading the finished project is done in exactly the same way as you are familiar with from ProTool.

The process diagnostics configuration is checked at the same time as the general consistency checks are carried out.

Accessing the shared database

During the process of compilation, ProTool accesses the database shared with STEP7 and imports from it the message texts defined in STEP7 as well as all diagnostic data required.

The message texts and the data are then downloaded to the operating unit together with the remaining project data.



Compiling and downloading

Proceed as follows**Note**

Before starting the compilation process, please make sure that the database is fully up to date. If you have made any alterations in STEP7, retranslate the blocks concerned. The database is also updated during translation (see "Shared database with STEP7").

Data is only imported from the shared database if synchronization has not been deactivated in ProTool under "File" > "Compile".

To compile and transfer the finished project, do the following:

	Procedure
1	Choose the menu option "File" > "Compile" as normal in ProTool.
2	Make sure that in the "Compilation settings" dialog box all options are selected (this is not absolutely necessary if no changes have been made in a particular category since the last compilation run). Tip Help on the relevant error messages can be obtained by positioning the cursor on the line with the message concerned and pressing "F1".
3	Choose the menu option "File" > "Transfer" as normal in ProTool. The diagnostic-compatible project is now on the operating unit.

5.7 How to port a diagnosable project to a computer without STEP7

Computers without STEP7

It may be that you have only installed ProTool plus ProAgent and STEP7 on your workstation PC but would like to take a finished project to a machine location on a notebook or a PU.

Although all the data shared with STEP7 is held in a common database (see "Shared database with STEP7") and ProTool plus ProAgent has to run integral with STEP7, it is possible with certain limitations to open, to compile and to download to an operating unit existing ProTool configurations using ProTool as a stand-alone product.

This is possible since a working copy of all necessary data is stored internally in the ProTool project (PDB file).



Caution

When opening a configuration in ProTool as a stand-alone project, data is not synchronized with the shared database.

You are responsible yourself for ensuring that data is synchronized with the shared database if any changes are subsequently made to the STEP7 program.

Limitations

All dialog boxes relevant to diagnostic functions can be selected in the stand-alone mode of ProTool CS, but cannot be edited.

Exporting a project

To copy a ProTool project from a STEP7 project to another computer, proceed as follows:

	Procedure
1	Start the SIMATIC Manager.
2	Open the STEP7 project.
3	Select the operating unit whose project you want to copy.
4	Use the menu option "Edit" > "Object properties" to open the "Properties" dialog box.
5	Make a note of the path specified for "Configuration file" and the name of the file with the extension * . PDB. This is the project you are looking for.
6	Copy the file (using the Windows Explorer, for example) to the computer and directory of your choice.

You can now open the project on the destination computer using ProTool alone. If you make any changes, you can subsequently reintegrate the project (see "ProTool User's Guide").

6 Configuring diagnostic screens in detail

This section provides detailed background information on how you can modify the standard diagnostic screens where necessary and create your own diagnostic screens.

In this connection you will find out which ProAgent-specific screen objects are available to you in the ProTool screen editor and how you configure them. In addition, you will get an overview of how you can use functions in your diagnostic screens.

6.1 Customize diagnostic screens or create own screens?

Standard screens

The standard diagnostic screens supplied with ProAgent enable you to perform all diagnostic tasks easily without having to bother with configuration yourself. You should take advantage of that opportunity and only make alterations to the diagnostic screens or create your own in exceptional circumstances.

You can skip the topic "Configuring the diagnostic screens in detail" if you are not intending to make any changes to the diagnostic screens.

Sensible adaptations

The diagnostic screens have a uniform design that is based on the design of the standard screens supplied with ProTool. That design represents the best possible compromise between a range of different requirements profiles but can, of course, not reflect very specific requirements in particular cases.

With a relatively small amount of effort, however, you can adapt the diagnostic screens to the layout and design of your own particular installation screens. process diagnostics can in this way be integrated perfectly into your installation visualization also with regard to how it looks.

If your system is particularly complex you might decide, for example, to use a smaller font size so that more units can be shown on the display at once.

And, of course, you can always adjust the layout to match the rest of your project, use different icons or colors, change the key assignments and restrict the use of certain functions by password protection.

Designing your own screens

You will only need to create your own diagnostic screens or merge diagnostic screens with other screens on your system in very rare cases.

This is possible in principle, but you will make things easier for yourself if you use a diagnostic screen as a "master". You can then first delete all the elements that you don't need and then add new elements.

6.2 Internal structure of the diagnostic screens

Conventions

The powerful process diagnostic system involves a particularly complex process and therefore demands that certain rules and conventions are adhered to. The diagnostic screens supplied with ProAgent conform to those rules.

If you make modifications to the screens you should make sure that you do not break any of the rules.

Common prefix ZP_

So that all the elements which affect process diagnostics are listed together in the different editors of ProTool, all names begin with the abbreviation "ZP_". (The "Z" ensures that these elements are placed at the end of the lists - in other words, they appear after your own elements. The "P" stands for "ProAgent".)

Since ProAgent is used in a large number of countries all over the world, all names are in English.

Diagnostic screen names

The names of the standard diagnostic screens supplied are as follows:

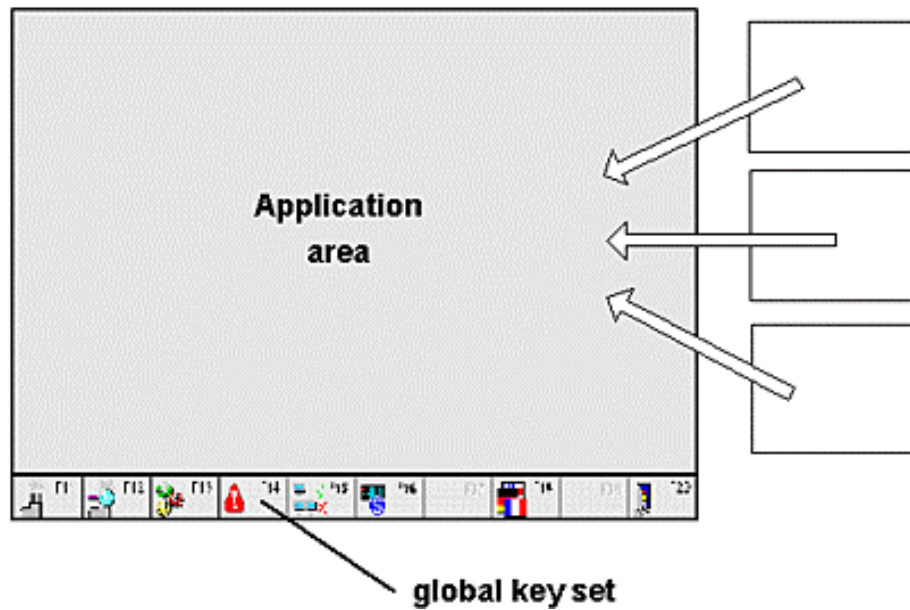
Name	Diagnostic screen
ZP_PROAGENT	Diagnostics Start Screen
ZP_ALARM	Message Screen
ZP_UNIT_OPERATE	Overview screen (for OP270 with 6" monitor only)
ZP_UNIT	Overview Screen
ZP_DETAIL	Detail Screen
ZP_STEP	Step Sequence Screen
ZP_MOTION	Movement Screen
ZP_FORCE	Status/control Screen (not on OP/TP/MP270)

Names of the diagnostic screens

Screen areas

All the diagnostic screens consist of various screen and application areas positioned next to each other and above and below each other. The basic structure of the screens is characterized by the clear division into a screen-specific part and two parts general to all screens: in each diagnostic screen a screen-specific application area is sandwiched between a global screen header and a global key set.

The figure shows this basic structure of the screens:



Screen areas of the diagnostic screens

The global screen header is realized using the ProTool fixed window. More information about the fixed window can be found in the "ProTool documentation".

Depending on the particular diagnostic screen, the application area contains different screens, dialog boxes and screen-specific key sets.

The global key set consists of buttons arranged next to each other. The number of keys depends on the operating unit which you are configuring. Above the keys is a message line displaying the oldest pending alarm message.

6.3 Customizing standard screens

Applications

In principle, there is scarcely any limit on the way the standard screens can be customized by the many and varied options offered by the ProTool screen editor. The following sections therefore offer just a few ideas for frequent applications.

Further information on the procedure can be found under the topic Customizing and configuring ProAgent screen objects and in the "ProTool documentation".

Diagnostic Start Screen

In the Diagnostic Start Screen you can replace the ProTool logo, for example, with your own company logo and embed additional symbols in your system.

To do this, in the ProTool screen editor open the screen ZP_PROAGENT and carry out your modifications here.

Global screen header

In the global screen header, for example, you can add a company symbol or modify the way in which the date and time are displayed.

To do this, in the screen editor open the fixed window, select the object in question and carry out your modifications here.

Font size and character set

You can change the font size and character set of the diagnostic screens. When doing so, observe the basic rules of text design. The size of the text should, therefore, be matched to the importance of the information contained in the text, but also to the distance the user will probably be away from the screen. The font should correspond to that of your other system screens.

If you use a large font size, make sure that longer texts still have sufficient room.

You can change the font size and the character set exactly as you are used to on the ProTool screens.

Icons on Keys

You can change the icons on the global and screen-specific keys by editing the icon linked with the key in the ProTool screen editor. To do this, right-click the key in the ProTool screen editor and select "Properties" from the shortcut menu. You can edit the icon on the "Icon" tab.

6.4 Creating your own diagnostic screens

Motivation

You will only need to create your own diagnostic screens or merge diagnostic screens with other screens on your system in very rare cases.

This is possible in principle, but you will make things easier for yourself if you use a diagnostic screen as a "master". You can then first delete all the elements that you don't need and then add new elements.






The same principles apply as on ProTool screens

The procedure for creating diagnostic screens does not differ greatly from that for creating other screens for your system, since they are also configured in the ProTool screen editor.

Consequently, the principles described in the "ProTool documentation" under the keyword "Screens" also apply to diagnostic screens.

Display elements for diagnostics

Installing ProAgent provides you with four new display elements in the ProTool screen editor that you can use in your diagnostic screens.

Screen object	Name	Description
	Overview display	Use this to show the operator the diagnosable units in your system. For instance, you can define which languages (S7-PDIAG, S7-GRAPH or S7-HiGraph) are to be used in your STEP7 project and whether all units or only units with a fault are to be displayed.
	Detail view	Use this to show the operator which instructions in the program have resulted in a particular alarm message. For instance, you can define what the default display type should be (symbol list, STL or LAD).
	Movement display	This allows the operator to trigger specific movements for a unit manually. For instance, you can define the mode of movement release.
	Message display	The message view, with which you are already familiar from ProTool, has been supplemented with an extra column in ProAgent to show the diagnosability of the messages.
	Step sequence display	Use this to show the operator a list of all the step sequences and steps which have been configured for a unit and its subordinate hierarchical levels.

The functioning of these screen objects depends on certain requirements being met. So make sure you note the information on the individual screen objects if you integrate them into your own diagnostic screens.

You can also paste more than one of the diagnostic display elements into a diagnostic screen, but these must not be of the same type. For instance, it is therefore possible to combine an overview display with a detail view. However, it is not possible to configure two overview displays in a diagnostic screen (nor would it make any sense to do so).

Functions for diagnostics

Specific functions are available for process diagnostics once ProAgent has been installed. Some of these functions require certain ProAgent screen objects to be used.

Detailed information on this can be found under the topic "Using ProAgent functions" and in the reference section.

6.5 Linking diagnostic screens

Opening your own diagnostic screens

You can incorporate your own diagnostic screens into your project just like the standard screens provided, i.e. normally by configuring a corresponding screen selection by assigning it to a key. In addition, however, you must be take account of the following:

- To allow you to switch back to the system screen from which the process diagnostics was activated, before you select the first Diagnostic Screen you must execute the function `ProAgent_Save_Screen`. You can then restore the last screen saved by configuring the function `ProAgent_Restore_Screen` by assigning it to the Back key.
- If your process diagnostics is to display diagnostic data for the alarm message selected in the relevant message view, before screen selection you must execute the function `ProAgent_Evaluate_Fault`.

Linking your own diagnostic screens

Both the detail view and the movement display require a diagnosable unit to have been selected. This selection can be carried out in the message view or in the overview display.

You should therefore start the process diagnostics with a Diagnostic Screen that contains a message view or an overview display. From there you can go on to a detail view or a movement display.

6.6 Working with password levels

Purpose

Buttons and keys can be password protected. Use of those keys/fields is then restricted to suitably authorized and qualified personnel. Password protection can, of course, also be incorporated in the diagnostic screens.

The default setting for all keys is no password protection (password level 0).

By altering the password level you could, for example, prevent an operator

- selecting specific screens
- setting the operating mode on the Overview Screen
- displaying the Movement Screen

You set the password level in exactly the same way as you are familiar with in ProTool.

6.7 Multi-lingual projects

Changing to another language

All text that appears on the diagnostic screens is basically stored in multi-lingual form provided that facility is supported by STEP7. When the function `Language` is executed, the screen is reconstructed in the relevant language.

Most text items are not configured in ProTool but provided by the S7 packages. Conflicts can occur if no text items have been defined in STEP7 for the language configured in ProTool. A warning message to that effect is then issued during the compilation process in ProTool. When the system is running, the text is shown in the default language.

More information on configuration in different languages can be found in the "ProTool documentation".

6.8 Operation of movements

Ensuring backup in the event of operating unit failure



Warning

In the event of failure of your operating unit whilst executing a movement using buttons or keys, the bit initiating the movement may get stuck until ProAgent is restarted. When this is done, the movement will continue to be executed.

To prevent uncontrolled execution of the movement you must monitor the failure of the operating unit in the PLC via a life bit. This life bit is changed cyclically. In the event of failure of the operating unit the PLC must stop the movement immediately.

You configure the life bit in the coordination area between the operating unit and the PLC using "System" > "Area pointer" (see "ProTool documentation"). Ensure that the cycle time of the life bit set is sufficient for the movement reaction time required in your system.

Delays caused by the communication process

In the movement display movements can be initiated:

- by clicking the mouse on the corresponding button
- by pressing the appropriate function key
- by triggering the functions `Start_movement` or `Stop_Movement`

For all three operating options you must expect a certain amount of delay between activating the key or button and the setting or resetting of the bit in the corresponding `UDT_Motion` in the PLC.

Direct keys

You can avoid these communication delays by using direct keys that can set bits in the PLC using separate PLC inputs. Quick operating actions are essential, for example, for typing mode.

On the Panel PC, HMI direct key modules are available for such applications.

ProAgent supports DP direct keys on Panels (TP/OP) and MultiPanels.

Note

When using direct keys the functions `Start_movement` and `Stop_Movement` should be removed from the Movement Screen.

More information

Further information on the topic of direct keys can be found

- under the heading "Movement Screen"
- in the User's Guide entitled "Communication" and in the "Equipment Manual" for the operating unit concerned.

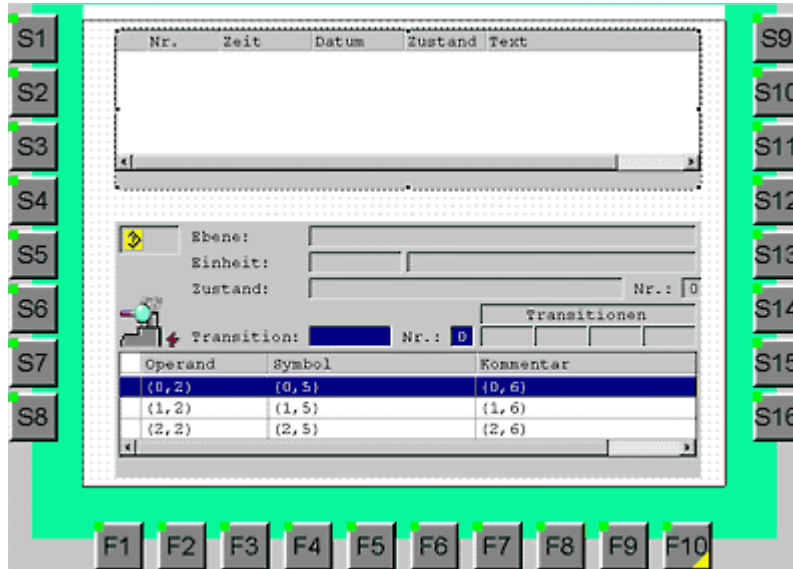
6.9 Example: More than one diagnostic display in a screen

Application

In ProAgent more than one diagnostic display can be configured to a single screen.

However, more than one diagnostic display of the same type cannot be configured to the same screen (e.g. you could not have two detail views).






A sensible combination would be, for example, a detail view, a step sequence display and a message display.



6.10 Customizing and configuring ProAgent screen objects

Display elements for diagnostics

Installing ProAgent provides you with the message display and four new display elements in the ProTool screen editor that you can use in your Diagnostic Screens.

Screen object	Name	Description
	Overview display	Use this to show the operator the diagnosable units in your system. For instance, you can define which languages (S7-PDIAG, S7-GRAPH or S7-HiGraph) are to be used in your STEP7 project and whether all units or only units with a fault are to be displayed.
	Detail view	Use this to show the operator which instructions in the program have resulted in a particular alarm message. For instance, you can define what the default display type should be (symbol list, STL or LAD).
	Movement display	This allows the operator to trigger specific movements for a unit manually. For instance, you can define the mode of movement release.
	Step sequence display	Use this to show the operator a list of all the step sequences and steps which have been configured for a unit and its subordinate hierarchical levels.
	Message display	The message view, with which you are already familiar from ProTool, has been supplemented with an extra column in ProAgent to show the diagnosability of the messages.

This section contains a description of these ProAgent-specific screen objects.

6.10.1 What is a message view?

Information displayed

Message view (or message display) is the central component in the Message Screen. It displays messages in the form of a table, e.g.:

- ALARM_S messages on a SIMATIC S7-300 or SIMATIC S7400 CPU
- the S7 diagnostic buffer on a SIMATIC S7-300 or SIMATIC S7-400 CPU
- bit messages
- message events from a particular message archive

In addition, you can combine the display of message events from the following message classes:

- Alarm messages
- Event messages
- System messages
- S7 diagnostic event

For use in diagnostic screens the message view was expanded by a column that uses an asterisk to show that the message in question is diagnosable.

Purpose

In diagnostic projects you use the message view so that the operator can select the diagnosable message for which he wants to carry out more precise process diagnostics (e.g. with a detail view or a movement display).

If a message is selected in a message view and the function `ProAgent_Evaluate_Fault` is initiated then the unit belonging to the message, the corresponding movements and the associated network are preselected for display in a Diagnostic Screen.

Optional operating elements

If necessary, you can overlay the following buttons:

- ACK to acknowledge alarm messages
- HELP to display help text

The individual columns can be overlaid or hidden as desired and can be edited on the operating unit like a table, e.g.:

- arrange order of columns
- set column width

A detailed description of operating a Message View can be found under the heading "Working with the Message Screen".

In the case of the message view there are no specific ProAgent functions available for configuring other operating elements.

Note on the acknowledgement key on the FI45:

Since the FI45 has no ACK key, the ProTool function `Acknowledge_Message` is assigned to the F7 key in screen ZP_ALARM in the standard ProAgentFI45 configuration. In contrast to the remaining functions, this particular function cannot be configured onto a button.

6.10.2 What is an overview display?

Information displayed

Overview display is the central component in the Overview Screen. It shows the diagnosable units of your system in the form of a table.

When configuring you specify whether all the units are to be shown or only those with faults.

The following are shown for each unit:

- whether it has a fault
- if programmed accordingly in STEP7, which operating mode you are in (e.g. manual or automatic mode)
- whether there are subordinate or superior units
- whether a movement exists for it
- in the case of S7-GRAPH sequences, which step in the sequence of steps is currently active
- in the case of S7-HiGraph units, which status is currently active.

Purpose

In diagnostic projects you use the overview display so that the operator can recognize the unit on which the fault first occurred. He can then tell immediately where the actual cause lies and which faults are consequential errors.

In the overview display the operator can select the unit for which he

- would like a more precise process diagnostics (e.g. performed using a detail view)
- on which he wants to initiate associated movements (e.g. using a movement display)

Optional operating elements

The individual columns can be overlaid or hidden as desired and can be edited on the operating unit like a table, e.g.:

- arrange order of columns
- set column width

You can configure further screen elements for an overview display with the aid of ProAgent functions.

A detailed description of operating an overview display can be found under the heading "Working with the Overview Screen".

6.10.3 What is a detail view?

Information displayed

Detail view is the central component in the Detail Screen. It shows the result of the criteria analysis, i.e. the points in the PLC program that triggered a process fault.

During configuration you specify the way in which the detail view will first be shown:

- as a clear symbol list containing only the statements that resulted in an alarm message being triggered
- in STL display mode, in which all statements for the selected unit are displayed with operators, operands, status bits, results of logical operations, symbols and comments
- in LAD display mode, as a ladder diagram with individual switches and operands

Additional information is shown for each unit depending on the programming language used.

Unit displayed

The detail view always shows information on the unit or subunit currently selected. You need to take this into account when integrating a screen with a detail view. The following integration options exist:

- Before opening the detail view a diagnosable message is selected in a message view. The function `ProAgent_Evaluate_Fault` is then executed. The selected message is noted in ProAgent and the first associated network is displayed when the detail view is opened.
- Before opening the detail view, an overview display is opened. Here the operator selects the unit on which he wants detailed information in the detail view. When the detail view is opened the oldest pending message for the selected unit is found and the associated network is displayed.

If you do not realize either of these options then networks will be shown for the unit still selected from earlier.

Purpose

In diagnostic projects you use the detail view so that the operator can see which statements in the program led to a particular alarm message. He can then tell straight away which monitoring routine triggered the error message and accordingly where the fault is to be found.

Optional operating elements

The individual columns can be overlaid or hidden as desired and can be edited on the operating unit like a table, e.g.:

- arrange order of columns
- set column width

You can configure further screen elements for a detail view with the aid of ProAgent functions.

A detailed description of operating a detail view can be found under the heading "Working with the Detail Screen".

6.10.4 What is a movement display?

Information displayed

Movement display is the central component in the Movement Screen. It shows a list of all movements configured for a unit and their subordinate hierarchy levels.

During configuration you specify:

- whether all the displayed movements are enabled (i.e. can be initiated by the operator)
- how many movements are displayed
- how many target positions are displayed per movement

Unit displayed

The movement display always shows the movements belonging to the unit currently selected. You need to take this into account when integrating the screen with a movement display in your project. The following options exist:

- Before opening the movement display a diagnosable message is selected in a message view. The function `ProAgent_Evaluate_Fault` is then executed. The selected message is noted in ProAgent and the associated unit and the corresponding movements are displayed when the movement display is opened.
- Before opening the movement display, an overview display is opened. Here the operator selects the unit for which he wants to initiate movements. When the movement display is opened the movements belonging to the unit currently selected are always shown.
- The operator is provided with a key which can be used to call the movement list. Here he can select movements and then execute them using a movement display.

If you do not realize either of these options then movements will be shown for the unit still selected from earlier.

Purpose

In diagnostic projects you use the movement display so that the operator can remove a fault by initiating manual movements on the unit with the fault.

In addition, the operator can see in the movement display which movements are blocked.

Optional operating elements

You can configure further screen elements for a movement display with the aid of ProAgent functions.

Sequence in the Movement Screen

The sequence of movements in the Movement Screen can be configured in S7PDIAG. However, the sequence of movements in the Movement Screen can only be defined within the movements of a unit.

Abbreviated movement names

In order to be able to display the right-hand part of the movement name on the operating unit, the left part of the name is truncated. This is done by searching for the second point from the right in the movement name and removing the left part of the name.

If you allocate the names of movements yourself, you should make sure that you do not include points in names and that names are not too long for the display.

6.10.5 What is a step sequence display?

Information displayed

Step sequence display is the central component in the Step Sequence Screen. It shows a list of all the steps in the selected sequence of steps.

During configuration you define which names will be displayed in the heading: the unit and/or the unit hierarchy.

For each step the following is displayed:

- Step disturbed, active or inactive
- Step name and number

Purpose

The Step Sequence Screen helps you when you are clearing a fault in an S7-Graph sequence of steps and shows the states of the individual steps.

Optional operating elements

The various columns can be edited on the operating unit like a table, e.g.:

- arrange order of columns
- set column width

You can configure further screen elements for a step sequence display with the aid of ProAgent functions.

A detailed description of operating a step sequence display can be found under the heading "Working with the Step Sequence Screen".

6.10.6 Introduction to configuring ProAgent screen objects

The introduction which follows will show you how to configure the following ProAgent screen objects in the ProTool screen editor:


- Message display
- Overview display
- Detail view
- Movement display
- Step sequence display

6.10.6.1 How to configure a message view

Default Message Screen as template

The Message Screen supplied with ProAgent is an example of the use of the message view. You can open the Message Screen ZP_ALARM in the ProTool screen editor and check the settings for your own configuration.

Configuring a message view


	Procedure
1	 In the opened screen, select the icon shown.
2	Position the mouse pointer where you want to put the message view. Hold down the left mouse button and drag the field to the size you want.
3	On the "General" tab control, set which messages are to be displayed. For a process diagnostics you need to activate alarm messages and event messages. You can also activate other message categories. Under "Display" you can select whether you want current or archived messages to be displayed: Choose "Messages" if you want to display current messages from the PLC that are arriving or awaiting acknowledgement. Choose "Message archive" if you want to select messages from a message archive. If you have configured ALARM_S messages with dummy entries for operands with faults, archived alarm messages will be displayed in place of the dummies. Further information on this topic can be found under the heading "Displaying the result of criteria analysis in the message text".
4	On the "Columns" tab control, select which columns are to be overlaid and whether they can be operated on the operating unit. For process diagnostics activate the "Diagnosability" column.
5	On the "Display" tab control, select which operating elements are available on the operating unit and how many messages are to be displayed.
6	If necessary, modify the font size and the font for the column headings and the display area on the "Font" tab control.
7	If necessary, assign a password level to the field on the "Enable" tab control, so that only authorized persons are able to make entries.
8	If necessary also specify on the "Enable" tab control under what conditions the field for runtime should be overlaid or removed.
9	Use the "Attributes" tab control if you want to change the runtime foreground and background colors or want to enable or disable flashing for the content of the field.
10	Use the "Position" tab control to specify the position of the field with pixel accuracy. Also specify on this tab control whether the position will be static or will be dynamically modified during runtime.
11	Use the "Functions" tab control if you want to initiate a function when selecting or deselecting the field.

6.10.6.2 How to configure an overview display

Default Overview Screen as template

The Overview Screen supplied with ProAgent is an example of the use of the overview display. You can open the Overview Screen ZP_UNIT in the ProTool screen editor and check the settings for your own configuration.

Configuring overview display

	Procedure
1	 In the opened screen, select the icon shown.
2	Position the mouse pointer where you want to put the overview display. Hold down the left mouse button and drag the field to the size you want.
3	Select from the list on the "General" tab control the columns and units you want to be displayed: all units or only those with errors.
4	On the same tab control choose how many units are to be shown and whether the size of the overview display should be modified to match this.
5	Still on the "General" tab control, determine how the display is to be shown and whether the operator is able to change the order of the columns.
6	If necessary, modify the font size and the font for the column headings and the display area on the "Font" tab control.
7	If necessary specify on the "Enable" tab control under what conditions the field for runtime should be overlaid or removed.
8	Use the "Position" tab control to specify the position of the field with pixel accuracy. Also specify on this tab control whether the position will be static or will be dynamically modified during runtime.
9	Use the "Functions" tab control if you want to initiate a function when selecting or deselecting the field.


Detailed information on the individual tab controls is given in the "ProTool Online Help".

6.10.6.3 How to configure a detail view

Default Detail Screen as template

The Detail Screen supplied with ProAgent is an example of the use of the detail view. You can open the Detail Screen ZP_DETAIL in the ProTool screen editor and check the settings for your own configuration.

Configuring detail view

	Procedure
1	 In the opened screen, select the icon shown.
2	Position the mouse pointer where you want to put the detail view. Hold down the left mouse button and drag the field to the size you want.
3	On the "General" tab control, select which display mode is to be used initially for the program code in the detail view: symbol list display mode STL display mode or LAD display mode
4	On the same tab control, choose how many lines are to be shown and whether the size of the detail view should be modified to match this.
5	If necessary, modify the font size and the font for the column headings and the display area on the "Font" tab control.
6	Use the "Position" tab control to specify the position of the field with pixel accuracy. Also specify on this tab control whether the position will be static or will be dynamically modified during runtime.
7	Use the "Functions" tab control if you want to initiate a function when selecting or deselecting the field.


Detailed information on the individual tab controls is given in the "ProTool Online Help".

6.10.6.4 How to configure a movement display

Default Movement Screen as template


The Movement Screen supplied with ProAgent is an example of the use of the movement display. You can open the Movement Screen ZP_MOTION in the ProTool screen editor and check the settings for your own configuration.

Configuring movement display

	Procedure
1	 In the opened screen, select the icon shown.
2	Position the mouse pointer where you want to put the movement display. Hold down the left mouse button and drag the field to the size you want.
3	On the "General" tab control, under "Movement control", select whether the movements are to be enabled as soon as they are displayed. In Touch Panels it makes good sense to ensure that only the "selected movement" can be controlled.
4	Under "Operand name" define how you want operand names to be shown.
5	On the same tab control, select how many movements and how many target positions per movement are to be displayed.
6	Still on the "General" tab control, select whether the size of the movement display is to be adapted to this.
7	If necessary, modify the font size and the font for the column headings and the display area on the "Font" tab control.
8	Use the "Position" tab control to specify the position of the field with pixel accuracy. Also specify on this tab control whether the position will be static or will be dynamically modified during runtime.

Colors of target positions

If a target position is active because its target position bit is set, green is used as the default background color for that target position. The color denoting that a target position is active can also be configured for each target position:


- The movement display must be switched to online mode in ProTool. Online mode can be selected when the zoom setting is 100% by pressing SHIFT+ENTER or by using the menu.
-  In online mode the cursor switches to the "Color fill" symbol over the target position. This indicates that you can modify the Target position active color by clicking the various target positions. You can select from the whole range of ProTool colors by clicking your way through them all.

6.10.6.5 How to configure a step sequence display

Default Step Sequence Screen as template

The Step Sequence Screen supplied with ProAgent is an example of the use of the Step Sequence display. You can open the Step Sequence Screen ZP_STEP in the ProTool screen editor and check the settings for your own configuration.

Configuring a step sequence display

Procedure	
1	 In the opened screen, select the icon shown.
2	Position the mouse pointer where you want to put the step sequence display. Hold down the left mouse button and drag the field to the size you want.
3	In the "General" tab control, choose what you want to be displayed in the heading of the step sequence display: the name of the unit and the unit hierarchy or neither of these.
4	On the same tab control choose how many steps are to be shown and whether the size of the step sequence display should be modified to match this.
5	Still on the "General" tab control, determine how the display is to be shown and whether the operator is able to change the order of the columns.
6	If necessary, modify the font size and the font for the heading and the display area on the "Font" tab control.
7	If necessary specify on the "Enable" tab control under what conditions the field for runtime should be overlaid or removed.
8	Use the "Position" tab control to specify the position of the field with pixel accuracy. Also specify on this tab control whether the position will be static or will be dynamically modified during runtime.
9	Use the "Functions" tab control if you want to initiate a function when selecting or deselecting the field.

Detailed information on the individual tab controls is given in the "ProTool Online Help".

6.11 Using ProAgent functions

Functions for diagnostics

Specific functions are available for process diagnostics once ProAgent has been installed. Some of these functions require certain ProAgent screen objects to be used.

This section tells you how you can use the functions in your diagnostic screens and how these interrelate during runtime.

Detailed information on individual functions can be found in the reference section.

6.11.1 ProAgent functions for selecting diagnostic screens

Overview

ProAgent functions are available for your own Diagnostic Screens that allow you to influence the selection of the screens. These functions perform the following tasks:

- In a Diagnostic Screen instead of the unit belonging to the oldest pending alarm message, the unit belonging to the message selected in the message view should be displayed.
- It is ensured that the operator can open the system screen again from which he started the diagnostics.

Note

On the standard screens supplied with ProAgent the corresponding functions for selecting the diagnostic screens have already been configured. If you use these screens unchanged you can skip this topic.

Displaying diagnostic data for the message currently selected

The ProAgent default screens are configured so that the operator will be shown a process diagnostics for the unit associated with the oldest pending alarm message.

You can configure your own screens so that the operator can select a message from a message display and receive the process diagnostics for the associated unit in the diagnostic screen just by pressing a key.

To achieve this, the function `ProAgent_Evaluate_Fault` must be executed before selecting the required diagnostic screen. This function checks whether the selected fault is diagnosable. If so, after screen selection information on the unit, movement or criteria analysis affected by the fault is displayed.

It is possible to configure more than one message display in one screen. In this event, before selecting a diagnostic screen do not execute the function `ProAgent_Evaluate_Fault` but the function `Message_View_Evaluate_Error` instead. You can use this function to define which message display will be taken into account when the diagnostic data is prepared.

The operator can also select a diagnosable message from system screens and then switch straight to the diagnostic screens.

The message with the highest priority in the screen area will be displayed in the diagnostic screen.

Selecting a unit and switching to a diagnostic screen

By using the function `ProAgent_Select_Unit` you can specify the DB/FB number to select a unit and switch to the desired diagnostic screen. You can specify the unit directly during configuration or dynamically with the aid of a tag via the PLC.

This enables you to select a unit from user-defined screens and switch to the desired diagnostic screen.

If you change to the Detail Screen, the criteria analysis for the oldest alarm on the selected unit is automatically displayed.

Switching back to the last screen

To allow you to switch back to the last system or Diagnostic Screen opened, before you select the new screen you must execute the function `ProAgent_Save_Screen`. The current screen number will then be saved.

The function `ProAgent_Save_Screen` only allows one screen number to be saved at a time. If you call up this function again, the previously saved screen number will be overwritten.

The operator can recall the screen with the last screen number saved. To do this you must provide a key in your screen to which the function `ProAgent_Restore_Screen` is configured.



This function has already been configured to the key alongside in the standard diagnostic screens.

6.11.2 ProAgent functions for an overview display

Use

In diagnostic screens with an overview display it is a good idea to assign functions to keys to allow the operator

- to influence the content of the overview display
- to call the Step Sequence Screen in order to set the operating mode
- to acknowledge the selected unit

Note

Depending on your system it may make sense to ensure that displaying the Step Sequence Screen, changing the operating mode and acknowledging messages are password protected operations.

Display all units or only units with faults

When configuring the overview display you specify whether all the units are to be shown or only those with faults. The user can toggle this setting in runtime if provided with a key to which the function `Change_Overview_Fault_Mode` is configured.



This function has already been configured to the key alongside in the standard Overview Screen.

Display subordinate and/or superior unit

When programming a PLC it is possible – depending on the programming language used – to define a hierarchy of the units. As soon as at least one subunit has a fault, the immediately superior unit is also marked as having a fault. In order for the operator to be able to establish the hierarchical level at which a fault has occurred he must be able to switch to and fro between the different levels. For this purpose you should configure the function `Overview_Subordinate_Units` to a key, and the function `Overview_Superior_Units` to another key.



In the standard Overview Screen the function `Overview_Subordinate_Unit_Level` is configured to the neighboring keys, and on the MP270 to the ENTER key.



In the standard Overview Screen the function `Overview_Superior_Unit_Level` is configured to the neighboring key to the BACKSPACE key.

Indication of step sequences

If a unit has been programmed in S7-GRAPH, the operator can execute specific steps in the step sequence selected in the Step Sequence Screen.



If you have selected a unit that was programmed in S7-GRAPH, you can use the "Sequence" key to switch direct to the Step Sequence Screen.

Note

From ProAgent V6.0 and higher it is no longer necessary to call the former Step sequence mode dialog box via the function `Overview_Step_Sequence_Mode`.

The former Step sequence mode dialog box is replaced by the new step display.

In ProAgent default configurations the Step Sequence Screen `ZP_STEP` is provided for this purpose. If you have been operating S7-Graph step sequences in the Step sequence mode dialog box, you should copy new Step Sequence Screen `ZP_STEP` from the appropriate ProAgent default configuration and incorporate it in your configuration.

Change operating mode

In order for the operator to be able to remove a fault in the system he must switch to manual mode after programming the PLC. Only then can he initiate specific movements for individual units and so remove the fault. The operator can switch to manual mode by selecting this operating mode from a corresponding selection list. In order for the operator to be able to call up this selection list you must assign the function `Overview_Operating_Modes` to a key in your diagnostic screen.

How the operating mode is displayed depends on how the PLC is programmed:

- In S7-PDIAG, the operating mode display is controlled by using the UDT1 (with operating mode) or the UDT3 (without operating mode) during unit definition. In addition the object properties of the unit can be used in S7-PDIAG to define whether the operating mode is displayed and whether it can be selected.
- In S7-Graph the operating mode of the sequence of steps is always displayed. In S7-Graph, menu option "Tools" > "Application settings" > "Compile/save" can be used to prevent the operating mode from being selected.
- In the case of S7-HiGraph units, operating modes are not supported at all.



This function has already been configured to the key alongside in the Standard Overview Screen.

Acknowledging the unit

Unit acknowledgement should not be confused with message acknowledgement!

For each unit there is one bit on the PLC which can be used for acknowledging the unit. You can set this bit with the aid of function `Overview_Acknowledge_Unit`.

To do this, configure the function `Overview_Acknowledge_Unit` by assigning it to a key. When the system is running, pressing that key will acknowledge the selected unit.

In order to be able to acknowledge a unit, the UDT "Unit" must be used in S7-PDIAG. The function `Overview_Acknowledge_Unit` only sets the relevant bit. The PLC must make sure that the bit is reset again after acknowledgement.

This function is not realized in the Standard Overview Screen.

6.11.3 ProAgent functions for a detail view

Use

In diagnostic screens with a detail view it is a good idea to assign functions to keys to allow the operator

- to influence the content of the detail view
- to influence the display mode of the detail view
- to be able to switch from one fault or transition to the next

Criteria analysis for the currently selected message

On executing the function `ProAgent_Evaluate_Fault` before calling a screen by using a detail view, the operator is shown the criteria analysis for the currently selected message right away.



This function has already been configured to the key alongside in the Standard Detail Screen.

Further information on the topic of using a message to call a diagnostic screen can be found under the heading "How to call the Diagnostic Start Screen into your project".

Display all operands or only operands with faults

In the detail view all the operands can be shown or only those with faults. To allow the operator to toggle this display, configure a key that triggers the function `Reduced_Detail`.



This function has already been configured to the key alongside in the Standard Detail Screen.

In symbol list display mode the function `Reduced_Detail` is not active, since here only the units with faults are shown regardless.

Display initial values or current status

In the detail view you can have the current status bits displayed instead of the initial values (status bits at the time the error occurred). To allow the operator to toggle this display, configure a key that triggers the function `Detail_Status`.



This function has already been configured to the key alongside in the Standard Detail Screen.

Note

For S7-HiGraph transitions only the initial values can currently be displayed. Executing the function `Detail_Status` will also have no effect.

Moving from one fault to the next

Several messages may be pending for a unit. To enable the operator to switch to the next fault on the currently selected unit or subunit, configure a key that initiates the function `Detail_Change_Fault`.



This function has already been configured to the key alongside in the Standard Detail Screen.

Switching from one blocked transition to the next

Only one element can be shown in the Detail Screen at a time. However, the cause of the fault may be located in more than one element. If programmed in S7-GRAPH or S7-HiGraph these elements may be individual transitions; if programmed in S7-GRAPH they may also be the locking condition of the step.

To enable the operator to switch to the next faulty element on this unit, configure a key that initiates the function `Detail_Change_Transition`.



This function has already been configured to the key alongside in the Standard Detail Screen.

Changing between symbol list > STL > LAD display mode

To allow the operator to toggle the display mode of the Detail Screen, configure a key that triggers the function `Detail_Switch_Display_Mode`. In runtime the display mode of the Detail Screen can then be switched through the sequence Symbol list > STL > LAD > Symbol list etc. by pressing a key.



This function has already been configured to the key alongside in the Standard Detail Screen.

6.11.4 ProAgent functions for a movement display

Use

In diagnostic screens with a movement display it is a good idea to assign functions to keys to allow the operator

- to expand the movement display to additionally show movements of subordinate units
- to be able to display the outputs as symbols or as absolute output
- to initiate and stop movements

Displaying movements of subordinate units

If there are a number of hierarchical levels between the units of a system, the Movement Screen initially shows only the movements for the current unit. Only movements that can be displayed can be initiated. In order for movements of subordinate units to be able to be initiated the movement display must be expanded to include subordinate units.

To enable the operator to be able to see movements of subordinate units on the operating unit in addition, configure a key that initiates the function `Movement_Hierarchy` to toggle the display.



This function has already been configured to the key alongside in the Standard Movement Screen.

Toggling the display of outputs and target positions

In the movement display the outputs and target positions that can be initiated by the movements can be displayed as symbols or absolute. The corresponding attributes must have been stored during programming in S7-PDIAG.

To allow the operator to toggle the output display, configure a key that triggers the function `Movement_Symbolic_Names`.



This function has already been configured to the key alongside in the Standard Movement Screen.

Starting and stopping movements

Each movement can be executed in two directions, e.g. in/out, open/close, up/down, forward/backwards. The movement directions are stored during programming in S7-PDIAG.

In the movement display the side of the display (right or left) simply symbolizes the direction of the movement. Thus the movement direction on, open, up or forward may be assigned to the left hand side of the display, for example, and off, close, down or back to the right hand side.

Movements that can be seen in the movement display can be initiated or stopped with function keys, mouse clicks or using functions.

In order to use functions for movement control you must configure corresponding keys for each movement displayed.

- To trigger a movement, configure the function `Start_Movement` onto a key. As the event, select `Press key`. As parameter, specify the position of the movement in the display and the side of the display (right or left) assigned to the direction of movement that you want.
- To stop a movement, configure the function `Stop_Movement` by assigning it to the same key as the function `Start_Movement`. As the event, this time select "Release key". As parameter, specify again the same position of the movement in the display and the same side of the display (right or left).

Reallocating movements

After a disconnection or due to a software error, movements can remain allocated to a particular operating unit. So that these busied movements can be allocated to another operating unit again, the diagnostic function `Assign_Movements` can be configured in the Movement Screen.

When this diagnostic function is triggered, the movements displayed will be reallocated, even if they are already busied. When movements are deselected they are released again.

Note

When the operating unit concerned is reinitialized, the movement elements `Manual_Enable1/2` and `Display_Order` of all movements are reset to 0 and are therefore available for occupation by other operating units once more.

6.11.5 ProAgent function for displaying the movement list

Use

Generally, not all movements are visible in the Movement Screen. However, you can show the operator a list of the movements of all units. In this overview he can select the movement he wants. If a movement display is then opened, this movement will be triggered there.

Displaying the movement list

To allow the operator to open the movement list, configure a key that triggers the function `ProAgent_Movement_List`.



This function has already been configured to the key alongside in the standard Movement Screen.

6.11.6 ProAgent functions for a step sequence display

Use

In diagnostic screens with a step sequence display it is a good idea to assign functions to keys to allow the operator to carry out the following functions:

- enable or disable steps
- initialize or disable step sequences
- change the operating mode of a step sequence

operate steps and sequences of steps

In step sequence display all the steps in a sequence of steps are listed together with their status. Sequences of steps or individual steps can be operated using function keys, the mouse or functions.

In order to use functions for the Step Sequence Screen, you must configure an appropriate key or button for every function.

- To set or reset a step, configure the function `Enable_Step` or `Disable_Step` on a key. As the event, select "Press key".
- To reset or disable a sequence of steps, configure the function `Initialize_Step_Sequence` or `Disable_Step_Sequence` on a key. As the event, once more select "Press key".

Changing the operating mode of a step sequence

In order for the operator to be able to remove a fault in the system he must switch to manual mode after programming the PLC. Only then can he operate specific step sequences of individual units.

The operator can switch to manual mode by selecting this operating mode from a corresponding selection list. In order for the operator to be able to call up this selection list you must assign the function `Step_Sequence_Mode` to a key in your diagnostic screen.



This function has already been configured to the key alongside in the Standard Step Sequence Screen `ZP_STEP`.

7 Reference

The reference section offers you some suggestions on the following topics:

- System messages
- Functions

7.1 System messages

Overview

System messages inform you about critical operating conditions on the operating unit. As soon as such an operating condition occurs, the operating unit automatically displays a window showing a system message.

A description of the standard system messages is given in the device manual for your operating unit.

There are, however, a number of other system messages that are related to the process diagnostics functions. Only those system messages are described here.

You can look up the explanation easily by the message number.

Number	Cause	Remedy
320000	The movements are already being displayed by another device. The movements cannot be operated.	Deselect the movements on the other display devices and select the Movement Screen on the desired display device again.
320001	The network is too complex. The operands with faults cannot be shown.	Display the network in STL.
320002	More than one or no diagnosable Alarm Messages are selected. The unit belonging to the Alarm Message could not be selected.	Select a diagnosable alarm message in the Message Screen ZP_ALARM.
320003	There is no alarm message for the unit selected. A network cannot be shown in the Detail Screen.	Select the unit with a fault in the Overview Screen.
320004	The required signal states could not be read by the PLC. The operands with faults cannot be determined.	Check that the configuration on the display device and the PLC program loaded are consistent.
320005	The project contains elements of ProAgent that are not installed. ProAgent diagnostics cannot be performed.	To run the project, install the ProAgent option pack.
320006	You are trying to execute a function that is not possible in this configuration	Check the type of unit selected.
320007	No operands causing a fault have been found in the networks. ProAgent cannot display any blocked operands.	Switch the Detail Screen to STL display mode and check the status of the operands and exclusion operands.

Number	Cause	Remedy
320008	The diagnostic data saved in the configuration is not synchronized with that in the PLC. ProAgent can display only the diagnostic units.	Recompile the project and download it to the operating unit again.
320009	The diagnostic data saved in the configuration is not fully synchronized with that in the PLC. The diagnostic screens can be operated normally. ProAgent may be unable to display all diagnostic texts.	Recompile the project and download it to the operating unit again.
320010	The diagnostic texts saved in the configuration are not synchronized with those in STEP7. The ProAgent diagnostic data is not updated.	Recompile the project and download it to the operating unit again.
320011	There is no unit with the number and FB number concerned. The function cannot be executed.	Check the parameters of function <code>ProAgent_Select_Unit</code> and the units selected in the project.
320012	The "Step sequence mode" dialog box is no longer supported.	Use Step Sequence Screen <code>ZP_STEP</code> from the appropriate standard project for your project . Instead of calling function <code>Overview_Step_Sequence_Mode</code> , call function <code>Fixed_Screen_Selection</code> using <code>ZP_STEP</code> as the screen name.
320013	No ProAgent/MP authorization is installed. A system message is issued periodically.	Use ProSave to download the ProAgent/MP authorization to your operating unit.
320014	The message display configured in function <code>Message_View_Evaluate_Error</code> has not been found The fault selected cannot be analyzed for ProAgent.	Check the parameters for function <code>Message_View_Evaluate_Error</code> .

7.2 Functions (overview)

ProTool provides a large number of different functions. A description of those functions is provided in the ProTool User's Manual and the ProTool Online Help.

ProAgent supplements those general functions with a range of special functions required exclusively for process diagnostics. Those special functions are only available in ProTool after ProAgent has been installed.

All the process diagnostics functions will be found in the "ProAgent" group. Only those functions are described here.

Functions associated with screen selection

- ProAgent_Evaluate_Fault
- Message_View_Evaluate_Error
- ProAgent_Save_Screen
- ProAgent_Restore_Screen
- ProAgent_Movement_List
- ProAgent_Select_Unit

Functions for an overview display

- Overview_Fault_Mode
- Overview_Subordinate_Units
- Overview_Superior_Units
- Overview_Operating_Modes
- Overview_Acknowledge_Unit

Detail Screen functions

- Detail_Switch_Display_Mode
- Reduced_Detail
- Detail_Status
- Detail_Change_Fault
- Detail_Change_Transition

Movement Screen functions

Movement_Hierarchy
Movement_Symbolic_Names
Start_Movement
Stop_Movement
Assign_Movements

Step Sequence Screen functions

Set_Step
Reset_Step
Reset_Step_Sequence
Disable_Step_Sequence
Step_Sequence_Mode

7.2.1 Assign movements (function)

Use

This function forces a display unit to occupy the displayed movements, even if the movements have already been occupied by another display unit.

This function is used by the following diagnostic screen:

- ZP_MOTION

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	After a disconnection or due to a software error, movements can remain allocated to a particular operating unit.
Configuration stage	In order to make these allocated movements available again for allocation to another operating unit, in the Movement Screen configure the function <code>ProAgent_Select_Unit</code> to a key or button. As event select "Press key" or in the case of a button "Press".
Sequence	When the function is triggered, the displayed movements are occupied by the operating unit which triggered it. Occupied movements are released again once they are deselected.

Note

When the operating unit concerned is reinitialized, the UDT2 elements `Manual_Enable1/2` and `Display_Order` of all movements are reset to 0 and are therefore available for occupation by other operating units once more.

7.2.2 Detail: Change fault (function)

Use

In the detail view this function switches from one fault (or message) on a unit or subunit to the next fault (or message).

This function is used by the following diagnostic screen:

- ZP_DETAIL

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aim	On occurrence of a particular event you wish to switch to the next fault on a unit.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event the next fault on the unit in question is selected and shown in the detail view.

7.2.3 Detail: Change transition (function)

Use

In the detail view this function switches from one element to the next within a fault (or message):

- On S7-PDIAG units you move from one participating network to the next.
- On S7-GRAPH units that report a monitoring error you switch from one transition to the next.
- On S7-HiGraph units all the subsequent transitions are shown consecutively in the event of a monitoring timeout.
In the case of a status error the transition that led to the fault state is shown.

This function is used by the following diagnostic screen:

- ZP_DETAIL

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aim	On occurrence of a particular event you wish to switch to the next transition.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event the next transition is selected and shown in the detail view.

7.2.4 Detail status (function)

Use

This function is used for the detail view. It switches between the following displays of the signal status:

- status at the time of occurrence of the fault (initial values)
- current status

Note

On S7-HiGraph units only initial values can be shown at this moment in time.

This function is used by the following diagnostic screen:

- ZP_DETAIL

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	On occurrence of a particular event you wish to change the signals displayed, from the status at the time of occurrence of the fault (initial values) to the current status or vice versa.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event, the display mode of the signals is changed to the other status.

7.2.5 Detail: Switch display mode (function)

Use

This function is used for the detail view. When displaying the STEP7 program code you switch to the next display type in a cycle:

- symbol list
- STL
- LAD

This function is used by the following diagnostic screen:

- ZP_DETAIL

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	On occurrence of a particular event you wish to switch to the detail view of the program code.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event the display will switch to the next display mode.

7.2.6 Disable Step sequence (function)

Use

This function deactivates the currently selected sequence of steps.

This function is used by the following diagnostic screen:

- ZP_STEP

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	You wish to deactivate the sequence of steps selected in the Step Sequence Screen.
Configuration stage	Configure the function for a key or a button. Select the desired event.
Sequence	On occurrence of the event, the sequence of steps selected in the Step Sequence Screen will be deactivated.

7.2.7 Message View: Evaluate error (function)

Use

The function `Message display:_Evaluate_Fault` provides the associated diagnostic data for the message selected in the message view.

If an overview display, a detail view or a movement display is opened after initiating this function then the unit, movement and network belonging to the selected message will be displayed.

You should use this function in screens with more than one message display, in order to define the message display containing the messages intended as the starting point for diagnostics.

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	Message display: Screen object name of the message display containing messages that are intended to be analyzed. The screen object name can be found via the shortcut menu in the message display (right mouse button), menu option "Properties" on the "Name" tab control.

Use in practice

Aim	<p>You have configured a screen containing more than one message display. One of these message displays serves as the starting point for process diagnostics. The operator can select a message and have the diagnostic data associated with the message displayed in a Detail view or movement display. Messages selected from the other message displays in the same screen are ignored.</p> <p>To do this you configure a function for opening a screen containing the overview, detail or movement display to a key or button in the screen containing the message view.</p>
Configuration stage	<p>Configure the function <code>Message display:_Evaluate_Fault</code> to this key or button. As event, choose "Press key" or in the case of a button "Press". As the parameter, specify the screen object name of the message display. The screen object name can be found via the shortcut menu in the message display (right mouse button), menu option "Properties" on the "Name" tab control.</p> <p>Make sure that this function is executed before the function <code>Select screen</code>.</p>
Sequence	<p>When this event occurs the operating unit reads the diagnostic data belonging to the selected message from the PLC.</p>

7.2.8 Movement hierarchy (function)

Use

This function is used in the movement display. It determines whether only the movements of the selected unit are displayed or all movements of the subordinate units of that unit as well.

This function is used by the following diagnostic screen:

- ZP_MOTION

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	On occurrence of a particular event, you wish to determine whether only the movements of the selected unit or the movements of all subunits are displayed in the movement display.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event, the extent of the movement display is changed.

7.2.9 Movement symbolic names (function)

Use

This function is used for the movement display. It switches the display of output names and target position names between the following display modes:

- symbolic names
- absolute names

This function is used by the following diagnostic screen:

- ZP_MOTION

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	On occurrence of a particular event, you wish to switch the display mode for output names and target position names in the movement display from symbolic to absolute or vice versa.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event, the display mode for the output names and target position names in the movement display is changed.

7.2.10 Overview Acknowledge unit (function)

Use

This function is used for the overview display. For each unit one bit can be made available which can be used for acknowledging the unit. This bit is set if a unit is selected in the overview display and the function `Overview_Acknowledge_Unit` is initiated.

Note

In order to be able to acknowledge a unit, the UDT "Unit" must be used in S7-PDIAG. The ProAgent function only sets the relevant bit. The PLC must make sure that the bit is reset again after acknowledgement.

Unit acknowledgement should not be confused with message acknowledgement.

This function is not used by the standard diagnostic screens.

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aim	On occurrence of a particular event you wish to be able to trigger a unit acknowledgment.
Configuration stage	Configure the function for a button or a key, and preferably a global function key. Select the desired event.
Sequence	On occurrence of the event the unit selected in the Overview Screen will be acknowledged.

7.2.11 Overview Fault mode (function)

Use

This function is used for the overview display. You can switch the display between the following modes:

- display all units
- display only the units with faults for which messages are outstanding.

This function is used by the following diagnostic screen:

- ZP_UNIT

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	On occurrence of a particular event, you wish to switch the display mode to the overview display.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event the display mode will switch to the overview display.

7.2.12 Overview Operating modes (function)

Use

This function is used for the overview display. If a unit is selected in the overview display and this function is initiated, a list is displayed for selecting the operating mode. The operating mode for the selected unit can be changed here.

The function `Overview_Operating_Modes` is used by the following diagnostic screen:

- ZP_UNIT

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	On occurrence of a particular event in the overview display you wish to call up a list for selecting the operating modes for the selected unit.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event the selection list for the operating modes is displayed.

7.2.13 Overview Subordinate units (function)

Use

This function is used for the overview display. It indicates the units that are subordinate to the selected unit in the unit hierarchy.

This function is used by the following diagnostic screen:

- ZP_UNIT

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	On occurrence of a particular event in the overview display, you wish to display the units that are subordinate to the selected unit.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event the units at the subordinate unit level are shown.

7.2.14 Overview Superior units (function)

Use

This function is used for the overview display. It shows the units that are superior to the selected unit in the unit hierarchy.

This function is used by the following diagnostic screen:

- ZP_UNIT

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	On occurrence of a particular event in the overview display, you wish to display the units that are superior to the selected unit.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event the units of the superior unit level are shown.

7.2.15 ProAgent: Evaluate fault (function)

Use

The function `ProAgent_Evaluate_Fault` provides the associated diagnostic data for the message selected in the message view.

If an overview display, a detail view or a movement display is opened after initiating this function then the unit, movement and network belonging to the selected message will be displayed.

If a number of messages are displayed in different screen areas and no message has the focus, the message in the screen area with the highest priority is selected. If a number of message displays are shown, function `ProAgent_Evaluate_Fault` selects the message display in the following order of priority:

Message display with focus (dotted rectangle)

Alarm message window

Message line

Message display in the fixed window

Message display in the basic screen

This function is used by the following diagnostic screen:

- ZP_ALARM

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aim	In a message view you want to select a message and then view the associated diagnostic data in a detail view or a movement display. To do this you configure a function for opening a screen containing the overview, detail or movement display to a key or button in the screen containing the message view.
Configuration stage	Configure the function <code>ProAgent_Evaluate_Fault</code> for that key or button. As event select "Press key" or in the case of a button "Press". Make sure that this function is executed before the function <code>Select screen</code> .
Sequence	When this event occurs the operating unit reads the diagnostic data belonging to the selected message from the PLC.

7.2.16 ProAgent movement list (function)

Use

This function is used to display a selection list of all existing movements. Here the user can select a movement which is then shown in the movement display so that it can be triggered.

This function is used by the following diagnostic screen:

- ZP_MOTION

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	On occurrence of a particular event you wish to call up a list for selecting movements.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event the selection list for the operating modes is displayed. Here the operator can select the movement that he wants to trigger in a movement display.

7.2.17 ProAgent: Restore screen (function)

Use

The function `ProAgent_Restore_Screen` selects the screen with the number saved previously using the function `ProAgent_Save_Screen`. You can thus use these two functions to jump to a particular screen.

This function is used by the following diagnostic screen:

- ZP_ALARM
- ZP_UNIT
- ZP_DETAIL
- ZP_MOTION
- ZP_STEP

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aim	In a screen you configure a function for jumping back to the screen with the last number stored to a key or a button.
Configuration stage	Configure the function <code>ProAgent_Restore_Screen</code> for that key or button. As event select "Release key" or in the case of a button "Release".
Sequence	When the event occurs the screen last called up with the function <code>ProAgent_Save_Screen</code> will be called up.

7.2.18 ProAgent: Save screen (function)

Use

The function `ProAgent_Save_Screen` saves the number of the screen in which it was called up. Use the function `ProAgent_Restore_Screen` to select the screen with the stored number again. You can thus use these two functions to jump to a particular screen.

The function `ProAgent_Save_Screen` only allows one screen number to be saved at a time; if the function is called up again the screen number stored previously will be overwritten.

This function is used by the following diagnostic screen:

- ZP_PROAGENT

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aim	In a screen you want to configure a function for calling up one of the diagnostic screens to a key or a button, so that you can return to the original screen.
Configuration stage	Configure the function <code>ProAgent_Save_Screen</code> for that key or button. As event select "Press key" or in the case of a button "Press". Make sure that this function is executed before the function <code>Select screen</code> .
Sequence	When the event occurs the operating unit will save the number of the current screen.

7.2.19 ProAgent: Select unit (function)

Use

Function `ProAgent_Select_Unit` selects a unit and moves to the specified screen.

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	PLC: PLC of the unit to be selected DB number: Number of the data block (instance DB) of the superordinate unit to be selected FB number: Number of the function block of the subunit to be selected (0 = undefined) Screen: Number or name of the screen that has to be called

Use in practice

Aim	You want to select a unit on a fixed or dynamic basis and display the associated diagnostic data.
Configuration stage	Configure the function <code>ProAgent_Select_Unit</code> for that key or button. As event select "Press key" or in the case of a button "Press". Make sure that this function is executed before the function <code>Select</code> screen.
Sequence	When the event occurs, the unit of the corresponding PLC is selected and switched to the specified screen.

7.2.20 Reduced detail (function)

Use

This function is used for the detail view. It switches between partial and full view. In partial view, only those signals are displayed which have led to a fault.

This function is used by the following diagnostic screen:

- ZP_DETAIL

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	On occurrence of a particular event, you wish to switch the detail view mode from normal to reduced or vice versa.
Configuration stage	Configure the function for a key or a button and select the desired event.
Sequence	On occurrence of the event, the display switches between full and partial display mode.

7.2.21 Reset Step Sequence (function)

Use

This function initializes the currently selected sequence of steps.

This function is used by the following diagnostic screen:

- ZP_STEP

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	You wish to initialize the sequence of steps selected in the Step Sequence Screen.
Configuration stage	Configure the function for a key or a button. Select the desired event.
Sequence	On occurrence of the event, the sequence of steps selected in the Step Sequence Screen will be initialized.

7.2.22 Reset Step (function)

Use

This function disables the currently selected step.

This function is used by the following diagnostic screen:

- ZP_STEP

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	You would like to disable the step selected in the Step Sequence Screen.
Configuration stage	Configure the function for a key or a button. Select the desired event.
Sequence	On occurrence of the event, the step selected in the Step Sequence Screen will be disabled.

7.2.23 Set Step (function)

Use

This function enables the currently selected step.

This function is used by the following diagnostic screen:

- ZP_STEP

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	None

Use in practice

Aims	You would like to enable the step selected in the Step Sequence Screen.
Configuration stage	Configure the function for a key or a button. Select the desired event.
Sequence	On occurrence of the event, the step selected in the Step Sequence Screen will be enabled.

7.2.24 Start movement (function)

Use

This function is used for the movement display. It starts a displayed movement in a particular direction.

Note

In order to be able to stop the movement again you must configure the function `Stop_Movement` to the event "Release key" by assigning it to the same key.

This function is used by the following diagnostic screen:

- ZP_MOTION

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	Line: Line in the movement display in which the movement is displayed. The value of "Line" must be between 1 and 6. Direction Right = the direction of movement displayed to the right of the movement display Left = the direction of movement displayed to the left of the movement display

Use in practice

Aims	On occurrence of a particular event, you wish to start a movement in the movement display in a particular direction.
Configuration stage	Configure the function for a key or a button. Select the desired event, preferably "Press key" or in the case of a button "Press". Select the parameters "Line" and "Direction" and set which movement is to be started and the direction in which it is to take place.
Sequence	The movement is triggered when the event occurs.

7.2.25 Step Sequence mode (function)

Use

This function is used in the step sequence display. If a unit is selected in the step sequence display and this function is initiated, a list is displayed for selecting the operating mode. The operating mode for the selected sequence of steps can be changed here.

The function `Step_Sequence_Mode` is used by the following diagnostic screen:

- ZP_STEP

Parameter

"Configurable for"	Key Button
"Events"	Press key, release key Button: Press, release, click
"Parameters"	None

Use in practice

"Aims"	On occurrence of a particular event in the step sequence display you wish to call up a list for selecting the operating modes for the selected sequence.
"Configuration stage"	Configure the function for a key or a button and select the desired event.
"Sequence"	On occurrence of the event the selection list for the operating modes is displayed.

7.2.26 Stop movement (function)

Use

This function is used for the movement display. It stops a displayed movement that is being carried out in a particular direction.

Note

To start the movement you must configure the function `Start_Movement` by assigning it to the same key for the event `Press key`.

This function is used by the following diagnostic screen:

- ZP_MOTION

Parameter

Configurable for	Key Button
Events	Press key, release key Button: Press, release, click
Parameter	Line: Line in the movement display in which the movement is displayed. The value of "Line" must be between 1 and 6. Direction Right = the direction of movement displayed to the right of the movement display Left = the direction of movement displayed to the left of the movement display

Use in practice

Aims	On occurrence of a particular event, you wish to stop a movement in the movement display that is currently being executed in a particular direction.
Configuration stage	Configure the function by assigning it to the same key or the same button that you use to start the movement. In the case of a key select the event "Release key" and in the case of a button "Release". Select the parameters "Line" and "Direction" and set which movement is to be stopped and in which direction this was previously being carried out.
Sequence	On occurrence of the event the movement will be stopped.

8 Configuration procedures in STEP7 for process diagnostics

Some of the configuration procedures that you carry out in STEP7 have an effect on process diagnostics. A detailed discussion of these aspects can be found under the following headings:

- Configuring ALARM_S messages
- Displaying the result of criteria analysis in the message text
- Target position modes in the S7-PDIAG Movement Screen

8.1 Configuring ALARM_S messages

Configuring messages in STEP7

ALARM_S messages are always configured in STEP7 rather than in ProTool. The advantage of this is that you can use the messages on different display units but only have to enter them once.

When configuring messages in STEP7 you can either enter simple unformatted text or make use of the facility for device-specific message configuration. Depending on the display unit in question, you can then specify such effects as flashing text and define additional information.

Detailed reference information on the individual dialog boxes is given in the STEP7 Online Help. The following sections provide you with a brief overview of the general procedure for S7-PDIAG.

General procedure

If you create an operand monitoring routine in S7-PDIAG, the following dialog box appears initially:

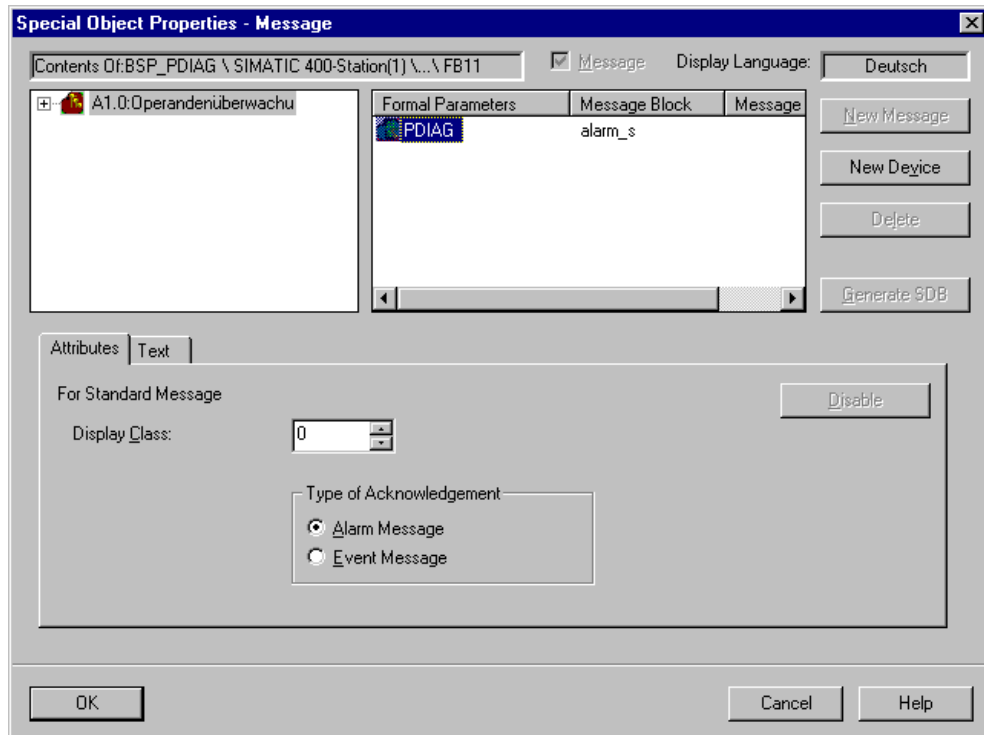
The screenshot shows the 'S7 PDIAG: Address Monitoring' dialog box with the 'Definition' tab selected. The 'Initial Diagnostic Address' is set to 'A1.0'. The 'Monitoring Definition' is 'DNDT(A1.0, 5000)'. Under 'Monitoring Definition', radio buttons are set to '2: Level 1', '3: Edge 0->1', and '4: Edge 1->0'. The 'Delay' checkbox is checked, and the 'Time' is set to '5000'. The 'Monitoring Active' checkbox is also checked. Under 'Criteria Analysis', 'Initial Value Acquisition' is checked, and 'Negative Criteria Analysis' is selected. The 'Message' section shows 'Number' as an empty box, 'Priority' as '1', and 'Text' as 'No part arrived within monitoring period'. The 'With Acknowledgement' checkbox is checked. A 'Configure...' button is visible at the bottom right of the message section. At the bottom of the dialog are 'OK', 'Cancel', and 'Help' buttons.

Configuring simple message texts

If you have no special output requirements for the message, all you need to do is enter the message text in the "Text" box.

If, however, you wish to make use of the particular display capabilities of your operating unit, you can click the "Configure" button to define a display-specific message configuration.

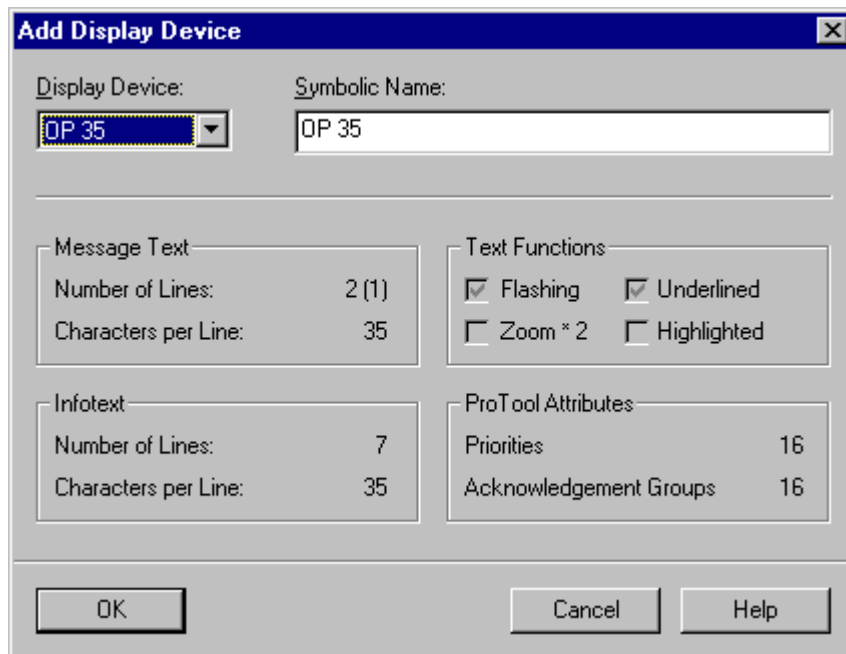
The "Special object properties message" dialog box then opens. As soon as you have selected a message from the list, you can specify general attributes for that message such as "Display classes" and "Acknowledgement method". Those attributes are globally valid, i.e. they are not exclusive to a specific display unit.



General attributes

In order to be able to specify attributes for a specific display unit, you must first create the display unit. To do so, click the "New device" button.

The "Insert display unit" dialog box appears.



Inserting a display unit

There you select the required display unit and you can also assign it a symbolic name. For devices MP270, MP370, PC670, FI 45 and PCs select device type OP35.

In the bottom section of the dialog box you will see the details of the display options for the selected device.

Once you have selected a device, that operating unit appears in the "Special object properties messages" dialog box in the list of display units.

If you then select that operating unit, additional tabs appear in the lower half of the dialog box on which you can finally specify the device-specific settings.

The image displays three sequential screenshots of a configuration dialog box, illustrating the process of setting up a display unit. Each screenshot shows the 'Attributes', 'Text', and 'Infotext' tabs.

Attributes Tab: This tab is active in all three screenshots. It contains the following settings:

- For a Display-Specific ProTool Message: [Disable]
- Acknowledgement Group: [0]
- Priority: [1]
- Message Logging Active

Text Tab: This tab is active in the middle screenshot. It shows a message editor with two lines:

- Line1: **No part arrived within monitoring period**
- Line2: (empty)

Formatting options are visible on the right:

- Text
- I** (Italic)
- U** (Underline)
- B** (Bold)
- [List Icon]

Infotext Tab: This tab is active in the bottom screenshot. It shows a message editor with seven lines:

- Line1: **Please check**
- Line2: **- Stock feed**
- Line3: **- Magazine**
- Line4: (empty)
- Line5: (empty)
- Line6: (empty)
- Line7: (empty)

Device-specific settings

Process data in the message text

A message can include dynamically updated process data (associated data). For example a message could read: "Furnace 1: temperature 10.5 degrees too high." The values "1" and "10.5" would in this case be the process values.

Each ALARM_S message can supply one item of process data. That item of process data can, however, consist of an array of data so that in practice more than one item of data can be communicated. An array can contain a maximum of 12 bytes of usable data.

Whether process data is available and if so which depends on the PLC program. S7-GRAPH and S7HiGraph always provide a process value automatically. When programming in LAD/CSF/STL you must create the necessary program code yourself.

8.2 Displaying the result of criteria analysis in the message text.

Dummy entries in the message text

By inserting dummy entries into the ALARM_S message text you can also have the message text display the symbols and remarks relating to the operands that led to the fault. In this way the system operator obtains the most important information about the system fault in the message window itself or in the message line without having to switch to the Diagnostic Screens.

For the faulty operands to be displayed and archived, appropriate dummy entries must be inserted in the ALARM_S message text.

Dummy entries in ALARM_S message texts are configured in the message dialog boxes in STEP7.

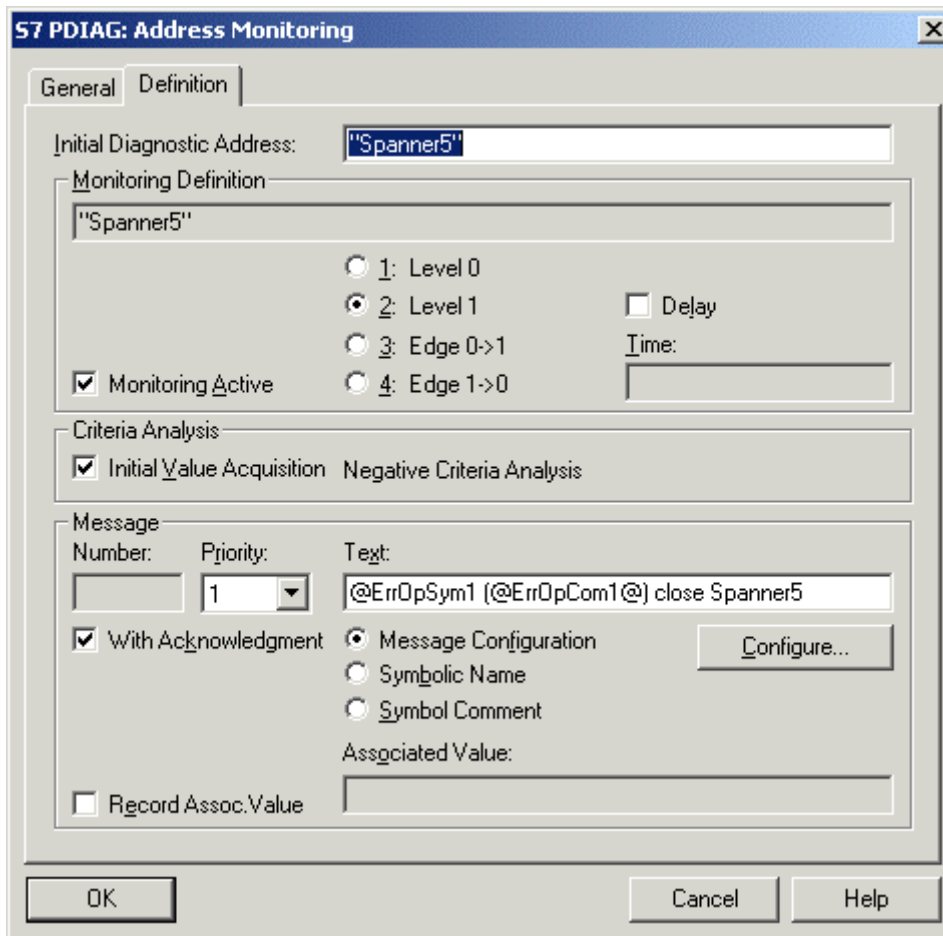
The following dummies are available:

@ErrOpSym1 @:	for the symbol associated with the first disturbed operand and/or
@ErrOpAbs1 @:	for the absolute address of the first disturbed operand and/or
@ErrOpCom1 @:	for the remark associated with the first disturbed operand and/or
@ErrOpAll@:	for the absolute operands, symbols and remarks associated with all disturbed operands

When such a message occurs, criteria analysis is carried out in the background on the display unit and consequently, depending on the dummy entry, the symbol or remark is used instead of the dummy concerned.

On archiving a message containing a dummy, a text containing the most recent process values of all disturbed operands is archived at the same time (depending which of the three dummies is contained in the message text). When the archived message is displayed, the disturbed operands are displayed exactly as when the message occurred.

Example: Use of @ErrOpSym1@ and @ErrOpCom1@ in the message text



Message text with dummies for criteria analysis

Dummy @ErrOpSym1@ is replaced by the symbol for the first operand "PEU" and dummy @ErrOpCom1@ is replaced by the remark associated with the first operand "Periphery unclear":

No.	St...	Text
10	A	S7GRAPH Supervision Fault: FB10, DB10, S2

Display showing message with first disturbed operand

8.3 Target position modes in the S7-PDIAG Movement Screen

Different display modes of target positions

From S7-PDIAG V5.0 HF3 and higher you can use the S7-PDIAG Movement Screen to configure different display modes for the selected movement to all target positions. The target positions of movements are displayed in ProAgent's Movement Screen in accordance with the configured S7-PDIAG display modes.

This means that different functions can be performed at a given target position:

- multilingual text,
- absolute or symbolic names of address references, or
- decimal numbers.

Detailed information on displaying target positions can be found under the heading "Target position modes in the S7-PDIAG Movement Screen".

The following situations are possible:

Meaning of the target position modes:	Address reference example
<p>Automatically preset as text, free text:</p> <p>The display unit displays the text stored in the attribute "Multilingual text". This text is automatically preset via S7-PDIAG.</p> <p>The text is updated by changing the background colors. The control bits for updating are retrieved from the UDT2.Final_Position[].</p>	-
<p>Automatically preset as operand:</p> <p>The display unit displays the absolute or symbolic name of the operand specified in "Address reference". The name is updated by changing the background colors. The control bits for updating are retrieved from the UDT2.Final_Position[]. If the target position bit has the value 1, the corresponding target position is highlighted in the configured background color.</p>	M1.0
<p>Editable operand (bit):</p> <p>The display unit updates the target position by means of the current value of the binary tag described by the attribute "Address Reference".</p> <p>The absolute or symbolic name of the operand specified in the address reference is displayed. The name is updated by changing the background colors.</p> <p>The control bits for updating are retrieved from the address specified by the address reference. If the target position bit has the value 1, the corresponding target position is highlighted in the configured background color.</p>	E1.0

Meaning of the target position modes:	Address reference example
Editable operand (free): The display unit displays the current decimal value of the tag complete with sign described by the attribute "Address reference" (possible operands: BOOL, Byte, WORD, DWORD). The resulting output is a decimal value complete with sign.	EW0

Examples of the various target position modes

By way of explanation here is a comparison between the configuration of a target position in the S7-PDIAG Movement Screen and the display in the ProAgent movement Screen

Configuration in S7-PDIAG				Display in ProAgent	
Target position	Application in HMI	Text/ formatted text	Operand	Target position text	Background color updated by
1	Automatically preset as text	Target position 1	---	Target position 1	UDT2.Final_Position[0]
2	Automatically preset as operand	---	M1.0	Symbol for M1.0	UDT2.Final_Position[1]
7	Editable operand (Bit)	---	E1.0	Symbol for M1.0	E1.0
8	Editable operand (free)	---	EW0	Decimal value of EW0	UDT2.Final_Position[7]

8.4 Special aspects of S7 CPUs

Restarting S7 CPUs

When restarting S7 CPUs it is possible that some CPUs may delete all pending ALARM_S messages, depending on the hardware configuration of the CPU concerned. This can result in a situation where units are identified in the Overview Screen on the operating unit as disturbed or faulty, but on switching to a Detail Screen the operating unit is not displaying any disturbed elements.

The operating unit can only be switched back to the corresponding Detail Screen if the ALARM_S message associated with monitoring in the CPU arises again.

ALARM_S messages with an acknowledgement group in S7-300 CPUs

In STEP7 ALARM_S messages can be configured with acknowledgement groups that are known to the operating unit. If such messages are created for a common acknowledgement group on an S7-300 CPU, only one of the messages displayed on the operating unit is actually acknowledged. All the other messages in the acknowledgement group remain unacknowledged.

The problem will be remedied in a forthcoming revision of the S7-300 CPU.

9 Estimating Memory Requirement

In this section you will find information on the memory requirement of projects. On the basis of this information you can estimate whether the memory of your operating unit is large enough for the planned configuration.

9.1 System limits on diagnostics for ProAgent/MP

Storage space requirements

In ProAgent/MP there are quantity limitations due to the maximum size of the compiled ProTool configuration file (FWD file). The following table lists the average storage requirement for each of the ProAgent elements:

ProAgent element:	Typical memory requirement in bytes in the FWD file per ProAgent element
Unit + unit name	1400 + (2*number of characters)
Movement + movement name + direction name + disturbed operands + target position name + per target position that is not updated via UDT_Motion.Final_Position[]	1000 + (2*number of characters) + (2*number of characters) + (2*number of characters) + (2*number of characters) + 50
Network/step/transition (max. 64 signals per network) + network name	400 + (2*number of characters)
Operand + symbol + remark	40 + (2*number of characters) + (2*number of characters)
AlarmS message + message text + Help text	100 + (2*number of characters) + (2*number of characters)

As the table shows, the storage requirement for ProAgent elements results is derived from a basic requirement plus a dynamic component that depends mainly on the length of the texts used. Texts in different languages need additional storage of approximately $10 + (2 * \text{number of characters})$ bytes per language.

Example

The following example lists the number of ProAgent elements for which the ProAgent data in the FWD file adds up to a storage requirement of 1 Mbyte on average:

Structures	Max. number
Units	20
Movements	80
Messages in a language without help texts	1000
Error monitoring	500
Networks/steps/transitions	500
Signals used in a language	3000
Maximum number of signals per network	64

The size of the configuration file includes the data for all the ProTool and ProAgent elements. In principle the compiled configuration file (FWD file) must be within the memory limits of the display unit.

9.2 System limits on diagnostics for ProAgent/PC

Quantity limitation

In the case of ProAgent/PC the quantity restriction primarily results from the desired ProTool compilation time of 5 minutes (with a Pentium III, 600 MHz, 128 MB main memory).

This results in the following individual guide values:

Structures	Max. number
Units	100
Movements	500
Messages in a language without help texts	4000
Error monitoring	4000
Networks/steps/transitions	4000
Signals used in a language	10 000
Maximum number of signals per network	64

Index

- A**
- Access protection 6-9
 - Actions 2-5
 - Activating process diagnostics 3-2
 - Advantages of the process diagnostics 2-2
 - ALARM_S
 - Configuring message texts 8-2
- B**
- Branch possibilities 3-9
 - between the Diagnostic Screens 3-9
- C**
- Call Information online 1-4
 - Call Online help 1-4
 - changing 6-2
 - Diagnostic Screens 6-2
 - Operating modes in the Overview
 - Screen 3-32
 - Standard screens 6-5
 - Commissioning 5-6
 - S7-PDIAG project 5-6
 - Compiling 5-21
 - Configuration stage 5-1
 - ALARM_S messages 8-2
 - Compiling 5-21
 - Downloading 5-21
 - Incorporating Diagnostic Screens 5-3
 - Linking Diagnostic
 - Screens 5-9, 5-10, 5-12
 - Moving directly to a Diagnostic
 - Screen 5-12
 - Overview on steps 4-11, 5-1
 - Porting onto computers without
 - STEP 7 5-23
 - Process diagnostics 2-8
 - Selecting display classes 5-18
 - Selecting the units 5-14
 - Configuring 6-27
 - Detail display 6-26
 - Message view 6-24
 - Movement display 6-27
 - Overview display 6-25
 - Step sequence display 6-28
 - Conventions 6-3
 - in the Diagnostic Screens 6-3, 6-5
 - CPU
 - selecting 5-14
 - creating 6-6
 - Diagnostic Screens 6-6
 - Customizing 6-2
 - Diagnostic Screens 6-2
 - Customizing standard screens 6-5
- D**
- Database 2-8
 - Accessing 5-21
 - shared with STEP 7 2-8, 4-5
 - Detail display 6-18, 6-26
 - Functions 6-35
 - Detail Screen 2-6, 3-3, 3-9, 3-33
 - Change fault 3-54
 - Change transition 3-54
 - Displaying element in LAD 3-44
 - Displaying element in STL 3-42
 - Information about the unit 3-38
 - Initial values / current status 3-53
 - Keys 3-46
 - Layout 3-36
 - Practical approach 3-48
 - Switching view 3-52
 - symbol list 3-41
 - Use 3-33
 - Detail Screen (LAD) 3-33
 - Detail Screen (STL) 3-33
 - Detail Screen (symbol list) 3-33
 - Diagnostic display 6-13
 - more than one in a screen 6-13
 - Diagnostic Screens 2-6, 3-3
 - changing 6-2
 - creating 6-6
 - Functions for selection 6-30
 - incorporating 5-3
 - internal structure 6-3, 6-5
 - Layout 3-10
 - linking 5-9, 5-10, 5-12
 - Linking own screens 6-8
 - Links 3-9
 - Tasks 3-3
 - Diagnostic Start Screen 3-3, 3-9, 5-9, 5-12
 - Direct keys 6-11

Display	3-14, 3-21, 3-66, 3-77		
switching in the Detail Screen	3-52		
switching in the Overview Screen	3-31		
Display classes			
selecting	5-18		
displaying initial values	3-53		
Displaying the element as a symbol			
list	3-41		
Downloading	5-21		
E			
Errors	7-2		
Changing in the Detail Screen	3-54		
Exclusion operands	3-60		
F			
Fixed window	5-3		
Foreign languages	6-10		
Functions			
Assign movements	7-6		
Detail			
Change display	7-10		
Change fault	7-7		
Change transition	7-8		
Detail Status	7-9		
Disable step sequence	7-11		
Movement hierarchy	7-14		
Movement symbolic names	7-15		
Overview			
Acknowledge unit	7-16		
Fault mode	7-17		
Operating modes	7-18		
Subordinate units	7-19		
Superior units	7-20		
ProAgent			
Evaluate fault	7-21		
Movement list	7-23		
Restore screen	7-24		
Save screen	7-25		
Select unit	7-26		
Reduced detail	7-27		
Reset sequence	7-28		
Reset step	7-29		
Set step	7-30		
Start movement	7-31		
Step sequences			
Operating sode	7-32		
Stop movement	7-33		
G			
Global key set		3-12	
H			
Hierarchical units	3-30, 3-75		
in the Movement Screen	3-75		
in the Overview Screen	3-30		
I			
Incorporating the Diagnostic Screens	5-3		
Information on the unit in the Detail Screen	3-38		
K			
Keys			
Detail Screen	3-46		
Global key set	3-12		
Message Screen	3-16		
Movement Screen	3-70		
Overview Screen	3-25		
Step Sequence Screen	3-79		
L			
LAD	3-33		
Languages	6-10		
Linking the Diagnostic			
Screens	5-9, 5-10, 6-8		
M			
Manual mode	3-32		
Memory requirement of the diagnostic			
structures	9-2, 9-4		
Menu items	4-5		
Synchronizing	4-5		
System -> ProAgent	5-14		
Message acknowledgement	3-2		
Message Screen	2-6, 3-3, 3-9		
Keys	3-16		
Layout	3-14		
Practical approach	3-17		
Use	3-13		
Message view	6-15, 6-24		
Messages	3-2		
diagnosable	3-2		
Monitoring types	2-2		

Scope of functions for process		
diagnostics	2-2	
Screen object	6-24, 6-25, 6-26, 6-27, 6-28	
Detail display	6-18	
Message view:	6-15	
Movement display	6-20	
Overview display	6-17	
Step sequence display	6-22	
selecting	5-14	
Display classes	5-18	
Units when configuring	5-14	
Selecting Diagnostic Screens	6-30	
Functions	6-30	
Setting password levels	6-9	
Shared database	2-8	
Accessing	5-21	
with STEP 7	4-5	
Soft keys	3-70	
Detail Screen	3-46	
Message Screen	3-16	
Movement Screen	3-70	
Overview Screen	3-25	
Standard screens	3-3	
changing	6-2	
incorporating	5-3	
linking	5-9, 5-10	
Tasks	3-3	
Starting process		
diagnostics	3-2, 5-9, 5-10, 5-12	
STEP 7	2-11	
Accessing the database during		
compilation	5-21	
Requirements	4-2	
shared database with	4-5	
Step sequence display	6-22, 6-28	
Functions	6-40	
Step Sequence Screen		
Keys	3-79	
Layout	3-77	
Practical approach	3-80	
Use	3-76	
STL	3-33, 3-42	
Structure of the Diagnostic Screens	3-10	
symbol list	3-33, 3-41	
Synchronizing	4-5, 5-21	
System -> ProAgent	5-14	
System limits		
ProAgent/MP	9-2	
ProAgent/PC	9-4	
System messages	7-2	
T		
Target positions		
Display	8-9	
Terms	2-5	
Transition		
Changing in the Detail Screen	3-54	
Transitions	2-5	
Translation	6-10	
Triggering movements	6-11	
U		
Unit		
selecting during configuration	5-14	
Units	2-5	
display all	3-31	
display blocked	3-31	
hierarchical in the Movement		
Screen	3-75	
hierarchical in the Overview Screen	3-30	
Upgrading	4-10, 4-11	
Requirements	4-10	
Steps	4-11	