SIEMENS

SIMATIC HMI

**ProTool
Configuring Windows-
Based Systems**

Start Up Instructions

Release 12/02

Safety Guidelines

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

Danger

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

Warning

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

Caution

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

Caution

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

Notice

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

Note

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

Qualified Personnel

Equipment may be commissioned and operated only by **qualified personnel**. Qualified personnel within the meaning of the safety notices in this manual are persons who are authorized to commission, ground and identify equipment, systems and circuits in accordance with safety engeneering standards.

Correct Usage

Please note the following:

Warning

The device may only be used for the application cases specified in the catalog and the technical description and may only be used in combination with third-party equipment and components recommended or approved by Siemens.

Startup must not take place until it is established that the machine which is to accommodate this component is conforms with the guideline 98/37 EC.

Appropriate transport, and appropriate storage, installation and assembly, as well as careful operation and maintenance, are required to ensure that the product operates perfectly and safely.

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Impressum

Editor and Publisher: A&D PT1

Preface

Purpose

This document is a component part of the ProTool CS configuration software documentation. It provides a step-by-step introduction to configuring Windows-based systems.

Notation

Different font formats simplify orientation within the text:

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

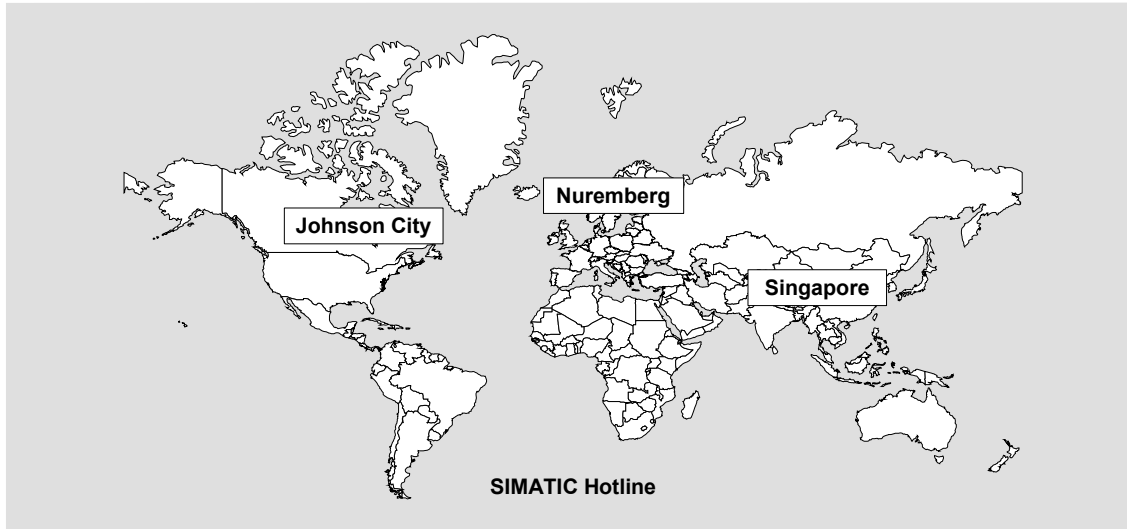## Trademarks

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Training Center

Siemens offers a number of training courses to familiarize you with the SIMATIC S7 automation system. Please contact your regional training center or our central training center in D 90327 Nuremberg, Germany for details.

Telephone: +49 (911) 895-3200

Internet: http://www.sitrain.com

E-Mail: info@sitrain.com

Other Sources of Assistance

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

The addresses can be found:

- In the Siemens Catalog ST 80

- In the Internet under
  http://www.siemens.com/automation/partner

- In the Interactive Catalog CA01
  http://www.siemens.com/automation/ca01

Contents

Introduction

<div style="text-align: right; font-size: 3em; font-weight: bold;">1</div>

Projects whose processes need to be visualized are created using the ProTool configuration software on a configuration computer (PC or PU) under Windows® for the following operating units:

- Text displays (e.g. TD 17)

- Operator panels with text-based displays (e.g. OP 3, OP 7, OP 17)

- Operator panels with graphics displays (e.g. OP 27, OP 37)

- Touch Panels (e.g. TP 27, TP 37)

- Windows-based systems

  - ➢ Panels (TP 170A, TP 170B, OP 170B, TP 270, OP 270)

  - ➢ Mobile Panels (Mobile Panel 170)

  - ➢ Multi Panels (MP 270, MP 270B, MP 370)

  - ➢ OP 37/Pro

  - ➢ Panel PCs (Panel PC 670, Panel PC 870, Panel PC IL, FI 25, FI 45)

  - ➢ PCs

- C7-units (e.g. C7-621/623/633/634/635OP/635TP)

The configuration software is available in three release levels:

- **ProTool/Pro**
  to configure the entire unit family.

- **ProTool**
  to configure text displays, text and graphic operator panels and the Windows-based units.

- **ProTool/Lite**
  to configure text displays, text-based operator panels and the Windows-based units TP 170A, TP170B and OP170B.

This quick reference manual provides introductory, step-by-step instructions on how to begin configuring Windows-based systems without going into specific details regarding the creation of the associated control program.

1.1   ProTool Components

The following two components are supplied with SIMATIC ProTool according to the version supplied:

- Configuration software ProTool/Lite, ProTool or ProTool/Pro CS (Configuration System)

- Process visualization software ProTool/Pro RT (Runtime) and simulation software for Windows-based systems

Configuration software:
The configuration software is used to create projects on the configuration computer under the following operating systems:

- Microsoft® Windows® 98 SE

- Microsoft® Windows® ME

- Microsoft® Windows® NT 4.0 as of Service Pack 6a

- Microsoft® Windows® 2000 as of Service Pack 2

- Microsoft® Windows® XP Professional

Runtime software ProTool/Pro RT:
ProTool/Pro RT is implemented to run the project under Windows® in order to visualize or operate the process on SIMATIC Panel PCs or standard PCs.

The runtime software is provided with a software protection feature. This means that each Runtime software is installed on a standard PC or SIMATIC Panel PC requires licensed authorization in order to enable unrestricted operation. If no authorization is available, ProTool/Pro RT runs in Demo mode.

No authorization is required for Windows-based panels and Multi Panels. It is only necessary to load the project you have created onto the unit.

Simulation software for Windows-based systems:

The simulation software is used to test a project on the configuration computer without having to connect the PLC and operating unit.

The diagram illustrates an example of a project for a SIMATIC Panel PC with ProTool/Pro CS.
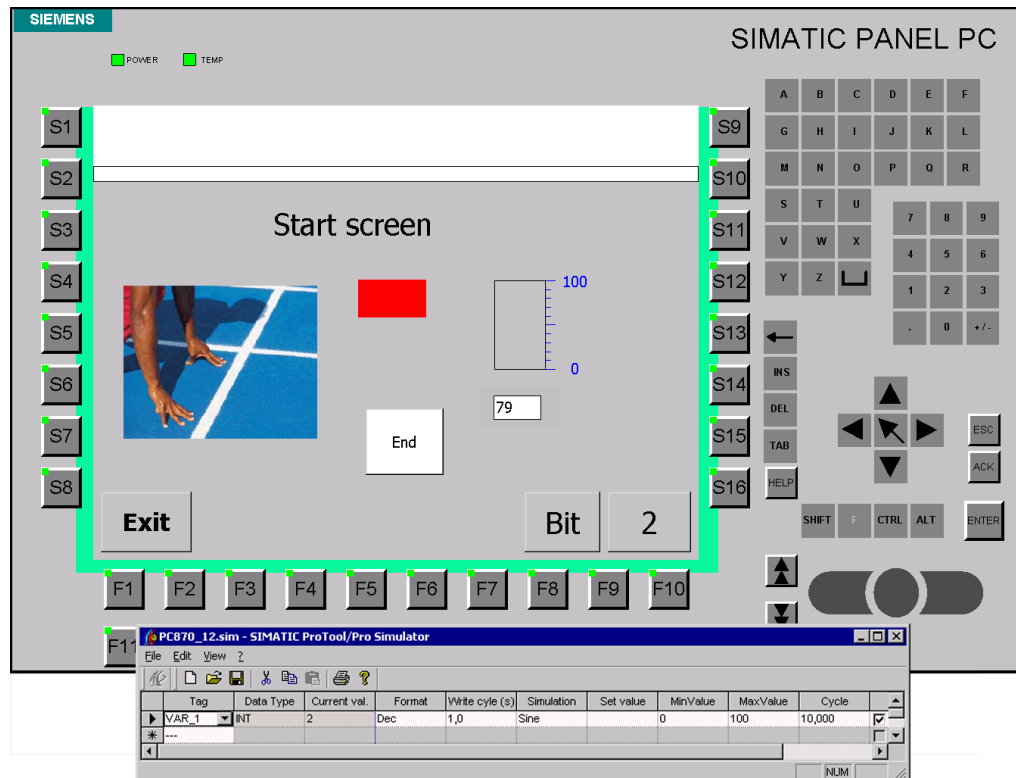
1.2   Create Project

Numerous objects are available with which to create a project. The basic objects are explained in the configuration examples provided in this Getting Started manual. Not all objects are available for every operating unit.

The following steps are explained in this Quick Reference Manual.

Creating screens
Processes are visualized by means of screens. Screens show the operator the current process status in the form of numeric values, bar graphs or trend curves and enable intervention by changing values and clicking buttons.

Linking screens
The screens within a process can be linked to form a structure.

Setting and resetting bits in the PLC

Bits in the PLC can be manipulated by means of appropriately configured buttons and function keys. This enables active intervention in process events.

Input/Output of PLC process values

Input/Output fields are provided with which process values can be displayed and modified directly. Entries can be assigned limit values and protected by passwords. Various representation formats are available for the output, e.g. decimal, binary or symbolic text are possible.

Displaying PLC process values graphically

Bars represent a PLC value in the form of a rectangular area. They are suited, for example, for representing fill levels.

Integrating graphics

Graphic fields can be used to provide users with a visual representation of a system or process.

Integrating vector graphic objects

Vector graphic objects can be integrated and assigned attributes according to process values and moved in order to display system behavior visually.

Integrating texts

Texts can be used to label operating and display elements, e.g. input/output fields or buttons.

Displaying messages

Messages indicate events and statuses in the control process. ProTool distinguishes between event messages and alarm messages. Event messages relate to the status of a machine or process. Alarm messages indicate operating faults concerning a machine or process and must be acknowledged.

Archiving process values

Windows-based systems provide the possibility of archiving process values, i.e. saving them on a permanent basis, and evaluating them.

1.3 Further information

Further information is provided in the following:

- ProTool Online Help
- ProTool Information System
- ProTool User's Guide, Configuring Windows-based Systems
- ProTool/Pro Runtime User's Guide
- Communication for Windows-based Systems User's Guide
- Equipment manual of the Windows-based operating units
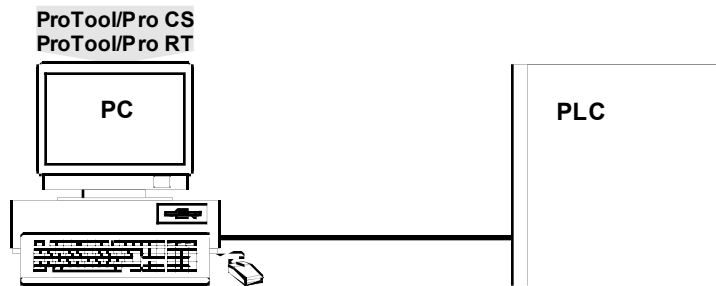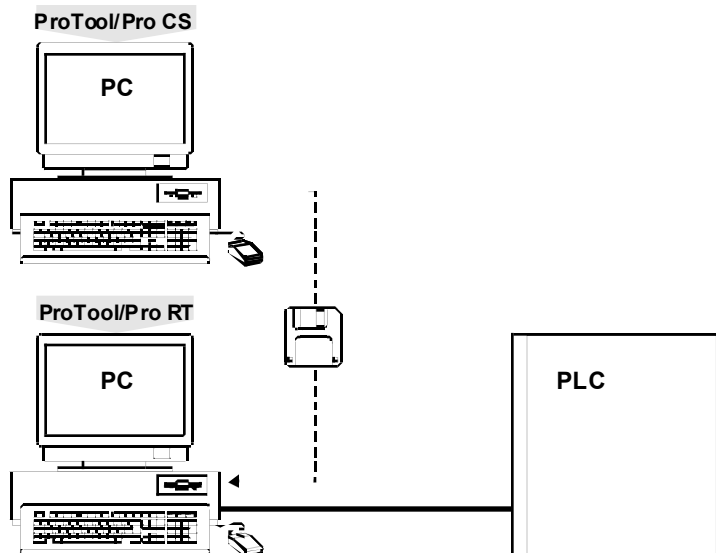
Starting Up Operating Units   **2**

2.1 Hardware Structure

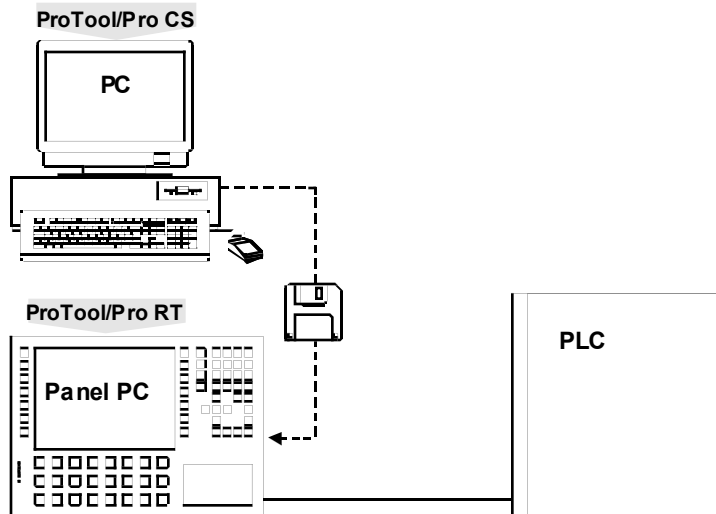The following figures illustrate the hardware structure variations:
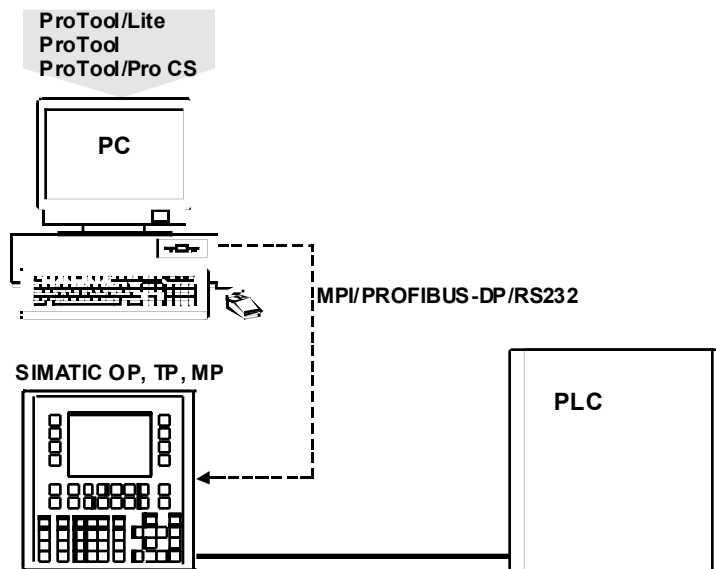
PC as operating unit and configuration computer

PC as operating unit, second PC as configuration computer

SIMATIC Panel PC as operating unit, PC as configuration computer

SIMATIC OP, TP, MP as operating unit, PC as configuration computer

2.2 Installing the Software

Installing the configuration software on the PC

> **Note**
> Administration rights are required for installation under Windows® NT, Windows® 2000 and Windows® XP.

- Insert the installation CD in the CD-ROM drive. The Setup program starts automatically after a few seconds

- Click on "Installation"

- Click on "ProTool", "ProTool/Lite" or "ProTool/Pro"

- Follow the instructions which appear on the screen

> **Note**
> Following the installation under Windows® NT, Windows® 2000 and Windows® XP, the configuration software must be started once by a user with local administration rights so that the ProTool system files can be registered successfully.

Installing the runtime software or simulator on the PC

- Insert the installation CD in the CD-ROM drive. The Setup program starts automatically after a few seconds.

- Click on "Installation"

- Click on "ProTool/Pro RT"

- Follow the instructions which appear on the screen

- Install the license on request

Ready-to-operate SIMATIC operating unit

In the case of ready-to-operate operating units, the runtime software ProTool/Pro RT is fully installed on leaving the factory. Depending on the user, authorization is either unnecessary or is enclosed with the unit.

SIMATIC operating unit with runtime software enclosed

Before a SIMATIC operating unit can be started up for the very first time together with the runtime software enclosed, the runtime software itself must be installed first. The authorizing license for the runtime software is purchased together with the operating unit; it is also enclosed with the unit.

2.3   Using the Online Help

If questions arise during configuration or further information is required concerning a specific point, simply call in the online help provided for the configuration software.

Calling in context-sensitive help in dialog boxes

- Click on the icon depicted, located in the dialog title bar
- Click on the element for which information is required

Calling in context-sensitive help, e.g. on buttons

- Click on the button depicted, located in the toolbar
- Click on the element for which information is required

Alternatively, context-sensitive help can be requested in any operating situation by pressing the function key F1.

2.4   Calling in Context Menus

Context menus are available for the objects in a project. Context menus can be used to trigger actions which are associated with the corresponding object:

- Select the object
- Press the right-hand mouse button

Basic Steps

<div style="text-align: right; font-size: 3em; font-weight: bold;">3</div>

3.1 Starting the ProTool Configuration Software

- Double click on the ProTool configuration software icon on the desktop

3.2 Creating a New Project

- Select "File" > "New"

- Select the Windows-based operating unit to be configured

- Click on "Continue"

- Select a PLC

- Define further parameter settings for the PLC in "Parameters"

The predefined parameters do not match the standard settings for the SIMATIC S7-300/400 PLC. Since communication using these parameters works, it is not normally necessary to modify them.

Example: Parameters when an S7 is connected
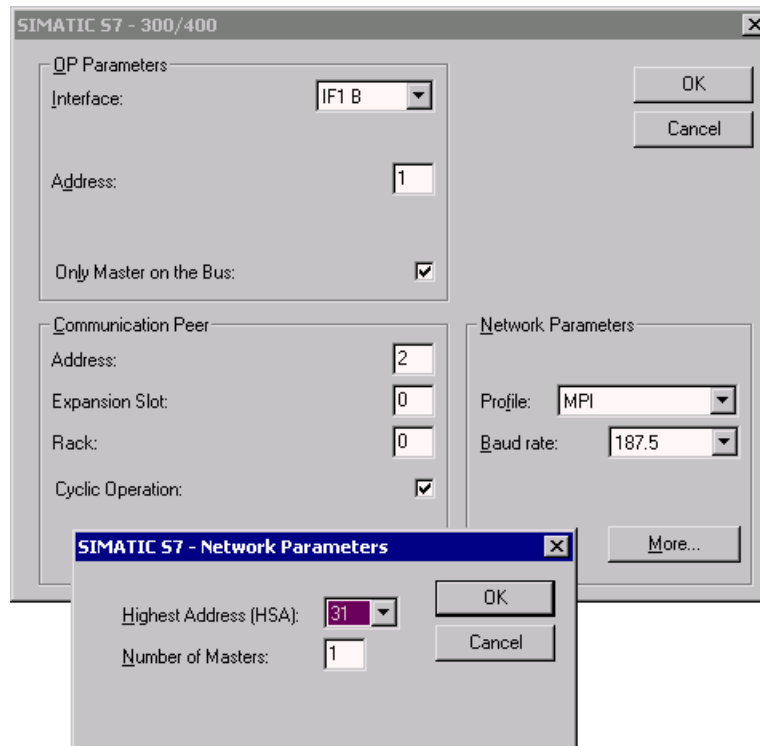
- Click on "Continue"
- Enter the name of the project in "Project"
- Click on "Finish"

3.3   Defining Screen Partitions

Note

Before starting the actual configuration, the settings for partitioning the screen on the operating unit must be defined. These settings are then valid for the entire project. In addition, communication areas must be specified which are required for messages, for example.

Defining the display partitions

These settings relate to the representation, size and position of the message areas for event and alarm messages.

The system setting contains the fixed window. The fixed window is an area which appears in each screen. This can be used, for example, to label the system or position the date/time fields.

Proceed as follows to ensure that alarm messages are always displayed in the message window and event messages in a message line:

- Select "System" > "Screen / Keys"

- Select the "Window/Line" option under "Alarm/Event Message"

In order to define the position of the message line:

- Select the "Message Area" option under "Active"

- Press and hold the mouse button and position the message line within the screen layout.

- Click on "OK"

The figure below illustrates a possible partitioning of the screen:
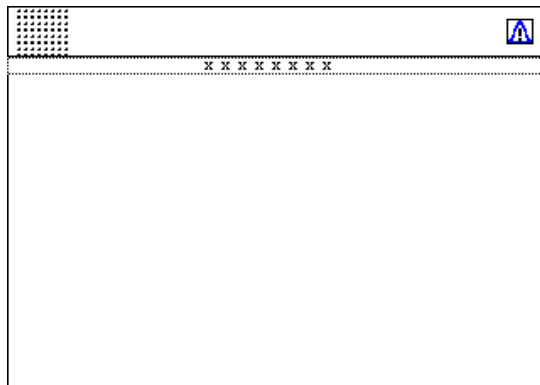
Defining communication areas

Communication areas must be defined in the PLC in order that special tasks can be carried out by the operating unit. Communication areas are necessary, for example, to trigger and acknowledge messages. Operating unit and PLC both access the defined data areas in order to communicate with each other.

Defining the communication area for alarm messages:

- Double click on "Area Pointers" in the project window

- Select the "Alarm Messages" option from "Available Types"

- Click on "OK"

- Select the PLC to be used from the "PLC" options

- Define the other settings for alarm messages.

- Click on "OK"

Setup this data area in the PLC program too.
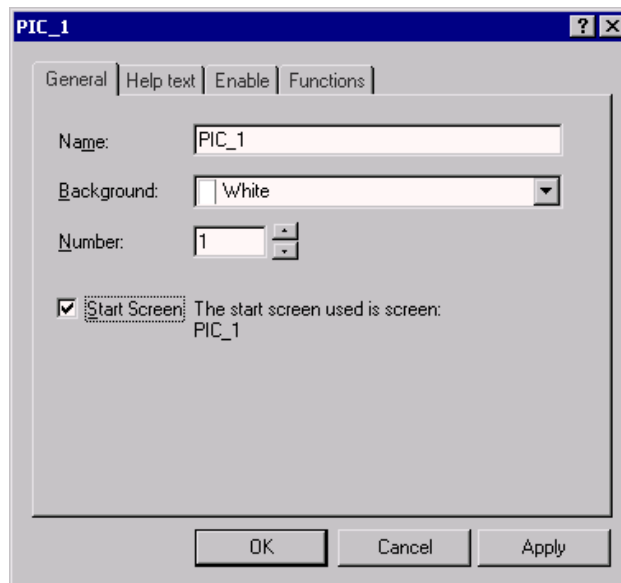
3.4   Creating a Start Screen

The start screen is the first screen displayed with regard to a project.

Adding a new screen

- Double click on "Screens" in the project window

A new screen is added and opened.

Identifying a screen as a Start Screen

- Click the right mouse button when positioned on the screen entry in the right-hand side of the project window

- Select "Properties" in the context menu

- Activate the "Start Screen" checkbox

```
PIC_1                                    ? X

 General | Help text | Enable | Functions |

   Name:          PIC_1

   Background:    | White              ▼

   Number:        1     ▲▼

   ☑ Start Screen  The start screen used is screen:
                   PIC_1


                   OK      Cancel      Apply
```

- Click on "OK"

Adding descriptive text to the Start Screen

A
- Click on the Text icon in the screen editor
- Click on the required position in the screen
- Enter the text "Start Screen"

3.5 Terminating ProTool/Pro RT

In order to provide the operator with the option of terminating the runtime software, the function "Exit_runtime" should be assigned to a function key or button.

Assigning the "Exit_runtime" function to a status button

- Click on the icon, depicted on the left, in the screen editor

- Position the mouse pointer at the point where the Status button should be located. Press and hold the left mouse button and draw the Status button to the required size

- Select "General" tab control, choose the "Text" option and enter the label "EXIT"

- Click on the "Functions" tab control

- Open the "Other Functions" folder in the "Select Object" option

- Double click on the function "Exit_runtime"

- Click on "OK" twice
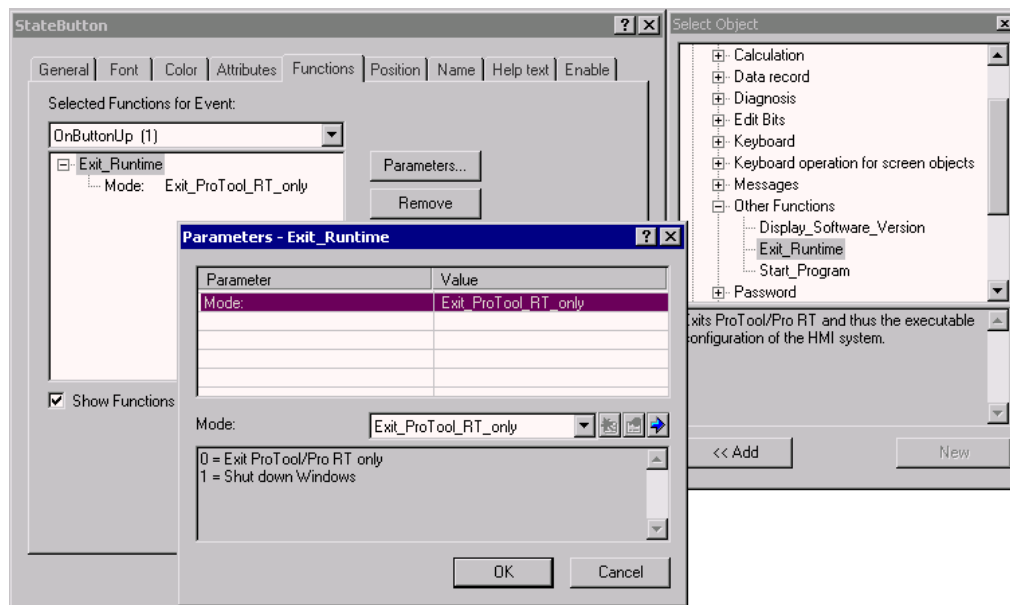
3.6   Entering and Displaying a PLC Process Value

In this example, a PLC process value should be entered and displayed using an input/output field on the operating unit.

Inserting an input/output field

- Click on the Input Field icon

- Click on the required position for the field in the screen and draw the field to the required size

- Ensure that the "Update" option is activated (basic setting) so that the display is updated when a value changes.

Assigning a tag to the input/output field

- Click on the icon depicted

- Click on "New" in the context menu
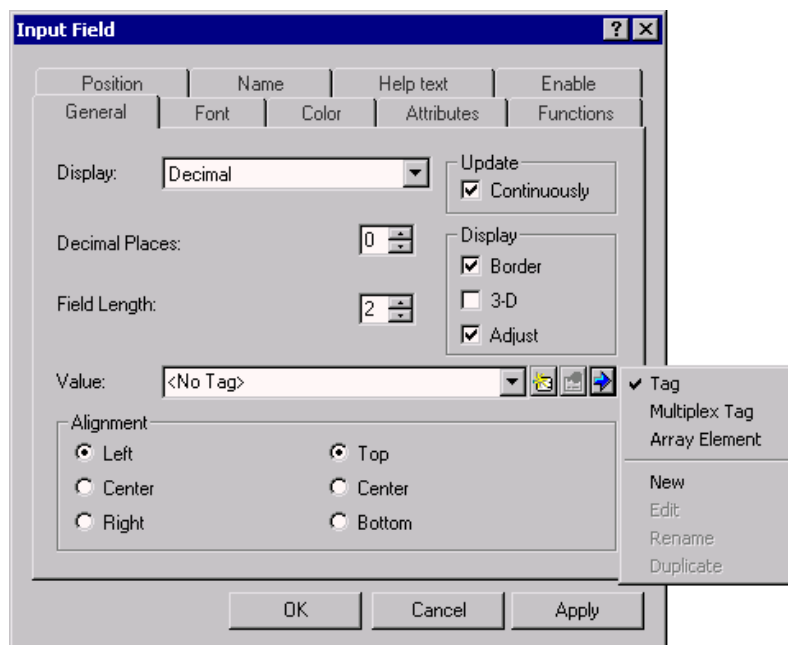
- Name the new tag "VAR_1"

- Define the parameters for the tag

- Click on "OK" twice

Example: SIMATIC S7

Each tag has a symbolic name and defined data type. The value of the tags change as the control program progresses. Tags linked to the PLC are called global tags. Tags without links to the PLC are called local tags.

The acquisition cycle of a tag determines the time interval at which it is updated with a value from the PLC.

The address defines the storage location of a global tag in the PLC. It is, therefore, dependent on the PLC implemented.

Set up a data area in the PLC for the tag used in this example. The input field on the operating unit can then be used to enter a process value in the PLC.

Note

When defining tag types, always take the intended purpose of the specific tags into account. If the value selected for the acquisition cycle is too low, it affects communication between the PLC and operating unit.

Testing the Project   **4**

4.1   Simulating the Project

The material supplied with ProTool contains a simulation program with which a project can be tested on the configuration computer without needing to connect a PLC and operating unit to it.

The simulation program

- modifies the value of configured tags in a definable way, e.g. incrementally, decrementally, sinusoidally, randomly or via shift bits,

- sets bits in the area pointers for event and alarm messages, thus triggering configured messages on the operating unit.

A condition for performing the simulation is that the simulation program has been installed on the configuration computer.

Example: Manipulating the input/output field tags

- Save the project using the icon depicted

- Start the simulation program by clicking on the icon depicted directly from the configuration software which is running

- Select the tags from the simulation table under "Tags" whose values are to be manipulated, in this case "VAR_1"

- Enter the value "1.0" in "Write Cycle"

- Select the "Sinus" option in "Simulation"

- Enter the value "0" in "MinValue"

- Enter the value "100" in "MaxValue"

- Enter the value "10" in "Interval"

- Activate the "Start" checkbox to start the simulation

- During the simulation, the various tag values can be observed in the input/output field

- Deactivate the "Start" checkbox to stop the simulation of the respective tags

Saving the simulation

All the settings defined in the simulation table can be stored in a file. Proceed as follows:

- Click on the Save icon

- Select the directory which contains the project file (*.fwd)

- Enter a name for the simulation file

- Click on "OK"

- This creates a file of the type "*.sim"

Note

Always store the simulation file (*.sim) and project file (*.fwd) in the same directory.

The simulation file can be used later to simulate the project again using the stored settings. A condition for this is that the tags and area pointers in the project which are to be simulated have not been modified in the meantime.

Exit the simulation

Exit from the Simulation program by closing the window.

4.2   Testing the Project on the Operating Unit

After the project has been successfully simulated on the configuration computer, it can be tested on the operating unit connected to the PLC. If the configuration computer simultaneously serves as the operating unit, the project can be tested immediately. Otherwise, the project must be downloaded onto the operating unit.

Caution

A project currently loaded on the operating unit will be overwritten during the process.

Generating the run-capable project

- Click on the icon depicted

- Follow the instructions which appear on the screen

- A file of the type "*.fwd" is created

Defining settings on the operating unit

- Activate Download mode on the operating unit:
  The Download mode setting is dependent on the respective operating unit. In the case of Windows CE units (except TP 170A), Download mode is activated by means of an applet in the Control Panel. In the case of other units, e.g. PC and TP 170A, Download mode can be activated from the Loader menu while the unit is starting up.

The storage location for project file and source file has a default setting.

Note

The download type selected in ProTool and set on the operating unit must match.

Downloading using ProTool

- Select menu items "File" > "Download" > "Setting..."

- Define the download settings:
  Select between serial download (RS232), MPI PROFIBUS DP, USB, Ethernet or Filecopy (PC only)

- Define the transfer settings:

- Press this button to trigger the downloading process or select menu items "File" > "Download" > "Start Project Download"

The project file is downloaded.

When the downloading process is completed successfully, the "*.fwd" file is located on the operating unit in the directory specified.

On completion of downloading, the operating unit is rebooted and the start screen is displayed.

If downloading is not completed error-free, the corresponding messages are displayed in the "system message window" under "Download".

Extend Project with Simple Objects   **5**

A condition for the procedures described in this section is that the following
configuration steps, defined in the Section "Basic Steps" have been carried out:

- Creating a New Project (Page 3–1)

- Defining Screen Partitions (Page 3–2)

- Creating a Start Screen (Page 3–4)

- Terminating ProTool/Pro RT (Page 3–5)

5.1   Inserting Graphics in the Start Screen

Proceed as follows in order to insert a company logo, for example, in the start screen:

- Click on the Graphic icon in the screen editor

- Click on the required position for the field in the screen and draw the field to the
  required size

- Select whether an existing graphic is to be inserted in the project or a new one
  created

- Insert existing graphic:
  Select the "Create from file" option. Either enter the path name directly or search
  through the directory structure of the data medium by selecting "Browse".

- Create new graphic:
  Select the "Create new" option. Select the object type required from the list,
  e.g. Bitmap. Click "OK" to start the associated application, e.g. Microsoft Paint.
  Create the graphic, close the application and return to ProTool.

5.2   Adding a Second Screen

At this point, the project only contains the start screen. If other screens need to be
added, the operator must be able to switch between the screens.

This example illustrates how a second screen is linked to the start screen. A button
should be assigned to each screen which enables toggling between the screens.

Creating a second screen

- Double click on "Screens" in the project window

A new screen is added and opened.

Adding descriptive text to the new screen

A

- Click on the Text icon in the screen editor
- Click on the required position in the screen
- Enter the text "Second screen"

Configuring a Change of Screens

Configuring switching to the second screen

2

- Create a Status button in the start screen, as described on Page 3–5 and label it "2", for example
- In the "Properties" dialog box, click on the Status button on the "Functions" tab control
- Select "Select Object"and open the "Screens" folder
- Double click on "Select_screen"
- Select the name of the second screen, e.g. "PIC_2" in "Screen Name"
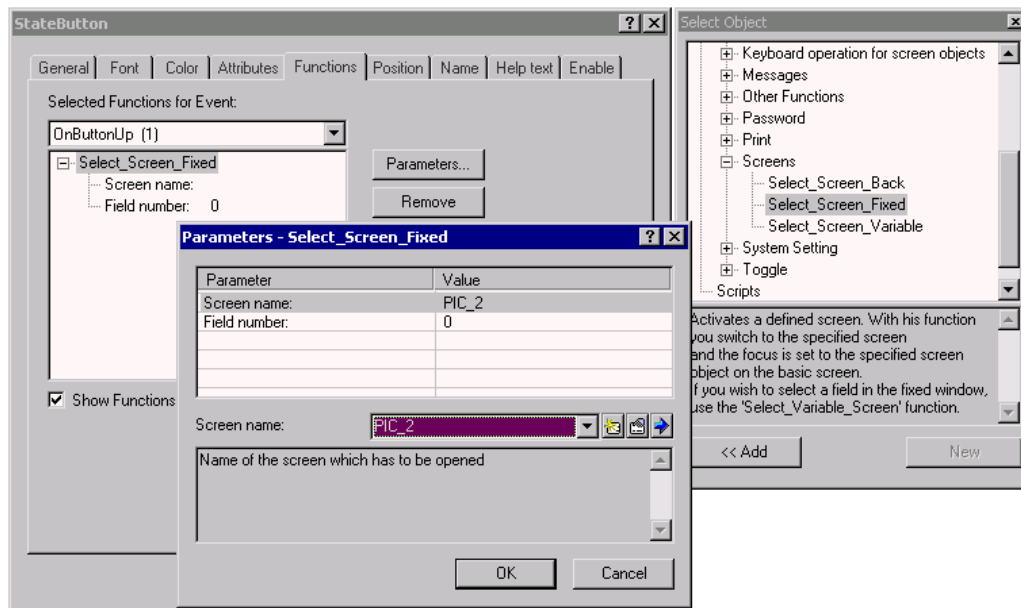
Configuring switching to the start screen

| 1 |

- Create a Status button in the screen PIC_2, as described on Page 3–5 and label it "1", for example.

- Configure switching screens to the start screen, e.g. "PIC_1", as described on Page 5–2.

Note

At this point, the project can be tested using the simulation program. The basic procedure is described in Section "Testing the Project" (Page 4–1).


After pressing Status button "2" in the start screen, the operating unit displays the second screen. On pressing Status button "1", the start screen reappears.

5.3   Inserting a Bar Graph

- Click on the bar graph icon

- Click on the required position for the bar graph in the screen and draw the field to the required size

- Use "Bar Value" to select the tag, VAR_1, created in Section "Assigning a tag to the input/output field (Page 3–6)

- Click on "OK"
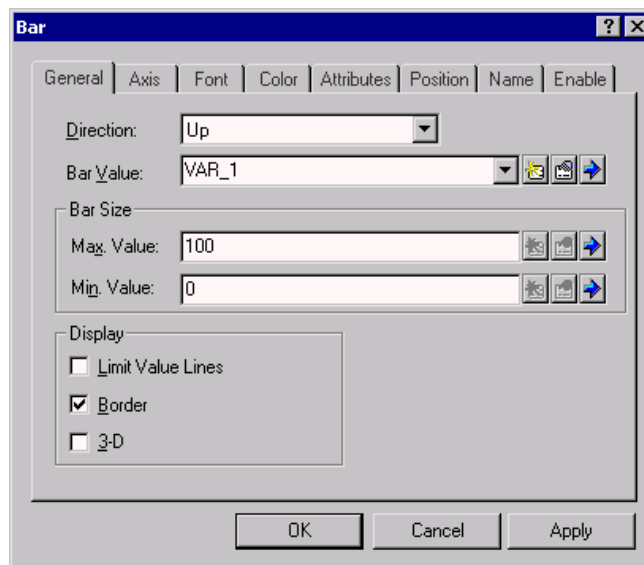
Note

At this point, the project can be tested using the simulation program. The basic procedure is described in Section "Testing the Project" (Page 4–1).

5.4   Movement of a Graphic Object According to the Process Value

In this example, a red rectangle should be integrated in the project and move in relation to a process value.

Integrating a rectangle in the start screen

- Click on the rectangle icon
- Click on the required position in the screen and draw the rectangle to the required size
- Click on the rectangle with the right mouse button
- Select "Properties" in the context menu
- Click on the "Color" tab control
- Click on "BackColor"
- Click on the red color field in "Standard Colors"
- Click on "OK"
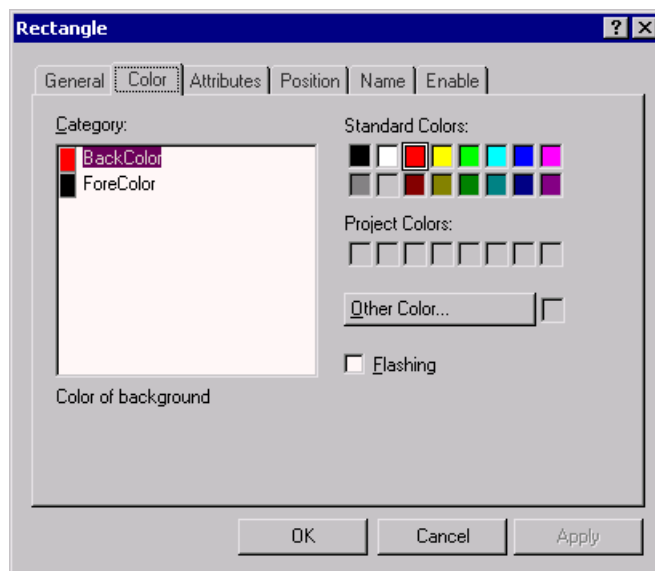
Linking the rectangle to the process value

Proceed as follows in order that the rectangle in the display moves in accordance with the changes in the tag value:

- Click on the rectangle with the right mouse button
- Select "Properties" in the context menu
- Select the "Position" tab control
- Use Y Offset to select the tag, VAR_1 created in Section "Assigning a tag to the input/output field (Page 3–6).
- Click on "OK"

The Y-Offset defines the movement of the rectangle in relation to the starting position defined in the project.
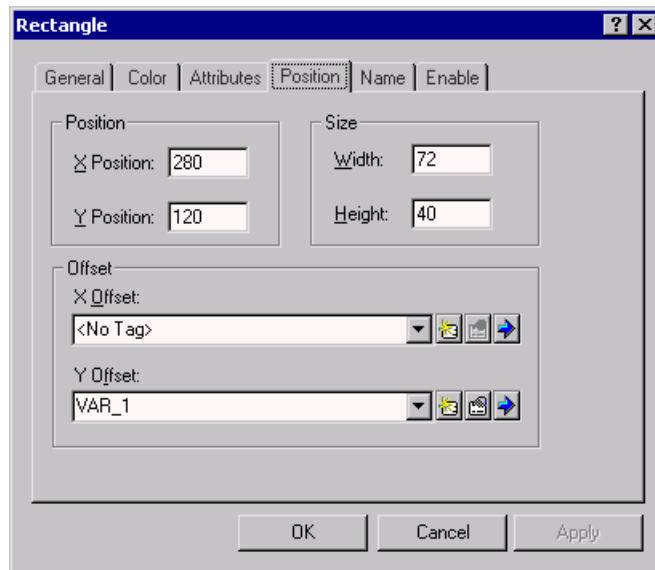
Note

At this point, the project can be tested using the simulation program. The basic procedure is described in Section "Testing the Project" (Page 4–1).

5.5   Influencing Bits in the PLC

Bit

- Create a Status button, as described on Page 3–5 and label it "Bit", for example.

- In the "Properties" dialog box, click on the "Functions" tab control

- Select "Select Object" and open the folder "Edit Bits"

- Double click on "Invert_bit"

- Click on the context menu icon

- Click on "New" in the context menu in order to create a new tag

- Name the new tag "VAR_2"

- Define the parameters for the tag

- Click on "OK" twice

5.6   Visualizing the Bit Status with Flashing Rectangle

In the following example, the attribute for the configured rectangle is set to "Flashing" on or off, in accordance with the status of the bit.

- Click on the rectangle with the right mouse button

- Select "Properties" in the context menu

- Select the "Attributes" tab control

- Mark the option "Bit" in the "Type" field

- Set the following attributes for status "0":
  Flashing: Off; Foreground: Red; Background: Red

- Click on the "Add " button

- Set the following attributes for status "1":
  Flashing: On; Foreground: Red; Background: White

- Click on the "Add " button

- Click on the "Control" button
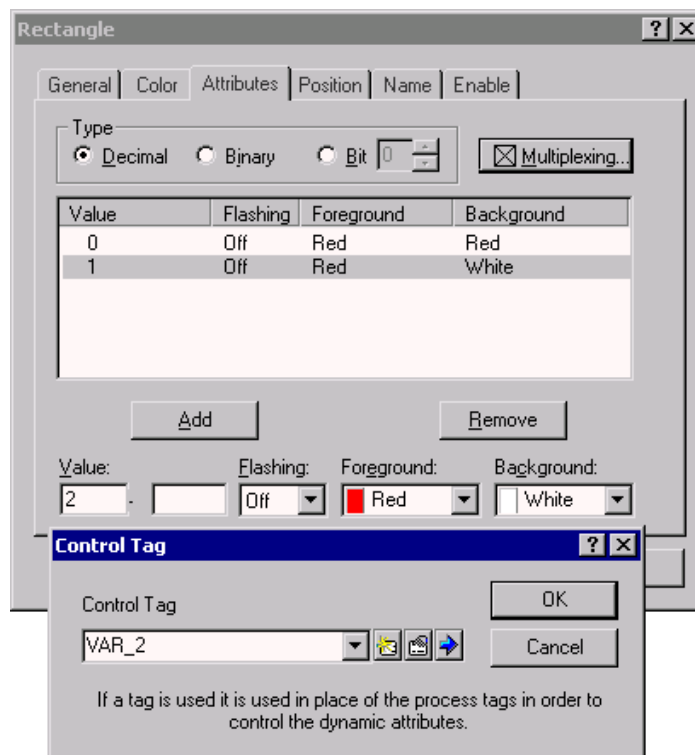
- Select "VAR_2" as the control tag

- Click on "OK" twice

Note

At this point, the project can be tested using the simulation program. The basic procedure is described in Section "Testing the Project" (Page 4–1).

Each time the Status button is pressed, the bit tag "VAR_2" toggles between set and reset. The "Flashing" attribute of the rectangle configured changes accordingly.

5.7   Displaying Messages

In order to issue information on the operating unit concerning current process faults in the form of messages, a communication area was configured for alarm messages in Section "Defining communication areas" (Page 3–3).

Configuring alarm message texts

- Click on "Messages" in the project window

- Double click on "Alarm Messages" on the right-hand side of the project window

- Enter the message text "Alarm Message 1" in line "0001"

- Enter the message text "Alarm Message 2" in line "0002"

- Enter the message text "Alarm Message 3" in line "0003"

The status line, at the bottom right of the screen, indicates the respective address corresponding to the alarm message in the communication area of the PLC. This information is PLC-specific.

In order to display the configured alarm messages on the operating unit, the corresponding bits must be set in the PLC using the PLC program.

Note

At this point, the project can be tested using the simulation program. The basic procedure is described in Section "Testing the Project" (Page 4–1).

Select the communication area for alarm messages from the simulation table under "Tags". Select "Bin" as the format and enter the binary numbers "1", "10" and "100" one after the other in the "Set value" column. Activate the "Start" checkbox after each entry.

This triggers the three configured alarm messages in succession.

5.8   Archiving Process Values

Windows-based systems provide the possibility of archiving process values, i.e. saving them on a permanent basis, and evaluating them.

Note

The internal Flash memory not permissible as the storage location for archive files in the case of Windows CE-based units because cyclical archiving reduces the service life of the Flash memory and, thus, the service life of the unit itself.

In this example, the process values of the tag "VAR_1" created in Section "Assigning a tag to the input/output field (Page 3–6) should be saved in an archive. The archive, in this case, is a text file in which the process values are stored according to the Microsoft® CSV standard.
In CSV files, all data is stored as ANSI characters and separated by separators (e.g. semi-colons). They can be read in and edited for evaluation by other programs.

Adding a new archive

- Double click on "Archives" on the left-hand side of the project window

    A new archive is created and the appropriate Properties dialog opens. The standard setting "Start Archiving Automatically" in "Behavior on Restart" causes process value archiving to be started automatically when the unit is activated.

- Click on the "Settings" tab control
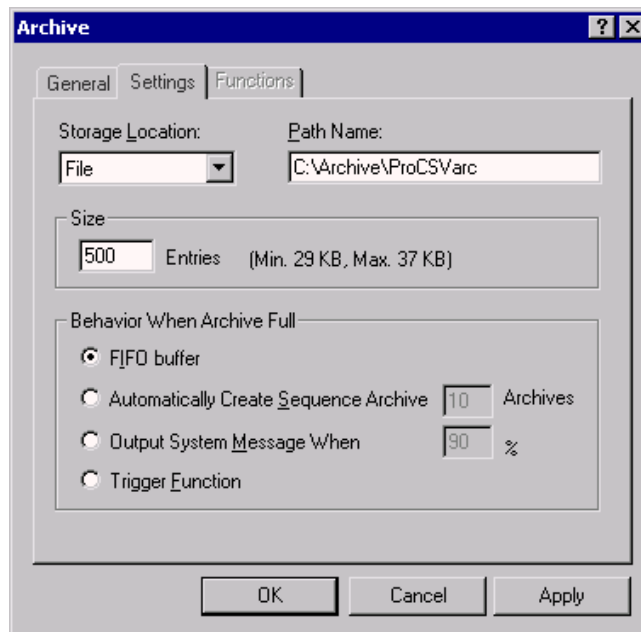
The standard setting, "FIFO buffer" in "Behavior When Archive Full", causes the oldest data to be overwritten when the archive is full.

- Enter the name of the path in which the archive is to be store in "Path Name"
- Click on "OK"

Assigning a tag to the archive

- Click on "Tags" on the left-hand side of the project window
- Click on the right mouse button in the right-hand side of the project window on the entry of the tag to be archived, e.g. "VAR_1"
- Select "Properties" in the context menu
- Click on the "Archive" tab control
- Select the newly created archive from Archive, e.g. B. "ARCHIVE_1"
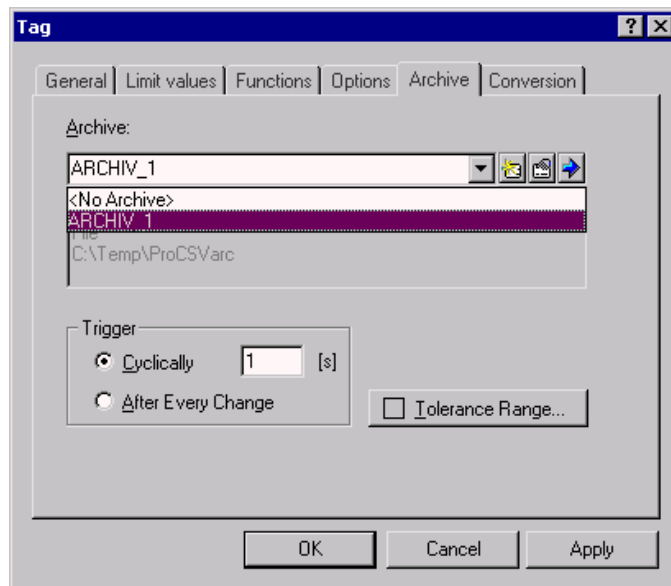
The standard setting "Cylically 1 [s]" in "Trigger" causes the process value of the tag to be stored once per second.

- Click on "OK"

Note

At this point, the project can be tested using the simulation program. The basic procedure is described in Section "Testing the Project" (Page 4–1).

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