SIEMENS

SIMATIC HMI

ProTool
Configuration Software

User's Guide

Release 9/96

Trademarks

SIMATIC® is a registered trademark of SIEMENS AG.

Microsoft, MS and MS-DOS are registered trademarks, and Windows is a trademark of Microsoft Corporation in the United States and other countries.

Subject to change without prior notice.

Although the contents of this publication have been checked for agreement with the hardware and software described, we do not accept liability for total agreement since differences cannot be completely excluded. The information in this publication is checked at regular intervals and necessary corrections included in the next release. Your suggestions for improving this publication are welcome.

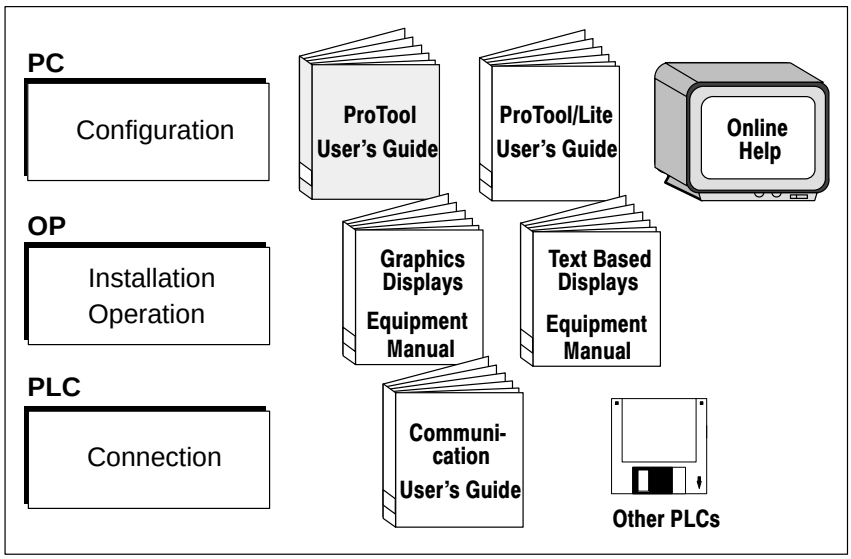
Preface

Purpose

With ProTool, you perform system-specific configuration for Operator Panels (OPs) having graphics displays. The *ProTool User's Guide* explains the way in which you use the ProTool configuration tool and what configuring involves. The manual is applicable to the Operator Panels
– OP37,
– OP25,
– OP35 and
– OP45.

How it fits in

This manual is part of the SIMATIC HMI documentation. The documentation includes the mauals for the configuration tool, the Operator Panels and communciation between the PLC and the OP. Below, you will find an overview diagram and a description of when you require the different manuals.



Document Type	Target Group	Contents
Getting started Product brief	Beginners	This document guides you step by step through the configuration of • a screen containing static text • a screen containing an input/output field and a bar graph • changing from one screen to another • a message A document is available for each of the following: – OP3, OP5, OP15 – OP7, OP17 – OP25, OP35, OP45
ProTool User's Guide	Configurer	Provides information for working with the ProTool configuring tool. It contains • basic rules for configuration • a detailed description of objects and functions that you can configure • examples of configuring objects This document is valid for OPs having graphics displays.
ProTool/Lite User's Guide	Configurer	Same contents as the ProTool User's Guide. This document is valid for OPs having text based displays.
ProTool Online Help	Configurer	Provides information on your computer (PU or PC) screen for working with the ProTool configuring tool. The online Help is context-sensitive and contains • a general description of the editors to be found in ProTool • a detailed description of the different fields in the dialog boxes • a comprehensive description of the functions
Application Example Commissioning Instructions	Beginners	Example configurations are supplied with ProTool together with the associated PLC programs. This document describes • how you load the examples onto the OP and the PLC • how you can run the example • how you can upgrade the connection for your application

Document Type	Target Group	Contents
OP37 Equipment Manual OP25, OP35, OP45 Equipment Manual OP7, OP17 Equipment Manual OP5, OP15 Equipment Manual	Commissioning engineers, users	Describes the OP hardware and general operation. It contains • installation and commissioning • a description of the OP device • electrical installation with connection of the PLC, printer and configuration computer • OP modes • OP operation • description of the standard screens supplied with the software and their usage • how to install options • maintemance and replacement of spare parts
OP3 Equipment Manual	Commissioning engineers, users, programmers	Describes the OP hardware, general operation and the connection to a SIMATIC S7.
Communication User's Guide	Programmers	Provides information on connecting OPs to the following PLCs: • SIMATIC S5 • SIMATIC S7 • SIMATIC 500/505 • block drivers for other PLCs This document describes • the configuration and parameters required to connect the OP to the PLC and to the network • the user data areas used for exchanging data between the OP and the PLC
Other PLCs Online Help	Programmers	Provides information for connecting OPs to PLCs such as • Mitsubishi • Allen Bradley • Telemecanique The drivers for connections to these PLCs are located on separate floppy disks and are referred to as NATIVE drivers. Installation of a driver also installs the associated online Help.

How the manual is organized

The *ProTool User's Guide* is organized as follows:

Chapters 1–4 contain general information. This is information about what ProTool represents, what functions ProTool supports and how ProTool is run under Windows.

Chapter 5 describes the basic approach to configuration with ProTool. You should study this chapter before you start configuring.

Chapters 6–10 contain detailed information on how to configure different objects. Instructions are given on step-by-step basis.

Chapters 11–17 show you how to

- create your configuration in different languages
- compile and download your configuration to the OP
- print your configuration
- copy and archive your configuration.

Conventions

The following conventions are used in this manual:

VAR_23	Typewriting identifies inputs or outputs as shown on the screen. They may be commands, filenames, entries in dialog boxes or system messages.
F1	Names of keys are shown in a different type for identification purposes.
File → *Edit*	Menu items are shown in this form. The whole path is always specified, showing how the menu item is accessed.
Variable	Dialog boxes as well as fields and buttons in dialog boxes are shown in italic type.

Applicability

The different issues of the User's Guide apply to the following ProTool versions:

Issue 07/94	Valid for ProTool versions up to and including 1.31.
Issue 09/95	Extensions and revisions. Valid for ProTool version 2.0 or later.
Issue 09/96	Correction of errors and inclusion of the OP37. Valid for ProTool version 2.5 or later.

Obtaining product support

In the event of technical queries, please get into touch with your point of contact at the Siemens agency or branch which takes care of your affairs. You will find the addresses in Appendix D *Siemens Worldwide*. In addition, you can call our hotline on *+49 (911) 895-7000 (Fax 7001)*.

Abbreviations

The abbreviations used in the *Protool User's Guide* have the following meanings:

AG	Automatisierungsgerät (German for ”PLC”)
AM	Alarm Message
ANSI	American National Standards Institute
AS 511	Driver of the PU interface to the SIMATIC S5
ASCII	American Standard Code for Information Interchange
EM	Event Message
EM	Equipment Manual
LED	Light-Emitting Diode
MPI	Multipoint Interface (SIMATIC S7)
OLE	Object Linking and Embedding
OP	Operator Panel
PC	Personal Computer
PG	Programming Unit
PPI	Point to Point Interface (SIMATIC S7)
PLC	Programmable Logic Controller
RAM	Random Access Memory (working memory)
UM	User Manual

Contents

Introduction 1

ProTool

ProTool is an easy-to-use configuration tool for Operator Panels (OPs). It can run under Microsoft® Windows™. You can use a mouse or the keyboard to execute most of the actions that have to be performed in ProTool.

Configuration

Configuration consists in creating screens and messages and linking them to the PLC program. This means that the sequences of events on the PLC can be visualized and manipulated.

Screens

Screens are used to create an image of the process. This means that the operator can quickly grasp the relationships and intervene in the process, should this be necessary. Text explains individual elements on the screen. Graphics, such as trends and bar graphs, display trend patterns – for example, of temperature or current fill levels. The operator has to call screens. He can also enter values which are then transferred to the PLC.

Messages

Messages draw the operator's attention to certain operating states or display malfunctions in process execution. Messages are displayed automatically.

Keys

Operator Panels have a system keypad and a function keypad. The system keypad contains the keys for operating the Operator Panel, such as cursor control and inputs. Functions can be assigned to function keys in the configuration. By that the actual control sequence is implemented.

Configuration data

Configuration is performed on a PC or a programming unit (PU). The configuration then has to be compiled under ProTool and downloaded to the OP. If connected to the PLC, the OP displays the current values. Figure 1-1 shows the different phases in which work is performed with configuration data.

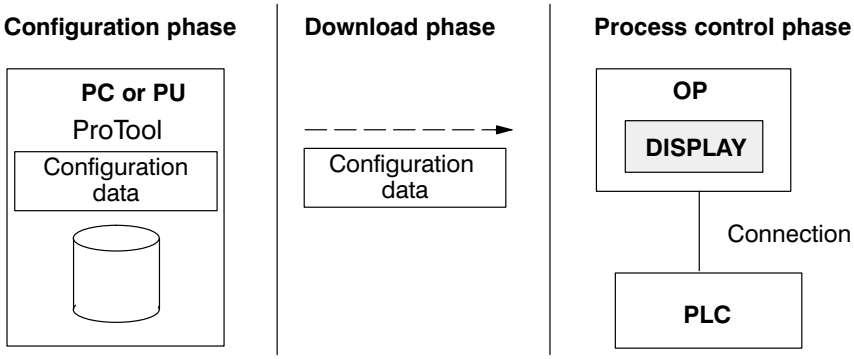


Figure 1-1 Configuration Phase, Download Phase and Process Control Phase

Components of a configuration

A configuration consists of different components, including:
– setting the PLC and the type of connection
– general settings for the Operator Panel
– objects such as variables screens and messages.

Object types

ProTool incorporates different editors with which you can configure the different object types. Every object is created under a symbolic name, by which it is referenced.

Printing a configuration

Part or all of the configuration can be printed with ProTool. ”Part” means that all the objects of a single object type, such as messages or variables, are printed.

Installation 2

System requirements

Table 2-1 shows the system requirements for running ProTool.

Table 2-1 System Requirements for ProTool

Device	Required
CPU	80486 SX/33 MHz
Main memory	8 MB
Free space on hard disk	2 MB in Windows directory 20 MB for ProTool
Graphics card	VGA
Floppy disk drive	3.5 ”
Microsoft Windows	MS Windows 3.1 MS Windows for Workgroups 3.11 Windows95

The system requirements depend on the operating system being used.

Virtual memory

To improve performance, and thus speed, we recommend that you create virtual memory for Windows®.

Virtual memory should be of the `Permanent` type and at least 8 MB. You create virtual memory in the Windows *main group* under the *Control Panel* program group. At this point you choose the *386 Enhanced* icon.

Information is written temporarily from main memory to a file on your hard disk. This file is a hidden file which reserves storage space on your hard disk. When you require the information again, Windows loads it back into main memory.

Methods of installation

You have to install ProTool under Windows. You can install it either from the floppy disks supplied to you or – for example, for networks – from your hard disk.

STEP 7 integration

If STEP 7 programming software, version 2 or higher, is available on your computer, you can install ProTool integrated in STEP 7. The advantages of doing this are as follows:

- You manage ProTool projects with the SIMATIC Manager, the same tool as you use for managing your STEP 7 projects.
- You can select STEP 7 symbols and data blocks from a text or graphic list as variables. The data type and the address are entered automatically.
- ProTool lists all the PLCs in your STEP 7 project and determines the corresponding address parameters once a PLC has been selected.

Selecting a language

Before installation proper begins, the system asks you what language and options you wish to use. Installation begins in the same language as Windows is installed. After you have selected the language in which you want to have ProTool installed, installation is resumed in the language you specified. You cannot change the ProTool language in Online mode. If you wish to be able to use the ProTool user interface in a different language, you have to re-install ProTool.

Installing from floppy disk

To install ProTool, proceed as follows:

Step	Windows 3.1 or later	Windows95
1	Start Windows.	
2	Insert the first floppy disk into the drive.	
3	Select in the File Manager the drive in which the floppy disk is inserted and double-click on the `setup.exe` program.	Select in the Explorer the drive in which the floppy disk is inserted and double-click on the `setup.exe` program.
4	A dialog box appears in which you can click, under *Options*, the software packages you wish to have installed. Perform modifications here only if you have ordered optional software packages.	
5		Under *STEP 7*, select whether ProTool should be installed as *Integrated* or *Standalone*.
6	Follow the setup instructions on the screen.	

Installable components

You can vary the size of your installation by means of the options. The following components are installed using the options offered to you:

ProTool is the program for creating configurations.

Examples are executable example configurations for both the OP and the PLC.

Graphics library is ready-made symbols for different topics.

OP firmware is the firmware for the OP. You have to specify this function when you are installing ProTool for the first time.

Optional PLC drivers are drivers and examples for ”non-SIMATIC” PLCs and have to be ordered separately.

Optional functions are loadable functions which you have to order separately.

Floppy disk for OP45

For the OP45, you are supplied with a separate floppy disk labeled `CONFIGURATION-DISK COROS OP45`, which you should install only on the OP45. This floppy disk formats the hard disk of the OP45 and installs the operating system for *Operator Control and Process Monitoring*.

Installing from hard disk

For you to be able to install ProTool from hard disk, you have to copy the floppy disks to your hard disk before you can start installing. When copying to hard disk, abide by the conventions described below.

ProTool consists of four components, which are also labeled separately on their floppy disks. These four components are:

- *ProTool software* labeled `ProTool`
- *Firmware* labeled `Firmware`
- *Optional PLC drivers* labeled `Driver`
- *Optional functions* labeled `Functions`

Create a separate directory for every one of the four components and the floppy disks containing the name of the component and the number of the floppy disk. The directories have to be created in accordance with the labels on the floppy disks.

This means that you create for the ProTool software the directories

`\PROTOOL\DISK`*n*

where *n* is the number of the floppy disk. For floppy disk *1*, you therefore create a directory called `\PROTOOL\DISK1`; for floppy disk *2* you create a directory called `\PROTOOL\DISK2`, and so on.

For the firmware, create a directory called `\FIRMWARE\DISK1`.

Icons in the program group in Windows 3.x

ProTool is installed in a program group of its own. Following installation, you will see the following icons in the program group:

Double-clicking this icon launches ProTool.

For late breaking information about ProTool, double-click this icon.

To call online Help, double-click this icon. You can also call online Help in ProTool by pressing key F1.

To modify Setup, double-click this icon. You can modify Setup to install, for example:
– a different language,
– an option or
– ProTool *integrated* or *Standalone*

The taskbar with Windows95

With Windows95, you call ProTool by means of the taskbar. The icons described under Windows 3.x will be found here as entries on the taskbar.

If you have installed ProTool to be *Standalone*, you will find it in the *Programs* folder. If you have installed ProTool to be *Integrated*, you will find it in the *Simatic* folder.

Note

Before you start work on a configuration, you should first read about the file structure created for ProTool and the significance of the standard screens supplied to you by consulting section 16.

Overview of Device-Specific Functions

3

The following tables give you an overview of

- objects (table 3-1),
- settings for the target system (table 3-2) and
- general settings (table 3-3).

that can be configured for the individual devices. The tables refer to the parameters in the dialog boxes.

Table 3-1 Configurable Objects

Objects					
			OP25	**OP35 OP37**	**OP45**
Screens	Text		x	x	x
	Character graphic		x	x	x
	Graphic		x	x	x
	Input	Display	x	x	x
		Password level	x	x	x
		Field length	x	x	x
		Variable	x	x	x
		Colors	mono	x	x
		Hide	x	x	x
		Functions	x	x	x
		Multiplexing	x	x	x
		Information text	x	x	x
	Output	Display	x	x	x
		Field length	x	x	x
		Variable	x	x	x
		Colors	mono	x	x
		Hide	x	x	x
		Multiplexing	x	x	x
	Trend graphic	Actual Value	x	x	x
		Samples/max.	x	x	x
		Background color	mono	x	x
		Scale color	mono	x	x
		X axis	x	x	x
		Y axis	x	x	x
		Hide	x	x	x
		Multiplexing	x	x	x
		Trends	x	x	x

Table 3-1 Configurable Objects, continued

Objects					
			OP25	**OP35 OP37**	**OP45**
	Bar	Direction	x	x	x
		Scale color	mono	x	x
		Border	x	x	x
		Y axis	x	x	x
		Colors	mono	x	x
		Hide	x	x	x
		Multiplexing	x	x	x
		Variable	x	x	x
	Function keys/soft keys		10/14	16/20	16/20
	Attributes	Background color	mono	x	x
		Start screen	x	x	x
		Information text	x	x	x
		Functions	x	x	x
		Hide	x	x	x
Event messages	Standby message		x	x	x
	Information text		x	x	x
	Message field	Display	x	x	x
		Field length	x	x	x
		Variable	x	x	x
		Colors	x	x	x
		Hide	x	x	x
		Functions	x	x	x
	Attributes	Priority	x	x	x
		Port	x	x	x
		Print	x	x	x
		Relay	x	x	x
		Functions	x	x	x
Alarm messages	Information text		x	x	x
	Message field	Display	x	x	x
		Field length	x	x	x
		Variable	x	x	x
		Colors	x	x	x
		Hide	x	x	x
		Functions	x	x	x
	Attributes	Priority	x	x	x
		Acknowledgment	x	x	x
		Port	x	x	x
		Print	x	x	x
		Relay	x	x	x
		Functions	x	x	x

Table 3-1 Configurable Objects, continued

Objects					
			OP25	**OP35 OP37**	**OP45**
Variables	Type		x	x	x
	Length		x	x	x
	Polling time		x	x	x
	Decimals		x	x	x
	Address		x	x	x
	PLC		x	x	x
	Limit values		x	x	x
	Functions		x	x	x
	Options	3 identifications max. Initial value	x x	x x	x x
	Download	Write directly Write indirectly Read continuously Online	x x x x	x x x x	x x x x
Recipes	Download	Direct/indirect	x	x	x
	PLC		x	x	x
	Identifications	3 max.	x	x	x
	Name		x	x	x
	Number		x	x	x
	Version		x	x	x
	Structure	Fix/abolish	x	x	x
	Variable		x	x	x
	Entry name		x	x	x
Trends	Display		x	x	x
	Samples		x	x	x
	Colors		mono	x	x
	Trigger	Bit/pulse	x	x	x
	Variable		x	x	x
	Line type		x	x	x
	Limit values		x	x	x
	Multiplexing		x	x	x
	Guide lines		x	x	x
Text or graphic lists	Text list	Value/binary/bit Text	x x	x x	x x
	Graphic list	Value/bit Graphic	x x	x x	x x

Table 3-2 Configurable settings for the target device

Settings for the system					
			OP25	**OP35 OP37**	**OP45**
Screen/Keys	Window	Fixed window	x	x	x
		Message indicator	x	x	x
	Messages	Alarm messages	x	x	x
		Event messages	x	x	x
PLC	System clock		x	x	x
	Driver	SIMATIC S5–AS511	x	x	x
		SIMATIC S5–FAP	x	x	–
		SIMATIC S5–L2-DP	x	x	–
		SIMATIC S7–300/400	x	x	–
		SIMATIC S7–200	x	x	–
		FREE SERIAL	x	x	–
		SIMATIC 500/505	x	x	–
	Parameters	Depend on PLC	x	x	x
Area pointer	Interface area		x	x	x
	User version		x	x	x
	Screen number		x	x	x
	Data mailbox		x	x	x
	Event messages		x	x	x
	Alarm messages		x	x	x
	Alarm acknowledgment PLC		x	x	x
	Alarm acknowledgment OP		x	x	x
	System key assignment		x	x	x
	Function key assignment		x	x	x
	LED assignment		x	x	x
	Trend request		x	x	x
	Trend transfer 1		x	x	x
	Trend transfer 2		x	x	x
Parameters	Messages	Printout	x	x	x
		Alarm messages	x	x	x
		Overflow warning	x	x	x
		Character/Titles	x	x	x
	Miscellaneous	User version	x	x	x
		Time/date format	x	x	x
		OP password	x	x	x
		Recipe parameter record	x	x	x

Table 3-2 Configurable settings for the target device, continued

Settings for the system					
			OP25	**OP35 OP37**	**OP45**
Printer	Interface	Interface Type Data bits Parity Stop bits Baud rate	x x x x x x	x x x x x x	x x x x x x
	Settings	OP printer selection Active OP printers Setup	x x x	x x x	x x x
Language assignment	Configuration possible in all Windows languages		x	x	x
	Languages simultaneously loadable on the OP	3 configuration languages	x	x	x
Character set	Attributes		x	x	x
	Language dependent (3)		x	x	x
	Language independent (1)		x	x	x
Functions	Entry points		x	x	–
	Functions		x	x	–

Table 3-3 Configurable General Settings

General settings					
			OP25	**OP35 OP37**	**OP45**
PC Interface	Download	MPI / serial	x	x	–
	Interface		x	x	x
	Baud rate		x	x	x
Function Keys	LED image		x	x	x
	Keyboard image		x	x	x
	Password level		x	x	x
	Functions		x	x	x
Soft Keys	LED image		x	x	x
	Keyboard image		x	x	x
	Password level		x	x	x
	Functions		x	x	x
	Global assignment		x	x	x

Working with ProTool

4

This chapter contains a general description of how to run ProTool. This description is not a substitute for the general Windows documentation.

4.1 General Handling

ProTool is primarily designed to be run with a mouse. The different editors are provided with special tool bars that have editor-specific buttons. These tool bars are shortcuts to frequently used functions.

ProTool can, however, be configured with the keyboard to a large extent.

The following sections tell you how to handle mice and keyboards.

Working with a Mouse

In ProTool, you always use the left mouse button when you work with the mouse. An exception to this is on selecting the background color, when you use the right mouse button. Refer to online Help: Color palette.

In the ProTool documentation, the following terms are used for working with a mouse:

Click	The mouse button is pressed and released.
Drag	The mouse button is pressed and held down, the cursor is moved to its new position, and the mouse button is released.
Double-click	The mouse button is pressed twice in quick succession.

Working without a Mouse

If you work without a mouse, the same key conventions apply in ProTool as in Windows.

Table 4-1 shows the key combinations for fine adjustment of the fields on screens.

Table 4-1 Keys and Key Combinations in ProTool

Keys/Key Combinations	Functions
Message editor:	
SHIFT + left arrow	Select character to left of cursor
SHIFT + right arrow	Select character to right of cursor
CTRL + arrow	Next configured message
Character graphic field:	
CTRL + arrow	Show line strokes
Move fields on screens:	
Left arrow / right arrow	Move field left/right
Up arrow / down arrow	Move field up/down
Enlarge fields on screens:	
CTRL + left arrow	Enlarge field horizontally to left
CTRL + right arrow	Enlarge field horizontally to right
CTRL + down arrow	Enlarge field vertically down
CTRL + up arrow	Enlarge field vertically up
Reduce fields on screens:	
SHIFT + CTRL + left arrow	Reduce field horizontally to left
SHIFT + CTRL + right arrow	Reduce field horizontally to right
SHIFT + CTRL + down arrow	Reduce field vertically down
SHIFT + CTRL + up arrow	Reduce field vertically up

Details of keys and key combinations

On some menus, the menu items are followed by details of keys and key combinations. If you press that key or key combination, the menu item is initiated. You do not have to chose the menu beforehand.

If menu items, icons or buttons are dimmed, the functions are unavailable.

4.1.1 Opening Several Configurations and Editors

Opening several configurations

Under ProTool, you can open several configurations and editors simultaneously. You can copy data to and from a configuration via the Clipboard. This simplifies work, since you do not have to re-configure all of the data.

Opening several editors

The same applies to editors, for you can also open several editors simultaneously. You can also open an editor several times over, thus being able to work at different points in the editor.

Active window

A window is opened every time you select a configuration or an editor. You can open up to three projects simultaneously.

You can always edit the active window. You can recognize an active window by the color of its title bar, which is different from that of the other windows (refer to figure 4-1).

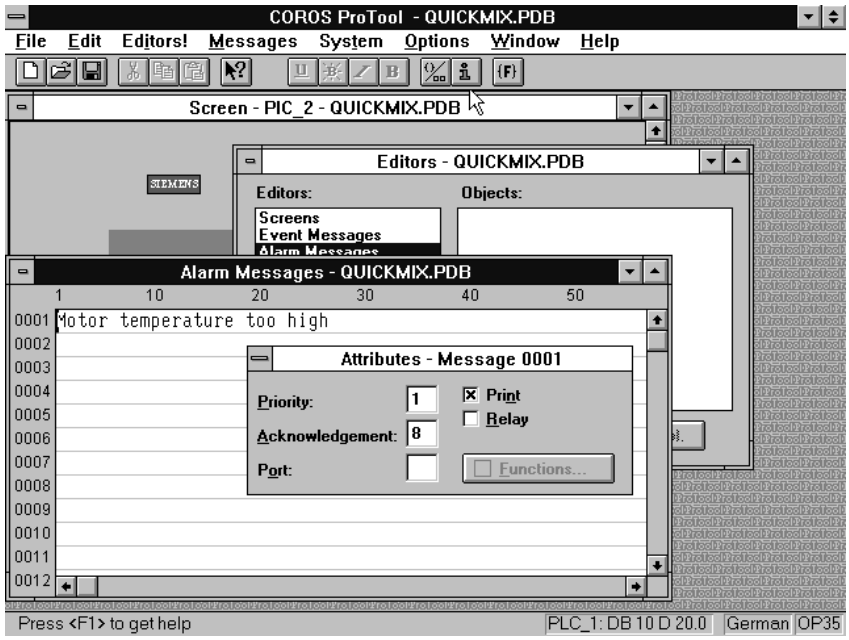


Figure 4-1 ProTool Screen with Several Open Windows

4.1.2 Using Online Help

Purpose

Online Help is a complete reference tool which you can choose at any time while you are configuring. By using online Help, you obtain information about dialog boxes, menus, ranges of values etc.

Calling online Help

You can call online Help in several ways:

F1

You can always press F1 in ProTool to consult online Help. Online Help is automatically called for the editor in which you happen to be working or for the dialog box you selected.

Context-sensitive

Clicking the Help button on the tool bar transforms the cursor into an arrow with a question mark. Clicking this cursor in ProTool on an item about which you would like more information calls online Help, and the corresponding position in online Help is displayed.

The topics you click may be dialog boxes, menu items, buttons on the menu bar or palettes.

If you are not working with a mouse, you activate context-sensitive Help by pressing SHIFT + F1.

Help menu

You can call online Help by choosing *Help* → *Contents* from the menu. The first page of ProTool online Help is then displayed. You can specify a search term directly by choosing *Help* → *Search* from the menu.

Online Help window

Figure 4-2 shows the online Help window:

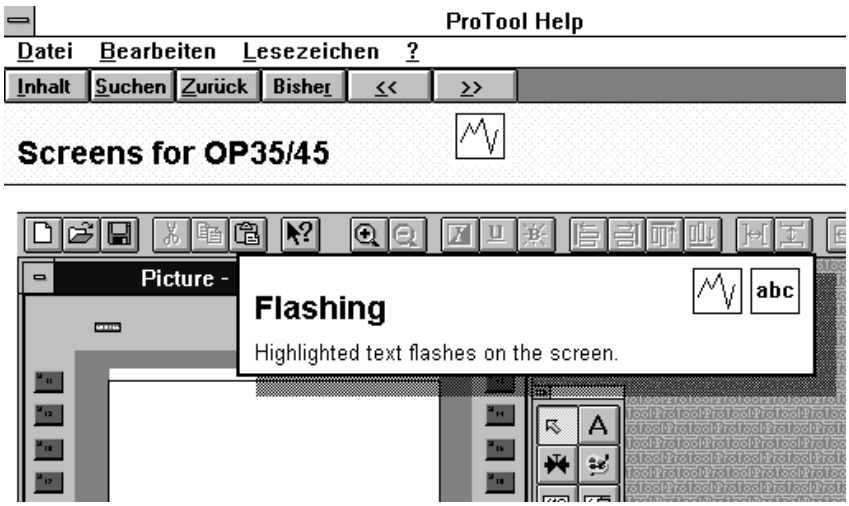


Figure 4-2 Online Help in ProTool

Green text

A green, underlined topic indicates a jump which links to another topic. If you click on the jump, the new topic is displayed in a different window.

A green, dotted underlined topic indicates a jump which references a brief explanation. Clicking the cursor on this jump displays a window containing the explanation. The window is hidden by clicking anywhere on its surface.

Jumps in screen dumps

Furthermore, online Help frequently displays screen dumps of ProTool, i.e. editors, dialog boxes etc. There are jumps under many of these screen dumps. If you point to a jump, the pointer changes to a hand shape. If you click on the jump, you go to other topics or call a secondary window. You obtain further information in this superimposed window.

If you click in online Help on a button or a menu item in a screen dump which causes the ProTool software to branch to a dialog box, online Help similarly branches to the related topic. If you click in online Help on a field in which an entry has to be made in the ProTool software, a secondary window containing a description is opened.

Displaying jumps

To make the jumps in screen dumps visible, press the following key combinations:

CTRL + TAB	All invisible jumps are displayed while you hold down CTRL + TAB.
TAB	The first invisible jump is displayed. Every time you press TAB thereafter, the next jump is displayed. Press RETURN to initiate the jump.
SHIFT + TAB	This key combination displays the previous jump. Press RETURN to initiate the jump.

4.1.3 Status Bar in ProTool

Purpose

The status bar is the bar at the bottom of the screen. In ProTool, the status bar displays general information and editor-specific details.

The general information includes items such as the OP that you have selected or how you can call online Help. Editor-specific details, on the other hand, might be the language and the assignment of the message in the area pointer. Figure 4-3 shows the status bar with messages.

Figure 4-3 Status Bar with Messages

Displaying information

In the status bar you can also display information about the functions of jumps and menu items. To do so, click the topic you require and hold down the mouse button. While you do this, the corresponding information will be displayed in the status bar. If you do not want to initiate the function, continue to hold down the mouse button and drag the mouse away from the selected topic.

4.1.4 All Menus

Menu bar

There are various editing levels with configuration. They are represented by main menu items on the menu bar (see figure 4-4).

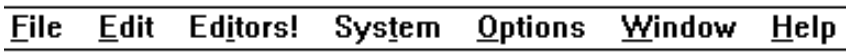


Figure 4-4 Menu Bar

Main menu items

All the editing steps of an editing level are arranged under one main menu item. The main menu items are specifically:

File — All editing actions concerning the entire configuration are concentrated here. At this point you can, for example, open and save files, compile files and download them to the OP etc.

Edit — All editing actions concerning selected or highlighted sections of the configuration are concentrated under this main menu item. At this point you can, for example, cut, copy, paste etc. fields or text.

Editors!	The *Editors* window is displayed. All the editors used for configuring the OP are concentrated here. At this point you can select the editor you want to work with – for example, for screens, event messages etc.
System	General settings for the OP are listed under this main menu item. At this point you define the structure of the display, the link to the PLC program and PLC-specific settings.
Options	At this point you will find default settings, cross-references and OLE settings.
Window	All the editing steps for arranging the windows of ProTool are located here. You can select, for example, the window you want to have on top, or you can arrange all the open windows on the screen, etc.
Help	By choosing Help, you go to online Help.

Editor-dependent menu items

Editor-dependent menu items appear only after the corresponding editor has been called. All the editing steps specific to that editor appear under these menu items. The following menu items are affected:

Screen	At this point you can, for example, select screen attributes, create fields, display palettes etc.
Messages	By choosing messages, you can, for example, edit variables or information text, open additional windows etc.
Cross-reference	You obtain information about which objects refer to each other in your configuration.

4.2 Tool Bar

Purpose

Some functions can be accessed via the menu system and also directly by means of the tool bar at the top border of the screen. The buttons are self-explanatory and represent shortcuts.

The tool bar always features the functions belonging to a specific editor. The structures of the tool bar for the screen editor and the message editor are shown in figures 4-5 and 4-6.

Figure 4-5 Tool Bar for Screen Editor

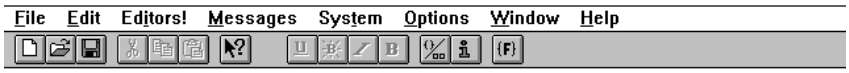
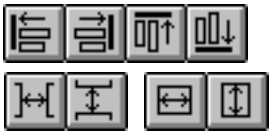


Figure 4-6 Tool Bar for Message Editor

Summary of functions

Below, a description is given of all the buttons on tool bars:

	New	Open a new project with the default settings.
	Open	Open an existing project. The *File Open* dialog box is opened. You choose the project you require from the dialog box.
	Save	Save a project under its name. If it is a new, unnamed project, the *Save as* dialog box is opened.
	Cut	Cut highlighted sections from a project and store them on the Clipboard.
	Copy	Copy highlighted fields from the project and store them on the Clipboard.
	Paste	Paste fields in the project from the Clipboard.
	Context-sensitive help	Obtain a special cursor. Click the cursor on the item about which you require more information. Online help is chosen.

	Enlarge/ Reduce	Enlarge/reduce the screen segment on the display.
	Style	Assign a style to highlighted text: inverse, underlined, flashing.
	Align	Align selected fields in relation to each other: left- or right-justified, from top or bottom margin, with identical column or row spacing, of identical width or height.
	Monochrome	Toggle the screen display between Monochrome and Color.
	Foreground/ Background	Place the selected graphic object in the foreground or background.
	WYSIWYG mode	Toggle variables between their symbolic name and their actual length.
	Edit information text	Toggle between message and information text.
	Insert field	Insert fields in a message.

4.3 General Settings

Menu items

You can customize the ProTool user interface. This includes arranging the windows and displaying or hiding palettes. Specifically, the following menu items are involved:

Options → Default Setting	At this point you can modify the default settings of names and settings.
Options → OLE Preferences	At this point you select the programs which you wish to use for creating and editing graphics.
Screen → Surface	At this point you can set how the surface should be displayed on your screen. That is, whether you prefer a grid, with dots or without dots.
Screen → Zoom	At this point you enlarge or reduce the image on the screen.
Screen → Tool Palette	At this point you can display or hide the tool palette for the screen editor. When displayed, the tool palette is used for quick configuration of fields. You do not have to choose *Screen → Fields* from the drop-down menu.
Screen → Character Graphics Palette	At this point you can display or hide the character graphics palette for the screen editor. The character graphics palette is displayed only if you are creating a field with graphics characters.
Screen → Size/Position	If you choose Size/Position, a window is displayed or hid. It contains details of the current cursor position and the size of the object you selected. Values are specified in pixels.
Screen → Black/White	In an OP25 configuration, the image on the screen is toggled between Black/White and Color.
Screen → Reference Text	If you select Reference Text, the screen in the reference language corresponding to the active screen is displayed. If you choose the *Apply* button on the reference screen, all text strings on the reference screen are applied to the active screen.
Messages → Attribute Window	You use this menu item to display or hide the attribute window. In this window, you set different options which apply to just one message. This might be its priority, for instance.
Messages → Reference Text	You use this window to display or hide the reference text window. In this window, message text is displayed in the reference language.
Window	Under this menu item, you will find settings for customizing your screen. This includes displaying more than one window on your screen simultaneously, for instance.
Window → Keyboard	You use this menu item to display or hide the language-dependent keyboard assignment.

4.4 Information Functions

Summary

ProTool contains functions that provide information about the entire configuration. These items are listed below:

File → Project Information

Here you will find general information about the project: device type, date created and modified, author etc.

File → Download

Once the connection to the OP has been established, you can learn here the firmware version and available storage capacity on the OP.

System → Memory Requirements

After a configuration has been downloaded, the storage space it requires on the OP is displayed.

Options → Cross-reference

The objects that refer to each other are displayed. If, for example, you wish to delete a variable which is being used in a field, you find the associated field by means of Cross-Reference. Double-click on the specified field to have ProTool jump directly to the field.

4.5 Dialog Boxes

Settings

When you open a dialog box, only the essential settings are visible initially. Optional settings may be accessed by clicking a button. Clicking a button opens yet another dialog box, which may contain more buttons.

An example of the structure of a dialog box is shown in figure 4-7.

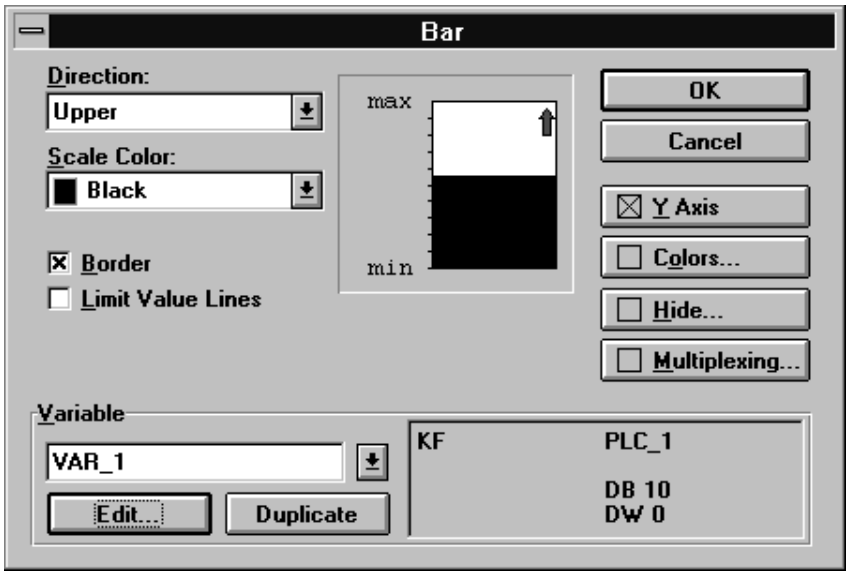


Figure 4-7 Bar Dialog Box

A description is given below of all the points that you have to remember when you are using dialog boxes.

Branching to other dialog boxes

If there is an ellipsis after an option in a dialog box (see figure 4-7: *Edit*), ProTool branches to another dialog box if you choose the button.

If there is a check box in front of an option in a dialog box, you branch to an optional setting (see, for example, figure 4-7: *Y axis*) by choosing the button. You can tell from the check box whether a configuration is present in the dialog box (checked box) or not (unchecked box).

Closing a dialog box

Dialog boxes contain either *OK* and *Cancel* buttons or a *Close* button.

In the first case, you have two options for closing a dialog box – you can close with or without saving.

To close a dialog box and to save any changes you may have made at the same time, exit from the dialog box by pressing the *OK* button.

If you exit from the dialog box by pressing the *Cancel* button, any changes you may have made are lost.

In the second case, the *Close* button is used to close the dialog box. In this type of dialog box, any changes you may have made take immediate effect; in other words, changes do not have to be explicitly saved.

Configuring with ProTool

5

Device type

You configure the different OPs in basically the same manner. Before you can start work on your configuration, you have to set the device type – for example, OP25. You are now offered only the functions that are available with this device type. You cannot modify the device type for this configuration once it has been set.

You can use configurations created for the OP35 on the OP37. By choosing *File* → *Convert* from the menu, you can convert a configuration created for an OP35 into a configuration for an OP37.

Display

The display on the Operator Panel can be customized. This refers to the location and size of the different windows in which screens and messages are displayed. The display format applies to the whole configuration. ProTool exhibits a default setting.

Object types

The items you configure are individual objects. We distinguish between different types of objects, such as messages, screens, variables etc. A separate editor is available for every type of object.

Variables

The link to the PLC is established by means of variables. Variables are used on screens and in messages to read values from the PLC and to display them on the OP. Similarly, variables can be used to write values to the PLC.

Information text

Information text can be configured to provide the OP operator with additional information about inputs and messages.

General settings

General settings for the system and the communication areas in the PLC have to be performed centrally.

Compiling, downloading

Upon completion, the configuration has to be downloaded to the OP. In this procedure the configuration is first compiled. ”Compile” means that an OP-readable file is created. This file is then downloaded to the OP.

5.1 Procedure for Configuration

Introduction

A configuration has to be created step by step. Certain steps are mandatory, others are optional.

An explanation is provided in the following of the different configuration steps in the order in which they have to be performed. This followed by a list of the settings required for configuring different functions.

Required details

Figure 5-1 shows the basic details that have to be provided for the Operator Panel and the PLC in your configuration. These details include

- OP type
- display partitioning
- PLC to which the OP will be connected
- driver which the PLC and OP will use to communicate with each other
- communication areas.

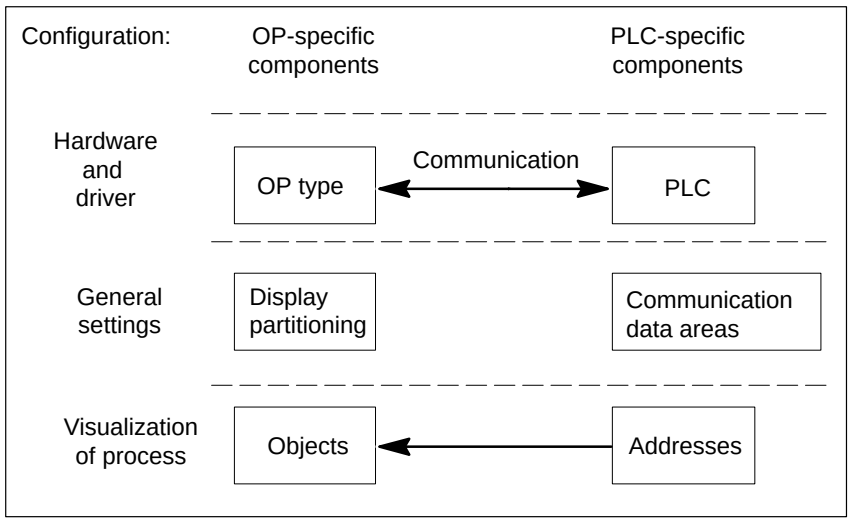


Figure 5-1 Basic Structure of a Configuration

Objects

The actual visualization of a process is performed by using objects, such as screens and messages. These objects are supplied with current values from the PLC. The specific values concerned are set by means of addresses.

Procedure

You create your configuration on a PC or a PU and then download it to the OP. The procedure for configuration is specifically as follows:

1. **Set device type**

   After a new configuration has been opened, the *Device Selection* dialog box appears. At this point you set the device type – for example, OP35. The other items displayed by ProTool thereafter are device-specific.

2. **Set display partitioning**

   You set the partitioning of the display by choosing the menu command *System → Screen/Keys*. The *Screen/Keys* dialog box is opened. The settings you perform here apply to the whole configuration. There is a default setting. Check whether the default setting applies to your configuration. If not, modify the default setting to meet your requirements.

3. **Set PLC and communication driver**

   You must specify in the configuration the PLC to which the OP will be connected and the driver which the PLC and OP will use to communicate with each other. This is done by choosing the menu command *System → PLC*. The *PLC* dialog box is displayed. All the settings you perform here are saved under a symbolic name. If you use a variable in an object, you specify this symbolic name to connect the OP to the PLC.

4. **Enter communication areas (area pointers)**

   For the OP and the PLC to be able to communicate with each other, you must define common data areas. These data areas are known as communication areas. You enter them by choosing *System → Area Pointers* from the menu. The communication areas you enter will depend on the types of object that are being configured. Table 13-1 shows the dependencies.

   For the SIMATIC S5 PLC, you must create the interface area by choosing *Area Pointers*. A detailed description of the interface area will be found in the *Communication User's Guide*.

5. **Configure objects**

   Now configure messages, screens and recipes, depending on the requirements of your process.

   Variables enabling the link to the PLC can be created either directly using the *Variables* editor or you have to wait until you configure the different objects. If, for example, you create an input field on a screen, you can call the dialog box for creating variables by choosing the *Edit* button.

6. **Compile configuration**

   For the configuration to run on the OP, it must be first compiled. To do this, choose File → *Compile* from the menu in ProTool

   During compilation, a check is made for inconsistencies in the configuration. One inconsistency might be, for example, that a particular type of object has been configured without the corresponding communication area being created.

7. **Download configuration to OP**

   You download the configuration to the OP by choosing *File → Download* from the menu. Should there be a current, compiled version already, it is downloaded. If a compiled version does not exist, the configuration is first compiled and then downloaded.

Example for SIMATIC S5

To create a configuration for an OP35, proceed as follows:

1. Call ProTool, open the file `S5_35.pdb` from the directory called `protool\standard` and save it choosing a new file name.
2. Choose *System → PLC* from the menu to set the PLC.
3. Press the *Edit* button. The *Driver* dialog box now appears. We want to establish the connection using the SIMATIC AS511 driver.
4. Press the *Parameters* button. The *SIMATIC S5-AS511* dialog box is now displayed.
5. Select in the *SIMATIC S5-AS511* dialog box, for example, the *CPU Type* `S5 115U CPU944` if you wish to connect the OP35 to that PLC.
6. If you close the dialog box by clicking *OK*, the settings are applied. Do exactly the same in all the other dialog boxes which you may have opened. Exit from the *PLC* dialog box by clicking the *Close* button in order to apply all the settings.
7. Choose *System → Area Pointers* from the menu to configure the interface area, DB-TDOP.
8. In the *Type* field, you will see that *Interface Area* has already been selected. Press the *Add* button. A dialog box having the title *Interface Area* is opened.
9. Enter the following values in the *Interface Area* dialog box: *DB:* `51`, *Length:* `255`. This means that DB51 is the interface area.
10. Exit from the *Interface Area* dialog box by pressing *OK* in order to apply the settings.

11. Then partition the OP display by choosing *System→ Screen/Keys* from the menu.
12. Select for *Alarm/Event Mess.* the setting *Window/Window,* to enable both event messages and alarm messages to be displayed on screens simultaneously.
13. Via *Active*, select the *Message Area* and, holding down the mouse button, position it in the screen layout. This concludes partitioning of the OP display.
14. Configure a screen (refer to section 7).
15. Choose *File → Save* from the menu to save the file.
16. Choose *File → Compile* from the menu to compile the configuration.
17. Connect the OP to your PC or PU. Choose *File → Download* from the menu to download the configuration to the OP.

5.2 Special Features of STEP 7 Integration

STEP 7 Integration

If you have installed ProTool as being integrated, you can access the same database with ProTool as with the engineering tools of STEP 7. You assign your symbolism only once and use it everywhere. This saves you repeated inputs.

The communication parameters of the PLC are applied directly to your configuration. When you are configuring variables and area pointers, you access the STEP 7 symbol table.

Calling ProTool

You call ProTool as follows:

1. Start the SIMATIC Manager.
2. Select an S7 project or create a new one.
3. Choose *Insert* → *Hardware* → *COROS OP* from the menu. The ProTool project OP1 is created.
4. Double-click on *OP1* to start ProTool.

You can copy, move and delete the ProTool project in the SIMATIC Manager.

Using the symbol table

When you are configuring variables, the STEP 7 symbol table is displayed for you. When you click on a symbolic name, the name and the complete address are applied automatically to the configuration. This is illustrated in figure 5-2.

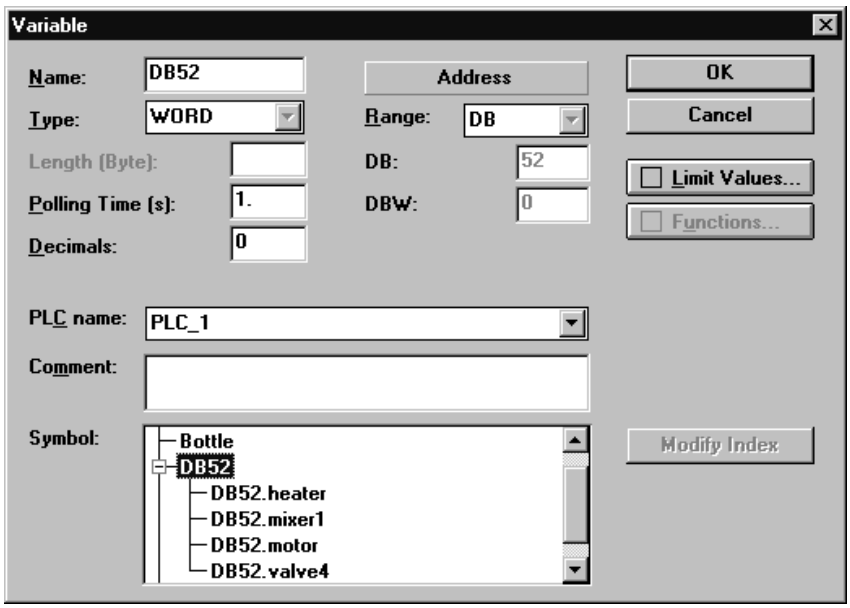


Figure 5-2 *Variable* Dialog Box with Embedded STEP 7 Symbol Table

Selecting the PLC

Select the PLC in the way you normally would. For the parameters, the *SIMATIC S7 - 300/400* dialog box (refer to figure 5-3) displays all the networks, CPUs and FMs available in the STEP 7 project. Once you have selected the network and the CPU by means of symbolic names, the parameters and addresses are entered for you automatically.

You can select the CPU symbolically only if you have placed it in an S7 station using the SIMATIC Manager, assigned parameters to it and networked it.

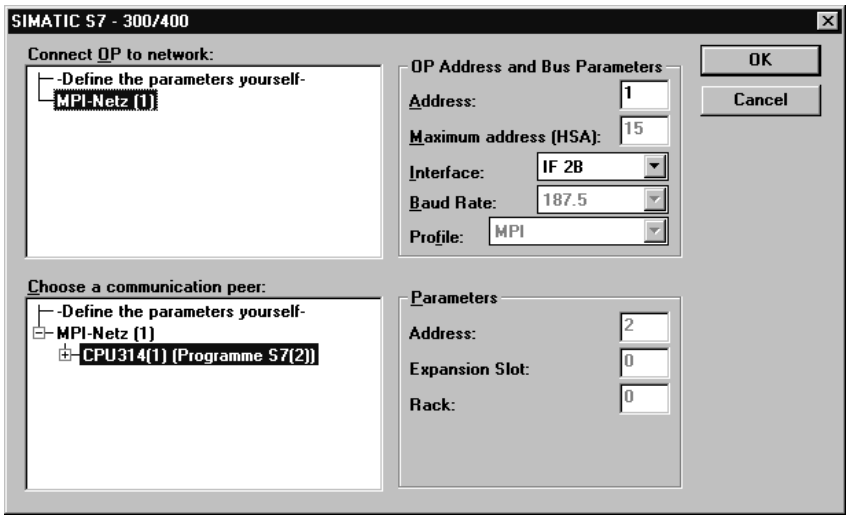


Figure 5-3 *SIMATIC S7 – 300/400* Dialog Box

If you have not yet created the STEP 7 configuration, you can type in the parameters. To type in the parameters, select *Define the parameters yourself*.

Updating

The symbol table and the address parameters are continuously updated via the symbolic link. STEP 7 modifications are applied immediately.

Menu File

Choose menu items *File* → *New*, *File* → *Open* and *File* → *Save As...* in ProTool to open STEP 7 dialog boxes. By way of an example, figure 5-4 shows the *Open* dialog box.

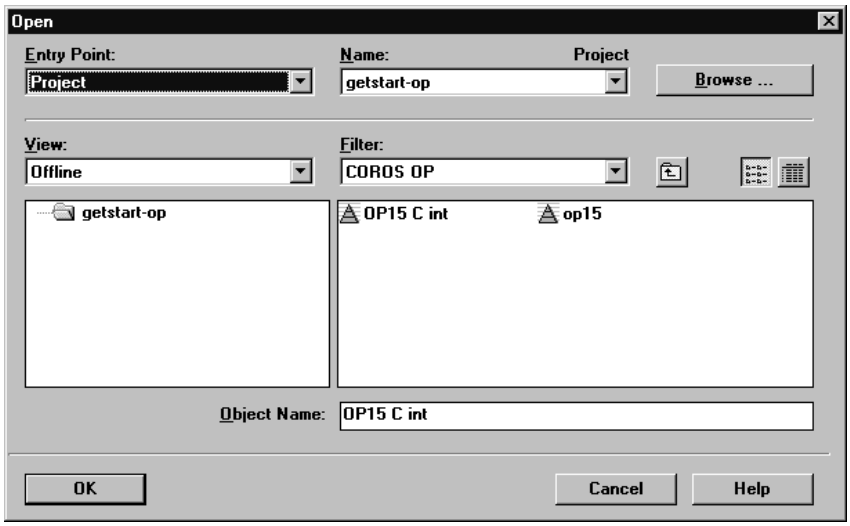


Figure 5-4 *Open* Dialog Box

In this dialog box, you can open ProTool projects. You can recognize ProTool projects by the icon preceding them

 .

The dialog boxes for *New* and *Save As...* look alike, but they have different functions.

On opening, specify in the *Object Name* entry field an existing ProTool project. When creating a new project, you can enter at this point a new name having a length not exceeding 24 characters.

Integrating projects

You cannot call projects under the SIMATIC Manager that have been created as stand-alone projects. For these projects to be linked to a STEP 7 project, they have to be integrated. To integrate these projects, choose in ProTool *File* → *Integrate* from the menu. Give the ProTool project a different name in the STEP 7 configuration from that in the original project.

ProTool Standalone

ProTool can still be started as a stand-alone program if you call ProTool Setup and choose *Standalone*. If you wish to modify this setting in Setup, ProTool is not re-installed, only the link to STEP 7 is canceled.

Example: Creating a ProTool project

In this example, you will create a ProTool project, including all the preliminary work for connecting the OP to the S7 PLC.

1. Create a new STEP 7 project called *GETSTART* in the SIMATIC Manager.
2. Select the *GETSTART* project. Then choose *Insert → Hardware → SIMATIC 300-Station* from the menu. The *SIMATIC 300-Station1* icon appears in the SIMATIC Manager.
3. If, when you are creating the *GETSTART* STEP 7 project, the icon for an MPI network does not appear, choose *Insert → Subnet → MPI Network*.
4. Select the *SIMATIC 300-Station1* icon and choose *Edit → Open Object* from the menu. The *Hardware Configuration* dialog box appears.
5. Open the hardware catalog by choosing *View → Catalog* from the menu.
6. Click in the hardware catalog on the + sign preceding *SIMATIC 300*, then on the + sign preceding *RACK 300*. Select *Mounting Rail* and drag it to the empty, blue bar of the *Hardware Configuration* dialog box. The first line (expansion slot 0) of the configuration table appears; the rail is entered on it.
7. Click on the + sign preceding expansion slot 0 to open the configuration table completely.
8. Click in the hardware catalog on the + sign preceding CPU-300. Select CPU314 and drag it to expansion slot 2 of the configuration table. The CPU314 is entered in expansion slot 2, and the line remains selected.
9. Choose *Edit → Object Properties*. The *Properties – CPU 314* dialog box appears.
10. Click the *MPI* button on the *Properties* card. The *Properties – MPI Node* dialog box is opened.
11. Enable the *Networked* list box by clicking it. Select the *MPI Network 1* entry beneath it.
12. Then, close all the dialog boxes by clicking *OK* or by saving. In this way you have created and networked the PLC to the extent required for ProTool. The blank STEP 7 symbol table has been created automatically.
13. To open it, click first on the + sign preceding the *GETSTART* project, on the + sign preceding *SIMATIC 300 Station1*, on the + sign preceding *CPU314* and on the + sign preceding *S7 Program1*. Select *Symbol table* `SY` and then choose *Edit → Open Object*. The symbol table is opened.
14. Make the following entries:
    Symbol: `Mixer1`
    Address: `I0.1`
    The `BOOL` data type is entered automatically.
15. Save and then close the symbol table. You can use the *Mixer1* symbol later to configure a variable.
16. Open the *ProTool* project containing the standard configurations which were supplied to you. Copy object `OP25 – S7` to your *GETSTART* project.

17. Double-click on the *Copy OP25 – S7* icon. ProTool is started, and the standard configuration for OP25 is opened.
18. Choose *System* → *PLC* from the menu. The *PLC* dialog box is opened. By default, the *SIMATIC S7–300/400* PLC is entered at this point in the case of STEP 7 integration.
19. Now, first click the *Edit* button and then the *Parameters* button. The *SIMATIC S7 300/400* dialog box appears.
20. Select the entry *MPI Network1* in the *Connect OP to Network* list box. This entry now appears in the *Select Communicating Peer* list box.
21. Click in the *Select Communicating Peer* list box on the + sign preceding the *MPI Network1* entry. The entry *CPU314 (S7 Program1)* appears.
22. Select the *CPU314 (S7 Program1)* entry and close all the dialog boxes dealing with the PLC by clicking *OK* or *Close*. The connection between the OP and the PLC is thus established.
23. Double-click in the editor window on *Variable*. The *Variable* dialog box appears.
24. In the *PLC* list box, choose `PLC_1`. In the *Symbol* list box, you will now see the *Mixer1* symbol from the STEP 7 symbol table. Double-click this symbol. The following values are applied to the dialog box:
    `Mixer 1` in the *Name* entry field
    `BOOL` in the *Type* list box
    `I` in the *Area* list box
    `0` in the *E* entry field
    `1` in the *Bit* entry field

5.3 The Most Important Objects and Their Settings

When you configure an object type – for example, messages – more settings have to be performed in ProTool. These details refer to communication, the method of presentation on the display, and printout. Table 5-1 lists the most important types of object and the settings required for them.

Table 5-1 Objects Used and the Necessary Settings

Objects Used	Associated Settings	Menu Item or Dialog Box
PLC	PLC type, driver	*System → PLC*
	Interface Area (SIMATIC S5 only)	*System → Area Pointers*
Event messages	Event message area	*System → Area Pointers*
	Event message area or message line	*System → Screen/Keys*
	Message printout	*Messages → Attribute Window* *System → Parameters → Messages*
	Message buffer	*System → Parameters → Messages*
	Call event message area and event message buffer using function keys: – local – global	 Screen *System → Screen/Keys*
– Text – Output	Edit text Variable	 *Messages → Edit/Insert Field*
Alarm messages	Alarm message area	*System → Area Pointers*
	Acknowledgment area	*System → Area Pointers*
	Alarm message area or message line	*System → Screen/Keys*
	Message indicator	*System → Screen/Keys*
	Message printout	*Messages → Attribute Window* *System → Parameters → Messages*
	Message buffer	*System → Parameters → Messages*
– Text – Output	Edit text Variable	 *Messages → Edit/Insert Field*

Table 5-1 Objects Used and the Necessary Settings, continued

Objects Used	Associated Settings	Menu Item or Dialog Box
Screens		
– Text	Edit text	*Screen → Fields → Text*
– Input and output	Variable	*Screen → Fields → Input/Output*
– Dynamic input/output	Variable and text or graphic list	*Screen → Fields → Text or Graphic List*
– Trend graphic	Trends and variables	*Screen → Fields → Trend Graphic*
– Bar graph	Variable	*Screen → Fields → Bar*
– Graphic character	–	*Screen → Fields → Character Graphic*
– Bitmap	–	*Screen → Fields → Graphic*
Call screen	Assign function key – local – global	 *Screens* *System → Screen/Keys*
Trends		*Screen → Fields → Trend Graphic*
– Trends	Time-triggered: variable Bit-triggered: variable trend request trend transfer 1	 *System → Area Pointers*
– Trend patterns	Variable Trend request Trend transfer 1 Trend transfer 2 (for configured switch buffer only)	*System → Area Pointers*
Recipes	Variables Data mailbox	*System → Area Pointers*
	Place standard screens for ”Create Data Records” on function keys: – local – global	 *Screens* *System → Screen/Keys*

5.4 Partitioning the Display

Areas for setting

The display on the Operator Panel can be partitioned into different areas. On the one hand, there are the different areas for displaying screens and messages. On the other hand, there is the area for the function keys. Icons can be displayed at the edge of the display for the soft keys.

Setting

You set the areas by choosing *System* → *Screen/Keys* from the menu. The settings you perform here apply to the whole configuration. Therefore, define the areas before you start work on the configuration.

Some areas can be enabled and disabled, and their size and location can be modified. Many areas are permanently assigned. Table 5-2 lists all the areas that are possible and the extent to which they can be modified.

Table 5-2 Settable Areas for the Display

Area	Enable/Disable	Modify	
		Size	Location
Basic area	No	No	No
Fixed window	Yes	Yes	No
Event message area	Yes	No	Yes
Alarm message area	Yes	No	No
Message line	Yes	Yes	Yes
Message indicator	Yes	No	Yes
Icons (individual)	Yes	No	No

All the other areas, such as the system message area, Help window, date and time window and setpoint inputs, cannot be configured.

Example

Figure 5-5 shows an example of how the display on the OP25 might be partitioned. The fixed window located at the top border of the screen can contain the date and time, which should always be displayed. The event message area is partially superimposed on the fixed window. When the event message area is called on the OP, the date and time display is less important.
Current process data, however, should still be visible to the extent possible. Icons have been assigned to the six soft keys on the bottom border of the screen.

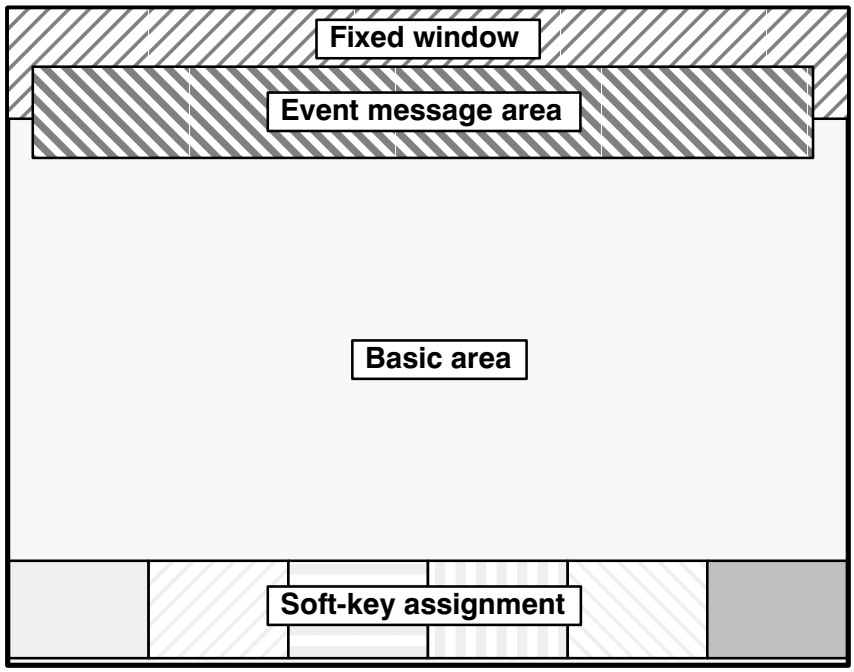


Figure 5-5 Example of Partitioning the Display on the OP25

Significance

The different areas have the following significance for the Operator Panel:

Basic area

The lowest level, extending over the whole display. All other areas are superimposed on parts of the basic area. The location and size of the basic area cannot be modified. Screens are configured in the basic area. This means that the contents of the basic area depends on the screen you call.

Fixed window

A window that is permanently open. It occupies part of the basic area. The fixed window can be enabled/disabled by choosing *Screen/Keys* from the menu. If it is enabled, it is displayed while screens are being configured, thus reducing the available area for screens. You can adjust the size of the fixed window; it is permanently located at the top border of the screen. You configure the fixed window with the *screen* editor.

Alarm message area

The window in which alarm messages appear. The window is opened only when an alarm message is issued. The window disappears when the alarm message is acknowledged.

The size and the location of the alarm message area cannot be configured. Its size is set automatically with the size of the event message area.

The display of alarm messages cannot be disabled. Either an alarm message area or a message line has to be configured.

Event message area

The window in which event messages appear. The window is opened only if it is called. The event message area can be enabled and disabled by choosing *Screen/Keys.* There is a choice of two settings for its height. Its location can also be changed.

Message line

The area in which alarm messages and event messages are displayed. The message line can be enabled and disabled by choosing *Screen/Keys*. However, you cannot set the message line and the event message area.
The dependencies between the message area and the line are listed in table 5-3. There is a choice of two settings for the height of the message line. Its location can also be changed.

Message indicator

A symbol which draws your attention to waiting alarm messages. The message indicator can be enabled and disabled by choosing *Screen/Keys*. Its size cannot be modified, but you can change its location.

Dynamic position

With the OP35 and OP37, the message and information text windows are positioned dynamically as a function of the cursor position so that inputs undergoing editing are not concealed. This function can be enabled and disabled by choosing *System* → *Screen/Keys*.

Icon

An icon can be placed on the display for the soft keys. This is possible only for the *Fx* keys that are directly arranged around the screen. You can assign every key separately. An assignment applies globally. The icons appear on every configured screen. The assignment and the icon for every screen can be modified later. The modification then applies only locally.

Dependencies

There are dependencies between the display options for alarm messages and event messages. Table 5-3 lists those dependencies.

Table 5-3 Possible Settings for Event Messages and Alarm Messages

Display of Alarm messages	Display of Event Messages
Window	Window
Window	Line
Window	Off
Line	Line

Priorities

The areas have different priorities. This is noticeable when the areas are cascaded. The high-priority area is superimposed on the low-priority area. Table 5-4 contains a matrix which tells you which areas are superimposed when cascading is effective.

Table 5-4 Priorities of the Areas when Cascading is Effective

Area	**Superimposed**						
	Basic area	Fixed window	EM area	AM area	Message line	Message indicator	Soft-keys
Basic area	–	–	–	–	–	–	–
Fixed window	x	–	–	–	–	–	–
EM area	x	x	–	–	–	–	x
AM area	x	x	x	–	–	–	x
Message line	x	x	–	–	–	–	x
Message indicator	x	x	x	–	x	–	x
Soft-keys	x	x	–	–	–	–	–

5.5 Editors

Editors in ProTool

ProTool provides various editors for the different types of object. There are editors for:
– screens
– event messages
– alarm messages
– variables
– recipes
– trends
– text or graphic lists
– graphic objects

Fig. 5-6 shows the box in which you choose editors.

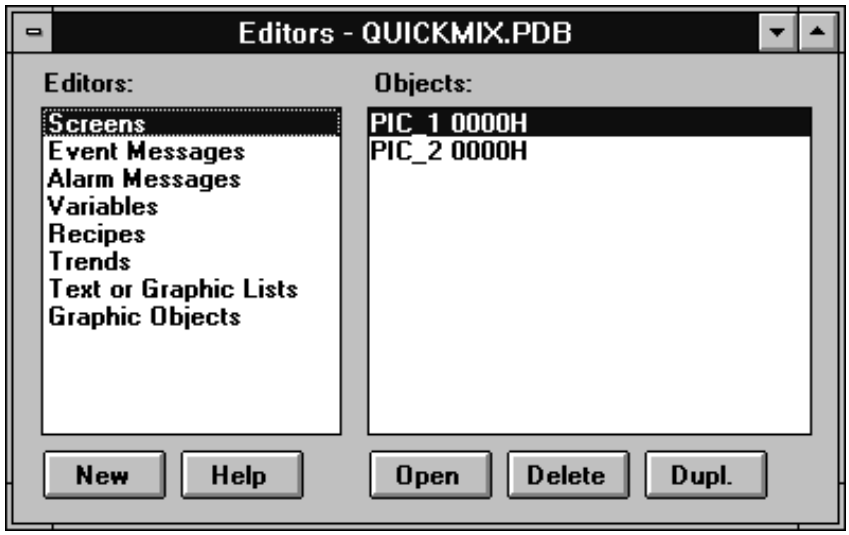


Figure 5-6 ProTool's Editors

Symbolic name

Objects such as screens, variables and text or graphic lists are saved under a symbolic name. The symbolic name is valid only for that configuration. You have to specify this symbolic name whenever you create, delete and edit objects or reference objects from within other objects. Symbolic object names are displayed under *Objects* in the *Editors* Box.

Symbolic object names may have default settings and may be numbered automatically. The default settings may be entered by choosing *Options* → *Default Setting* from the menu. Default settings were performed before ProTool was shipped.

Object types

The user interface of the different editors has been adapted to the specific configuration of the various types of object. Detailed descriptions of the different object types will be found elsewhere in this manual. A brief summary is presented in the following.

Screens

A screen may consist of static text, a representation of values, graphics and graphic characters. Values can be represented as
– figure
– text
– graphic
– bar or
– trend.

Values are always based on variables which define the link to the PLC. The OP reads a process value from the PLC and displays it in its configured form. In the case of inputs, a value is sent to the PLC.

Figure 5-7 shows a configured screen comprising output fields, a bar and an icon for function key F14.

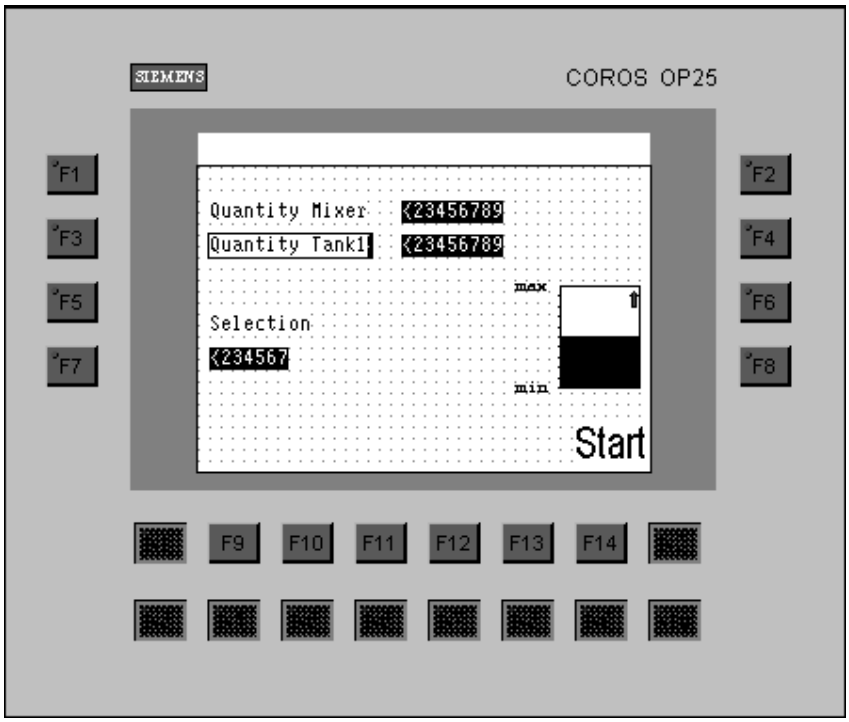


Figure 5-7 Configured Screen for Screen Editor (Shown here for the OP25)

Event and alarm messages

Event messages and alarm messages are used to display operating states and malfunctions in a process. In event messages and alarm messages, values as well as static text can be output (figure 5-8).

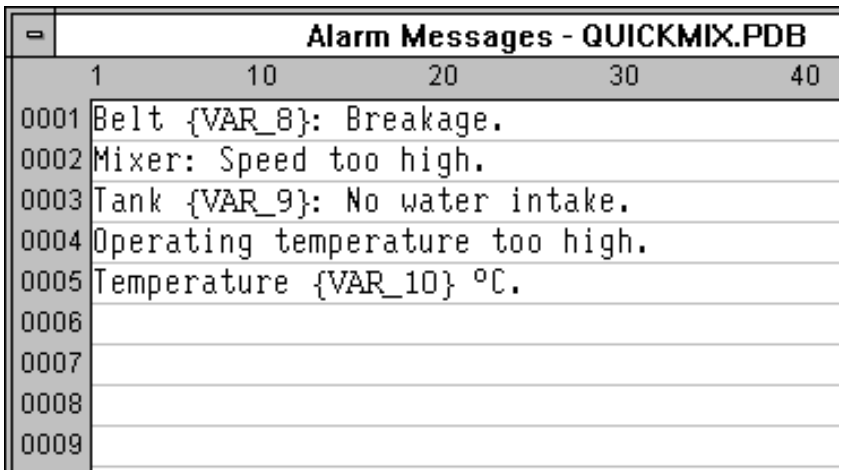


Figure 5-8 Configured Alarm Messages

Variables

Variables represent the link to the PLC. They contain the address in the memory area of the PLC. From these addresses, the OP reads values or it writes values.

The *Variable* dialog box is PLC-specific. Depending on the PLC that you set, the appropriate data types and addresses are presented to you. An example of a variable configured for the SIMATIC S5 is shown in figure 5-9.

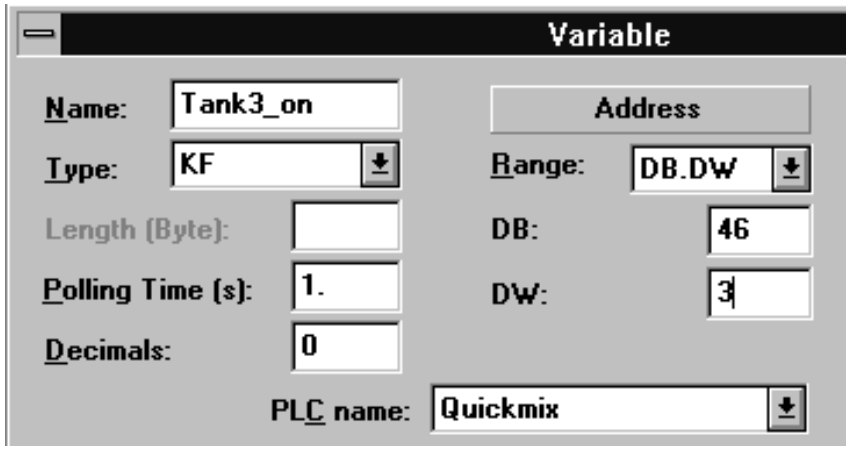


Figure 5-9 Variable Configured for the SIMATIC S5

Recipes

Recipes are groupings of technologically associated PLC setpoints for a specific application. Data are assigned on the OP to the configured data structure.

Trends

Trends are used to visualize data – for example, test values from the PLC – in the form of lines, dots or bar graphs.

Text or graphic list

Text or graphic lists are used for the dynamic display of text and graphics. On text or graphic lists, you assign different text elements or graphics to the values of a variable. Instead of the value, text or a graphic is output to the OP.

Graphic objects

Graphic objects are static graphics. They are used either directly on a screen or they are assigned as fixed-size icons to soft keys.

5.6 Copying to and from the Clipboard

Scope

Message text, messages, information text and fields on screens can be copied to and from the Clipboard. You can copy from one editor to another and – with the exception of variables – even from one project to another.

In this way text components can be copied from a text list or from the alarm message editor to the event message editor, or graphic elements can be copied from one screen to another.

Cutting, copying, pasting

You can cut, copy and paste selected objects or text elements in the same way as with other Windows applications. You select fields in the screen editor by clicking, while you drag the mouse over text elements.

If the whole message is selected, the attributes and information are copied.

Constraint

Addresses (variables) and general settings cannot be copied from one configuration to another.

This means that when you copy dynamic elements on screens and in messages, variables are not copied too. If you copy this kind of element from one configuration to another, the symbolic name of the variable is retained. The values of the variable, however, are lost.

Text fields cannot be copied from screens to a message editor via the Clipboard.

Example

Copy variable_XX from Configuration_1 to Configuration_2:

- If there is not a variable having this symbolic name in Configuration_2, Variable_XX will be created with the default values of Configuration_2.
- If there is already a variable with this symbolic name, that variable will be used.

5.7 Assigning Function Keys

Assigning

You can assign functions to function keys in your configuration. Click the function key displayed on the screen. The *Function Key – Fx* dialog box is opened. With the *Function* button, select the function call you require for key assignment from the list of functions.

You can assign two types of function key: global and local. Local assignments have priority over global ones.

Global	signifies that the assignment applies to the whole configuration.
Local	signifies that the assignment applies only to individual screens. The assignment of a function key may vary from one screen to another. In this way you can have functions initiated in keeping with the situation. A function key whose assignment may change from screen to screen is known as a *soft key.*

Always place functions that must always be at hand on function keys, never on soft keys.

Soft keys

Soft keys are the keys that are arranged directly around the screen. You can assign the following keys as soft keys on the different OPs:

OP25	Keys F1 to F14,
OP35, OP45	Keys F1 to F20,
OP37	Keys F1 to F20.

You assign soft keys in the editor. You can assign an icon to a soft key that is labeled with text or a graphic.

Soft keys can also be assigned globally. You perform global assignment by choosing *System→ Screen/Keys* from the menu. If, for example, you want to return to the same system screen every time you exit from a screen, you can place this function on a soft key by choosing *System → Screen/Keys* from the menu and you can assign an icon such as ESC. This means that the key is assigned to every screen.

Function keys

Function keys are labeled K*x*. You assign function keys by choosing *System → Screen/Keys* from the menu. You can record the functions you assigned to a key on labeling strips.

Variables

6

Definition

Variables represent the lowest level in a configuration. Variables are defined memory locations on the OP to which values are written and/or from which values are read. This may be done from the PLC or by means of an operator input.

Usage

Variables are used either to display process values or for settings that can be modified on the OP. The following table shows the different uses of variables.

Process Values	Settings
Input/output	Limit values
Bars	Scale
Trends	Hiding fields
	Multiplexing
	Dynamic attributes
	Function parameters

Types of variable

Basically, we distinguish between two different types of variable:

- **Global variables**
  Global variables are used to establish the link to the PLC. An address has to be defined on the PLC for every global variable. The OP accesses this address in Read or Write mode.
- **Local variables**
  Local variables are not linked to the PLC and are available only on the OP. You have to create local variables when, for example,you wish to enter limit values by means of an operator input on the OP.

Defining addresses

Figure 6-1 presents an example of the *Variable* dialog box for the SIMATIC S5. For global variables, you enter here the address from which the OP should read a value or to which address it should write a value. In addition to the address, you have to set the PLC. You define the PLC under a symbolic name by choosing *System* → *PLC* from the menu. You have to specify this symbolic name in the *Variable* dialog box. The complete setting of an address depends on the PLC you are using.

For variables not having a link to the PLC, you do not have to enter an address. In the *Variable* dialog box, you select `No PLC` under *PLC:*.

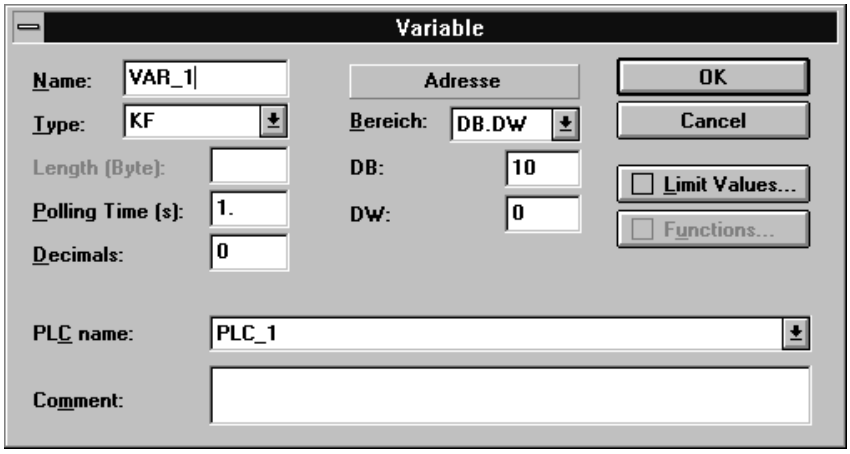


Figure 6-1 *Variable* Dialog Box for SIMATIC S5

Updating

There are the following settings for transferring the values of variables to the PLC from the OP and back again:

- **Write Directly**
  The value of a variable is written directly to the configured address of the PLC after it has been entered. This setting is the default setting for input fields. With direct writing to the address, synchronization with the PLC does not take place.
- **Write Indirectly**
  With indirect writing, the value of a variable is written on the PLC to intermediate storage, known as the data mailbox. You will find a detailed description of the data mailbox in section 9. In the PLC program, the value can be fetched from the data mailbox at the appropriate time. By choosing *Options* from the menu, you enter the *Identifications* for the variable so that it can be identified on the PLC. The identifications are similarly written to the data mailbox.

  Write Indirectly is possible only with the SIMATIC S5 and SIMATIC S7 PLCs.
- **Read Continuously**
  The variable is continuously updated, even when it is not on the current screen. This is important with trends. A trend is usually required to be written even when the screen has not been selected.
- **Online**
  If you select the Online mode (default setting), the variable is supplied during operation by the PLC. If you deselect the Online mode, the variable is unlinked from the PLC during operation. You can use this function if, for example, you wish to take only parts of the system into service.

- **Polling time 0**
  If you enter `0` for the polling time, the variable is read only when the screen is called. It is not updated on the screen that is waiting.

  Polling time is a multiple of the standard clock pulse in seconds. By default, the standard clock rate is set to 500 msec. If you enter a polling time of 1.5 sec, for instance, it is three times the value of the standard clock pulse. If you increase the standard clock pulse to 1000 msec by choosing *System → PLC* from the menu, the specified polling time is raised to 3 sec.

  By modifying the standard clock pulse, you can globally raise the polling times of all the variables in a project.

  If `0` is entered for the polling time, the variable is read only when a screen, message or recipe is called. It is no longer updated thereafter.

Limit values

For every variable, you can configure an upper limit value and a lower limit value. Configured limit values have different effects in input fields from output fields:

Input field

If you enter a value outside the configured limit values, the input is not accepted.

Output field

If values are output by the process that are outside the configured limit values, a change of color that you configured under *Color* takes place.

Upper and lower limit values are set in the *Limit Values* dialog box. Figure 6-2 shows the dialog box.

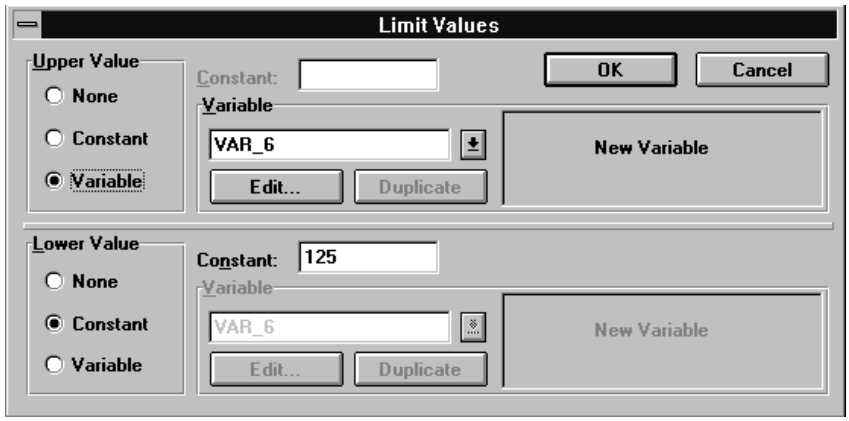


Figure 6-2 *Limit Values Dialog Box*

Upper and lower limit values

The upper and lower limit values can be configured independently of each other. By default, the limit values are disabled. You can define whether the specified limit value is determined by a *constant* or a *variable* . If you specify a limit value variable, it must have the same format as the corresponding variable.

Interpretation of digits behind the decimal points

Limit values for variables are entered without a decimal point. Depending on whether digits behind the decimal points are specified for the variable, the constant for the limit value is interpreted in different ways. The same number of digits behind the decimal points as specified is taken to be the number of digits behind the decimal points for the limit value as well. Table 6-1 shows an example.

Table 6-1 Example of Interpreting Digits behind Decimal Points

Configured Digits behind Decimal Points	Limit Value Input	Interpretation by ProTool
0	2222	2222
1	2222	222.2
2	2222	22.22

Functions

Functions may be assigned to variables – for example, to convert a value. This means that a value on the PLC is converted before being displayed. Inputs are similarly converted before being written to the PLC. A detailed description will be found in section 10.

Options

Under *Options*, you can configure up to three *identifications* for every variable. These identifications are important only with the *Write Indirectly* update mode. The identification may contain, for example, the address of the variable.

You can give the variable an *initial value*. Following OP startup, the variable then has its initial value. If variables are used for the scales of trends and bar graphs, the default value of the scale could be the initial value.

Variables of same address

If you use an address more than once on the PLC – for example, for input and output fields, we recommend that you configure different variables. If the input field and the output field access the same variable, the output field is updated every time the variable is modified.

A variable is also modified by an input on the OP, not merely by reading from the PLC. This means that once the input has been terminated on the OP, the output field is updated to reflect the new value. In the meantime, the value – which is still the old value – has been read from the PLC. The old value is then displayed briefly in the output field. While this is happening, the new value is being transferred to the PLC. The new value is displayed the next time the output field is updated.

6.1 Using Variables to Perform Settings

Usage	Variables can further be used to perform settings in a flexible manner. The value can be specified by means of an operator input on the OP or by the PLC. The different settings are described briefly below.
Limit values	You can configure limit values for variables. These limit variables can be read from variables.
Scale	The X and Y axis scales of trends as well as the Y axis scale of bar graphs can be configured with variables.
Hiding	Depending on the value of a variable, you can hide fields on screens.
Multiplexing	Multiplexing is possible with input and output, trends and bar graphs. A variable is assigned to these elements. In the case of multiplexing, several variables, not just one, are assigned to these elements. The current variable is determined by means of the value of the multiplex variable.
Dynamic attributes	You can configure the colors of an input/output field in dependence of the value of a variable. In exactly the same way, you can control the flashing of a field by means of a variable.
Function parameters	With some functions such as ”Language”, you can specify the parameter either as a constant or by means of a variable. This enables flexible assignment of the function.

6.2 Dependencies between Representation and Type of Variable

Dependence of PLC

There are different types of variable for every PLC. Use the tables below to determine the dependence between these types of variable and the representation on the OP.

Table 6-2 Variable Types for SIMATIC S5

Representation	Types of Variable										
	DF	**DH**	**KC**	**KF**	**KG**	**KH**	**KM**	**KT**	**KY**	**KZ**	**BCD4**
Decimal	x KG	x G	–	x KG	x KG	n G	n G	x KG	n G	x G	x
Hexadecimal	n KG	x G	–	n KG	–	x G	n G	n KG	n G	n G	n
Binary	–	–	–	n KG	–	n G	x G	n KG	n G	n G	n
String	–	–	x	–	–	–	–	–	–	–	–
Dec,Dec	–	–	–	n KG	–	n G	n G	n KG	x G	n G	n
Text	–	–	–	x KG	–	x G	x G	x KG	x G	x G	x
Graphic	–	–	–	x KG	–	x G	x G	x KG	x G	x G	x

x Combination possible
n Combination not advisable
– Combination not possible
K Digits behind decimal point possible
G Limit values possible

Table 6-3 Types of Variable for SIMATIC S7, Part I

Representation	Types of Variable					
	CHAR	**BYTE**	**INT**	**WORD**	**DINT**	**DWORD**
Decimal	x G	x G	x KG	x KG	x KG	x KG
Hexadecimal	x G	x G	x KG	x KG	x KG	x KG
Binary	x G	x G	x KG	x KG	–	–
String	–	–	–	–	–	–
Dec,Dec	–	–	x KG	x KG	–	–
Text	x G	x G	x KG	x KG	–	–
Graphic	x G	x G	x KG	x KG	–	–

x Combination possible
– Combination not possible
K Digits behind decimal point possible
G Limit values possible

Table 6-4 Types of Variable for SIMATIC S7, Part II

Representation	Types of Variable				
	REAL	**BOOL**	**STRING**	**Timer** 1)	**Counter** 1)
Decimal	x KG	x	–	x KG	x G
Hexadecimal	–	x	–	x KG	x G
Binary	–	x	–	x KG	x G
String	–	–	x	–	–
Dec,Dec	–	–	–	x KG	x G
Text	–	x	–	x KG	x G
Graphic	–	x	–	x KG	x G

x Combination possible
– Combination not possible
K Digits behind decimal point possible
G Limit values possible

1) Not with SIMATIC S7–200

Table 6-5 Types of Variable for SIMATIC 500/505

Representation	Types of Variable						
	BIT	**+/–INT**	**INT**	**+/–DOUBLE**	**DOUBLE**	**REAL**	**ASCII**
Decimal	x	x KG	x KG	x KG	x KG	x KG	–
Hexadecimal	x	x KG	x KG	x KG	x KG	–	–
Binary	x	x KG	x KG	–	–	–	–
String	–	–	–	–	–	–	x
Dec,Dec	–	x KG	x KG	–	–	–	–
Text	x	x KG	x KG	–	–	–	–
Graphic	x	x KG	x KG	–	–	–	–

x Combination possible
– Combination not possible
K Digits behind decimal point possible
G Limit values possible

Table 6-6 Types of Variable for PLCs Other Than SIMATIC PLCs

Representation	Types of Variable					
	INT	**UINT**	**LONG**	**ULONG**	**FLOAT**	**STRING**
Decimal	x KG	x KG	x KG	x KG	x KG	–
Hexadecimal	x KG	x KG	x KG	x KG	–	–
Binary	x KG	x KG	–	–	–	–
String	–	–	–	–	–	x
Dec,Dec	x KG	x KG	–	–	–	–
Text	x KG	x KG	–	–	–	–
Graphic	x KG	x KG	–	–	–	–

x Combination possible
– Combination not possible
K Digits behind decimal point possible
G Limit values possible

6.3 Dispalying Timers on the OP

Using timers

You can set the time base for PLCs SIMATIC S5, S7-300 and S7-400. You can choose between 10 msec, 100 msec, 1 sec and 10 sec. The OP detects the time base you have set and standardizes the displayed value to a notation in seconds.

The inputs on the OP are similarly made in seconds. The OP converts the entered value to the lowest possible time basis, irrespective of the configured number of digits behind the decimal point.

On the S7-200, every timer has a fixed time basis. The OP does not standardize the timer value, but displays it unmodified.

Digits behind decimal point and time basis

With timers, the time basis is specified with digits behind the decimal point. The time basis determines the interval between clock pulses. Differentiation between the time basis of 1 sec and 10 sec is made only by the size of the field. If the field length is 3, the time basis is 1 sec; if the field length is 4, the time basis is 10 sec. The following table shows the dependencies between digits behind the decimal point and the time basis.

Digits behind Decimal Points	Time Basis	Range of Values	Step Size
2	10 msec	0.01 – 9.99 sec	10 msec
1	100 msec	0.1 – 99.9 sec	0.1 sec
0	1 sec	1 – 999 sec	1 sec
0	10 sec	10 – 9990 sec	10 sec

Examples

A few examples are shown below for you to see how the OP standardizes inputs in seconds to the corresponding time base.

Input on OP	Configured Digits behind Decimal Point	Standardization to Time Base
3.8 sec	1	10 msec
13.8 sec	1	100 msec
3.81	2	10 msec
3	0	1s
3000	0	10 sec

Limit values with timers

Limit values may be specified only as integers. The actual limit value depends on the configured digits behind the decimal point in respect of variables. Limit values are similarly specified only in seconds.

Digits behind Decimal Point	Time Basis	Maximum Limit Value Entry	Interpretation by ProTool
2	10 msec	999	9.99 sec
1	100 msec	999	99.9 sec
0	1 sec	999	999 sec
0	10 sec	9990	9990 sec

6.4 Example of a Local Variable

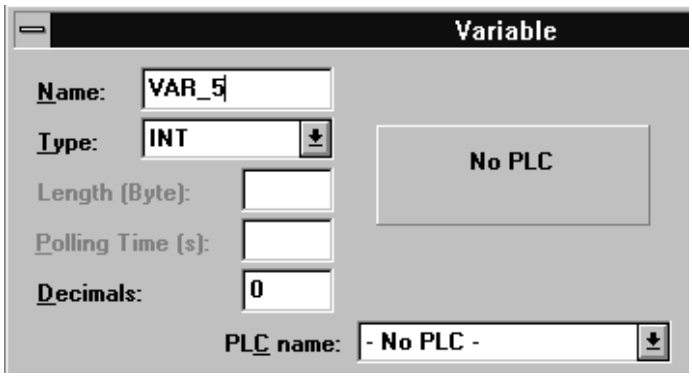
Description

You first configure an input field with a variable that is linked to the PLC. We will refer to it as the *process variable*. For the process variable, specify the upper limit value, which is read from a local variable. We will call this latter variable the *limit value variable*. Attach the limit value variables to an input field. You can then enter a limit value on the OP. Then go to the input field containing the process variable and enter a value. If, for example, the value is higher than the upper limit value, it is not accepted by the OP.

1. Choose *Screen* → *Field* → *Input/Output* from the menu. Hold down the left mouse button and drag the field to any size you wish. The *Input/Out put* dialog box appears.
2. For the *Field Type:* select `Input`.
3. Click in the *Variable* field on the *Edit* button and configure the process variable to have the following values:

   Name: `Var_4`
   DB: `12`
   DW: `0`
   PLC: `PLC_1`

4. Click on the *Limit Values* button. The *Limit Values* dialog box appears.
5. For the *Upper Limit Value*, click *Variable*. Specify the name of the variable as `Var_5`.
6. Configure variable `Var_5` as shown in the figure below.



7. Click in the *Variable* box on *OK* to apply your inputs. Exit from all the other open boxes by clicking on *OK*.
8. Create a new input field and assign the variable `Var_5` to it.

6.5 Using the STEP 7 Symbol Table

Definition

In STEP 7, you can assign informative symbolic names, called symbols, for addresses. Symbols are stored together with the data type, address and comments in a symbol table. You can use a symbol contained in the symbol table in ProTool for configuring a variable.

A symbol contained in the symbol table may also be a structured data block, which you can open by double-clicking.

Requirements

The following requirements must be met before you can use the symbol table:

1. You have installed ProTool under Windows95 with STEP 7 integration.
2. You have assigned parameters to an S7 PLC connection in ProTool and selected an S7 CPU in it (refer to section 5.2). This sets the corresponding STEP 7 symbol table.
3. Symbols have already been created in the STEP 7 symbol table.

Applying symbols for configuring variables

To apply symbols from the STEP 7 symbol table, open the *Variable* dialog box. The symbols contained in the symbol table are now listed in the *Symbol* field.

The following entries are applied to the dialog box as soon as you select one of the symbols:

- the symbol name as the variable name
- the address and
- the data type.

You can subsequently modify the variable name without the link to the symbol table being lost. Changes made to the symbol table in STEP 7 are applied to ProTool after the STEP 7 symbol table has been saved.

Figure 5-2 shows the *Variable* dialog box with the STEP 7 symbol table.

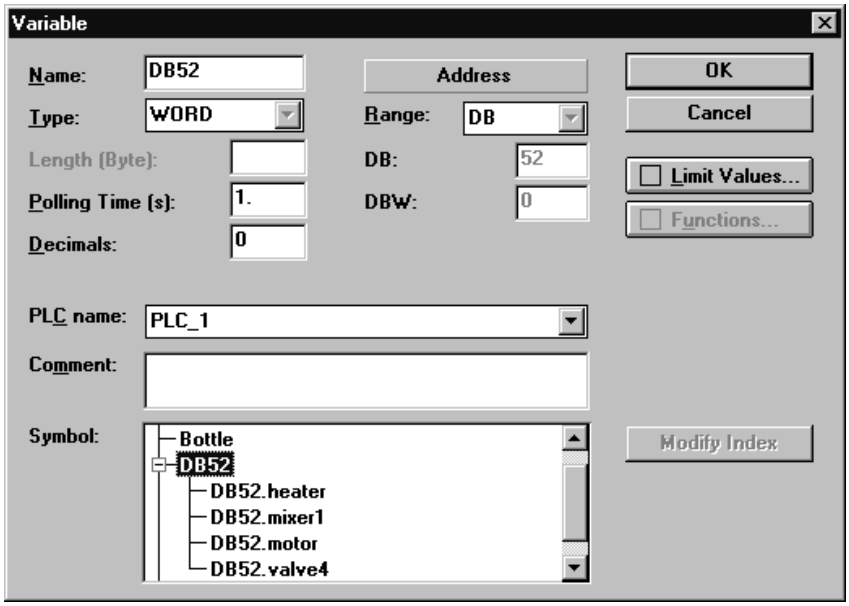


Figure 6-3 *Variable* Dialog Box with Embedded STEP 7 Symbol Table

Screens

7

Example

Screens display a process. They are thus an image of the process. Figure 7-1 shows an example of a screen illustrating a mixing unit. This might be a unit for mixing various fruit juices. Ingredients are filled into a mixer from different tanks and then mixed. The liquid levels in the tanks and in the mixer are displayed. The intake valves can be opened and closed by means of operator inputs on the OP. The motor for the mixer can be turned on and off in a similar manner.

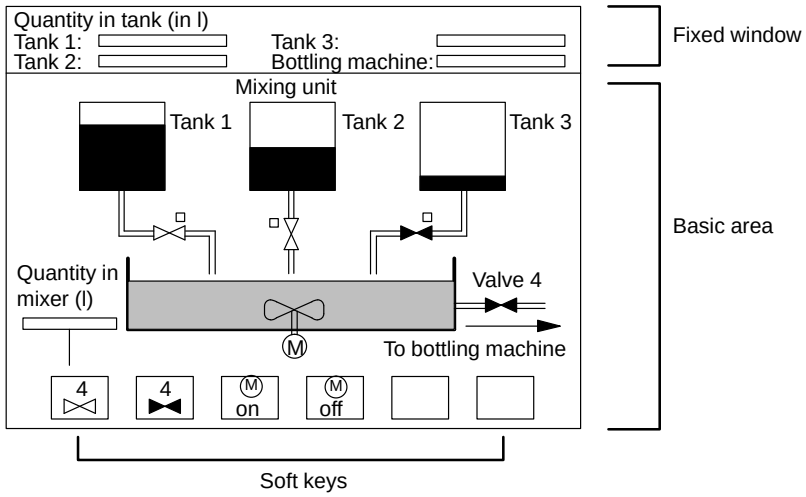


Figure 7-1 Example of a Screen – A Mixing Unit

Components of a screen

A screen can consist of static and dynamic components. Static components include text and graphics. Dynamic components are linked to the PLC and visualize current values from the PLC memory. Visualization may take place in the form of alphanumeric displays, trends or bars. Dynamic components are also inputs made by the operator on the Operator Panel and written to the PLC memory. The link to the PLC is established by means of variables.

Screen editor

Screens are created with a separate editor. When you call the screen editor, the OP is displayed together with its display and its function keys. You can zoom this display in or out. If, for example, you wish to edit details, you can do it much more simply with an enlargement. If you have several windows open simultaneously, a reduction in size may suffice for reasons of space.

Basic area

Screens are configured in the basic area. A symbolic name is assigned to every screen. Names are entered by choosing *Screen → Attributes* from the menu. You specify this name whenever you edit, reference or delete the screen. In addition, screens are numbered automatically. You cannot modify this number.

Fixed window

You enable and disable the fixed window by choosing *System → Screen/Keys* from the menu. You configure the contents of the fixed window in the screen editor. You do not have to assign a symbolic name to the contents of the fixed window. Since the fixed window is always present on the display, its contents do not change with the different screens. To access the fixed window, click it with the mouse.

Soft keys

Soft keys can be configured for specific screens. ”Configure” means you assign a function to a soft key. In addition, you can insert an icon containing the name of the function in the screen. Icons are graphics which can be created using any application, such as Paintbrush, or embedded from an existing file. Soft keys, for example, can be used to call another screen, to turn a motor on and off or to call the message buffer.

Selecting screens

Every configured screen has to be integrated into the control process of the OP so that it can be called. The *Select Screen* function is available for this purpose. You place this function, for example, in an input field or on a function key. You specify the name of the screen as the parameter. This means that a screen can be called by means of an input field or a function key. When doing so, make sure with input fields and soft keys that the function is available only on this screen. With function keys labeled K*x*, a function is permanently available.

Figure 7-2 illustrates the configuration of two screens. `Screen_2` is called by `Screen_1` using a soft key.

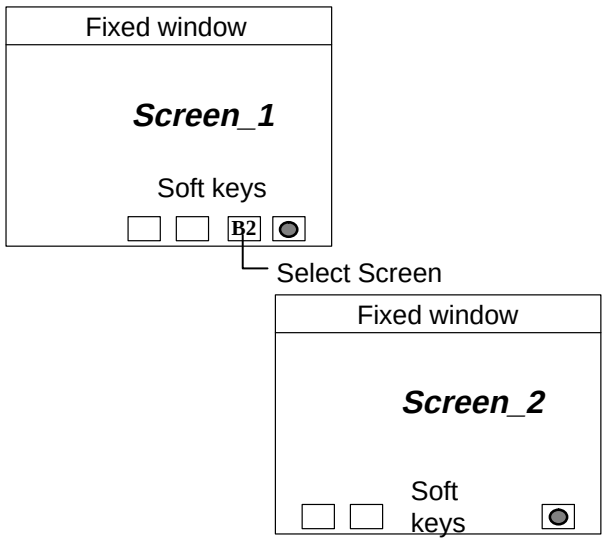


Figure 7-2 Diagrammatic Illustration of Screens

Menu for screens

When you call a screen, the *Screen* command is added to the menu bar. The different submenu items are described below in the order in which they appear on the screen.

Attributes

With *Attributes*, you specify user-specific settings for the screen. At this point you can set, among other things, the start screen or you can modify the name of the screen. The start screen is the first screen to appear after the OP starts up.

Black/White

This menu item refers to the OP25 only. You use it to toggle the display of the configuration on the screen between Monochrome and Color.

Fields

Screens consist of different fields. There are various types of field; their use is unrestricted as far as the configuration of screens is concerned. ”Unrestricted” means that you can determine the numbers and types of fields, as well as their location and size.

When you select a field, the cursor assumes the symbol of the field. ProTool provides the following types of field:

– Text
– Character Graphic
– Graphic
– Input/Output
– Trend Graphic
– Text or Graphic List
– Bar

Zoom

You use this menu item to reduce or enlarge the display on the screen.

Surface

You use this menu item to customize the user surface while you are configuring – for example, the grid or the type of grid.

Print

You use this menu item to print the *Screens* chapter.

Tool Palette

A tool palette (figure 7-3) can be used as a shortcut to fields. You can display and hide it by means of this menu item. On the tool palette, the following types of field are represented as symbols. They are the same symbols as the cursor assumes when you select a field.

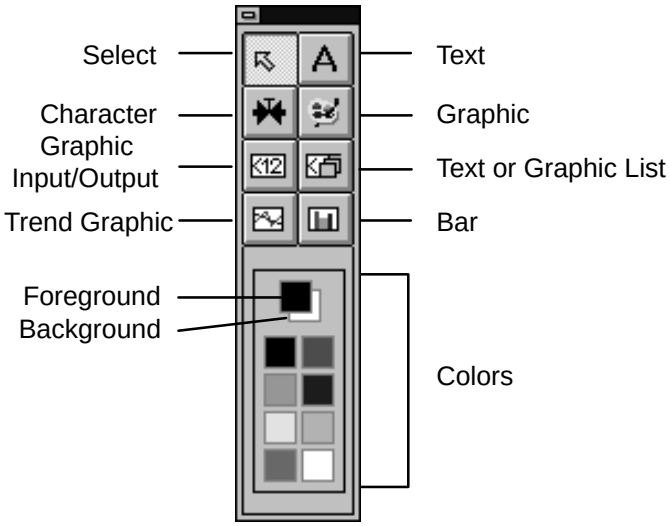


Figure 7-3 Tool Palette for Shortcuts to Fields

By means of the colors in the lower part of the tool palette, you define the color of the foreground (left mouse button) and that of the background (right mouse button). The current setting is displayed in the upper part of the color palette.

Character Graphics Palette

You use this menu item to display and hide the palette with the symbols for the *Character Graphic* field.

Size/Position

A dialog box containing the current position of the cursor and the size of the element that you selected is displayed or hidden.

Reference Text

For the active screen, the screen is displayed or hidden in the reference language.

7.1 Text, Character Graphic and Graphic

The static components *text*, *character graphic* and *graphic* of a screen are described in the following.

7.1.1 Text

Purpose

Depending on the configuration, text components refer to different parts of a screen in order to be able to assign the displayed fields to the actual process. In terms of the example in figure 7-1, the names `Mixing Unit`, `Tank 1` and `Tank 2` are static text components.

Fonts

Different fonts are available for identifying the relative priorities of text components within a screen by the font or type size. You can set up to four different fonts for the OP. Three fonts are language-dependent, the other is language independent. To use the different fonts, proceed as follows:

1. Choose *System* → *Fonts* from the menu.
2. Select the language and assign the fonts from the list on the left, *Windows Fonts*, to the right side.
3. Call a screen. Choose *Edit* → *Font* from the menu and select a font. If you now create a text field, the font you selected is used.

Language dependence

”Language-dependent” means that different fonts can be used for the three languages available on the OP. ”Language-independent” means that the same font is used in every OP language. By default, the symbol set is set for the language-independent font. The symbol set is used with the graphic character. The fonts have to be constant-width fonts. This means that every letter occupies an equal amount of space. By contrast, with proportional fonts every letter requires a different amount of space. In this particular case, for example, an ”i” requires less space than a ”w”.

Default setting

By default, ProTool fonts are supplied for the language-dependent fonts. However, you can also use Windows fonts. The only condition is that you use a constant-width font. For this reason, only these fonts are displayed in the list box of the *Fonts* dialog box.

7.1.2 Character Graphic

Purpose

With character graphics you compose graphics from different symbols. For example, you can create a rectangle from the characters ”|” and ”–”. One application of character graphics is tables, for instance.

When you select Character Graphic, a window containing the symbols available to you is opened (figure 7-4). You click on a symbol to insert it in the character graphic field.

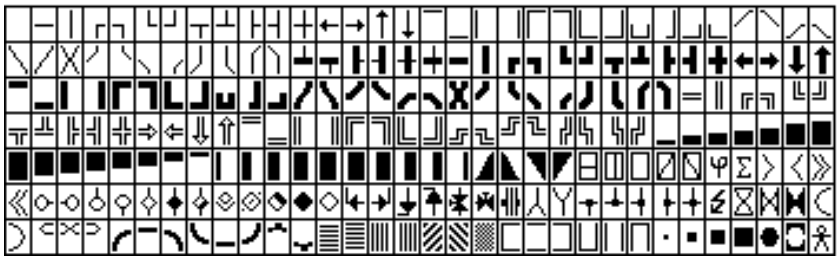


Figure 7-4 Character Graphic Symbols

Symbol packages

Symbol packages are grouped in the *Line Character* field. A symbol package contains the symbols for all directional representations. Specifically, this refers to horizontal and vertical directions, corners, crosses and bifurcations. Click on the arrow keys on the character graphics palette. Every click inserts the corresponding symbol in the graphic character field. Using CTRL and the arrow keys, you can draw lines quickly and simply.

User-specific symbol packages

Three fixed symbol packages are supplied with ProTool. These are the line characters `single`, `bold` and `double`. In addition, four other symbol pakkages are available, called `USER 1` to `USER 4`. You can modify and customize these symbol packages.

7.1.3 Graphics

Creating graphics

To create graphics, ProTool features the option of embedding external graphic editors via the OLE interface of Windows. You can thus always work with the tool you know best.

Graphics can be created directly by means of a graphics program or existing graphics can be embedded. To create or embed graphics, choose *Screen* → *Fields* → *Graphic* from the menu.

Representation in ProTool

Every graphic used in ProTool is represented as a bitmap, irrespective of whether the graphic was created with a pixel-oriented graphics program, such as Paintbrush, or a vector-oriented graphics program, such as Designer. Vector graphics are first converted into pixel graphics before being displayed in ProTool.

If you have created a graphic, Windows scales it so that it fits in the open field. If the graphic and the open field have different height/width ratios, this will result in distortions. We will give you a few tips on how to avoid this later in this chapter. Generally speaking, you should bear the following in mind:

1. Use pixel graphics mainly in those cases where the size of the window cannot be modified, such as with icons for soft keys.
2. You should use vector graphics when the size of the window has to be modified later.
3. If you use the same graphic in different sizes, you have to create several objects for them in ProTool. It is not possible for ProTool to scale to several sizes from a single graphic, but it creates the graphics several times over. This uses memory.
4. Always create graphics in your graphics program with the same height/width ratio as the open field in ProTool. Remember that a graphic having a size of, say, 10 x 20 cm cannot be reproduce faithfully from a pixel point of view in a field of 1 x 2 cm. In doing so, information is lost.

Creating icons for soft keys

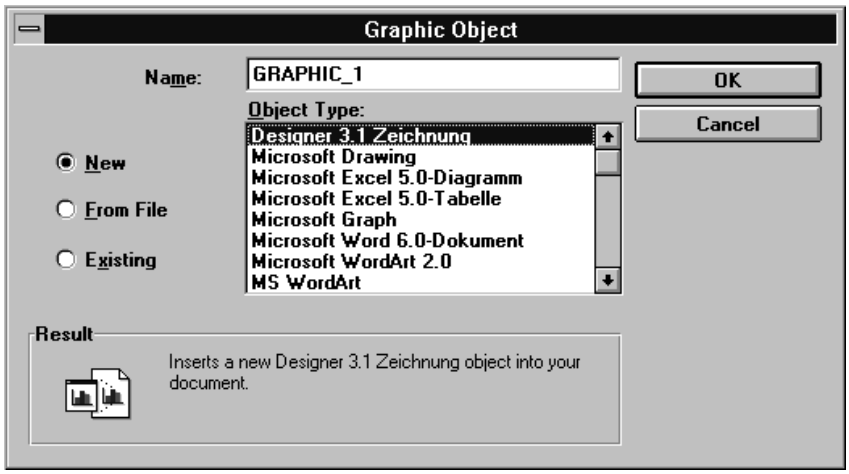
If you create icons for soft keys with a pixel editor such as Paintbrush, a border of the correct size is automatically set for you in the pixel editor.

If you are using a vector editor, you have to create the border yourself. In this instance, the height/width ratio x:y is as follows:

OP25	53 x 38 pixels
OP35/OP37/OP45	80 x 58 pixels

Embedding graphics

Create a graphic field. The dialog box shown below appears. A new name is displayed for the graphic in the dialog box:
GRAPHIC_ + serial number.



New

If you wish to create a new graphic, you are offered OLE-compatible applications. From these applications, select the one you want. ProTool initiates this application.

From File

If a graphic you want to embed exists already, you can enter its path and filename directly. Clicking the *Browse* button displays a menu tree from which you can select the file.

Existing

Click this option field to view all the graphic objects already in your configuration.

Preferred Applications

If you choose *Options* → *OLE Preferences* from the menu, you will find all the possible applications that ProTool offers as *Preferred Applications*.

This corresponds to the list box when you create new graphics. If you wish to restrict the list of *Preferred Applications* to the applications you use, remove the applications that you do not use.

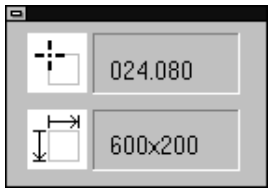
Constraints

You will find known constraints for graphics programs, graphic cards and drivers by clicking the *ReadMe* icon in the *ProTool* program group.

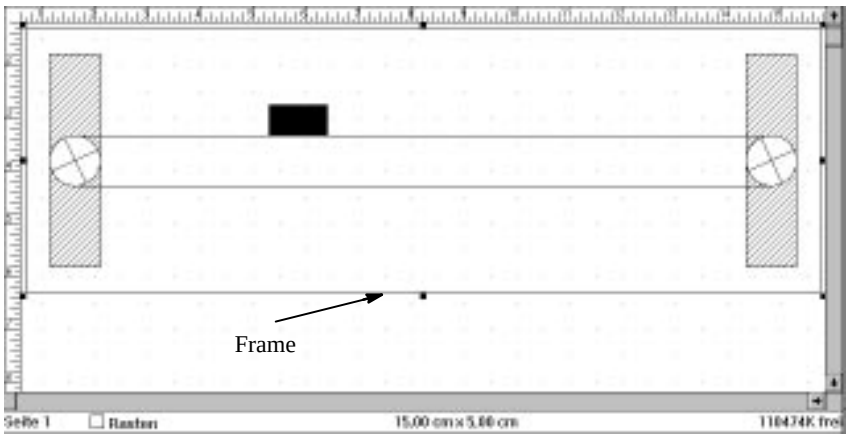
Example: Distortion-free graphics

To obtain distortion-free graphics, the sizes of the open graphic field in ProTool and of the graphic must be identical. In this way, distortions due to different scaling factors for x and y coordinates are avoided. To achieve this, proceed as follows:

1. Choose the menu item *Screen* → *Size/Position* and activate the box for position details. This box displays the present position of the mouse pointer or the size of the current object in pixels.

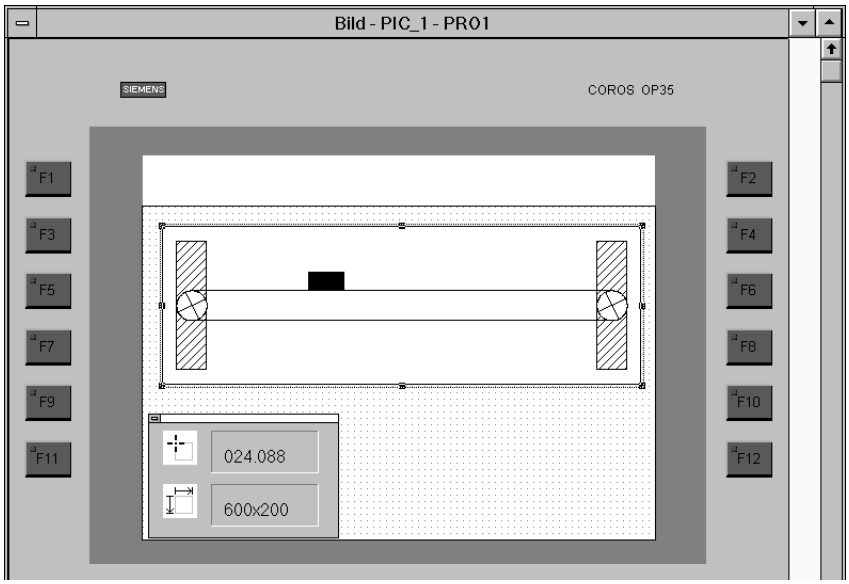


2. Open a graphic field having a size, say, of 600 x 200. This means that the field has a height/width ratio of 3:1. Note the pixel values specified in the lower section of the box.
3. Choose the graphic editor – for example, Designer – you require in the *Graphic Object* dialog box.
4. Display the ruler of the graphic editor (if it is not displayed by default).
5. Before you start on a drawing in a graphics program, create a frame first. The frame must have the same height/width ratios as the field in ProTool.
6. Create or import the graphic you require such that it does not protrude beyond the frame at any point. The following illustration shows a graphic in a 15 cm x 5 cm frame – that is, likewise a height/width ratio of 3:1.



7. Once you have finished the drawing, set the color of the frame to ”White”, so that it is not visible in the configuration. If you modify the graphic, you will still have your frame with the correct height/width ratio.

8. Return to ProTool. The graphic is now scaled without distortion.



Example: modifying a graphic

If you wish to modify the size of a vector graphic embedded in ProTool, it is not enough to change the field in ProTool. You must also modify its size in the graphic editor so that distortions do not occur. Proceed as follows:

1. Choose *Screen* → *Size/Position* from the menu and activate the box for position details.
2. Modify the size of the graphic field and note the details referring to its size.
3. Double-click the graphic field to start the graphic editor.
4. In the graphic editor, select all the objects of the graphic, including the frame, and enlarge the graphic with the same height/width ratio as in ProTool.
5. Close the graphic editor by updating the file. To do this, choose *File* → *Exit and return to ProTool*, or similar, from the menu, depending on the graphic editor you are using.

7.2 Input and Output

Input

With input fields, you enter a value on the OP and the value is transferred to the PLC.

Output

The current value is read from the PLC and displayed in the output field on the OP.

Input/Output

The current value is read from the PLC and displayed in the input/output field on the OP. You can also make inputs in the input/output field at the same time.

Symbolic input/output

Input and output may even be symbolic in all fields. ”Symbolic” means that work is performed with text or graphics instead of values. Either text or a graphic is assigned to the value of a variable.

Text symbol

For turning a motor on and off, for example, the values of a variable are not self-explanatory. Text is easier for the operator to understand. The assignment of values and text might look as follows:

```
0    OFF
1    SLOW
2    FAST
```

The OP now displays the corresponding text instead of a value.

Graphic symbol

If, for example, you wish to display the status (ON/OFF) of a valve on the screen, you can do this by assigning a graphic. The assignment of values and graphics might look as follows:

0 ⋈ (for CLOSED)

1 ⧗ (for OPEN)

The OP now displays the corresponding graphic symbol instead of a value.

Creating input/ output fields

You create input/output fields by choosing *Screen* → *Fields* → *Input/ Output* from the menu. The dialog box shown in figure 7-5 is opened. You create symbolic inputs and outputs by choosing *Screen* → *Fields* → *Text or Graphic List* from the menu.

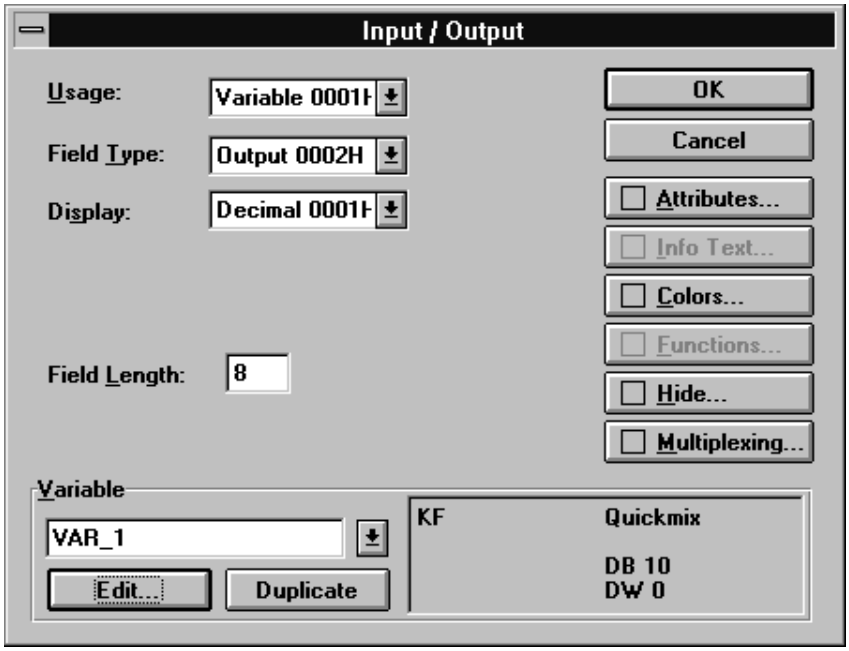


Figure 7-5 Input/Output Dialog Box

To display an input/output field on the OP, you have to provide the following details in your configuration. These details are:

Usage

The only setting that is possible here is *Variable*. You can use an input/output field only in conjunction with a variable.

Field Type

At this point you set the field as an input field, an output field or an input/output field.

Display

At this point you set how the contents of the field will be displayed. You can choose between different formats:
– decimal (as an integer or with digits behind the decimal point)
– hexadecimal
– binary
– string.

Field Length

The field length is specified as a number of characters. With message fields, an input value of `0` means that the field length is automatically adjusted to the variable.

Example: Configuring an input field

The procedure for configuring an input field is demonstrated in the following example for the SIMATIC S5:

1. Select *Input/Output* from the open screen either by choosing *Screen* → *Fields* from the menu or directly from the tool palette.
2. Position the mouse pointer within the screen at the position where you want to place the input field. Hold down the left mouse button and drag the field to the size you require. Then the *Input/Output* dialog box appears, in which you specify the input field.
3. Perform the following settings:

```
Usage           Variable
Field Type      Input
Display         Decimal
Field Length    5
Password Level  1
```

4. The field for variables displays the symbolic name *VAR_1*. Click the *Edit* button to edit a variable. The *Variable* dialog box appears.
5. Enter the following values in the *Variable* dialog box:
   DB: `10`
   DW: `2`
   Type: `KF`
   PLC: `PLC_1`
6. Exit from the *Variable* and *Field* dialog boxes by choosing *OK*.
7. You will now see the following display on the screen:
   `<234.`
   This represents the configured field, to which variable *VAR_1* is appended.

7.2.1 Input/Output Fields Containing a Symbolic Display

Usage

Text elements or graphics often explain a setting better than a value can. For this reason you can display the value of a variable symbolically in input/output fields. This means that you can display static components, such as text and graphics, dynamically too. ”Dynamically” means different text elements or graphics, different colors in a graphic, tilted graphic.

Text or graphic list

Symbolic inputs and outputs are entered by using text or graphic lists. To do this, choose *Screen* → *Fields* → *Text or Graphic List* from the menu.

If you want to assign text, select the *Text Symbol* display and edit the text list. For text lists, text is displayed or entered instead of the value of the variable. Text lists are possible with input and output fields. In the case of input fields, a window is displayed on the OP for selecting text.

If you wish to assign a graphic, select in the *Input/Output* dialog box *Graphic Symbol* as the display and edit the graphic list. The graphic used here has to be created directly using an application or has to be embedded as a file. For graphic lists, a graphic is displayed instead of the value of the variable. Graphic lists are possible only with output fields.

To edit the text or graphic list, choose *List* and click on the *Edit* button.

Formats of text or graphic lists

You can specify the values of variables in different formats – as a digit or as the state of a bit. This means that you can drive the display either by means of a digit or by means of a bit. In all, there are three different settings; their significance is as follows:

Decimal

The value of a variable is evaluated as a decimal. Text or a graphic may be assigned to any value between 0 and 9999. You can also assign text or a graphic to a whole range of values. For example, the string `Warming-up phase` might occur in the range from 0 to 10 and `Ready` in the range from 11 to 100.

Binary

The bits of a variable are evaluated. If a bit is set to 1, the assigned text or graphic appears on the display. In the case of text lists, the corresponding bit is set on the PLC when the text is selected.

Up to 16 bits of a data word can be assigned. In this instance, you can distribute the bits of a data word over several text or graphic lists. If you do not require all the bits of the data word in a text or graphic list, you can use the remaining bits in other text or graphic lists. The only condition is that no two bits can be set simultaneously by the PLC within a text or graphic list. If this were the case, a blank field would appear on the OP.

Bit

The status of a bit of the variable is evaluated. You can assign text or graphic for 0 or 1.

Example of a text list

The text list for the different operating modes of a motor might look as follows:

```
0    OFF
1    SLOW
2    FAST
```

Figure 7-6 shows the dialog box in which this example is configured.

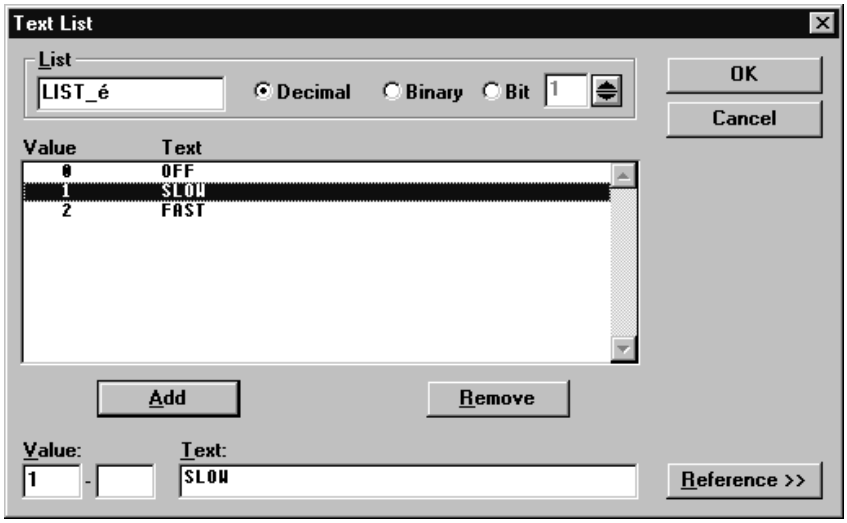


Figure 7-6 *Text List* Dialog Box

Example of a graphic list

The states ”OFF” and ”ON” should always be represented by a symbol. The corresponding variable values are `0` and `1`. The graphic list thus looks as follows:

`0`
`1`

1. Choose *Screen* → *Fields* → *Text or Graphic List* from the menu and click a rectangular field and drag.
2. In the *Input/Output* dialog, select *Display:* to read `Graphic Symbol`. Figure 7-7 shows the dialog box with the selection. Click at *List* on the *Edit* button.

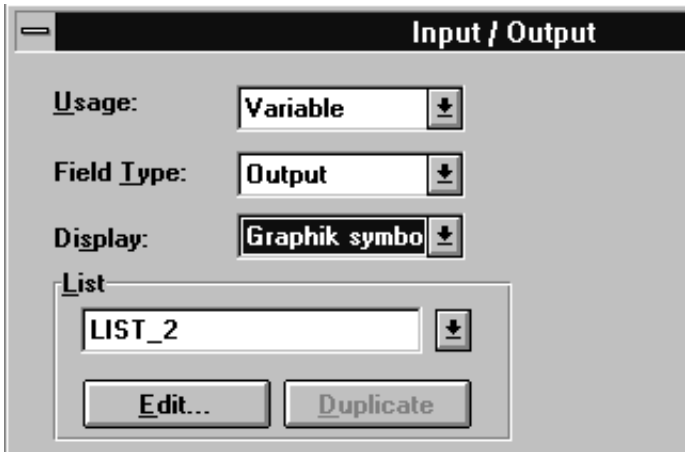


Figure 7-7 Selecting Graphic Symbols for Graphic Lists

3. Click in the *Graphic list* dialog box on the *New* button. Select the program called *Paintbrush* from the servers offered to you to choose from. Paintbrush is called. You will see a border of the same size as the field that you clicked and dragged. You can draw only within this border.
4. Create the symbol .
5. Update the file and exit from Paintbrush. The drawing you have just created is stored under the symbolic name *GRAPHIC_1*.
6. Click the *Add* button. Figure 7-8 shows how your dialog box should now look.

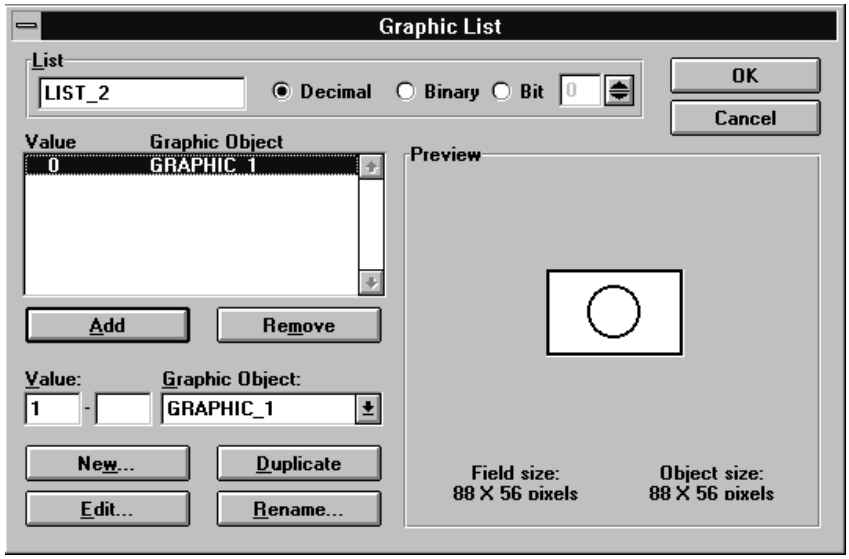


Figure 7-8 Creating a Graphic List

7. Click the *Duplicate* button. This causes your drawing to be copied and stored under the name *GRAPHIC_2*.
8. Click the *Edit* button and modify the drawing to  .
9. Update the file and exit from Paintbrush.
10. Enter `1` as the value and click the *Add* button.
11. Exit from all dialog boxes by choosing *OK* to apply the settings.

7.2.2 Dynamic Attributes

Usage

Attributes are available for input and outputs fields in ProTool to draw the user's attention to certain situations, for example exceeding a limit value. The attributes relate to the color of a field and its flashing. You can assign attributes dynamically, that is, a different value may apply depending on the value of the variable. For example, you can configure attributes in such a manner that the field is shown in red when the limit value is exceeded.

The attributes available for use are either linked to the value of a variable assigned to the input/output field or to a separate variable, referred to as the control variable. The advantage of control variables lies in the fact that they may influence several input/output fields simultaneously. This means, for example, that upon a change in production input/output fields flash, because fresh inputs have to be made by the operator.

To use a control variable, click in the *Dynamic Attributes* dialog box on the *Control* button. The *Control Variable* dialog box appears. As yet, the control variable is still de-activated. To activate it, remove the highlight from the *Deactivate* field. Then choose the variable with which you wish to control the variable.

Example of dynamic attributes

Figure 7-9 shows an example of the way in which the color of the output field indicates to the user whether he is in the normal or critical range.

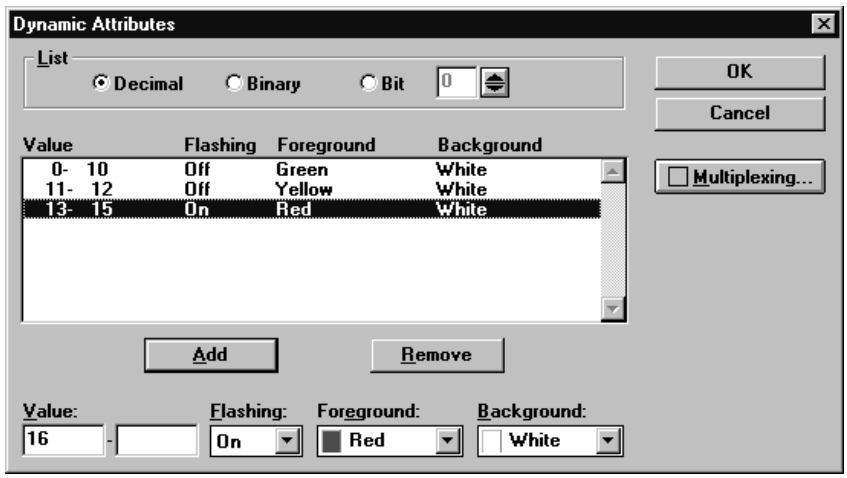


Figure 7-9 *Dynamic Attributes* Dialog Box

The example might have the following assignment:

Meaning	Range of Values	Attributes
Normal range	0 to 10	Color is green
Critical range	11 to 12	Color is amber
Limit value exceeded	13–15	Color is red and flashes

7.3 Bar graphs

Definition

A bar graph displays a value from the PLC in the form of a rectangular area. With bar graphs, you can recognize at a glance how far away the current value is from the limits or whether a specified setpoint has been reached. Bar graphs can be used to display parameters such as fill levels and quantities produced. Figure 7-10 shows a bar graph.

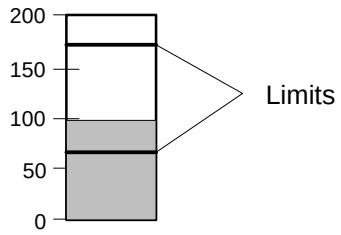


Figure 7-10 A Bar Graph

Settings

With bar graphs, you are free to define the labeling of the Y axis, the direction, the border, and the scale, bar graph and background colors in any way you like. You can include upper and lower limit lines to denote limit values.

Bar graphs are linked to the PLC by means of variables. You can use other variables in addition to the variable containing the bar graph value which you wish to display. Depending on the value of these variables, it is possible, for example, for a limit value to be visualized when it has been reached by means of a change of colors, or the field can be hidden or displayed.

Hiding fields

Depending on the configured value of a variable, it is possible for the *Bar* field to be hidden or displayed.

Example

The following example shows you how to configure a bar graph:

1. After opening the screen, choose *Screen* → *Fields* from the menu and select *Bar*, or select it directly from the tool palette.
2. Position the mouse pointer within the screen at the location where you wish to insert the field. Hold down the left mouse button and drag the field to the size you require. When you release the mouse button, the dialog box, which is shown in figure 7-11 and in which you specify the bar graph, is displayed.

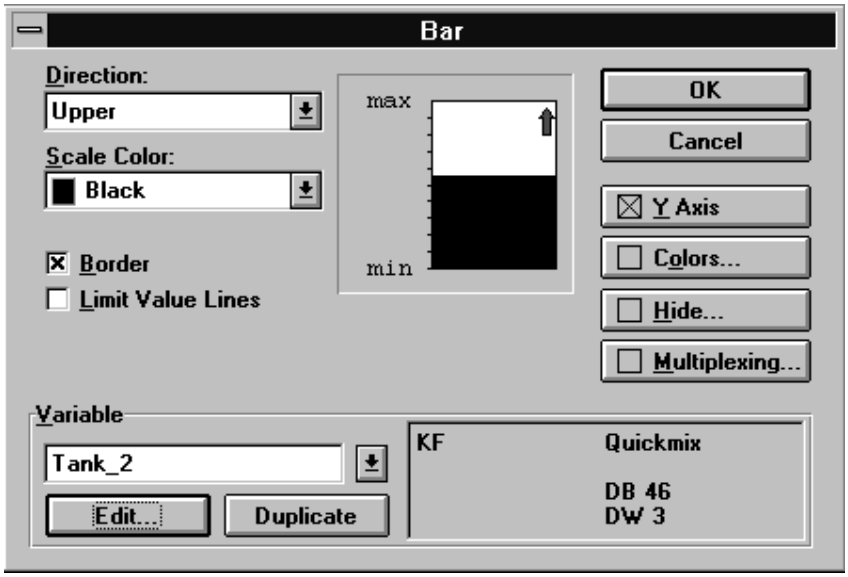


Figure 7-11 Specifying a Bar Graph

3. Apply the default settings for *Direction*, *Scale Color*, *Border*, *Y Axis* and *Colors*.
4. Click on *Edit* beneath *Variable*.
5. In the *Variable* dialog box, enter the *Name* as `Tank_2`. Under *Type*, assign the format *KF* to the variable.
6. Under *PLC*, enter the name you set earlier by choosing *System* → *PLC*, `Quickmix` from the menu, and enter the variable address as `DB46`, `DW3`.
7. With the *Limit Values* button, define the two constants as `175` for the upper limit value and `65` for the lower limit value.
8. Press `OK` in both cases to confirm your input and to exit from the *Limit Values*, *Variable* and *Bar* dialog boxes.

7.4 Trend Graphics

Definition

Trends are used continuously to display a value from the PLC. A trend graphic contains all the settings for the coordinate system such as scales of axes, the number of samples and colors. Up to four trends can be shown in a trend graphic simultaneously.

Trends may be created independently of the trend graphic. Every trend is stored under a symbolic name. Specify in the curve graphic the symbolic name of the trend(s) which you require to be displayed in the curve graphic. The total of all the configured trends is called the trend list.

Display types

Trends can be displayed in different forms – for example, as lines, dots or bars. In addition, you can also specify the shift direction of the trend. This depends on where the actual value of the trend is currently located.

Types of trend

We distinguish between two types of trend, depending on how trend values are recorded:

Trends
are suitable for slowly varying values. The OP reads the value from the PLC upon a clock pulse or trigger and stores it internally. When a screen containing the trend is called, the internal OP buffer is output and displayed.

Pattern trends
are for quickly changing values. In this instance the values are stored on the PLC. By setting a bit, the OP reads the memory area on the PLC and displays all the values together as a trend.

Coordinate axes

You first have to set the X and Y axes in a trend graphic. One of two Y axes can be assigned to any trend in the trend graphic. You can set the labeling of the X axis by using
– the time,
– the number of variables that can be displayed or
– a variable or a constant.

Display of the axes, and their labeling, can be enabled and disabled in the configuration.

Guide lines and limit value lines

You can define a horizontal guide line in the trend graphic for any Y axis. This means that, for example, you can insert a setpoint line in your trend graphic in order to obtain a quick overview of deviations from setpoints by actual values.

In addition, you can configure upper and lower limit lines for every trend.

Hiding trend graphics

Depending on the value configured for a variable, the trend graphic may be hidden or displayed.

Multiplexing trends

Trends can be controlled by a multiplex variable. A trend is assigned to every value of the multiplex variable. This means that, depending on the value of the multiplex variable, the corresponding trend is displayed on the OP.

To multiplex a trend, click the *Multiplexing* button in the *Trend Graphic* dialog box. Then assign the trends to the values of the variable. The multiplex variable is entered in the *Trend Graphic*dialog box instead of the trend (refer to figure 7-12). You can thus see the trends for which ”Multiplexing” is set at a glance.

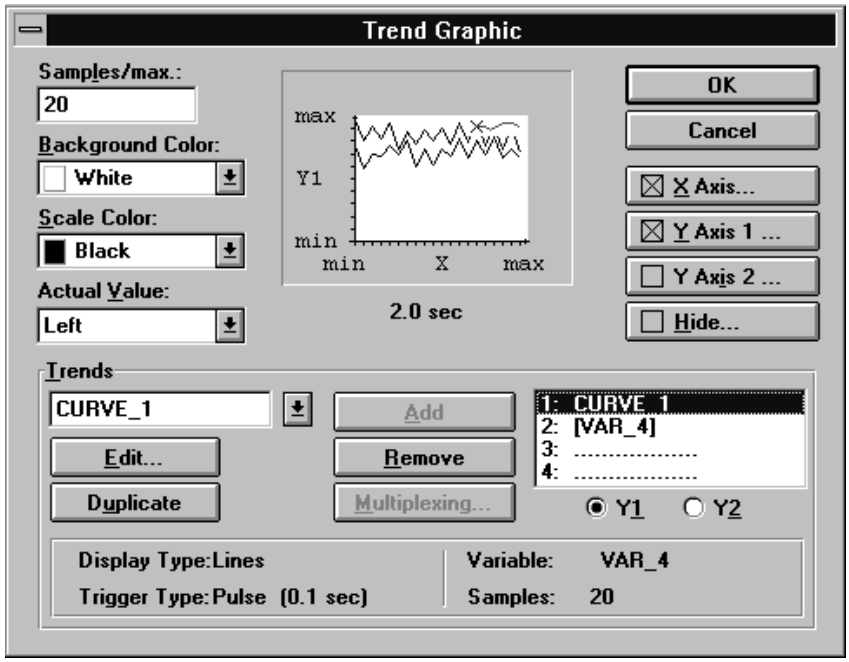


Figure 7-12 Multiplexing Trends

7.4.1 Trends

Reading trend data

Trends can be triggered by a clock pulse or a bit. Just one trend value is read from a variable for every clock pulse or trigger. The ”Samples/max.” of the trend are stored on the OP. Once the maximum number of samples of a trend has been reached, the oldest value is overwritten every time there is a new value.

Usage

Trends are suitable for displaying continuous variations such as the operating temperature of a motor.

Setting a trigger

Trends triggered by a clock pulse are set by selecting at *Trigger* the option `Pulse`. For bit-triggered trends, you have to set *Trigger* to `Bit` and `Value`. In this case, you have to define the two bit areas

- *trend request area* and
- *trend transfer area 1*

that are used by the OP and PLC to communicate with each other.

You define these areas by choosing *System* → *Area Pointers* from the menu. A specific trigger bit is assigned to every trend in all the bit areas. If, for example, trigger bit 4 has been assigned to a trend, the trend is identified in all the bit areas by bit 4. You will find a description of the bit areas under 7.4.2 *Pattern Trends*.

Example

The fill levels of `Tank_A`, `Tank_B`, `Tank_C` and `Mixer` are required to be recorded every 1.5 seconds and displayed in a combined trend graphic. The OP is required to display 24 values simultaneously (figure 7-13).

1. First define the common settings in the *Trend Graphic* dialog box:
   - Samples/max. `24`
   - Background Color `White`
   - Scale Color `Black`
   - X Axis
     - `Show Axis`
     - Labeling: `Samples/max.`
   - Y Axis
     - `Show Axis`
     - `Labeling`
     - Scale *Max*: *Constant* `2000`
       Min: *Constant* `0`

2. Then specify the first trend. In the *Trend* field, enter `Tank_A` and click *Edit*. Perform the following settings in the *Trend* dialog box:
   - Display `Lines`
   - Samples `24`
   - Color `Red`
   - Trigger `Pulse`
     `1.5 seconds`

   Specify under *Variable* the point at which the OP is required to read the values for trend `Tank_A`. Enter:
   - Name `Contents_A`
   - Type `KF`
   - DB `10`
   - DW `4`
   - PLC `Quickmix`

   Confirm with *OK*.
3. Apply the configured trend by choosing *Add* to the trend graphic.
4. Perform the settings for the three trends `Tank_B`, `Tank_C` and `Mixer` in a similar way to that for `Tank_A`. Assign a different color and/or display to every trend to distinguish the trends clearly from one another.

   Make sure when you are configuring that you use the same trigger type and trigger pulse for all the trends in the trend graphic.

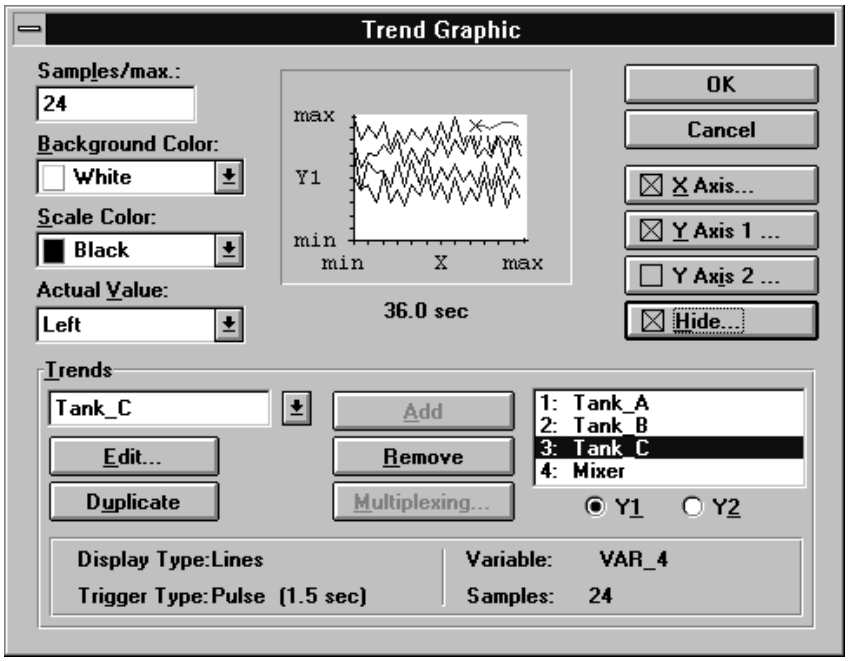


Figure 7-13 Configuring a Trend

7.4.2 Pattern Trends

Reading trend data

With pattern trends, all the trend values are read simultaneously out of a buffer on the PLC by setting a trigger bit and are displayed on the OP as a trend. The variable associated with the trend contains the start address of the buffer. The length of the buffer is not explicitly entered. It results from the number of ”Samples/max.” that are configured in the trend.

Usage

Pattern trends can be used for quickly changing values, for example, when only the overall variation – the pattern – is of interest. If values change more quickly than communications between the OP and the PLC can transfer them, the values have to be stored on the OP. The OP then reads out the whole buffer at once. One example of using pattern trends is injection pressure in manufacturing plastic components.

Setting trigger

Pattern curves are set by selecting *Trigger* `Bit` and `Buffer`. Since pattern trends are initiated by a trigger bit, you have to define at least two bit areas

- *trend request area* and
- *trend transfer area 1*

that are used by the OP and PLC to communicate with each other. The numbers located in the bit areas of figures 7-14 and 7-15 are the trigger bit for the trend.

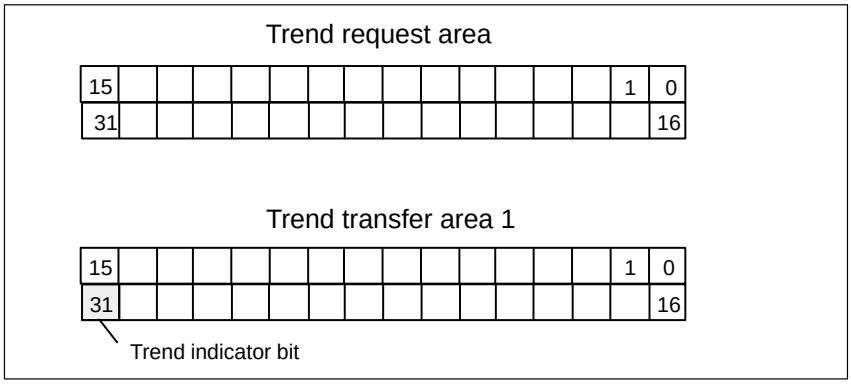


Figure 7-14 Bit Areas for Trends with the SIMATIC S5

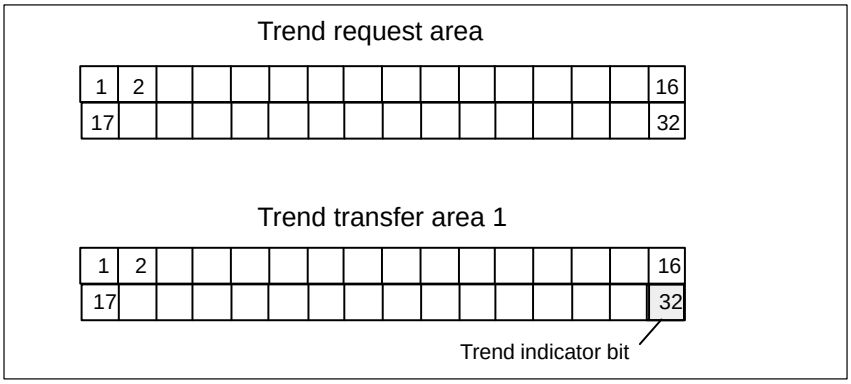


Figure 7-15 Bit Areas for Trends with the SIMATIC 500/505

You set these areas by choosing *System → Area Pointers* from the menu and create them on the PLC. A specific trigger bit is assigned in all the bit areas to every trend. If, for example, trigger bit 4 has been assigned to a trend, the trend is identified in all the bit areas by bit 4.

Displaying trends

If a screen is opened on the OP with one or more trends, the OP sets the corresponding bits in the *trend request area*. In the PLC program, set the bit assigned to the trend in the *trend transfer area* and the *trend indicator bit*. The OP detects the trigger and resets the trend bit and the trend indicator bit. Depending on the configuration, it then reads out a single value or the whole buffer.

Switch buffer

Let us assume that the process displayed as a pattern curve recommences while the OP is reading out the buffer. In this case values would be overwritten. To avoid this, a second buffer is created for the same trend. The second buffer has to be set in the configuration. To do this, you set under *Trigger* both *Bit* and *Switch Buffer.* You also have to create a bit area for buffer 2, *trend transfer area 2*. Its structure is exactly the same as that of *trend transfer area 1*

While the OP is reading values from buffer 1, the PLC writes the new values to buffer 2. While the OP is reading buffer 2, the PLC writes to buffer 1. Figure 7-16 shows this procedure.

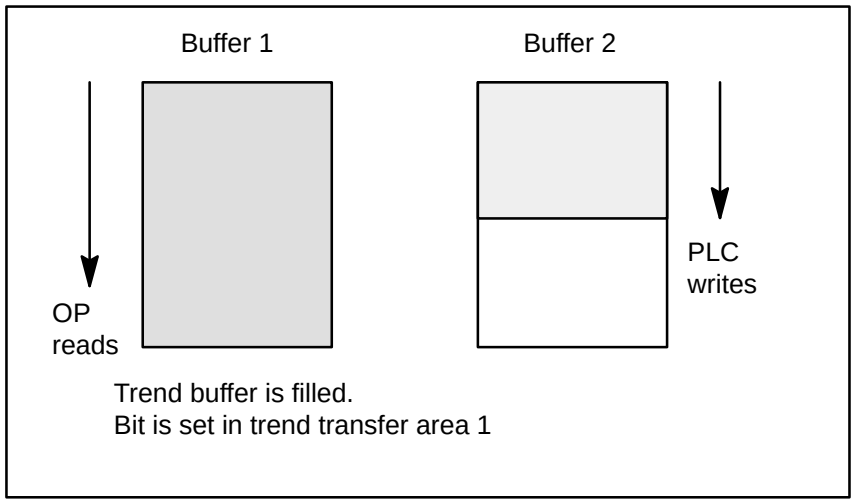


Figure 7-16 Switch Buffer

Example of SIMATIC S5

The configuration of a pattern curve with the necessary settings is explained in the following by means of an example. Figure 7-17 shows the different bit areas and the steps that have to be performed by the OP and the PLC. The trend is called `Trend_4`, since trigger bit 4 is assigned to it.

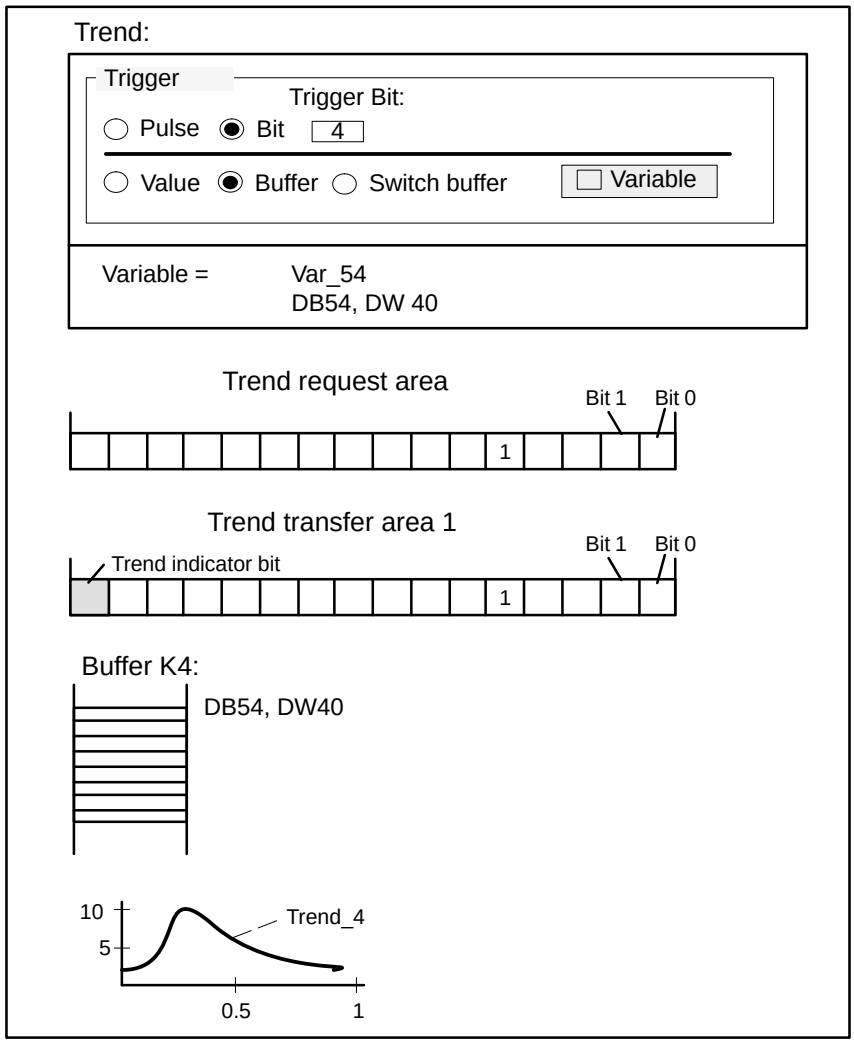


Figure 7-17 Interrelationships between Configuration and Display of Pattern Curves

Let us assume the screen is called on which `Trend_4` is configured. In the *trend request area*, the OP then sets bit 4 to `1`. If buffer 4 is full, the PLC sets bit 4 in *trend transfer area 1* to `1`. When the *trend indicator bit* is set, the OP then reads buffer 4, whose address is contained in variable `VAR_54`. The buffer is located on the PLC.

7.5 The Hide and Multiplex Options

Hide

Depending on the value of a variable, fields on screens can be displayed and hidden. This option is practical, for example, for displaying fields on the OP in the commissioning phase which are no longer visible during routine operation. The variable could be assigned by means of the current password level. The field is displayed only after the system administrator has logged in.

A different variable from that assigned to the field must be used to hide it. The conditions for hiding the field must be set in dependence of the variable. In this instance, you must take into account whether the variable is an integer or Boolean type variable. A few examples are listed below.

Example involving integer variables:

Variable > 10
Variable < 50 The field is hidden when the variable is in the range from 11 to 49.

Variable > 50
Variable < 10 The field is hidden when the variable is outside the range from 10 to 50. Figure 7-18 shows this setting.

Example involving Boolean variables (not with SIMATIC S5):

Variable >
Variable < 1 The field is hidden when the variable is 0.

Variable > 0
Variable < The field is hidden when the variable is 1.

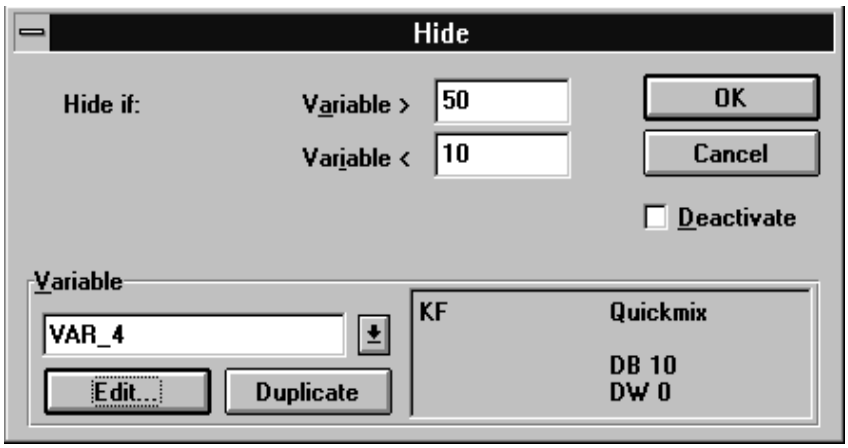


Figure 7-18 *Hide* Dialog Box

Multiplexing

ProTool features an option for assigning different variables to a field. This is known as multiplexing. A variable can be assigned to every value of a variable called an index variable. The variable just being used depends on the value of the index variable. This means, for example, that all the variables of a screen could be controlled by means of the index variable. This means that there is no need to configure several screens for identical applications.

Example of Multiplexing

Figure 7-19 shows a practical example. On a bar graph, we want to display the contents of tank *T1*, *T2* or *T3*, as a function of switch position *S1*. To do this, the index variable *VAR_S1* is assigned to switch *S1*. The contents of the tanks is read from variables *VAR_T1* to *VAR_T3*.

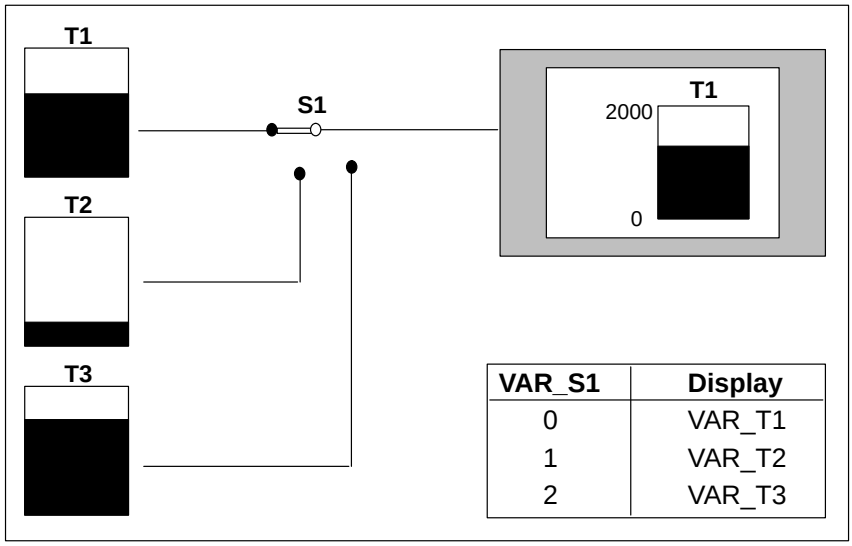


Figure 7-19 Example of Multiplexing Variables

In the example shown below, the variables *VAR_T1* to *VAR_T3* are assigned to three values of index variable *VAR_S1*. The PLC in this example is a SIMATIC S7.

Value of *VAR_S1*	Display from
0	*VAR_1*
1	*VAR_2*
2	*VAR_3*

1. Create a field for bar graphs on a screen by choosing *Screen* → *Fields* → *Bar* from the menu. The *Bar* dialog box appears.

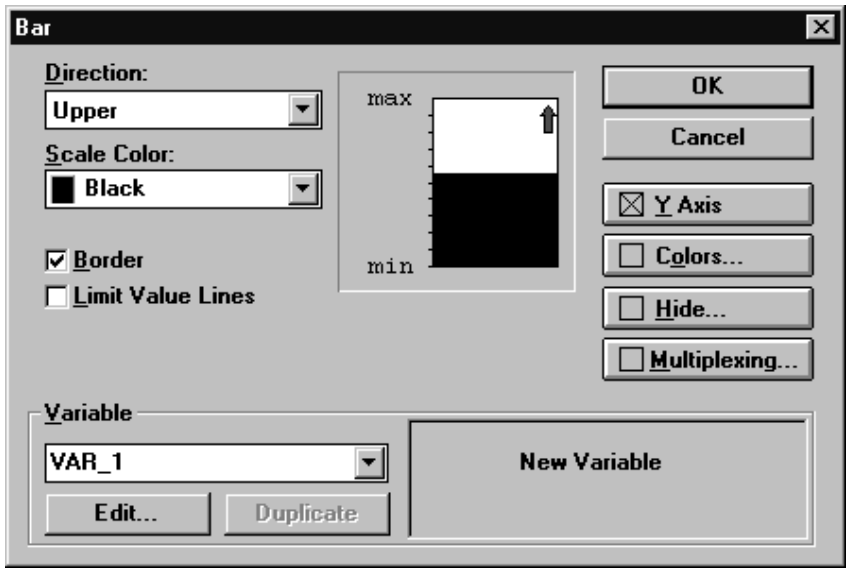


Figure 7-20 Creating the Index Variable for Bar Graphs

2. Click the *Multiplexing* button.
3. Enter the symbolic name `Var_S1` in the *Index Variable* field. Click *Edit* in order to edit the variable. The *Variable* dialog box is opened.
4. Type in:

Type:	`INT`
DB:	`15`
DBW:	`0`
PLC:	`PLC_1`

   Depending on the switch position, *VAR_S1* assumes a value of *0*, *1* or *2*. A variable (*VAR_T1*, *VAR_T2* and *VAR_T3*) representing the current value of tank *T1*, *T2* or *T3* is assigned to every one of these three values.
5. Enter the symbolic name `VAR_T1` in the *Variable* field. Click *Edit* in order to edit the variable. The *Variable* dialog box is opened.
6. Enter:

Type:	`INT`
DB:	`16`
DBW:	`2`
PLC:	`PLC_1`

7. Now, click the *Add* button in the *Bar* dialog box. The variable *VAR_T1* is applied to the display field and assigned to the value (index) `0` of index variable *VAR_S1*.
8. Repeat steps 5. and 7. for variables *VAR_T2* and *VAR_T3*. Figure 7-21 shows the appearance of the corresponding configuration.

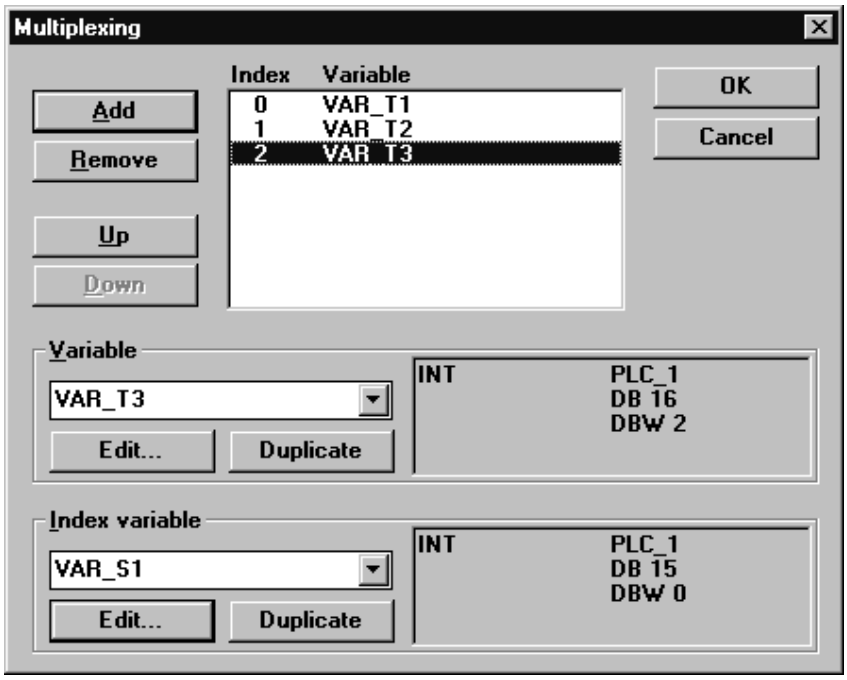


Figure 7-21 *Multiplexing* Dialog Box

9. Exit from the *Multiplexing* dialog box by clicking *Ok*. There is now a check mark on the *Multiplexing* button in the *Bar* dialog box to indicate that multiplexing is in use (refer to figure 7-22). In addition, the index variable is specified instead of the *Variable* field.

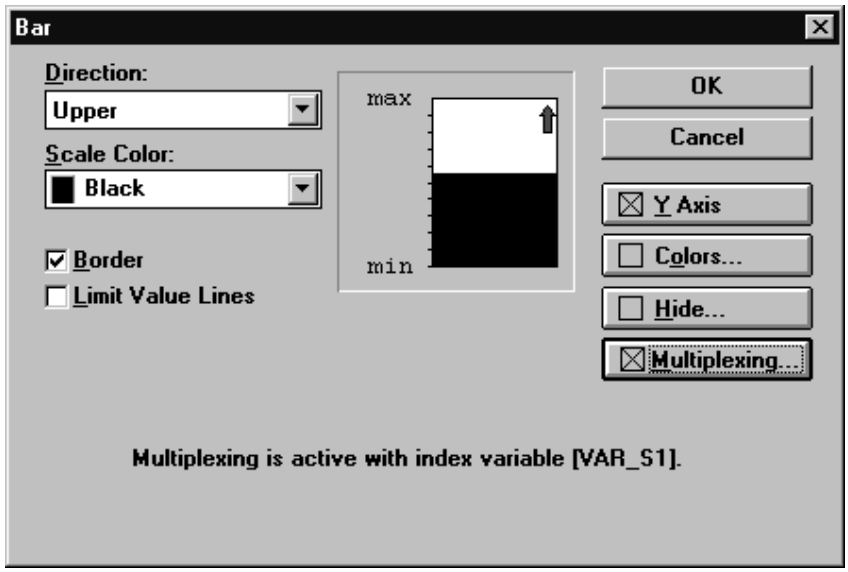


Figure 7-22 *Display with Active Multiplexing*

7.6 Detecting a Called Screen on the PLC

Application

To be able to detect on the PLC the screen that has just been called on the OP, you have to create a *Screen Number* area on the PLC. The OP stores in formation in the screen number area about the screen called on the OP.

In this way it is possible to transfer information on the current contents of the OP display to the PLC. Certain reactions can be initiated in the PLC program – for example, calling another screen or selecting an LED.

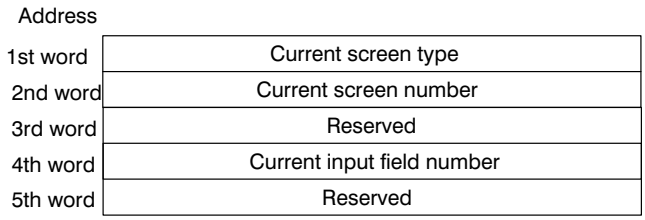
Condition

If you wish to use the screen number area, you have to specify it during configuration as *Area Pointer* – Type *Screen Number.* It can be created only on one PLC – and once only.

The screen number area is transferred spontaneously to the PLC, i.e. a transfer takes place whenever a change is registered on the OP. There is therefore no need to configure a polling time.

Structure

The screen number area is a data area having a fixed length of five data words. The structure of the screen number area is displayed below.



Entry	Assignment
Current screen type	1: screen
Current screen number	1 to 65535
Current input field number	0 to 65535

Event Messages and Alarm Messages

8

Overview

Event messages and alarm messages are initiated by the PLC. They contain information about events and states in the control process. Alarm messages have to be acknowledged on the OP. After being issued, event messages and alarm messages are stored in separate message buffers on the OP. Stored messages can be displayed on the OP and output to an attached printer.

Variables

A message consists of static text and/or variables. You can freely configure text and variables. Before you can use variables in a message, you have to insert a field. With event messages and alarm messages, you can use only output fields.

Assigning functions

You can assign functions to event messages and alarm messages. You have to set in your configuration the functions that you want to have initiated for the different events. Events are the

– arrival of a message
– acknowledgement of a message (alarm messages only)
– departure of a message.

You select functions in the attribute window of the message editor.

Printout

So that you can print messages on your printer, you have to check in your configuration the *Print* attribute in the *Attribute Window* of the message editor for every message you want to have printed. By choosing *System* → *Parameters* → *Messages* from the menu, you can perform the following settings for printing messages:

- *Messages*: The printing of all events is enabled.
- *Off*: Message printing is disabled.
- *Overflow*: When a message buffer is full, the OP deletes messages before new ones are entered. If the *Overflow* field is checked, all the messages are printed prior to deletion. This is done irrespective of whether the *Print* attribute has been set.

Overflow warning

If you choose *System* → *Parameters* → *Messages* from the menu and check the Overflow Warning field, a warning is issued on the OP as soon as the configured remaining space of the message buffer is reached or the space is less than that configured. You can set the remaining buffer size. By default, the setting is 10 %.

Relay/port

You can directly use a message to drive an output on the OP. This might be as follows:
– a relay drive circuit
– a port drive circuit (with direct key module only)

Message priority

You can set the message priority of a configured message in the attribute window of the message editor under *Priority.* If more than one message is present, the messages are displayed according to their configured message priorities (1: low through 16: high).

Message areas

You have to define in your configuration an *event message area* for event messages and an *alarm message area* for alarm messages. You set the message areas by choosing *System → Area Pointers* from the menu.

An event message or an alarm message can be configured for every bit in the configured message area. When the address area concerned is created, the number of messages which you can create in it is displayed.

Every message area can be divided into several address areas. Table 8-1 shows the number of message areas for event messages and alarm messages, the number of alarm acknowledgement areas and the overall length of all areas for the different OPs.

Table 8-1 OP Message Areas

Device	**Event Message Area**		**Alarm Message Area and Alarm Acknowledgement Area**	
	Total	**Length** (Words)	**Total per Type**	**Overall Length per Type** (Words)
OP25	8	125	8	125
OP35	8	125	8	125
OP37	8	125	8	125
OP45	8	125	8	125

Message number

The message numbers are listed in the left margin of the message editor. A bit number is assigned to each message number. This means that you can immediately see the bit to which a configured message belongs in the event message area or the alarm message area. Further, the status bar displays the address to which the message belongs.

Assigning message area and message number

The assignment of message areas and message numbers is illustrated below by means of an example.

Example 1 for SIMATIC S5:
Let us assume that the following message area was configured for the SIMATIC S5 PLC:

```
DB 60       Address 43  Length 5 (in DW)
```

Figure 8-1 shows the assignment of bit numbers and message numbers for data words. Message numbers and bit numbers are assigned automatically on the OP.

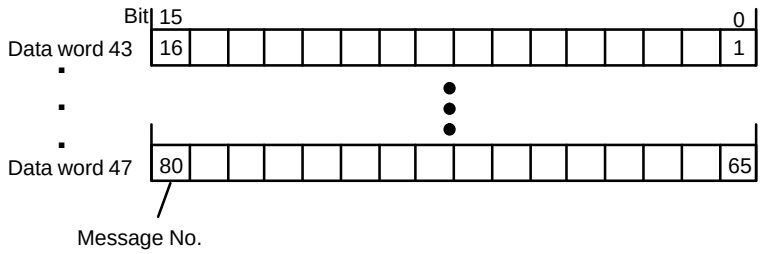


Figure 8-1 SIMATIC S5:
Message Area and Message Number Assignment for Data Words

Example 2 for SIMATIC 500/505:
The assignment of message areas and message numbers is illustrated below by means of an example. Let us assume that the following message area was configured for the SIMATIC 500/505 PLC:

```
V 43        Length 5    (in DW)
```

Figure 8-2 shows the assignment of a total of 80 (5 x 16) message numbers to the individual bit numbers in the event message area of the PLC.

Their assignment is performed automatically on the OP.

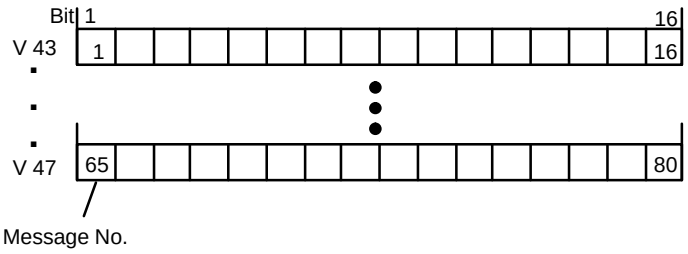
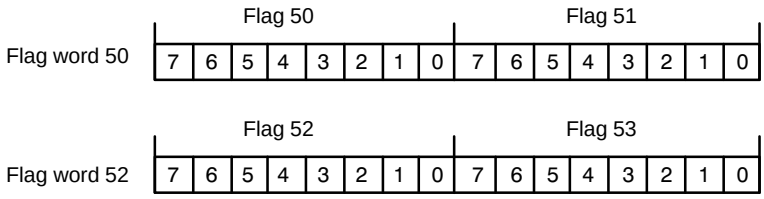


Figure 8-2 SIMATIC 500/505:
Message Area and Message Number Assignment

Example 3 for SIMATIC S5:
You can also define the message area in flag words. For the example below, the following alarm message area was defined:

`FW 50` `Length 2` (in FW)

Figure 8-3 shows the assignment of message numbers and bit numbers for flag words.



Flag No.	Message No.
F51.0	1
...	...
F51.7	8
F50.0	9
...	...
F50.7	16
F53.0	17
...	...
F53.7	24
F52.0	25
...	...
F52.7	32

Figure 8-3 SIMATIC S5:
Message and Message Number Assignment for Flag Words

8.1 Event Messages

Definition

Event messages display a status such as

- Motor switched on
- Motor off
- Motor speed of xx/min reached
- PLC to manual mode
- Operating temperature of xx reached

The configurer defines what constitutes an event message. With event messages, the status of a bit in the PLC is evaluated on the OP. If the bit is set in the PLC, an event message is initiated on the OP. The configurer defines the bits that will initiate an event message.

Standby message

If an event message numberered 0 is configured, it is interpreted to be the standby message. The standby message is displayed in the event message window when event messages are not waiting. If a *message line* was configured, the standby message is always visible when messages are not waiting. The standby message may consist only of text.

Procedure

If a bit is set in the event message area in the PLC program, the OP detects the corresponding message as having **arrived** and displays it. If the bit is reset, the OP detects the message as having **departed**. The message is not displayed any more.

Configuration example for SIMATIC S5

In this example, you first configure the event message area, followed by an event message containing a field.

1. Choose *System* → *Area Pointers* from the menu to create the event message area. The *Area Pointers* dialog box is opened (figure 8-4).

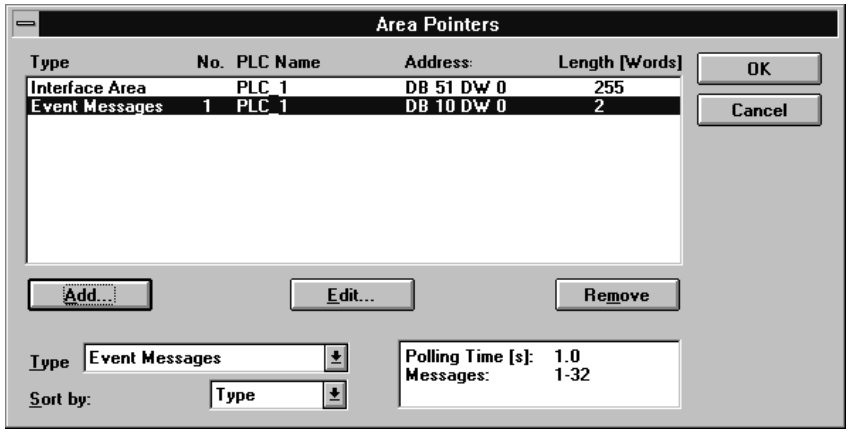


Figure 8-4 *Area Pointers* Dialog Box

2. Select in the *Type* field the area pointer for *Event Messages*. Press the *Add* key. The *Event Messages* dialog box is opened.

3. Enter:

DB:	`10`
DW:	`0`
Length:	`2`
PLC:	`PLC_1`

   You have now created an event message area for 32 event messages.

4. Exit from the *Event Messages* dialog box by choosing *OK* in order to apply the settings. Exit from the *Area Pointers* dialog box, likewise by choosing *OK*.

5. Call the editor for *Event Messages*.

6. Position the cursor on message No. 1.

7. Enter the following message:

```
Motor speed of {Var_2}/min reached
```

   where `{Var_2}` is an output field.

8. To insert the output field, choose *Messages* → *Edit/Insert Field* from the menu. The *Message Field* dialog box is opened.

9. Set:

Display:	***Decimal***
Field length:	***4***

10. Enter in the *Variable* field the symbolic name `Var_2`.
    Click *Edit* so that you can edit the variable. The *Variable* dialog box is opened.

11. Enter:

Type:	`KF`
DB:	`10`
DW:	`3`
PLC:	`PLC_1`

12. Exit from the *Variable* and *Message Field* dialog boxes by choosing *OK*.

Figure 8-5 shows the configured event message.

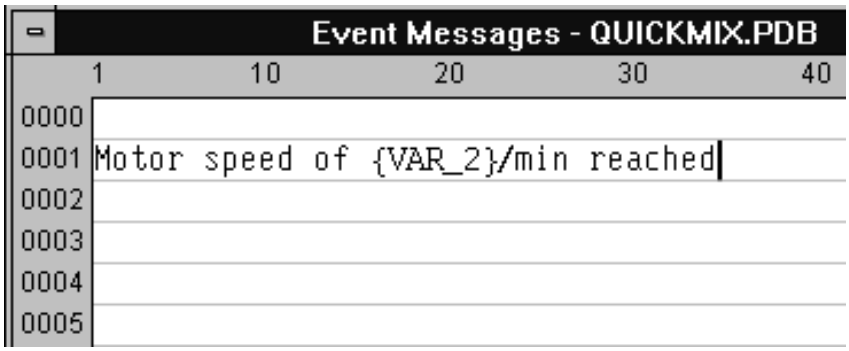


Figure 8-5 Configured Event Message

8.2 Alarm Messages

Definition

Alarm messages display an operating fault such as

- Motor temperature too high
- Coolant empty
- Valve will not open
- Fault, compressor 4
- Switch M208 open

The configurer defines what constitutes an alarm message. With alarm messages, the status of a bit in the PLC is evaluated by the OP. If the bit is set on the PLC, an alarm message is initiated on the OP. The configurer defines the bits which initiate an alarm message.

Acknowledging

Since alarm messages are used to display extraordinary operating states, they have to be acknowledged. Alarm messages are acknowledged either by an operator input on the OP or by the PLC.

Procedure

If a bit is set in the alarm message area in the PLC program, the OP detects the corresponding message as having **arrived** and displays it. If the bit is reset, the OP detects the message as having **departed**. Only when the message is acknowledged is it no longer displayed.

Acknowledgement areas

If you require the PLC to be informed when an alarm message has been acknowledged or if the PLC itself is to be able to acknowledge alarm messages, you have to create suitable acknowledgement areas by choosing *System* → *Area Pointers* from the menu. The acknowledgement areas are as follows

- **Alarm Acknowledgement Area PLC → OP**
  A bit set in this area by the PLC causes the corresponding alarm message to be acknowledged on the OP.

  The Alarm Acknowledgement Area PLC → OP
  – must be contiguous without the corresponding event message area
  – must have the same polling time as the alarm message area
  – can have a maximum length equal to that of the corresponding alarm message area.

- **Alarm Acknowledgement Area OP → PLC**
  A bit set in this area by an operator input on the OP reports the acknowledgement of the corresponding alarm message to the PLC. The acknowledgement area OP → PLC can have a maximum length equal to that of the corresponding alarm message area.

Assigning acknowledge bits to message numbers

The same bit x of the alarm message area and the same bit x of the acknowledgement area are assigned to every alarm message number. Normally, the acknowledgement area have the same length as the alarm message area and must be contiguous with the alarm message area.

Acknowledgement groups

When you are configuring alarm messages, you can place several messages together to form an *acknowledgement group*. In this way, when the first alarm message is acknowledged – for example, the cause of the fault – all the other alarm messages of the same acknowledgement group (consequential faults) are acknowledged at the same time.

To do so, assign a value between 0 and 16 to every alarm message under *Acknowledgement* in the *Attribute Window* of the message editor. A blank field is the equivalent of entering 0. The value 0 results in individual acknowledgement; this means that when you acknowledge an alarm message, only that alarm message is acknowledged. If you acknowledge any alarm message of acknowledgement groups 1 through 16, all the alarm messages in that group are acknowledged simultaneously.

Display options

By choosing *System* → *Parameters* → *Messages* from the menu, you set whether the last or first alarm message to arrive should be displayed. To do this, check either of the fields *First* or *Last*. This setting is important whenever there are several messages waiting at any one time.

Configuration example for SIMATIC S5

In this example, you first configure the alarm message area, followed by an alarm message.

1. Choose *System* → *Area Pointers* from the menu to create an alarm message area. The *Area Pointers* dialog box is opened (figure 8-6).

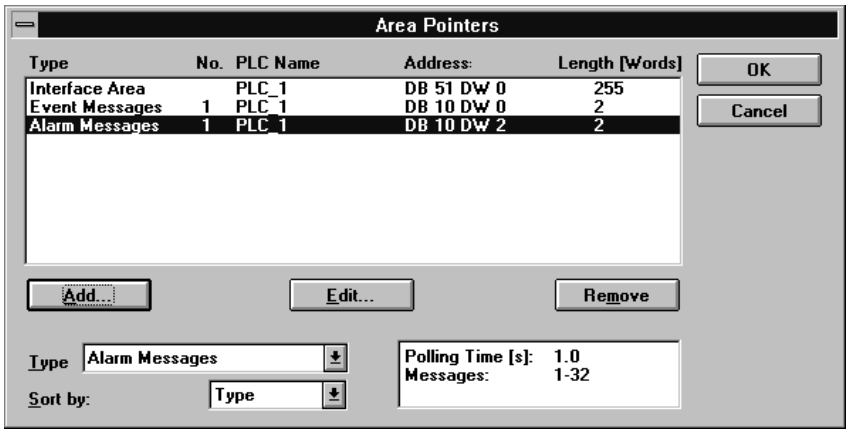


Figure 8-6 *Area Pointers* Dialog Box

2. Select the area pointer for *Alarm Messages* in the *Type* field. Press the *Add* key. The *Alarm Messages* dialog box is opened.

3. Enter:

	DB:	`10`
	DW:	`2`
	Length:	`2`
	PLC:	`PLC_1`

   You have now created an alarm message area for 32 alarm messages.

4. Exit from the *Alarm Messages* dialog box by choosing *OK* to apply the settings. Exit from the *Area Pointers* dialog box, likewise by choosing *OK*.
5. Call the editor for *Alarm Messages*.
6. Position the cursor on message No. 1.
7. Enter the following message:

   ```
   Motor temperature too high
   ```

8. Perform the following settings in the attribute window:

   Priority: `1`
   Acknowledgement: `8`
   Print: `x`

Figure 8-7 shows the configured alarm message.

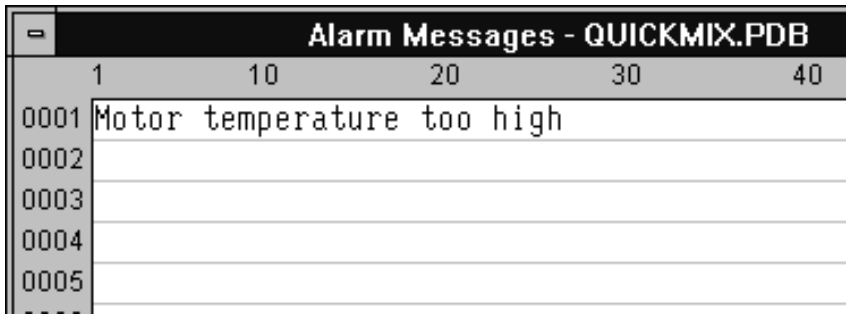


Figure 8-7 Configured Alarm Message

Recipes

9

Overview

Recipes are groups of variables for a specific application. The purpose of recipes is to download several items of data en bloc to the PLC. Furthermore, the OP and the PLC are synchronized.

In the configuration, the recipe defines the data structure. Data are assigned to the structure on the OP. Since the data structure can be assigned several times, we now speak of data records. Data records are stored on the OP, thus saving storage space on the PLC.

Organization of the chapter

The chapter is divided into two general parts. The first part provides detailed information about recipes. That is the theoretical part. The second part presents an example of how to configure a recipe, create a data record and download it to the PLC. If you wish to become familiar with recipes by referring to an example, go straight to section 9.5.

Example of a recipe

A practical example of a recipe is the bottling machine of a fruit juice system. Let us assume that orange nectar, an orange juice drink and orange juice all have to be produced on the same bottling machine. The ratios of mixture differ from drink to drink, but the ingredients are the same. To accomplish this, the *Mixture* recipe, containing the following data structure, is created:

```
Var_23      Name
Var_11      l Orange
Var_7       l Water
Var_19      kg Sugar
Var_21      g Flavor
```

Data records now contain the values for the different drinks. The data records might look as follows:

Orange Drink		Orange Nectar		Orange Juice	
Name	**Drink**	Name	**Nectar**	Name	**Juice**
l Orange	**90**	l Orange	**70**	l Orange	**95**
l Water	**10**	l Water	**30**	l Water	**5**
kg Sugar	**1.5**	kg Sugar	**1.5**	kg Sugar	**0.5**
g Flavor	**200**	g Flavor	**400**	g Flavor	**100**

Ingredients of a recipe

A recipe comprises several variables and their names, called entry names. Entry names are displayed on the OP. This means that a variable can be identified, such as `l Orange` in the preceding example, to denote orange as a constituent part of the mixture. Figure 9-1 shows the dialog box used to create recipes.

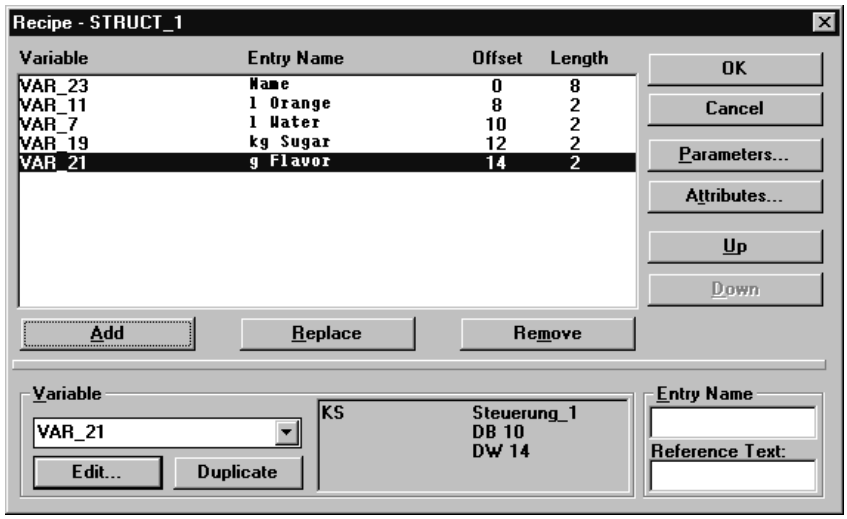


Figure 9-1 *Recipe* Dialog Box

Data records are created on the OP by saving the instantaneous values of variables.

Variables used in recipes may also occur in other objects such as screens. The following example shows one application.

Description of example

Let us assume that there are separate screens, containing a storage tank, valves, quantity consumed and other details, for all of the ingredients, i.e. orange, water etc. The screens contain input fields for setting the intake amounts for the mixer. The ratios of mixture can thus be entered screen by screen, and then the mixer can be started. This process has to be repeated for every fruit juice. This process is beneficial when, for example, the system is undergoing commissioning.

Identical variables on screens and recipes

If the variables of input fields are combined to form a recipe, mixtures for the different fruit juices that have been completed can be stored by creating data records on the OP. Figure 9-2 illustrates how variables are used on screens and in a recipe.

If you now wish to produce a specific fruit juice, the corresponding data record is downloaded to the PLC. This means that the requisite values are assigned to all of the variables.

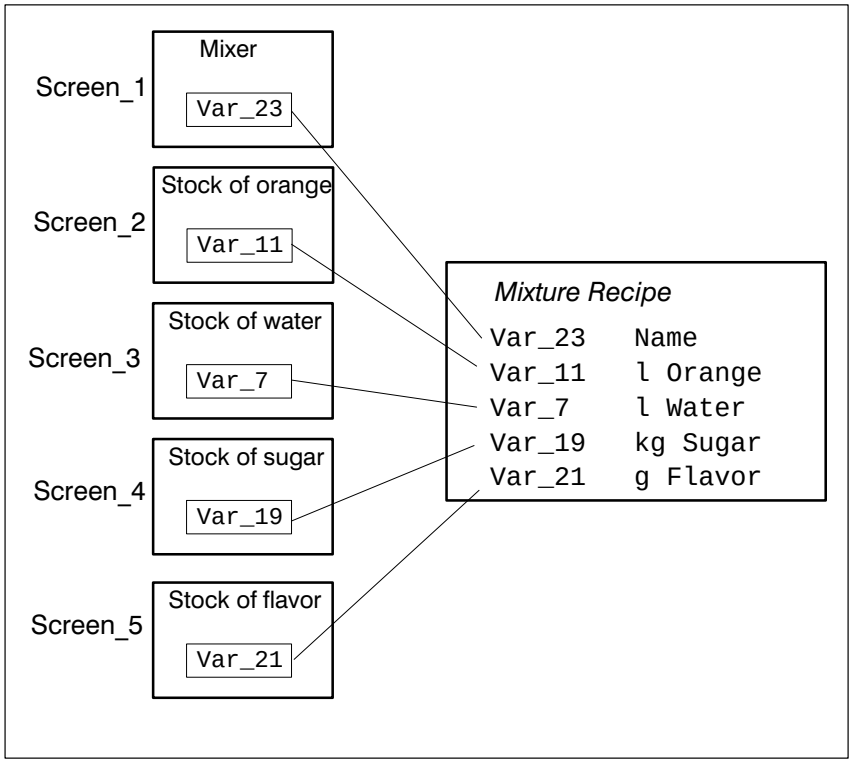


Figure 9-2 Identical Variables on Screens and in the Recipe

9.1 Creating Recipes

Identifying a recipe on the OP

A recipe is stored under a symbolic name in your configuration. You also select the recipe by its symbolic name on the OP. The recipe is simultaneously numbered, the number being specific to that configuration. You can modify the recipe's name and number by choosing the *Attributes* button in the *Recipes* dialog box.

Identifying a recipe on the PLC

There are three *identifications* available for identifying a recipe on the PLC. You enter the identifications in the *Parameters* dialog box. The identifications can be defined freely. ProTool automatically enters the recipe number in the first identification. Only these identifications are written to the PLC when a data record is downloaded.

Identifying a data record

You create a data record with a symbolic name on the OP. This name applies only to the OP. When a data record is downloaded, only the data and the identifications of the recipe are downloaded. For the PLC, there is no particular identification available for the data record apart from the recipe identification. If you wish to identify the data record on the PLC, create in the recipe a variable containing the name of the data record.

Using variables

Only certain settings are meaningful for variables used in recipes. In addition, the settings impact on the download.

Variables used in recipes must have an address on the PLC and the attribute `Write Directly`. Only variables of this type are downloaded to the PLC when a data record is downloaded. Variables not having an address are not included in the download.

The attributes are set in the *Variable* dialog box by pressing the *Options* button. Figure 9-3 shows the *Variable* and *Options* dialog boxes with the corresponding settings.

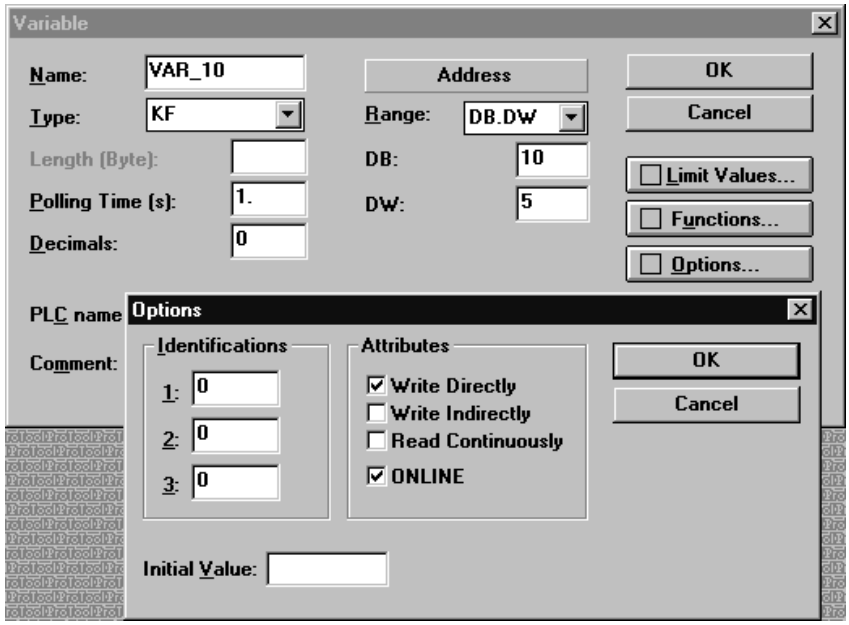


Figure 9-3 Dialogboxen *Variable* und *Options*

Standard screens for Recipes

For creating, saving and downloading data records on the OP, two standard screens, `Z_RECORD_1` and `Z_RECORD_2`, are available. If you wish to use these screens on the OP, you have to be able to call them. Both screens are available in their standard configuration but are not embedded as yet. Embed the standard screens in your configuration by assigning the ”Select Screen” function, say, to a function key. Specify the parameter as standard screen `Z_RECORD_1` or `Z_RECORD_2`. If you wish to use both standard screens, you must assign them to separate function keys.

Text list for recipes

After you have created the first recipe, a *text list* called `Z_RECIPES` is created. This text list is used on the standard screens supplied for data records. The order in which the recipes are entered in the text list is determined by the recipe number. You can also see this order on the OP when you select a recipe.

Data mailbox

To download data records, you have to create a data mailbox by choosing *System → Area Pointers* The OP writes the identifications and the length of the data record to the data mailbox. This is why the data mailbox must have a length of at least five words. The following figure shows the structure of the data mailbox.

Address	
1st word	Identification 1
2nd word	Identification 2
3rd word	Identification 3
4th word	reserved
5th word	Length of the data record in words

Fixing the recipe structure

If you have finished the configuration, you should *fix* the structure of your recipe. To fix the recipe structure, go to the *Attributes* dialog box by choosing the *Attributes* button in the *Recipe* dialog box. Fixing a structure is synonymous with write protect. The structure of the recipe can be modified from now on only under certain conditions. You can still delete variables but a gap remains in the structure. You can add variables only at the end of the structure.

Fixing the structure insures that once data records have been created on the OP they can be re-used. When data records are created, only the values are saved. Structure information, i.e. how the value is to be interpreted – for example, as an integer or a string – is not stored in the data record. If the structure were to be modified, values would be interpreted incorrectly.

9.2 Downloading Data Records

General

This section describes the standard case of downloading data records from the OP to the PLC and from the PLC to the OP. Special cases are described in the *Communication User's Manual*. We recommend you download data records only by means of operator input on the OP. For this purpose, use the standard screen `Z_RECORD_1`.

Setting the type of download

To set the download type, go to the *Parameters* dialog box by choosing the *Parameters* button in the *Recipes* dialog box. Here you have to set `Direct` as the download type.

With direct download from the OP → PLC, the values of the variables are written to the addresses on the PLC. The identifications are written to the data mailbox. Variables not having an address are not downloaded.

With direct download from the PLC → OP, the values are read from the system memories of the PLC and downloaded to the OP.

Creating and downloading data records

Data records can be created on the OP and then stored on a data medium. The type of data medium you can use depends on the OP. On standard screen `Z_RECORD_1`, the text list `Z_MEMORY` containing the data medium and value assignments is used. The assignments are as follows:

`0` Flash
`1` Module
`2` Floppy disk
`3` Hard disk

A detailed description of creating data records and downloading them to the PLC is contained in the *OP25/35/45 Equipment Manual* and in the *OP37 Equipment Manual*.

Synchronization during download

A major feature with recipes is that data download is synchronized and any uncontrolled overwriting of data is inhibited. To insure a coordinated process when data records are downloaded, bits are set in the control and check-back areas of the interface area. The interface area is described for all PLCs, apart from the SIMATIC, in Chapter 11. The interface area for SIMATIC PLCs is described in the *Communication User's Manual*. For non-SIMATIC PLCs, the interface area is described in section 11.1.

9.3 Transferring Data Records Upon a Trigger from the PLC

PLC jobs 69 and 70

Data records can be transferred from the PLC to the OP and in the reverse direction by means of PLC jobs 69 and 70. However, a PLC job merely writes to the variables or reads from the variables. A data record cannot be saved directly on the data medium by means of the PLC job, nor is reading from the data medium directly possible. An operator input on the OP is required.

Function replaces PLC job

ProTool features functions
- for reading data records from the PLC and saving them on the data medium on the OP
  and
- for reading data records from the data medium and for transferring them to the PLC.

This kind of function has to be assigned to a variable. The parameters of the function contain the recipe name and the data record name. Assign the function parameters from the PLC first. The function is triggered by the PLC modifying the value of the variable.

A detailed description is given below of the steps you have to perform for OP → PLC transfers. The procedure for the PLC→ OP direction is similar.

Example

It is assumed in this example that you are basing your work on the standard configuration. A few text lists and the corresponding variables, which you should use, have already been created in the standard configuration.

Assigning the DAT → OP/PLC function

The DAT → OP/PLC function has to be attached to a variable. For the function parameters, use variables which are already in use for the `Z_Record_1` standard screen.

1. Create a variable with the symbolic name `VAR_212`, which may have the `KF` format and is linked to the PLC.
2. In the *Variable* dialog box, click *Options*. Place a check mark in the `Read Continuously` check box under *Attributes*. The OP now detects whether the value of the variable has changed.
3. Exit from the *Options* dialog box by pressing *OK*.
4. Click *Functions* in the *Variable* dialog box.
5. Choose the DAT → OP/PLC function in the *Functions* dialog box and move it to the *Selected Functions* field using the >> key.

6. Click *Parameters* and assign the parameters as described below. In doing so, always choose the variable specified under *Variable*. Figure 9-4 shows the dialog box with the parameters.

Data Medium	`Z_MEMORY`
Data Record Name	`Z_DATRNAME`
Information Text	`Z_DATRINFO`
Recipe	`Z_RECIPE`
Edit mode	`0`

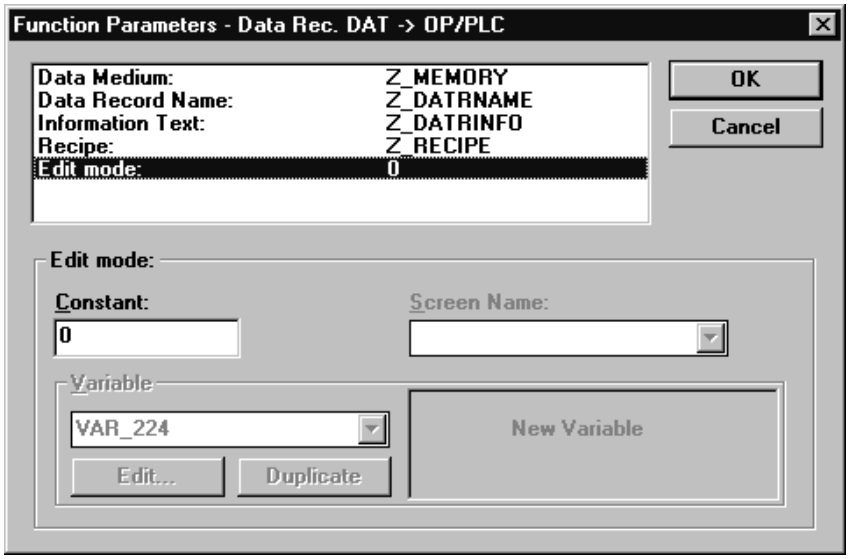


Figure 9-4 Assigning Parameters for the DAT → OP/PLC Function

Assigning variables an address on the PLC

For you to be able to write to variables from the PLC, you must have a link to the PLC. Configure an address on the PLC for all the variables specified under 6. above. In addition, assign the attribute `Read Continuously` to all the variables by pressing the *Options* button. Only when this attribute has been enabled does the OP detect any change in the variable.

Triggering the function

Assign the following variables on the PLC:
`Z_MEMORY`
`Z_DATRNAME`
`Z_DATRINFO`
`Z_RECIPE`
with the recipe names and the data record names which you wish to transfer from the OP to the PLC. Specify the data medium as well. Comments are optional.

Now, change the value of the `VAR_212` variable on the PLC. This triggers the function attached to the variable. The data record is now transferred from the OP to the PLC.

9.4 Points to Remember with Recipes

Variables on screen and in recipe

Variables that are linked to the PLC are treated in recipes as follows:

If a variable was used in a recipe and if it was also assigned to an output field on a screen, the PLC can overwrite the instantaneous value. This occurs, for example, when data records are downloaded from the data medium to the PLC. First the variables on the OP are updated, and then the values are downloaded from the OP to the PLC. In the meantime, the output field variable may have been updated by the PLC. The PLC value is downloaded, not the data record value.

Constraints

Variables having a counter or timer as their address must not be used in recipes.

The `Read Continuously` attribute must not be used for variables being used in recipes.

9.5 Example of Recipes and Data Records

Description

This chapter guides you step by step through
– creating a recipe,
– creating data records on the OP and
– downloading data records to the PLC.

In our example, you will create a recipe for the mixing unit of a fruit juice system. You wish to mix different fruit juices on the same system. The ingredients are identical, only the ratios of mixture are different. You first create a recipe called *Mixture*, followed by a data record called *Orange*. This data record contains the ratio of mixture for orange juice. The data record is downloaded indirectly; this means that the data are written to the data mailbox. While the data record is being downloaded, the OP sets bits in the control and check-back areas. You must then similarly set and reset bits in the PLC program to re-enable the data mailbox.

Example system

You create the example recipe for an OP25, which is connected to the SIMATIC S5 by means of AS511. It is the AG115U with the CPU 944.

Open standard configuration `s5_op25.pdb`. Save this configuration under a new name – for example, `QUICKMIX.PDB`.

Set the SIMATIC S5 PLC with driver AS511 by choosing *System* → *PLC* from the menu. Keep the symbolic name *PLC_1*. Choose the *Parameters* button to set the CPU.

Creating a recipe with ProTool

Call the editor for *recipes* and create the recipe described below. The recipe is shown in figure 9-5.

Create variable *Var_23* as *Type* `KC`, since it contains the name of the data record. The variable must have a length of four data words. Give the variable an address on the PLC – for example, `DB 12, DW 0`, length `4`. Specify the PLC as *PLC_1*. This means that you can use the variables on screens and in messages too. Do not modify the variable's attributes, since they have already been set correctly for recipes. Variables *Var_11*, *Var_7*, *Var_19* and *Var_21* are of *Type* `KF` and are all one data word long. For the address, specify data block 12 too. With variable *Var_19*, specify the digits behind the decimal point as `1`.

The order of the variables determines the structure of the recipe.

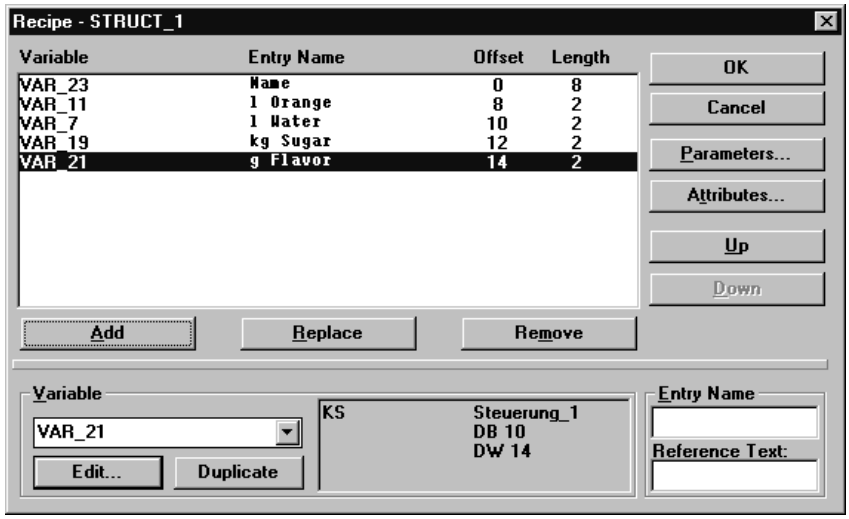


Figure 9-5 The *Mixture Recipe*

The *Length* specification in the *Recipe* dialog box is the length in bytes. The *Offset* specification sets the position in the structure. It is similarly specified in bytes.

Other necessary settings

You now have to modify the name of the recipe, set the identification and the type of download, and create the data mailbox.

1. Click in the *Recipe* dialog box on the *Attributes* button. At this point, modify the name of the recipe to `Mixture`. Freeze the structure of the recipe by clicking on the *Fix*button. All the entries in the recipe are now dimmed. Figure 9-6 shows the *Attributes* dialog box with the settings.

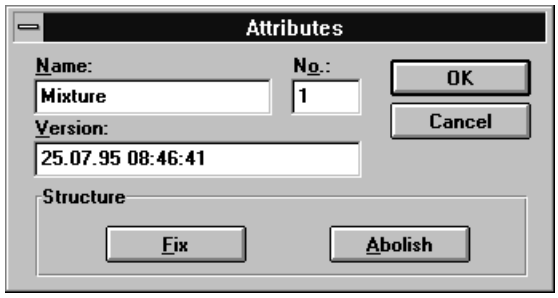


Bild 9-6 *Attributes* Dialog Box with Settings

Exit from the dialog box by choosing *OK*.

2. Click on the *Parameters* dialog box. The dialog box shown in figure 9-7 is displayed. Set the type of download here by clicking *Direct*.

   The recipe number has already been entered under *Identifications*. Do not modify anything here. The identification of the recipe is downloaded every time a data record is downloaded.

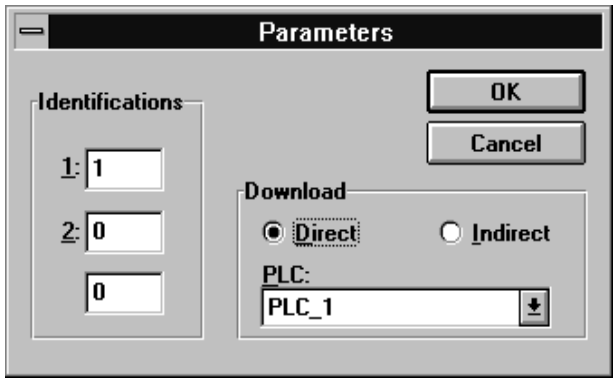


Bild 9-7 *Parameters* Dialog Box with Settings

Exit from the dialog box by choosing *OK*.

After you have created the first recipe, ProTool automatically creates a text list called *Z_RECIPES*. Figure 9-8 shows the text list. This text list is used automatically on screens *Z_RECORD_1* and *Z_RECORD_2*. You do not have to perform any more settings for it.

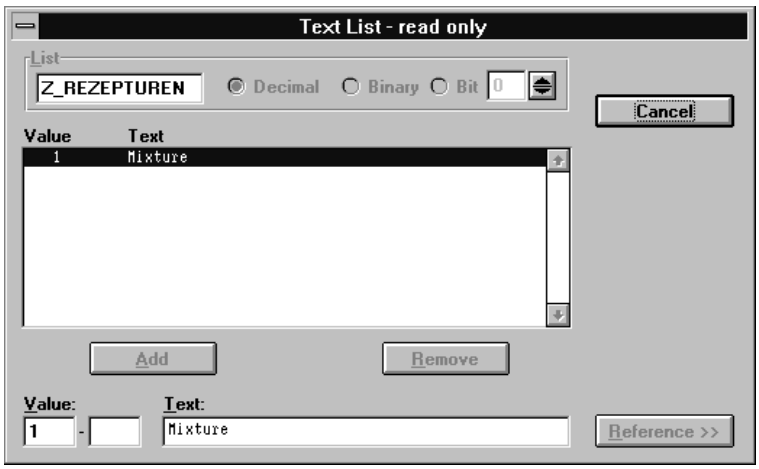


Bild 9-8 Text List for Recipes

3. Choose *System* → *Area Pointers* from the menu. Set the interface area here. Click *Add*. Set the following interface area:
   DB: 51
   DW: 0
   Length: 185

   Under *Type:*, select *Data Mailbox*. Click the *Add* button again. Set a data mailbox that is in data block DB 14, starts with DW 0 and is five data words long. Create data block 14 with a length of at least five data words in your PLC program as well. Figure 9-9 shows the settings which have just been described.

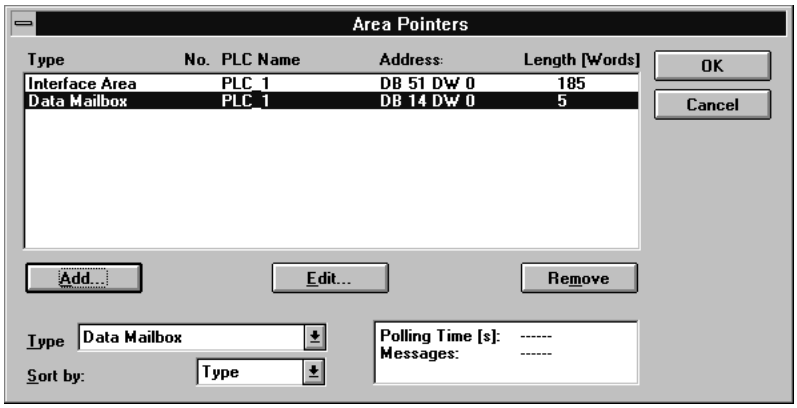


Bild 9-9 *Area Pointers* Dialog Box with Settings

Linking screens

For you to be able to use standard screens on the OP, you have to embed them in your configuration. To embed standard screens, proceed as follows:

1. Create a new screen. Choose *Screen* → *Attributes* from the menu. Click the *Start Screen* option. Call the screen *Start*. Exit from the dialog by choosing *OK*.
2. Place the selection of standard screens on key F9. To do this, click on key F9. Now select the *Select Screen* function and apply it by using the double-headed arrow to the right field. Click the *Parameters* button. Under *Screen Name*, select standard screen Z_SYSTEM_MENU. Exit from the dialog by choosing *OK*.

   Create an icon containing the word Standard by using Paintbrush or some other drawing program.
3. Assign to function key F11 the standard screen *Z_RECORD_1* as described under 2. above. Here again, create an icon using Paintbrush. Give standard screen *Z_RECORD_1* the name DAT_1.
4. Call screen *Z_RECORD_1*. Click key F14. Select the *Select Screen* function. Under *Parameters*, specify the *Start* screen. Using Paintbrush, for example, create an icon called ESC.

Downloading the configuration

Save your configuration by choosing *File* → *Save* from the menu. Connect the OP to the PC or PU by means of the connecting cable. Go to *File* → *Download* on the menu system. Answer `Yes` to the query whether the configuration should be compiled first.

After the configuration has been downloaded, you can see the start screen on the OP. At the same time, the system displays the message `S5 not available`. Connect the OP to the CPU. The system message then disappears.

Creating a data record on the OP

You now first select and format the data medium on the OP. With the OP25, the only data medium that is possible is ”FLASH”. Then create a data record for the orange juice mixture and save it on the flash. The value of the variables is now `0`. Then edit the data record and enter the actual values.

1. From the start screen, call screen *DAT_1*. Figure 9-10 shows standard screen *Z_RECORD_1* on the OP. The FLASH data medium has already been set. Move the cursor to the *Format Data Medium* field. Press ENTER twice. In reply to the following queries, enter `0` for `Yes` in every instance.

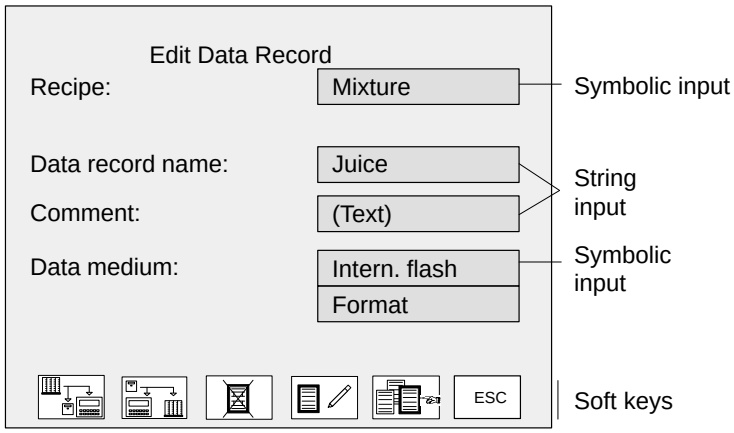


Bild 9-10 The *Z_RECORD_1* Standard Screen on OP

2. The *Mixture* recipe has already been selected. Move the cursor to the *Data Record* field. Now specify the name `Orange` for the data record.
3. Press key F12 to edit the data record. ProTool now asks:
   `Create new data record?`
   `0 Yes / 1 No`
   Specify `0` for `Yes`.

4. Move the cursor to the different entries of the data record, one after the other, and enter the following values:
   JUICE
   95
   5
   0.5
   100
5. Save the data record on the flash by pressing ENTER. Then press 0 for Yes.

Downloading the data record from the OP to the PLC

While the data record is being downloaded, the OP sets bits in data word 64 of the interface area. You must then confirm the download in the PLC program.

1. To download the data record, call screen *DAT_1* if it is not still available following editing of the data record. Press key F10 to download the data record from the OP to the PLC.
2. In the PLC program, set bit 13 in DW 64 of interface DB 51 to 1 for ”error-free download”. Then reset bit 11 in DW64 to re-enable the data mailbox. The program code for this might look as follows:

```
A DB 51          DB-TDOP
L DL 64          Control/reset bits
T MB 200         Scratch flag
UN M 200.7       Data record download not running
U M 200.6        Data record download complete
S M 200.5        Data are free of errors
R M 200.3        Data mailbox enabled
L MB 200         Scratch flag
T DL 64          Control/reset bits
BE
```

Result

The values for ”Juice” are now in the addresses on the PLC. The identifications are in the data mailbox.

Functions

10

Purpose

ProTool features a whole number of functions which you can use in your configuration. Functions are used to

- design the configuration for a specific process – for example, to jump from one screen to another.
- control the process by, for example, setting a bit, thus causing a motor to be switched on.
- take advantage of OP characteristics – for example, to view or print a message buffer,
- perform system settings online on the OP – for example, to modify interface parameters,

Using functions

For you to be able to use functions, they must be assigned to an object. Possible objects are screens, messages, function keys, fields and variables. Depending on the object you select, only those functions are offered by ProTool which are actually possible. Thus some functions, for example, can be assigned only to function keys; an example of this is the function *Set Bit*. Figure 10-1 shows the *Functions* dialog box for function keys.

A list of all the functions available in ProTool will be found together with descriptions in Appendix A.

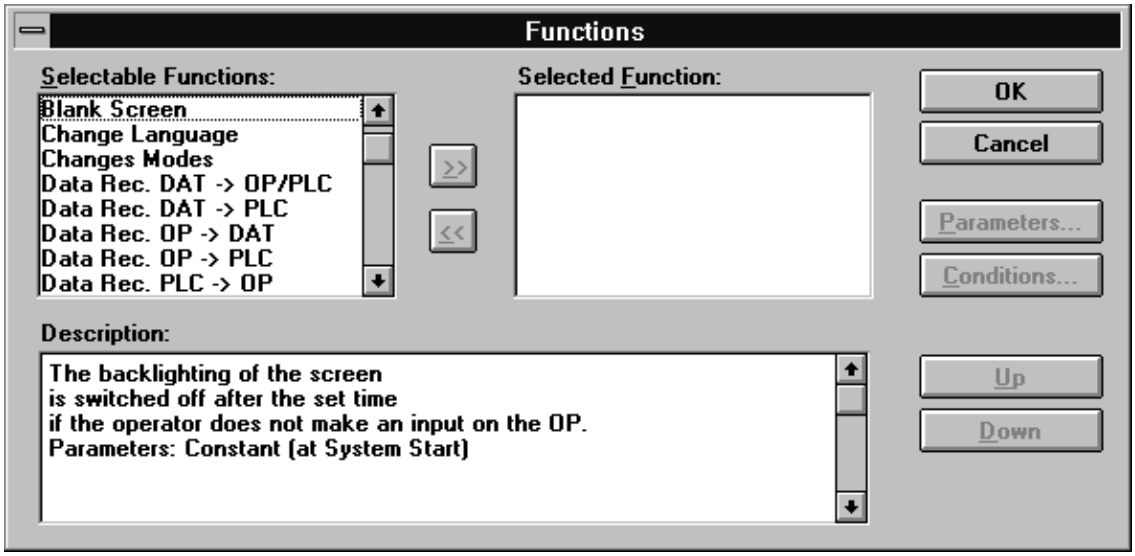


Figure 10-1 *Function* Dialog Box

Assigning several functions

You can assign several functions to an object simultaneously. They are then processed one after the other, as if it were a batch file. You set their order during configuration in the *Functions* dialog box. It can be modified by means of the *Up* and *Down* buttons.

Configuration principle

Figure 10-2 shows the basic structure of a function. An input parameter is transferred to the function. It may be constant or it may be read from a variable. The variable in its turn may be only local or it may be linked to the PLC. In the case of a link to the PLC, the value is specified by the process. The result of the function is written to a variable, which in its turn may be local or linked to the PLC.

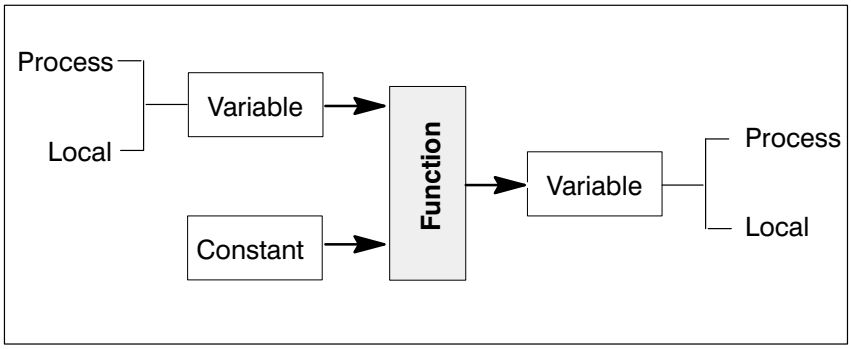


Figure 10-2 Configuring a Local Variable (Principle)

There are three different types of function:

- Functions without input parameters
  These are functions which by definition trigger a specific action. They include functions such as ”Date and Time” or ”Alarms – Delete Buffer”.
- Functions with input parameters
  With these functions you have to specify the object or the setting at which the function is to be executed. They include the functions ”Select Screen” and ”Event Window (ON/OFF)”
- Functions with input and output parameters
  With these functions you have to specify the object or the setting at which the function is to be executed. The result of this function is written to a variable. These functions include ”Message Log (ON/OFF)” and ”Mode”.

There are also functions which are linked to each other. In such a case, the output parameter of the first function is the input function of the second. They include the functions ”Define Password” and ”Define Password Level”.

Using functions

Functions can be attached to different objects. They are:
- variables
- function keys
- fields
- screens
- messages

Functions are not supplied for messages with standard ProTool. They are available only by installing optional packages.

Conditions

Apart from function parameters, you must also specify conditions for triggering the function – for example, on pressing or releasing a function key. The conditions differ from function to function. The default setting for *Conditions* has to be modified only in specific cases.

In the following, the conditions are briefly listed which are basically possible for the different objects. Not all conditions are desirable or possible with every function. ProTool, therefore, makes available only those conditions which are applicable to the different functions concerned.

Object	Condition	Explanation
Variable	Initialization	The function is triggered when the variable is initialized.
	Entering Value	The function is executed after you enter a value in the input field. Not until then is the value entered in the variable of the input field.
	Value Output	The function is executed before a changed value is entered in the variable by the PLC.
	Reading Data Record Variable	The function is executed after the data record variable is read by the data medium and before the contents are saved.
	Reading Message Variable	The function is executed after the message variable is read and before the contents of the message field are output in a message.
	Applying Value to Trend Buffer	The function is executed when the value is applied to the trend buffer.
Function keys	Key Pressed	The function is executed when the function key is pressed.
	Key Released	The function is executed when the function key is released.
Fields	Select Field	The function is executed when the field is selected.
	Exit Field	The function is executed upon exiting from the field.

Object	Condition	Explanation
Screens	Select Screen	After formatting: The function is executed upon selection of the screen after the screen has been formatted. Before formatting: The function is executed upon selection of the screen before the screen has been formatted.
	Exit Screen	The function is executed upon exiting from the screen.
Messages	Message Arrives	The function is executed when the message arrives.
	Message Departs	The function is executed when the message departs.
	Message Acknowledged	The function is executed when the message is acknowledged.

Global functions

You can configure functions globally by choosing *System* → *Functions* from the menu. The functions specified under this menu option are not assigned to individual objects but, depending on the configured condition, executed on every occasion. If, for example, the function *Set Bit* is configured with the condition *Entering Value*, the function is executed every time a value is entered, irrespective of which field is selected.

Configuration example

You wish to enable and disable automatic printing of messages on the OP35 by pressing a key. Function key K7 will be used to disable, K8 will be used to enable. The current status is to be displayed on the screen in plain language, either as ”Log ON” or as ”Log OFF”.

1. Choose *System* → *Screen/Keys* from the menu and click key K7.
2. In the *Function Key K7* dialog box, click the *Function* button.
3. Select on the list of *Selectable Functions* the function *Message Log ON/OFF*. Apply the function by choosing the >> button to the list of *Selected Functions*.
4. Click the *Parameters* button.
5. In the *Function Parameters Message Log ON/OFF* dialog box, select the first parameter, *ON/OFF (Key)*. Enter in the *Constant* field the value 0 (for Printout OFF).
6. Select the second parameter, *ON/OFF (Field)*. In the *Variable* field, enter the name Log. The Log variable is a type *BOOL* variable and is set to No PLC. Figure 10-3 shows the settings which have just been described.

   The *Log* variable assumes the value 1 when Printout is enabled and the value 0 when it is disabled.

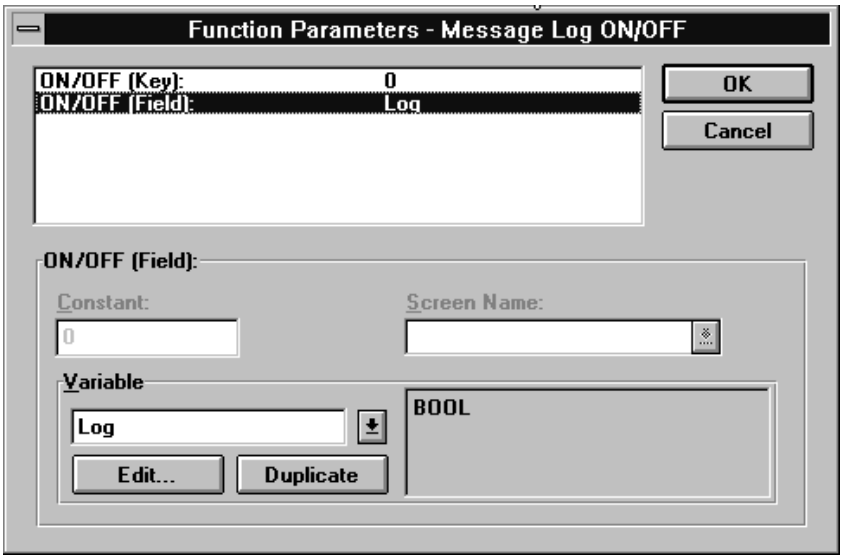


Figure 10-3 *Function Parameters* Dialog Box

7. Close the *Function Parameters...*, *Functions* and *Function Key K7* dialog boxes by choosing *OK*.
8. Repeat steps 1. through 7. for function key K8. Enter under 5. in the *Constant* field the value 1 (for Printout ON). Under 6., use the same variable, i.e. Log.
9. Exit from the *Screen/Key* dialog box by choosing *OK*.

10. Open the screen on which you wish to have the current log status displayed. Configure a symbolic output by choosing *Screen* → *Fields* → *Text or Graphic List* from the menu.

    Set: *Usage*: `Variable`
    Field Type: `Output`
    Display: `Text Symbol`

    Under *Variable*, select the name *Log*. Figure 10-4 shows the *Input/Output* dialog box with settings.

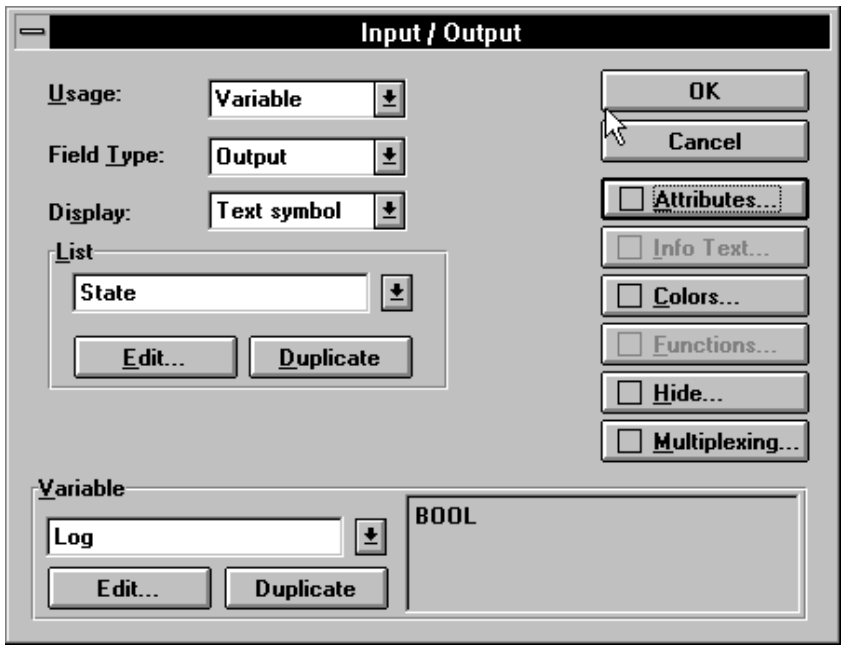


Figure 10-4 Settings in the *Input/Output Dialog Box*

11. Enter under *List* the name `Status` of the new text or graphic list and click the *Edit* button.

12. Enter in the *Text or Graphic List* dialog box the corresponding symbolic text for both of the variable values that are possible, i.e. `0` and `1`:

    ```
    0       Log OFF
    1       Log ON
    ```

    Apply every entry separately to the text or graphic list by clicking *Add*.

13. Close the *Text or Graphic List* and *Input/Output* dialog boxes by choosing *OK*.

Date and time functions

The date and time are displayed on the OP and modified by means of functions. There is one function called *Date Display/Edit* and one called *Time Display/Edit*. Attach these functions to variables that are not linked to the PLC.

At any one time in a configuration, you can use only one variable to which the date or time is attached. If you use several variables for this, they are not updated when the date and time are set or modified.

In the following, you will find an example of how the date is displayed on the OP and can be modified. To do this, you have to create an input/output field on a screen and attach the function *Date Display/Edit* to the field variable.

1. Create a field. The *Input/Output* dialog box appears. Specify the field length as `10`.
2. Select `Input/Output` under *Type*.
3. Select `String` under *Display.*
4. Enter the name `Date` under *Variable*. Now, configure the variable by clicking *Edit*. Set the following values:

Set:	*Type*:	`STRING`
	Length:	`10`
	PLC name:	`– no PLC –`

5. Click *Functions* to assign a function to the variable.
6. Select in the left list box the *Date Display/Edit* function and move it to the right box using the `>>` button. The function is then attached to the variable.
7. Exit from all open dialog boxes by pressing OK. The date is now displayed in this field on the OP, and you can also modify the date.

If you now wish to display the date in another field, then use only the *Date* variable in this case as well.

General Communication Areas

11

Contents

This chapter describes data areas used by the OP and the PLC to communicate with each other. These data areas are required only when you wish to use the corresponding OP functions. You then have to create the data areas on the PLC and set them in the configuration.

11.1 Interface Area for Non-SIMATIC PLCs

Usage

The interface area described below applies to all PLCs except SIMATIC PLCs. The interface area for SIMATIC PLCs is described in the *Communication User's Manual*.

The interface area is required when you use the following functions:

- send PLC jobs to the OP
- synchronize date and time between the PLC and the OP
- check version number
- edit recipes (transfer of data records)
- detect OP startup in the PLC program
- evaluate the OP mode in the PLC program
- evaluate the OP life bit in the PLC program

Creating the interface area

You set the interface area in ProTool by choosing *System* → *Area Pointers* from the menu. In addition, the area has to be available on the PLC. Figure 11-1 shows the structure of the interface area.

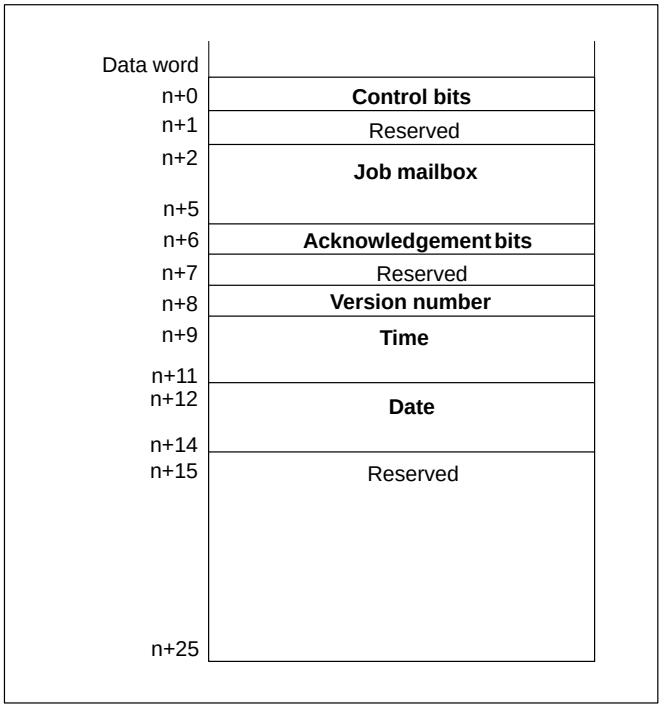


Figure 11-1 Structure of the Interface Area in data words

Counting direction of bits

The counting direction of the bits in a data word depends on the PLC. It may be clockwise, starting at 0, or counter-clockwise, starting at 1.

When data words are illustrated in the description that follows, there are always two illustrations. If only one bit is mentioned, its number is shown
– without parentheses for a clockwise direction
– with parentheses for a counter-clockwise direction

11.1.1 Control and Acknowledgement Bits

Introduction

A word is available for every control and acknowledgement bit. Word n+0 contains the control bits. Control bits are written by the PLC and read by the OP. Word n+6 contains the acknowledgement bits. They are written by the OP and read by the PLC.

Detailed structure of control and acknowledgement bits

The following illustrations show the detailed structure of the control and acknowledgement bits. This is followed by a description of achieving synchronization of the OP with the PLC by setting bits.

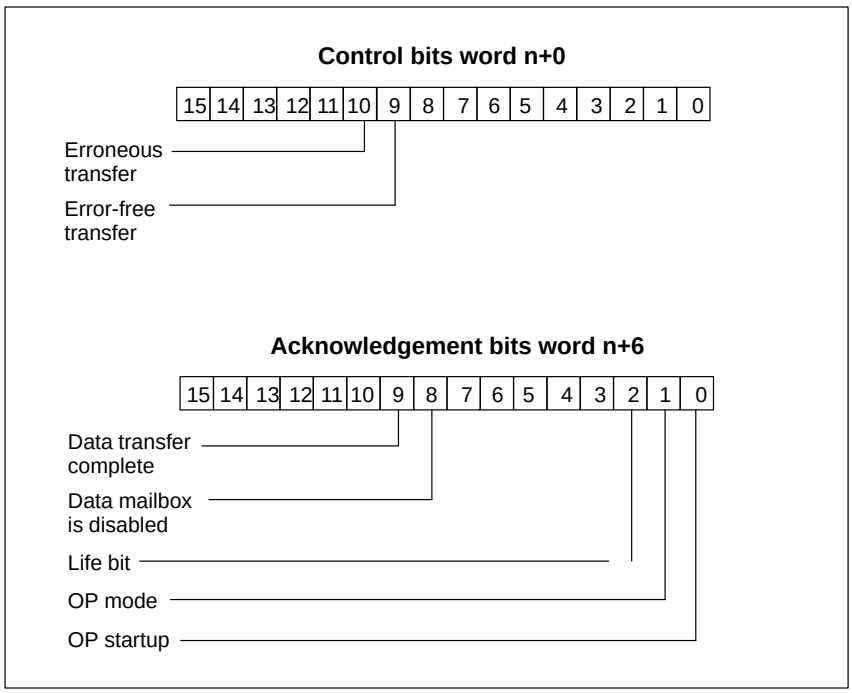


Figure 11-2 Control and Acknowledgement Bits for Clockwise Direction

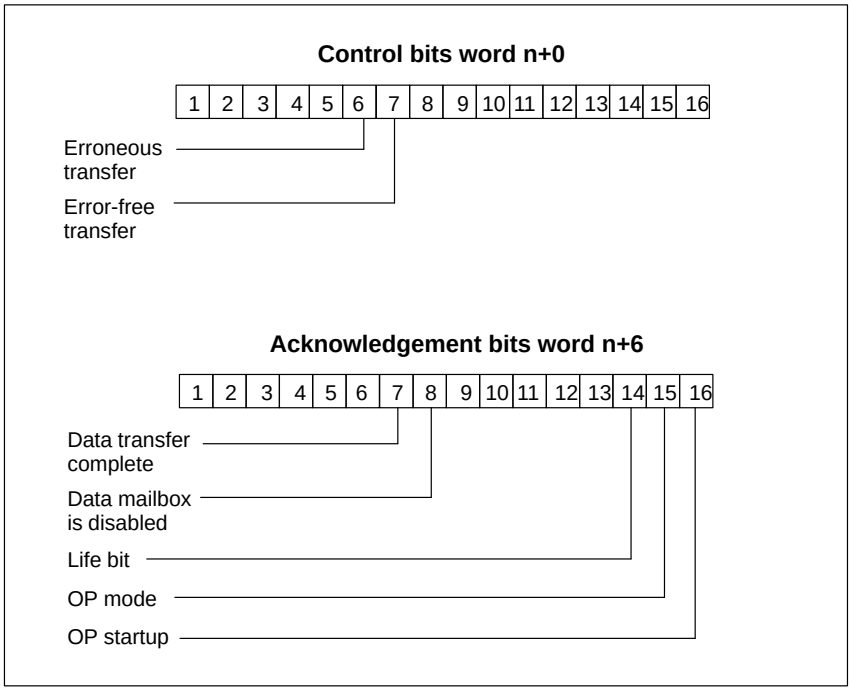


Figure 11-3 Control and Acknowledgement Bits for Counter-Clockwise Direction

OP startup

Bit 0(16)* in acknowledgement bits

`1`= OP has started
`0` = OP is starting

The bit is set by the OP when startup has finished.

OP mode

Bit 1(15) in acknowledgement bits

`1` = OP is offline
`0` = OP in normal mode

The bit is set if the OP is switched to Offline mode by the operator. In Online mode, the bit is set to `0`.

Life bit

Bit 2(14) in acknowledgement bits

The purpose of the life bit is to insure that any disruption of the connection from the OP to the PLC is detected immediately. The OP inverts the life bit in the interface area at regular intervals.

* The number in brackets refers to the counter-clockwise direction

Synchronizing the transfer of data records and indirect variables

Control bits:

Bit 10(6)* `1` = Data record/variable is erroneous
`0` = Evaluation not performed

Bit 9(7) `1` = Data record/variable is erroneous
`0` = Evaluation not performed

Acknowledgement bits:

Bit 9(7) `1` = Data transfer ended
`0` = Evaluation not performed

Bit 8(8) `1` = Data mailbox is disabled
`0` = Data mailbox is vacant

The control and acknowledgement bits in the interface area synchronize the transfer of data records. The standard case is that a transfer is initiated by means of an operator input on the OP.

Transferring OP → PLC (OP initiated)

The following description deals with the process of setting sync bits by the OP and the reaction to them by the PLC program.

Step 1: Bit 8(8) of the acknowledgement bits is checked by the OP. If bit 8(8) is set to `1` (= data mailbox disabled), the transfer is completed with a system error message. If bit 8(8) is set to `0`, the OP sets the bit to `1`.

Step 2: The OP enters the identifications in the data mailbox.

With a data record that is required to be transferred indirectly, the values of the variables are also written to the data mailbox. With a data record that is required to be transferred directly, the values of the variables are written to the configured address.

Step 3: The OP sets bit 9(7) of the acknowledgement bits to `1`
(= data transfer complete).

Step 4: Acknowledge in the PLC program whether the transfer was error-free or erroneous.
Error-free: Bit 9(7) is set to 1
Erroneous: Bit 10(6) is set to 1

Step 5: The OP resets bits 9(7) and 8(8) of the acknowledgement bits.

Step 6: Bits 10(6) and 9(7) have to be reset in the PLC program.

* The number in brackets refers to the counter-clockwise direction

11.1.2 Data Areas in the Interface Area

General

This section describes the structure and usage of user data areas located in the interface area.

The PLC initiates an action on the OP via the job mailbox. All the other bytes are areas to which the OP writes data. These areas can be evaluated by the PLC program. The bytes are described in detail below.

Job mailbox

Word n+2 through n+5:
PLC jobs can be transferred to the OP via the job mailbox, thus initiating actions on the OP.

The job mailbox consists of four words. The first word of the job mailbox contains the job number. The job parameters (three at most) have to be entered in the other words.

Job mailbox:

Data word	
n+2	Job No.
	Parameter 1
	Parameter 2
n+5	Parameter 3

If the first word of the job mailbox is not equal to zero, the OP evaluates the PLC job. The OP resets this data word thereafter to zero. For this reason it is necessary to enter the parameters in the job mailbox before entering the job number.

The PLC jobs that are possible are listed with their job numbers and parameters in Appendix B.

Version number

Word n+8

The OP enters the version number of the driver in word n+8. It can be evaluated by the PLC program.

Date and time

Time = Words n+9 through n+11
Date = Words n+12 through n+14

PLC job 41 can initiate the transfer of time and date from the OP to the PLC.

Figure 11-4 shows the structure of the data area. All specifications are BCD-coded.

Data word	Left byte	Right byte	
n+9	Not assigned	Hour (0 to 23)	Time
n+10	Minute (0 to 59)	Second (0 to 59)	
n+11	Not assigned		
n+12	Not assigned	Day (1 to 7)	Date
n+13	Day (1 to 31)	Month (1 to 12)	
n+14	Year (0 to 99)	Not assigned	

Figure 11-4 Structure of the **Time** and **Date Data** Area

To detect when the date and time were transferred, you should set the data words to `0` before initiating the PLC job.

11.2 OP Keyboard and LED Assignments

Usage

Key operations on the OP can be transferred to the PLC and then evaluated. In this way it is possible to draw the operator's attention to the incorrect operation of a key by means of, say, a message.

The light-emitting diodes (LEDs) on the function keys of the OP can be driven by the PLC. This means that it is possible, for example, to indicate to the operator by means of a lit LED on a key, depending on the situation, that he should press a specific key.

Condition

To be able to use this option, you have to create suitable data areas – called assignments – on the PLC and to specify them as *area pointers* in your configuration.

Transfer

Keyboard assignments are transferred spontaneously to the PLC, meaning that a transfer is performed whenever a modification has been registered on the OP. There is therefore no need to configure a polling time.

- **OP25/35/37**
  Up to two simultaneously pressed keys are transferred.
- **OP45**
  Only one pressed key is transferred.

Assigning values

All keys (apart from SHIFT)

While the corresponding key is pressed, its assigned bit in the keyboard assignment has 1 as its value; at all other times its value is 0.

Note

If the OP is switched off while the key is pressed or if it is separated from the PLC, the corresponding bit will remain set in the keyboard assignment.

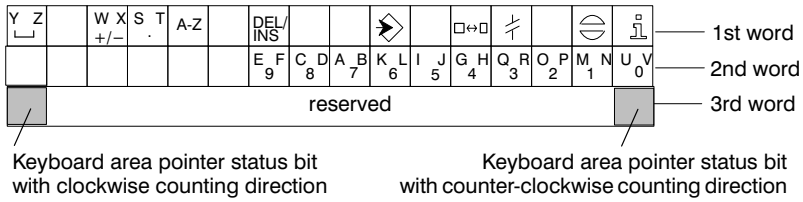
11.2.1 System Keyboard Assignment

Structure

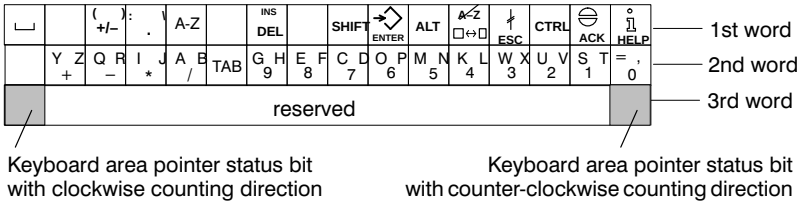
The system keyboard assignment is a data area having a fixed length of three data words. To be able to use the system keyboard assignment, you have to create a *system keyboard* type data area under *Area Pointers* in your configuration.

Precisely one bit is permanently assigned in the system keyboard assignment to every key belonging to the system keyboard.

Keyboard assignment for OP25:



Keyboard assignment for OP35, OP37 and OP45:



Note

Unused bits must not be overwritten by the user program.

Keyboard area pointer status bit

The keyboard area pointer status bit is used as a check bit. It is set to 1 every time the keyboard assignment is transferred from the OP to the PLC and should be reset following evaluation of the data area by the user program.

By regular reading of the area pointer status bit, it is possible to determine in the user program whether the keyboard assignment has been re-transferred.

11.2.2 Function Keyboard Assignment

Data areas

The function keyboard assignment can be divided into separate data areas, which are shown in the following table. To use the function keyboard assignment, you have to create a *function keyboard* type data area in your configuration under *Area Pointers*.

Data Areas	OP25/35/37/45
Maximum number	8
Overall length of all data areas (words)	8

Key assignment

The assignment of the different keys to the bits of the data areas is set when the function keys are configured. In this context, the number within the assignment area is specified for every key.

Keyboard area pointer status bit

The highest order bit of **every** data area is the keyboard area pointer status bit. It is used as a check bit. The keyboard area pointer status bit is set to `1` every time the keyboard assignment is transferred from the OP to the PLC. After the data area has been evaluated by the user program, the keyboard area pointer status bit should be reset.

By regular reading of the area pointer status bit, it is possible to determine in the user program whether a block has been re-transferred.

11.2.3 LED Assignment

Data areas

The LED assignment can be divided into separate areas, as the following table shows. To use the LED assignment, you have to create a *LED assignment* type data area in your configuration under *Area Pointers*.

Data Areas	OP25/35/37/45
Maximum number	8
Overall length of all data areas (words)	16

Polling time

If a polling time of 0 is specified for a data area, it is not transferred cyclically to the OP. To drive the LEDs, PLC job No. 42 has to be used (refer to Appendix B).

LED assignment

The assignment of the different LEDs to the bits of the data areas is set when the function keys are configured. In this context, the number of the assignment area and the bit number within this area are specified for every LED.

Bit number (n) denotes the first of two successive bits, which control a total of four different LED states (refer to tables 11-1 and 11-2).

Table 11-1 LED Functions for clockwise counting direction

Bit n + 1	Bit n	LED Function
0	0	Off
0	1	Flashing at approx. 2 Hz
1	0	Flashing at approx. 0.5 Hz
1	1	Permanently on

Table 11-2 LED Functions for counter-clockwise counting direction

Bit n + 1	Bit n	LED Function
0	0	Off
0	1	Flashing at approx. 0,5 Hz
1	0	Flashing at approx. 2 Hz
1	1	Permanently on

Exception

The OP45 flashes only at a frequency of 0.5 Hz. You initiate flashing by setting either bit n or bit n+1.

Configuring in Different Languages 12

Display levels

With languages, we generally differentiate between two display levels. They are:

- the *user interface language* of ProTool and
- the *configuration language* for the OP.

User interface language

The *user interface language* is the language in which text is displayed on the menus and in the dialog boxes of ProTool. The user interface language for ProTool has to be set during installation. The languages you can set are English, French, German, Italian and Spanish.

Configuration language

The *configuration language* is the language in which the configuration is created. This is the language in which the configuration appears on the OP. You can create a configuration in any of the languages available under Windows. Of the configuration languages that are possible, you can load up to three on the OP simultaneously by choosing *System → Language Assignment* from the menu.

When you call ProTool, the configuration language is the same as the user interface language. You change the configuration language by choosing *Edit → Languages* from the menu. If you want to set a different configuration language or if you have created your configuration in one language and now wish to configure the next language, choose this menu item. The dialog box shown in figure 12-1 appears.

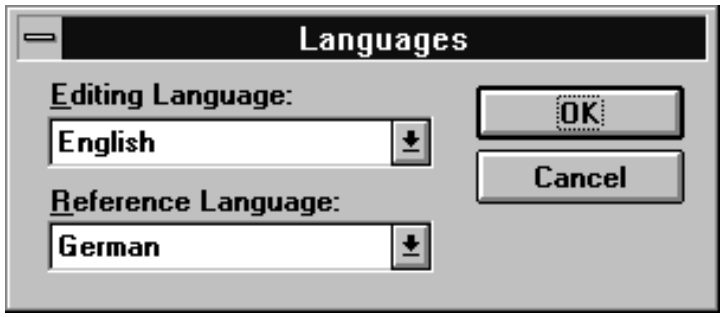


Figure 12-1 Dialog Box for Setting Languages

Editing language and reference language

In the *Languages* dialog box, specify the ***editing language*** and the ***reference language***.

- The *editing language* is the current configuration language in which configurable text is entered.
- The *reference language* should be regarded from the viewpoint of translation. If, for example, the second language is being configured, the text of the first language can be displayed as the reference language. This means that you can see the first language as a reference for the translation.

Objects with language-dependent text

The following objects contain language-dependent text:

- event messages,
- alarm messages,
- screens,
- recipes,
- text lists and
- information text.

Configuring in several languages

If you create a multi-lingual configuration, you should first finish configuring one language and then test it on the PLC. You can then type in the text strings for the other languages.

Note

If you wish to modify a configuration which has already been created in several languages, make sure that fields are not subsequently moved when event messages and alarm messages contain configured fields. Since there is no permanent association between a field and its position within text, the text should be moved, not the fields, if necessary.

Language-dependent fonts

On screens, you can also set fonts so that they are language-dependent by choosing *System* → *Fonts* from the menu. Depending on the editing language you selected, you can configure up to three language-dependent fonts.
A further font is language-independent. It applies to all editing languages.

The first language-independent font is used for messages and text lists, for instance, and has to have a character size of 8×16. Figure 12-2 shows the dialog box.

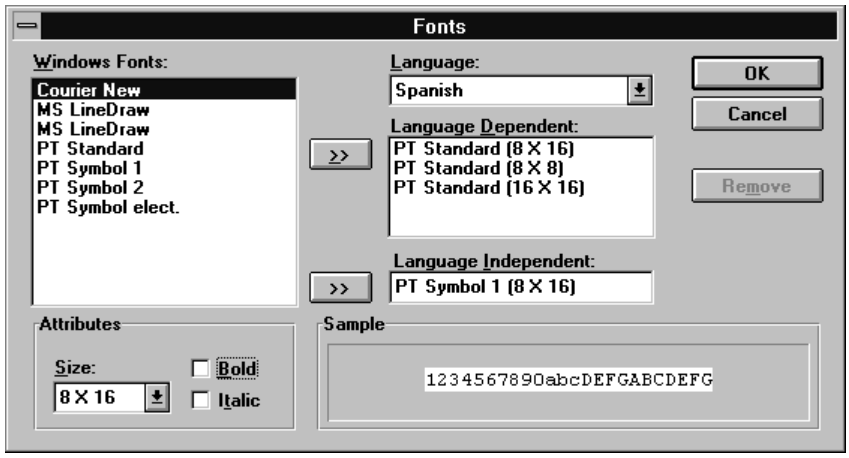


Figure 12-2 Setting Language-Dependent Fonts

Note

If you change languages on the OP, the corresponding language-dependent fonts are also changed. This is important with languages whose fonts are not contained in the ANSI Code.

Language-dependent keyboard assignment

If you choose *Edit → Languages...* from the menu and then select a language in the *Editing Language* input field, the corresponding font is loaded and the keyboard assignment is modified. If the editing language is not the same as your Windows language, a keyboard assignment with a new key assignment appears on the screen (refer to figure 12-3). You can now see where the differing characters are located on your keyboard and can enter them. There is also the possibility of clicking the cursor directly on the keys in the keyboard assignment to enter characters in the editor.

Figure 12-3 Example of a Keyboard Assignment with French as the Editing Language

The keyboard assignment disappears from the screen automatically when you change the editing language back to your Windows language. However, you can also disable it by choosing *Window → Keyboard* from the menu.

Setting OP languages

Before the configuration is downloaded to the OP, set the OP languages by choosing *System → Language Assignment* from the menu (figure 12-4).

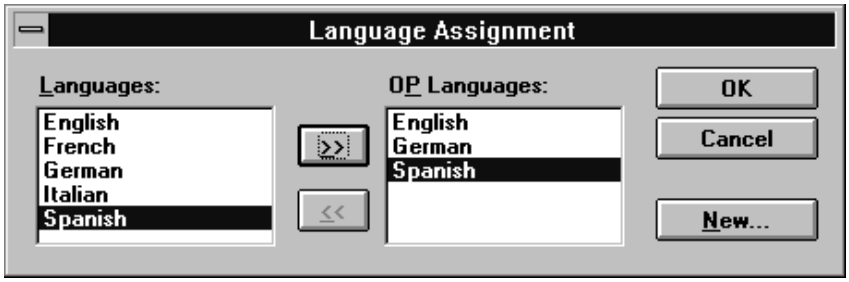


Figure 12-4 Setting OP Languages

OP languages are the languages which you can select on the OP. Select in succession not more than three of the existing configuration languages as OP languages. These languages are also downloaded to the OP during the download operation. The language entered first is the one that is set after the OP has started up. In routine operation, you can change the language on the OP by using the *System Settings* standard screen.

With this button you select not more than three OP languages in succession from the left list box.

With this button you can remove individual languages from the list of OP languages.

You can change the OP languages in the configuration. If, for example, you wish to load an identical configuration on several OPs with different languages, you can change the OP languages prior to the download operation.

Adding OP languages

By default, ProTool offers the five languages listed below as configuration languages. Standard screens are available for all of these five languages:

- English
- French
- German
- Italian and
- Spanish.

With the *New* button you can add all the languages available under Windows to the configuration languages.

System messages and keyboard assignment

System messages that appear on the OP are available in the seventeen languages listed below. There is a corresponding keyboard assignment for every one of these languages.

- Czech
- Danish
- Dutch
- English
- Finnish
- French
- German
- Greek
- Hungarian
- Italian
- Norwegian
- Polish
- Portuguese
- Russian
- Spanish
- Swedish
- Turkish

General Settings for the System 13

This chapter describes all the settings which affect the OP. Some settings have already been mentioned in other chapters when called for by the context. This chapter summarizes all the settings that are possible.

All the settings are performed by choosing ***System*** from the menu. The following items can be chosen from the submenus:

Screen/Keys

Here you set the basic partitioning of the screen. In addition, you have to assign the function keys at this point. The assignment applies to the entire configuration. You can assign Kx function keys only under this menu item. If you require the Fx function keys to be assigned globally, you do this likewise by choosing *Screen/Keys*. You perform local assignments on screens (refer to section 5.7).

Functions

At this point functions can be configured globally. The functions specified here are not assigned to individual objects but, depending on the condition configured, are executed every time.

Parameters

Here you perform general settings for the OP. The menu item is divided into two submenu items:

Messages — This menu item contains settings that are common to all the editors. They include the printing of messages, display type for alarm messages, warning on buffer overload, language-dependent designation of messages in the buffer, and titles for pages and buffers.

Miscellaneous — Here you perform general settings such as the password for the system administrator, the language-dependent time and date format and the record set for recipes, in addition to the reserved data record memory for the flash and the Jeida module.

Printer

Here you perform all the settings for the printer attached to the OP. They include the printer type and the interface parameters. When an OP printer is installed, a text list called `Z_OP_PRINTER` is created automatically. This text list is used on the standard screen for printer settings, which is supplied as part of the package. You perform the settings for the OP printer by choosing the following two items from the menu system:

Interface Here you set the interface parameters, such as baud rate, level (TTY or V.24) and the interface to which the printer is physically attached.

Settings Here you set the printer type. You can define several printers as OP printers. For the OP, the first printer on the text list is the default printer. If a printer other than the default printer is attached, you must change the printer type online on the OP by means of the `Z_PRINTER` standard screen.

When ProTool is shipped, a few printers have already been defined on the text list. But you can also add more printers to this text list. If necessary, you must define setup of these printers as detailed in the printer manual concerned.

Memory Requirements Shows the memory required by the configuration in the OP memory.

PLC Here you set the PLC to which the OP is connected. Set at the same time the driver, with its driver parameters, that is used by the OP and the PLC to communicate with each other.

Area Pointers Here you set the data areas required for communication between the OP and the PLC. The data areas have to be available on the PLC. The *Area Pointers* menu item is used to tell the OP what data areas it should access. The data areas that have to be set depend on the objects which are being configured. Table 13-1 contains an overview of the data areas that are required and when they are required

Language Assignment Here you set the languages which you require to be available on the OP. You can create the configuration in any of the languages available under Windows. Of these languages, you can set up to three as OP languages.

Fonts Here you set the fonts which you may use in your configuration. They are three language-dependent fonts and one language-independent font. With the language-dependent fonts, you can access special characters, for example, or compensate different text lengths in individual languages by means of different type sizes.

The language-independent font is used for symbols.

Overview

Table 13-1 shows who has read and write privileges to the different data areas that can be configured by choosing *Area Pointers* from the menu. The area pointers are listed in alphabetical order. The abbreviations ”R” and ”W” have the following meanings:

R Read access
W Write access

Table 13-1 Using Data Areas

Data Area	Required for	OP	PLC
User version	Version check by OP	R	W
Event messages	Configured event messages	R	W
Screen number	Evaluation of currently open screen by PLC	W	R
Data mailbox	Recipes; Indirect transfer of variables	W/R	R/W
Function key assignment	Evaluation by PLC of function key pressed	W	R
Trend request	Configured trends with ”Bit Trigger” and ”Read Whole Buffer”	W	R
Trend transfer 1	Configured trends with ”Bit Trigger” and ”Read Whole Buffer”	R	W
Trend transfer 2	Configured trends with ”Bit Trigger”, ”Read Whole Buffer” and ”Switch Buffer”	R	W
LED assignment	Driving LEDs from PLC	R	W
Alarm acknowledgment PLC	Acknowledgment of an alarm message by the PLC	R	W
Alarm acknowledgment OP	Message from the OP to the PLC that an alarm message was acknowledged	W	R
Interface area	Communication between OP and PLC (vital with SIMATIC S5)	W/R	R/W
Alarm messages	Configured alarm messages	R	W
System key assignment	Evaluation by PLC of system key pressed	W	R

Compiling and Downloading a Configuration to the System 14

Compiling

You have to compile your configuration before it can be downloaded to the OP. ”Compile” means creating a file from the configuration to run on the OP.

Consistency checks are made during the compilation process. If any specifications are missing or are incorrect, corresponding error messages are written to a status window. If event messages were configured, for example, but an event message area has not been created under *Area Pointers*, an error message is issued.

Downloading

When downloading is in progress, both the firmware and the compiled file are downloaded to the OP. The OP itself is only the hardware including a flash memory and RAM. The firmware for the OP is supplied together with the ProTool configuration tool.

14.1 Downloading a Configuration to the OP

Download methods

You can download a configuration for a specific device in two ways:

– serially, over a direct link from the PU or PC to the OP.

– by means of a MPI network configuration (not with OP45).
In this particular instance, the PC or PU is located in the MPI network configuration. You set the download parameters by choosing *File → PC Interface* from the menu.

If the OP is still without a configuration, only a serial download is possible. A download can take place via the MPI only when there is a configuration already on the OP.

Baud rate

Bear the following points in mind when setting the baud rate:

– With a cable set for level TTY (PU cable), the maximum baud rate you can set is 9600 bauds. Higher baud rates can be used only with a cable set for level RS232.

– With a low-performance PC or PU, you have to decrease the default baud rate of 56000 bauds in steps until reliable downloading is possible. A low-performance PC or PU means, for example, a 80386 processor and/or clocking at 25 MHz.

14.1.1 Downloading a Configuration to the OP25, OP35 or the OP37

Serial download

To download your configuration from your PU or PC to the OP, proceed as follows:

1. Connect the OP to the PC or PU with a cable set
(refer to the *OP25, OP35, OP45 Equipment Manual* or the *OP37 Equipment Manual*).
2. Place the OP in Download mode
(refer to the *OP25, OP35, OP45 Equipment Manual* or the *OP37 Equipment Manual*).
3. Set the serial interface of the PU or PC by choosing
File → PC Interface from the menu.
4. Start downloading of the configuration by choosing
File → Download from the menu.
5. Following the download operation, the OP starts up and shows the start screen.

Downloading via MPI

To download your configuration from your PU or PC to the OP25, OP35 or OP37, proceed as follows:

1. Connect the PU or PC to the MPI network configuration. For this, a MPI board is required on the PU or PC. Further, STEP 7 software must be installed.
2. Connect the OP to the MPI network configuration. For this purpose, take into account the following notes on the MPI address.
3. Place the OP in Download mode
   (refer to the *OP25, OP35, OP45 Equipment Manual* or the *OP37 Equipment Manual*).
4. Set the MPI interface of your PU or PC by choosing
   File → *PC Interface* from the menu.
5. Specify the MPI address of the OP25, OP35 or OP37 by choosing
   File → *PC Interface* → *Edit* from the menu.
6. Start downloading of the configuration by choosing
   File → *Download* from the menu.
7. Following the download operation, the OP starts up and shows the start screen.

Setting the MPI address

Figure 14-1 shows a MPI configuration with an OP35. If you connect an OP35 which is still without a configuration to the MPI configuration, its MPI address is `1` by default.

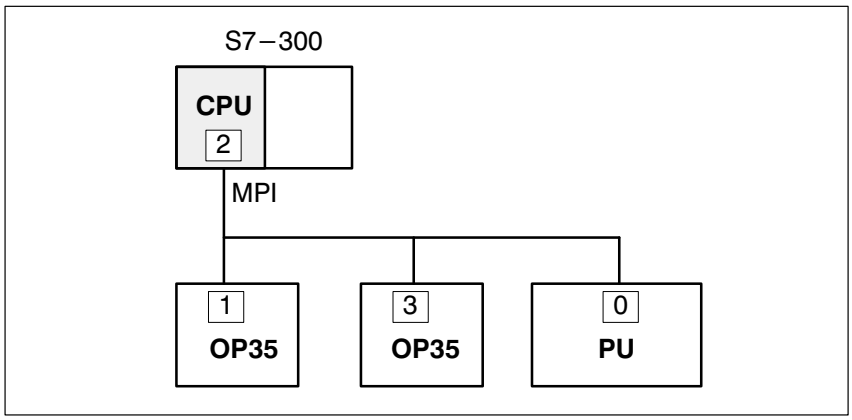


Figure 14-1 MPI Configuration with OP35

If you now load a configuration on the OP35 via the MPI, you must specify `1` as the MPI address. In your configuration, however, you gave the OP35 `3` as the MPI address. Now that the configuration has been downloaded, the OP35 has `3` as the MPI address.

Connecting several OPs to the MPI configuration

If you wish to connect several OP25/35/37s to the MPI configuration, you must connect them one after the other. First physically connect a device. Then download the configuration. Only then can you physically connect the next OP. If you were to physically connect both OPs first and then download the configuration, address conflicts would result. The reason for this is that both OPs have the same address. This is not allowed in the MPI configuration.

14.1.2 Downloading a Configuration to the OP45

Download methods

With the OP45, you can download the configuration in two ways. This depends on the device – PC (or PU) or OP45 – on which you created the configuration.

Configuration created on PC or PU

Download the configuration as described in section 14.1.1 (serial download)

or

copy the compile file, *name*`.fud`, to a floppy disk. Place the OP45 in DOS mode and copy the file called *name*`.fud` as `OP45.fud` to drive `D:\`. The configuration called `D:\OP45.fud` is active every time the OP45 starts up in normal operation (control and process monitoring).

Configuration created on OP45

If your configuration was created on the OP45 in DOS mode, copy the compiled file called *name*`.fud` to drive D:\ as `D:\OP45.fud`. The configuration called `D:\OP45.fud` is active every time the OP45 starts up in normal operation (control and process monitoring).

Note

When copying the compiled file, always specify its full name. On account of a DOS problem, when you use wildcard characters such as *, it is possible that not all of the file will be copied.

14.2 Managing Configuration Data on the OP

Flash memory

The flash memory on the OP is equivalent to the hard disk of a PC. Data are not deleted from the flash memory when the power is turned off. This is the reason why data have first to be loaded into the flash memory. When the OP starts up, it automatically loads the data from the flash into RAM. Data are stored in compressed form in the flash.

RAM

The RAM is equivalent to the main memory of a PC. Data in RAM are deleted when the power is turned off. Figure 14-2 shows the data in the different storage devices. Stored data in RAM are not compressed and therefore require more storage space than in the flash. This is true of both configuration data and firmware.

Memory card

The memory card (PCMCIA/Jeida) is an external memory, comparable to a floppy disk. It takes priority over a flash memory. The memory card can be used

- to back up data stored in the internal flash memory of the OP
- to restore backups
- to load or store recipe data records
- to load the data of one configuration station onto another destination OP without using a PC or PU
- as a storage medium, as an alternative or in addition to the internal flash memory.

The data mentioned above relate to firmware, configurations and/or data records.

Benefits of the memory card

Compared to the internal flash memory, the memory card exhibits the following benefits:

- The memory card is a portable storage medium; this means, for example, that recipe data can be ported from one OP to another.
- Configurations can be executed directly from the module, since the OP detects whether a module has been inserted and, when this is the case, accesses the module before accessing the internal flash memory.
- With up to 16 MB, there is sufficient space for large configurations or a large number of recipe data records.

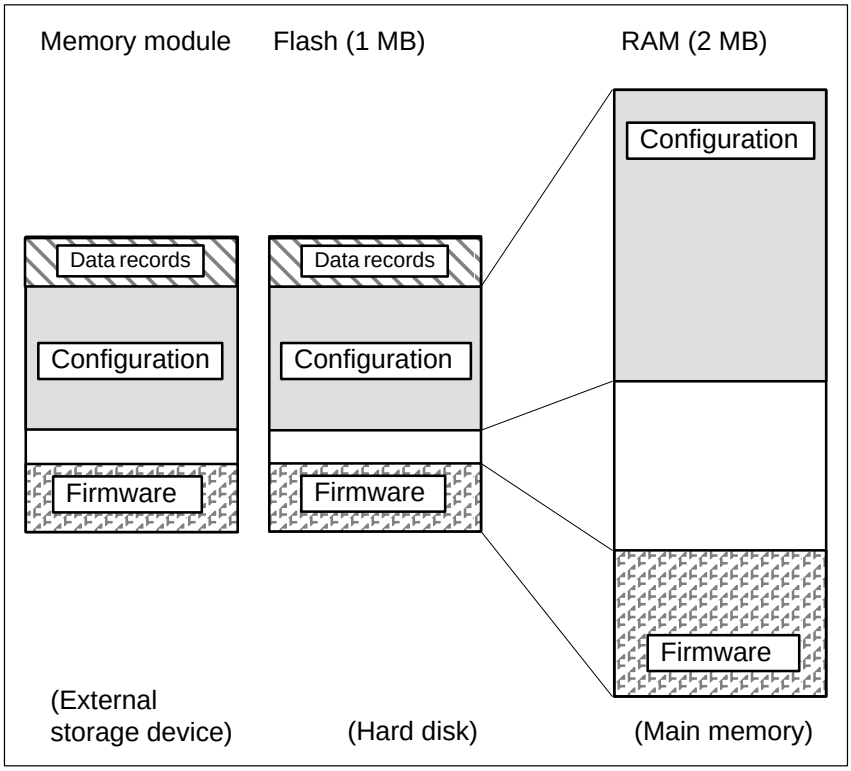


Figure 14-2 Managing Configuration Data on the OP

Memory requirements for data records

By choosing *System* → *Parameters* → *Miscellaneous* from the menu, you can set the reserved data record memory for the flash memory and the memory card. Up to 448 kByte and 384 kByte can be reserved for the flash memory and the memory card, respectively. Remember that 64 kByte of the flash memory are used for management data.

Creating data records

Data records can be created only on the OP. The flash memory or the memory card can be used as a storage medium. Once the area for the data records has been created, it is not automatically deleted when a new configuration is transferred. If a configuration is so large that it does not fit into the storage space available, polling takes place with a view to overwriting the reserved data record area.

Initial download

If you are loading a configuration onto the OP for the very first time, you can select only the flash or the memory card as the storage medium.

If the memory card has been inserted, you can select only the memory card. You cannot select the flash. The firmware is always downloaded automatically too.

Download update

If a configuration is already present on the OP, you can choose between the flash memory/memory card and RAM if you wish to perform another download. When downloading to the flash memory/memory card, the firmware is downloaded again only if the version on the PC is different from that on the OP.

You should download to RAM only during commissioning. Since RAM is not backed up in a power failure, the data are lost. The advantage of downloading to RAM is download updating. With download updating, only modifications are downloaded to the OP. This means that the download time is shorter. Once the configuration has been downloaded, it should be transferred to the flash memory.

14.3 Troubleshooting Download Problems

Problems may arise when you download the configuration to the OP. In the majority of cases either the baud rate is too high or other drivers are being used simultaneously on the PU or PC – for example, in the case of connection to a network. Table 14-1 shows possible problems, their cause and remedy.

Table 14-1 Possible Download Problems and Their Causes

Problem	Cause	Remedy
Downloading is aborted after the message `Line Error` is issued several times.	The cable set is too long.	Select lower baud rate.
	The cable set is poorly screened or interference signals are induced into the cable from other equipment.	Select lower baud rate.
	PC or PU performance insufficient.	Select lower baud rate.
	Another driver is running in the background – for example, with networking	Select lower baud rate or modify `autoexec.bat` and `config.sys` files.
Downloading is aborted and ProTool crashes.	PC performance insufficient.	Select lower baud rate.
Downloading does not take place.	The `system.ini` file in your Windows directory does not contain the default Windows communication driver which ProTool requires.	Check whether your `system.ini` file contains the entry `comm.drv=comm.drv`. If a different driver has been entered at this point, then installed communication programs – for example, for a modem or network – are using another driver. Modify the configuration of your PU or PC, or install ProTool on a stand-alone PC or PU.
	Interrupt problems. Various boards use the same interrupt.	Modify the configuration of your PU or PC, or install ProTool on a stand-alone PC or PU.

PG 740

Connect the cable set to the OP and the PU before starting Windows.

Communication drivers

Many interface boards are fitted with SMC chips FDC37C665 or FDC37C663. With some versions (FDC37C665: Rev. A through Rev. D; FDC37C663: Rev. B), problems may occur when you download your configuration to the OP. This chip is used on the PG 740, for example.

In ProTool, two error-corrected drivers (`comm.drv` and `serial.386`) are supplied for this chip; problems do not occur with them. You will find these drivers and their README files in the `\PROTOOL\SMC` directory. Rename the original drivers in the `\WINDOWS\SYSTEM` directory as `comm.old` and `serial.old` and then copy the error-corrected drivers to this directory.

Printing Your Configuration

15

Chapters

You can print all or part of the current configuration. ”Part” means that you can print either one or more *chapters* or individual pages of a *chapter. Chapter* refers to the type of object. All the objects of any one type, such as screens, variables etc., are printed in a separate *chapter.*

Standard reports

When ProTool is supplied to you, the following standard reports are available:

– **complete**
– **screens**
– **event messages**
– **alarm messages**
– **variables**

Initiating printing

Printing is initiated by choosing *File* → *Print* from the menu. Figure 15-1 shows the dialog box. The printer settings and the printer options are automatically the same as the default Windows functions which you set for your computer.

With the editors for event messages, alarm messages and screens, there are also editor-specific menu items on the menu bar. If you choose *Print* at this point, the corresponding standard report is set automatically.

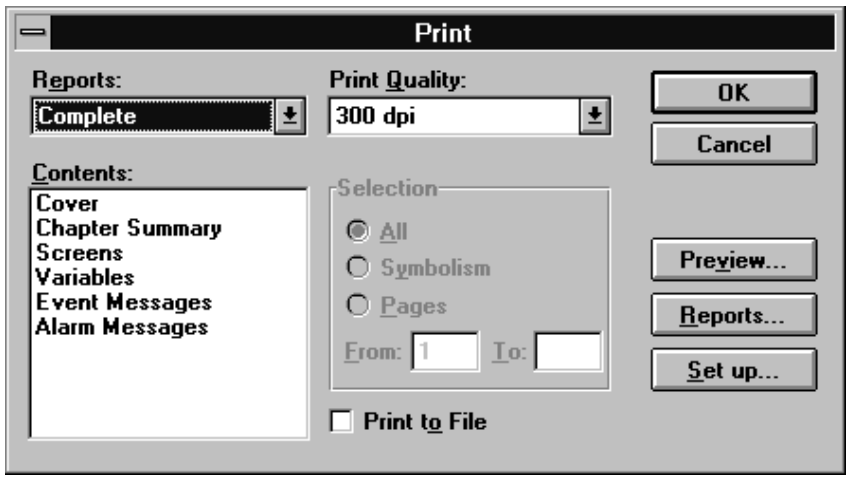


Figure 15-1 Print Dialog Box

Print to file

You can also print to a file. To print to a file, check *Print to File* in the *Print* dialog box. If you then confirm by choosing *OK*, you are prompted to enter the filename. Your configuration is then processed according to the printer you set, and the data are written to the file.

Printing separate pages

You can also print separate pages of a chapter. To print separate pages, click the corresponding chapter in the *Contents* dialog and specify under *Selection* the pages you want to have printed.

Preview

Press the *Preview* button for a preview of the report on the screen. Here you can see the prospective size of the report or the page on which a particular object will appear. Similarly, you can also check your settings.

Settings

You can create individual designs for configuration printouts. In this instance, make sure that the settings for the reports do not apply to other projects as well. The following settings are possible for reports:

– page margins
– text for headers and footers
– parameters for individual chapters
– design cover
– create self-defined reports.

Creating and modifying reports

Choosing the *Reports* button takes you to another dialog box, in which you can perform the settings for the reports. Make sure that you do not re-name the standard reports or add or delete any chapters to or from them, respectively. You must create self-defined reports under a new name.

The cover can be created once only. You can create a graphic or text by using an application. Similarly, you can embed an existing file.

Page — Here you can define the page margins along with the headers and footers.

Parameters — The parameters are specific to each object type. An object of an object type comprises different components in the configuration. Some settings are optional, others are mandatory. In your printout, you can specify whether you would like all or just selected components of the objects to be printed. Figure 15-2 shows, by way of an example, the dialog box in which you can specify the parameters for variables.

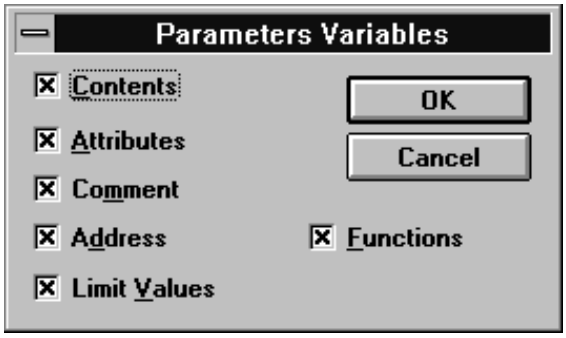


Figure 15-2 Parameters Dialog Box for the Variables Chapter

Note

Printer drivers	– It might not be possible to print the configuration if you are using CANON drivers. In this instance, printing is aborted. – With the Apple laser printer, the first line is omitted. When the drivers for the `HP LaserJet III PostScript` or `PostScript Printer` are used, this problem does not occur.
ASCII character set	With many printers it may not be sufficient to set the ASCII character set in the configuration only. Make sure that the ASCII character set is set on the printer as well.

Managing Your Configuration

16

This chapter describes ProTool's file structure and Project Manager's functions.

Special features of STEP 7 integration

If you have installed ProTool with STEP 7 integrated, use the SIMATIC Manager instead of the Project Manager. It allows you to copy, move, back up and restore projects, in exactly the same way as you do with your STEP 7 projects. The Project Manager is no longer available.

16.1 File Structure

Overview

Figure 16-1 shows the file structure as created with the default installation of ProTool.

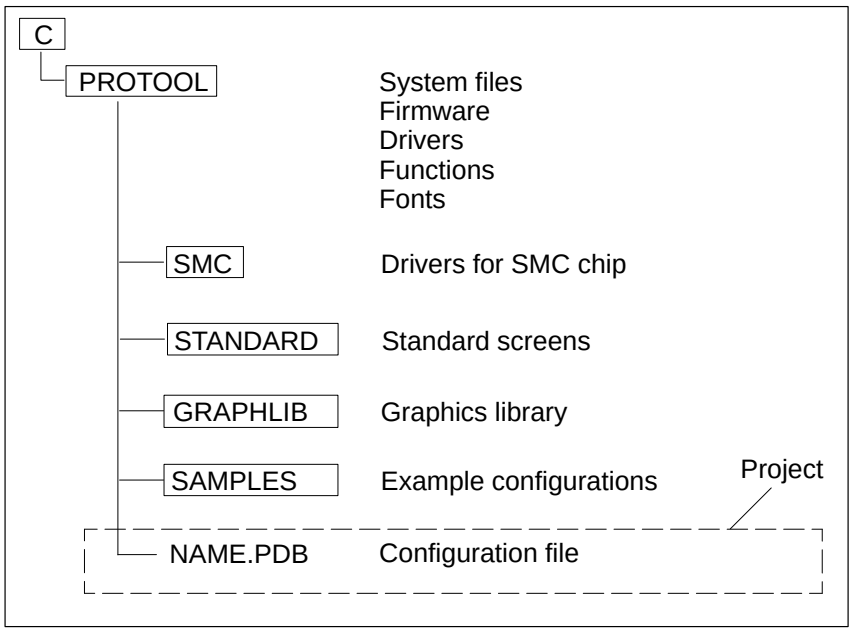


Figure 16-1 ProTool's File Structure

Directory: *PROTOOL*

The C:\PROTOOL directory contains all the files belonging to the ProTool program. Furthermore, all the entries required for initializing ProTool are made in the Windows directory. ProTool is installed as a separate program group.

New configurations are also stored in the C:\PROTOOL directory after they have been created. Every configuration consists of one file (name: **.PDB*). This file identifies the configuration. Different configurations have to be stored under different names. By default, the names PRO0 through PRO65535 are assigned.

When a configuration is compiled, a file is created. The file is stored as *NAME.FUD* in the *C:\PROTOOL* directory too.

Directory: *PROTOOL\STANDARD*

The C:\PROTOOL\STANDARD directory contains the standard configurations supplied for the different OPs. Standard configurations contain screens on which functions of a general nature have already been configured. These functions include, for example, Change Modes, Download Mode, message handling, printer settings and Status/Force Variable.

A separate standard configuration is available for every type of OP. The standard configurations are installed under the following names:

Standard Configuration	For OP	For PLC
s5_25.pdb	OP25	SIMATIC S5
s5_35.pdb	OP35	SIMATIC S5
s5_37.pdb	OP37	SIMATIC S5
s5_45.pdb	OP45	SIMATIC S5
s7MPI_25.pdb	OP25	SIMATIC S7
s7MPI_35.pdb	OP35	SIMATIC S7
s7MPI_37.pdb	OP37	SIMATIC S7
s7PPI_25.pdb	OP25	SIMATIC S7
s7PPI_35.pdb	OP35	SIMATIC S7
s7PPI_37.pdb	OP37	SIMATIC S7

Standard configurations already contain configured standard screens. Table 16-1 shows the names of the standard screens and the uses to which they are put.

Note

Since screens cannot be copied to other projects, you should always build on the standard configuration. Therefore, make a copy of the standard configuration and then work with the copy. You copy a configuration by saving it under a different name in ProTool.

The symbolic names of variables in a standard configuration begin with Z_ to distinguish them from other variables.

Table 16-1 Standard Screens Supplied with ProTool

Screen Name	Use
Z_PASSWORD	Allocate and modify password Login
Z_PRINTER	Set printer and printer parameters
Z_STATUS	Status variable for diagnosing the PLC
Z_SETTINGS	General system settings such as – Change Modes – Change Language – Blank Screen – Enter date and time – Display First/Last Alarm Message – Message log ON/OFF – Buffer Overflow Warning ON/OFF
Z_MESSAGES	Message handling such as – Call event message window – Call event buffer/event message page – Delete event buffer – Call alarm buffer/alarm message screen – Delete alarm buffer
Z_RECORD_1	Basic functions for using data records
Z_RECORD_2	Extensions for using data records
Z_FORCE	Status/Force Variable
Z_SYSTEM_MENU	Summary screen for standard screens. From this screen, you can go to the following standard screens: – Z_PASSWORD – Z_PRINTER – Z_STATUS – Z_SETTINGS – Z_MESSAGES

Directory: *PROTOOL\SMC*

The `C:\PROTOOL\SMC` directory contains the drivers for serial data communications. This directory further contains the two communication drivers `comm.drv` and `serial.386` with the associated README files (refer to section 14.3).

Directory: *PROTOOL\GRAPHLIB*

The `C:\PROTOOL\GRAPHLIB` directory contains a graphics library comprising symbols for different subjects. The symbols are available in the following three formats:

– in CorelDraw (`*.cdr`)
– in Micrografix Designer (`*.drw`)
– as a bitmap (`*.bmp`)

The CorelDraw and Designer files both contain all the symbols of any one subject. The bitmap files contain only one symbol. The filenames for the bitmaps are numbered consecutively for every subject. The bitmap files for every subject are stored in separate directories. The name of the directory is the subject. Table 16-2 shows how the file and directory names are called for the different subjects.

Note

The graphics library supplied with the package is available only in compressed form after it has been installed. To decompress the library, run the `*.exe` files.

Directory: *PROTOOL\SAMPLES*

The `C:\PROTOOL\SAMPLES` directory contains the example configurations supplied for ProTool. The directory also contains the PLC programs for the example configurations. Example configurations and PLC programs have been geared to each other.

Table 16-2 File Names of the Subjects in the Graphics Library

Name	Subject
DRIVE	Servo drives
FITTING	Fittings
VESSEL	Vessels
BINARY	Switching elements
DOCUMENT	Symbol for document
FILTER	Filters
COMPUTER	Stylized PC with printer
INSTRUM	Indicating instrument
CARDFILE	Symbol for card file
BUTTFLY	Butterfly valves
COOLTWR	Cooling towers
CURVESYM	Trend symbols
CCTDIA	Drive circuit diagram
TESTEQPT	Test equipment
MEASURE	Measurements
MOTOR	Symbol for motor
MILL	Mills
PUMP	Pumps
REACTOR	Reactor image
MIXER	Mixer
S5155U	Symbol for PLC 155U
SLIDEVLN	Sliding valves
RECORD	Recordings
DRAWER	Symbol for drawer
RSFLIP	RS flip-flop
SYMBOLS	Pointing symbols
KEYS	Keys
XCHANGER	Exchangers
TEXTSYMBS	Text symbols
VALVE	Valves
COMPRESS	Compressors
BALANCE	Symbol for scales
PTGHAND	Pointing hand
PULSERS	Pulsers

16.2 Project Manager

Purpose

The Project Manager contains functions for user-friendly management of the configurations you create with ProTool:

- backup
- restore
- project overview.

Calling

You call Project Manager by choosing *File* → *Project Manager* from the menu. When you call Project Manager for the first time, the dialog box shown in figure 16-2 appears.

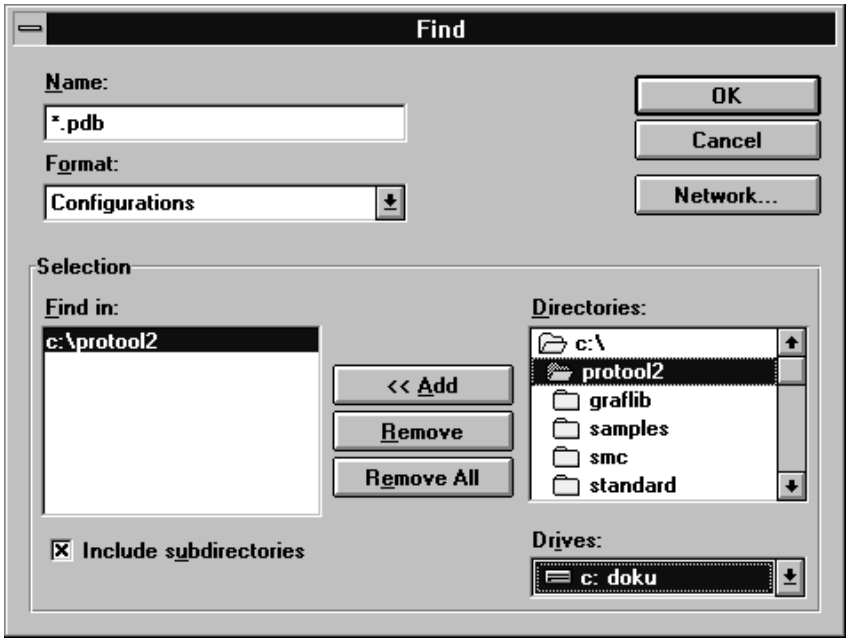


Figure 16-2 *Find* Dialog Box for Specifying Search Criteria

File formats

The *Find* dialog box is where you specify your search criteria. In this case, you can choose from the following file formats under *Format*:

- configurations (`*.pdb`),
- backups (`*.ar?`) and
- configurations/backups (`*.pdb;*.ar?`).

Selecting a file

Under *Selection*, you set the drives and directories which are applicable to your requirements. Click *OK* to go to the dialog box shown in figure 16-3. You select the file in this dialog box. This dialog box also appears if you call Project Manager again. On clicking the *Find* button, you return to the dialog box shown in figure 16-2).

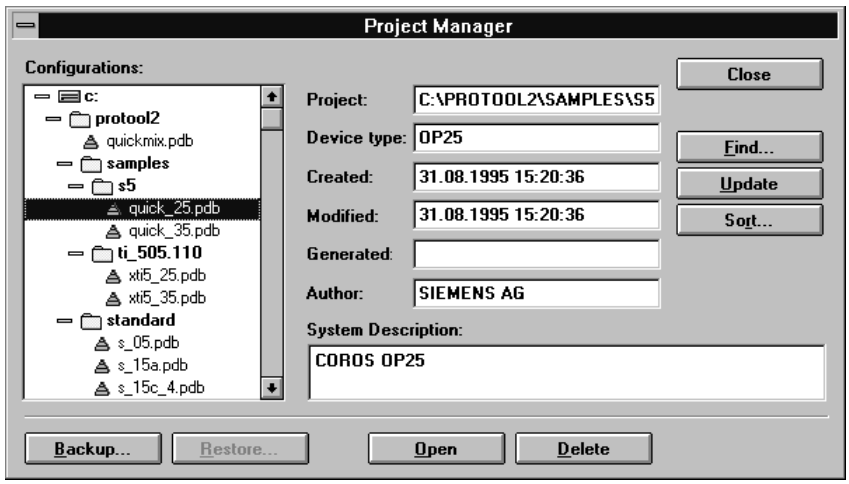


Figure 16-3 Project Manager Dialog Box

Backup and restore

For backing and restoring project files, Project Manager provides *Backup* and *Restore* functions. Project Manager supports data backup and restore over several floppy disks. This is necessary, in particular, with large configurations for which one floppy disk is insufficient.

The Backup and Restore dialog boxes are identical in structure. Figure 16-4 shows the *Backup* dialog box.

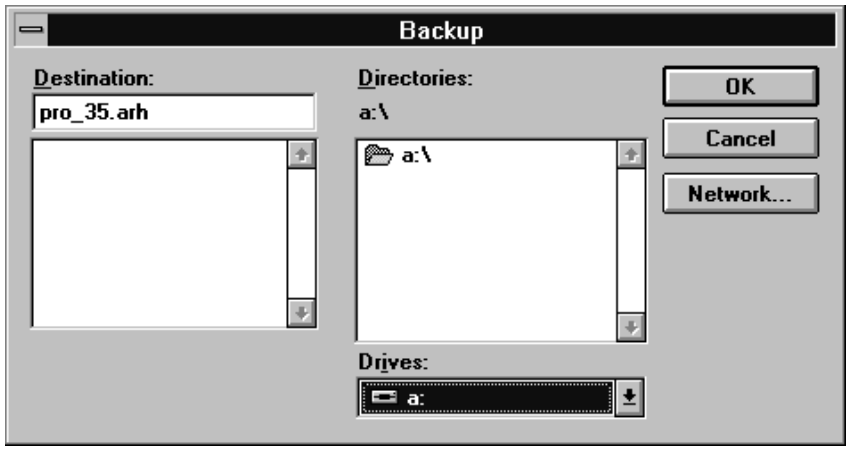


Figure 16-4 Backup Dialog Box

Starting Backup

When you wish to archive a configuration (backup), you first select the configuration file in the *Project Manager* dialog box. In the *Backup* dialog box, enter the destination drive and the file name of the file you want to back up. Backup is started by clicking the *OK* button.

ProTool automatically prompts you to insert a new floppy disk, if required. The backup procedure is then interrupted until you insert a new floppy disk and confirm it in the displayed dialog box.

Note the floppy disk number on the floppy disk with backups extending over more than one floppy disk. This is the only successful way of reading in the backup disks in the correct order.

Starting Restore

You restore backups in a similar manner.

Hints on Optimization 17

17.1 Polling time and update time

The polling times specified in the configuration software for *area pointers* and the polling times for variables are important aspects for the update times actually achieved. The update time is polling time plus transfer time plus processing time.

To achieve optimum update times, observe the following points when you are configuring:

- Make the different data areas as small as possible and as large as necessary.
- Define contiguous data areas when they belong together. The actual update time improves if you create one large area as opposed to several smaller ones.
- Polling times that have been dimensioned too short unnecessarily degrade overall performance. Set the polling time commensurate with the speed of variation of process values. The temperature variation of a furnace, for example, is distinctly more inert than the variation in speed of an electric drive.

  Recommended value for polling time: approx. 1 second.
- Do without cyclic transfer of the user data areas, if necessary, to improve update times (polling time 0). In its place, use PLC jobs to transfer the user data areas spontaneously.
- Place the variables of a message or a screen without gaps in a data area.
- So that modifications on the PLC can be properly detected by the OP, they must be present at least during the actual polling time.

17.2 Optimizing Loading and Saving Times

The loading and saving of configurations may take a very long time, especially if you are using large quantities of graphics created with Designer, Corel Photo Paint or Corel Draw. This time can be drastically cut by means of optimization.

Observe the following points to cut times:

1. **Save As**
   Perform “Save As” every now and again. Data storage is optimized in this manner and the .pdb is kept small in size.
2. **Close Applications**
   You should close all other programs. In this way, more working memory is made available for ProTool.
3. **Configurations on local hard disk**
   Configurations should not be started across networks but should be located on your local hard disk. Network access is often too slow.
4. **Available disk storage**
   Additional free disk storage of at least the size of the configuration should be available. This applies equally if the configuration is started across a network.
5. **More RAM**
   Very good times can be achieved with 16 MB or more RAM. Requirements rise proportionally with the number and size of the graphic objects being used.
6. **Graphics editor**
   Avoid large numbers of graphics created with Designer, Corel Photo Paint and Corel Draw. Parts of these editors are used to edit these graphics. They are very slow. The best times are achieved with Paintbrush.
7. **Swap file, data access, cache in Windows 3.1/3.11**
   If your PC has less than 20 MB RAM, it is essential that you create a swap file. The swap file should have a size of several MB, and its type should be set to Permanent. File and disk access should be set to 32 bits. The size of the cache should be several MB. All the settings are performed under *Main → Control Panel → 386 Enhanced → Virtual Memory.*

   Temporary directory
   The temporary directory should be located on your local hard disk. The setting in your autoexec.bat file is as follows:

```
SET TMP = C:\TMP
SET TEMP = C:\TEMP
```

8. **Check system resources**
   20 – 40 MB should be shown in your Program Manager under *Help* → *About Program Manager* for the free amount of memory. This may be increased by means of additional RAM or virtual memory. System resources should indicate at least 65% free. This can be raised by closing all the applications. Fonts you do not require should be deleted (Main, Control Panel, Fonts). If the value is not attained, you must re-start Windows. Some programs permanently use up system sources on account of errors – Designer, for instance. System sources are released by re-starting Windows.

Description of Functions

A

General hints

The listing below presents an overview of all functions featured by ProTool. Functions in complex contexts are not explained here. However, they are fully configured on the standard screens. The equipment manuals explain how you handle standard screens.

In ProTool, a dialog box makes only those functions available that are possible in that particular dialog box. Functions that can be configured only in connection with a function key are not made available in the case of variables.

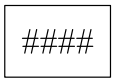
Under the following conditions, a function can also be triggered by the PLC:

- The variable configured for a function is linked to the PLC.
- In the *Functions* dialog box, the selection you made under *Conditions* was the item *Value Output*.

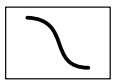
Icons

Each function is followed by an icon:

The function can be triggered by pressing a function key.



The function is triggered by means of the variable in an I/O field.



The function has been implemented on a standard screen. This is followed by the name of the standard screen.

Overview

ProTool makes the following functions available:

General:
– Backup/Restore (OP25, OP35, OP37) (refer to page A-4)
– Mode (OP25, OP35, OP37) (refer to page A-6)
– Mode (OP45) (refer to page A-8)
– Select Screen (refer to page A-10)
– Dynamic Screen Selection (OP25, OP35, OP37) (refer to page A-11)
– Blank Screen (OP25, OP35, OP37) (refer to page A-12)
– Language (refer to page A-13)

Editing Bits:
– Set Bit in Word (refer to page A-15)
– Reset Bit in Word (refer to page A-16)
– Set/Reset Bit in Word (refer to page A-17)
– Set Bit When Key Is Pressed (OP25, OP35, OP37) (refer to page A-18)

Editing BOOL variables:
– Set Bit (refer to page A-19)
– Reset Bit (refer to page A-20)
– Set/Reset Bit (refer to page A-21)
– Initialize Bit in Startup (refer to page A-22)
– Set BOOL Variable (refer to page A-23)
– Reset BOOL Variable (refer to page A-24)

Transferring and editing a data record (implemented on the standard screen):
– Data Record: PLC –> OP
– Data Record: DAT –> OP
– Data Record: PLC –> OP/DAT
– Data Record: OP –> DAT
– Data Record: OP –> PLC
– Data Record: DAT –> OP/PLC
– Select Data Record
– Edit Data Record
– Delete Data Record
– Format Data Medium

Date and time:
– Date and Time (refer to page A-25)
– Date I/O (refer to page A-26)
– Time I/O (refer to page A-27)

Print screen and printing (implemented on the standard screen):
– Printer Parameters
– Printer Parameters (Anchor)
– Assign Colors to Printers
– Print Screen Parameters
– Print Screen Parameters (Anchor)

Printing
– Print Screen List (OP25, OP35, OP37) (refer to page A-28)
– Start/Stop Print Screen (refer to page A-29)

Editing messages:
– Display Events (OP25, OP35, OP37) (refer to page A-30)
– Change EM Page/Buffer (refer to page A-31)
– Event Window (refer to page A-32)
– Events – Delete Buffer (refer to page A-34)
– Message Log ON/OFF (refer to page A-35)
– Buffer Overflow (refer to page A-36)
– Change AM Page/Buffer (refer to page A-37)
– Alarms – Delete Buffer (refer to page A-38)
– Display Alarms (OP25, OP35, OP37) (refer to page A-39)
– Alarms – Display First/Last (refer to page A-40)

Editing passwords (implemented on the standard screen):
– Define Password
– Define Password Level
– Enter Password
– Display Passwords

Status/force (implemented on the standard screen):
– STV Status/Force Init 1
– STV Status/Force Init 1 S7
– STV Status/Force Init 2
– STV Status/Force Select
– STV Status/Force De-select
– STV Status Variable
– STV Status Start/Stop
– STV Force Variable
– STV Force Variable S7
– STV Force Input/Start

Scalings:
– Scaling Linear 1 (refer to page A-41)
– Scaling Linear 2 (refer to page A-42)
– Scaling Square 1 (refer to page A-43)
– Scaling Square 2 (refer to page A-44)

Backup/Restore

Purpose (not OP45)

You use this function to write data from data areas of the OP to the memory card or from the memory module to the data areas of the OP. There are three data areas: Firmware, Configuration, and Data Records.

Assigning to a function key or a soft key

Objective

You wish to write data records from the OP to the module or from the module to the OP by means of two keys.

To configure

Select the key which you require to be set with the OP –> Module direction. Under the selected *Backup/Restore* function, assign the following parameters:
– a constant which is to apply to the direction OP –> Module: *Direction*: 0 and
– a constant which is to apply to the data area Data Record: *Scope*: 2.

Proceed in a similar manner for the second key. For the constant *Direction*: use the value 1. For the constant *Scope*: use the value 2.

Execution

The function is triggered whenever you press on one of the keys. The constants are evaluated, and the data records are written, depending on the direction, to either the module or the OP.

Attaching to the variable of an I/O field

Objective

You wish to write data records from the OP to the module using an input/output field on the screen.

To configure

Create an input/output field having a random variable on a screen. For this variable, configure the function you selected, *Backup/Restore*, to which the following parameters apply:
Constant: *Direction*: 0
Constant: *Scope*: 2

Execution

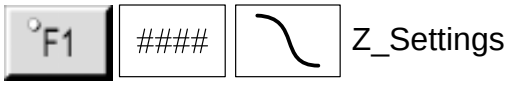
The function is triggered as soon as the value of the input/output field is modified and the values of the constants are evaluated. The data records are written from the OP to the module.

Parameters

Constant for *Direction* with
- 0 = OP –> Module
- 1 = Module –> OP

Constant for *Scope* with
- 0 = Firmware + Configuration + Data Records
- 1 = Firmware + Configuration
- 2 = Data Records

Mode



Purpose (not OP45)

With this function you change operating modes on the OP. There are five operating modes: Online, Offline, Serial Download, Loop–Through Connection and MPI Download.

Assigning to a function key or a soft key

Objective

You wish to set one of the four operating modes – Online, Offline, Serial Download or Loop–Through Connection – by means of one of four keys. You wish to be able to see on the screen which operating mode has been set.

To configure

Select the key you wish to use for setting the first operating mode. Select the *Mode* function and define the following parameters:
– a constant that applies to Online operating mode: *Operating Mode (Key)*: 0
and
– a random internal variable (*– No PLC –*): *Operating Mode (Field)*.

Proceed in a similar manner for the other three keys. For the constant, use the values corresponding to the operating modes: 1, 2 and 3. For the variable, always use the same variable.

So that you can recognize the selected operating mode on the screen, configure a symbolic output field to which the variable that you configured above is assigned. Further, create a text list to whose values 0 to 3 the Online, Offline, Serial Download and Loop–Through Connection operating modes are assigned.

Execution

The function is triggered whenever you press one of the keys. The constant is evaluated, and the corresponding operating mode is set on the OP. The value of the constant is transferred to the variable, and the output field is updated.

Attaching to the variable of an I/O field

Objective

You wish to change from one of the four operating modes to another one by means of a symbolic I/O field on the screen.

To configure

Create a symbolic I/O field having a random internal variable on a screen. For this variable, configure the function you selected, *Mode*, to which the following parameter applies:
internal variable: *Operating Mode (Field)*:

Specify for the function the same variable for which you are configuring the function.
Example: You are configuring the *MODE* variable. You are defining the *Mode* function for this variable. The parameter of this function you select for *Operating Mode (Field)* is the same variable: *MODE*.

0 is entered as the value by ProTool for the constant *Operating Mode (key)*:. However, this value is **not** evaluated for a function using a variable.

Also, create a text list and assign the values 0 to 3 the Online, Offline, Serial Download and Loop–Through Connection operating modes.

Execution

The operating mode you selected is displayed in the symbolic I/O field. Select another operating mode from the list box. The function is triggered. The value of the variable is evaluated, and the corresponding operating mode is set on the OP. The I/O field is updated.

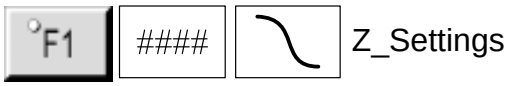
Parameters

Variable for displaying *Operating Mode (Field)*
Constant for *Operating Mode (Key)* with
0 = Online
1 = Offline
2 = Serial Download
3 = Loop–Through Connection
5 = MPI Download

Condition

The variable of the function must be in INTEGER format.

Mode



Purpose (OP45 only)

With this function you change operating modes on the OP. There are six operating modes: Online, Offline, Serial Download, Loop–Through Connection, Exit from System and Change to DOS.

Assigning to a function key or a soft key

Objective

You wish to set one of the four operating modes – Online, Offline, Serial Download or Loop–Through Connection – by means of one of four keys. You wish to be able to see on the screen which operating mode has been set.

To configure

Select the key you wish to use for setting the first operating mode. Select the *Mode* function and define the following parameters:
– a constant that applies to Online operating mode: *Operating Mode (Key)*: 0
and
– a random internal variable (*– No PLC –*): *Operating Mode (Field)*.

Proceed in a similar manner for the other three keys. For the constant, use the values corresponding to the operating modes: 1, 2 and 3. For the variable, always use the same variable.

So that you can recognize the selected operating mode on the screen, configure a symbolic output field to which the variable that you configured above is assigned. Further, create a text list to whose values 0 to 3 the Online, Offline, Serial Download and Loop–Through Connection operating modes are assigned.

Execution

The function is triggered whenever you press one of the keys. The constant is evaluated, and the corresponding operating mode is set on the OP. The value of the constant is transferred to the variable, and the output field is updated.

Attaching to the variable of an I/O field

Objective

You wish to change from one of the four operating modes to another one by means of a symbolic I/O field on the screen.

To configure

Create a symbolic I/O field having a random internal variable on a screen. For this variable, configure the function you selected, *Mode*, to which the following parameter applies:
internal variable: *Operating Mode (Field)*:

Specify for the function the same variable for which you are configuring the function.

Example: You are configuring the *MODE* variable. You are defining the *Mode* function for this variable. The parameter of this function you select for *Operating Mode (Field)* is the same variable: *MODE*.

0 is entered as the value by ProTool for the constant *Operating Mode (key)*:. However, this value is **not** evaluated for a function using a variable.

Also, create a text list and assign the values 0 to 3 the Online, Offline, Serial Download and Loop–Through Connection operating modes.

Execution

The operating mode you selected is displayed in the symbolic I/O field. Select another operating mode from the list box. The function is triggered. The value of the variable is evaluated, and the corresponding operating mode is set on the OP. The I/O field is updated.

Parameter(s)

Variable for displaying *Operating Mode (Field)*
Constant for *Operating Mode (Key)* with
0 = Online
1 = Offline
2 = Serial Download
3 = Loop–Through Connection
4 = Exit from System
5 = Change to DOS

Condition

The variable of the function must be in INTEGER format.

Select Screen

Purpose With this function you call another screen.

Assigning to a function key or a soft key

Objective: You wish to select another screen by means of a key.

To configure: Select the key with which you wish to select the screen. Select the *Select Screen* function and define the *Screen Name:* parameter.

Execution: Whenever you press the key, the function is triggered and the contents of the *Screen Name:* parameter are evaluated. The corresponding screen is shown on the display.

Attaching to the variable of an I/O field

Objective: You wish to select another screen using an input or output field.

To configure: Create an input or output field having a random variable on a screen. For this variable, configure the function you selected, *Select Screen*, and define its *Screen Name:* parameter.

Execution: The function is triggered as soon as the value of the input or output field is modified. The contents of the *Screen Name:* parameter are evaluated, and the screen is refreshed.

Parameter(s) *Screen Name*

Dynamic Screen Selection

Purpose (not OP45)

With this function you call another screen.

The Dynamic Screen Selection function can be attached to the variable of an I/O field.

Objective

You wish to select other screens using an input/output field.

To configure

Create an input/output field having a random variable on a screen. For this variable, configure the function you selected, *Dynamic Screen Selection*.

Execution

You enter the screen number of the screen you require in the input/output field. The function is triggered as soon a value is applied. The contents of the variable is evaluated, and the screen is refreshed.

Parameter(s)

None

Condition

The variable for which the function has been configured must be in CHAR or INTEGER format.

Blank Screen

Purpose (not OP45)

With this function, the back-lighting of the screen is switched off after a set time if there is no operator input on the OP. The back-lighting is switched on again when a key is pressed on the OP.

Assigning to a function key or a soft key

Objective

You wish to blank the screen on the OP by means of a key.

To configure

Select the key which you wish to use for blanking the screen. Select the *Blank Screen* function and define the *Idle Time (min):* parameter. The value of this parameter is, however, **not** evaluated for a function using a key.

Execution

As soon as you press the key, the function is triggered, and the screen is blanked.

Attaching to the variable of an I/O field

Objective

You wish to blank the screen on the OP automatically if there is no input by the operator.

To configure

Create a random variable. For this variable, configure the function you selected, *Blank Screen*, and define its *Idle Time (min):* parameter. You enter the value of the parameter in minutes.

Execution

The function is initiated and the *Idle Time (min):* parameter is evaluated as soon as you power up the OP. If the operator has not made an input by the end of the idle time, the screen is blanked. The time count starts after any input made by the operator on the OP.

Parameter

Constant for *Idle Time (min)*.

Condition

In the *Functions* dialog box, you must have selected – under *Conditions* – the item called *Initialization*.

Language

Z_Settings

Purpose

With this function you change the language on the OP. This means that system text and all items of configured text are displayed in the new language that you have selected.

Basics

You create your configuration in various languages. However, only three languages can be downloaded to the OP. You define these languages by choosing *System → Language Assignment*. The OP detects how many languages have been downloaded and assigns the languages the numbers 0, 1 and 2 in the order that they were configured. This number is used again when the function is configured.

Assigning to a function key or a soft key

Objective

You wish to toggle between three languages – A, B and C – by means of three keys. You wish to be able to see on the screen which language has been set.

To configure

Select the key with which you wish to set language A. Select the *Language* function and define the following parameters:
– a constant which is to apply to language A:: *Language (Key)*: 0 and
– a variable: *Language (Field)*.

Proceed in a similar manner for the other two keys. For the constant, use the values corresponding to the languages: 1 and 2. For the variable, always use the same variable.

So that you can recognize the selected language on the screen, configure a symbolic output field to which the variable that you configured above is assigned. Also, create a text list and assign the values 0 to 2 to the languages A, B and C.

Execution

The function is triggered whenever you press one of the keys. The constant is evaluated and the corresponding language is set on the OP. The value of the constant is transferred to the variable, and the output field is updated.

Special feature

You can use a kind of toggle function. In this instance, you use a **single** key to toggle between the three languages, A, B and C. You configure in the manner described above, the only difference being that you define just one key. For the constant, you specify a value of –1. If you press the key, the function is triggered, and you toggle between the three languages: A –> B –> C –> A.

Important

If you:
– use a key to employ the function **and**
– have configured a symbolic output field to display the language, **and**
– you later modify the OP languages:
  – their order,
  – their number **or**
  – their grouping,

you must remember to make the corresponding adjustments to your text list.

Attaching to the variable of an I/O field

Objective

You wish to toggle between three languages – A, B and C – by means of a symbolic I/O field on the screen.

To configure

Create a symbolic I/O field with a variable on a screen. For this variable, configure the function you selected, *Language*, to which the following parameter applies:
Variable: *Language (Field)*:

Use the same variable for the I/O field and for the function. The value 0 is entered for the constant *Language (Key):* by ProTool. However, this value is **not** evaluated for a function using a variable.

Also, create a text list and assign the values 0 to 2 to the languages A, B and C.

Execution

The language you selected is displayed in the symbolic I/O field. Using the list box, select another language. The function is triggered. The value of the variable is evaluated, and the corresponding language is set on the OP. The I/O field is updated.

Parameter(s)

Variable for displaying *Language (Field)*,
Constant for *Language (Key)* with
0 = Language 1,
1 = Language 2,
2 = Language 3,
–1 = Toggle (Language 1 –> 2 –> 3 –> 1).

Condition

The variable of the function must be in INTEGER format.

Set Bit in Word

Purpose

With this function you set a bit in the word of a variable. The variable is transferred to the PLC.

The *Set Bit in Word* function can be assigned to a function key or a soft key.

Objective

You wish to set a bit in a word of a variable by means of a key. The variable will then be transferred to the PLC.

To configure

Select the key you wish to use for setting a bit in a word of a variable. Select the *Set Bit in Word* function and define the following parameters:
– a PLC variable that applies to the word: *Word:*
– a constant that applies to the bit: *Bit:*

Execution

Whenever you press the key, the function is triggered, and the parameters are evaluated. The corresponding bit is then set in the word of the variable, and the variable is transferred to the PLC.

Parameter(s)

Variable for *Word*
Constant for *Bit* number.

Condition

The variable of the function must be in INTEGER format.
The value of the variable must not be modified by the PLC.

Reset Bit in Word

Purpose

With this function you reset a bit in the word of a variable. The variable is transferred to the PLC.

The *Reset Bit in Word* function can be assigned to a function key or a soft key.

Objective

You wish to reset a bit in the word of a variable by means of a key. The variable will then be transferred to the PLC.

To configure

Select the key you wish to use for resetting a bit in the word of a variable.
Select the *Reset Bit in Word* function and define the following parameters:
– a PLC variable that applies to the word: *Word:*
– a constant that applies to the bit: *Bit:*

Execution

Whenever you press the key, the function is triggered, and the parameters are evaluated. The corresponding bit is then reset in the word of the variable, and the variable is transferred to the PLC.

Parameter(s)

Variable for *Word*
Constant for *Bit* number.

Condition

The variable of the function must be in INTEGER format.
The value of the variable must not be modified by the PLC.

Set/Reset Bit in Word

Purpose

With this function you set a bit in the word of a variable and reset a bit in the word of a variable. The variable is transferred to the PLC.

The *Set/Reset Bit in Word* function can be assigned to a function key or a soft key.

Objective

You wish to set and reset a bit in the word of a variable by means of a key. The variable will then be transferred to the PLC.

To configure

Select the key you wish to use for setting and resetting a bit in the word of a variable. Select the *Set/Reset Bit in Word* function and define the following parameters:
– a PLC variable that applies to the word: *Word:*
– a constant that applies to the bit: *Bit:*

Execution

Whenever you press the key, the function is triggered, and the parameters are evaluated. The corresponding bit is then set in the word of the variable, and the variable is transferred to the PLC. If you press the key a second time, the corresponding bit is reset, and so on.

Parameter(s)

Variable for *Word*
Constant for *Bit* number.

Condition

The variable of the function must be in INTEGER format.
The value of the variable must not be modified by the PLC.

Set Bit When Key Is Pressed

Purpose (not OP45)

With this function you set a bit in the word of a variable. The bit remains set until the key is released.

The *Set Bit When Key Is Pressed* function can be assigned to a function key or a soft key.

Objective

You wish to set a bit in a word of a variable by means of one key for such time until you release the key.

To configure

Select the key you wish to use for setting a bit in the word of a variable. Select the *Set Bit When Key Is Pressed* function and define the following parameters:
– a PLC variable that applies to the word: *Word:*
– a constant that applies to the bit: *Bit:*

Execution

Whenever you press the key, the function is triggered, and the parameters are evaluated. The corresponding bit is then set in the word of the variable, and the variable is transferred to the PLC. The bit remains set until the key is released.

Parameter(s)

Variable for *Word*
Constant for *Bit* number.

Condition

The variable of the function must be in INTEGER format.
The value of the variable must not be modified by the PLC.

Set Bit

Purpose (not SIMATIC S5)

With this function you set a variable.

The *Set Bit* function can be assigned to a function key or a soft key.

Objective

You wish to set a variable by means of a key.

To configure

Select the key you wish to use for setting a variable.
Select the *Set Bit* function and define the following parameters:
the PLC variable: *Bit:*

Execution

The function is triggered whenever you press the key. When you do so, the variable is set.

Special feature

With this function you require a separate function key for every variable that you wish to set. Depending on the key you press, the corresponding variable is set. Compare the *Set BOOL Variable* function with which you can set different BOOL variables by means of a **single** key.

Important

Do not use an internal variable or else the function will not be executed.

Parameter(s)

Variable for *Bit*

Condition

The variable of the function must be in BOOL format.

Reset Bit

Purpose (not SIMATIC S5)

With this function you reset a variable.

The *Reset Bit* function can be assigned to a function key or a soft key.

Objective

You wish to reset a variable by means of a key.

To configure

Select the key you wish to use for resetting a variable. Select the *Reset Bit* function and define the following parameters:
the PLC variable: *Bit:*

Execution

The function is triggered whenever you press the key. When you do so, the variable is reset.

Special feature

With this function you require a separate function key for every variable that you wish to reset. Depending on the key that you press, the corresponding variable is reset. Compare the *Reset BOOL Variable* function with which you reset different BOOL variables by means of a **single** key.

Important

Do not use an internal variable or else the function will not be executed.

Parameter(s)

Variable for *Bit*

Condition

The variable of the function must be in BOOL format.

Set/Reset Bit

Purpose (not SIMATIC S5)

With this function you can set and reset a variable.

The *Set/Reset Bit* function can be assigned to a function key or a soft key.

Objective

You wish to set and reset a variable by means of a key.

To configure

Select the key you wish to use for setting and resetting a variable. Under the *Set/Reset Bit* function that you selected, define the following parameters: the PLC variable: *Bit:*

Execution

The function is triggered whenever you press the key. When you do so, the variable is set. If you press the key a second time, the bit is reset. The reason for this is that it is a toggle function.

Parameter(s)

Variable for *Bit*

Condition

The variable of the function must be in BOOL format.

Initialize Bit in Startup

####

Purpose

With this function you assign a specific status to a variable when the OP starts up.

The *Initialize Bit in Startup* function can be attached to a variable.

Objective

You wish to set a variable to a specific state when the OP starts up (for example, you wish to define in the PLC that the OP has started up).

To configure

Create a random variable. For this variable, configure the function you selected, *Initialize Bit in Startup*, to which the following parameter applies:
Constant: *Status after System Startup:* 1

Proceed in a similar manner if you specifically wish to reset a variable in the OP. Appropriately, use 0 as the value for the constant.

Execution

The OP starts up. The function is triggered, and the value of the constant is evaluated at the same time. The variable is set or reset.

Parameter(s)

Constant for *Status after System Startup* with
0 = FALSE, reset,
1 = TRUE, set.

Condition

The variable for which the function has been configured must be in BOOL format. With the SIMATIC S5, therefore, the variable can only be an internal variable.

Set Bool Variable

Purpose

With this function you set a BOOL variable. To do so, the cursor must be located in an input field for which this BOOL variable was configured.

The *Set BOOL Variable* function can be assigned to a function key or a soft key.

Objective

You wish to set a BOOL variable by means of a key.

To configure

Configure an input field, to which you assign a BOOL variable. Select the key you wish to use for setting a BOOL variable. Assign the *Set BOOL Variable* function to the *Selected Functions*.

Execution

Whenever the key is pressed and the cursor is located in the input field, the function is triggered. The BOOL variable is then set.

Special feature

With this function you can set different BOOL variables by means of a **single** key. To do this, configure several input fields, to which you assign BOOL variables. Depending on the position of the cursor, the corresponding BOOL variables are set when the key is pressed.
Compare the *Set Bit* function, for which you require a separate function key for every bit that you wish to set.

Parameter(s)

None

Condition

The variable for which the function has been configured must be in BOOL format. With the SIMATIC S5, therefore, the variable can only be an internal variable.

Reset Bool Variable

Purpose

With this function you reset a BOOL variable. To do so, the cursor must be located in an input field for which this BOOL variable was configured.

The *Reset BOOL Variable* function can be assigned to a function key or a soft key.

Objective

You wish to reset a BOOL variable by means of a key.

To configure

Configure an input field, to which you assign a BOOL variable. Select the key you wish to use for resetting a BOOL variable. Assign the *Reset BOOL Variable* function to the *Selected Functions*.

Execution

Whenever the key is pressed and the cursor is located in the input field, the function is triggered. The BOOL variable is then reset.

Special feature

With this function you can reset different BOOL variables by means of a single key. To do this, configure several input fields, to which you assign BOOL variables. Depending on the position of the cursor, the corresponding BOOL variables are reset when the key is pressed.
Compare the *Reset Bit* function, for which you require a separate function key for every bit you wish to reset.

Parameter(s)

None

Condition

The variable for which the function has been configured must be in BOOL format. With the SIMATIC S5, therefore, the variable can only be an internal variable.

Date and Time

Purpose

With this function you display for a few seconds a line containing the current date and the current time of the OP.

The *Date and Time* function can be assigned to a function key or a soft key.

Objective

You wish to display a line containing the current date and the current time by means of a key.

To configure

Select the key you wish to use for displaying a window containing the date and time. Assign the *Date and Time* function to the *Selected Functions*.

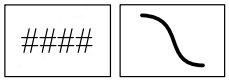
Execution

The function is triggered whenever you press the key. The window containing the date and time is displayed and disappears again a short time later.

Parameter(s)

None

Date I/O



Purpose

With this function you show the current date of the OP. At this point you can also modify the date.

The *Date I/O* function can be attached to a variable.

Objective

You wish to view the current date and modify it, if necessary.

To configure

Create an I/O field with a random variable on a screen. For this variable, configure the function you selected, *Date I/O* function.

Execution

The date is displayed in the I/O field. If the cursor is located in the I/O field, you can modify the date.

Special feature

Use the same variable for all the date fields. Only then are changes made by the operator displayed and updated in all the fields.

Important

The field length of the I/O field must be at least ten for it to be possible to enter the complete date.

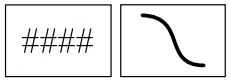
Parameter(s)

None

Condition

The variable for which the function was configured must be in KC or STRING format. For this, the I/O field must contain String as its display.

Time I/O



Purpose

With this function you display the current time of the OP. At this point you can also modify the time.

The *Time I/O* function can be attached to a variable.

Objective

You wish to view the current time and modify it, if necessary.

To configure

Create an I/O field with a random variable on a screen. For this variable, configure the function you selected, *Time I/O* function.

Execution

The time is displayed in the I/O field. If the cursor is located in the I/O field, you can modify the time.

Special feature

Use the same variable for all the time fields. Only then will changes made by the operator be displayed in all the fields.

Important

The field length of the I/O field must be at least ten for it to be possible to enter the complete time.

Parameter(s)

None

Condition

The variable for which the function was configured must be in KC or STRING format. For this, the I/O field must contain String as its display.

Print Screen List

Purpose (not OP45)

With this function you print a screen list which you have set in your configuration.

Assigning to a function key or a soft key

Objective

You wish to print a screen list comprising three screens by means of one key.

To configure

Select the key with which you wish to initiate printing of the screen list. Select the *Print Screen List* function and define the following parameters:
– Constant applying to the page of the printout: *Page 1 –> Screen Number:*
– Constant applying to the page of the printout: *Page 2 –> Screen Number:*
– Constant applying to the page of the printout: *Page 3 –> Screen Number:*
All the other constants have a default value of –1. Do not modify these values.

Execution

The function is triggered whenever you press on the key, and the parameters are evaluated. The corresponding screens are then printed.

Attaching to the variable of an I/O field

Objective

You wish to print a screen list comprising three screens by means of an input/output field.

To configure

Create an input/output field having a random variable on a screen. For this variable, configure the function you selected, *Print Screen List*, and set the following parameters:
– Constant applying to the page of the printout: *Page 1 –> Screen Number:*
– Constant applying to the page of the printout: *Page 2 –> Screen Number:*
– Constant applying to the page of the printout: *Page 3 –> Screen Number:*
All the other constants have a default value of –1. Do not modify these values.

Execution

The function is triggered as soon as the value of the input/output field is modified and the parameters are evaluated. The corresponding screens are then printed.

Parameter(s)

Constant for *Page 1 –> Screen number*
...
Page 20 –> Screen number
1 ... x = Screen number
–1 = not assigned

Start/Stop Print Screen

Purpose

With this function you print the current screen.

The *Start/Stop Print Screen* function can be assigned to a function key or a soft key.

Objective

You wish to print the current screen by means of a key.

To configure

Select the key you wish to use for initiating the print function. Assign the *Start/Stop Print Screen* function to the *Selected Functions*.

Execution

The function is triggered whenever you press the key. The current screen is printed. If you press the key a second time, the print function is aborted.

Important

The setting of the printout parameters on the standard Printer screen is applied here.

Parameter(s)

None

Display Events

Purpose (not OP45)

With this function you open the event message page or the event message buffer. Press the *ESC* key to exit from the function and hide the event message page or the event buffer.

The *Display Events* Function can be assigned to a function key or a soft key.

Objective

You wish to select the event message page or the event message buffer by means of two keys.

To configure

Select the key which you wish to use for selecting the event message page. Under the function you selected, *Display Events*, set the following parameters: the constant for displaying: *Page or Buffer:* 0

Proceed in a similar manner for the second key. For the constant, use the corresponding value to display the event message buffer: 1.

Execution

The function is triggered whenever you press one of the keys. The constants are evaluated. The event message page or the event message buffer is opened.

Parameter(s)

Constant for *Page or Buffer* with
0 = Page
1 = Buffer

Change EM Page/Buffer

Z_Messages

Purpose

With this function you always open the event message page first. Every time the function is triggered thereafter, it toggles between the event message page and the event buffer. Press the *ESC* key to exit from the function and hide the event message page or the event buffer.

The Change EM Page/Buffer function can be assigned to a function key.

Objective

You wish to select the event message page by means of a key and, whenever the key is pressed toggle between the event message page and the event buffer.

To configure

Select the key which you wish to use for selecting the event message page. Assign the *Change EM Page/Buffer* to the *Selected Functions*.

Execution

The function is triggered whenever you press the key. The event message page is opened. Every time the key is pressed thereafter, it toggles between the event message page and the event buffer.

Important

Never use soft keys (Fx), since all the soft keys are disabled on the event page and you therefore cannot toggle between the event page and the event buffer.

Parameter(s)

None

Condition

This function is allowed only for function keys (Kx).

Event Window

Z_Messages

Purpose With this function you open and hide the event window.

Assigning to a function key or a soft key

Objective: You wish to open and hide the event window by means of two keys.

To configure: Select the key with which you wish to open the event window. Select the *Event Window* function and define the following parameters:
the constant for opening the event window: *ON/OFF:* 1

Proceed in a similar manner for the other key. For the constant, use the corresponding value for hiding the event window, i.e. 0.

Execution: The function is triggered and the value of the constant is evaluated whenever either of the keys is pressed. The event window is opened or hidden accordingly.

Special feature: You can use a toggle function. In this instance, you open and hide the event window by means of a **single** key. You configure in the manner described above, the only difference being that you define just one key. For the constant, specify –1 as the value. If you press the key, the function is triggered, and the event window is enabled. If you press the key a second time, the event window is disabled, and so on.

Attaching to the variable of an I/O field

Objective: You wish to open and hide the event window by means of an input and an output field.

To configure: Create an input or output field having a random variable on a screen. For this variable, configure the function you selected, *Event Window*, to which the following parameter applies:
the constant for opening the event window: *ON/OFF:* –1

Execution: Whenever the value in the input or output field is modified, the function is triggered and the value of the constant is evaluated. The event window is opened or hidden.

Special feature

You can also open and hide the event window by means of two input or output fields, which may even be located on different screens. To do this, configure two input or output fields (as described above). For the constant, specify 1 as the value on the first occasion and 0 as the value on the other occasion.

As soon as the values in the input or output field are modified, the function is triggered, and the event window is opened or hidden accordingly.

To trigger the function from the PLC, proceed as follows:
Configure a PLC variable for which you set *Read Continuously.* Define the *Event Window* function for this variable. From the *Functions* dialog box, select under *Call Function At* the item called *Output*. The function is triggered whenever the value is modified by the PLC.

Parameter(s)

Constant for *ON/OFF* with
0 = OFF,
1 = ON,
–1 = Toggle (OFF <–> ON).

Events – Delete Buffer

Purpose With this function you delete the event messages from the buffer. All messages that are still waiting to be serviced are not deleted.

Assigning to a function key or a soft key

Objective: You wish to delete the event buffer by means of a key.

To configure: Select the key which you wish to use for deleting the event buffer. Assign the *Events – Delete Buffer* function to the *Selected Functions*.

Execution: The function is triggered whenever you press the key. The event buffer is deleted.

Attaching to the variable of an I/O field

Objective: You wish to delete the event buffer by means of an input or output field on the screen.

To configure: Create an input or output field having a random variable on a screen. For this variable, configure the function you selected, *Events – Delete Buffer.*

Execution: The function is triggered as soon as the value of the input or output field is modified. The event buffer is deleted.

Parameters None

Message Log ON/OFF

Z_Settings

Purpose

With this function you enable and disable the automatic printout of messages. Messages having the ”print” attribute are printed whenever their status is modified (arrived, departed or acknowledged).

The *Message Log ON/OFF* function can be assigned to a function key or a soft key.

Objective

You wish to enable and disable the message log by means of two keys.

To configure

Select the key you wish to use for enabling the message log. Select the *Message Log ON/OFF* function and define the following parameters:
– a constant for enabling the message log: *ON/OFF (Key):* 1 and
– a variable: *ON/OFF (Field).*

Proceed in a similar manner for the other key. For the constant, use the corresponding value, i.e. 0, to disable the message log. For the variable, use the same variable.

So that you can recognize on the screen whether the message log has been enabled or disabled, configure a symbolic output field to which the variable you configured above is assigned. Also, create a text list and assign the values 0 and 1 to the corresponding conditions OFF and ON.

Execution

The function is triggered whenever you press one of the keys. The constant is evaluated, and the message log is enabled or disabled accordingly. The value of the constant is transferred to the variable, and the output field is updated.

Special feature

You can use a toggle function. In this instance, you enable and disable the message log by means of a **single** key. You configure in the manner described above, the only difference being that you define just one key. For the constant, enter –1 as the value. If you press the key, the function is triggered, and the message log is enabled. If you press the key a second time, the message log is disabled.

Parameter(s)

Variable for displaying *ON/OFF (Field)*,
Constant for *ON/OFF (Key)* with
0 = OFF,
1 = ON,
–1 = Toggle (ON <–> OFF).

Condition

The variable of the function must be in BOOL format.

Buffer Overflow

Z_Settings

Purpose

With this function you enable and disable a warning on buffer overflow.

The *Buffer Overflow* function can be assigned to a function key or a soft key.

Objective

You wish to enable and disable a warning on buffer overflow by means of two keys.

To configure

Select the key you wish to use to enable output of a warning when a buffer overflows. Select the *Buffer Overflow* function and define the following parameters:
– a constant for enabling the warning: *ON/OFF (Key):* 1 and
– a variable: *ON/OFF (Field)*.

Proceed in a similar manner for the other key. For the constant, use the corresponding value, i.e. 0, to disable the warning. For the variable, use the same variable.

To be able to recognize on the screen whether Warn on Buffer Overload has been enabled or disabled, configure a symbolic output field to which the variable you configured above is assigned. Also, create a text list and assign the values 0 and 1 to the corresponding conditions OFF and ON.

Execution

The function is triggered whenever you press one of the keys. The constant is evaluated, and Warn on Buffer Overflow is enabled or disabled accordingly. The value of the constant is transferred to the variable, and the output field is updated.

Special feature

You can use a toggle function. In this instance, you enable and disable a warning on buffer overflow by means of a **single** key. You configure in the manner described above, the only difference being that you define just one key. For the constant, enter –1 as the value. If you press the key, the function is triggered and Warn on Buffer Overload is enabled. If the key is pressed a second time, Warn on Buffer Overload is disabled, and so on.

Parameter(s)

Variable for displaying *ON/OFF (Field)*
Constant for *ON/OFF (Key)* with
0 = OFF
1 = ON
–1 = Toggle (ON <–> OFF)

Condition

The variable of the function must be in BOOL format.

Change AM Page/Buffer

Z_Messages

Purpose

With this function you always open the alarm message page first. Every time the function is triggered thereafter, it toggles between the alarm message page and the alarm buffer. Press the *ESC* key to exit from the function and hide the alarm message page or the alarm buffer.

The *Change AM Page/Buffer* function can be assigned to a function key or a soft key.

Objective

You wish to select the alarm message page by means of a key and, whenever the key is pressed toggle between the alarm message page and the alarm buffer.

To configure

Select the key you wish to use for selecting the alarm message page. Assign the *Change AM Page/Buffer* to the *Selected Functions*.

Execution

The function is triggered whenever you press the key. The alarm message page is opened. Every time the key is pressed, it toggles between the alarm message page and the alarm buffer.

Important

Never use soft keys (Fx), since all the soft keys are disabled on the alarm message page and you therefore cannot toggle between the alarm message page and the alarm buffer.

Parameter(s)

None

Condition

This function is allowed only for function keys (Kx).

Alarms – Delete Buffer

Purpose With this function you delete the alarm messages from the buffer. All messages that are waiting to be serviced or have yet to be acknowledged are not deleted.

Assigning to a function key or a soft key

Objective: You wish to delete the alarm buffer by means of a key.

To configure: Select the key which you wish to use for deleting the alarm buffer. Assign the *Alarms – Delete Buffer* function to the *Selected Functions*.

Execution: The function is triggered whenever you press the key. The alarm buffer is deleted.

Attaching to the variable of an I/O field

Objective: You wish to delete the alarm buffer by means of an input or output field on the screen.

To configure: Create an input or output field having a random variable on a screen. For this variable, configure the function you selected, *Alarms – Delete Buffer.*

Execution: The function is triggered as soon as the value of the input or output field is modified. The alarm buffer is deleted.

Parameters None

Display Alarms

Purpose (not OP45)

With this function you open the alarm message page or the alarm message buffer. Press the *ESC* key to exit from the function and hide the alarm message page or the alarm buffer.

The *Display Alarms* function can be assigned to a function key or a soft key.

Objective

You wish to select the alarm message page or the alarm message buffer by means of two keys.

To configure

Select the key which you wish to use for selecting the alarm message page. Under the function you selected, *Display Alarms*, set the following parameters: for the constant for displaying: *Page or Buffer*: 0

Proceed in a similar manner for the second key. For the constant, use the corresponding value to display the alarm message buffer: 1.

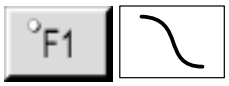
Execution

The function is triggered whenever you press one of the keys. The constants are evaluated. The alarm message page or the alarm message buffer is opened.

Parameter(s)

Constant for *Page* or *Buffer* with
0 = Page
1 = Buffer

Alarms – Display First/Last



Z_Settings

Purpose

With this function you set whether the first or last message to arrive is displayed. This setting also affects display of the event page and of the alarm page.

The *Alarms – Display First/Last* function can be assigned to a function key or a soft key.

Objective

You wish to set, by means of two keys, whether the first or last message to arrive should be displayed.

To configure

Select the key you want to use for setting the display to the last message to arrive. Select the *Alarms – Display First/Last* function and define the following parameters:
– a constant which applies to the Last setting: *First/Last (Key):* 0 and
– a variable: *First/Last (Field)*.

Proceed in a similar manner for the other key. For the constant, use the corresponding value, i.e. 1, to display the first message to arrive. For the variable, use the same variable.

So that you can recognize whether the first or last message to arrive is being displayed on the screen, configure a symbolic output field to which the variable that you configured above is assigned. Also, create a text list and assign the values 0 and 1 to the corresponding conditions *Last* and *First*.

Execution

The function is triggered whenever you press either of the keys. The constant is evaluated, and the first or last message to arrive is displayed accordingly. The value of the constant is transferred to the variable, and the output field is updated.

Special feature

You can use a toggle function. In this instance, you choose by means of a **single** key whether the first or last message should be displayed. You configure in the manner described above, the only difference being that you define just one key. For the constant, you enter –1 as the value. If you press the key, the function is triggered, and the first message to arrive is displayed. If the key is pressed a second time, the last message to arrive is displayed, and so on.

Parameter(s)

Variable for displaying *First/Last (Field)*
Constant for *First/Last (Key)* with
0 = Last
1 = First
–1 = Toggle (First <–> Last)

Condition

The variable of the function must be in BOOL format.

Scaling Linear 1

Purpose

With this function values are scaled linearly. Values from the PLC are scaled prior to being displayed on the OP. Inputs on the OP are scaled prior to the values being transferred to the PLC. The formula for scaling is: Y = a × X + b. *Scaling Linear 1* is the inverse function of *Scaling Linear 2*.

The *Scaling Linear 1* function can be attached to a variable.

Objective

You wish to scale linearly a value from the PLC prior to the value being displayed on the OP and/or you wish to scale an input on the OP prior to the value being transferred to the PLC.

To configure

Create an I/O field with a random variable on a screen. For this variable, configure the function you selected, *Scaling Linear 1*, to which the following parameters apply:
– constant for the slope: *a*
– constant for the offset: *b*

Execution

A value, Y, is transferred from the PLC. The variable is updated, and the scaling function is triggered. The scaled value is displayed as the display value, X, in the I/O field. If the operator enters a value, X, on the OP, the function is triggered. The value is scaled and is then transferred to the PLC as the PLC value, Y.

Example

You have configured a value of 3 for the slope, *a*, and a value of 6 for the offset, *b*. A value of 21 is transferred from the PLC. It is inserted into the scaling function: 21 = 3 * X + 6. This results in a value of 5 for X. This value is displayed on the OP.

Parameter(s)

Constant for the slope, *a*
Constant for the offset, *b*

Condition

The variable of the function must be in INTEGER format.

Scaling Linear 2

####

Purpose

With this function values are scaled linearly. Values from the PLC are scaled prior to being displayed on the OP. Inputs on the OP are scaled prior to the values being transferred to the PLC. The formula for scaling is: $Y = a \times X + b$. *Scaling Linear 2* is the inverse function of *Scaling Linear 1*.

The *Scaling Linear 2* function can be attached to a variable.

Objective

You wish to scale linearly a value from the PLC prior to the value being displayed on the OP and/or you wish to scale an input on the OP prior to the value being transferred to the PLC.

To configure

Create an I/O field with a random variable on a screen. For this variable, configure the function you selected, *Scaling Linear 2*, to which the following parameters apply:
– constant for the slope: *a*
– constant for the offset: *b*

Execution

A value, X, is transferred from the PLC. The variable is updated, and the scaling function is triggered. The scaled value is displayed as the display value, Y, in the I/O field.
If the operator enters a value, Y, on the OP, the function is triggered. The value is scaled and is then transferred to the PLC as the PLC value, X.

Example

You have configured a value of 3 for the slope, *a*, and a value of 6 for the offset, *b*. A value of 21 is transferred from the PLC. It is inserted into the scaling function: $Y = 3 \times 21 + 6$. This results in a value of 69 for Y. This value is displayed on the OP.

Parameter(s)

Constant for the slope, *a*
Constant for the offset, *b*

Condition

The variable of the function must be in INTEGER format.

Scaling Square 1

Purpose

With this function values are scaled quadratically. Values from the PLC are scaled prior to being displayed on the OP. Inputs on the OP are scaled prior to the values being transferred to the PLC. The formula for scaling is:
Y = a × X^2 + b × X + c.
Scaling Square 1 is the inverse function of *Scaling Square 2*.

The *Scaling Square 1* function can be attached to a variable.

Objective

You wish to scale a value from the PLC quadratically prior to the value being displayed on the OP and/or you wish to scale an input on the OP prior to the value being transferred to the PLC.

To configure

Create an I/O field with a random variable on a screen. For this variable, configure the function you selected, *Scaling Square 1*, to which the following parameters apply:
– constant for the slope: *a*
– constant for the slope: *b*
– constant for the offset: *c*

Execution

A value, Y, is transferred from the PLC. The variable is updated, and the scaling function is triggered. The scaled value is displayed as the display value, X, in the I/O field. If the operator enters a value, X, on the OP, the function is triggered. The value is scaled and is then transferred to the PLC as the PLC value, Y.

Example

You have configured a value of 2 for slope *a*, a value of 3 for slope *b*, and a value of 6 for the offset *c*. A value of 71 is transferred from the PLC. It is inserted into the scaling function: 71 = 2 × X^2 + 3 × X + 6. This results in a value of 5 for X. This value is displayed on the OP.

Parameters

Constant for the slope, *a*
Constant for the slope, *b*
Constant for the offset, *c*

Condition

The variable of the function must be in INTEGER format.

Scaling Square 2

####

Purpose

With this function values are scaled quadratically. Values from the PLC are scaled prior to being displayed on the OP. Inputs on the OP are scaled prior to the values being transferred to the PLC. The formula for scaling is:
Y = a × X^2 + b × X + c.
Scaling Square 2 is the inverse function of *Scaling Square 1*.

The *Scaling Square 2* function can be attached to a variable.

Objective

You wish to scale a value from the PLC quadratically prior to the value being displayed on the OP and/or you wish to scale an input on the OP prior to the value being transferred to the PLC.

To configure

Create an I/O field with a random variable on a screen. For this variable, configure the function you selected, *Scaling Square 2*, to which the following parameters apply:
– constant for slope: *a*
– constant for slope: *b*
– constant for the offset: *c*

Execution

A value, X, is transferred from the PLC. The variable is updated, and the scaling function is triggered. The scaled value is displayed as the display value, Y, in the I/O field. If the operator enters a value, Y, on the OP, the function is triggered. The value is scaled and is then transferred to the PLC as the PLC value, X.

Example

You have configured a value of 2 for slope a, *a* value of 3 for slope *b*, and a value of 6 for the offset *c*. A value of 71 is transferred from the PLC. It is inserted into the scaling function: Y = 2 × 71^2 + 3 × 71 + 6. This results in a value of 10301 for Y. This value is displayed on the OP.

Parameters

Constant for the slope, *a*
Constant for the slope, *b*
Constant for the offset, *c*

Condition

The variable of the function must be in INTEGER format.

PLC Jobs

B

Description

PLC jobs can be used to initiate functions on the OP from the PLC – for example,
- display screen
- set date and time
- modify general settings

A PLC job consists of four data words. The first data word contains the job number. Up to three parameters are transferred to data words 2 through 4, depending on the function. The basic structure of a PLC job is shown in figure B-1.

Address	Left Byte (LB)	Right Byte (RB)
1st word	0	Job No.
2nd word	Parameter 1	
3rd word	Parameter 2	
4th word	Parameter 3	

Figure B-1 Structure of a PLC Job

List

This section of the Appendix lists all of the PLC jobs, and their parameters, that are possible for the different operator panels which have a graphics display. The **No.** column denotes the job number. Generally speaking, jobs can be initiated **by the PLC** only when the OP is in Online mode.

No.	Function		OP25	OP35	OP37	OP45
2	**Blank Screen**		●	●	●	–
	Parameter 1	0: off 1: on				
	Parameters 2, 3	–				
3	**Printout**		●	●	●	●
	Parameters 1, 2, 3	–				
4	**Drive Port**		●	●	●	–
	Parameter 1	Port number: 1 through 8 for OP25 1 through 16 for OP35, OP37				
	Parameter 2	Keyboard number: LB 1 for OP25, OP35, OP37 RB: 0				
	Parameter 3	0: off 3: on				
	Set Relay		●	●	●	–
	Parameter 1	0				
	Parameter 2	LB: FF_H RB: FF_H				
	Parameter 3	0: off 3: on				
12	**Enable/Disable Message Printout**		●	●	●	●
	Parameter 1	0: off 1: on				
	Parameters 2, 3	–				
13	**Change Language**		●	●	●	●
	Parameter 1	0: 1st language 1: 2nd language 2: 3rd language				
	Parameters 2, 3	–				
14	**Set Time (BCD-Coded)**		●	●	●	●
	Parameter 1	LB: – RB: Hours (0 through 23)				
	Parameter 2	LB: Minutes (0 through 59) RB: Seconds (0 through 59)				
	Parameter 3	–				

No.	Function	OP25	OP35	OP37	OP45
15	**Set Date (BCD–Coded)** Parameter 1 LB: – RB: Day of week (1 through 7: Sunday through Saturday) Parameter 2 LB: Day (1 through 31) RB: Month (1 through 12) Parameter 3 LB: Year	●	●	●	●
21	**Alarm Messages Display Type** Parameter 1 0: First (oldest message) 1: Last (latest message) Parameters 2, 3 –	●	●	●	●
23	**Set Password Level** Parameter 1 0 through 9 (0 = lowest password level; 9 = highest password level) Parameters 2, 3 –	●	●	●	●
24	**Password Logout** Parameters 1, 2, 3 –	●	●	●	●
37	**Enable/Disable Overflow Warning for Event Messages** Parameter 1 0: off 1: on Parameters 2, 3 –	●	●	●	●
38	**Enable/Disable Overflow Warning for Alarm Messages** Parameter 1 0: off 1: on Parameters 2, 3 –	●	●	●	●
41	**Transfer Date/Time to PLC** Parameters 1, 2, 3 – Too frequent initiation of this job may lead to overloading, since two transfers to the PLC are necessary for each job.	●	●	●	●
42	**Fetch LED Area from PLC** Parameter 1 Block number: 1 through 8 Parameters 2, 3 –	●	●	●	●
43	**Fetch Event Message Area from PLC** Parameter 1 Block number: 1 through 8 Parameters 2, 3 –	●	●	●	●

No.	Function	OP25	OP35	OP37	OP45
44	**Fetch Alarm Message Area from PLC** Parameter 1 Block number: 1 through 8 Parameters 2, 3 –	●	●	●	●
45	**Fetch Acknowledgment Area from PLC** Parameter 1 Block number: 1 through 8 Parameters 2, 3 –	●	●	●	●
47	**Transfer LED Area Directly to OP** Parameter 1 LED assignment area number: 1 through 8 Parameter 2 LED assignment: 1st word Parameter 3 LED assignment: 2nd word Unlike job **No. 42** (Fetch LED Area from PLC), the LED assignment is transferred in this instance in the PLC job, thus enabling the LEDs to be driven more quickly. The specified LED area must not be configured with more than 2 DW.	●	●	●	●
49	**Delete Events Buffer** Parameters 1, 2, 3 –	●	●	●	●
50	**Delete Alarms Buffer** Parameters 1, 2, 3 –	●	●	●	●
51	**Select Screen** Parameter 1 RB: Screen number (1 through 255) Parameter 2 – Parameter 3 Field number (1 through 255) Output fields are not taken into account in the serial number.	●	●	●	●
69	**Transfer Recipe Data Record from PLC to OP** Parameter 1 Key word 1 Parameter 2 Key word 2 Parameter 3 Key word 3	●	●	●	●
70	**Transfer Recipe Data Record from OP to PLC** Parameter 1 Key word 1 Parameter 2 Key word 2 Parameter 3 Key word 3	●	●	●	●
72	**Position Cursor on Current Screen** Parameter 1 – Parameter 2 Field number (1 through 255) Parameter 3 –	●	●	●	●

System Limits for OP25/35/37

C

Object	Elements	Maximum Number
Screens		300
	Fields per screen	600
	Process outputs per screen	400 Bytes (e.g. 200 output fields with WORD variables)
	Trend samples per screen	2,000 for OP35/37 1,000 for OP25
Trend graphics		total 300 (e.g. 300 trends with 50 samples each in WORD)
	Bit-triggered	120
	(Number of trends x 30) + (total samples x 4)	< 40,000 (DOUBLE, REAL)
	(Number of trends x 30) + (total samples x 2)	< 40,000 (rest)
Text or graphic lists		500
	Entries per list	255 (50,000 characters max.)
Graphic objects		1,000
Event messages and alarm messages		2,000 each
	Variables linked to the PLC	5,000
Text elements	Total recipe entries, information texts, text list entries	30,000
Variables		5,000 (4,000 WORD/INT plus 1,000 DWORD)
	Variables per CPU/PLC	2,000
	Variables with `Read continuously`	200
	Subtract a process variable for every	25 trend samples WORD (SIMATIC S5, SIMATIC 505, Driver V1.30); 96 trend samples WORD (SIMATIC S7, Driver V2.0)

Object	Elements	Maximum Number
Variable types per configuration	SIMATIC S5:	
	KF	2,000
	KH, KM, KY, KT, KC	2,000
	DF	1,800
	DH	1,800
	KG	1,800
	KS	2,500 (10,000 characters max.)
	SIMATIC S7:	
	CHAR, INT	2,000
	BYTE, WORD, Timer, Counter	2,000
	DINT	1,800
	DWORD	1,800
	REAL	1,800
	BOOL	2,500
	STRING	2,500 (10,000 characters max.)
	SIMATIC 500/505:	
	+/– INT	2,000
	INT	2,000
	+/– DOUBLE	1,800
	DOUBLE	1,800
	REAL	1,800
	BIT	2,500
	ASCII	2,500 (10,000 characters max.)
Maximum values for REAL and DOUBLE	Significant digits for REAL	6
	Calculation and indication	500,000 (e. g. with scaling for trends and bars)
Recipes		255
	Total entries	5,000
	Entries per recipe	500 (2,000 Bytes max.)

Siemens Worldwide

D

In this Appendix

In this appendix you will find a list of:

- All cities in the Federal Republic of Germany with Siemens Sales Offices and
- All European and non-European Siemens Companies and Representatives

Siemens Sales Offices in the Federal Republic of Germany

The following table lists all Siemens Sales Offices in the Federal Republic of Germany.

Aachen	Kassel
Augsburg	Kempten/Allg.
Bayreuth	Kiel
Berlin	Laatzen
Bielefeld	Leipzig
Bonn	Lingen
Bremen	Magdeburg
Brunswick	Mainz
Chemnitz	Mannheim
Coblenz	Munich
Cologne	Münster/Westf.
Constance	Nuremberg
Darmstadt	Osnabrück
Dortmund	Regensburg
Dresden	Rostock
Duisburg	Saarbrücken
Düsseldorf	Siegen
Erfurt	Stuttgart
Essen	Ulm
Frankfurt am Main	Wetzlar
Freiburg	Wilhelmshaven
Hamburg	Wuppertal
Heilbronn	Würzburg
Karlsruhe	

European Companies and Representatives

The following table lists all European Siemens Companies and Representatives.

Austria

Siemens AG Österreich

- Bregenz
- Graz
- Innsbruck
- Linz
- Salzburg
- Vienna

Belgium

Siemens S.A.

- Brussels
- Liège

Siemens N. V.

- Antwerp

Bosnia-Herzegovina

Generalexport Predstavnistvo Sarajevo

- Sarajevo

Bulgaria

Siemens AG, Bulgaria Representative

- Sofia

Croatia

Siemens d. o. o.

- Zagreb

Cyprus

GEVO Ltd.

or

Jolali Ltd.

- Nicosia

Czech Republic

Siemens AG

- Brno
- Mladá Boleslav
- Prague

Denmark

Siemens A/S

- Copenhagen, Ballerup

Finland

Siemens Oy

- Espoo, Helsinki

France

Siemens S.A.

- Haguenau
- Lille, Seclin
- Lyon, Caluire-et-Cuire
- Marseille
- Metz
- Paris, Saint-Denis
- Strasbourg
- Toulouse

Great Britain

Siemens plc

- Birmingham, Walsall
- Bristol, Clevedon
- Congleton
- Edinburgh
- Glasgow
- Leeds
- Liverpool
- London, Sunbury-on-Thames
- Manchester
- Newcastle

Greece

Siemens A.E.

- Athens, Amaroussio
- Thessaloniki

Hungaria

Siemens Kft

- Budapest

Iceland

Smith & Norland H/F

- Reykjavik

Ireland

Siemens Ltd.

- Dublin

Italy

Siemens S.p.A.

- Bari
- Bologna
- Brescia
- Casoria
- Florence
- Genoa
- Milan
- Padua
- Rome
- Turin

Luxemburg

Siemens S.A.

- Luxemburg

Malta

J. R. Darmanin & Co. Ltd.

- Valletta

Netherlands

Siemens Nederland N.V.

- The Hague
- Rijswijk

Norway

Siemens A/S

- Bergen
- Oslo
- Stavanger
- Trondheim

Poland

Siemens GmbH

- Gdansk-Letnica
- Katowice
- Warsaw

Portugal

Siemens S.A.

- Albufeira
- Coímbra
- Lisbon, Amadora
- Matosinhos
- Porto

Romania

Siemens birou de consultatii tehnice

- Bukarest

Russia

Siemens AG

or

Mosmatic

- Moscow

Siemens AG

- Ekaterinburg

Slovak Republic

Siemens AG

- Bratislava

Slovenia

Siemens d. o. o.

- Ljubljana

Spain

Siemens S.A.

- Barcelona
- Bilbao
- Gijón
- Granada
- La Coruña
- Las Palmas de Gran Canaria
- León
- Madrid
- Málaga
- Murcia
- Palma de Mallorca
- Pamplona
- Sevilla
- Valencia
- Valladolid
- Vigo
- Zaragoza

Sweden

Siemens AB

- Göteborg
- Jönköping
- Malmö
- Sundsvall
- Upplands Väsby, Stockholm

Switzerland

Siemens-Albis AG

- Basel
- Bern
- Zürich

Siemens-Albis S.A.

- Renens, Lausanne

Turkey

SIMKO

- Adana
- Ankara
- Bursa
- Istanbul
- Izmir
- Samsun

Ukraine

Siemens AG

- Kiev

Non-European Companies and Representatives

The following table lists all non-European Siemens Companies and Representatives of Siemens AG.

Africa

The following table lists all Siemens Companies and Representatives of Siemens AG in Africa.

Algeria

Siemens Bureau d'Alger

- Alger

Angola

TECNIDATA

- Luanda

Bophuthatswana

Siemens Ltd.

- Mafekeng

Egypt

Siemens Technical Office

- Cairo-Mohandessin

Siemens Technical Office

- Alexandria

EGEMAC S.A.E.

- Cairo-Mattaria

Ethiopia

Addis Electrical Engineering Ltd.

- Addis Abeba

Ivory Coast

Siemens AG

- Abidjan

Libya

Siemens AG, Branch Libya

- Tripoli

Morocco

SETEL

Société Electrotechnique et de Télécommunications S.A.

- Casablanca

Mozambique

Siemens Liaison Office

- Maputo

Namibia

Siemens (Pty.) Ltd.

- Windhoek

Nigeria

Electro Technologies Nigeria Ltd. (ELTEC)

- Lagos

Rwanda

Etablissement Rwandais

- Kigali

Sambia

Electrical Maintenance Lusaka Ltd.

- Lusaka

Simbabwe

Electro Technologies Corporation (Pvt.) Ltd. (ETC)

- Harare

South Africa

Siemens Ltd.

- Cape Town
- Durban
- Johannesburg
- Middelburg
- Newcastle
- Port Elizabeth
- Pretoria

Sudan

National Electrical & Commercial Company (NECC)

- Khartoum

Swaziland

Siemens (Pty.) Ltd.

- Mbabane

Tanzania

Tanzania Electrical Services Ltd.

- Dar-es-Salaam

Tunesia

Sitelec S.A.

- Tunis

Zaire

SOFAMATEL S.P.R.L.

- Kinshasa

America

The following table lists all Siemens Companies and Representatives of Siemens AG in America.

Argentina

Siemens S.A.

- Bahía Blanca
- Buenos Aires
- Còrdoba
- Mendoza
- Rosario

Bolivia

Sociedad Comercial é Industrial Hansa Ltda.

- La Paz

Brazil

Siemens S.A.

- Belém
- Belo Horizonte
- Brasilia
- Campinas
- Curitiba
- Fortaleza
- Pôrto Alegre
- Recife
- Rio de Janeiro
- Salvador de Bahia
- São Paulo
- Vitória

Canada

Siemens Electric Ltd.

- Montreal, Québec
- Toronto

Chile

INGELSAC

- Santiago de Chile

Colombia

Siemens S.A.

- Barranquilla
- Bogotá
- Cali
- Medellín

Costa Rica

Siemens S.A.

- Panama
- San José

Cuba

Respresentación

Consult iva EUMEDA

- La Habana

Ecuador

Siemens S.A.

- Quito

El Salvador

Siemens S.A.

- San Salvador

Guatemala

Siemens S.A.

- Ciudad de Guatemala

Honduras

Representaciones Electroindustriales S de R.L. - Relectro

- Tegucigalpa

Mexico

Siemens S.A. de CV

- Culiacán
- Gómez Palacio
- Guadalajara
- León
- México, D.F.
- Monterrey
- Puebla

Nicaragua

Siemens S.A.

- Managua

Paraguay

Rieder & Cia. S.A.C.I.

- Asunción

Peru

Siemsa

- Lima

United States of America

Siemens Industrial Automation Inc.

Automation Division

- Alpharetta, GA

Numeric Motion Control

- Elk Grove Village, Illinois

Uruguay

Conatel S.A.

- Montevideo

Venezuela

Siemens S.A.

- Caracas
- Valencia

Asia

The following table lists all Siemens Companies and Representatives of Siemens AG in Asia.

Bahrain

Transitec Gulf

- Manama

Bangladesh

Siemens Bangladesh Ltd.

- Dhaka

Brunei

- Brunei Darussalam

Hong Kong

Siemens Ltd.

- Hong Kong

India

Siemens Limited

- Ahmedabad
- Bangalore
- Bombay
- Calcutta
- Madras
- New Delhi
- Secúnderabad

Indonesia

P.T. Siemens Indonesia, P.T. Siemens Dian-Grana Elektrika, Representative Siemens AG

- Jakarta

Iraq

Samhiry Bros. Co. Limited

or

Siemens AG (Iraq Branch)

- Baghdad

Iran

Siemens S.S.K.

- Teheran

Japan

Siemens K.K.

- Tokyo

Korea

Siemens Ltd.

- Changwon
- Seoul
- Ulsan

Kuwait

National & German Electrical and Electronic Services Co. (NGEECO)

- Kuwait, Arabia

Lebanon

Ets. F.A. Kettaneh S.A.

- Beirut

Malaysia

Siemens Electrical Engineering Sdn. Bhd.

- Kuala Lumpur

Nepal

Amatya Enterprises (Pvt.) Ltd.

- Kathmandu

Oman

Waleed Associates

- Muscat

Pakistan

Siemens Pakistan Engineering Co., Ltd.

- Islamabad
- Karachi
- Lahore
- Peshawar
- Quetta

People's Republic of China

Siemens AG Representation

- Beijing
- Guangzhou
- Shanghai

Philippine Islands

Maschinen & Technik Inc. (MATEC)

- Manila

Qatar

Trags Electrical Engineering and Air Conditioning Co.

- Doha

Saudi Arabia

Arabia Electric Ltd. (Equipment)

- Al-Khobar
- Jeddah
- Riyadh

Singapore

Siemens (Pte.) Ltd.

- Singapore

Sri Lanka

Dimo Limited

- Colombo

Syria

Siemens AG, Branch (A.S.T.E.)

- Damascus

Taiwan

Siemens Ltd., TELEUNION Engineering Ltd.

or

TAI Engineering Co., Ltd.

- Taichung
- Taipei

Thailand

Berti Jucker Co. Ltd.

- Bangkok

United Arab Emirates

Electro Mechanical Co.

or

Siemens Resident Engineers

- Abu Dhabi

Scientechnic

or

Siemens Resident Engineers

- Dubai

Vietnam

OAV Representative Office

- Hanoi

Yemen (Arab. Republic)

Tihama Tractors & Engineering Co., Ltd.

or

Siemens Resident Engineers

- Sanaa

Australia

The following table lists all Siemens Companies and Representatives of Siemens AG in Australia

Australia

Siemens Ltd.

- Adelaide
- Brisbane
- Melbourne
- Perth
- Sydney

New Zealand

Siemens Ltd.

- Auckland
- Wellington

Index

E

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

U

V

W

Z