SIEMENS

SIMATIC

Microbox T
Operating Microbox 420-T

Operating Instructions

06/2006
A5E00495967-01

Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ **Danger**

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ **Warning**

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ **Caution**

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

Caution

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

Notice

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

⚠ **Warning**

This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 가정 외의 지역에서 사용하는 것을 목적으로 합니다.

Siemens AG
Automation and Drives
Postfach 48 48
90437 NÜRNBERG
GERMANY

Order No.: A5E00495967-01
Edition 06/2006

Table of contents

Tables

Product overview 1

1.1 Introduction

Introduction

The Microbox T consists of an industrial PC system microbox with integrated DP-PCI-104 expansion board on which a PC-based software controller is installed with integrated technology functions. The software controller is also referred to as controller in this document.

Purpose of the operating instructions

These operating instructions contain all information about the following topics:

- Use of STEP 7 for the programming
- Operation and functions of the controller
- Setting of the operational performance
- Memory concept
- Communication with connected devices

Requirements

These operating instructions are intended for engineers, programmers and service personnel with general knowledge of automation systems.

Knowledge of the following is required to understand these operating instructions:

- Windows XP Embedded operating system
- Drive technology
- STEP 7 basic software
  For further information, refer to the *Programming with STEP 7 V5.3* manual.
- Technology functions
  For further information, refer to the *S7-Technology* manual.

Scope of the operating instructions

The operating instructions are valid for the WinLC T software installed on the Microbox 420-T and describes the delivery status from Version 1.0.

Conventions

Within the manual and the online help, the abbreviations Microbox 420-T, Microbox T or device are also used for the product designation SIMATIC Microbox 420-T.

Position in the information landscape

Information about the hardware, the installation and the connections of the Microbox 420-T are contained in the *Microbox 420-T Installation* hardware manual.

Information for commissioning the Microbox T is contained in *Getting Started With Microbox 420-T*.

Information about the STEP 7 basic software can be found in the *Programming with STEP 7 V5.3* manual.

Information about the programming and the technology functions can be found in the *S7-Technology* manual.

Information about the communication via Industrial Ethernet can be found in the *SIMATIC NET - Twisted-Pair and Fiber-Optic Networks* manual.

A description of the SOFTNET communication software can be found in the *SIMATIC NET - Introduction of SOFTNET for Industrial Ethernet* manual. The manuals for SIMATIC NET can be found as PDF documents on the CD contained in the Microbox T scope of delivery.

1.2 System architecture

System structure

The Microbox T is a hardware/software package comprising the following components:

- Industrial PC system microbox
- WinLC T PC-based controller with integrated motion control

WinLC T PC-based controller

WinLC T is a programmable software controller that provides a functionality similar to that of a SIMATIC S7 CPU with integrated motion control. The software is installed on the industrial PC system microbox and is executed on this. In this document, the term controller is also used instead of WinLC T for the software controller.

The controller integrates motion control functions and technological configurations (technology objects, axis configurations, tools).

WinLC T supports several networks and establishes a connection to the distributed I/O via the DP interfaces of the Microbox T.

A PROFIBUS DP(DRIVE) interface and digital outputs are available for the control of drive systems.

As part of the SIMATIC automation product range, WinLC T can also communicate with STEP 7 or other SIMATIC products, e.g. with WinCC, via PROFIBUS or Industrial Ethernet networks.

Using STEP 7

You can use the same programming languages, program structure and programming interface (STEP 7) as for S7-300/400 target systems in order to develop your process control. Programs that have been written for S7 automation systems can be used on PC-based controllers and vice versa.

Configuration

The Microbox T has been preconfigured. You can start immediately with the operation of the controller. You operate the controller via the control panel which is displayed on a monitor.

Notice

Hot-plug I/O devices (USB) may **not** be connected while the WinLC T controller is in operation. Monitor, keyboard and mouse are not included in this restriction.

If, for example, you want to connect a USB memory to store data, you must first shut down the WinLC T controller.

Customer-specific software

Caution

To ensure a high-quality, correctly functioning complete system, the SIMOTION P motion control component comes configured and ready to run. For this purpose, the system components used are subject to a certification procedure at SIEMENS as the system manufacturer. The certification process establishes and documents the real-time features of the entire configuration.

If PC components (hardware or software) are modified or expanded by a third party, compliance with product features cannot be guaranteed. The OEM or user involved must assume sole responsibility for such components.

Certification of expansions

The PC is basically an open system. In some cases, software or hardware expansions or modifications are necessary to attain a particular functionality.

Please contact your local SIEMENS sales representative in this respect.

1.3 Functions of WinLC T

SIMATIC functionality supported by WinLC T

WinLC T provides the following functions:

- Contains a large number of S7 code blocks of SIMATIC controllers:
  Organization blocks (OBs), system function blocks (SFBs) and system functions (SFCs)
- Uses S7 communication services and provides compatibility with STEP 7 for tasks such as programming, testing and monitoring.
- WinLC T has a tuning panel for the display and setting of the system operational performance.
- Can be connected to a SIMATIC NET OPC server, which allows OPC client applications to access process data.

1.4 Integrated technology

Technology functions

Technology functions for the control of drive systems are integrated in the WinLC T software controller.

A detailed list can be found under "Technology functions".

Evaluation of technology data blocks

The integrated technology of WinLC T provides current information on the status and on the values of the technology objects via the technology data blocks. To achieve short response times, the technology data blocks can be evaluated in OB 65.

Reference

Further information about the technology functions that can be used under WinLC T and the technology data blocks can be found in the *S7-Technology* manual.

Fundamentals of the PC-based controller 2

2.1 Overview

The Microbox T contains the WinLC T PC-based controller. This is always installed and is executed on the Microbox T. The WinLC T PC-based controller is also referred to as controller in this document.

The "Fundamentals of the PC-based controller" section explains the basic terms in order to understand the WinLC T PC-based controller:

- PC station
- Communication interface
- Index

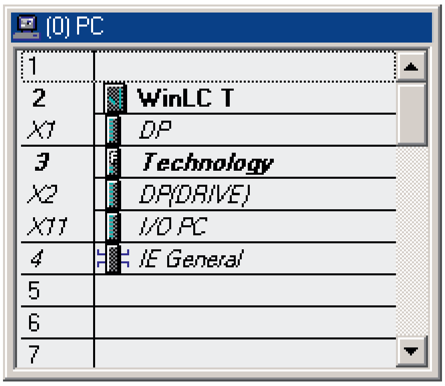
2.2 Explanation of the terms

2.2.1 PC station

Description

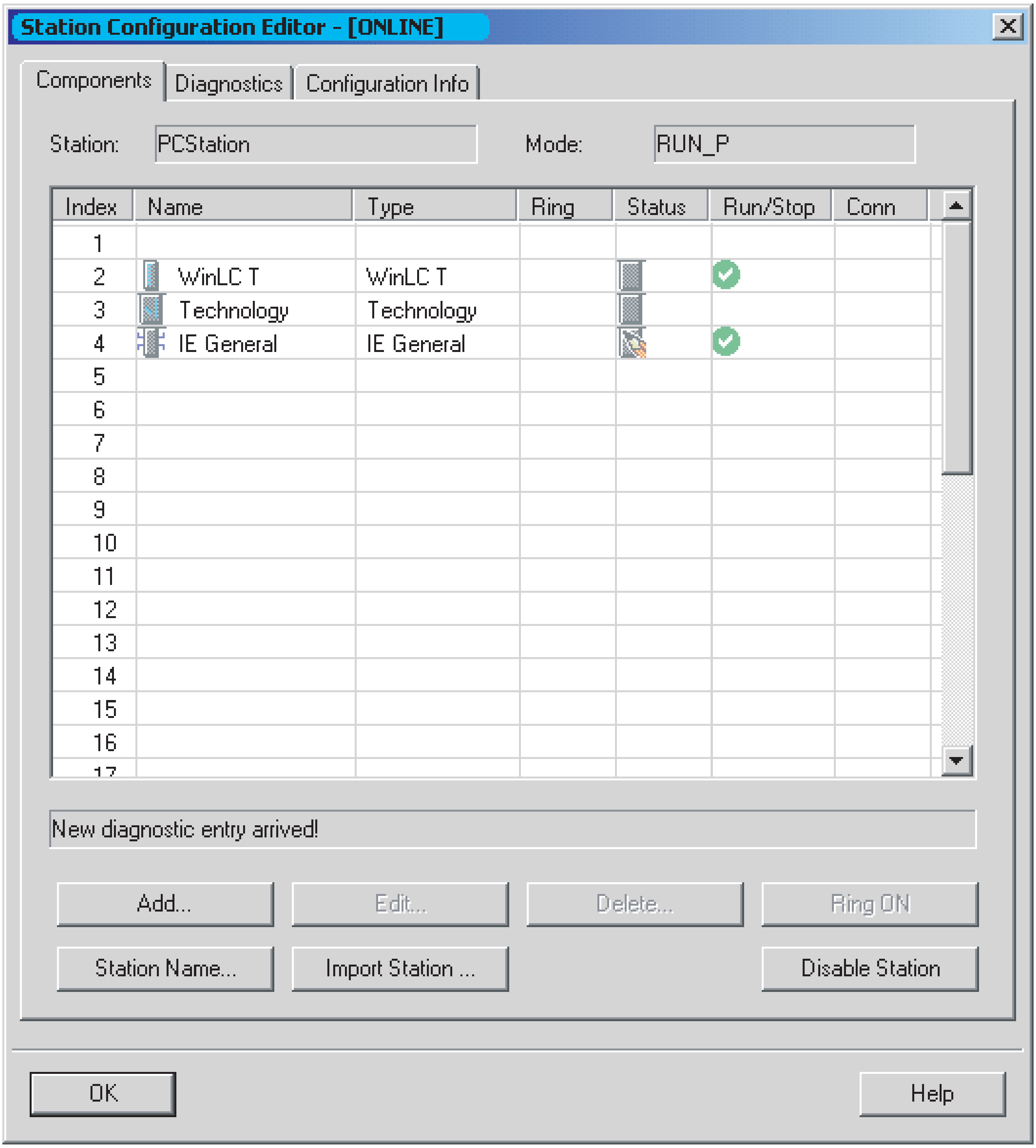
The PC station is a software-based virtual rack used for the creation of a PC-based automation system. As with a hardware rack of an automation system based on an S7 CPU, the PC station provides space for several components required for the PC-based automation system.

The PC station is displayed in STEP 7 HW Config and in the station configuration editor:



1	
2	WinLC T
X1	DP
3	Technology
X2	DP(DRIVE)
X11	I/O PC
4	IE General
5	
6	
7	

Figure 2-1 Display in STEP 7 HW Config



Station: PCStation

Mode: RUN_P

Index	Name	Type	Ring	Status	Run/Stop	Conn
1						
2	WinLC T	WinLC T		▨	✓	
3	Technology	Technology		▨		
4	IE General	IE General		▨	✓	
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

New diagnostic entry arrived!

Figure 2-2 Display in the station configuration editor

When you work with the Microbox T, the following components are available in the PC station:

- WinLC T controller
  The controller is part of the Microbox T. It is configured with STEP 7.
- Technology
  The technology is parameterized with S7T Config.
- Communication interfaces
  The Microbox T contains two PROFIBUS interfaces configured as DP interfaces and two integrated Ethernet interfaces for use with Industrial Ethernet.
- I/O PC (I/O interface, digital outputs)
  The Microbox T has eight digital outputs with switching times below 1 ms.
- Further applications (optional)
- OPC server (optional)
- Station manager
  The station manager is part of the Microbox T.

2.2.2 Communication interface

Description

A communication interface is a CP, an integrated PROFIBUS interface or an Industrial Ethernet interface.

The following communications interfaces exist for WinLC T on the Microbox 420-T:

- DP interface

  WinLC T can use the DP interface not only for communication with STEP 7 or other S7 applications, but also for communication with the distributed I/O via PROFIBUS DP.
- DP(DRIVE) interface

  The DP(DRIVE) interface is used for the communication with drive systems.
- Ethernet interfaces

  The Microbox T contains two integrated Ethernet interfaces for use with Industrial Ethernet. These can be used for the communication between STEP 7 or other S7 applications and the WinLC T controller.

2.2.3 Index

Description

An index is a numbered slot on the virtual rack of the PC station.

When you work with the Microbox 420-T, you are provided with following configuration:

- The WinLC T controller has been assigned to Index 2.
- The integrated technology has been assigned to Index 3.
- IE general has been assigned to Index 4.
- The station manager has been assigned to Index 125.

In addition to the previously configured slots, you can add your own applications (e.g. C programs or Visual Basic programs) or an OPC server.

Programming 3

3.1 Use of STEP 7 with the controller

Description

STEP 7 with the S7-Technology option package provides programming and configuration tools for the work with WinLC T. They perform the following operations in STEP 7:

- Definition of the controller, DP, DP(DRIVE) and IE configuration using STEP 7 HW Config and configuration of the operating parameters and I/O addresses for the controller
- Development of a STEP 7 user program with one of the STEP 7 programming languages
- Definition of the drive technology with the tools of the S7-Technology option package

  The definition is performed with the S7T Config tool. The technology object data are stored in data blocks for use by the STEP 7 user program.

  S7-Technology also includes a library containing PLCopen-compliant function blocks which are used to program the actual motion control tasks. You call these FBs in your STEP 7 user program.
- Loading of the configuration and the STEP 7 user program to the controller

The STEP 7 languages LAD, FBD and STL and all the engineering tools, e.g. S7-SCL or S7-GRAPH, are available for the creation of the STEP 7 user program (incl. the motion control tasks).

Further information can be found in the STEP 7 documentation and in the documentation for the S7-Technology option package.

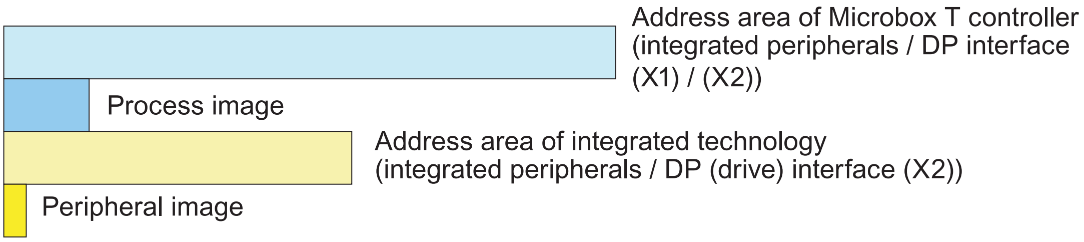
Note on the initialization of the integrated technology through overloading of the SDBs

You **cannot** re-initialize the integrated technology of the Microbox 420-T by reloading the unchanged SDBs to the Microbox 420-T. The system variables and configuration data retain their last valid value and are **not** reset to the initial value as with the CPU31xT.

If you want to reset the integrated technology of the Microbox T to the configured values, you must first execute the MRES command (overall reset) on the Microbox T and then reload the project.

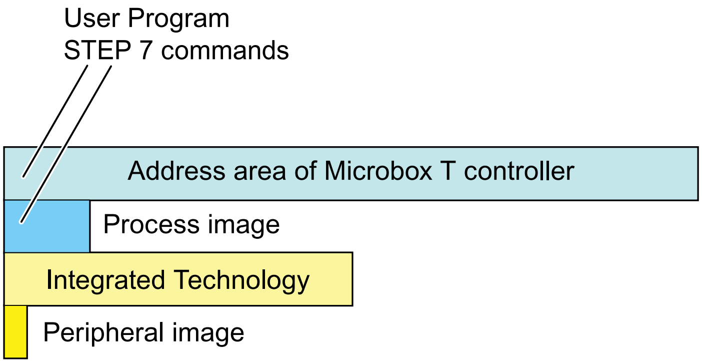
Access to address areas of the Microbox T

The Microbox T has a common address area for the controller and the integrated technology. The address area can be assigned with addresses on the DP interface (X1), the DP(DRIVE) interface (X2) and addresses of the integrated technology.


Address area of Microbox T controller (integrated peripherals / DP interface (X1) / (X2))
Process image
Address area of integrated technology (integrated peripherals / DP (drive) interface (X2))
Peripheral image

	Microbox 420-T addresses
Microbox-T controller	0 to 2047
Process image (default setting *)	0 to 511
Integrated technology	0 to 2047
I/O image	0 to 63
* Size of the process image can be set in HW Config	

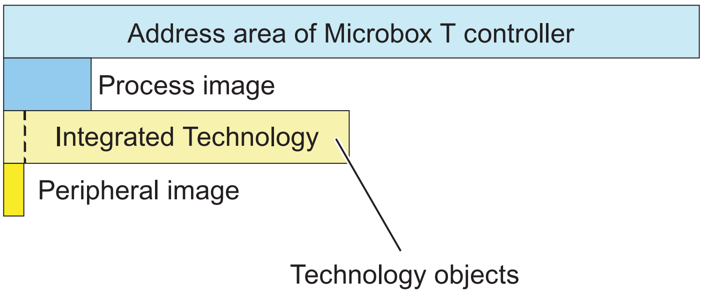
Access via the controller



In principle, the entire address area of the Microbox T can be addressed with STEP 7 commands in the user program. However, the addressed addresses must be assigned to the DP interface (X1) in HW Config.

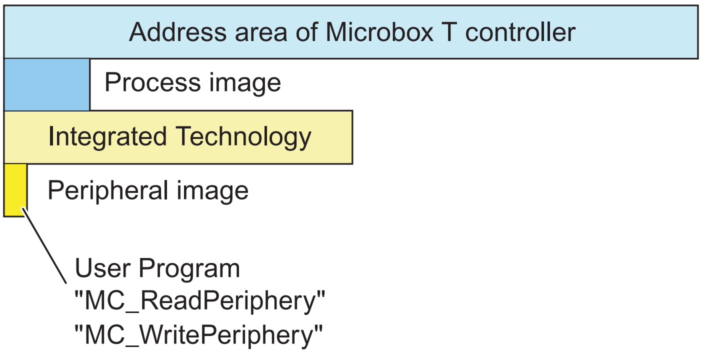
Direct access to addresses of the integrated I/O or addresses that have been assigned to the DP(DRIVE) interface (X2), is not possible. If these addresses are accessed in the user program, the controller reacts as if these addresses are physically not assigned.

Access via technology objects



Set the addresses that you want to access via technology objects in the address area 64 to 1023. Technology objects can access addresses that have been assigned to the DP(DRIVE) interface (X2) or the integrated I/O in HW Config.

Access via the "MC_ReadPeriphery" and "MC_WritePeriphery" technology functions.



Use the "MC_ReadPeriphery" and "MC_WritePeriphery" technology functions when you want to access the I/O image of the integrated technology (address area 0 to 63).

Set all the addresses that you want to access with "MC_ReadPeriphery" and "MC_WritePeriphery" technology functions in this address area. The specified technology functions cannot access addresses outside of this area.

Addresses of the DP(DRIVE) interface (X2) or the integrated I/O can be assigned to the I/O image.

Note

If the "MC_ReadPeriphery" technology function is used to access address areas or subareas that have been assigned to the DP interface (X1), invalid values are read for these addresses.

If the "MC_WritePeriphery" technology function is used to access address areas or subareas that have been assigned to the DP interface (X1), writing for these addresses is not performed.

3.2 Creating a project with STEP 7

Introduction

You configure the STEP 7 project for a PC station with a PC-based controller in STEP 7 in exactly the same way as for an S7 hardware controller. Detailed information on this subject can be found in the help and in the documentation for STEP 7.

Creating a project and PC station with the SIMATIC Manager

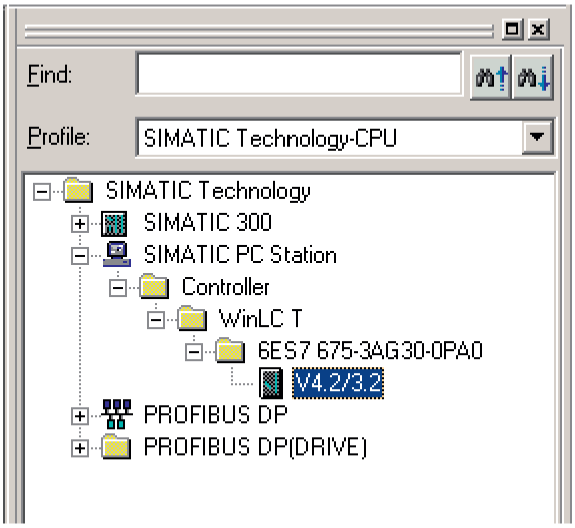
Proceed as follows to create a project and PC station:

1. In the SIMATIC Manager, select **File > New** to create a new project.
2. Enter a name for the new project.
3. Select **Insert new object > SIMATIC PC station** to insert a PC station in the project.

Configuring the PC station in STEP 7 HW Config

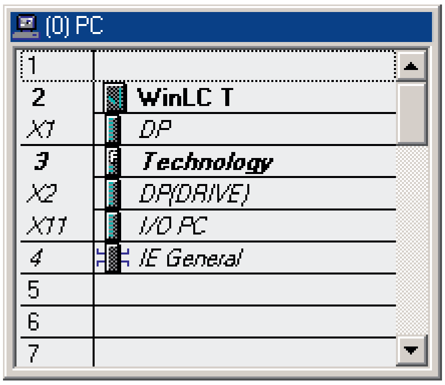
Proceed as follows to configure the PC-based controller and the distributed I/O for the PC station:

1. Open the PC station folder in the project and double-click the symbol for the configuration to call up the STEP 7 HW Config.
2. Navigate to the WinLC T controller below the SIMATIC PC station.


Find:
Profile: SIMATIC Technology-CPU

- SIMATIC Technology
  - SIMATIC 300
  - SIMATIC PC Station
    - Controller
      - WinLC T
        - 6ES7 675-3AG30-0PA0
          - V4.2/3.2
  - PROFIBUS DP
  - PROFIBUS DP(DRIVE)

3. Drag the controller to the slot with Index 2.
   WinLC T is configured in Index 2. The technology is then automatically configured on Slot 3 and IE general on Slot 4.



(0) PC

1	
2	WinLC T
X1	DP
3	Technology
X2	DP(DRIVE)
X11	I/O PC
4	IE General
5	
6	
7	

The technology on Slot 3 and IE general on Slot 4 cannot be removed separately. However, you can change the object properties and perform the clock synchronization.

Further options in the hardware configuration

The following operations are optional and depend on the specific application:

1. Insert all HMI devices, e.g. Runtime ProTool or Runtime WinCC flexible.
2. Parameterize the WinLC T, Technology, IE General modules and their interfaces.
3. Configure WinLC T for the S7 communication:
   – In SIMATIC Manager, select the name of the controller.
   – In the right-hand window pane, double-click the symbol for connections.
   – Configure the network with NetPro.
4. Configure the drives to be used in HW Config.

After you have configured WinLC T, you can develop and load your STEP 7 user program in the SIMATIC Manager.

Caution

If you load a STEP 7 user program that is too large for the computer memory, the computer may crash or the operation of WinLC T may become unstable. This may result in material damage and/or violations.

Even when STEP 7 and WinLC T do not limit the number of blocks and the size of the STEP 7 user program, the Microbox T has a limit, which depends on the memory available on the Compact Flash card and in the RAM. The limit for the size of the STEP 7 user program and the number of blocks for your Microbox T can only be determined when you test a system for the requirements of your control application.

After you have loaded your program to the controller, you can start the controller and monitor and change the process variables with STEP 7.

3.3 Configuring the operating parameters for the controller

Introduction

HW Config and S7T Config are available for configuring the operating parameters of the controller in STEP 7 with the S7-Technology option package. This configuration is saved to the SDBs of the system data container.

After you have loaded the system data, the controller uses the configured parameters:

- When the controller starts up
- During the transition to the RUN mode (if you have changed the hardware configuration online while the controller was in the STOP mode)
- During operation, the drive configuration controls the behavior of the technology objects.

To configure the operating parameters in STEP 7 HW Config, right-click the controller entry in the station window and select "Object properties". Configure the operating parameters in the "Properties" dialog box.

Use the S7T Config tool to configure the technology objects. More detailed information on this can be found in the documentation for the S7-Technology option package.

Accessing operating parameters

To configure these operating parameters in STEP 7, open the SIMATIC Manager and proceed as follows:

1. In the SIMATIC Manager, select the PC station.
2. Double-click the configuration icon to open HW Config.
3. In the station window, right-click the module or submodule whose properties you want to change, and select "Object properties".
4. Open the tab with the name of the parameter that you want to configure (e.g. time interrupt), and enter the appropriate values.
5. Confirm your configuration with "OK".

Further information about the configuration of the controller properties and the operating parameters can be found in the STEP 7 documentation.

3.4 Code blocks supported by WinLC T

Supported blocks

As with all S7 controllers, WinLC T has different types of code blocks for the processing of the user program: Organization blocks (OBs), system functions (SFCs) and system function blocks (SFBs).

Organization block (OB)	System function (SFC)	System function block (SFB)
OB1 OB 10 OB 20 OB 30 to OB 38 OB 40 OB 52 to OB 57 OB 65 OB 80, OB 82 to OB 86 and OB 88 OB 100 OB 121 and OB 122	SFC 0 to SFC 6 SFC 9 and SFC 10 SFC 11 to SFC 15 SFC 17 to SFC 24 SFC 26 to SFC 34 SFC 36 to SFC 44 SFC 46 and SFC 47 SFC 49 to SFC 52 SFC 54 to SFC 59 SFC 62 and SFC 64 SFC 78 to SFC 80 SFC 82 to SFC 84 SFC 85 and SFC 87	SFB 0 to SFB 5 SFB 8 and SFB 9 SFB 12 to SFB 15 SFB 22 and SFB 23 SFB 31 to SFB 36 SFB 52 to SFB 54 SFB 65001 and SFB 65002

Further S7 blocks

In addition to these system blocks, you can also use the following S7 blocks to create your STEP 7 user program:

- Functions (FCs): WinLC T supports up to 65,536 FCs (FC 0 to FC 65535). Every function can have a maximum of 65,570 bytes.
- Function blocks (FBs): WinLC T supports up to 65,536 FBs (FB 0 to FB 65535). Every function block can have a maximum of 65,570 bytes.
- Data blocks (DBs): WinLC T supports up to 65,535 DBs (DB 1 to DB 65535). (DB 0 is reserved.) Every data block can have a maximum of 65,534 bytes.

The number and size of the FCs, FBs and DBs is restricted to the available system memory. Detailed information about the operations supported by WinLC T can be found in the following sections:

- Technical data
- Organization blocks (OBs)
- System functions (SFCs)
- System function blocks (SFBs)

See also

Technical data (Page 10-1)

3.5 S7 communication functions

Overview

As with other S7 automation systems, S7 communication between controllers in the network is also possible with WinLC T. The controllers can either be hardware or software controllers.

SFB or SFC	Name	Description
SFB 8 SFB 9	USEND URCV	Data exchange by means of SFBs for sending and receiving.
SFB 12 SFB 13	BSEND BRCV	Exchange of data blocks with variable length between an SFB for sending and an SFB for receiving.
SFB 14 SFB 15	GET PUT	Reading data from a remote device. Writing data to a remote device.
SFB 22 SFB 23	STATUS USTATUS	Specific query of the status of a remote device. Receipt of status messages from a remote device.
SFC 62	CONTROL	Query of the status of a connection.

Further information about the S7 communication can be found in the STEP 7 documentation.

3.6 PROFIBUS DPV1

Description

DPV1 extensions for PROFIBUS DP enable the extended communication required by complex slave devices. This extended communication includes acyclic data exchange, alarm and status messages and the transfer of complex data types.

WinLC T supports the following DPV1 functionality:

- DP standard and DPV1
- Interrupt and status OBs for the processing of DPV1-defined events including:
  - OB 40 (process interrupt)
  - OB 55 (status interrupt)
  - OB 56 (update interrupt)
  - OB 57 (manufacturer-specific interrupt)
  - OB 82 (diagnostic interrupt)
  - OB 83 (Insert/remove module interrupt)
- Function blocks for reading and writing data sets:
  - SFB 52 (RDREC), Read data set
  - SFB 53 (WRREC), Write data set
  - Execution of SFB 54 (RALRM), Read interrupt data, in the context of the triggering interrupt
- Station and interface address
- Buffering of interrupts that have been received in the DP mode CLEAR

3.7 Organization blocks (OBs)

3.7.1 General information on OBs

Supported organization blocks

Organization blocks (OBs) are the interface between the controller operating system and the STEP 7 user program. With OBs, you can execute certain components of the STEP 7 user program when the following events occur:

- During the start and restart of the controller.
- During cyclic processing or at specific intervals.
- At certain times or on certain days.
- On expiration of a certain period.
- When errors occur.
- When a process interrupt occurs.

The program logic in an OB may have a max. of 65,570 bytes.

Organization blocks are executed in the priority assigned to them.

The OBs supported by WinLC T are listed in the following table:

OB	Description	Priority class
OB 1	Free cycle	1 (lowest)
OB 10	Real-time interrupt	0, 2 to 24
OB 20	Delay interrupt	0, 2 to 24
OB 30 to OB 38	Time interrupts	0, 2 to 24
OB 40	Process interrupt	0, 2 to 24
OB 52 to OB 54	ODK interrupts	15
OB 55	Status interrupt	0, 2 to 24
OB 56	Update interrupt	0, 2 to 24
OB 57	Manufacturer-specific interrupt	0, 2 to 24
OB 65	Task synchronous interrupt	25
OB 80	Time error	26
OB 82	Diagnostic interrupt	24 to 26 (or 28)* Default setting: 25
OB 83	Insert/remove interrupt	24 to 26 (or 28)* Default setting: 25
OB 84	CPU hardware fault	24 to 26 (or 28)* Default setting: 25
OB 85	Program execution error	24 to 26 (or 28)* Default setting: 25
OB 86	Rack failure	24 to 26 (or 28)* Default setting: 25

OB	Description	Priority class
OB 88	Process interrupt (stop avoidance)	28
OB 100	Restart (warm restart)	27
OB 121	Programming error	Priority class of the OB causing the error
OB 122	I/O access error	
* Priority class 28 in the STARTUP mode, priority class (from 24 to 26) can be set by the user in the RUN mode		

OBs for the free cycle of the program and for the warm restart

The following table shows the OBs for the free cycle of the program and the warm restart. WinLC T has OB 1 (free cycle) for the continuous processing of the STEP 7 user program. WinLC T executes OB 100 (warm restart) at the transition from the STOP to the RUN mode. When OB 100 has been executed successfully, WinLC T executes OB 1.

Organization block (OB)		Start event (in hex)	Priority class
Free cycle	OB 1	1101, 1103, 1104	1
Warm restart	OB 100	1381, 1382	27

Notes on the time resolution and jitter

All cycle clocks that you set in HW Config for organization blocks (e.g. for OBs 30...38) are automatically rounded up to the next integer multiple of the DP(DRIVE) cycle time on the PROFIBUS DP. This can cause a jitter for one to two cycles for the execution of the OBs.

This means the configured minimum cycle time can be overshot or undershot by these two cycles.

3.7.2 Interrupt OBs

Supported interrupt OBs

WinLC T has various OBs that interrupt the execution of OB 1. The following table lists the interrupt OBs supported by WinLC T. These interrupts occur depending on the type and configuration of the OB.

The priority class specifies whether the controller interrupts the execution of the STEP 7 user program (or other OBs) and executes the interrupt OB. You can change the priority class of the interrupt OBs (**exception**: OB 65).

Interrupt		Start event (in hex)	Preset priority class
Real-time interrupt	OB 10	1111	2
Delay interrupt Range: 1 ms to 60000 ms	OB 20	1121	3
Time interrupts Range: 2 ms to 60000 ms Recommended: > 10 ms	OB 30 OB 31 OB 32 OB 33 OB 34 OB 35 OB 36 OB 37 OB 38	1131 1132 1133 1134 1135 1136 1137 1138 1139	7 8 9 10 11 12 13 14 15
Process interrupt	OB 40	1141	16
Status interrupt	OB 55	1155	2
Update interrupt	OB 56	1156	2
Manufacturer-specific interrupt	OB 57	1157	2
Task synchronous OB	OB 65	116A	25
Error OBs	OB 80-88 OB 121/122	The error OBs are described in detail at "Supported error OBs" (see below).	

If you have configured WinLC T so that a certain interrupt OB is to be executed, but this OB has not been loaded, then WinLC T reacts in the following way:

- If OB 10, OB 20, OB 40, OB 55, OB 56 or OB 57 are missing and OB 85 has not been loaded, WinLC T changes the operating mode (from RUN to STOP).
- WinLC T remains in the RUN mode when a time interrupt OB (OB 32 to OB 36) or the task synchronous OB (OB 65) is missing.
  If these OBs cannot be executed at the respective time and OB 80 has not been loaded, WinLC T changes from RUN mode to STOP mode.

Evaluation of technology data blocks

The integrated technology of WinLC T provides current information on the status and on the values of the technology objects via the technology data blocks. To achieve especially short response times, the technology data blocks can be evaluated in OB 65.

Notes on time interrupt OBs

Depending on the interval parameterized for the time interrupt by means of the operating parameters, WinLC T starts the execution of the time interrupt OB at the appropriate time. The optimum interval for your application depends on the processing speed of your computer and the execution time of the cyclic OB. For the Microbox T, we recommend a minimum cycle time for time interrupts of 2 ms or the same as the DP cycle clock.

Jitter can occasionally override the start event for a cyclic OB, whereby WinLC T may change to STOP mode. Note the remarks on time resolution and jitter in the "General information on OBs" section. The following situations illustrate other factors that can influence the execution of the OB:

- The execution of the program in the OB needs longer than the permitted interval. If the execution of the program continually overrides the start event of the cyclic OB, WinLC T may change to STOP mode (if OB 80 has not been loaded).
- Programs in other priority classes often cause interruptions or have a long execution time and the controller cannot execute the cyclic OB at the specified time. If this occasionally causes an overload, WinLC T starts the cyclic OB after the first OB is completed.
- STEP 7 executes a task or function which prevents the controller executing the cyclic OB at the specified time.

If you configure a time interrupt OB (OB 30 to OB 38) so that it is to be executed at certain intervals, you must ensure that the program can be executed within this time and that your STEP 7 user program can also execute the OB within the assigned time.

Supported error OBs

WinLC T has a number of error OBs. Some of these error OBs have a configured (assigned by the user) priority class, while other OBs (OB 121 and OB 122) take over the priority class of the block in which the error occurs.

The local variables for OB 121 and OB 122 receive the following information, which can be used by the STEP 7 user program to react to the error:

- The block type (Byte 4) and the number (Bytes 8 and 9) of the block causing the error.
- The address within the block (Bytes 10 and 11), in which the error has occurred.

If the start event occurs for a certain error OB that has not been loaded, WinLC T changes the operating mode (from RUN to STOP).

Error		Start event (in hex)	Preset priority class
Time error	OB 80	3501, 3502, 3505, 3507	26
Diagnostic interrupt	OB 82	3842, 3942	26
Insert/remove interrupt	OB 83	3861, 3863, 3864, 3865, 3961	26
CPU hardware fault (Windows malfunction)	OB 84	3585	26 (or 28)
Program execution error: • The start occurs for an OB that has not been loaded. • During the I/O cycle, WinLC T attempts to access a module or a DP slave that is defective or not connected.	OB 85	35A1, 35A2, 39B1, 39B2	26
Rack failure (distributed I/O): A node in the PROFIBUS DP network has failed or been restored.	OB 86	38C4, 38C5, 38C7, 38C8, 39C4, 39C5	26 (or 28)
Process interrupt: The execution of a program block has been aborted.	OB 88	3571, 3572, 3573, 3575, 3576, 3578, 357A	28
Programming error (Example: The user program attempts to address a time which is not available.)	OB 121	2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 253A, 253C, 253E	Same priority class as the OB causing the error.
I/O access error (Example: The user program attempts to access a defective module or a module that is not connected.)	OB 122	2942, 2943	

Detailed information about the OBs can be found in the STEP 7 online help or in the *System Software for S7-300/400 System and Standard Functions* reference manual.

3.8 System functions (SFCs)

Supported system functions

WinLC T contains system functions that can execute various tasks. The STEP 7 user program calls the SFC and transfers the required parameters. The SFC then performs the task and outputs the result. The SFCs supported by WinLC T are listed in the following table:

SFC	Name	Description
SFC 0	SET_CLK	Sets the system clock.
SFC 1	READ_CLK	Reads the system clock.
SFC 2	SET_RTM	Sets the run-time meter.
SFC 3	CTRL_RTM	Starts or stops the run-time meter.
SFC 4	READ_RTM	Reads the run-time meter.
SFC 5	GADR_LGC	Determines the logical address of a channel.
SFC 6	RD_SINFO	Reads the start information of an OB.
SFC 9	EN_MSG	Enables block-related and symbol-related messages as well as group status messages.
SFC 10	DIS_MSG	Disables block-related and symbol-related messages as well as group status messages.
SFC 11	DPSYNC_FR	Synchronized groups of DP slaves.
SFC 12	D_ACT_DP	Disables and enables DP slaves.
SFC 13	DP_NRM	Reads the diagnostics data of a DP slave Tested DP configuration: An ET 200M slave with a module with 8 inputs and 8 outputs and a module with 16 outputs.
SFC 14	DPRD_DAT	Reads the consistent data of a DP slave.
SFC 15	DPWR_DAT	Writes the consistent data to a DP slave.
SFC 17	ALARM_SQ	Generates a block-related message that can be acknowledged.
SFC 18	ALARM_S	Generates a block-related message that can be permanently acknowledged.
SFC 19	ALARM_SC	Queries the acknowledgement status of the last message (SFC 17 or SFC 18).
SFC 20	BLKMOV	Copies variables.
SFC 21	FILL	Initializes a memory area. 1 word 50 words 100 words
SFC 22	CREAT_DB	Creates a retentive data block in the working memory. The current values of the DB are saved after a warm restart.
SFC 23	DEL_DB	Deletes a data block. WinLC T allows an application to delete a data block which is not relevant for the execution.
SFC 24	TEST_DB	Provides information on a data block. In WinLC T, SFC 24 can output the DB length and write protection flags for data blocks that are not relevant for the execution. In spite of this, error code 80B2 is output for data blocks that are not relevant for the execution.

SFC	Name	Description
SFC 26	UPDAT_PI	Updates the process input image.
SFC 27	UPDAT_PO	Updates the process output image.
SFC 28	SET_TINT	Sets the real-time interrupt (OB 10).
SFC 29	CAN_TINT	Cancels the real-time interrupt (OB 10).
SFC 30	ACT_TINT	Activates the real-time interrupt (OB 10).
SFC 31	QRY_TINT	Queries the real-time interrupt (OB 10).
SFC 32	SRT_DINT	Starts the delay interrupt (OB 20).
SFC 33	CAN_DINT	Cancels the delay interrupt (OB 20).
SFC 34	QRY_DINT	Queries the delay interrupt (OB 20).
SFC 36	MSK_FLT	Masks synchronous faults.
SFC 37	DMSK_FLT	Unmasks synchronous faults.
SFC 38	READ_ERR	Reads the error register.
SFC 39	DIS_IRT	Disables the processing of new alarm events.
SFC 40	EN_IRT	Enables the processing of new alarm events.
SFC 41	DIS_AIRT	Delays interrupts with higher priority and asynchronous errors.
SFC 42	EN_AIRT	Enables the processing of new alarm events with higher priority than the current OB.
SFC 43	RE_TRIGR	Retriggers the watchdog.
SFC 44	REPL_VAL	Transfers a replacement value to ACCU1 (Accumulator 1).
SFC 46	STP	Changes to the STOP mode.
SFC 47	WAIT	Delays the execution of the STEP 7 user program by the specified number of microseconds, rounded off to the next millisecond.
SFC 49	LGC_GADR	Determines the slot belonging to a logical address.
SFC 50	RG_LGADR	Determines all logical addresses of a module.
SFC 51	RDSYSST	Reads a part or the entire system status list.
SFC 52	WR_USMSG	Writes a user-defined diagnostics event to the diagnostics buffer.
SFC 54	RD_DPARM	Reads the defined parameter.
SFC 55	WR_PARM	Writes the dynamic parameters.
SFC 56	WR_DPARM	Writes the preset parameters.
SFC 57	PARM_MOD	Assigns the parameters to a module.
SFC 58	WR_REC	Writes a data set.
SFC 59	RD_REC	Reads a data set.
SFC 62	CONTROL	Checks the connection status of an SFB instance.
SFC 64	TIME_TCK	Reads the system time.
SFC 78	OB_RT	Reports OB runtime information with a resolution to the next microsecond.
SFC 79	SET	Sets an output range.
SFC 80	RESET	Resets an output range.
SFC 82	CREA_DBL	Creates a data block in the load memory.
SFC 83	READ_DBL	Copies data from a block in the load memory.

SFC	Name	Description
SFC 84	WRIT_DBL	Writes a block in the load memory, so that the data is stored immediately. Blocks in the load memory, which are used for the restoration after incorrect program abort, can be updated during the program execution. Only use SFC 84 for larger segments of a database, not for frequent variable processing.
SFC 85	CREA_DB	Creates a retentive or non-retentive DB, depending on the input parameter: • With a retentive DB, the current values of the DB are saved after a warm restart (OB 100). • With a non-retentive DB, the current values of the DB are not saved after a warm restart (OB 100).
SFC 87	C_DIAG	Determines the current status of all S7 connections.

Detailed information about the SFCs can be found in the STEP 7 online help or in the *System Software for S7-300/400 System and Standard Functions* reference manual.

Note

Some SFCs require special consideration with respect to a possible Windows malfunction. Further information on this can be found under "Effects of SFC 22, SFC 23, SFC 82, SFC 83, SFC 84 or SFC 85" in the "Operation of WinLC T with a Windows malfunction" section.

Simultaneous execution of asynchronous SFCs

The number of asynchronous OBs that may run simultaneously in WinLC T, is restricted according to the following rules:

- A maximum of five instances of the asynchronous system function SFC 51 (Index B1, B3) may run in WinLC T.
- A maximum of 20 asynchronous SFCs of the following SFCs may run in WinLC T: SFC 13, SFC 55, SFC 56, SFC 57, SFC 58 and SFC 59.
- A maximum of 32 asynchronous SFCs in any combination of the following SFCs may run in WinLC T: SFC 82, SFC 83 and SFC 84.

SFCs that can cause deviations in the cycle

The following SFCs that can cause deviations in the cycle ("jitter"):

- SFC 22 (CREAT_DB)
- SFC 23 (DEL_DB)
- SFC 52 (WR_USMG)
- SFC 85 (CREA_DB)

Notes for SFC 82, SFC 83 and SFC 84

In contrast to the S7-300, WinLC T supports a synchronous interface for SFC 82, SFC 83 and SFC 84 during STARTUP. WinLC T permits the first call (with REQ = 1) and the second call (with REQ = 0) in STARTUP mode, so that the processing can be completed during STARTUP.

The normal STEP 7 error codes are valid for SFC 82, SFC 83 and SFC 84. The error code 80C3 is also output. These SFCs output the error code 80C3, if WinLC T exceeds the limit of 32 SFC 82, SFC 83 and SFC 84 jobs that have not been executed.

3.9 System function blocks (SFBs)

Supported system function blocks

System function blocks are code blocks (similar to SFCs) that execute basic tasks when called from the STEP 7 user program. You require a data block (DB) to call a SFB.

The SFBs supported by WinLC T are listed in the following table:

SFB	Name	Description
SFB 0	CTU	Counts up.
SFB 1	CTD	Counts down.
SFB 2	CTUD	Counts up/down.
SFB 3	TP	Generates a pulse.
SFB 4	TON	Generates an ON delay.
SFB 5	TOF	Generates an OFF delay.
SFB 8	USEND	Sends a data packet with CPU-specific length (two directions), uncoordinated with receiving partner.
SFB 9	URCV	Receives a data packet with CPU-specific length (two directions) asynchronously.
SFB 12	BSEND	Sends a segmented data block with max. 64 KByte (two directions).
SFB 13	BRCV	Receives a segmented data block with max. 64 KByte (two directions).
SFB 14	GET	Reads data with max. CPU-specific length (one direction) from a remote CPU.
SFB 15	PUT	Writes data with max. CPU-specific length (one direction) to a remote CPU.
SFB 22	STATUS	Queries the status of a remote device.
SFB 23	USTATUS	Receives the status of a remote device.
SFB 31	NOTIFY8P	Generates block-related messages without acknowledgement display for eight signals.
SFB 32	DRUM	Implements a step sequence.
SFB 33	ALARM	Generates block-related messages with acknowledgement display.
SFB 34	ALARM_8	Generates block-related messages without values for eight signals.
SFB 35	ALARM_8P	Generates block-related messages with values for eight signals.
SFB 36	NOTIFY	Generates block-related messages without acknowledgement display.
SFB 52	RDREC	Reads a data set.
SFB 53	WRREC	Writes a data set.
SFB 54	RALRM	Receives interrupt data for a DP slave.
SFB 65001	CREA_COM	(WinAC ODK CCX)
SFB 65002	EXEC_COM	(WinAC ODK CCX)

Detailed information about the SFBs can be found in the STEP 7 online help or in the *System Software for S7-300/400 System and Standard Functions* reference manual. If you want to call up this manual on a PC, on which STEP 7 is installed, select **Start > Simatic > Documentation > English** and double-click "STEP 7 - System and standard functions for S7-300 and S7-400".

3.10 Technology functions

Supported technology functions

Technology functions for the control of drive systems are integrated in the WinLC T software controller.

The function blocks supported by WinLC T are listed in the following table:

FB	Name	Description
FB 401	MC_Power	Enable/disable axis
FB 402	MC_Reset	Acknowledge errors/interrupts
FB 403	MC_Home	Home/set axis
FB 404	MC_Stop	Stop axis and prevent new traversing tasks
FB 405	MC_Halt	Normal stop
FB 406	MC_ReadSysParameter	Read parameter
FB 407	MC_WriteParameter	Change parameter
FB 409	MC_ChangeDataset	Change data set
FB 410	MC_MoveAbsolute	Absolute positioning
FB 411	MC_MoveRelative	Relative positioning
FB 412	MC_MoveAdditive	Relative positioning to the current target position
FB 413	MC_MoveSuperImposed	Superimposed positioning
FB 414	MC_MoveVelocity	Travel with speed specification
FB 415	MC_MoveToEndPos	Travel to fixed endstop / terminals
FB 420	MC_GearIn	Start gearing
FB 421	MC_CamIn	Start camming
FB 422	MC_GearOut	End gearing
FB 423	MC_CamOut	End camming
FB 424	MC_Phasing	Change phase shift between leading axis and following axis
FB 430	MC_CamSwitch	Position-based cam / uni-directional output cam
FB 431	MC_CamSwitchTime	Time-based cam
FB 432	MC_ExternalEncoder	External encoder
FB 433	MC_MeasuringInput	Measuring input
FB 434	MC_CamClear	Clear cam
FB 435	MC_CamSectorAdd	Add cam sector
FB 436	MC_CamInterpolate	Interpolate cam
FB 437	MC_SetTorqueLimit	Activate/deactivate torque limiting
FB 438	MC_GetCamPoint	Read points from cam
FB 439	MC_SetCharacteristic	Activate valve characteristic
FB 440	MC_GearInSuperImposed	Start superimposed gearing
FB 441	MC_CamInSuperImposed	Start superimposed camming
FB 442	MC_GearOutSuperImposed	End superimposed gearing
FB 443	MC_CamOutSuperImposed	End superimposed camming

FB	Name	Description
FB 444	MC_PhasingSuperImposed	Change superimposed phase shift
FB 450	MC_ReadPeriphery	Read technology I/O
FB 451	MC_WritePeriphery	Write technology I/O
FB 453	MC_ReadRecord	Read data set
FB 454	MC_WriteRecord	Write data set
FB 455	MC_ReadDriveParameter	Read drive parameter
FB 456	MC_WriteDriveParameter	Write drive parameter

Reference

Further information about the technology functions that can be used under WinLC T and the technology data blocks can be found in the *S7-Technology* manual.

3.11 System clock and run-time meter

Supported SFCs

As with an S7 hardware controller, WinLC T has a system clock based on the computer hardware clock.

You can change and read the system clock with the following SFCs. Detailed information about these functions can be found in the STEP 7 online help or in the *System Software for S7-300/400 System and Standard Functions* reference manual.

SFC	Name	Description
SFC 0	SET_CLK	You can set the time and date of the system clock with this SFC. The clock then starts to run with the set time and date. Format: DT#1995-01-15-10:30:30
SFC 1	READ_CLK	You can read out the current time and date of the system clock with this SFC.
SFC 64	TIME_TCK	You can read the system time of the controller with this SFC. The system time is a "time counter" that counts cyclically from 0 to maximum 2147483647 ms. If an overflow occurs, the system time is recounted starting with 0 again. The resolution is 1 ms. The system time can only be influenced by the operating states of the controller.

3.12 Porting STEP 7 programs

3.12.1 Porting a STEP 7 program for WinAC RTX

Introduction

You can execute a STEP 7 program, which was written for WinAC RTX, on the Microbox T in WinLC T. However, there are some restrictions.

Code blocks supported by WinLC T

WinLC T supports the same code blocks for the processing of a program as WinAC RTX V4.2, with the following exceptions:

- OB 61, OB 62, OB 63 and OB 64 are not supported by WinLC T.
- No cold start: WinLC T does not support OB 102.
- SFC 103, SFC 112, SFC 113, SFC 114, SFC 126 and SFC 127 are not supported by WinLC T.

Restrictions

Take the following restrictions into account:

- The program execution on the Microbox T can be different than that under WinAC RTX on a PC.
- The maximum size of the WinLC T address area is 2 KByte.

3.12.2 Porting a STEP 7 program for CPU317T

Introduction

You can execute a STEP 7 program, which was written for a CPU317T, on the Microbox T.

Restrictions

Take the following restrictions into account:

- The program execution on the Microbox T can be different than that on the CPU317T.
- The maximum size of the WinLC T address area is 2 KByte.
- In contrast to a SIMATIC CPU-300, the size of the process image can be set. During the porting, the size must be set as for the CPU317T.
- In contrast to the CPU317T, the devices connected to the DP and the DP(DRIVE) interface have a common address area. Any resulting address conflicts must be resolved during the porting.

3.13 Using WinAC ODK on the Microbox T

WinAC ODK interfaces under WinLC T

Note

WinAC ODK is not part of WinLC T. It can be purchased as an option package.

The following user-specific applications can be implemented in your control jobs with the WinAC Open Development Kit (ODK) interfaces:

- Custom Code Extension (CCX): Enables your control program to call user-specific DLLs directly from the control program being executed by the PLC.
- Shared Memory Extension (SMX): Enables a very fast and efficient data exchange between the PLC and an application via direct access to a specified PI/PO area (via dual-port RAM).
- Controller Management Interface (CMI): Enables the functionality of the WinLC control panel to be embedded in a user-specific application.

Restrictions

If you use WinAC ODK with WinLC T, you must take the following restrictions into account:

- You can only implement applications that run under Windows with the Custom Code Extension (CCX) interface.

  WinLC T does not support the implementation of real-time applications with this interface.
- Modifications have been made in WinLC T for the Controller Management Interface (CMI).

  The following features or attributes are **not** supported by WinLC T (sorted according to groups):

Group	Feature	Attribute
Operations of the PLC	LED	BatteryFault, Force
	FMR	-
Start or shut down PLC	PLCPower	Value
Configure options for PLC	AutoLoad	Value, KeySwitch, TargetFile, Buffer, BufferSize
	Security	…

Group	Feature	Attribute
Tune performance of WinLC controller	Priority	Value, LowerLimit, UpperLimit, Normal, Critical
	MinCycleTime	Value, LowerLimit, UpperLimit
	MinSleepTime	Value, LowerLimit, UpperLimit
	OBExecution	WakeInterval, SleepInterval, DefaultWakeInterval, DefaultSleepInterval, UpperLimit, LowerLimit
	Timing	ExecTimeMin, ExecTimeMax, ExecTimeAverage, ExecTimeLast, SleepIntervalCounter
	Usage	PC, PLC, CPUCount, CPU_

The following features or attributes have been added (sorted according to groups):

Group	Feature	Attribute
Start or shut down PLC	Personality	Slot, Rack, Owner, Company, SerialNumber, ASname, AKZ, OKZ
Tune performance of WinLC controller	UsageT	Technology, OB, Windows, Idle, DPCycle, ServoCycle, IPOCycle, TODBCycle, MaxOBLoad, MaxOBLoadMax, MaxOBLoadMin

Description of the newly added attributes

Attribute	Data type	Type	Value	Description
"Start or shut down PLC" group, "Personality" feature				
Slot	String	Read	*	Slot number
Rack	String	Read	*	Rack number
Owner	String	Read	*	Details of the owner
Company	String	Read	*	Company name
SerialNumber	String	Read	*	Serial number
ASname	String	Read	*	Name of the workstation
AKZ	String	Read	*	Plant identifier
OKZ	String	Read	*	Location identifier

Attribute	Data type	Type	Value	Description
"Tune performance of WinLC controller" group, "UsageT" feature				
Technology	Integer	Read	0...100	Percentage of CPU resources currently required by the integrated technology
OB	Integer	Read	0...100	Percentage of CPU resources currently required by the control section **Note**: Corresponds to the "S7 PLC" specification in the tuning panel.
Windows	Integer	Read	0...100	Percentage of CPU resources currently required by Windows
Idle	Integer	Read	0...100	Percentage of CPU resources currently available
DPCycle	Integer	Read	-	DP of the DP(DRIVE) interface in µs **Note**: This value is displayed in ms in the tuning panel.
ServoCycle	Integer	Read	-	Position control cycle clock in µs **Note**: This value is displayed in ms in the tuning panel.
IPOCycle	Integer	Read	-	Interpolator cycle clock in µs **Note**: This value is displayed in ms in the tuning panel.
TODBCycle	Integer	Read	-	Update cycle clock of the technology DBs in µs **Note**: This value is displayed in ms in the tuning panel.
MaxOBLoad	Integer	Read/Write	10...50	Maximum permissible controller percentage of the CPU utilization **Note**: Corresponds to the "Max. S7 PLC load" specification in the tuning panel.
MaxOBLoadMax	Integer	Read	50	Maximum possible controller percentage of the CPU utilization
MaxOBLoadMin	Integer	Read	10	Minimum controller percentage of the CPU utilization
* The current values of the "Personality" feature are displayed when the menu command **Help > About** is called.				

3.14 Operation of WinLC T with a Windows malfunction

Description

WinLC T supports OB 84 (CPU hardware fault), with which you can correctly shut down your process, if a Windows malfunction occurs while WinLC T is in operation. Then one of the following situations occurs:

- If WinLC T is in RUN mode and the user program receives OB 84, WinLC T starts OB 84 and remains in RUN mode until the controller is switched to STOP mode. Windows only completes the shutdown of the system after WinLC T has changed to STOP mode, either by calling SFC 46 or by changing to STOP mode.
- If WinLC T is in RUN mode and the user program does not receive an OB 84, WinLC T changes to STOP mode and Windows then completes the shutdown of the system.
- If WinLC T in STOP mode, Windows is closed completely.

The operation of WinLC T with a Windows malfunction can be influenced by SFC 22, SFC 82, SFC 83, SFC 84 or SFC 85.

You can configure Windows and WinLC T for an automatic restart after a Windows malfunction.

Restrictions

The following restrictions apply if Windows shuts down:

- The WinLC T control panel is not available.
- Some system functions are deactivated, including SFC 22, SFC 82, SFC 83, SFC 84 and SFC 85.
- Block operations are unsuccessful and an error code is output.
- Communication with Windows applications is not available.
- It may not be possible to send alarm messages.
- PG/OP communication via the Ethernet interface no longer functions.
- WinAC ODK can no longer be used.
- The connection to the integrated technology is interrupted. This also means that no diagnosis of the integrated technology is possible.

Effects of SFC 22, SFC 23, SFC 82, SFC 83, SFC 84 or SFC 85 on WinLC T

If a Windows malfunction occurs while WinLC T is in RUN mode, WinLC T tries to stay in RUN mode and starts OB 84. However, the operation of WinLC T during a Windows malfunction can be adversely affected by SFC 22, SFC 23, SFC 82, SFC 83, SFC 84 or SFC 85.

In most cases, SFC 22, SFC 23, SFC 82, SFC 83, SFC 84 and SFC 85 output error code 8092 for a Windows malfunction. Applications that must continue to run after a Windows malfunction can query on this error code. If, however, one of these SFCs is called during the Windows malfunction, the SFC cannot output error code 8092 and WinLC T cannot start OB 84.

Warning

Certain SFCs, if they are active at the time of the malfunction, can cause the WinLC T to no longer react:

- If SFC 22, SFC 23 or SFC 85 are in the call of a Windows function at the time of the malfunction, the SFC cannot return from the SFC call and WinLC T cannot maintain the control of the process. In this case, the I/O time monitoring deactivates the inputs and outputs.
- If SFC 82, SFC 83 or SFC 84 are in the call of a Windows function at the time of the malfunction, WinLC T tries to remain in the RUN mode (and maintain the control of the process), but background functions, including some communication functions, may crash. If you switch WinLC T to the STOP mode, whether program-controlled or via user access from a remote system, this can affect the shutdown operation of the computers.

A Windows malfunction that causes the controller or the background functions to crash, can damage process devices or injure personnel. You can prevent this through appropriate safety precautions during the development of your STEP 7 user program.

If your process application has to survive a Windows malfunction, only call these SFCs (SFC 22, SFC 23, SFC 82, SFC 83, SFC 84 or SFC 85) during the initialization (during the execution of OB 100) or in uncritical parts of the control process.

Automatic restart of WinLC T after a Windows malfunction

If Windows is configured so that it automatically restarts after a Windows malfunction, WinLC T will restart automatically if it has been configured for startup after PC start. (You can set up Windows accordingly by opening the "System Properties" dialog box with **Start > Control panel > System**. In the "Start and Recovery" section of the "Advanced" tab, click "Settings" to open the "Startup and Recovery" dialog box. You can activate the "Automatically restart" option in the "System failure" section. This option is activated per default.)

When WinLC T is restarted, it works with the program loaded last and executes OB 100 if it is present. WinLC T starts OB 100 with event 1382 (hex). The current/last startup type is specified in the diagnostics buffer as "Automatic restart (warm restart) after unbuffered POWER ON (with overall reset of the system)".

You can program OB 100 so that it reacts to event 1382. Detailed information can be found in the STEP 7 online help or in the *System Software for S7-300/400 System and Standard Functions* reference manual.

3.15 Operation of WinLC T with a technology malfunction

Response of WinLC T

With a malfunction of the technology, the control panel can no longer be used for the operation of WinLC T.

The error messages generated by the malfunction are written to the Eventlog file.

Caution

If the EWF (Enhanced Write Filter) is active, the Eventlog file will be deleted when the Microbox T is switched off.

The applications running under Windows will continue to be executed with a technology malfunction.

Reaction to a technology malfunction

To find the error source, proceed as follows:

1. Read the error messages in the Eventlog file.
2. Look at the diagnostics information in the diagnostics buffer of the technology with S7T Config.

3.16 Restart of WinLC T after malfunction of WinLC T

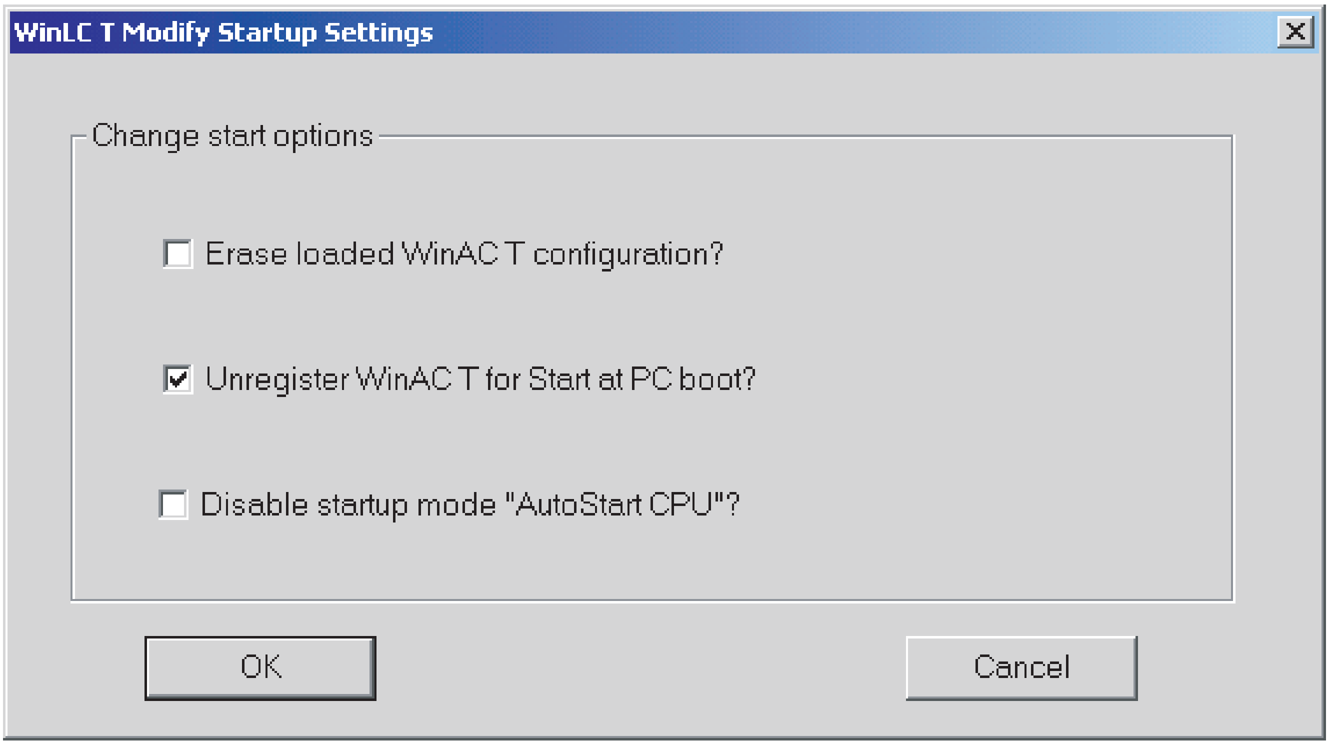
WinLC T malfunction

The overloading of WinLC T by a user program can result in a malfunction of WinLC T. If the controller is registered for automatic start during startup and the Autostart function is activated, the WinLC T can no longer be shut down as WinLC T automatically starts up and immediately goes to RUN mode when the Microbox T is booted.

To still be able to shut down the WinLC T, you can switch off the Microbox T and restart in interactive mode.

Restarting Microbox T after a malfunction

1. Switch off the power supply to the Microbox T.
2. Switch the power supply back on.
3. Select the boot option "Boot only in Windows Mode without starting WinAC T" to start the Microbox T in the **interactive mode**.
   You have approximately three seconds to select this option. If you could not select the option within this time, start the Microbox T in normal mode.
4. The "WinLC T Modify Startup Settings" dialog box is opened.


WinLC T Modify Startup Settings

Change start options

□ Erase loaded WinAC T configuration?

☑ Unregister WinAC T for Start at PC boot?

□ Disable startup mode "AutoStart CPU"?

1. Change the start options according to your requirements.
   You can reset the registration of the controller for automatic start during startup and deactivate the Autostart function.
2. Click "OK" to confirm the changes.

Result:

The Microbox T starts with the settings you changed.

Operation and functions of the controller 4

4.1 Overview

Panel structure

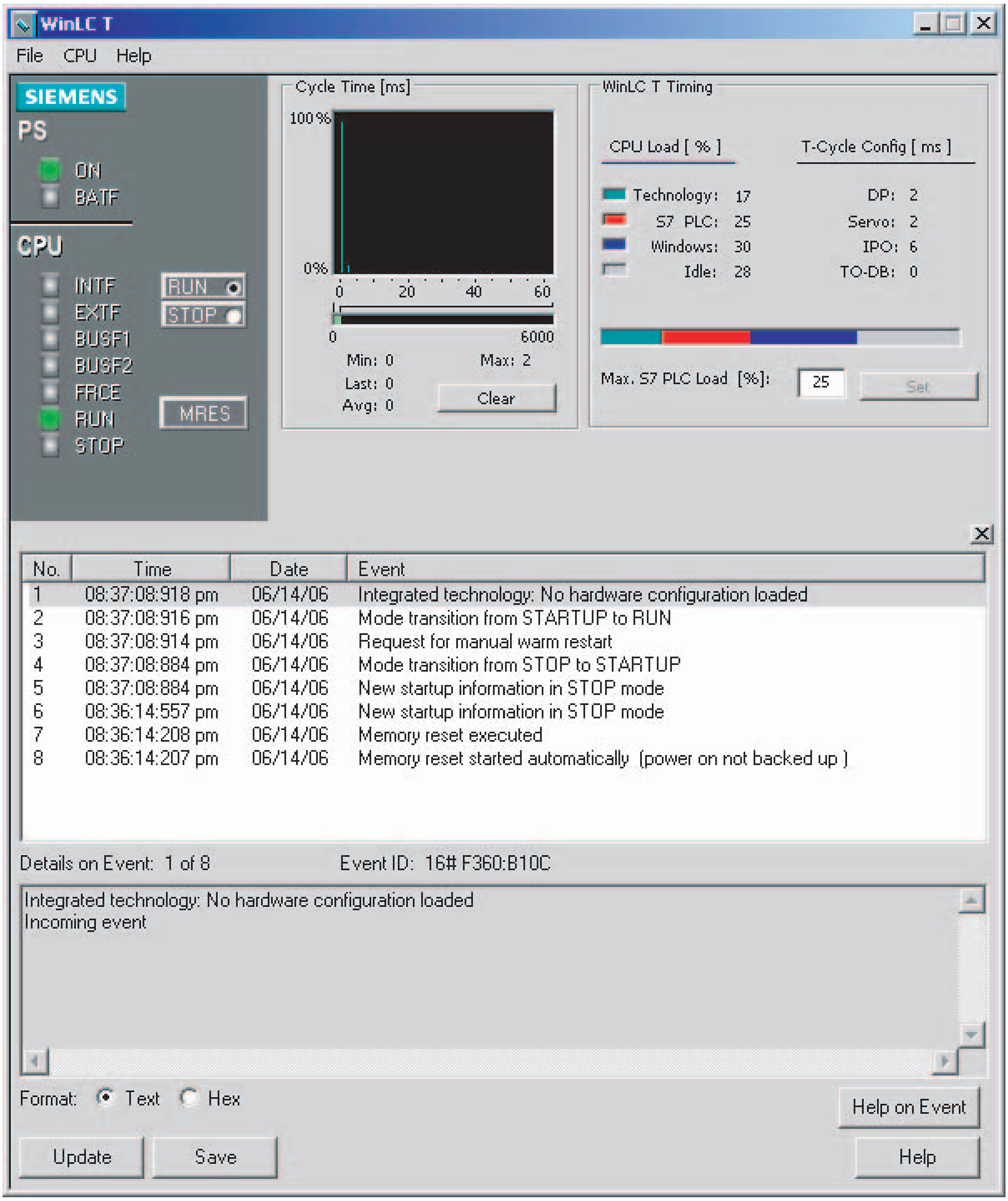
The user interface of the WinLC T software control (controller) essentially consists of three components:

- Control panel for the operation of the controller
- Tuning panel to display and set the operational performance of the controller
- Diagnostics buffer for the display of the diagnostics information

The tuning panel and the diagnostics buffer are called from the control panel.

Note

The following shows the panel after being switched to the "German" language selection.



Min: 0 Max: 2
Last: 0
Avg: 0

CPU Load [%]		T-Cycle Config [ms]	
🟦 Technology:	17	DP:	2
🟥 S7 PLC:	25	Servo:	2
🟦 Windows:	30	IPO:	6
▭ Idle:	28	TO-DB:	0

Max. S7 PLC Load [%]: 25

No.	Time	Date	Event
1	08:37:08:918 pm	06/14/06	Integrated technology: No hardware configuration loaded
2	08:37:08:916 pm	06/14/06	Mode transition from STARTUP to RUN
3	08:37:08:914 pm	06/14/06	Request for manual warm restart
4	08:37:08:884 pm	06/14/06	Mode transition from STOP to STARTUP
5	08:37:08:884 pm	06/14/06	New startup information in STOP mode
6	08:36:14:557 pm	06/14/06	New startup information in STOP mode
7	08:36:14:208 pm	06/14/06	Memory reset executed
8	08:36:14:207 pm	06/14/06	Memory reset started automatically (power on not backed up)

Details on Event: 1 of 8 Event ID: 16# F360:B10C

Integrated technology: No hardware configuration loaded
Incoming event

Format: ● Text ○ Hex

4.2 Control elements of the controller

4.2.1 Control panel

Introduction

You use the control panel to operate the controller. It is used to start or close the controller and execute other controller functions.

The control panel is displayed on a monitor connected directly to the Microbox T and which can be operated via mouse and keyboard.

Structure

The control panel looks like the front of a SIMATIC S7 CPU.

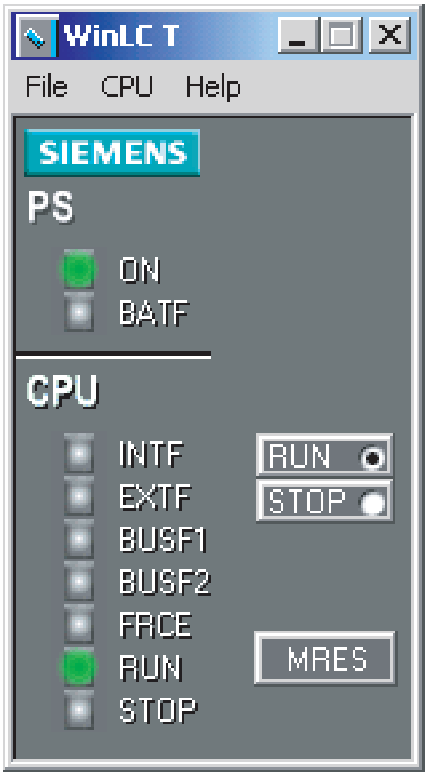


Figure 4-1 Control panel

The control panel contains the following elements for working with the controller:

- Mode selector to set the operating mode of the controller
- Status display for the controller
- MRES button for an overall reset
- Menus with controller function
  The tuning panel and the diagnostics buffer can also be called via the menus.

Icon for WinLC T in the Windows taskbar

The icon is displayed in the Windows taskbar when the controller is in operation. If the controller is in operation and the control panel is closed, you can double-click this icon to open the control panel.

The icon will be displayed with a colored frame that depends on the controller mode:

- A green frame indicates that the controller is in the RUN mode.
- A yellow frame indicates that the controller is in the STOP mode.
- A red frame indicates that the controller is in the fault state.

4.2.2 Mode selector

Description

The mode selector on the control panel is used to set the operating mode of the controller:

- RUN: The controller executes the STEP 7 user program.
- STOP: The controller does not execute the STEP 7 user program.
  The output on the PROFIBUS DP is set to a "safe" state. The integrated outputs for technology and the distributed I/Os on the PROFIBUS DP(DRIVE) may still be active.

Alternatively, you can select the corresponding command in the **CPU** menu to set either the RUN mode or the STOP mode.

Note

The RUN and STOP settings of the mode selector show the selected operating mode. This may differ from the actual operating mode, e.g. when the operating mode has been changed with STEP 7.

Permitted and prohibited functions in each operating mode

Depending on the operating mode, certain controller functions are permitted or prohibited. This is shown in the following table:

Operating mode	Description
RUN	Permitted: • Loading of a program to the controller • Loading of individual blocks to the controller • Changing of program variables in STEP 7 and changing the operating mode of the controller • Overall reset via the control panel or via STEP 7 The controller automatically goes into STOP mode when you perform an overall reset of the memory in the control panel. If you want to perform an overall reset of the memory in STEP 7, you must first switch the controller to STOP mode. Not permitted: • Archiving and restoring of a STEP 7 user program
STOP	Permitted: • Loading of a program from the controller to your programming device • Loading of a program or individual blocks to the controller • Changing of program variables with STEP 7 • Overall reset via the control panel or via STEP 7 • Archiving and restoring of a STEP 7 user program Not permitted: • Changing the operating mode with STEP 7 when the mode selector STOP is activated

4.2.3 Status displays

Description

The status displays on the control panel show the current operating status. These displays correspond to the LED displays on an S7 hardware PLC.

You can use the status displays for troubleshooting, but not for changing the controller status by clicking the status displays.

When the user program reaches a breakpoint configured in the STEP 7 program editor, the status displays for RUN and STOP light up as long as the breakpoint is active: The status display for the RUN mode flashes and the display for the STOP mode is illuminated.

With a mode transition from STOP to RUN, the display for RUN flashes and the display for STOP is illuminated. When the display for STOP is switched off, the outputs are activated.

With a mode transition from RUN to STOP, the display for STOP flashes and the display for RUN is illuminated during the shutdown operation.

The individual status displays of the control panel are described in the following table:

Display	Description
ON	Power supply. Lights up (permanently) when you start the controller. Is switched off when you close the controller.
BATF	Always switched off for the controller.
INTF	This display lights up when a fault condition occurs in the controller, e.g. programming error, arithmetic error, time error or counter error. If the user program processes the error by executing OB 80, OB 121 or OB 122, the INTF display is switched off after three seconds as long as there is no subsequent fault condition.
EXTF	This display lights up when a fault condition occurs outside of the controller, e.g. hardware fault, parameter error, communication error or I/O fault. If the user program processes the error by executing OB 122, the EXTF display is switched off after three seconds as long as there is no subsequent fault condition.
BUSF1 BUSF2	This display lights up (flashing) to display a fault condition in the communication with the distributed I/O. BUSF1 refers to the DP interface. BUSF2 refers to the DP(DRIVE) interface.
FRCE	WinLC T does not support forcing.
RUN STOP	Lights up in accordance with the operating mode (RUN or STOP). The RUN and STOP displays show the actual operating mode of the controller. When RUN flashes and STOP is steadily illuminated, the user program has reached a breakpoint. RUN flashes with a frequency of 0.5 Hz.

Displays during ramp-up:

All status displays except BATF and FRCE (always switched off) light up briefly during the controller ramp-up.

Flashing displays

Flashing patterns of the RUN and STOP displays provide further information about the controller or the STEP 7 user program:

Display		Description
RUN	STOP	
Flashing, 2 Hz	Flashing, 2 Hz	The controller is defective. All status displays flash.
Flashing, 0.5 Hz	On	The STEP 7 user program has stopped at a breakpoint.
Flashing, 2 Hz	On	A warm restart is being executed. The RUN display flashes until the restart is completed. The time required for the warm restart depends on the time the startup OB requires for the execution.
Off	Flashing, 0.5 Hz	An overall reset of the controller must be performed.
Off	Flashing, 2 Hz	An overall reset (MRES) is being performed.
On	Flashing, 2 Hz	The controller is in the "Shutdown" state.
Flashing, 0.5 Hz	Flashing, 2 Hz	The STEP 7 user program has stopped at a breakpoint. The integrated technology is in the "Shutdown" state.

Shutdown

The following happens during shutdown:

1. The control section of the controller is already in STOP mode. The outputs of the distributed I/Os on DP are deactivated. The STOP display flashes at 2 Hz. The RUN display is illuminated.
2. The outputs for the integrated technology and the distributed I/Os on the DP(DRIVE) are still active.
3. The integrated technology shuts down the drives on the DP(DRIVE) in a controlled manner.
4. The integrated technology then also switches to STOP. The outputs for the integrated technology and the distributed I/Os on the DP(DRIVE) are deactivated. The STOP display is illuminated.

The maximum duration of shutdown depends on your configuration in S7T Config.

⚠ **Warning**

The distributed I/Os on DP(DRIVE) cannot be controlled from the user program during "shutdown". The outputs that can be controlled with MC_WritePeriphery retain their last current value.

Measure when the STOP display flashes slowly

When the STOP display flashes slowly, you must perform an overall reset of the controller with the MRES command.

Measure when all status displays flash

If all status displays flash simultaneously, the controller is in the fault state and has detected a fault condition, which cannot be corrected by an overall reset of the memory with the MRES menu command. You must perform the following steps to correct this state:

1. Close the controller.
2. Restart the controller. The STOP display flashes and the RUN display is switched off.
3. Perform an overall reset of the memory with the MRES command.
4. Load the user program and the system configuration with STEP 7 or restore an archived user program.

If the problem cannot be corrected by closing and restarting the controller, you may have to restart your Microbox T.

4.2.4 MRES button

MRES (overall reset) command

The MRES (overall reset) command resets the controller to the default settings. To do this, select the MRES button on the control panel. Alternatively, you can select the **CPU > MRES** menu command.

If required, the MRES command switches the controller to the STOP mode and then performs the following tasks:

- The entire STEP 7 user program (OBs, DBs, FCs, FBs) and the system data (the configuration) are deleted not only in the working memory but also in the load memory.
- The memory areas (I, O, M, T and C) are reset to 0.
- The preset system configuration, e.g. the size of the areas in the process image and the size of the diagnostics buffer, are reloaded.
- All active communication jobs, e.g. TIS, and the open communication are deleted. In addition, all online connections are disconnected, e.g. STEP 7, WinCC, PROFIBUS or S7 communication.

The network address and the set baud rate of the IE module as well as the contents of the diagnostics buffer are retained during the overall reset.

The STOP display flashes during the overall reset. After the memory has been reset, the preset size is reset for the diagnostics buffer. The memory areas of the inputs (I) and outputs (O) are also reset to the preset sizes. You must then configure your specific values for these values again after the overall reset.

Usually you perform the MRES before you load a new program to the controller. You must perform an overall reset when the STOP display on the control panel flashes slowly and this notifies you of one of the following conditions:

- Errors have been detected in the working memory, e.g. the size of the user program is greater than that of the working memory.
- The controller has been switched off and then on again as response to a fault state.

4.3 Functions of the controller

4.3.1 Starting and closing the controller

Settings

The following settings affect the starting and closing of the controller:

- Activation of the autostart function
- Configuration of the controller for start at PC start

Starting WinLC T

If the control panel is not open, proceed in one of the following ways to start the control panel and WinLC T:

- Select **Start > All programs > Simatic > PC-based control**. Then select the name of your WinLC T controller. After you have loaded the user program in WinLC T, the name in the menu corresponds to the name in STEP 7.
- Double-click the WinLC T icon on the desktop:

If the control panel is open, but WinLC T not in operation, select **CPU > Start controller**.

Closing WinLC T

Select **CPU > Close controller** to close down the controller. This command does not close the control panel. The command is only available on the control panel when the controller is in operation. After you have closed down the controller, you can still change the options.

Closing the control panel

The **File > Exit** menu command closes the control panel.

Caution

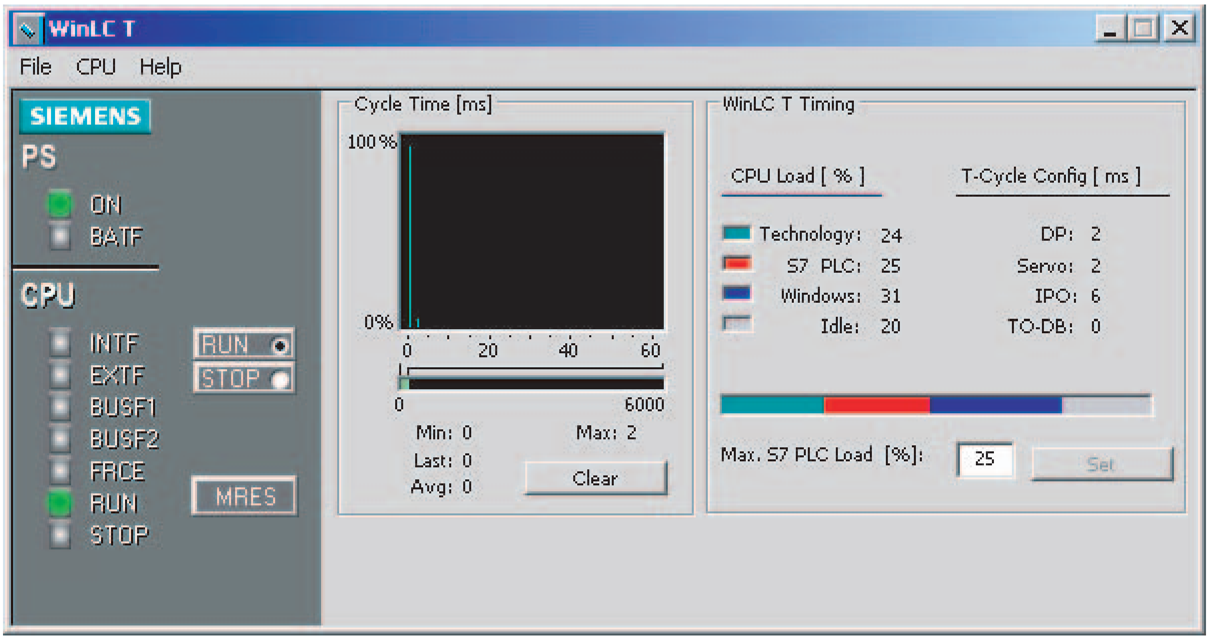
Closing the control panel does not close down the controller ("closed"). The state of the switches and the status displays are stored in the controller.

4.3.2 Tuning panel

Description

The tuning panel is used to check the operational performance of WinLC T. For this purpose, the tuning panel displays the current operational performance of the controller and allows you to set the maximum share of the S7 controller on the CPU utilization. The tuning panel is divided into two areas:

- Cycle time [ms]
- WinLC T timing



Min: 0
Max: 2
Last: 0
Avg: 0

CPU Load [%]		T-Cycle Config [ms]	
🟦 Technology:	24	DP:	2
🟥 S7 PLC:	25	Servo:	2
🟦 Windows:	31	IPO:	6
⬜ Idle:	20	TO-DB:	0

Max. S7 PLC Load [%]: 25

Figure 4-2 Tuning panel

Note

As the tuning panel is an additional load on the resources of the Microbox T, you should close the tuning panel during the normal operation of WinLC T.

Opening and closing the tuning panel

Select **CPU > ... tuning panel** to open and close the tuning panel.

Cycle time [ms]

This area displays a histogram of the cycle execution times in a range of 60 ms. This histogram displays the shortest and the longest cycle time as well as the percentage of cycles that fall into various ranges of the cycle time. To delete the chart data and start a new histogram, click "Delete" when the Microbox T is in RUN mode. The display of the cycle time is reset. The chart data cannot be deleted when the Microbox T is in STOP mode.

WinLC T timing

This area provides the following information and timing setting of WinLC T:

- CPU load [%]

  The WinLC T controller is a software controller with integrated motion control. Not only the control section, but also the motion control requires resources on the CPU. In addition, the installed Windows XP Embedded operating system requires resources. The values displayed here show the current percentages of the total CPU performance required by the individual sections (percentage of the CPU utilization):

  – Technology

    The integrated technology requires resources for the control, evaluation and monitoring of all hardware components on the DP(DRIVE) that are needed to execute the motion control tasks.

  – S7 PLC

    The resources currently required by the control section of WinLC T are displayed here.

    You can set the maximum control section percentage of the CPU load.

  – Windows

    The resources currently required by the Windows XP Embedded operating system are displayed here.

  – Idle

    The resources of the CPU that are still available (as a percentage of the total computer performance) are displayed here.

  The bar diagram displays the same information graphically.

- T-Cycle Config [ms]

  The values displayed here specify the cycles and cycle clocks of the integrated technology configured with S7T Config:

  – DP: DP(DRIVE) cycle

    The equidistant DP cycle of the DP(DRIVE) interface forms the base cycle clock of the technology system cycle clocks.

  – Servo: Position control cycle clock

    The position control of the axes, etc. is calculated in this cycle clock.

  - IPO: Interpolator cycle clock

    The motion control of the axes is calculated in the "interpolator cycle clock".

  - TO-DB: Update cycle clock of the technology DBs

    The "Update cycle clock of the technology DBs" specifies the intervals in which the integrated technology is to update the technology data blocks.

- Max. S7 PLC load [%]

  The control section of the WinLC T software controller has to share the resources on the CPU with the motion control and the operating system. With this value, you define the maximum percentage of the total CPU performance required by the control section (without technology functionality) (maximum permissible control section percentage of the CPU load).

  The default value is 25%. The minimum value is 10% and the maximum value 50%.

  To change the set value, overwrite the displayed value and click "Set". The controller must be in the STOP mode for this. The value set by you is accepted at the next transition from STOP to RUN.

Warning

Changing the value can cause an overload of the integrated technology. In an overload situation, the controller enters the STOP mode and **cannot** be returned to the RUN mode by changing the value again. In this case, you must reload your project.

Warning

Variations in the execution time or in the response time of the user program can possibly lead to a situation in which the controlled devices or the controlled process display an unpredictable behavior, which may result in personal injury or material damage.

If the controller does not have sufficient idle time in which other applications can be executed, this may result in a malfunction of the Microbox T or the controller and other applications may react unexpectedly. The execution of the user program may also display a non-deterministic behavior (jitter), so that execution times vary and start events are delayed.

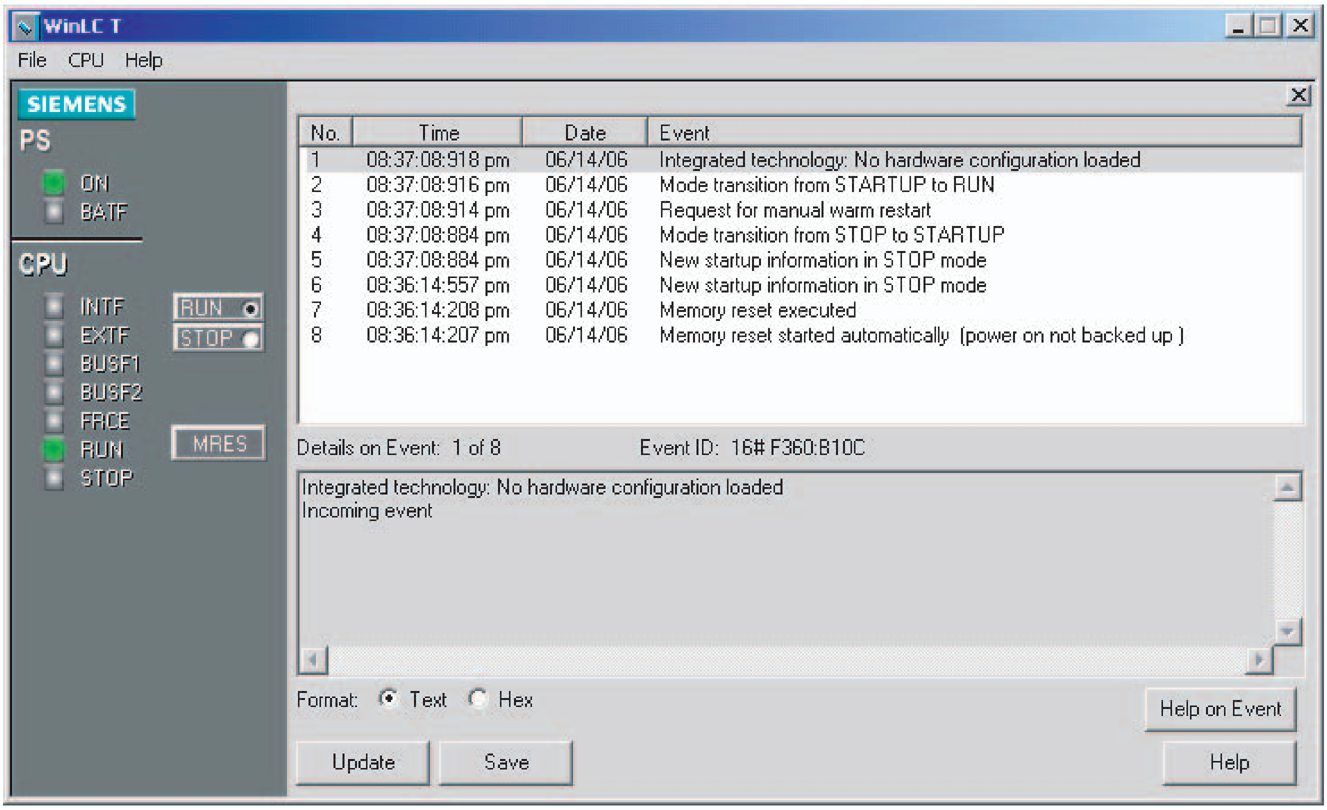
Always make sure there is an EMERGENCY STOP circuit. In addition, always set the idle time and manage the operational performance of the controller in such a way that your user program is executed consistently.

4.3.3 Displaying diagnostics information

Diagnostic buffer

The menu command **CPU > Diagnostics buffer…** displays the SIMATIC diagnostics buffer.

You can view diagnostics information about the system in the diagnostics buffer, without having to call the SIMATIC STEP 7 programming software. The diagnostics buffer consists of an upper window pane, in which an event list is displayed, and a lower window pane, in which specific details of the events are displayed.



No.	Time	Date	Event
1	08:37:08:918 pm	06/14/06	Integrated technology: No hardware configuration loaded
2	08:37:08:916 pm	06/14/06	Mode transition from STARTUP to RUN
3	08:37:08:914 pm	06/14/06	Request for manual warm restart
4	08:37:08:884 pm	06/14/06	Mode transition from STOP to STARTUP
5	08:37:08:884 pm	06/14/06	New startup information in STOP mode
6	08:36:14:557 pm	06/14/06	New startup information in STOP mode
7	08:36:14:208 pm	06/14/06	Memory reset executed
8	08:36:14:207 pm	06/14/06	Memory reset started automatically (power on not backed up)

Details on Event: 1 of 8   Event ID: 16# F360:B10C

Integrated technology: No hardware configuration loaded
Incoming event

Format: ● Text ○ Hex

Figure 4-3 Diagnostics buffer

The diagnostics buffer is implemented as a ring buffer which contains individual event entries. The events are displayed in descending chronological order, whereby the latest event is at the top. When the ring buffer is full, the oldest entry is overwritten by a new event.

The diagnostics buffer displays the following information:

- Event list (upper window pane): This list displays all events that are in the diagnostics buffer. The following information is displayed for each event:
  - The number of the entry
  - The date and time of the diagnostics event
  - A brief description of the event

- Event ID (between the upper and lower window panes): Displays the ID number of a certain event.
- Details of the event (lower window pane): Displays details of the event in text or hexadecimal format.

  If you have set Text format, the following details of the selected event are displayed in the lower window pane:

  - A brief description
  - Depending on the event, further information, e.g. the address of the operation which triggered the event, and the operating state change that has been caused by the event
  - The status of the event (incoming or outgoing)

If an individual text parameter cannot be identified, the diagnostics buffer displays the character string "###". If no text is available for new modules or new events, event numbers and parameters are displayed in hexadecimal values.

If you have set Hexadecimal format, the hexadecimal values of the selected event are displayed in the lower window pane

Sorting of events (upper window pane)

You can sort the events listed in the upper window pane by clicking on the required column header:

- Number (defined by time and date)
- Event description

Selecting the format (lower window pane)

You can display the diagnostics information in the lower window pane in text or hexadecimal format. In hexadecimal format, the hexadecimal values of the 20 bytes of the selected event are displayed. To select the format:

- Click "Text" to display the details of the events in text format.
- Click "Hex" to display the hexadecimal values of the event.

Saving the diagnostics buffer

Click "Save" to save a text file containing the list of the events and the details of the events. The text file contains the information either in text or in hexadecimal format.

4.3.4 Archiving and restoring STEP 7 user programs

Archive file

With the archive command you can save the configuration and the STEP 7 user program in an archive file (*.wld). You can quickly restore the configuration and the STEP 7 user program for the controller with the aid of the archive file.

You can only archive or restore a STEP 7 user program when the mode selector is in the STOP position and the controller is in STOP mode. You cannot archive or restore a STEP 7 user program when the controller is in the RUN mode.

The archive file functions like a plug-in memory card of an S7-CPU. However, the difference is that the controller does not automatically restore the archive file after an overall reset (MRES). You must restore the archive file manually.

Creating an archive file

An archive file stores the current STEP 7 user program, the current system configuration and the current values of the DBs. The archive file does **not** store the configuration of the PC station.

To create and archive file, select **File > Archiving of CPU**. This command calls up the "Save as" dialog box in which you can assign a name to the file. The controller then creates the archive file with the extension *.wld

You can also create an archive file in the SIMATIC Manager of STEP 7. Select **File > Memory card file > New**.

Restoring an archive file

When you restore an archive file, you reload the STEP 7 user program and the configuration for the controller. You can only restore archive data with the extension *.wld

Before you can restore an archive file, you must switch the controller to the STOP mode. Proceed as follows to load an archived configuration and an archived STEP 7 user program:

1. Click the "STOP" button to switch the controller to the STOP mode.
2. Select **File > Load to CPU**.
3. Select the archive file that you want to restore and confirm with "OK".

4.3.5 Options for the configuration

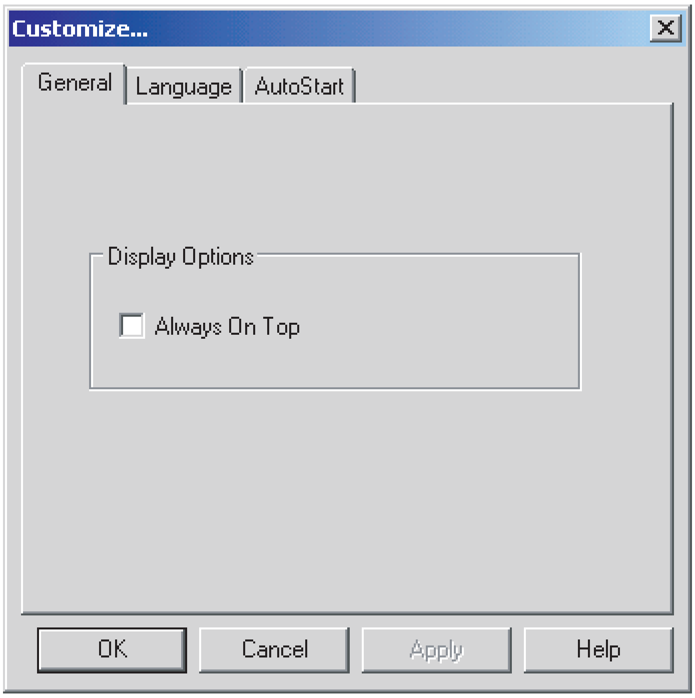
4.3.5.1 Overview

Options for the configuration

Select **CPU** > **Options** > **Options…** to call up the "Options" dialog box. The following settings for the control panel can be made in the tabs of the "Options" dialog box:

- **General**

  Select **Always in the foreground** to always display the control panel in front of all other opened windows.



□ Always On Top

- **Language**

  The "Language" field shows the language currently set for the display of the control panel.

  All the languages that have been installed for the control panel are displayed in the selection list. Select a new language if you want to display the control panel in another language.

- **Autostart**

  The **CPU autostart** option sets the Autostart function. The Autostart function specifies the operating mode in which the controller is switched after start. More detailed information can be found in "Activating the Autostart function".

4.3.5.2 Selecting the language

You can change the language displayed in the menus and the online help of the control panel.

Procedure

Proceed as follows to change the language:

1. Select **CPU > Options > Options…** to call up the "Options" dialog box.
2. Open the "Language" tab in the "Options" dialog box.
3. Select the language for the control panel.
4. Click the "Apply" button to change the language.
5. Click "OK" to close the "Options" dialog box.

Result

The control panel sets the selected language.

4.3.5.3 Activation of the autostart function

Description

The control panel has an autostart function which allows the controller to start up in the same operating mode that it was in before it was closed down. When the autostart function is activated:

- If the controller was in the RUN mode before it was closed down, it starts up in the RUN mode.
- If the controller was in the STOP mode before it was closed down, it starts up in the STOP mode.

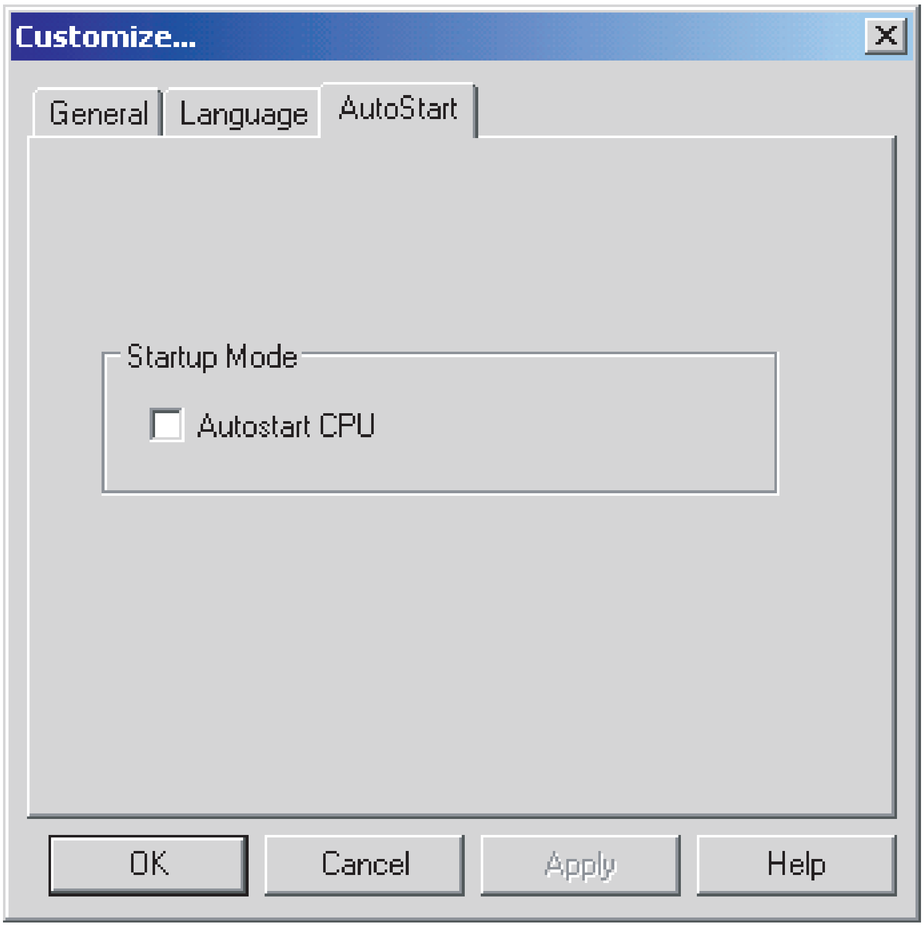
When the autostart function is **not** activated, the controller always starts up in the STOP mode.

To ensure that the controller starts automatically during the Microbox T startup, you must register the controller to start during the Microbox T startup. The procedure for making this setting is described in "Startup Options for the Controller".

Procedure

To activate the autostart function, proceed as follows:

1. Select **CPU > Options > Options…** to call up the "Options" dialog box.
2. Open the "Autostart" tab in the "Options" dialog box.
3. Select the "CPU autostart" option as startup type.



Startup Mode

□ Autostart CPU

4. Select "Apply" to activate the autostart function and close the "Options" dialog box with "OK".

4.3.6 Options for the access protection

4.3.6.1 Configuring the options for the access protection

Description

The **CPU > Options > Access protection** menu command changes the options for the access protection. The control panel displays the "Access Authorization" dialog box. You must enter your password in this dialog box so that you can change the settings for the access protection of the controller.

Note

The preset password is an empty field without characters. To enter the password, press the Enter key.

Protection level

You can configure the protection levels for the password in the "Access Authorization" dialog box, which restrict the access to the controller. The following access restrictions are possible:

- **Password**

  If you select a password, it is necessary that you enter a password for certain functions in the control panel, e.g. to set the operating mode, to archive and restore user programs and to open the tuning panel.
- **Confirmation**

  If you select "Confirmation", the user must acknowledge a confirmation when changing the operating mode.
- **Without**

  If you select "Without", neither a confirmation nor a password is required.

Note

If you configure a password and select the option "Without" for the protection level (this deactivates the password), you must still enter the configured password in order to be able to call up the "Access Authorization" dialog box again.

Warning

If you operate the controller without confirmation and without password, you increase the risk that the operating mode of the controller be changed unintentionally. This can lead to unpredictable behavior of the process or machine, which may result in death, severe personal injury and/or material damage.

Proceed with caution and make sure that you do not change the operating mode. Only allow qualified personnel access to machines and processes. Install a physical EMERGENCY STOP circuit for the machine and the process.

Validity of the password

You can enter any value between 0 and maximum 23 hours, 59 minutes for the query interval of the password. After you have entered your password, you are prompted to enter the password again after the interval has expired. The default setting 0 means that you must enter the password for each password-protected function.

Closing and starting the controller does not affect the query interval for the password. The query interval is not reset every time the controller is closed. At the next start of the control panel, you must enter the password when you want to call up a password-protected function.

4.3.6.2 Changing the password

In the "Access Authorization" dialog box, click the "Change password" button to call up the "Change Password" dialog box. You can then change the current password in this dialog box.

Note

The preset password is an empty field without characters. To enter the password, press the Enter key.

Procedure

To change the password, proceed as follows:

1. Enter the old password in the "Old password" field.
2. Enter the new password in the "New password" field (maximum length of 12 characters).
3. Enter the new password again in the "Confirm new password" field.
4. Confirm all the changes made in this dialog box with "OK" or discard all the changes with "Cancel".

If you then want to edit the options for the access protection, you must enter the password in the "Access Authorization" dialog box.

4.3.7 Startup options for the controller

Starting the controller during startup

Per default, you must start the controller manually after the Microbox T has started. However, you can register the controller that it is started automatically during startup.

Note

If you want to configure the controller so that it starts in the same operating mode (STOP or RUN) as it was when closed down, select the autostart function.

Registering the controller for start during startup

To register the controller for the automatic start, proceed as follows:

1. Close down the controller with the **CPU > Close controller** menu command.
2. Select **CPU > Register controller for start during PC startup**.

WinLC T is now started automatically when you start your Microbox T.

Canceling the registration of the controller for start during startup

To cancel the registration of a controller for the automatic start, proceed as follows:

1. Close the controller.
2. Select **CPU > Cancel registration of the controller for start during PC startup**.

WinLC T is now **not** started during the startup sequence. To start WinLC T, you must start the controller manually.

Startup mode

You set the startup mode for the controller in STEP 7. WinLC T only supports the startup mode "Warm restart" (OB 100).

The set startup mode is saved in the configuration (in the system data) of the controller, which you load with the control program.

Warm restart

The controller executes OB 100 before the free cycle (OB 1) is started. The warm restart clears the inputs of the distributed I/O (PI) and sets the outputs of the distributed I/O (PO) in a predefined safe state (default setting is 0). A warm restart saves the current values of the retentive memory areas of flags (F), timers (T), counters (C) and data blocks (DBs).

If you left-click the RUN button on the panel to switch from STOP mode to RUN mode, WinLC T performs a warm restart.

Setting of the operational performance 5

5.1 Optimizing the technology system cycle clocks

Executing the user program

After you have created your user program with STEP 7 and loaded it to the controller, the controller starts to execute the user program as soon as it is switched to RUN. As with every other S7 automation system, the controller executes your STEP 7 user program cyclically.

Operational performance

During the execution of the STEP 7 user program, a variation in the execution time or the response time of the process may occur in WinLC T, whereby the cycle times change and a non-deterministic behavior ("jitter") occurs.

To set the operational performance of WinLC T, optimize the technology system cycle clocks. You set these cycle clocks in S7T Config.

Further information about the system cycle clocks can be found in the "Time model of the Microbox T" section in the *S7-Technology* manual.

Detailed specifications for the setting of the technology system cycle clocks can be found in the "Setting technology system cycle clocks" section in the same manual.

Tuning panel

The values for the cycle times and the execution times are displayed in the tuning panel. Here you set the maximum control section percentage of the CPU load of the controller.

5.2 Functions under Windows XP Embedded

5.2.1 Monitoring functions

The following individual functions are implemented:

- Temperature monitoring
- Watchdog

Messages from the monitoring modules can be passed on to applications.

The SOM software (Safecard On Motherboard) is available on the devices for Windows XP Embedded.

Safecard on Motherboard (SOM)

This application is used for monitoring the hardware of the Microbox T (temperature and watchdog). The current temperatures and the limits are displayed here.

Caution

The application is used on the Microbox T only for diagnostic purposes. Do not make any settings on the application!

Response when the maximum temperature is reached

When the maximum temperature is reached, the Microbox T enters the STOP mode. You can return the Microbox T to the RUN mode only when the temperature threshold is undershot and you have closed the controller again.

5.2.2 Enhanced Write Filter (EWF)

Task and function

The EWF (Enhanced Write Filter) is a function that is available under the Windows XP Embedded operating system.

It represents a write filter that can be configured by the user, which, when required, can prevent changes to the Compact Flash card. In this way, the system can be maintained in a clearly defined, functional state after a power failure.

EWF can be used to minimize write access to Compact Flash cards. This is important because the write cycles on Compact Flash cards are limited due to technical reasons. We therefore recommend that the EWF be enabled.

Note

Per default, the EWF is disabled on the Microbox T so that you can load your configuration to the Compact Flash card.

Enable the EWF after you have loaded your configuration to minimize write access to the Compact Flash card.

The enabling/disabling of the EWF only takes effect after a restart of the Microbox T.

The EWF is disabled on partition D: of the Compact Flash card. The WinAC T project file (WAF file) is stored on this partition. This file is still available after a reboot or an operating system crash.

Setting EWF

The EWFMGR.EXE program can be used to set, enable or disable the EWF. Use the command prompt to call up the program. The following functions are available:

Function	Command
Write protection for drive C: enable	`ewfmgr c: -enable`
Write protection for drive C: disable (modified data are accepted)	`ewfmgr c: -commitanddisable`
Write protection for drive C: disable (modified data are lost)	`ewfmgr c: -disable`
Modified data on drive C: accept	`ewfmgr c: -commit`
Display information about the EWF drive	`ewfmgr c:`
Display help	`ewfmgr c: /h`

Note

The "disable" cannot be executed under Windows XP Embedded SP 1.
Use the "commitanddisable" function instead under Windows XP Embedded SP1 to switch off the EWF.

After you have switched off the EWF, you must activate the PC station in the configurator component ("Enable Station" button).

Special features for the use of the Enhanced Write Filter (EWF)

- In the event of a power failure, if the EWF is active, changes made on drive C: are lost. To prevent data loss in the event of a power failure, the use of a UPS is recommended.
- You can back up the data in the EWF RAM overlay on the Compact Flash card before you switch off the Microbox T. To do so, enter the following command in the command prompt:

```
ewfmgr c: -commit
```

Connecting WinLC T with the SIMATIC NET OPC server

6

6.1 Overview

Tools

WinLC T can use the SIMATIC NET OPC server to read and write data over a network. Use the following tools to set up the OPC connection for WinLC T:

- OPC Scout for the configuration of the connection to the SIMATIC NET OPC server
- STEP 7 (HW Config and NetPro) for the configuration of the controller
- Station configurator for the configuration of the PC station

The most important, but frequently overseen, step is the configuration of the S7 connection for the OPC server in NetPro. After adding the connection for the OPC server, you must set the "S7 connection" connection type and enter a local ID for the connection.

Overview of the steps

Button	Description
	Step 1: Station Configurator (SIMATIC NET) Adding OPC server to the PC station
	Step 2: HW Config (STEP 7) Add the OPC server to the configuration for WinLC T
	Step 3: NetPro (STEP 7) Add an S7 connection for the OPC server to the configuration for WinLC T
	Step 4: SIMATIC Manager (STEP 7) Load the configuration into the WinLC T controller
	Step 5: OPC Scout (SIMATIC NET) Connect WinLC T with the OPC server

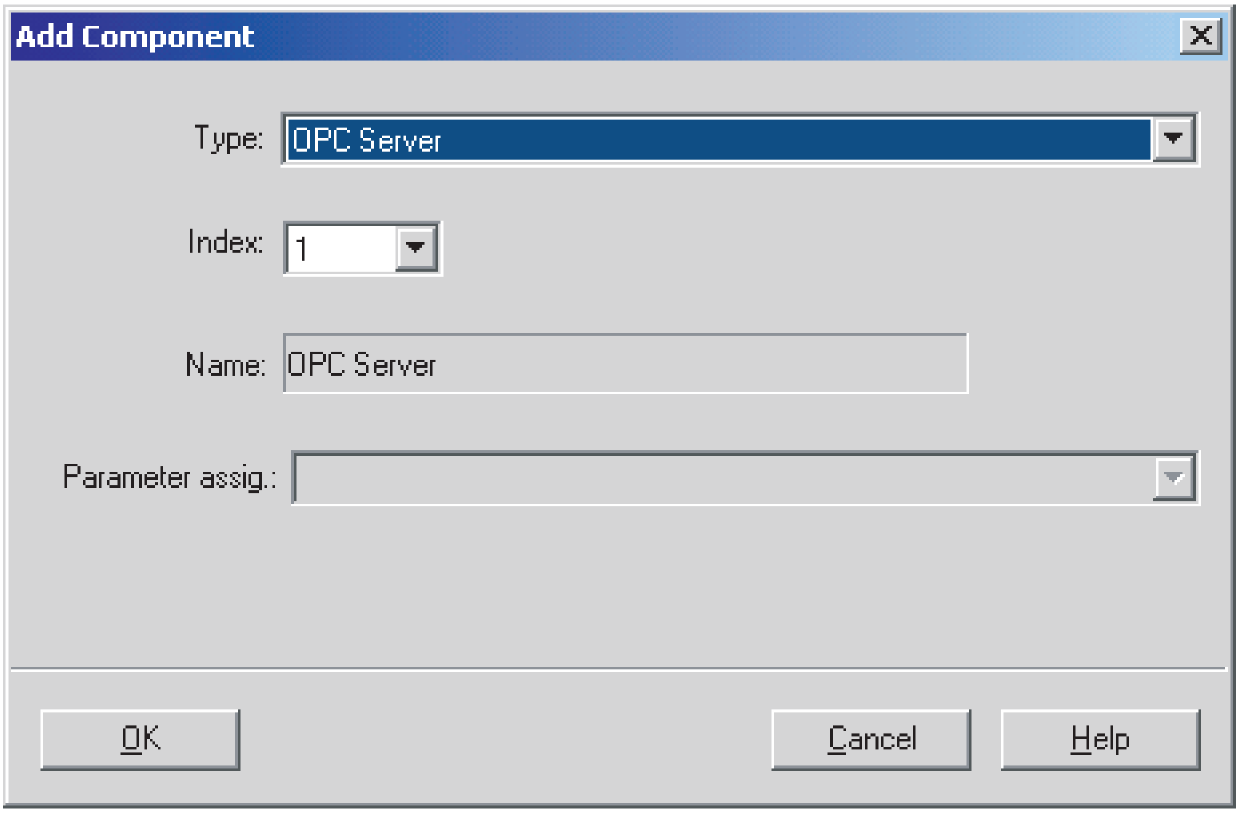
6.2 Step 1: Add the OPC server to the PC station

Procedure

How to set up the OPC server on the Microbox T.

To set up the OPC server for an index of the PC station, proceed as follows:

1. Open the station configurator and select an index in the station configurator.
2. Click the right mouse button to display the "Add" option. Click the "Add..." button. The "Add Component" dialog box will be called.
3. Select the "OPC Server" component type in the pulldown listbox.



Add Component

Type: OPC Server

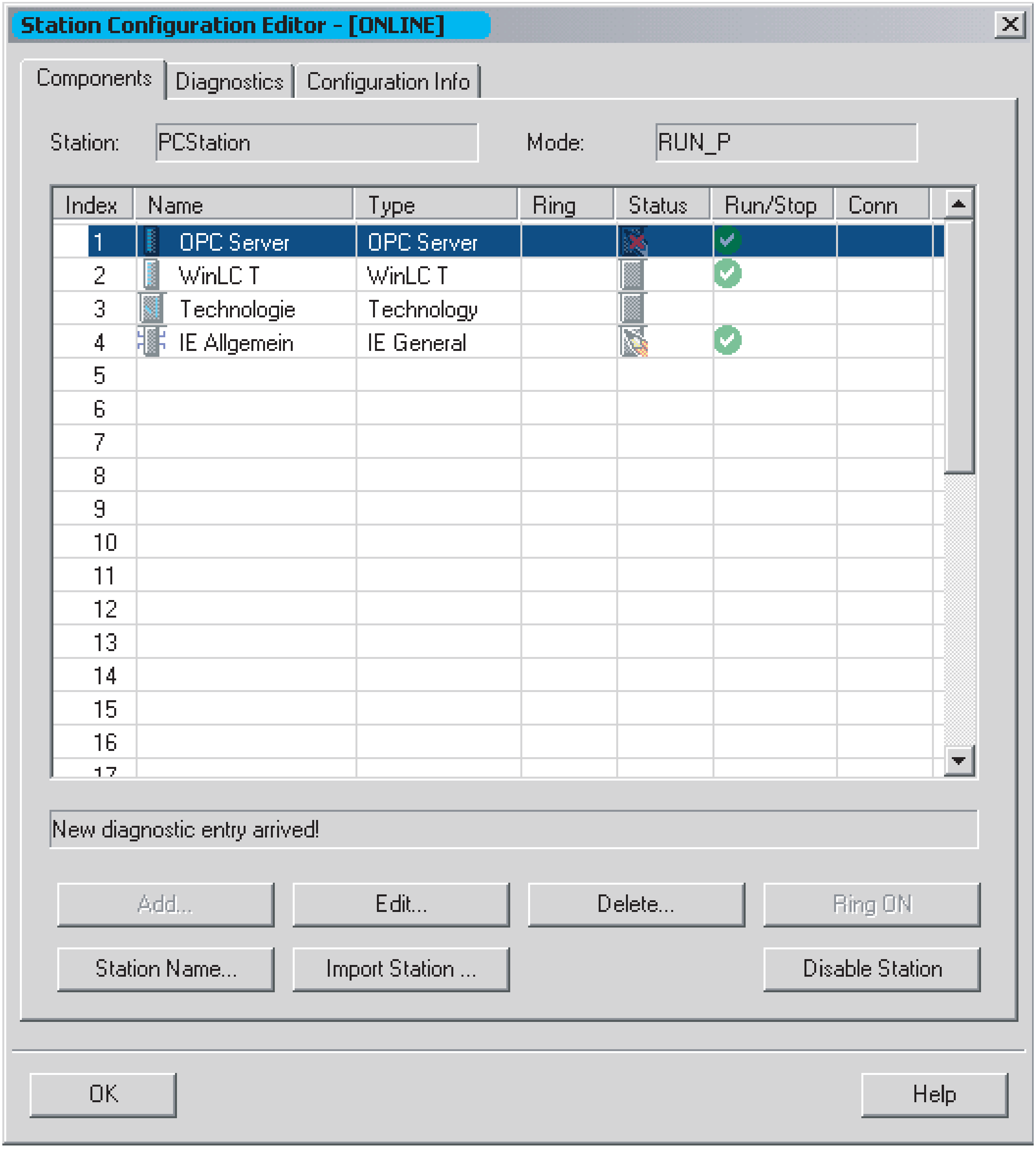
Index: 1

Name: OPC Server

Parameter assig.:

4. Click the "OK" button to add the OPC server to the station configuration. The OPC server will be displayed in the selected in the station configurator.

5. Click "OK" to save the configuration of the PC station.



Station Configuration Editor - [ONLINE]

Station: PCStation

Mode: RUN_P

Index	Name	Type	Ring	Status	Run/Stop	Conn
1	OPC Server	OPC Server			✓	
2	WinLC T	WinLC T			✓	
3	Technologie	Technology				
4	IE Allgemein	IE General			✓	
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

New diagnostic entry arrived!

6.3 Step 2: Add the OPC server to the hardware configuration

Introduction

How you set up WinLC T with STEP 7 on your PC for the OPC server.

To set up WinLC T for the OPC server, proceed as follows:

- Create a STEP 7 project for a PC station with WinLC T.
- Add the OPC server to the hardware configuration.
- Configure the OPC server.

Procedure

1. Open STEP 7 and create a project.
2. Add a SIMATIC PC station with the same name as in the component configurator. Double-click the configuration icon of the PC station to open HW Config.
3. Add the WinLC T controller in the same index as in the station configurator.
4. Open the "User application" folder in the catalog.
5. Open the "OPC server" folder and select the "SW V6.3" component.
6. Drag the component with the mouse to the same index that you created in the station configurator.
7. Double-click the OPC server entry (index 1) to open the "Properties" dialog box.
8. Optional: Open the "S7" tab and select the "Activate" option (under "Access protection").
9. If you want to use STEP 7 icons for configuring the connections in OPC Scout, select the "All" option (or "Selected" to use specific icon table entries) in the "Use icons" field.
10. Click “OK” to close the “Properties” dialog box.
11. Select the "Save and compile" button to create the hardware configuration for the PC station.

Result

Once you have compiled the configuration in the STEP 7 project, you can close the HW Config and return to the SIMATIC Manager.

6.4 Step 3: Add a S7 connection for the OPC server to NetPro

Introduction

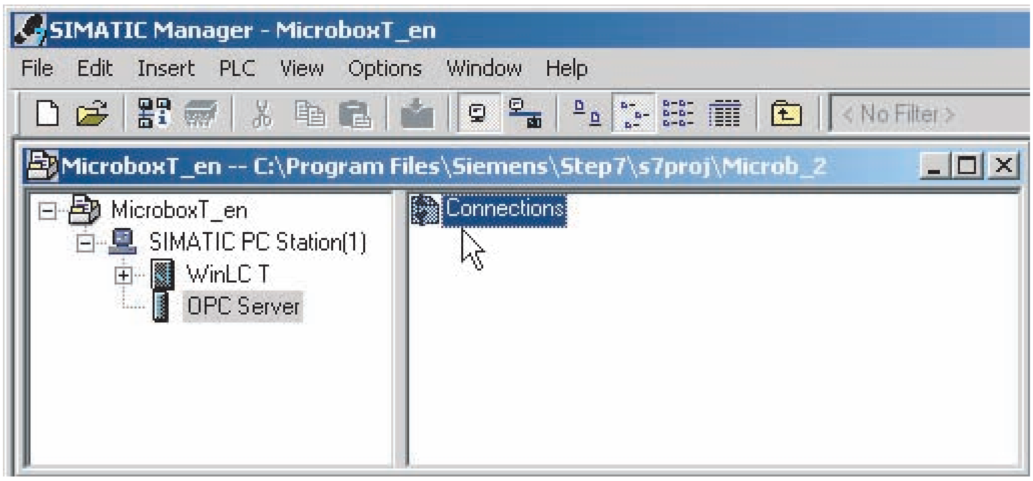
Adding the OPC server with STEP 7 on your PC to the configuration for WinLC T.

To add the OPC server to the configuration for WinLC T, proceed as follows:

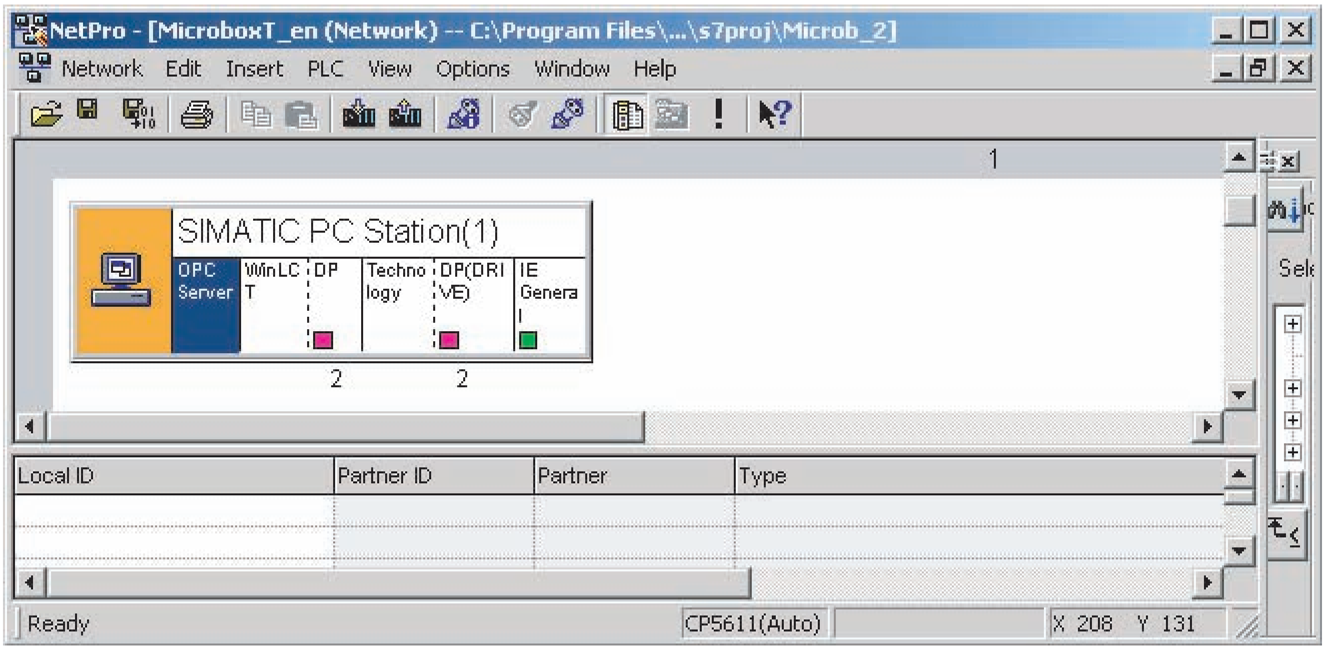
- Add a connection for the OPC server to the WinLC T configuration.
- Create the connection of the OPC server as S7 connection.
- Assign a local ID to the OPC server connection.

Procedure

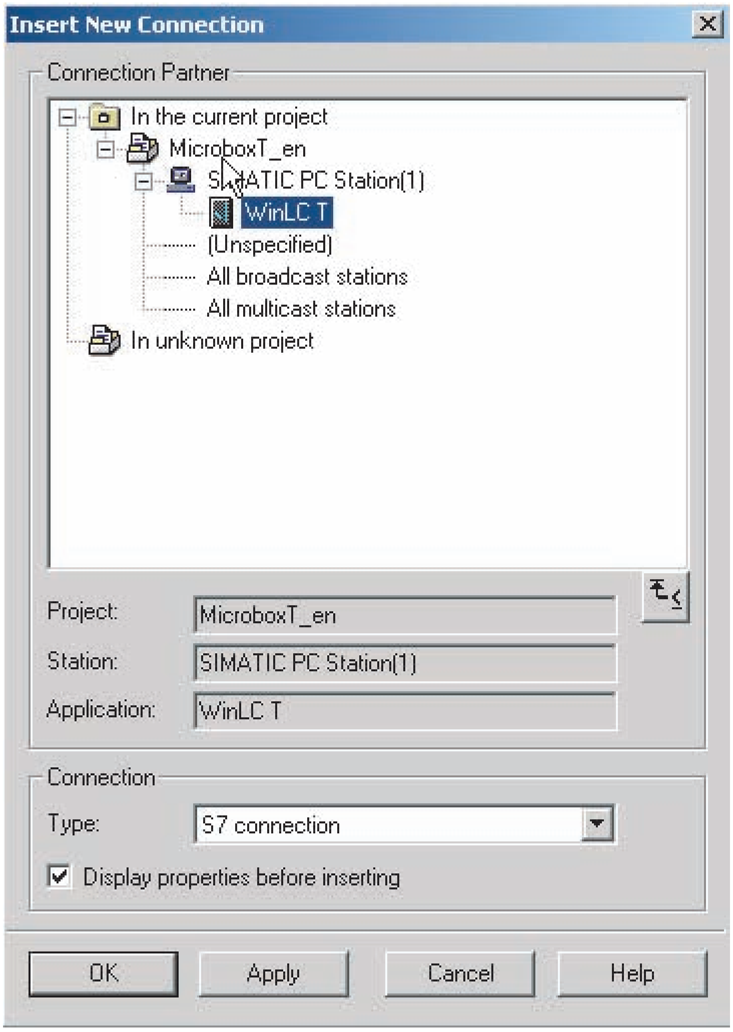
1. Search for the OPC server in the SIMATIC Manager and double-click the "Connections" icon to open NetPro.


SIMATIC Manager - MicroboxT_en
File Edit Insert PLC View Options Window Help
< No Filter >
MicroboxT_en -- C:\Program Files\Siemens\Step7\s7proj\Microb_2
MicroboxT_en
SIMATIC PC Station(1)
WinLC T
OPC Server
Connections

2. Select the OPC server in the PC station.



3. Right-click the OPC server to open the context menu. Select the "Add new connection" option to open the "Add new connection" dialog box.



Insert New Connection

Connection Partner

- In the current project
  - MicroboxT_en
    - SIMATIC PC Station(1)
      - WinLC T
    - (Unspecified)
    - All broadcast stations
    - All multicast stations
- In unknown project

Project: MicroboxT_en

Station: SIMATIC PC Station(1)

Application: WinLC T

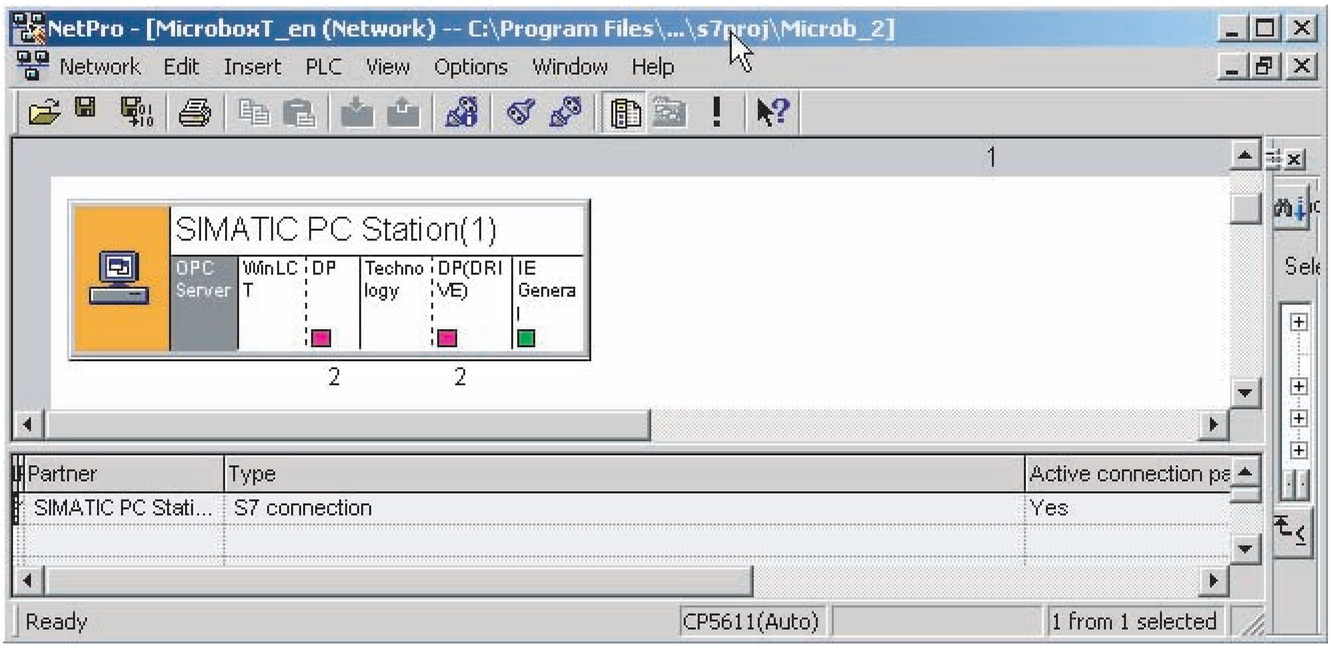
Connection

Type: S7 connection

☑ Display properties before inserting

4. Set "S7 connection" as connection type and click "OK" to add the S7 connection for the OPC server. The "Properties" dialog box for the S7 connection will open automatically.

5. Enter the local ID for the S7 connection.
6. Click "OK" to add the S7 connection to NetPro.
7. Click the "Save and compile" button to save and compile the changes in the STEP 7 project.



Partner	Type	Active connection pa
SIMATIC PC Stati...	S7 connection	Yes

Result

Once you have compiled the S7 connection for the OPC server in the STEP 7 project, you can close NetPro and return to the SIMATIC Manager.

6.5 Step 4: Load the configuration into the WinLC T controller

Introduction

Loading the configuration with STEP 7 on your PC into the controller.

To load the configuration into the controller, proceed as follows:

- Start the controller.
- Load the configuration.

Requirement

The controller must be operating in order to load the configuration. To start the controller, select the **Start > SIMATIC > PC-based control > WinLC T** menu command of double-click the icon for WinLC T on the desktop.

Procedure

Once the controller has been started, you can load the configuration:

1. In the SIMATIC Manager, select the PC station icon.
2. Select the **Target system > Load** menu command or click the "Load" button in the task bar.

6.6 Step 5: Connect the controller with the OPC server

Introduction

Connecting WinLC T on the Microbox T with the OPC server.

To connect WinLC T with the OPC server, proceed as follows:

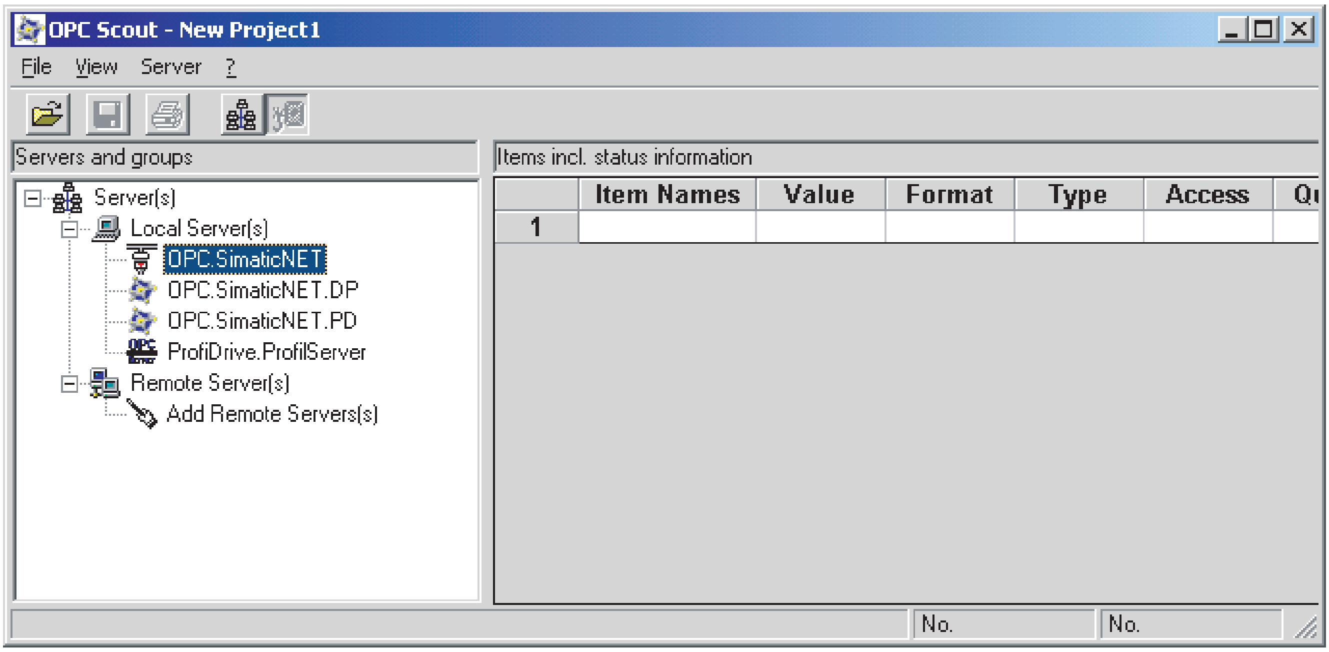
- Create an OPC project.
- Add the connection to the SIMATIC NET OPC server.
- Define the objects to be accessed using the OPC server.

Creating an OPC project

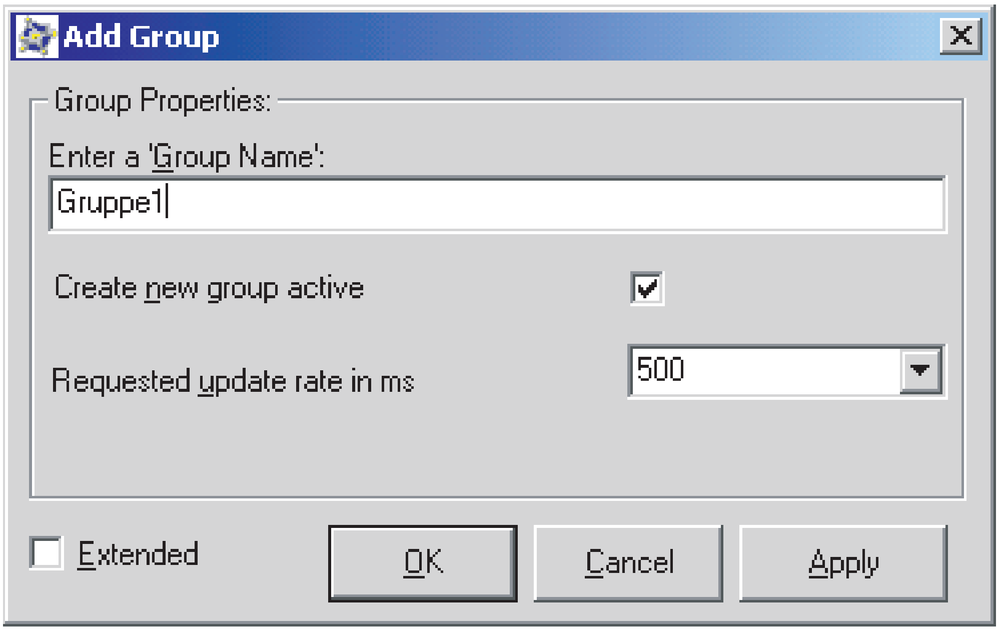
Select the **Start** > **All Programs** > **SIMATIC** > **SIMATIC NET** > **OPC SCOUT** menu command to create a new project in the OPC Scout.

Adding a connection (group) for the OPC server

1. Open the local server directory for "Servers and groups" of the project.
2. Double-click the "OPC.SimaticNET" element to add a connection (or group) for the SIMATIC NET OPC server.



3. Enter the group name for the connection in the "Add Group" dialog box.



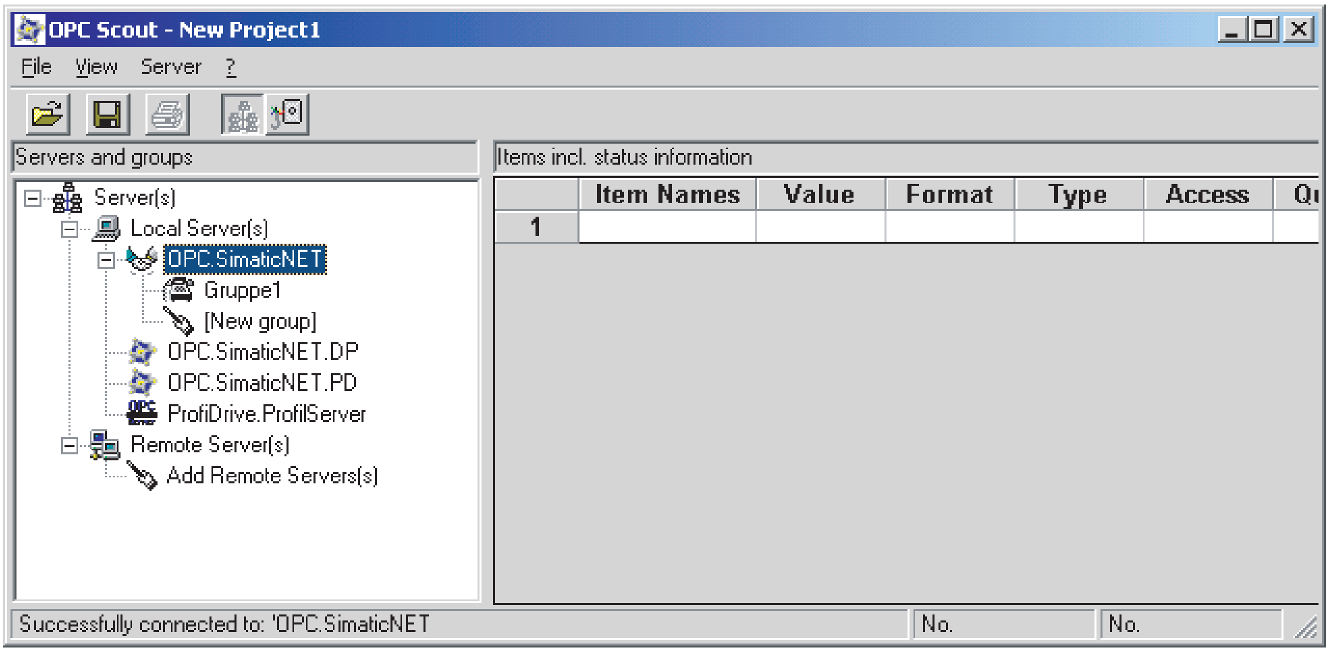
Enter a 'Group Name': Gruppe1

Create new group active ☑

Requested update rate in ms 500

☐ Extended

4. Click "OK" to add the group to the OPC server. OPC Scout adds the connection to the OPC server.



	Item Names	Value	Format	Type	Access	Qu
1						

Successfully connected to: 'OPC.SimaticNET

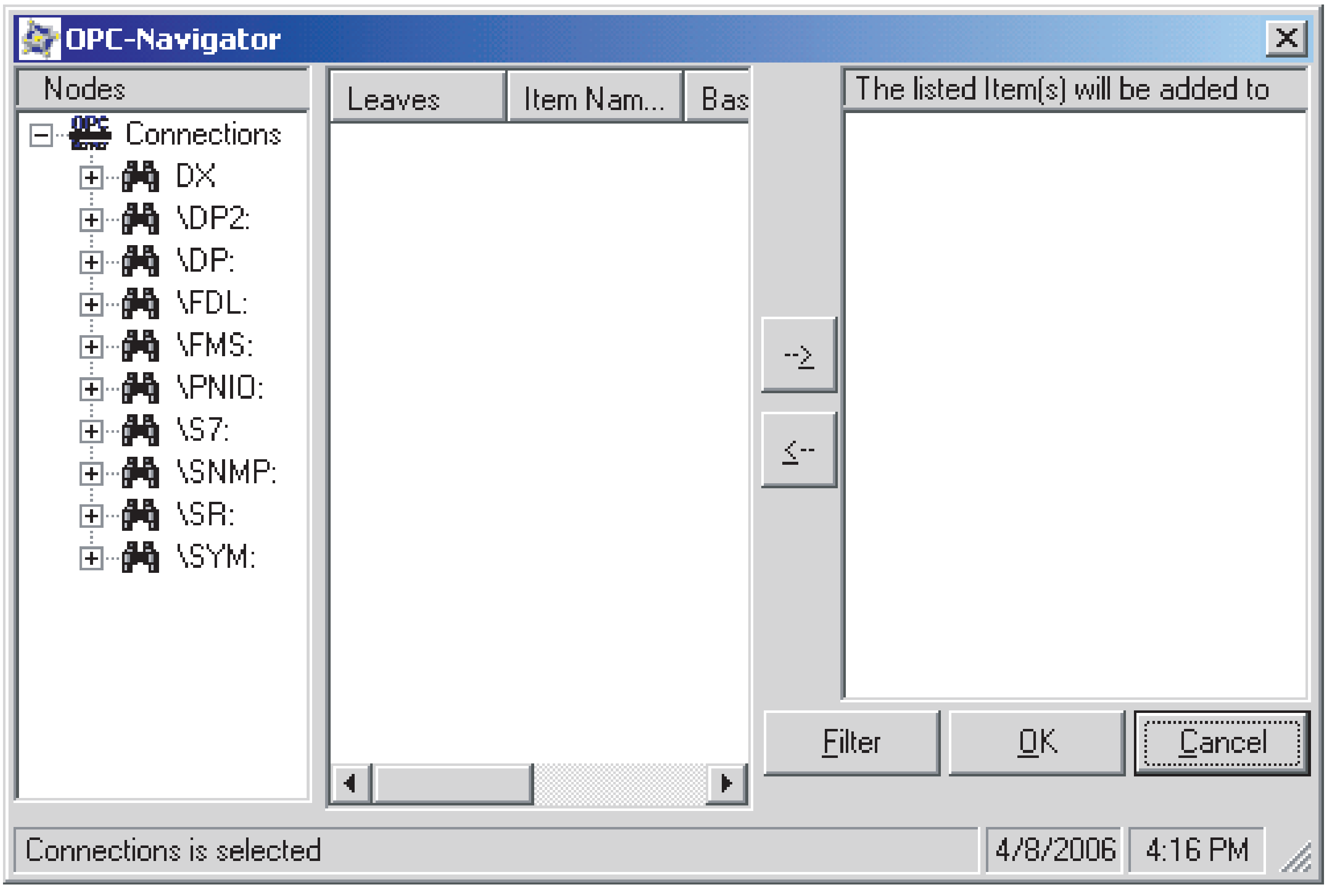
Configuring the objects to be accessed (using absolute addressing)

Note

This procedure describes how you use the absolute addressing for the configuration of the OPC server. You can also use the STEP 7 icon table to establish the connection to the OPC server.

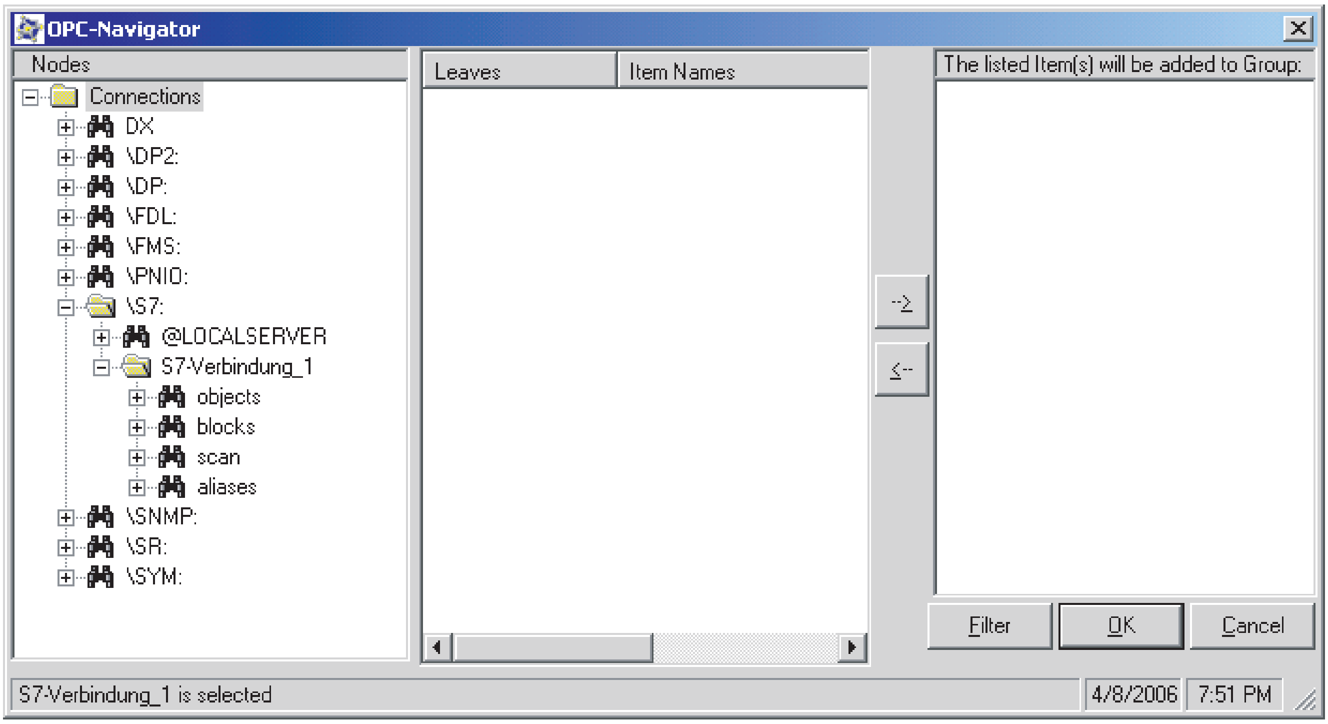
Proceed as follows to configure the OPC server so that it uses absolute addresses to access the data in the controller:

1. Double-click the OPC server connection to open the OPC navigator.



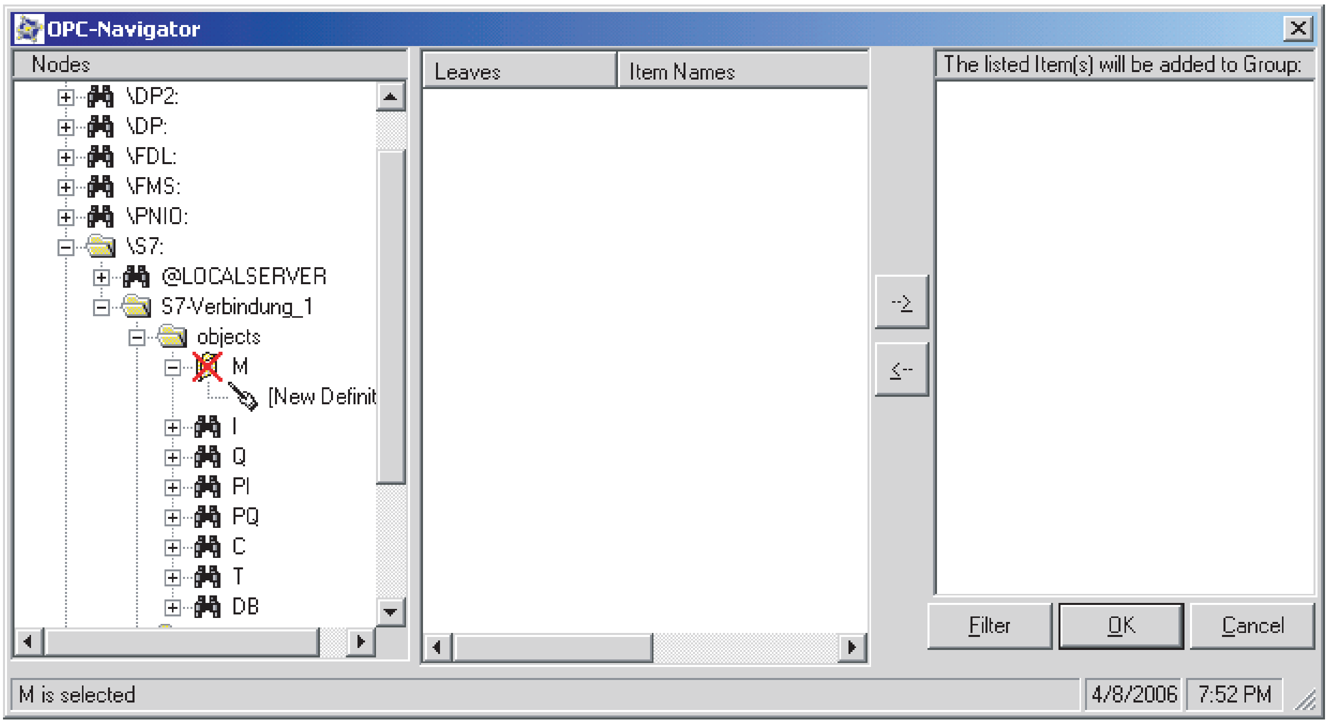
Connections is selected 4/8/2006 4:16 PM

2. Adding an object to be accessed to the "\S7" folder.



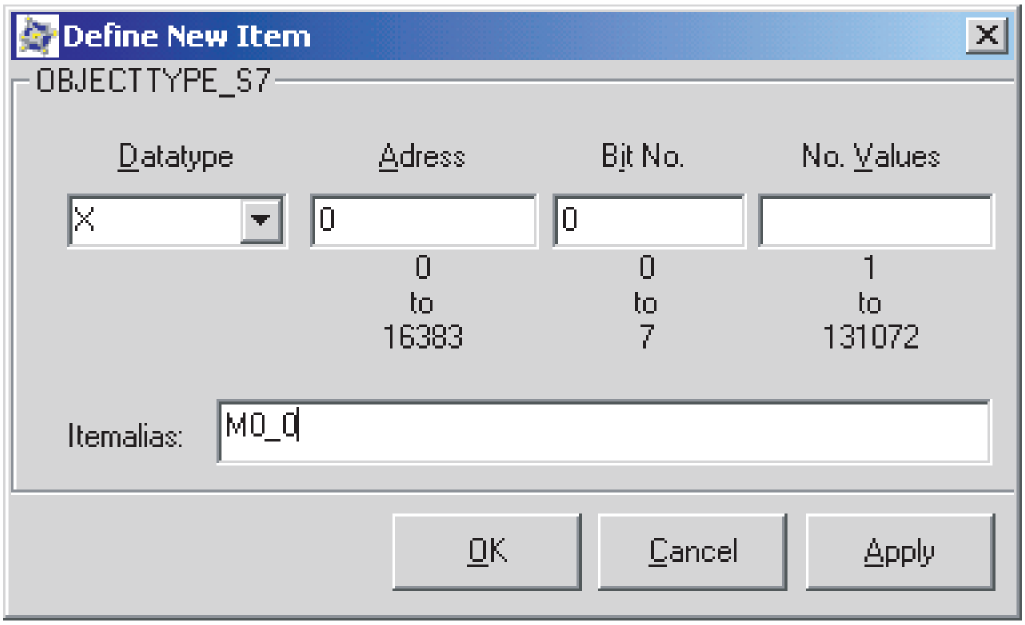
S7-Verbindung_1 is selected 4/8/2006 7:51 PM

3. To setup the access to M0.0, expand the "objects" folder and the "M" folder (for the save area of the flags).



M is selected 4/8/2006 7:52 PM

4. Double-click the "New Definition" icon to call the "Define New Item" dialog box.
5. To define a connection for M0.0, select "X" (for bit) as "Datatype" in the pulldown list box and enter the byte address (0) and the bit number (0).



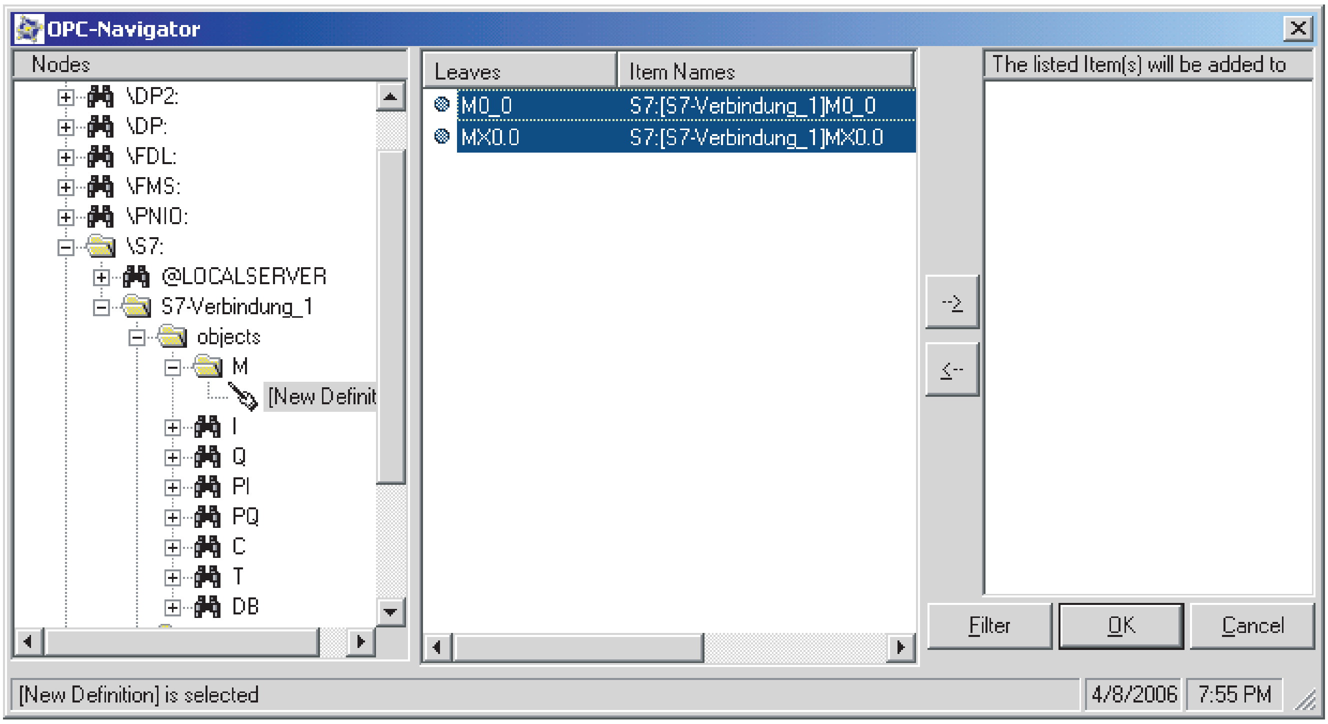
Define New Item

OBJECTTYPE_S7

Datatype	Adress	Bit No.	No. Values
X	0	0	
	0 to 16383	0 to 7	1 to 131072

Itemalias: M0_0

6. Click "OK" to define an object for M0.0.



OPC-Navigator

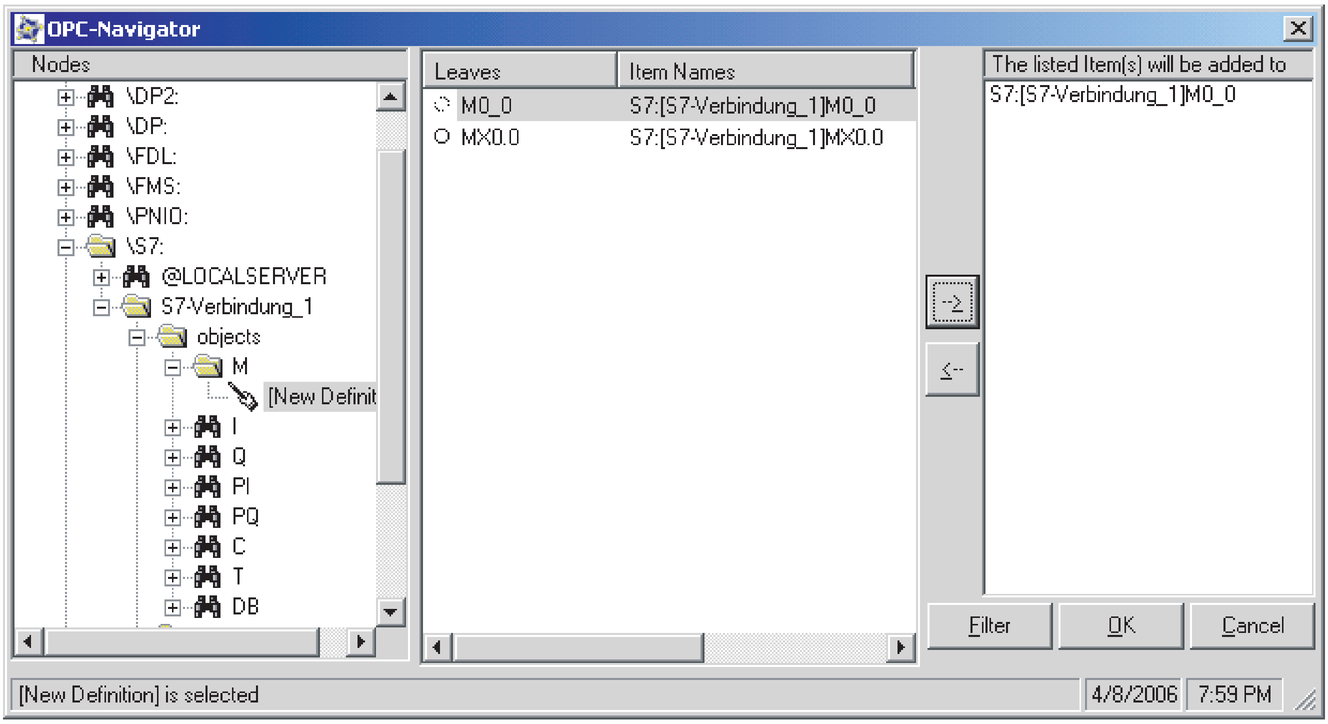
Nodes
- \DP2:
- \DP:
- \FDL:
- \FMS:
- \PNIO:
- \S7:
  - @LOCALSERVER
  - S7-Verbindung_1
    - objects
      - M
        - [New Definit
      - I
      - Q
      - PI
      - PQ
      - C
      - T
      - DB

Leaves	Item Names
M0_0	S7:[S7-Verbindung_1]M0_0
MX0.0	S7:[S7-Verbindung_1]MX0.0

The listed Item(s) will be added to

[New Definition] is selected | 4/8/2006 | 7:55 PM

7. Select the M0.0,1 entry and click the "Add" arrow to add the following syntax that defines a connection for M0.0:
   S7:[S7-connection_1]M0.0,1
8. Select the entry and click "OK" to add the connection for M0.0 to the group.



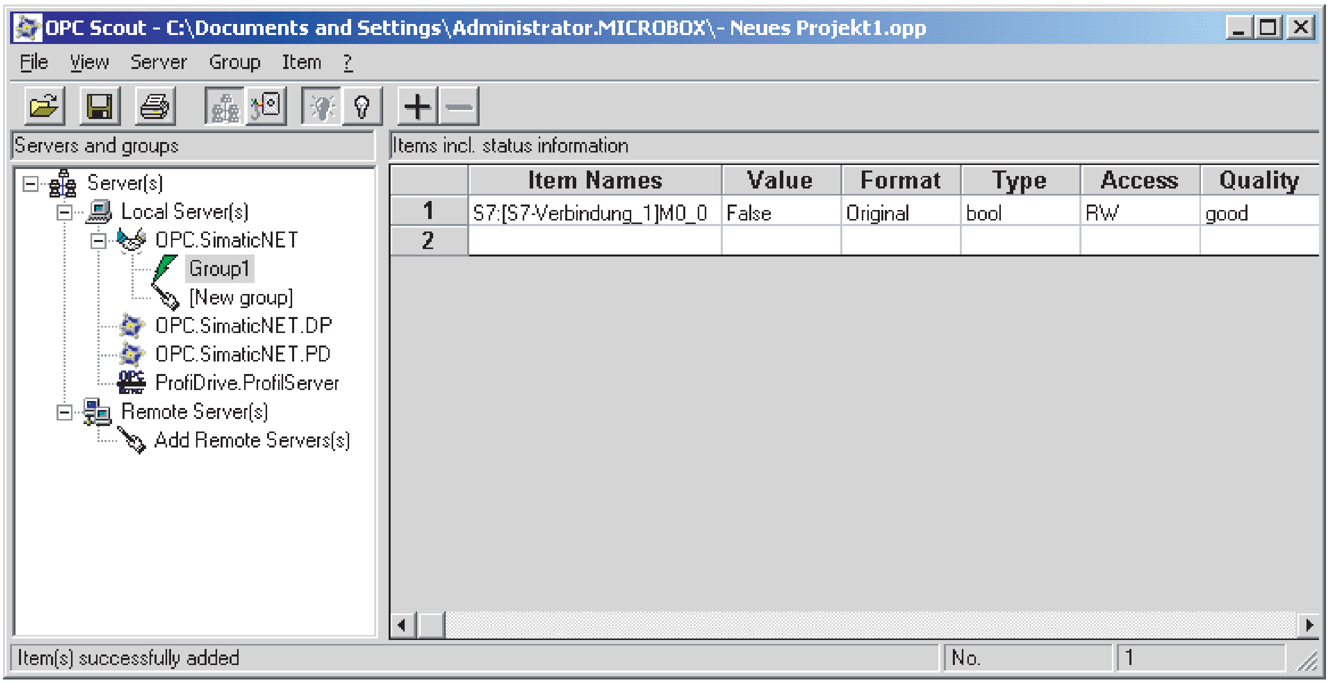
Leaves	Item Names
M0_0	S7:[S7-Verbindung_1]M0_0
MX0.0	S7:[S7-Verbindung_1]MX0.0

The listed Item(s) will be added to
S7:[S7-Verbindung_1]M0_0

[New Definition] is selected | 4/8/2006 | 7:59 PM

Result

Once the object has been added to the group, the name and other parameters for the object will be displayed in OPC Scout. You can now use all methods supported by NET OPC server.



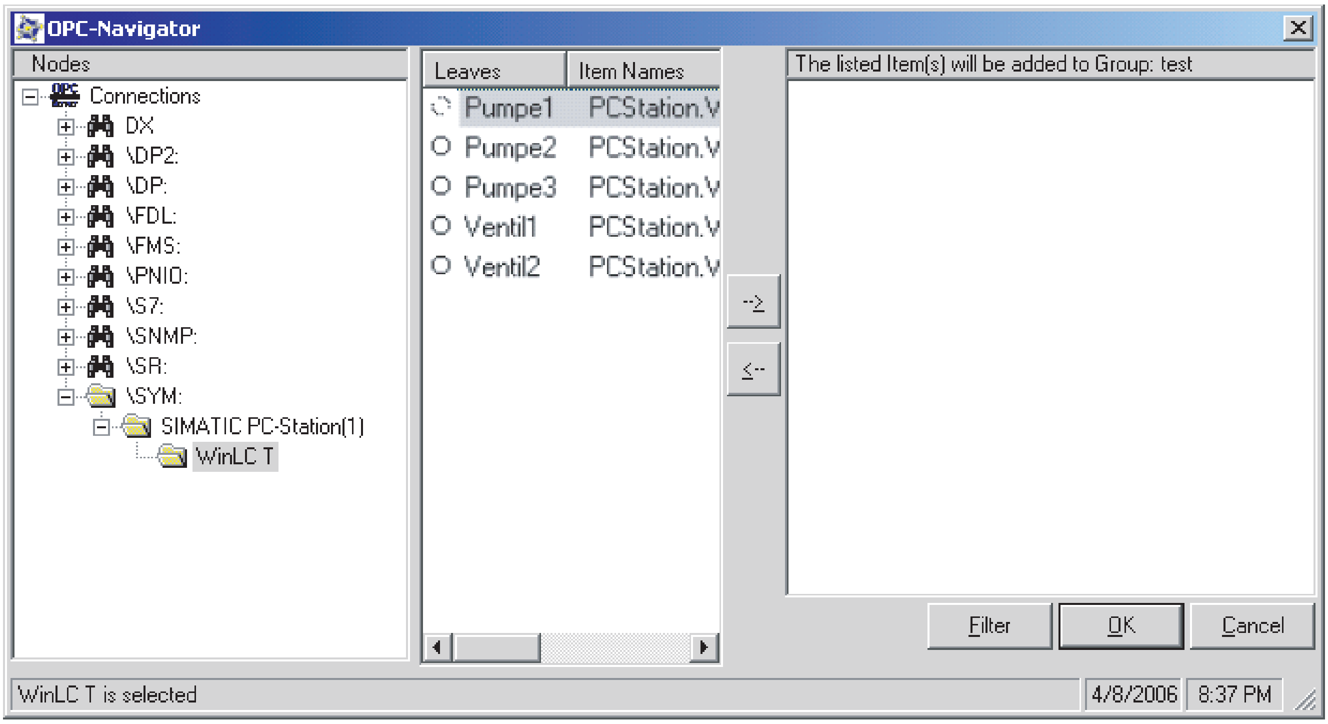
	Item Names	Value	Format	Type	Access	Quality
1	S7:[S7-Verbindung_1]M0_0	False	Original	bool	RW	good
2						

Item(s) successfully added | No. | 1

Configuring the objects to be accessed (using the STEP 7 icon table)

If you have created an icon table for the STEP 7 program that you have loaded into the target system, you can use the icons to connect the OPC server with the data in the controller.

1. Double-click the OPC server connection to open the OPC navigator.
2. Search the controller folder to display the icons that have been loaded into the controller.

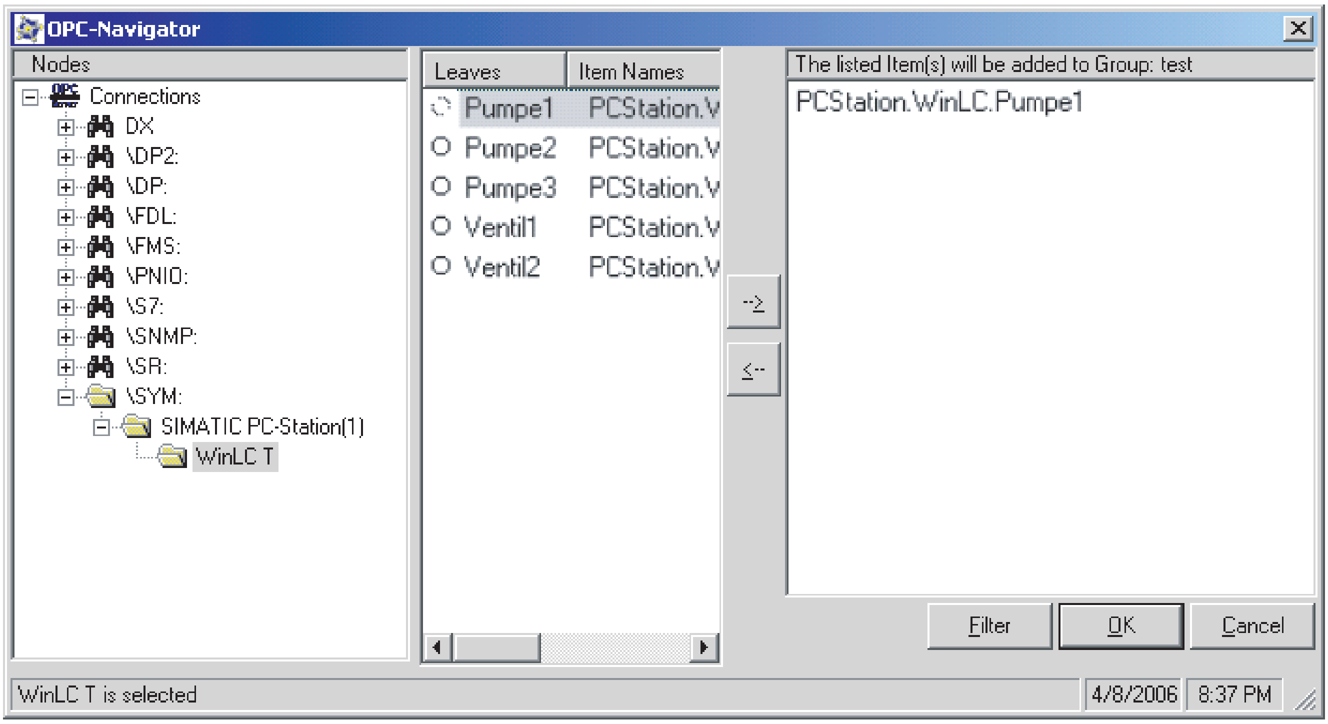


Leaves	Item Names
Pumpe1	PCStation.V
Pumpe2	PCStation.V
Pumpe3	PCStation.V
Ventil1	PCStation.V
Ventil2	PCStation.V

The listed Item(s) will be added to Group: test

WinLC T is selected 4/8/2006 8:37 PM

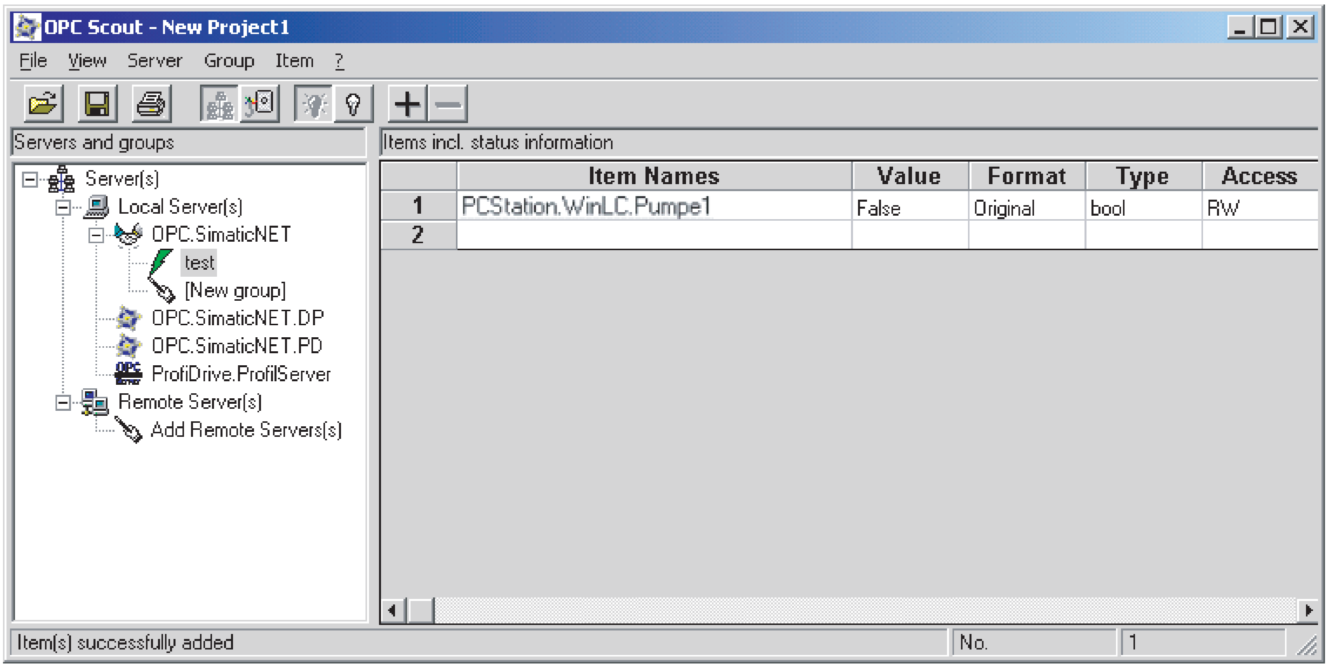
3. Once the icons of the data to be connected to the OPC server have been selected, click the "Add" button.



4. Click "OK" to confirm that the icon is to be added to the group.

Result

Once the object has been added to the group, OPC Scout shows the icon name and other parameters for the STEP 7 icon.



	Item Names	Value	Format	Type	Access
1	PCStation.WinLC.Pumpe1	False	Original	bool	RW
2					

Item(s) successfully added

No. 1

Memory concept

7

7.1 Saving Controller Information

Saved information

WinLC T saves the following operational data on your Microbox T:

- The load memory contains the system data (configuration of the controller) and the initial values of the modules in the STEP 7 user program.
- The load memory contains the controller status. This includes the last change of the operational status (STOP, RUN, or STARTUP) of the controller and the setting of the mode selector (STOP or RUN).
- When the controller is closed, WinLC T creates the switched-off status of the controller. The switched-off status includes the contents of the diagnostic buffer, the current values of the non-volatile memory areas of the controller (e.g. timers, counters and flag bits) and the current values of the non-volatile data blocks.

WinLC T updates these areas during operation and uses this information for the controller start up.

Loading memory

When you load the STEP 7 user program, WinLC T saves the program blocks and the system data in the load memory. The blocks include the initial values for the process variables used by the STEP 7 user program.

You can use SFC 82 (CREA_DBL) to create new blocks in the load memory while the STEP 7 user program is executing. You can use SFC 84 (WRIT_DBL) to change the blocks. The blocks created by SFC 82 are saved in the load memory while the SFC 82 is running.

Note

Data blocks (DBs) created by SFC 22 (CREAT_DB) and SFC 85 (CREA_DB) are not saved in the load memory. These DBs are only saved in the work memory.

Work memory

The work memory is used to run the code and process the STEP 7 user program data. Programs only run in RAM and system memory.

Note

Note that the work memory (RAM) of the Microbox T is shared by the PLC, motion and Windows applications. A memory bottleneck can cause instability of the Microbox T. In these special situations, you should change or optimize the memory for your PLC, motion and Windows applications.

System memory

The system memory contains the following data:

- The address areas for address area memory bits, timers and counters
- The process image of the I/Os
- The local data

Memory areas for access to inputs and outputs

When you configure the distributed I/Os in STEP 7, you assign an area in the PE or PA memory to each I/O module. You also assign a diagnostic address for the I/O modules in the PE memory. The size of the PE and PA memory areas is determined by the configuration of the distributed I/Os, although the maximum size of the memory for the distributed I/Os is 2 KByte.

Note on the memory of the integrated technology

Siemens recommends a maximum memory utilization of 80% in the integrated technology.

Retentive data

When you set up WinLC T in STEP 7, you can define the areas of the non-volatile data for timers (T), counters (ZC), flag bits (F) and data blocks (DBs).

WinLC T saves the non-volatile memory areas, the diagnostic buffer and the current values of the non-volatile data blocks as well as data of the integrated technology in the battery-buffered RAM. If the switched-off state has been saved and the controller performs a restart (OB 100), WinLC T restores the non-volatile memory areas.

Controller state

WinLC T saves the current operating state of the controller and updates the state for the following events:

- Each time the controller changes the operating state (RUN to STOP, STOP to STARTUP or STARTUP to RUN), WinLC T updates the controller state to indicate the last change.
- Each time the mode selector on the control panel is changed (STOP or RUN), WinLC T updates the state of the mode selector to indicate the last change.

Switched-off state

Under normal conditions, WinLC T saves the current state of the controller and the non-volatile data, when you shutdown the controller. WinLC T saves the following information from the work memory:

- The values for the non-volatile data in the S7 memory areas (e.g. B. T, Z, M and DB)
- Diagnostic buffer

The switched-off state is saved when WinLC T is set inoperable. Once WinLC T has started, the switched-off state is loaded to WinLC T and then deleted (to prevent problems for abnormal termination of the controller).

7.2 Loading memory areas during startup

Principle

During the startup, WinLC T determines whether the controller was shutdown correctly. The following tasks are performed:

- The loaded modules of the STEP 7 user program will be loaded from the load memory.
- When the switched-off state is found (this indicates that the controller was shutdown correctly), the work memory will be updated with the switched-off state and the values saved when the controller was shutdown are loaded into the non-volatile data.
- When losing non-volatile data the work memory is reset to the initial state using the load memory (as loaded from STEP 7).
- The controller state is restored in accordance with the saved operating state and the autostart configuration, and the setting of the mode selector in the control panel is reset.

If WinLC T cannot read an element in the load memory, the state of the controller or the switched-off state, WinLC T starts an unconfigured (empty) controller.

Loading memory after a successful closing of the controller

If the switched-off state when the controller was shutdown has been saved successfully, WinLC T restores the operational data of the controller:

- WinLC T reloads during startup the data saved in the switched-off state. This includes the non-volatile S7 memory areas, the current values of the non-volatile data blocks and the contents of the diagnostic buffer.
- Depending on the autostart settings, WinLC T sets the controller status to the STOP or RUN mode. In case of a Windows crash, WinLC T restores the controller status prior to the Windows crash. Although the controller performs a "normal" transition from RUN to STOP, WinLC T cannot save the controller status during a Windows crash.

> **Note**
>
> If the controller has been configured for autostart, WinLC T produces a startup event that specifies the startup type: buffered or unbuffered. You can program OB 100 to read this start event. For an unbuffered startup, the OB100_STOP variable at address LW6 is set to W#16#4309.

- WinLC T sets for the mode selector the controller state that was last saved.

Problems during the controller start up

If WinLC T cannot read an element of the non-volatile memory (load memory, the state of the controller or the switched-off state), or an error occurs, WinLC T starts an unconfigured (empty) controller. In this case, the controller is placed in the STOP mode and the button for the mode set to STOP, and the system data and the user program are deleted.

Possible causes for this problem include a hardware error in your Microbox T or a sub-block in the load memory caused by an error when WinLC T wrote a block in the load memory.

To eliminate this error state, you must reload the user program and the system data from STEP 7.

Note

The mode selector of the controller is set to STOP. Although you can load the user program and the system data from a remote computer, you cannot use this remote computer to set the RUN mode for the controller. You must set the mode selector to RUN on the local computer for WinLC T in order that the controller is placed in the RUN mode.

Starting the controller after a Windows crash

If the controller during closing was in the RUN mode and is configured for autostart, WinLC T starts in the RUN mode. If OB 84 (CPU hardware error) responds to a Windows crash and prior to closing places the controller in the STOP mode, WinLC T starts in the RUN mode because WinLC T cannot save the controller state on the Compact Flash card during the close action caused by the Windows crash.

If you do not want the controller to start in the RUN mode after a Windows crash, you must add the code in the startup OB (OB 100) so that it can be detected that WinLC T was shutdown without the switched-off state being saved and thus the controller will not be placed in the STOP mode at a restart.

7.3 Buffering of Data with SFCs

Principle

You can use SFC 82 (CREA_DBL), SFC 83 (READ_DBL) and SFC 84 (WRIT_DBL) to save data for significant events in the process. If, for example, when you change a recipe, you want to store the recipe values in the load memory without loading new blocks for the user program into the CPU.

SFC 82 and SFC 84 change the data for the user program stored in the load memory. When you store blocks in the load memory, you must ensure that these blocks are available, even when WinLC T cannot save the status during the controller shutdown.

Note

When you use SFC 22, SFC 23, SFC 82, SFC 83, SFC 84 or SFC 85, you must cater for the possibility of a Windows crash.

During the execution in the STEP 7 user program, create and update the SFC 82 (CREA_DBL), SFC 83 (READ_DBL) and SFC 84 (WRIT_DBL) blocks that are stored as part of your STEP 7 user program in load memory.

SFC 82, SFC 83 and SFC 84 are asynchronous SFCs that run in the background.

Note

If you call SFC 82, SFC 83 or SFC 84 from the startup OB (OB 100), WinLC T executes these SFCs synchronously. This differs from the operation of a hardware automation system.

Note

Do not use any polling loops that wait for the completion of an asynchronous SFC. This is the case, in particular, for SFC 82, SFC 83 and SFC 84.

The asynchronous SFCs are executed in the background. If the user program contains loops, the execution of the OB that executes the polling loop will be extended until the end of the SFC. This can cause jitter.

Caution

When the user program calls SFC 82, SFC 83 or SFC 84, the SFC reads or writes data on the Compact Flash card. If you call these SFCs in each cycle (e.g. from OB 1) or from a cyclical OB that executes fast, the constant reading and writing on the Compact Flash card causes the card to be damaged or the occurrence of jitter.

You should only call SFC 82, SFC 83 or SFC 84 to record an important process event, e.g. a changed recipe.

7.4 Retentive data in the SRAM

Memory utilization in the SRAM

WinLC T saves the retentive data in the SRAM of the Microbox T. This SRAM is non-volatile (NVRAM).

The size of the SRAM depends on the utilization of the power supply by other devices:

Memory size	Additional utilization of the power supply
30 KByte	Sum of the USB devices, maximum 6 W

The available SRAM must be shared for the following types of information:

Element	Memory utilization	Standard
Startup information of the system	1 KByte	1 KByte
Diagnostic buffer	Number of entries * 20 bytes	2400 bytes (120 entries)
Flag memory (M)	Number of flag bytes	16 bytes (MB0 - MB15)
S7 timers	Number of timers * 2 bytes	0 byte (per default, no timer is retentive)
S7 counters	Number of counters * 2 bytes	16 bytes (Z0 - Z15)
Retentive DBs configured with STEP 7 or created by means of SFC 85 with ATTRIB = 0x00	Number of KB in retentive DBs	Configuration of the user program
Overhead for DBs created by means of SFC 85	Number of DBs * 45 bytes	0 bytes

Display of retentive data for data blocks

Per default, STEP 7 configures all data blocks as retentive. In the "Properties" dialog box, all three check boxes are **not** activated for a retentive data block:

- DB is write-protected in the AS
- Non-retentive
- Unlinked

If you activate one of these check boxes, the SRAM restrictions have no effect on the DBs.

Data blocks created with SFC 85

A data block created with SFC 85 is retentive when parameter ATTRIB = 0x00. These data blocks require memory for the overhead and for the retentive memory. For data blocks created with SFC 85 with parameter ATTRIB not equal to 0x00, the data block only requires memory for the overhead.

7.5 Power failure

Retentive data

If a power failure occurs, the non-volatile data is saved in the battery-buffered RAM. The backed up data is available at the next ramp up of the Microbox T. The Microbox T is ready for operation immediately.

Windows applications

If the Microbox T is shut down during operation and while the write protection is disabled, the Windows installation may be affected.

The data consistency of Windows applications cannot be guaranteed during a power loss.

In these cases, Siemens strongly recommends the use of a UPS system.

Caution

The data consistency can only be guaranteed after a power failure when the supply voltage of the Microbox T is at least 24 V.

7.6 Uninterruptible power supply (UPS)

Note

You can use an uninterruptible power supply (UPS) to supply your Microbox T with power in an emergency. The UPS system can ensure that the system shuts down correctly and the switch-off state is saved in the event of a power failure.

The manufacturer's documentation for the UPS system provides further information.

Microsoft Windows provides a dialog box to configure the UPS for your computer:

1. Select the **Start > Settings > Control Panel** menu command to display the control panel.
2. Select "Performance and Maintenance".
3. Double-click the "Power Options" icon to open the "Power Options Properties" dialog box.
4. Open the "UPS" tab and enter the parameters for your UPS system.
5. Click "Apply" or "OK" to set the UPS properties.

7.7 Backing up data

Data backup under Windows XP Embedded

For the data backup under Windows XP Embedded, you create an image of the installation. We recommend the " Image & Partition Creator V1.1" software tool for this purpose. This tool enables you to easily back up and restore the full content of Compact Flash card and individual partitions (images).

The software can be ordered from the Siemens A&D online ordering system (order number 6ES7-6AA02-0YX0). For detailed information about Image Creator, refer to the corresponding product information.

7.8 Restoring the factory settings (Restore)

Restore

You can restore the original factory software using the Restore CD (supplied with the Microbox T). The CD contains the required images and the tool for transferring the delivered state to the Compact Flash card of the Microbox T. You have the following possibilities for the restore:

- You can restore the entire Compact Flash card with drive C: (system) and drive D:
- or only drive C:. This allows you to retain any user data on drive D:.

Caution

With the option "Restore system partitions only", all data on drive C: (System) will be deleted. All data, user settings and all authorizations and license keys on drive C: will be lost in the process. All data on drive C: on the Compact Flash card will be deleted and rewritten with the original factory software.

When you select the "Restore entire hard disk" option, **all** data, user settings and authorizations or license keys will be lost on the Compact Flash card. Also on drive D: the installed programs will be deleted.

Note

Ensure that the correct boot drive is selected for the startup. You select the boot drive in the boot menu of the BIOS setup.

Reference

The restore CD contains a text file ("README.txt") that provides a detailed description for the procedure for restoring the delivered state. Follow the instructions in this file.

Communication 8

8.1 Ports

8.1.1 Overview

Overview

The Microbox T has four interfaces for communication with other devices:

- Ethernet interface for communication with PG, OP
- PROFIBUS DP interface (X1) for the communication with PG, OP, distributed I/O
- PROFIBUS DP(DRIVE) interface (X2) for the communication with drive systems.
- I/O interface (X11) with eight digital outputs for controlling output signals, e.g. output cam switching signals

8.1.2 Ethernet interfaces

Ethernet subnet

Industrial Ethernet is a communication network with a transmission rate of 10/100 Mbit/s. The Ethernet interfaces used in the Microbox T support the IEEE-Standard 802.3.

Properties of the Ethernet interface

You can use the Ethernet interface to communicate with STEP 7 and SIMATIC NET OPC using a PG/PC. You cannot, however, use the Ethernet interface for the communication from WinLC T with the distributed I/Os.

The Ethernet interface supports the following protocols / communication types:

- Industrial Ethernet
  - PG/OP communication
  - S7 communication
  - S7 routing

The SOFTNET-PG communications software is used for communication using Industrial Ethernet.

Note

In order to be able to use the full Ethernet functionality of the Microbox T, you must load the entire station from the SIMATIC Manager to the controller as data for the station manager must also be loaded. These data are **not** contained in the SDBs for the CPU. It is therefore **not** sufficient to only load the block folder.

Note

The S7 communication **cannot** be used with the SOFTNET-PG communications software. To use the S7 communication, a SOFTNET-S7 license must be transferred to the system.

Reference

A detailed description of the Industrial Ethernet can be found in the *SIMATIC NET - Twisted-Pair and Fiber-Optic Networks* manual.

A description of the SOFTNET communication software can be found in the *SIMATIC NET - Introduction of SOFTNET for Industrial Ethernet* manual.

See also

Setting PG/OP communication (Page 8-7)

8.1.3 PROFIBUS DP interface (X1)

Availability

The Microbox T has a PROFIBUS DP interface (X1). PROFIBUS DP is an international, open field bus standard specified in the European field bus Standard EN 50170 Part 2.

The DP interface has DPV1 functionality.

The following protocols / communication types are supported:

- PROFIBUS
  - PG/OP communication
  - S7 communication
  - S7 routing
  - DP

Restrictions

The following restrictions apply

- Note that when setting up a DP network, the Microbox T does not support the "Isochronous mode" system function.
- In contrast to hardware automation systems, a loading operation (L) or a transfer operation (T) cannot access bytes from several modules with PC-based controllers. Let us consider, for example, a configuration with two output modules, each module with five bytes. Module 1 is addressed from 10 to 14 and Module 2 is addressed from 15 to 19. OB 1 contains the following operations:

  ```
  L 5
  T PAW 14
  ```

  In this example OB 122 is called because an attempt is made to access bytes of different modules. A word operation at Address 14 attempts to access Addresses 14 and 15, which is prevented as the addresses do not belong to one module.

See also

PROFIBUS DPV1 (Page 3-9)

Setting PG/OP communication (Page 8-7)

8.1.4 PROFIBUS DP(DRIVE) interface (X2)

Features

The PROFIBUS DP(DRIVE) interface is used to connect to drive systems. You can connect drive systems in accordance with the PROFIdrive V3.0 profile.

The PROFIBUS DP(DRIVE) interface can be configured as master and provides a maximum transmission rate of 12 Mbit/s (the transmission rate should always be set to 12 Mbit/s).

The DP(DRIVE) interface is controlled isochronously by the integrated technology (and therefore also equidistant). The integrated technology only permits an equidistant bus cycle in the range from 1 ms to 8 ms.

The controller sends its bus parameter settings (e.g. baud rate) via the PROFIBUS DP(DRIVE) interface. In your configuration you can specify to disable bus parameter broadcasting.

Using the "Routing" function, you can access the drive parameters of the slaves in the DP(DRIVE) line for the purposes of commissioning and diagnostics. However, diagnostics cannot be performed via PROFIBUS DP(DRIVE) from the *STEP 7* user program.

Restrictions

If you deselect "Startup with different target / actual configurations" in the Microbox T properties in STEP 7, then the Microbox T will boot even if the stations configured on DP(DRIVE) are missing.

Connectable devices

You can connect drives to PROFIBUS DP(DRIVE), e.g.:

- MICROMASTER 420/430/440 and COMBIMASTER 411
- SIMODRIVE 611 universal
- SIMODRIVE POSMO CD/SI/CA
- MASTERDRIVES MC/VC
- SINAMICS S120/150 and G130/150
- ADI4 (analog drive interface)

You can also connect, for example, the following devices:

- ET 200M with IM 153-2 and SM 322 for additional cam output
- ET 200S with IM151-1

The components supported by Microbox T can be found in the *HW Config* hardware catalog in the "SIMATIC Technology CPU" profile.

Non-connectable devices

Do not operate any PG, PC, OP, TD, ... on PROFIBUS DP(DRIVE).

Reason: If you connect a PG; PC, OP, TD, ... to DP(DRIVE), the properties of DP(DRIVE) change (e.g. isochronism), and the synchronism between drives may be lost as a result.

8.1.5 I/O interface (X11)

Integrated outputs for technology

The I/O interface provides eight isolated digital outputs. You can use these integrated technology outputs for technology objects that you configure using *S7T Config* (included in the optional package *S7-Technology*).

The digital outputs are provided for high-speed camming functions. They can be programmed with technology functions in the STEP 7 user program.

You use the integrated outputs for applications in which rapid technological processing is of prime importance.

8.2 Communication services

8.2.1 Overview of communication services

Selecting the communication service

You need to decide on a communication service, based on functionality requirements. Your choice of communication service will have no effect on:

- the available functionality
- the necessity of an S7 connection
- the time when the connection is established

The user interface can vary considerably (SFC, SFB, ...), and is also determined by the associated hardware.

8.2.2 PG communication

Properties

You use the PG communication to implement the data exchange between engineering stations (e.g. PG, PC) and WinLC T. The service is possible using PROFIBUS and Industrial Ethernet subnets. Routing between subnets is also supported.

PG communication provides the functions needed to download/upload programs and configuration data, to run tests and to evaluate diagnostic information. These functions are integrated in WinLC T.

WinLC T can maintain several simultaneous online connections to one or more PGs.

Reference

Further Information

- on SFCs can be found in the *Instruction list*, for more details refer to the *STEP 7 online help* or to the *System and Standard Functions* reference manual.
- on communication are found in the *Communication with SIMATIC* Manual.

8.2.3 OP communication

Properties

You use the OP communication to implement the data exchange between operator stations (e.g. OP, TD) and WinLC T. The service is possible using PROFIBUS and Industrial Ethernet subnetworks.

OP communication provides functions you require for monitoring and modifying. These functions are integrated in WinLC T.

WinLC T can maintain several simultaneous connections to one or more OPs.

Reference

Further Information

- on SFCs can be found in the *Instruction list*, for more details refer to the *STEP 7 online help* or to the *System and Standard Functions* reference manual.
- on communication are found in the *Communication with SIMATIC* Manual.

8.2.4 Setting PG/OP communication

Introduction

The controller can be connected with STEP 7 in one of the following ways:

- Using the DP communications interface with STEP 7 on a different computer
- Using the IE communications interface with STEP 7 on a different computer

To configure the communication between the controller and STEP 7 on a different computer or programming device, set the specific communications interface and the type of the communication as access point for the PG/PC interface.

Setting the communication using the DP interface

The PROFIBUS communications type is supported for the communication using the integrated DP interface.

If you select the communication using the DP interface, no further settings need to be made on the Microbox T. Use the default settings of the DP interface:

- Address: 2
- Transmission rate: 1.5 Mbit/s

Setting the communication using the Ethernet interface

The Industrial Ethernet communications type is supported for the communication using the Industrial Ethernet.

Static or dynamic IP address assignment is possible.

For the static address assignment, you must observe the following:

- The "Local Area Connection 2" is used for the Ethernet interface.
- The IP address for "Local Area Connection 2" is 192.186.0.1.
- The subnet mask is 255.255.255.0.

If necessary, correct the IP addresses. To do this, open the "Local Area Connection 2 Status" dialog box with the **Start > Control Panel > Network Connections > Local Area Connection 2** command and click "Properties" to open the "Local Area Connection 2 Properties" dialog box.

For the dynamic address assignment, create a DHCP connection.

Note

Use a DHCP connection only when the DHCP server always supplies the same IP address for a specified MAC address.

8.2.5 Routing for test and diagnostic functions

Reference

Further Information

- about routing can be found in the *Programming with STEP 7* manual, or directly to the *STEP 7* online help.
- about configuring with *STEP 7* can be found in the *Configuring Hardware and Connections in STEP 7* manual
- of a basic nature is contained in the *Communication with SIMATIC* manual.
- about the TeleService adapter is available in the Internet at http://www.ad.siemens.de/support. You can download the documentation in "Search" input field using the A5E00078070 search term.
- on SFCs can be found in the *Instruction list*, for more details refer to the *STEP 7 online help* or to the *System and Standard Functions* reference manual.
- on communication are found in the *Communication with SIMATIC* manual.

8.2.6 Data consistency

Definition: Data consistency

A data area is consistent if it can be read or written to from the operating system as a consistent block. Data exchanged collectively between the stations should belong together and originate from a single processing cycle, that is, be consistent.

With PUT/GET functions

For S7 communication functions, such as PUT/GET or write/read via OP communication, which do not require a block in the user program on the CPU (operating in server mode), allowances must be made in the program for the extent of the data consistency.

The PUT/GET functions for S7 communication, or for reading/writing variables via OP communication, are executed at the CPU's scan cycle checkpoint.

8.3 S7 communication structure

8.3.1 Communication path of an S7 connection

Communication path

An S7 connection is established when S7 modules communicate with one another. This connection is the communication path.

S7 connection resources

Every communication link requires S7 connection resources on the CPU for the entire duration of this connection.

Thus, every S7 CPU provides a specific number of S7 connection resources. These are used by various communication services (PG/OP communication, S7 communication or S7 basic communication).

Connection points

An S7 connection between modules with communication capability is established between connection points. The S7 connection always has two connection points: The active and passive connection points:

- The active connection point is assigned to the module that establishes the S7 connection.
- The passive connection point is assigned to the module that accepts the S7 connection.

Any module that is capable of communication can thus act as an S7 connection point. At the connection point, the established communication link always uses **one** S7 connection of the module concerned.

Transition point

If you use the routing functionality, the S7 connection between two modules capable of communication is established across a number of subnets. These subnets are interconnected via a network transition. The module that implements this network transition is known as a router. The router is thus the point through which an S7 connection passes.

8.3.2 Assignment of S7 connections

Assignment of S7 connections

There are several ways to allocate S7 connections on a communication-capable module:

- Reservation during configuration
- Allocating connections during commissioning, testing and diagnostics routines
- Allocating connection resources to OCMS services

Reservation during configuration

- If a CPU is inserted when the hardware is configured with *STEP 7*, two S7 connections, one for PG and one for OP communication, are automatically reserved on the CPU.
- It is possible to reserve S7 connections in *STEP 7* for PG / OP communication and S7 basic communication.

Using connections for commissioning, testing and diagnostics

An active online function on the engineering station (PG/PC with *STEP 7*) occupies S7 connections for PG communication:

- An S7 connection resource for PG communication which was reserved in your CPU hardware configuration is assigned to the engineering station, that is, it only needs to be allocated.
- If all reserved S7 connection resources for PG communication are allocated, the operating system assigns a free S7 connection resource which has not yet been reserved. If no more connection resources are available, the engineering station cannot go online to the CPU.

Allocating connection resources to OCMS services

An online function of the OCM station (OP/TD/... with *ProTool*) allocates S7 connection resources for OP communication:

- An S7 connection resource for OP communication you have reserved in your CPU hardware configuration is therefore assigned to the OCM engineering station, that is, it only needs to be allocated.
- If all reserved S7 connection resources for OP communication are allocated, the operating system assigns a free S7 connection resource which has not yet been reserved. If no more connection resources are available, the OCM station cannot go online to the CPU.

Time sequence for allocation of S7 connection resources

When you program your project in *STEP 7*, the system generates parameter assignment blocks which are read by the modules in the startup phase. This allows the module's operating system to reserve or allocate the relevant S7 connection resources. That is, for instance, OPs cannot access a reserved S7 connection resource for PG communication.

The module's (CPU) S7 connection resources which were not reserved can be used freely. These S7 connection resources are allocated in the order they are requested.

Example

If there is only one free S7 connection left on the CPU, you can still connect a PG to the bus. The PG can then communicate with the CPU. The S7 connection is only used, however, when the PG is communicating with the CPU.

If you connect an OP to the bus while the PG is not communicating, the OP can establish a connection to the CPU. Since an OP maintains its communication link at all times, in contrast to the PG, you cannot subsequently establish another connection via the PG.

8.3.3 Distribution and availability of S7 connection resources

Distribution of the S7 connections

The distribution of the S7 connections of the CPUs can be found in the following table:

Table 8-1 Distribution of the S7 connections

Communication service	Distribution
PG communication OP communication	In order to avoid allocation of the S7 connections being dependent only on the chronological sequence in which various communication services are requested, S7 connections can be reserved for these services. At least one S7 connection is reserved by default for the PG and OP communication respectively. In the table below, and in the technical data of the CPUs, you can find the configurable S7 connection resources and the default configuration for each CPU. You "redistribute“ the S7 connections by setting the relevant CPU parameters in *STEP 7*.
S7 communication Other communications connections	Here you allocate S7 connections which are still available and not reserved for a specific service (PG/OP communication, S7-based communication).
Routing PG functions	The CPU provides a maximum of 62 connections for the routing of PG functions. These connections are available in addition to the S7 connections.

Availability of the S7 connections

The following table shows the available S7 connections.

Table 8-2 Availability of the S7 connections

Total number of S7 connections	Reserved for		Free S7 connections
	PG communication	OP communication	
64	1 to 63, default 1	1 to 63, default 1	Displays all non-reserved S7 connection resources as free connection resources.

Reference

Further Information

- on SFCs can be found in the *Instruction list*, for more details refer to the *STEP 7 online help* or to the *System and Standard Functions* reference manual.
- on communication are found in the *Communication with SIMATIC* manual.

Cycle and response times 9

9.1 WinLC T time model

Time model

The integrated technology processes your tasks in single processing cycles. The cycles of the integrated technology affect the task processing of the technology objects for WinLC T. This means the WinLC T time model must be considered for the programming of your user program.

Note for the minimum cycle time

The minimum cycle time is initialized to 0 ms. To better utilize the computing power of the Microbox T, the minimum cycle time, however, should be set to a value ≠ 0 ms.

Reference

Detailed information for the WinLC T time model is contained in the S7-Technology online help and in the "Time model of the WinLC T (Microbox T)" section of the *S7-Technology* manual.

Further details for setting the technology system cycle clocks are contained in the "Setting technology system cycle clocks" section of the same manual or in the specified online help.

Reference information 10

10.1 Technical data

General technical data of WinLC T on Microbox 420-T

General technical data	
Order No.:	6ES7 675-3AG30-0PA0
Product version	
Firmware version (integrated technology)	V3.2
Firmware version (CPU)	V4.2
Blocks	
DBs	
• Number	64k - 1 (from DB1 to DB65535)
• Size	64 KByte
FBs	
• Number	64k (from FB0 to FB65535)
• Size	64 KByte
FCs	
• Number	64k (from FC0 to FC65535)
• Size	64 KByte
OBs	
• Number	30
• Size	64 KByte
• Number of free cycle OBs	1
• Number of time-of-day-interrupt OBs	1
• Number of delay interrupt OBs	1
• Number of time interrupts	9
• Number of process interrupt OBs	1
• Number of startup OBs	1
• Number of asynchronous error OBs	7
• Number of synchronous error OBs	2
• Number of diagnostic interrupts	1
• Nesting depth – Per priority class – Additional nesting depth within an error OB	 24 2

General technical data	
Execution times	
Bit instructions, min.	0.004 µs
Fixed-point arithmetic, min.	0.003 µs
Floating-point arithmetic, min.	0.004 µs
Timers/counters and their retentive address areas	
S7 counters	
• Number	512
• Retentive address areas	Configurable
• Retentive address areas, lower limit	Z0
• Retentive address areas, upper limit	Z511
• Retentive address areas, preset	Z8
• Counting range	Configurable
• Counting range, lower limit	0
• Counting range, upper limit	999
IEC counters	
• Type	SFB
• Number	3
S7 timers	
• Number	512
• Retentive address areas	Configurable
• Retentive address areas, lower limit	T0
• Retentive address areas, upper limit	T511
• Retentive address areas, preset	T0
• Timer range	Configurable
• Timer range, lower limit	10 ms
• Timer range, upper limit	6390 s
IEC timers	
• Type	SFB
• Number	3
Data areas and their retentive address areas	
Retentive data area, in total	30 KByte
Retentive data area, in total (including timers; counters, flags), max.	30 KByte
Flag bits	16384 bytes
• Retentive address areas	Configurable
• Preset retentive address areas	MB 0 to MB 15
• Clock flag bits	1 flag byte
Data blocks	
• Number	64k - 1 (from DB1 to DB65535)
• Size	64 KByte
• Retentive address areas	Configurable
• Preset retentive address areas	Yes

General technical data	
Local data	
• Configurable	Max. 16 KByte
• Default	256 bytes
• Per priority class	Min. 20 bytes
Address areas (I/O)	
Total I/O address area	2048 bytes
• Inputs	2000 bytes
• Outputs	2048 bytes
I/O process image	
• Inputs	2048 bytes
• Outputs	2048 bytes
• Inputs, configurable	2048 bytes
• Outputs, configurable	2048 bytes
• Inputs, default	512 bytes
• Outputs, default	512 bytes
Partial process images	Max. 15
Digital channels	65536/65536
• Integrated channels (DI)	0
• Integrated channels (DO)	8
• Inputs	16000
• Outputs	16384
• Inputs/outputs, central	0
Analog channels	4096/4096
• Integrated channels (AI)	0
• Integrated channels (AO)	0
• Inputs	1000
• Outputs	1024
• Inputs/outputs, central	0
Addressing range	
• Inputs	2048 bytes
• Outputs	2048 bytes
Address space per module	Max. 244 bytes
Address areas (I/O) of the integrated technology	
Total I/O address area	Max. 2048 bytes / 2048 bytes (can be freely addressed)
I/O image DP (DRIVE)	64/64
Expansion	
Connectable PGs/PCs	Yes
Number of DP masters, integrated	2

General technical data	
Time-of-day	
Real-time clock	Hardware clock (real-time clock), battery-backed
Operating hours counters	
• Number	8
• Numbers	0 to 7
• Value range	32767 h
• Granularity	1h
• Retentive	Yes
Time synchronization	
• Supported	No
• On MPI, master	No
• On MPI, slave	No
• In the AS, master	No
• In the AS, slave	No
• On Ethernet via NTP	No
S7 message functions	
• Number of stations that can be logged on for signaling functions, max.	32
• Process diagnostics messages	Yes
• Simultaneously active Alarm-S blocks, max.	200
Test and startup functions	
• Status/control variables	Yes
• Variables	I/O/M/DB/Z/T
Monitoring functions	
Force	No
Block status	Yes
Single-step	Yes
Number of breakpoints	20
Diagnostic buffer	Yes
• Number of entries	Max. 120
• Configurable	Yes
• Default	120
Communication functions	
PG/OP communication	Yes, automatic
Routing	Yes, automatic
Global data communication	No
S7 communication	
• As server	Yes
• As client	Yes
• User data per job	Max. 64 KByte (bsend/breceive)
• User data per job, consistent	Max. 64 KByte (bsend/breceive)

General technical data	
S5-compatible communication	No
Standard communication (FMS)	No
Open IE communication	
• TCP/IP	No
• ISO-on-TCP	No
• UDP	No
Number of connections	
• Total	64
• Usable for PG communication	63
• Reserved for PG communication	1
• Configurable for PG communication	No
• Usable for OP communication	63
• Reserved for OP communication	1
• Configurable for OP communication	No
• Usable for S7 basic communication	0
• Usable for S7 communication	62
• Usable for routing	62
1st PROFIBUS DP interface	
Functionality	
• MPI	Yes
• DP master	Yes
• DP slave	No
• Point-to-point connection	No
DP master	
Number of connections	Max. 14
Services	
• PG/OP communication	Yes
• Routing	Yes
• Global data communication	No
• S7 communication	Yes
• S7 communication, as client	Yes
• S7 communication, as server	Yes
• Equidistance support	No
• SYNC/FREEZE	Yes
• Activation/deactivation of DP slaves	Yes
• Direct data exchange (data exchange broadcast)	Yes
• DPV1	Yes
Transmission speed	Max. 12 Mbit/s
Number of DP slaves	Max. 32

General technical data	
User data per DP slave	
• User data per DP slave	Max. 244 bytes
• Inputs	Max. 244 bytes
• Outputs	Max. 244 bytes
2nd PROFIBUS DP(DRIVE) interface	
Automatic determination of transmission rate	Yes
Number of connection resources	0
Functionality	
• MPI	No
• DP master	Yes, DP (DRIVE)
• DP slave	No
• Point-to-point connection	No
• PROFINET CBA	No
• PROFINET IO-controlled	No
DP master	
Number of connections	0
Services	
• PG/OP communication	No
• Routing	Yes, e.g. to drives
• Global data communication	No
• S7 communication	No
• S7 communication, as client	No
• S7 communication, as server	No
• Equidistance support	Yes
• SYNC/FREEZE	No
• Activation/deactivation of DP slaves	No
• Direct data exchange (data exchange broadcast)	No
• DPV1	Yes
Transmission speed	Max. 12 Mbit/s
Number of DP slaves	Max. 32
User data per DP slave	
• User data per DP slave	Max. 244 bytes
• Inputs	Max. 244 bytes
• Outputs	Max. 244 bytes

General technical data	
CPU programming	
Configuration software	STEP 7
Programming language	
• STEP 7	As of V 5.3 SP 3 and option package S7-Technology
• LAD	Yes
• FBD	Yes
• STL	Yes
• SCL	Yes
• CFC	Yes
• GRAPH	Yes
• HiGraph®	Yes
Software libraries	
• Process diagnostics	Yes
• Software controller	Yes
Instruction set	See "Programming" section
Nesting levels	8
User program protection / password protection	Yes
System functions (SFC)	See "System functions (SFCs)" section
System function blocks (SFB)	See "System function blocks (SFBs)" section
Cycle time monitoring	
• Lower limit	1 ms
• Upper limit	6000 ms
• Configurable	Yes
• Preset	6000 ms

Technological data

Technological data of WinLC T on Microbox 420-T	
Technology objects	
• Total	64 (axes, cams, output cams, measuring inputs, external encoders)
• Axes	32 axes (virtual or real axes)
• Output cams	32 output cams 8 output cams can be output as "high-speed output cams" on the integrated outputs of the Technology CPU. A further 24 output cams can be implemented via the distributed I/Os (e.g. on the ET 200M or ET 200S). These can be implemented as "high-speed output cams" on the TM15 and TM17 High Feature.
• Cams	32 cams
• Measuring inputs	16 measuring inputs
• External encoders	16 external encoders

Technological data of WinLC T on Microbox 420-T	
Technology functions	
• Maximum number of simultaneously active jobs	210
• Maximum number of simultaneously assigned job data compartments	100 The following technology functions each occupy (as long as they are active) one job data compartment: • "MC_ReadPeriphery" • "MC_WritePeriphery" • "MC_ReadRecord" • "MC_WriteRecord" • "MC_ReadDriveParameter" • "MC_WriteDriveParameter" • "MC_CamSectorAdd"

See also

System functions (SFCs) (Page 3-15)

System function blocks (SFBs) (Page 3-19)

Code blocks supported by WinLC T (Page 3-7)

10.2 System status list

10.2.1 Reading the SSL using SFC51

Description

STEP 7 saves write-protected the information about the controller in the system status list (SSL) which is a set of sublists.

Use the SFC 51 (RDSYSST) to access entries in the SSL. You specify the SSL_ID input parameters and the index to access the data records in the sublist. The SFC 51 outputs a header consisting of two words and a sublist or a part of a sublist. The header provides the following information for the sublist:

- The first word defines the length (in bytes) of a data record of the sublist.
- The second word defines the number of data records in the sublist.

The requested information follows the header. The size of the sublist in bytes is data record length multiplied by the number of data records.

Note

The SSL ID and the index values are represented as hexadecimal numbers.

Detailed information about the system status list can be found in the STEP 7 online help or in the *System Software for S7-300/400 System and Standard Functions* reference manual.

WinLC T supports the following SSL entries:

- Module code: 011, 0111, 0F11
- CPU properties: 0012, 0112, 0F12
- Memory areas: 0013
- System areas: 0014, 0F14
- Block types: 0015, 0115, 0F15
- LED status local module: 0019, 0F19
- Component identification: 001C, 011C, 0F1C
- Alarm status: 0222
- Process image partitions: 0025, 0125, 0225, 0F25
- Communications status: 0132. 0232
- LED status: 0174
- DP master system: 0090, 0190, 0F90
- Module status: 0A91, 0C91, 0D91, 0F91
- Module rack and station status: 0092, 0192, 0292, 0692

- Extended DP master: 0195, 0F95
- Diagnostics buffer: 00A0, 01A0, 0FA0
- Module diagnostics: 00B1, 00B3, 00B4

10.2.2 SSL_ID 0x11 (module identification)

0111 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0111	Module-specific information	0001: Order number, module type and version 0007: Firmware version

10.2.3 SSL_ID 0x12 (CPU properties)

0012, 0112, 0F12 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0012	All properties of a module	MC7 processor unit, time system, system response and MC7 language description
0112	A specific Properties group	0000: MC7 processor 0100: Time system 0200: System response 0300: MC7 language description
0F12	Only header information	

10.2.4 SSL_ID 0x13 (memory areas)

0113 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0113	Specific memory area	0001: User memory 0002: Load memory integrated 0003: Load memory installed 0004: Maximum installed load memory 0005: Backup memory 0006: Point-to-point connection (shadow memory)

10.2.5 SSL_ID 0x14 (system areas)

0014, 0F14 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0014	All system memory areas of a module	Size and other parameters for each area in the system memory
0F14	Only header information	

10.2.6 SSL_ID 0x15 (block types)

0015 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0015	All block types of a module	Maximum number and size of each block type

10.2.7 SSL_ID 0x19 (LED status local module)

0019, 0F19 (hexadecimal)

Note

SSL_ID 0x19 supports local non-redundant CPUs. You can only use the SSL_ID 0x19 in conjunction with a redundant H-CPU when the H-CPU is currently in a non-redundant operating state. Use the SSL_ID 0x74 to access information of redundant H-CPUs.

SSL_ID	Sublist	Index and contents of the data record
0019	All LEDs of the local module	State of all LEDs
0F19	Only header information	

10.2.8 SSL_ID 0x1C (component identification)

001C, 011C, 0F1C (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
001C	All information of a component	Controller name, module name, module variable, copyright, serial number, project ID, module type and manufacturer information
011C	Specific element of the component	0001: Name of the controller 0002: Name of the module 0003: Module variable 0004: Copyright entry 0005: Serial number 0007: Module type 0009: Manufacturer and profile identifier 000B: Location identifier (LID) of a module
0F1C	Only header information	

10.2.9 SSL_ID 0x22 (alarm condition)

0222 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0222	Start event for a specific OB	OB number: Start event and time of the requested OB

10.2.10 SSL_ID 0x25 (process image partitions)

0025, 0125, 0225, 0F25 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0025	All process image partitions	Process image partitions for all OBs that have been loaded into the module
0125	Process image partition of a specific OB	Partition number: for the partition of the configured OB
0225	OBs that have been assigned to a specific process image partition	OB number: partition that has been assigned to the OB
0F25	Only header information	

10.2.11 SSL_ID 0x32 (communications status)

0132, 0232 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0132	Specific parameter record	0001: Number and type of the connections 0002: Configured connections 0003: Operator interface 0004: Protection level and position of the mode selector 0005: Diagnostics 0006: Point-to-point status data 0008: Time system 000A: Baud rate
0232	Parameters of a redundant system (H-CPU)	0004: Protection level and position of the mode selector

10.2.12 SSL_ID 0x74 (LED status)

0174 (hexadecimal)

Note

The SSL_ID 0x74 is used to access information for the LEDs of all modules, including redundant H-CPUs. Also refer to SSL_ID 0x19.

SSL_ID	Sublist	Index and contents of the data record
0174	Specific LED	0002: INTF (internal error) 0003: EXTF (external error) 0004: RUN (run) 0005: STOP (stop) 0006: FRCE (force) 0008: BATF (battery failure) 000B: BUSF1 (fault interface 1) 000C: BUSF2 (fault interface 2) 0012: BUSF3 (fault interface 3) 0013: BUSF4 (fault interface 4)

10.2.13 SSL_ID 0x90 (DP master system)

0090, 0190, 0F90 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0090	All DP masters configured in the network and loaded into the module	DP master identification, address and attributes of all DP masters
0190	Specific DP master	DP master identification: Address and attributes
0F90	Only header information	

10.2.14 SSL_ID 0x91 (module status)

0591, 0991, 0C91, 0D91, 0E91 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0591	Module status information for all interfaces of the host module	Irrelevant
0991	Module status information for all interfaces of the host module in the specified module rack	Module rack or ID of the DP master system
0C91	Specific module, defined by the logical base address	Logical base address: Functions and parameters of the specified module
0D91	Specific station, defined by the module rack/station, the DP master identification or the DP master identification with station number	Station identifier: Functions and parameters for all modules of the specified station
0E91	Module status information for all assigned modules	Irrelevant

10.2.15 SSL_ID 0x92 (module rack and station status)

0092, 0192, 0292, 0692 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0092	Expected status of the stations of a DP master	0: local DP master DP master identification: specific DP master
0192	Configuration and activation status of the stations of a DP master	0: local DP master DP master identification: specific DP master
0292	Actual status of the stations of a DP master	0: local DP master DP master identification: specific DP master
0692	OK status of the stations of a DP master	0: local DP master DP master identification: specific DP master

10.2.16 SSL_ID 0x95 (extended DP master system)

0195, 0F95 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
0195	Specific DP master	DP master identification: Properties of the stations of the specified DP master (e.g. DP mode, equidistant mode and cycle, clock synchronization and transmission rate)
0F95	Only header information	

10.2.17 SSL_ID 0xA0 (diagnostic buffer)

00A0, 01A0, 0FA0 (hexadecimal)

SSL_ID	Sublist	Index and contents of the data record
00A0	All entries in the diagnostic buffer	Event information for all events listed in the diagnostic buffer
01A0	Latest entries in the diagnostic buffer	Number: Event information for the specified number of entries in the diagnostic buffer
0FA0	Only header information	

10.2.18 SSL_ID 00B1, 00B3 and 00B4 (module diagnosis)

00B1, 00B2, 00B4 (hexadecimal)

Note

The information is based on the associated module type.

SSL_ID	Sublist	Index and contents of the data record
00B1	Diagnostic information (4 bytes) for a specific module defined by the logical base address	Logical base address: First 4 bytes of the diagnostic information
00B3	All diagnostic information for a specific module defined by the logical base address	Logical base address: Complete diagnostic information
00B4	Specific DP slave defined by the configured diagnostic address	Diagnostic address: Standard diagnostic information for a DP station

ESD guidelines

A

A.1 ESD Guidelines

What does ESD mean?

All electronic modules are equipped with highly integrated modules or components. Based on their design, these electronic components are highly sensitive to overvoltage and thus to discharge of static electricity.

The electrostatic sensitive components/modules are commonly referred to as ESD devices. You can also find the commonly used international designation ESD for electrostatic sensitive device.

Electrostatic sensitive modules are identified by the following symbol:

Caution

Electrostatic sensitive devices may be destroyed by voltages and energies that are undetectable to a human. Voltages of this kind occur as soon as a component or an assembly is touched by a person who is not grounded against static electricity. The damage to a module as a result of overvoltage cannot usually be detected immediately. It may only become apparent after a long period of operation.

Electrical charge

Anyone who is not connected to the electrical potential of their surroundings can be electrostatically charged.

The figure below shows the maximum electrostatic voltages that can accumulate in a person who is operating equipment when he/she comes into contact with the materials indicated. These values correspond with specifications to IEC 801-2.

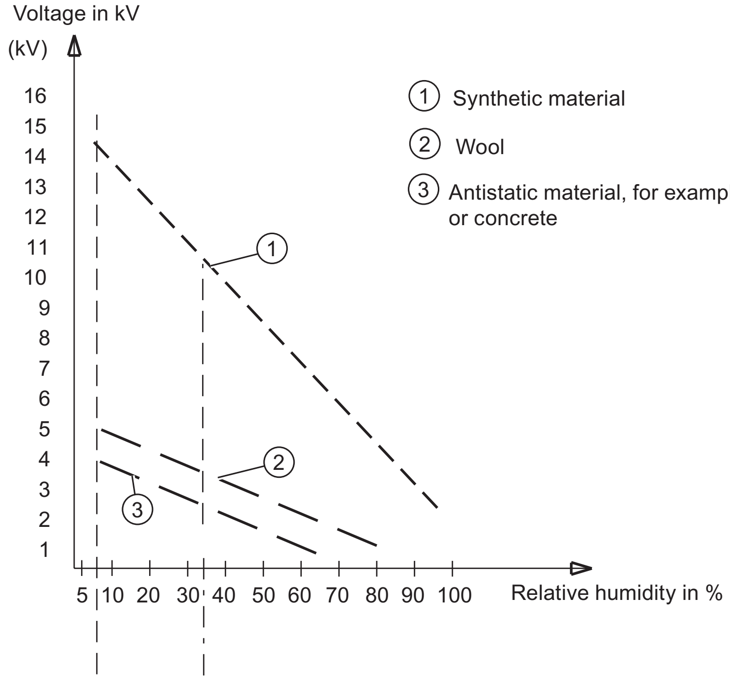


Figure A-1 Electrostatic voltages on an operator

Basic protective measures against discharge of static electricity

- Ensure good equipotential bonding:
  When handling electrostatic sensitive devices, ensure that your body, the workplace and packaging are grounded. This helps you avoid static charge.
-

  As a general rule, only touch electrostatic sensitive devices when this is unavoidable (e.g. during maintenance work). When you touch modules, make sure that you do not touch either the pins on the modules or the printed conductors. This prevents any discharge of static electricity to sensitive component and thus avoids damage.

  Discharge electrostatic energy from your body before you perform measurements on a module. To do so, touch a grounded metallic object. Always use grounded measuring instruments.

List of abbreviations/acronyms

B

B.1 Abbreviations

List of abbreviations

Abbreviation	Term	Explanation
AS	Automation system	
BIOS	Basic Input Output System	Basic Input Output System A set of vital software routines used to perform a hardware test after the startup of a computer, to load the operating system and to provide routines for the data transfer between hardware components.
CE	Communauté Européenne	CE mark
CF	Compact Flash card	
CLK	Clock pulse	Clock signal for controllers
COM	Communications Port	Term for the serial interface
CP	Communication Processor	Communication computer
CPU	Central Processing Unit	Central unit. Core component of the computer; responsible for all data processing routines. The processor receives the relevant data and programs from work memory.
DP	Distributed I/Os	
DOS	Disc Operating System	Operating system without GUI
ESD	Components sensitive to electrostatic charge	
EN	European standard	
EPROM / EEPROM	Erasable Programmable Read-Only Memory / Electrically Erasable Programmable Read-Only Memory	Plug-in submodules with EPROM/EEPROM chips. S5/S7 user programs can be permanently stored on them, for example. This programmed module is then inserted into the prepared slots of the PCs / automation devices / PLCs.
EWF	Enhanced Write Filter	
HMI	Human Machine Interface	User interface
HTTP	Hypertext Transfer Protocol	Protocol for data transfer on the Internet

Abbreviation	Term	Explanation
HW	Hardware	
I/O	Input/Output	Data input/output on computers
IEC	International Electronical Commission	
IP	Ingress Protection	Degree of protection
ISA	Industry Standard Architecture	Bus for expansion modules. PC bus system introduced by IBM in the year 1981; controls data flow between the processor and the interfaces/module cards.
LED	Light Emitting Diode	Light emitting diode
MS-DOS	Microsoft Disc Operating System	Standard PC operating system, a single-user system
PC	Personal Computer	
PCI	Peripheral Component Interconnect	High-speed expansion bus
PCMCIA	Personal Computer Memory Card International Association	Association consisting of approx. 450 member companies of computer industry. Their focus is set on providing worldwide standards for miniaturization and flexible use of PC expansion cards, and thus to provide a basic technology to the market.
PG	Programming device	Compact programming device which meets the special requirements of industry. The PG is fully equipped for programming SIMATIC PLCs.
SID	Security Identifier	Data structure for the clear identification of a device in a network
SOM	Safecard On Motherboard (SOM)	Safecard On Motherboard consists of monitoring blocks on the motherboard, a driver and the SOM program. It provides functions for monitoring various temperatures and program execution (Watchdog).
SW	Software	
WD	Watchdog	Program monitoring with error detection and alarming.
WWW	World Wide Web	
SCC (BeSy)	Cycle control point of the operating system	

Glossary

Application

An application is a program that runs directly on the MS-DOS / Windows operating system. Applications on your PG or PC, for example, are STEP 7, STEP 7-Micro/WIN.

Backup

Duplicate of a program, data carrier or database, used either for archiving purposes or for the protection of vital and non-replaceable data against loss when the working copy is corrupted. Some applications automatically generate backup copies of data files, and manage both the current and the previous versions on the hard disk.

Baud

Physical unit for the stepping rate in signal transmission. Defines the number of transferred signal states per second. With only two states, one baud is equivalent to a transmission rate of 1 bps.

Cache

High-speed access buffer for interim storage (buffering) of requested data.

CE Marking

Communauté Européene (EC label of goods)

Cold start

A start sequence, starting when the computer is switched on. The system usually performs some basic hardware checks within the cold start sequence, and then loads the operating system from the hard disk to work memory -> boot

Communication interface

The PROFIBUS interface or Industrial Ethernet interface integrated in the Microbox T that WinLC T uses for the communication.

Cycle

The cycle includes the writing to the outputs, the reading from the inputs, the execution of the OB 1 and all other OBs and the satisfying of the rest period requirement.

Cycle time

The time needed to execute the complete cycle. The cycle time includes the execution of the OB 1 and the minimum rest period.

Data consistency

A data area is consistent if it can be read or written to from the operating system as a consistent block. Data exchanged collectively between the stations should belong together and originate from a single processing cycle, that is, be consistent.

DP interface

A Siemens CP or a PROFIBUS interface for the PROFIBUS DP communication integrated in the Siemens PC.

ESD directive

Directive for handling **e**lectrostatic **s**ensitive **d**evices.

Ethernet

Local network (bus structure) for text and data communication with a transfer rate of 10/100/1000 Mbps.

Execution load

Percentage of the CPU time used by the controller.

Execution time

The execution time is the actual time that the controller needs to process all commands of the STEP 7 user program once. This also includes the processing of OB 1 and the updating of the inputs and outputs.

Free cycle

The free cycle consists of the basic tasks for priority class 1: writing to the outputs, reading from the inputs, execution of the OB 1 and termination of the rest period requirement before starting the next free cycle. The controller performs these tasks with the lowest internal priority level for the execution of the OBs. (In this case, the priority level applies to the OB priority classes rather than the priority level of the operating system.)

Index

Numbered slot in the PC station or in the virtual module rack that represents a PC-based automation system. The controller occupies an index. Other components can occupy other index slots.

Industrial Ethernet

Physical communications layer for the communication with STEP 7, S7 CPUs, PGs, OPs and S7 applications.

Interface

The connection between individual hardware elements such as PLCs, programming devices, printers or monitors via physical connections (cables).

Interface

The connection between individual hardware elements such as PLCs, programming devices, printers or monitors via physical connections (cables).

Operating system

Summarizing term describing all functions for program execution, allocation of system resources to the various user programs, and for controlling and monitoring consistency of the operating mode in cooperation with the hardware (e.g. Windows Embedded).

Organization block (OB)

Interface between the operating system and the STEP 7 user program. The organization blocks are called from the operating system and control the cyclical and alarm-controlled program execution, the startup behavior of the controller and the error processing.

Password

Unique sequence of characters that is entered for user identification.

PC station

Representation of a software-based virtual module rack that defines a PC-based automation system.

PCMCIA

Personal Computer Memory Card International Association Association consisting of approx. 450 member companies of the computer industry. Their focus is set on providing worldwide standards for miniaturization and flexible use of PC expansion cards, and thus to provide a basic technology to the market.

PG/OP communication

The communication between WinLC T and other S7 applications, such as programming devices, operator panels and S7 automation systems. WinLC RTX supports PROFIBUS and Industrial Ethernet for the PG/OP communication.

PROFIBUS

Process **Fi**eld **Bus** (standard bus system for process applications). Physical communications layer for the PROFIBUS DP communication with inputs/outputs or for the S7 communication with STEP 7, S7 CPUs and S7 applications.

PROFIBUS DP

Protocol for the communication with the distributed IOs in the network.

Recovery CD

Contains the tools for setting up the hard disks and the Windows operating system.

Restart

Warm restart of a computer already in operation without switching off the power supply (Ctrl + Alt + Del).

Retentive memory

A memory area is considered retentive if its contents are retained even after a power loss and transitions from STOP to RUN. The non-retentive area of memory flag bits, timers and counters is reset following a power failure and a transition from the STOP mode to the RUN mode.

Retentive can be the:

- Flag bits
- S7 timers
- S7 counters
- Data areas

S7 communication

Communication using S7 communications functions between hardware and software controllers in the network.

S7 routing

Communication between S7 automation systems, S7 applications or PC stations in various subnets using one or more network nodes that act as router. The configuration is made in NetPro.

Station configuration editor

Tool that can be called from the taskbar for configuring the PC station: In WinLC RTX, this covers the WinLC properties, the assignments of the interfaces and the diagnosis for some DP interfaces.

STEP 7

Programming software for the creation of user programs for SIMATIC S7 controllers.

STEP 7 user program

An application program created with STEP 7 and for execution is loaded into the controller. It includes all organization blocks (e.g. OB 1 or OB 35) and the other code blocks that are called, including functions (FCs), system functions (SFCs), function blocks (FBs) and system function blocks (SFBs).

System function (SFC)

Preprogrammed function integrated as part of the operating system of the controller and not loaded as part of the STEP 7 user program. You can call an SFC in your STEP 7 user program. Like a function (FC), an SFC is a block "without memory".

System function block (SFB)

Function block integrated as part of the operating system of the controller and not loaded as part of the STEP 7 user program. Like a function block (FB), an SFB is a block "with memory". You must also create an instance data block (DB) for the SFB. The instance DB is then loaded as part of the STEP 7 user program into the controller.

Time synchronization

The capability to transfer a standard system time from a single source to all devices in the system so that their clocks can be set to conform to the standard time.

User program

The user program contains all instructions and declarations, as well as signal processing data that can be controlled by the plant or the process. It is assigned to a programmed module and can be structured in smaller units (blocks).

Warm restart

The restart of a computer after a program was aborted. The operating system is loaded and restarted again. The hot key Ctrl + Alt + Del can be used to perform a warm start.

Windows

Microsoft Windows is a multitasking graphical user interface. Windows provides a standard graphical interface based on drop-down menus, windowed regions on the screen, and allows operation with a pointer device such as a mouse.

Windows crash

Failure of the Windows operating system where the severe error is displayed with blue background on the screen. Such a Windows crash is also called a "blue screen".

Work memory

This is a RAM area in the CPU which is accessed by the processor during user program execution.

Index