PC-based automation Migration guide S7-1500 Software Controller

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Table of contents

1 Introduction

This document contains recommendations and notes for users who have previously used SIMATIC WinAC RTX Software Controllers and plan to switch to the new generation, the SIMATIC Software Controller.

The family of new S7-1500 software controllers features a modern system architecture and, together with the TIA portal, offers new and efficient possibilities for programming and project planning.

Detailed information about the family of S7-1500 software controllers can be found at the following link:

- Product page[1]

Further product information about the CPU 1507S from the S7-1500 Software Controller family can be found at the following link:

- Industry Mall[2]

1.1 Purpose of the document

The aim of the document is to support plant migration to a modern software controller. It deals with the most important questions that arise in this context.

Migration refers to the conversion of software and hardware as well as the transfer of data from one environment to another, making extensive use of existing technological infrastructure. Migration goes beyond a simple update or upgrade to a fundamental system change.

The following sections show you the differences between the two software controller families, arranged according to topic areas "S7-1500 Software Controller" and "WinAC RTX".
The document supports you in finding the right configuration for your system.

1.2 Validity

- SIMATIC WinAC RTX → SIMATIC S7-1500 Software Controller
- SIMATIC STEP 7 V5.x → SIMATIC STEP 7 (TIA Portal) from V13 SP1
- SIMATIC WinCC flexible 2008 (Engineering & Runtime) → SIMATIC WinCC Advanced (TIA Portal) (Engineering & Runtime) from V13 SP1

[1] http://w3.siemens.com/mcms/programmable-logic-controller/de/software-controller/s7-1500-software-controller/Seiten/Default.aspx

[2] https://mall.industry.siemens.com/mall/ww/en/Catalog/Products/10268313

1.3 Delimitation

- The migration from SIMATIC ET 200S/S7-300/S7-400/S7-1200 to S7-1500 is not covered in this guide.
  Information on these migration paths can be found under entry ID 109478811[3] and 67121011[4].
- This document does not claim to show all conceivable system constellations and SIMATIC components used.

1.4 Additional information

This document will indicate relevant points in the literature.
The connected entries will delve deeper into the corresponding subjects or offer support via examples and example programs.

1.4.1 STEP 7: S7-300/S7-400 to S7-1500/S7-1500 Software Controller

Migration guide

- "Migration guide SIMATIC S7-300/400 to S7-1500"[3].

When migrating from WinAC RTX projects to S7-1500 software controllers, the same conditions apply as when migrating from S7-300/400 projects to S7-1500. Currently there is the restriction that no automatic migration from WinAC RTX to S7-1500 Software Controller can be performed.

Application example

- "PC-based Automation: Simple migration[4] from S7-300/S7-400 projects to S7-1500 Software Controller or WinAC RTX in TIA Portal".

It describes how an S7-300/S7-400 and HMI Panel is manually exchanged with the Open Controller (S7-1500 Software Controller) and the visualization software WinCC Runtime Advanced. For the S7-300/400 you can envision a WinAC RTX. The general procedures are transferable.

1.4.2 HMI: WinCC flexible to WinCC Advanced

Migration guide

- "Migration guide[5]; Support for the migration from WinCC flexible to WinCC (TIA Portal)".

Application example

- "PC-based Automation: Simple migration[4] from S7-300/S7-400 projects to S7-1500 Software Controller or WinAC RTX in TIA Portal".

  In the HMI section of the application example, an example of a WinCC flexible project is migrated to WinCC Runtime Advanced.

[3] https://support.industry.siemens.com/cs/ww/en/view/109478811
[4] https://support.industry.siemens.com/cs/ww/en/view/67121011
[5] https://support.industry.siemens.com/cs/ww/en/view/77430539

2 Migration aspects

2.1 10 good reasons for a migration to SIMATIC S7-1500 Software Controller

Table 2-1 Reasons for migration

	**Modern system architecture** Hard real-time capability, high availability and stability with maximum independence from the operating system
	**Safety and liability** Integrated know-how protection against unauthorized access and manipulation
	**Comfortable** Engineering in the TIA Portal - no Windows settings are necessary on the Controller.
	**Scalability** Easy implementation of various performance and functional requirements
	**High range of functions** The range of functions was based on the S7-1500 Advanced Controllers - motion functions, system diagnostics and security are already integrated. It is fully compatible with S7-1500 Advanced Controllers.
	**Integrated Web server** Remote access to the controller, even if Windows fails
	**Effective Retrofits** Optional hardware upgrades to increase performance and productivity; long-term availability over 4 to 6 years (plus 5 years spare parts); competitive advantage through early availability of the latest technologies
	**High productivity** High performance in terms of communication, system response and data processing: → significant reduction of tact times through direct screen processing integration → Complex regulations with high data influx can be easily realized
	**Integrated technology functions** • Time saving due to ready-to-use modules for the connection of PC applications (optional) → no high-level language knowledge required • Intuitive STEP 7 function blocks for the integration of high-level languages - reuse of existing high-level language codes without further knowledge
	**Standardization** • Open Development Kit (ODK 1500S) including development environment for user-specific real-time applications • Script-controlled operation of the Software Controller

2.2 Document contents

The migration of a plant is divided into several individual aspects, which must be considered in advance so that the migration of the entire plant can be completed quickly and successfully:

The migration of an installation is divided into several individual aspects. These must be examined in detail in advance so that the migration of the entire system can be completed quickly and successfully.

Table 2-2 Focus: Migration

Migration of projects and the engineering system	Section 7
• Shows the necessary steps to migrate a WinAC RTX project from STEP 7 V5 to a S7-1500 Software Controller project in the TIA Portal. • Shows additional program functionalities in STEP 7 (TIA Portal). • Shows differences in the ODK programming.	
Hardware migration	Section 4.6
• Clarifies whether existing PC hardware needs to be replaced and helps to select suitable IPC hardware. • Clarifies whether existing peripheral hardware needs to be replaced. • Clarifies the connection of the hardware periphery to the TIA Portal.	
HMI migration	Section 9
• Shows the migration of an HMI project from WinCC flexible to WinCC Advanced (TIA Portal).	
Software compatibility and dependencies during migration	Section 4.4
• Shows effects that must be considered when switching from a 32 bit to a 64 bit operating system.	
Loading and operating S7-1500 Software Controllers	Section 5 & 6
• Introduces the changes in loading, booting, and operating the S7-1500 software controller compared to the WinAC RTX.	

Table 2-3 Focus: new functionalities

System architecture of the software controller	Section 3 & 4.2
• Shows the difference between the architecture of the WinAC RTX Software Controller and the modern S7-1500 Software Controller. • Represents the features and benefits resulting from the changed architecture. • Shows changes regarding the necessary additional software.	
Selecting the suitable Software Controller	Section 4.3
• Shows the performance spectrum and areas of application of the new S7-1500 Software Controller.	
Technology and motion functions	Section 8
• Introduces newly available, already integrated technology components and motion functions.	
Diagnosis	Section 11
• Shows the available diagnostics options.	
Communication structure	Section 10
• Shows differences and innovations regarding the communication functions.	

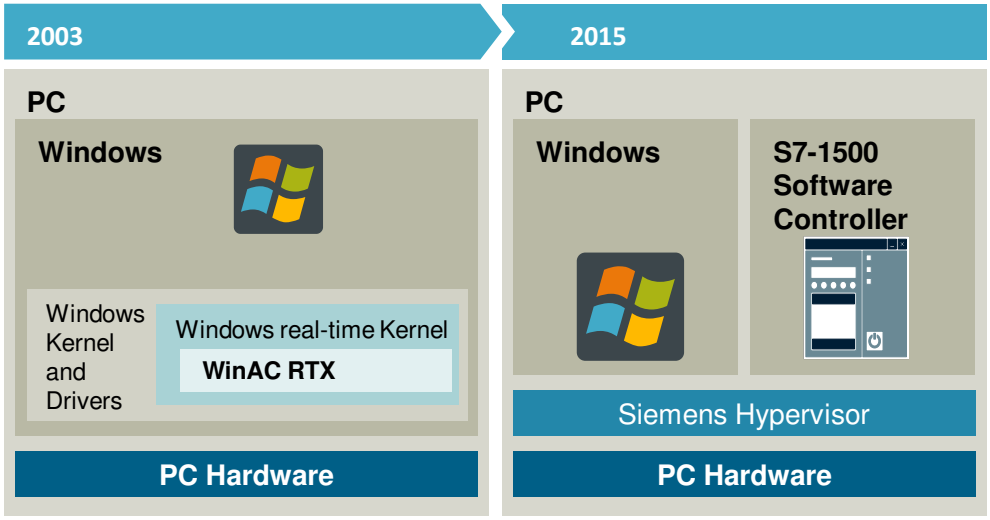
3 System architecture S7-1500 Software Controller and SIMATIC WinAC RTX

3.1 New technology: Siemens Hypervisor for the SIMATIC S7-1500 Software Controller

The Siemens Hypervisor is a technology that allows you to run the S7-1500 software controller directly on the hardware of the PC system and not as before, under the Windows real-time driver as a program in Windows.

The hypervisor lies as a layer between the operating system and the controller directly "on the hardware". It is therefore also referred to as a bare metal hypervisor.

Figure 3-1 PC system architectures



The Siemens Hypervisor allocates the hardware resources of the device and assigns a defined portion exclusively to the software controller. Windows and Windows applications have no access to these resources.

3.2 New architecture properties

Hard real-time

The Siemens hypervisor reserves for the S7-1500 software controller a fixed part of the hardware of the PC system. This enables hard real-time communication without additional software.

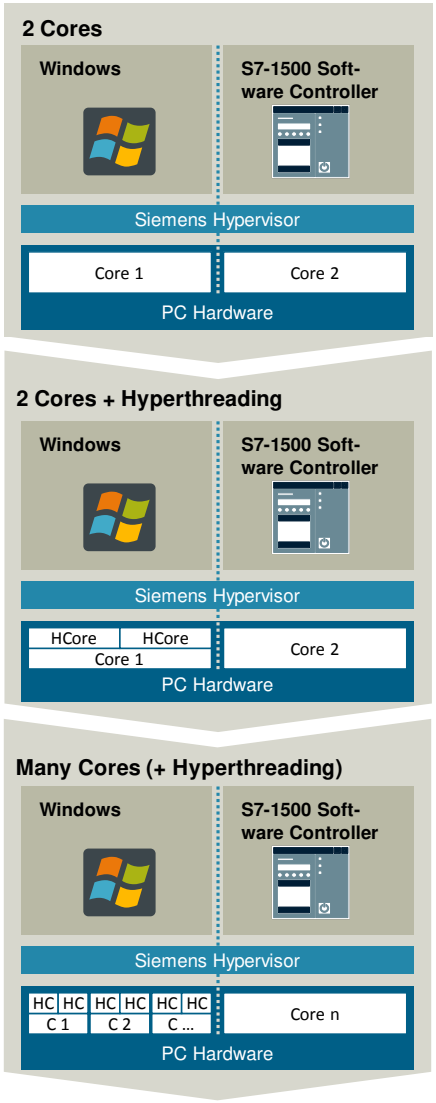
In addition, the performance of the controller cannot be impaired by Windows hardware requirements, since the operating system only recognizes the unreserved part of the hardware as available resources.

Reserved hardware: 1.3 GB RAM, 1 core of the CPU, and exclusive access to the PROFINET and PROFIBUS fieldbus interfaces.

Since the Siemens hypervisor reserves a core of the CPU for the software controller, a dual-core processor is the minimum requirement for the PC system.

Further cores are available in the Windows operating system. Hyperthreading allows multiple virtual processors to be used on a dual-core processor on the Windows side, even with only one core remaining.

Figure 3-2 Hyperthreading & Mulitcore



Independence from operating system

The S7-1500 Software Controller is independent from the operating system status due to the system architecture.

- during updates
- during restart
- during login
- during configuration
- during unexpected errors/ failures (blue screen, freezing, among other things)

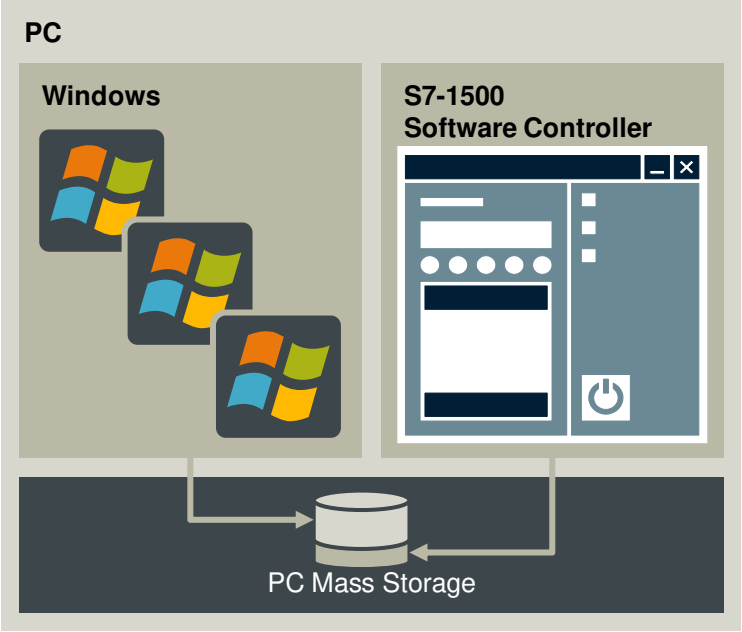
The software controller continues to run independently as long as the system is supplied with power.

This leads to improved availability and stability of the S7-1500 Software Controller - downtime is avoided.

Secure data management

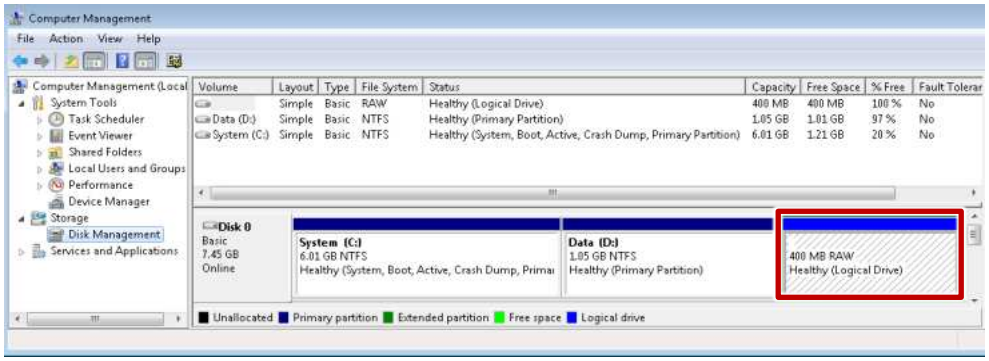
The data storage of Windows and S7-1500 Software Controller is done on separate partitions. This results in the best possible data integrity and prevents unauthorized modifications.

Figure 3-3 Separated data storage



For CPU 1505SP (FT) and CPU 1507S (F) the size of the reserved memory area is 400MB. This area is encapsulated by the hypervisor so that the operating system cannot access it. This protects the data from unauthorized access, for example via the network.

Figure 3-4 Reserved area: View in Windows



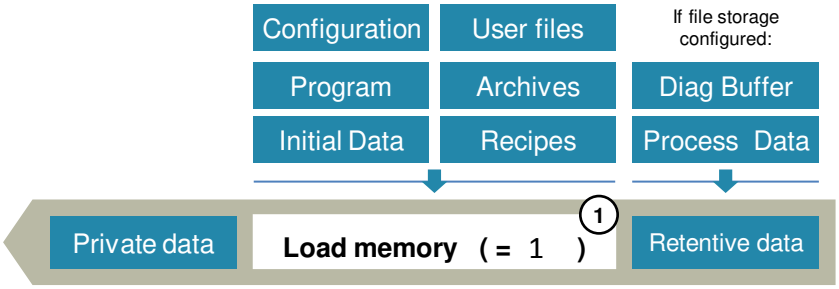
320 MB of it function as load memory (1), which contains the S7 program - with a standard SIMATIC S7-1500 CPU this would correspond to the area on the memory card.

For the CPU 1508S (F) the reserved memory is 1GB.

Table 3-1: Reserved storage in the overview

CPU	CPU volume
CPU 1505SP (FT)	400MB
CPU 1507S (F)	400MB
CPU 1508S (F)	1GB

Figure 3-5 Distribution of the reserved area:



The S7 program is loaded directly from the TIA portal into the software controller.

These measures result in know-how protection for the machine builder and access protection for the end user.

Extended write protection for Windows operating system

The extended write protection EWF[6] (**E**nhanced **W**rite **F**ilter) is a fixed component on SIMATIC IPCs for Windows 7 embedded operating systems or UWF[7] (**U**nified **W**rite **F**ilter) for Windows 10 operating systems. The EWF or UWF prevents write access to protected drives or partitions and is deactivated on delivery.
It is recommended that you protect your image after setting up your system with EWF/ UWF enabled. Please take note of the Table 3-2.

The "write protection" is implemented by redirecting to an "overlay". Modified or written data is only temporarily buffered in the overlay. Changes are lost when the system is restarted.

This prevents unintentional changes, protects against viruses and manipulation attempts. However, the EWF or UWF does not replace a complete antivirus program in 24/7 operation.

[6] https://www.youtube.com/watch?v=xpoHgPDtCKo
[7] https://support.industry.siemens.com/cs/ww/en/view/109475014

Note

Deactivate all write accesses to the protected partition (e.g. by log files, recipes, etc.) in order to avoid runtime-induced increased memory consumption.

If the EWF/UWF is active, the paths for configuration and program of the SIMATIC S7-1500 software controller must be set to a partition not protected by the write filter. If the write filter is active, it is no longer possible to load the software controller or other configurations (e.g. WinCC) on the device.

The following table gives an overview of the download options for the S7 program and the hardware configuration when write protection is activated or deactivated.

Table 3-2 EWF/ UWF write protection

EWF/ UWF (write protection)	Download content	Download target	
		WinAC RTX	S7-1500 Software Controller
Enabled (Partition protected)	S7 program	The download is possible, **but** the data is always lost during a Windows restart, because the S7 program was located in the EWF RAM.	The download is possible the data is **not** lost during a restart, because the S7 program is saved in the separate reserved partition.
Enabled (Partition protected)	Hardware configuration	Download is not possible.	Download is not possible.
Disabled (Partition not protected)	S7 program	Download is possible.	Download is possible.
Disabled (Partition not protected)	Hardware configuration	Download is possible.	Download is possible.

Secure communication

The SIMATIC communication architecture ensures transparent and secure communication between the software controller and the Windows applications:

- Local communication between the Software Controller, HMI or other Windows applications.
- Controlled "access" to PN and DP devices with HMI or TIA portal
- Communication with external partners via Windows interfaces (TIA Portal, HMI, TCP/UDP, Web)

More detailed information on this topic can be found in section 10 Communication.

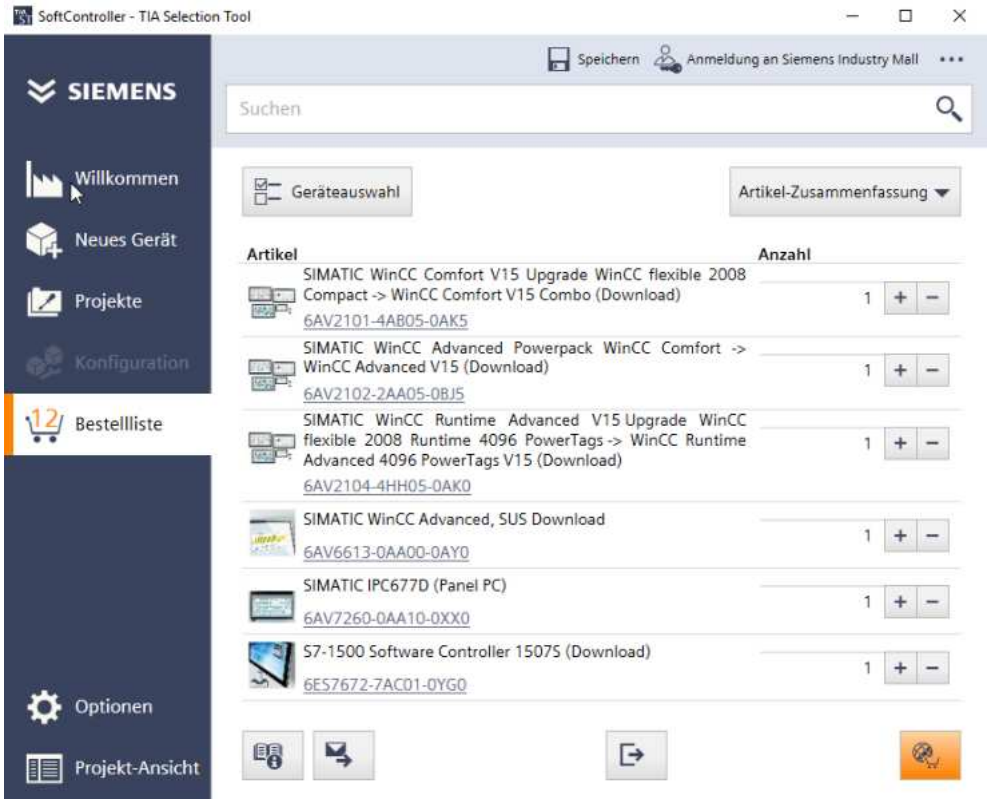
4 Selection of the suitable Hardware and software

In this section you will find information and help on selecting suitable hardware and software and on migrating peripheral hardware to the TIA Portal.

4.1 Compiling the hardware and software:

The TIA Selection Tool[8] supports the selection of hardware and software and conveniently lists all selected articles with article numbers.

Figure 4-1: Selection of the hardware and software in TST



You can save the configurations, export them, or use them directly in the Industry Mall.

[8] http://www.siemens.de/tia-selection-tool

The TIA Selection Tool[4] detects inappropriate configurations and suggests the necessary changes.

Figure 4-2: Configuration check negative: Tool shows the improvement suggestion

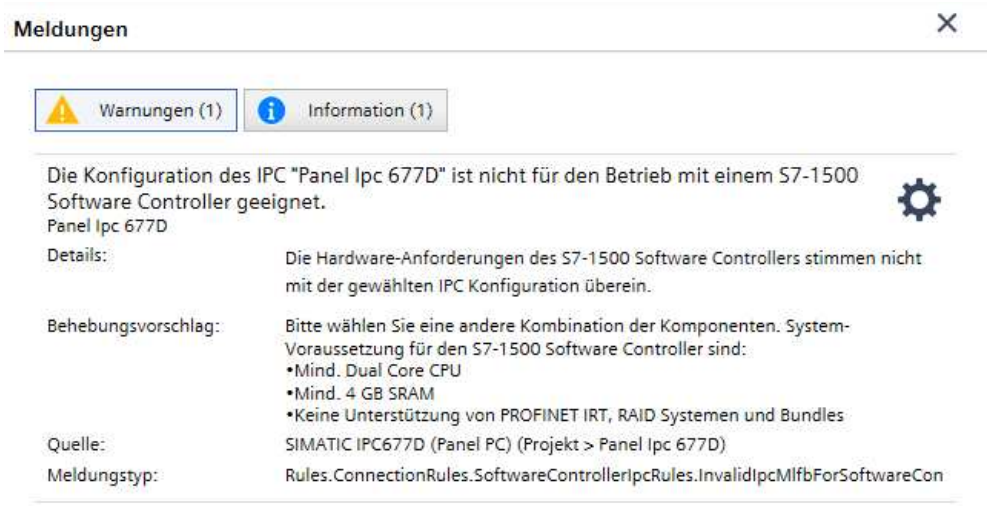
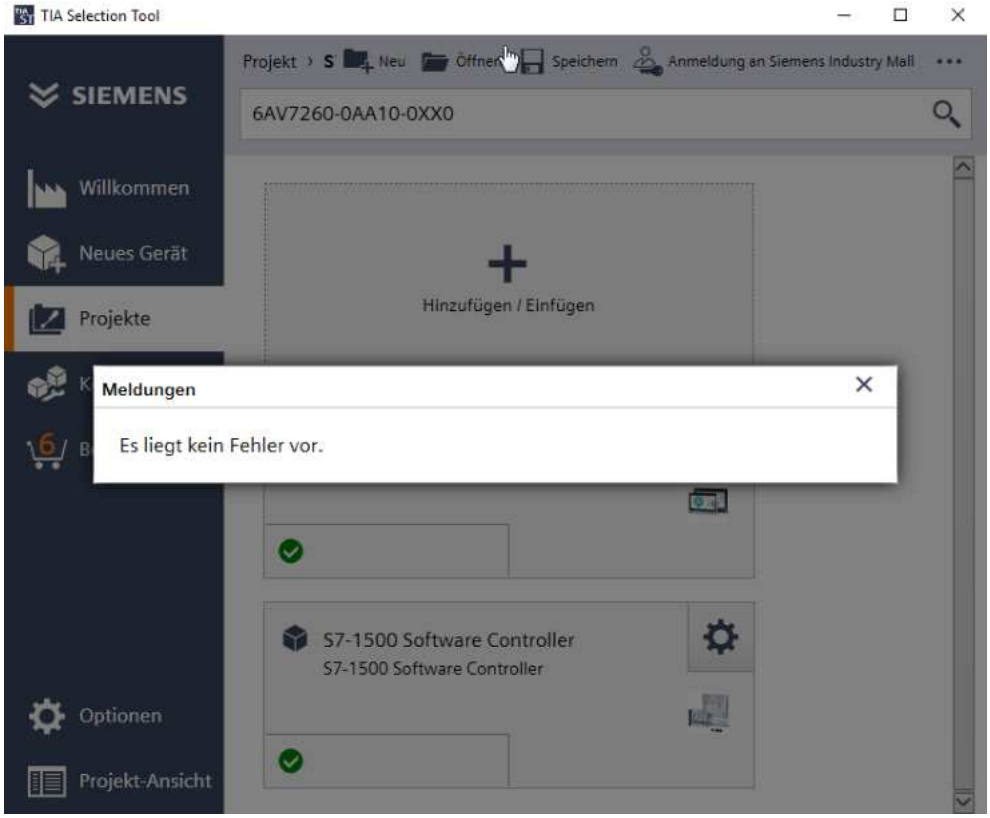


Figure 4-3: Configuration check successful



When selecting new HMI software, existing HMI software and licenses are also taken into account. The TIA Selection Tool[4] supports the migration of HMI licenses and suggests the most cost-effective variants.

All preconfigured bundles of hardware and software are also available.

4.2 Required software

The following table shows that no additional software is required for the SIMATIC S7-1500 Software Controller.

Table 4-1: Required software

WinAC RTX	S7-1500 Software Controller	Description
Windows **L**ogic **C**ontroller WinLC RTX [R]	S7-1500 Software Controller	The actual software of the software controller.
IntervalZero RTX [R]	×	RTX (**R**eal **T**ime e**X**tensions for Windows) is a real-time extension developed by IntervalZero. The WinAC RTX Software Controller runs in this "real-time core".
WinAC Time Synchronization [R]	×	Setting the Time Synchronization.
SIMATIC NET PC Software [R]	×	S7 communication via Ethernet, OPC Server
SIMATIC WinCC Flexible 2008 [E]	SIMATIC WinCC Advanced (TIA Portal) [E]	Engineering System HMI
SIMATIC WinCC Flexible 2008 Runtime [R]	SIMATIC WinCC Runtime Advanced (TIA Portal) [R]	HMI Runtime
STEP 7 V5.5 [E]	SIMATIC STEP 7 (TIA Portal) [E]	Engineering System control
Automation License Manager [R, E]	Automation License Manager [R]	Management of the license keys.

[R] Required/optional software on the Runtime PC (operator station)

[E] Required/optional software on the engineering PC

SIMATIC IPCs can partly be pre-installed and ordered ready to switch on in a bundle[9] with WinCC RT Advanced.

[9] https://w3.siemens.com/mcms/pc-based-automation/de/embedded-bundles/Seiten/Default.aspx

4.3 Selecting the suitable Software Controller

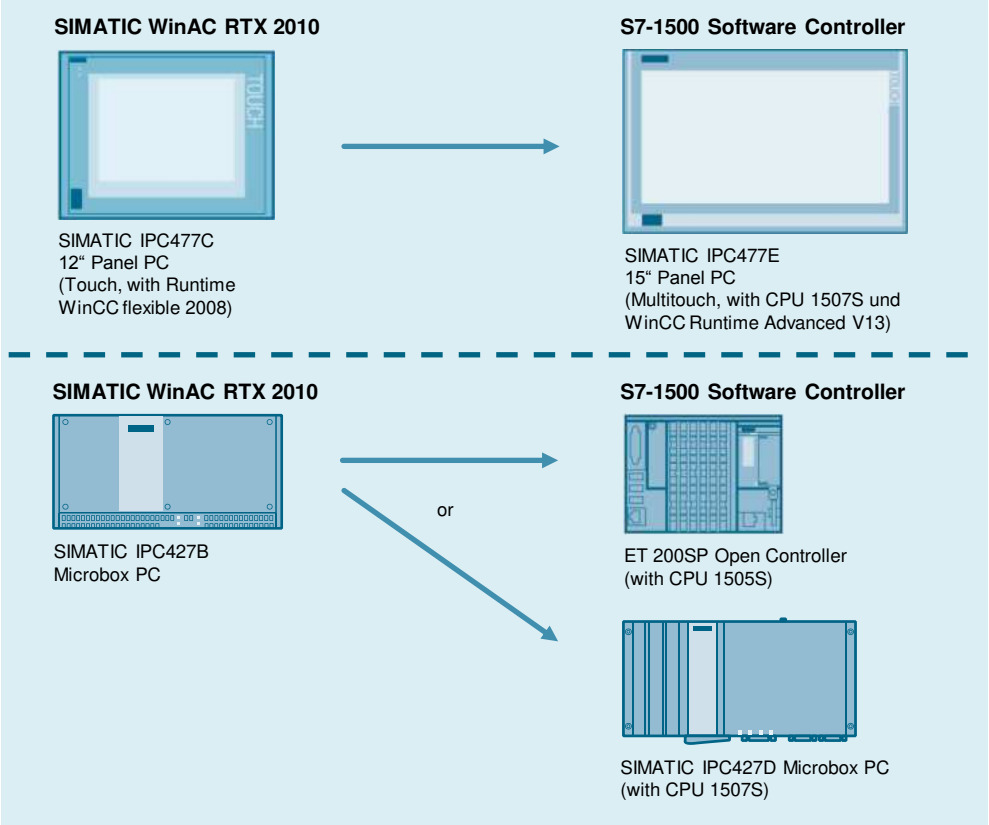
The requirements for the control system and the IPC hardware differ depending on the area of application.

In this section you will find an introduction to the SIMATIC software controller portfolio.

The S7-1500 software controller makes the advantages of a S7-1500 controller available on high-performance industrial PCs.

Depending on the application, the volume, real-time capability or low power consumption of the IPC may be of greater interest.

Figure 4-4 Migration example scenarios



The S7-1500 Software Controller can be used with IPCs of various configurations and performance classes.

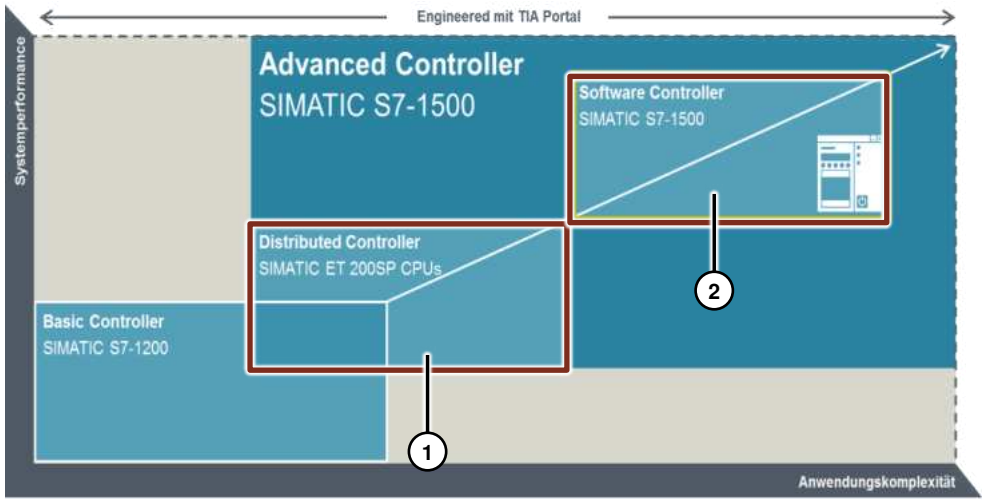
Depending on the performance range, migration to different software controllers is possible.

4.3.1 Performance range

Each machine or system has individual system performance and memory requirements. With its extensive range of controllers, Siemens offers you the right control solution for every application.

- Basic Controller S7-1200 for simple and stand-alone applications
- Advanced Controller S7-1500 for medium and complex applications
- Distributed Controller ET 200SP for distributed applications (1)
- Software Controller S7-1500 for PC-based applications (2)

Figure 4-5: Performance range controller



The functional range of the WinAC RTX software controller is comparable to that of the S7-300/S7-400 controllers.

The functional range of the S7-1500 Software Controller is comparable to the functional range of the Advanced S7-1500 Controllers.

The most important innovations of Advanced S7-1500 controllers compared to S7-300/S7-400 controllers:

- Communication via Ethernet
- Communication via PROFIBUS/PROFINET
- HMI communication
- Integrated web server
- Integrated technology
- Integrated system diagnostics
- Integrated industrial security functions
- Safety mode (all S7-1500 Hardware CPUs are also available as F variants)
- Fully symbolic programming
- Integrated motion functionality with CPU 1505SP T

When using the S7-1500 software controller, machines are easily scalable, i.e. different versions of a machine can be easily implemented.

4.3.2 Medium performance range CPU 1505SP

The SIMATIC ET 200SP Open Controller CPU 1515SP PC/ SIMATIC ET 200SP Open Controller CPU 1515SP PC2 is a controller consisting of the software controller CPU 1505SP and hardware in the size of an ET 200SP controller.

It therefore belongs to the portfolio of distributed controllers. (See Figure 4-5). The SIMATIC ET 200SP Open Controller is the first controller of this type to combine the functions of a PC-based software controller with the functionality of a S7-1500 CPU, Windows applications and central I/Os (input/output) in a compact device.

The ET 200SP Open Controller is suitable for use in series machine construction, for example, due to the following advantages:

- **Compact**
  Space-saving installation, no large control cabinet required.
  Over 30% space saving compared to comparable systems.
- **Distributed architecture**
  Distributed Controllers are suitable for machines with distributed architecture. The transfer of intelligence from the central control cabinet to distributed controllers at the individual stations has a positive effect on the availability of a system. If a fault should occur at a station, this can be remedied without the entire system coming to a standstill.
- **Clock synchronicity**
  ET 200SP Open Controller supports IRT (Isochronous Real-Time) in the transmission of real-time data via PROFINET.
- **Motion Control**
  Standard Motion Control for CPU 1505SP, CPU 1507S, CPU 1508S and extended Motion Control with CPU 1505SP T available, such as gear synchronism and cam plate synchronism.
- **Expandability**
  - Simple, modular extension with ET 200SP modules.
    Single-line design with up to 64 modules (with an extensive range of fine-granular I/O modules, technology and communication modules).
  - Thanks to the I-Device functionality[10] , the connection to a higher-level CPU can be carried out in exactly the same way as with a standard interface module. The ET 200SP station is characterized by an interference-insensitive design thanks to short signal and encoder wiring and low wiring effort.
  - The CPUs support additional functions such as PROFIenergy, clock synchronicity, configuration control (option handling) and DP master.
  - PROFINET onboard: The exchangeable bus adapter enables flexible connections
  - The available Windows memory space (not to be confused with the memory space for the STEP 7 project) can be extended by an external storage medium (SD card).
- **Robustness**
  - Continuous operation is possible at an ambient temperature of up to 50°C or 60°C without power loss (depending on the mounting position).
  - The fanless design reduces the maintenance effort considerably.

[10] https://w3.siemens.com/mcms/automation/en/industrial-communications/profinet/Documents/articles/de/profinet-innovations-2010-2.html

- The CPU 1515SP PC/ CPU 1515SP PC2 is designed for weatherproof, stationary use. The operating conditions exceed the requirements of DIN IEC 60721-3-3:
  - Class 3M3 (mechanical requirements)
  - Class 3K3 (climatic requirements)
- Thanks to short wiring, the module has a high EMC compatibility and is also insensitive to vibration and shock loads.
- Further information and technical data can be found at Manual "SIMATIC ET 200SP Open Controller CPU 1515SP PC"[11].

4.3.3 Top performance range CPU 1507S/ CPU 1508S

The S7-1500 software controller makes the advantages of a S7-1500 controller available on high-performance industrial PCs.
This means that you benefit from the highest possible user-friendliness and scalable system performance.

For efficient engineering, use the Totally Integrated Automation (TIA) Portal. S7-1500 software controllers are very suitable for use in special machine construction due to the simple connection of technology modules and software applications.

The CPU 1507S/ CPU 1508S can be used on all SIMATIC IPCs that meet the system requirements. However, hard real-time can only be guaranteed when used on SIMATIC IPCs.

The CPU 1507S runs on IPCs of the following series regardless of whether it is a Nano, Rack, Box or Panel PC:

- IPC2x7
- IPC4x7
- IPC6x7
- IPC8x7

The CPU 1508S runs on IPCs of the following series regardless of whether it is a rack, box or panel PC:

- IPC4x7
- IPC6x7
- IPC8x7

The software controller can be migrated to existing hardware, provided that the processor has at least two cores and the other system requirements are met. However, it is recommended that you check whether there are any advantages to upgrading the hardware:

- Modernized components → Higher performance for more demanding programs
- Reduced power consumption → Reduced maintenance costs
- Better cooling → Higher performance at lower noise level

[11] https://support.industry.siemens.com/cs/ww/en/view/109248384/71288553995

Note IRT functionality (Isochronous Real-Time/Clock Synchronity) is currently supported by the CPU 1507S/ CPU 1508S with the SIMATIC CP 1625.

4.3.4 Range of functions

The available S7-1500 software controller versions differ in the quantity structure.

- The scope of the respective motion functions can be found in sectionMotion Control.
- Table 4-2 shows a comparison of the available standard and software controllers (blue) in terms of memory space and performance.

Table 4-2 Memory space for the control program / data; performance

	CPU 1511	CPU 1513	CPU 1515	CPU 1516	CPU 1505SP (F)(T)	CPU 1517	WinAC RTX*	CPU 1518	CPU 1507S (F)	CPU 1508S (F)
Program memory	150 KB	300 KB	500 KB	1MB	1MB (1.5MB)	2MB	≥4MB	4MB	5MB (7.5MB)	10MB (12.5MB)
Data storage	1MB	1.5MB	3MB	5MB	5MB	8MB	≥4MB	20MB	20MB	100MB
Bit-Perfor-mance	60ns	40ns	30ns	10ns	10ns	2ns	~4ns	1ns	1ns	1ns

* Values depend on the host system

4.4 Compatibilities and dependencies

4.4.1 Compatible operating systems

The WinAC RTX software controller is approved exclusively for 32-bit operating systems.

With the new S7-1500 software controllers, 64-bit versions of Windows can also be used.

4.4.2 Advantage of 64 bit over 32 bit operating systems

With 32 bit systems, the use of the working memory results in the so-called "4 GB limit". Due to the architecture it is not possible to address more than 232 bytes (which corresponds to about 4 GB) with 32 bit systems.

With 64 bit systems this limit is omitted. The theoretically addressable RAM here is 264 bytes (which corresponds to over 18 million terabytes).
The actual usable memory depends on the processor architecture and the operating system used.

The maximum usable memory for 64 bit systems is for example

- in Windows 7 Home Basic 8 GB,
- in Windows 7 Home Premium 16 GB,
- in Windows 7 Professional/Ultimate/Enterprise 192 GB,
- in Windows 10 Enterprise 2016 LTSB 512GB

4.4.3 Compatible operating systems for SIMATIC WinCC Runtime Advanced/Professional

Follow the link to find the approved operating systems[12] for SIMATIC WinCC Runtime Advanced V15.1.

The system requirements for the S7-1500 Software Controller and WinCC Runtime Advanced are met by all SIMATIC IPCs with a dual-core processor or higher.

Use the "TIA Selection Tool"[13] to easily create compatible configurations.

4.4.4 Choice of boot mode

To operate the S7-1500 Software Controller, the operating system must be installed in legacy boot mode. The UEFI boot mode is not supported at this time.

4.4.5 Use of the Failsafe functionality

For S7-1500 software controllers with failsafe functionality, the IPC must be equipped with NVRAM or buffered SRAM.It is not possible to retrofit the NVRAM or SRAM.

[12] http://www.industry.siemens.com/topics/global/de/tia-portal/hmi-sw-tia-portal/wincc-tia-portal-rt/Seiten/default.aspx?tabcardname=systemanforderungen
[13] http://www.siemens.de/tia-selection-tool

4.5 Selection of suitable IPC hardware

The requirements for the control system differed depending on the area of application. The following overview will help you to select a suitable configuration.

- **Rack PC**
  Rack PCs are flexible, high-availability industrial PC systems for powerful yet compact applications using 19" technology.
- **Box PC**
  SIMATIC Box PCs provide mechanical engineers, plant engineers and control cabinet makers with particularly rugged industrial PC systems for use in powerful yet compact applications.
  Differentiation: Nanobox PC, Microbox PC, Box PC
- **Panel PC**
  SIMATIC Panel PCs (multitouch-capable all-in-one devices) are suitable for use in control cabinets, consoles and control panels as well as directly at the machine due to their high industrial suitability. Typical areas of application can be found in both factory and process automation.
- **Industrial monitors**
  The SIMATIC Industrial Flat Panels (IFP) are fail-safe and durable, multitouch-capable industrial monitors in an industrial design.

More detailed information on SIMATIC industrial PCs can be found under the following links:

- Industry Mall[14]
- Product page[15]

[14] https://mall.industry.siemens.com/mall/de/de/Catalog/Products/5109999
[15] https://new.siemens.com/global/en/products/automation/pc-based.html

4.6 Migrating peripheral hardware into TIA Portal

In addition to the migration of the software controller, it must be considered whether the existing peripheral hardware is compatible with the TIA portal and, if not, which changes must be made before the migration of the system.

4.6.1 Hardware Compatibility Checking Tools

Readiness Check Tool TIA Portal

Use the "Readiness Check Tool TIA Portal"[16] to check whether existing hardware in projects is supported by the TIA Portal.

The tool is usable for STEP 7 V5.4, STEP 7 V5.5, WinCC V7 and WinCC flexible 2008.

TIA Selection Tool

The "TIA Selection Tool"[17] allows you to assemble the complete hardware and check the configuration for compatibility.

4.6.2 GSD/HSP files for the connection of further products

If your hardware is not listed in the tools described above, GSD files (Device Description Files) or HSP files (Hardware Support Package Files) may be available that allow the product to be connected to the TIA Portal.

Storage locations for GSD/HSP files

- If you use GSD files in the STEP 7 project you want to migrate, you will find them in the installation directory of STEP 7, by default under "C:\Programs\SIEMENS\STEP 7\S7DATA\GSD".
- It is possible that the GSD/HSP files you are looking for are also available online as product-specific downloads.
  - Open the Product Support[18] of the Siemens Industry Online Support.
  - Enter "Download" as the filter criterion in the "Contribution type" selection.
  - Enter the article number or the name of your product in the search or select your product in the product tree.
- Open the entry "Support Packages[19] for the Hardware catalog in the TIA Portal (HSP)"

[16] https://support.industry.siemens.com/cs/ww/en/view/60162195
[17] http://www.siemens.de/tia-selection-tool
[18] https://support.industry.siemens.com/cs/ww/en/ps/dl
[19] https://support.industry.siemens.com/cs/ww/en/view/72341852

Installation of GSD / HSP files

Note Install required GSD files **before** migrating the project.

Installation of GSD files:

- In the TIA Portal, click "Extras> Manage Device Description Files (GSD)".
- Select the storage location of your GSD file(s) as the source path.
- Select the GSD file(s) and click "Install".

Installation of HSP files:

- In the TIA Portal, click "Extras > Support Packages".
- Click on "Add from the file system" or on "Download from the Internet".
- Select your HSP file and confirm your selection.
- Select the HSP file and click "Install".

For more information on installing GSD files, see the Manual[20].

4.6.3 Migration of the periphery

The peripheral hardware is part of the hardware configuration.
If all devices configured in the STEP 7 V5.x original project are compatible (or the corresponding GSD/HSP files have been installed), it is automatically upgraded when the STEP 7 V5.x original project is migrated to the TIA portal.

Information on migration from STEP 7 V5.x to STEP 7/TIA Portal) can be found in section 7.1 General information on migration.

[20] https://support.industry.siemens.com/cs/ww/en/view/109755202

5 Configuration of the software controller

5.1 Advantages of the S7-1500 Software Controller

Easy configuration of the S7-1500 Software Controller

On an IPC with S7-1500 software controller, the hardware configuration no longer has to be set with the component configurator.

The complete hardware configuration is only parameterized with the TIA Portal and downloaded to the IPC. This has the following advantages:

- Simple and intuitive hardware parameterization in the TIA Portal:
  - Configuration of the start-up mode of the software controller
  - Storage location for remanent data
  - Set up copy protection
  - Use hardware LEDs
  - Configuring the web server
  - Assigning Interfaces for Communication
  - Use open communication via Windows interface
  - Time synchronization with Windows clock
  - Using Uninterruptible Power Supply (UPS)
  - For CPU 1505SP T: Extended Motion Control
- No additional configuration at the IPC necessary
- Reduction of error sources during configuration

5.2 Configuration and loading via TIA Portal

Configuration and Loading Using the Example of the SIMATIC ET 200SP Open Controller

The following description gives you an overview of the necessary steps to configure a SIMATIC ET 200SP Open Controller with installed CPU 1505SP.

- Open the TIA Portal.
- Insert a SIMATIC ET 200SP Open Controller CPU 1515SP PC as new device. Select the variant you have with or without HMI Runtime.
- In the device view you have the possibility to add peripherals or communication modules from the HW catalog.
- By default, the Open Controller is configured with the bus adapter type RJ45. If you are using the FC (Fast Connect) bus adapter, navigate to the respective bus adapter in the hardware catalog and replace it in the Open Controller.
- Finally, insert a server module into the configuration.
- In the Inspector window you can set the hardware settings of the Open Controller, e.g.:
  - IP address of the X2 interface (Windows)
  - IP address of the bus adapter X1 (CPU 1505S)
- Click on the CPU 1505SP to make settings in the Inspector window. For example,
  - Startup
  - Cycle
  - System diagnosis (activated by default)

- Web server
- Display
- Time synchronization
- Access protection
- Hardware LED (Only with SIMATIC IPC)
- Retentive memory

- After the configuration you can perform the first loading into the device.

Note

Prerequisites for first loading

- The complete PC system must be loaded.
- It must be loaded via the X2 interface (Windows).
- The IP address of the X2 interface in the TIA Portal project must correspond to the IP address on the Open Controller.

Note

When the hardware configuration of the PC system is loaded, a restart is triggered in certain situations:

- Changing the index (PC internal address)
- Changing the interface assignment
- Activate/deactivate HW LED usage (SIMATIC IPC only)
- Changes to the remanence memory: NVRAM – PC Memory

Configuration and loading using SIMATIC IPC427E as an example

The configuration of the CPU 1507S/ CPU 1508S on an IPC427E is done analog to the Open Controller. Note the following differences:

- Insert the CPU 1507S manually from the hardware catalog into the device configuration of the IPC.
- Assign the Ethernet interface of the CPU 1507S/ CPU 1508S in the interface properties.
- Load via interface X1, which is always assigned to the Windows part of the SIMATIC IPC.

Prerequisite for Proper Operation of IPCs

- The configured device must correspond exactly to the actual device.
- DiagBase V1.5 or newer
- Current BIOS (see Online Product Information)
- Current Graphics drivers (see Online Product Information)

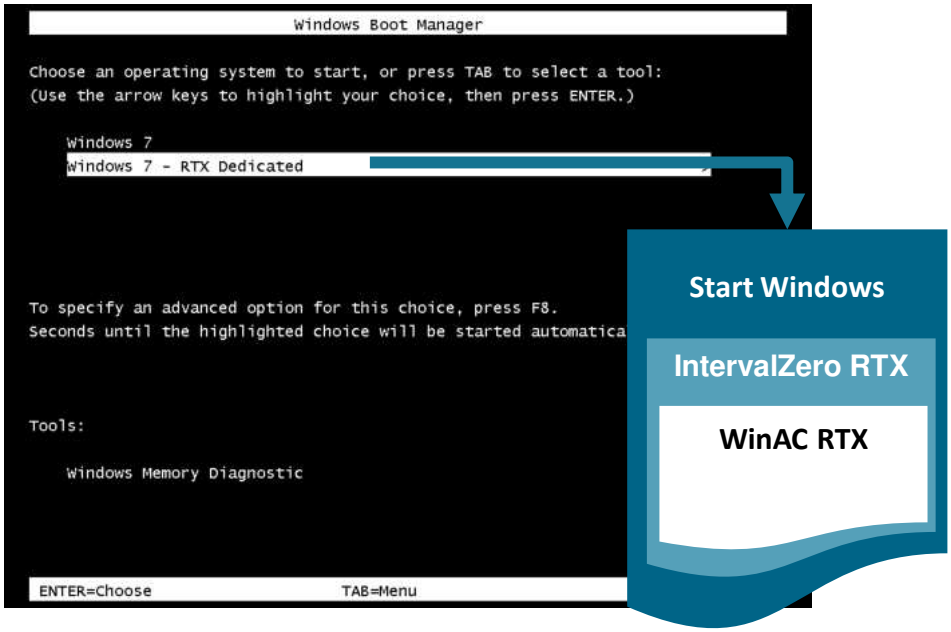
6 Operating the Software Controller

6.1 Booting of the S7-1500 Software Controllers

When starting an IPC with the software controller installed, a boot loader is displayed before loading the operating system.

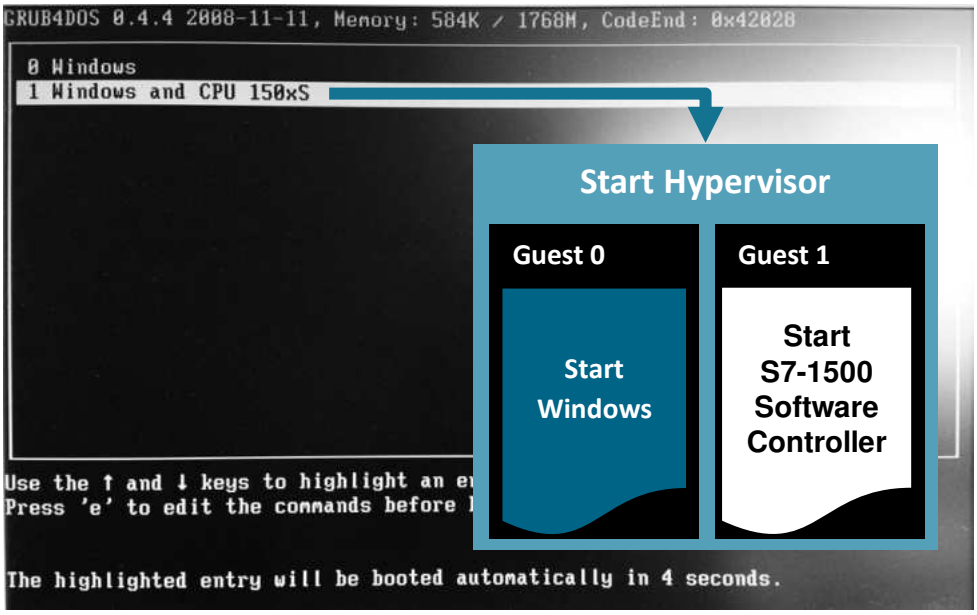
WinAC RTX – Windows Boot Manager

Figure 6-1: WinAC RTX – Windows Boot Manager



S7-1500 Software Controller – GRUB Bootloader

Figure 6-2: S7-1500 Software Controller – GRUB Bootloader



By default, the Windows operating system and the S7-1500 software controller are always started in parallel. The hypervisor completely decouples the Windows

operating system from the S7-1500 software controller. This makes it possible to restart Windows without interrupting the S7-1500 software controller.

In the GRUB Bootloader you have the possibility to start the operating system without the S7-1500 Software Controller (here CPU 150xS).
Note that the mouse and keyboard are disabled by default. Operation of the GRUB bootloader is not possible without activated input devices. When switching on the Open Controller, hold the operating mode switch in the MRES position to activate the mouse and keyboard[21].

The following settings of the GRUB bootloader can be adjusted:

- Hide GRUB Bootloader during system start
- Adapt waiting time

All settings are performed in the file "menu.lst" under "C:\Boot\Grub".

6.2 CPU S7-1500S Display application

The display application of the S7-1500 software controller offers the same menu structure as the display of the S7-1500 hardware controllers, as well as monitoring and control capabilities.

Figure 6-3: Display application S7-1500S

The display application of the S7-1500 Software Controller runs as a Windows application. You operate the display application with mouse, keyboard or touch screen.

This means convenient display operation for maximum user friendliness and detailed plain text information for full plant transparency.

After Windows has started up, you can start the display application via the shortcut on the desktop.

[21] https://support.industry.siemens.com/cs/ww/en/view/109479209

Figure 6-4: Desktop connection for display application

The operation of the display functions depends on the protection level selected.

By entering a protection level password, the protection level can be temporarily lowered for display operation:

- for an adjustable period or
- as long as the display application is open.

Entering the protection level password for the display does not change the protection level for other communication partners, such as HMI or TIA Portal.

On the following website you will find a display simulation of a standard S7 1500 hardware controller:
Information page "Getting Started SIMATIC S7-1500 / TIA[22] > Display Simulator > Display of the Controller Family SIMATIC S7-1500".

This display corresponds in its main components to the "Display Application" of the S7-1500 Software Controller. You can use the simulator to familiarize yourself with the operation of the display and to have its components explained to you.

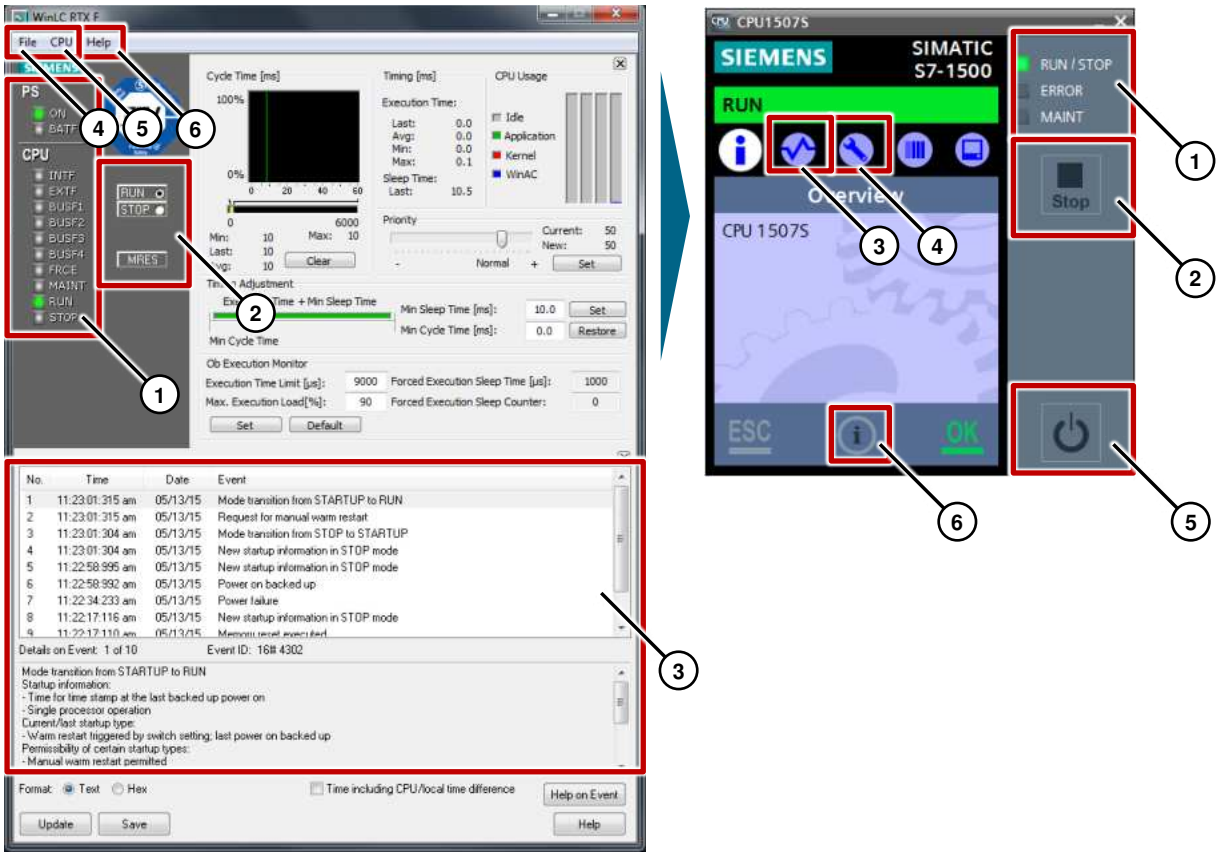
Functions of the Display application

- Start or stop the CPU without shutting down the PC
- Changing the operating state of the CPU
- Status displays for the CPU
- Menus for operating the CPU
- Display of diagnostic information
- Password assignment for the operation of the display is possible via STEP 7
- Setting language options on the display
- Setting the date and time
- Overall reset, factory settings, CPU volume formatting

[22] http://www.automation.siemens.com/salesmaterial-as/interactive-manuals/getting-started_simatic-s7-1500/_content/DE/content_de.html

Comparison with surface: SIMATIC WinAC RTX and SIMATIC S7-1500 Software Controller

Figure 6-5 Position of display elements with similar function



(1) Status LEDs
(2) RUN/ STOP
(3) Diagnostics
(4) Settings
(5) Shut down Software Controller
(6) Help

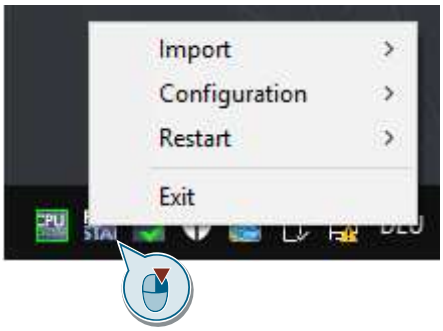
Advantages of the S7-1500 Software Controller Display Application

- Same look-and-feel as all S7-1500 controllers
- Intuitive operation
- Detailed device status information
- Reading and writing observation variables
- All controller settings in one tool (no component configurator necessary anymore)
- Shorter downtimes due to diagnostic messages in plain text
- Changing the interface settings on site without a programming device

6.3 PC station display

An icon for the PC station service appears in the notification area of the Windows taskbar. The symbol shows the current status of the service of the PC station and gives you the possibility to make configurations.

Figure 6-6: PC station display



The symbol indicates the current operating status (RUN/STOP) of the software controller.

Using the context menu, you can trigger the following actions by right-clicking the icon:

- Delete the current SIMATIC software configuration
- Changing the configuration data directory
- Restart of all services of the PC station
- Exit

Note Deactivate the extended write filter (EWF/ UWF/ FBWF) before executing the command "Delete current SIMATIC software configuration" in the context menu.

6.4 Web server

The S7-1500 Software Controller includes an integrated web server.

Overview

Using the Web server

The web server enables monitoring and management of the CPU by authorized users over a network. This allows evaluation and diagnostics to be carried out remotely. Monitoring and evaluation is possible without STEP 7, only a web browser is required. Note that you must take appropriate measures to protect the CPU from compromise[23] (e.g. limiting network access, using firewalls).

Activating the Web server

The CPU is supplied with the Web server deactivated. Access via the web browser is only possible after loading a project in which the web server is activated.

Safety functions

The Web server provides the following security functions:

- Access via the secure "https" transmission protocol via PROFINET interface
- Configurable user authorization by means of user list
- Interface granular activation

Web browser

To access the HTML pages of the CPU, you need a compatible web browser.

The following web browsers have been tested for communication with the CPU:

- Internet Explorer (Version 8 to 11)
- Microsoft Edge (Version 40)
- Mozilla Firefox (Version 47 to 56)
- Google Chrome (Version 47 to 62)
- Opera (Version 48)
- Mobile Safari and Chrome for iOS (iOS 10)
- Android Browser (Android 6)
- Android Chrome (Android 6 to 8 (certificate works only under restriction with Android 8))

Note For details on web servers, see the following entry ID: 59193560
https://support.industry.siemens.com/cs/ww/en/view/59193560

[23] https://support.industry.siemens.com/cs/ww/en/view/90885010

Access

Types of access to the integrated web server of the S7-1500 Software Controller

- Local access

The web server is called on the same PC on which the software controller is installed.

- Remote access

Access to the integrated web server of the S7-1500 Software Controller via a network.

Interfaces

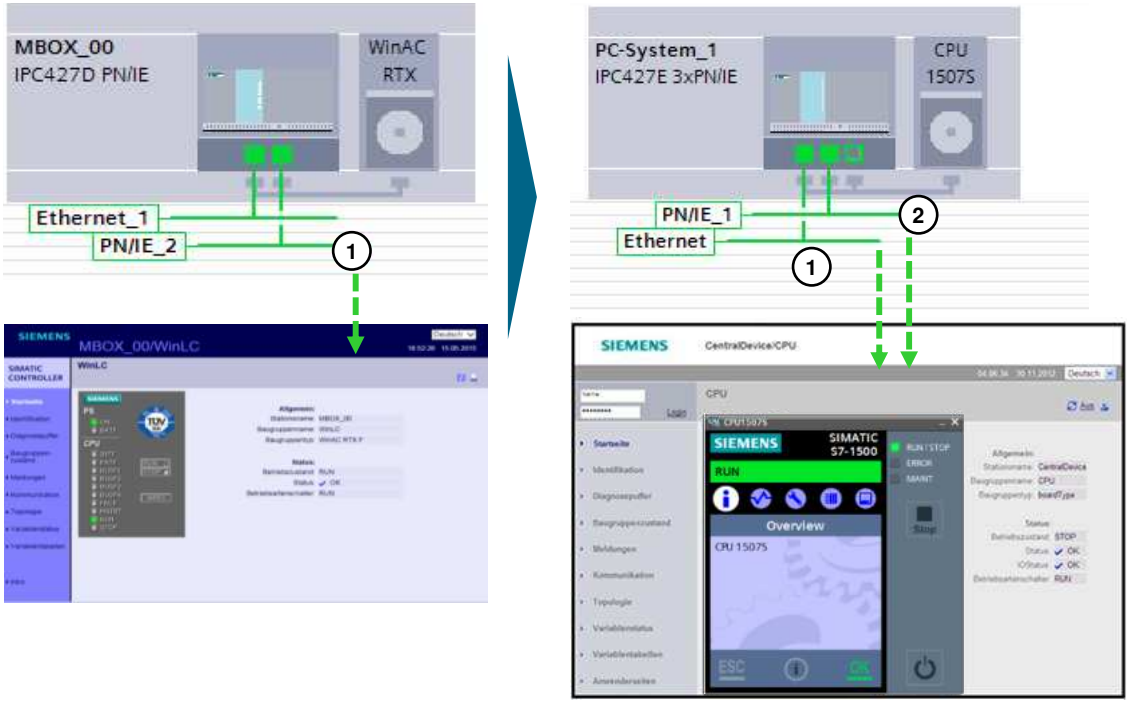
With the S7-1500 Software Controller, you can configure both local and remote access via the following interfaces:

- PROFINET (1)
- Ethernet (2)

Settings

- Remote access via PROFINET Interface: **http://<IP-Adresse>**
  For this type of access, create a new rule for port 81 in the Windows Firewall.
- Access via the local PC: **http://localhost:81**

Figure 6-7 Access options on the Web server WinAC RTX und S7-1500 Software Controller



Further information on the operation and configuration options of the web server can be found in the manual "SIMATIC S7-1500 Web server"[24].

[24] https://support.industry.siemens.com/cs/ww/en/view/59193560

7 Programming and Engineering

7.1 General information on migration of the S7 program

S7-1500 Software Controller corresponds to the S7-1500 Hardware CPU

When migrating from WinAC RTX projects to S7-1500 software controllers, the same conditions apply as when migrating from S7-300/400 projects to S7-1500. Currently there is the restriction that no automatic migration from WinAC RTX to S7-1500 Software Controller can be performed.

You can find information and help on migration in the "Migration guide SIMATIC S7-300/400 to S7-1500"[25].

In general, you can run most of your STEP 7 projects programmed for WinAC RTX on a S7-1500 software controller. Currently there are still some restrictions.

Current limitations

Currently (10/2015) there are only a few restrictions:

- SIMATIC ODK applications with …
  - Asynchronous Custom Code Extension Interface (CCX)
  - Shared Memory Extension Interface (SMX) for high-speed Software Controller data exchange with Windows applications[26]
  - Controller Management Interface (CMI) for integrating the WinAC Panel functionality into a Windows application
- CFC (Continous Function Chart)
- Hi-GRAPH

Rebuild program instead of migration

Depending on the STEP 7 commands or special components used, adaptation work may be required after migration.

For various reasons, it can make sense to create new programs or program parts.

Example reasons:

- Simple code
- Additional functions
- Improved diagnostics facility
- Creation of sustainable standard functions and libraries
- Same or higher migration effort compared to new creation
- Achievement of higher throughputs to increase performance

[25] https://support.industry.siemens.com/cs/ww/en/view/109478811
[26] https://support.industry.siemens.com/cs/ww/en/view/109741583

Application example as support for migration

To help you with the migration, use the following application example

- "PC-based Automation: Simple migration[27] from S7-300/S7-400 projects to S7-1500 Software Controller or WinAC RTX in TIA Portal".

It describes how an S7-300/S7-400 and HMI Panel is manually exchanged with the Open Controller (S7-1500 Software Controller) and the visualization software WinCC Runtime Advanced. For the S7-300/400 you can envision a WinAC RTX. The general procedures are transferable.

7.2 Programming languages

STEP 7 V5.x

Under SIMATIC STEP 7 V5.x these standard programming languages are available:

- Ladder diagram (LAD)
- Function block diagram (FBD)
- Statement list (STL)

The following languages can also be used as option packages:

- Structured Control Language (SCL)
- Continuous function chart (CFC)
- S7-GRAPH
- Hi-GRAPH

STEP 7 (TIA Portal)

The following programming languages are available under SIMATIC STEP 7 (TIA Portal):

- Ladder diagram (LAD)
- Function block diagram (FBD)
- Statement list (STL)
- Structured Control Language (SCL)
- S7-GRAPH

Note S7-SCL is a high-level programming language. This makes it easy and convenient to implement more extensive functions in particular.
We therefore recommend switching functions such as data handling, search algorithms, copy and comparison functions to S7-SCL when migrating from STEP 7 V5.x to STEP 7 (TIA Portal).

An overview of the instructions available for S7-1500 can be found in the manual "SIMATIC S7-1200 / S7-1500 Comparison List for Programming Languages"[28].

[27] https://support.industry.siemens.com/cs/ww/en/view/67121011

[28] https://support.industry.siemens.com/cs/ww/en/view/86630375

7.3 Optimized data storage

The most important difference in the system architecture of WinAC RTX and S7-1500 Software Controller is the internal data handling. The internal data storage of the S7-1500 software controller has been optimized to achieve a significant performance increase in program execution. For detailed information, refer to the section Programming Guide for S7-1200/1500[29].

In general, you can use all the recommendations in the Programming Guide for S7-1500 Software Controllers.

7.4 Data types

The following table shows the possible data types in comparison of WinAC RTX and S7-1500 Software Controller.

Table 7-1: Data types WinAC RTX and S7-1500 Software Controller

Data type	Size	Value range	WinAC RTX	S7-1500 Software Controller
USInt	8 bit	0 .. 255	✗	✓
SInt	8 bit	-128 .. 127	✗	✓
UInt	16-bit	0 .. 65535	✗	✓
Int	16-bit	-32768 .. 32767	✓	✓
UDInt	32 bit	0 .. 4.3 mil. (10^6)	✗	✓
DInt	32 bit	-2.14 mil. .. 2.14 mil.	✓	✓
ULint	64 bit	0 .. 18.4 trillion (10^{18})	✗	✓
LInt	64 bit	-9.2 trillion .. 9.2 trillion	✗	✓
Real	32 bit	-3.40e+38.. 3.40e+38	✓	✓
LReal	64 bit	-1.79e+308 ..1.79e+308	✗	✓
LWord	64 bit	16#0000 0000 0000 0000 to 16# FFFF FFFF FFFF FFFF	✗	✓
LTime	64 bit	LT#-106751d23h47m16s854ms775us808ns to LT#+106751d23h47m16s854ms775us807ns	✗	✓
LTime_Of_Day	8 byte	LTOD#00:00:00.000000000 to LTOD#23:59:59.999999999	✗	✓
LDT	8 byte	LDT#1970-01-01-0:0:0.000000000.. LDT#2263-04-11-23:47:16.854775808	✗	✓

[29] https://support.industry.siemens.com/cs/ww/en/view/81318674

7.5 Security Integrated

S7-300/S7-400 and WinAC RTX controllers offer only one component know-how protection. A comprehensive protection level concept has been developed for S7-1500 CPUs.

This new concept offers the following advantages:

- Increased know-how protection
- Higher copy protection (e.g. binding to mainboard serial number)
- Enhanced access protection
- Enhanced manipulation protection

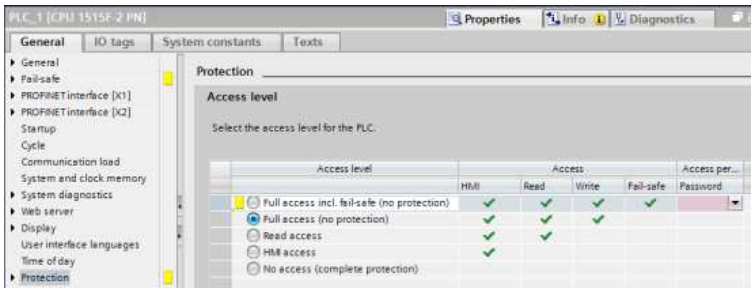
The following table explains the individual protection levels.

Table 7-2

Protection level	Description
Full access (no protection)	Hardware configuration and blocks can be read and changed by anyone.
Read access	Only read access to the hardware configuration and the blocks is possible, i.e. you can load the hardware configuration and blocks from the CPU into the programming device. HMI access and access to diagnostic data as well as change of operating state (RUN/STOP) are also possible. You cannot load blocks or hardware configurations from the programming device into the CPU. In addition, write test functions and firmware updates are not possible.
HMI access	Only HMI access and access to diagnostic data is possible. Variables can be read and written via an HMI device. In this access level you can neither load blocks and hardware configuration into the CPU nor load blocks and hardware configuration from the CPU into the programming device. In addition, the following is not possible: write test functions, change of operating state (RUN/STOP) and firmware update.
No access (complete protection)	Only identification data can be read, e.g. via "Accessible subscribers". Neither read nor write access to the hardware configuration and the blocks possible. Also the HMI access is not possible. The server function for PUT/GET communication is disabled at this access level (cannot be changed).

You can set the four protection levels in the TIA Portal in the device configuration of the software controller under "Protection". Further information can be found in the online help of the TIA portal.

Figure 7-1: Configuration in the TIA Portal



7.6 Time synchronization

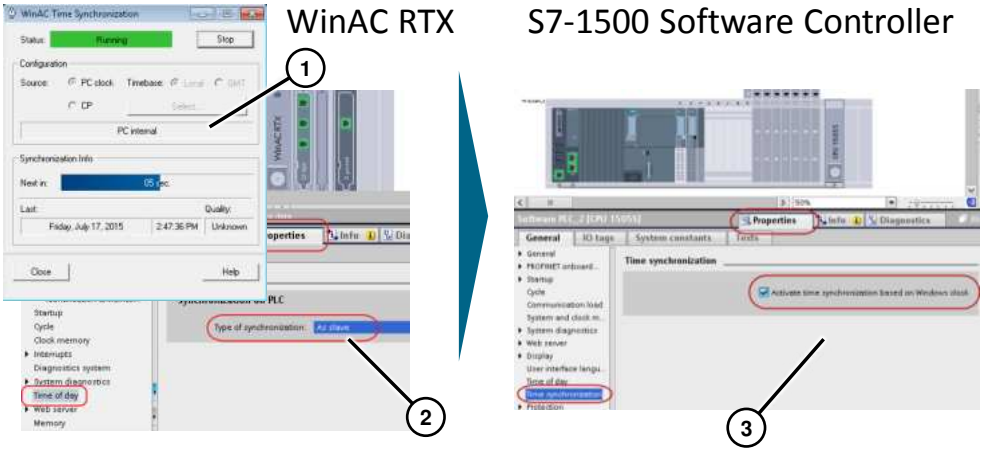
In order to synchronize the primeval time of WinAC RTX with the Windows operating system, two settings had to be made:

- Activation in the "WinAC Time Synchronization" tool on the IPC (1).
- Setting in the STEP 7 project of the WinAC RTX (2).

With the S7-1500 Software Controller only one setting has to be made:

- Activation of time synchronization in STEP 7 project (3).

Figure 7-2: Activation of time synchronicity



7.7 SIMATIC ODK (Open Development Kit)

With the option package SIMATIC WinAC ODK it is possible to integrate high-level language applications (C, C++) into the program execution of WinAC RTX. For the S7-1500 software controller there is a corresponding successor:

- SIMATIC ODK 1500S

Development Environment Eclipse

With WinAC RTX, Visual Studio and the additional IntervalZero SDK software were required by default for runtime applications to generate rtdll files.

Due to the changed system architecture of the S7-1500 software controller, only the Eclipse development environment is required for the creation of runtime applications. Eclipse is included with ODK 1500S. No further costs occur.

Visual Studio will continue to be used to create Windows applications.

Difference between SIMATIC WinAC ODK and SIMATIC ODK 1500S V2.5

The following table shows the differences between SIMATIC WinAC ODK and SIMATIC ODK 1500S[30].

Table 7-3: Difference between SIMATIC WinAC ODK and ODK 1500S V2.5

Function	SIMATIC WinAC ODK		SIMATIC ODK 1500S V2.5	
Engineering software C/C++ DLLs	Visual Studio 2010		Visual Studio C++ 2017 Visual Studio 2017 Visual Studio Community 2017	
Realtime APIs Engineering Software C/C++ SOs	Visual Studio 2010 + RTX SDK 2009		Eclipse (included in scope of supply)	
	Real-time	**Windows**	**Real-time**	**Windows**
Direct access to FB parameters in C code	✗	✗	✓	✓
Synchronous calls	✓	✓	✓	✗
Interruptibility of synchronous calls	✗	✗	✓	✗
Asynchronous calls	✓	✓	✗	✓
Unloading the ODK function	✗	✗	✓	✓
Operating system API (IPC, threads, etc.)	✓	✓	✗	✓
Debugging	✓	✓	✗	✓
OB call from C code	✓	✓	✗	✗
Communication between RT and Windows in C applications	✓	✓	✗	✗
Any access to all PLC data	✓	✓	✗	✗
Size of the FB interface	INPUT max. 64 Kbyte, INPUT max. 64 Kbyte,		IN, OUT and INOUT total max. 1MB	IN, OUT and INOUT total max. 1MB

[30] https://support.industry.siemens.com/cs/ww/en/view/109752683

Support for migration

You can also use C/C++ algorithms developed for WinAC RTX with S7-1500 software controllers.
Prerequisite is that the source code is adapted to the S7-1500 software controller and recompiled. For this purpose, only the functions that act as interfaces between the software controller and the high-level language program need to be adapted.

Use the following application examples to assist you:

- SIMATIC ODK 1500S Examples[31]

The examples provide an easy introduction and help you to integrate your existing high-level language programs into the S7-1500 Software Controller.

Further information on SIMATIC ODK 1500S

- Product Information[32]
- Manuals[33]
- Application examples[34]

[31] https://support.industry.siemens.com/cs/ww/en/view/106192387
[32] https://support.industry.siemens.com/cs/ww/en/view/109062891
[33] https://support.industry.siemens.com/cs/ww/en/ps/13914/man
[34] https://support.industry.siemens.com/cs/ww/en/ps/13912/ae

8 Technology and motion functions

The SIMATIC S7-1500 software controller has the functionality of SIMATIC S7-1500 controllers. This also enables the integration of technology and motion functions without additional modules.

Technology and motion functions are components that can be easily integrated into the project and parameterized. A technology object corresponds to the respective instance DB of a function module.

The following technology and motion functions are integrated in the TIA Portal and are available for S7-1500 software controllers:

- Counting and measuring
- PID Control
- SIMATIC Ident
- Motion Control

Note

Further information on these topics can be found in the STEP 7 manual[35], as well as on the topic page SIMATIC Technology[36].

You can find information on migrating S7-31xT to S7-1500(T) in the corresponding migration guide[37].

On the TIA Portal & SIMATIC S7-1500 Information page "Getting Started SIMATIC S7-1500 / TIA"[38] you will find video sequences and "Getting Started" documentation on the topic.

Further information on the use of Motion Control blocks can be found in the function manual "SIMATIC S7-1500 S7-1500 Motion Control V15"[39].

8.1 Quantity structure

The following table shows the number of controllable axes depending on the version of the S7 1500 software controller.

Table 8-1: Number of controllable axes with SIMATIC Motion Control

	CPU 1505SP	CPU 1505SP T	CPU 1507S	CPU 1508S
Number of axes	30	30	60	60

8.2 Counting and measuring

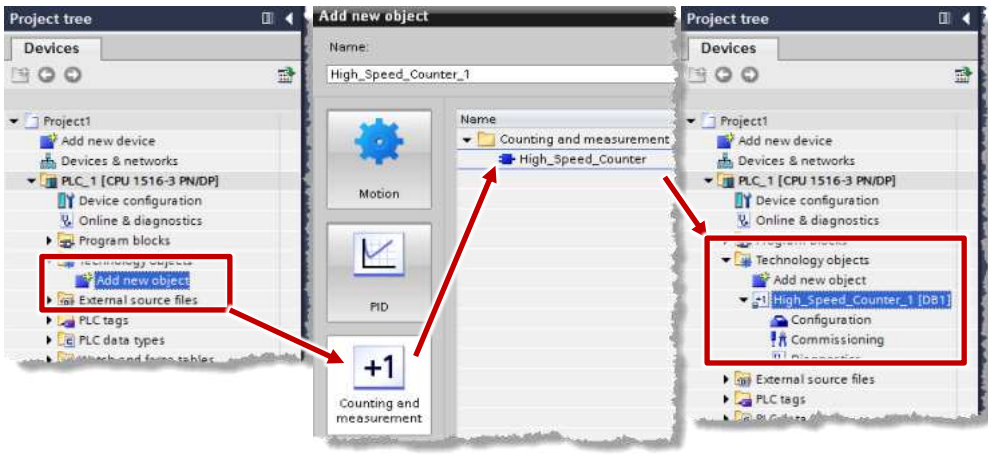
The "High Speed Counter" makes it easy to count, measure, compare and check pulses or counter values.

[35] https://support.industry.siemens.com/cs/ww/en/view/109755202
[36] https://support.industry.siemens.com/cs/ww/en/view/109751049
[37] https://support.industry.siemens.com/cs/ww/en/view/109743136
[38] http://www.automation.siemens.com/salesmaterial-as/interactive-manuals/getting-started_simatic-s7-1500/_content/DE/content_de.html
[39] https://support.industry.siemens.com/cs/ww/en/view/109749262

As with all technology objects, the integration of the building block is very simple:

- Add a new technology object
- Bringing a technology object into the project
- Parametrizing for technology objects

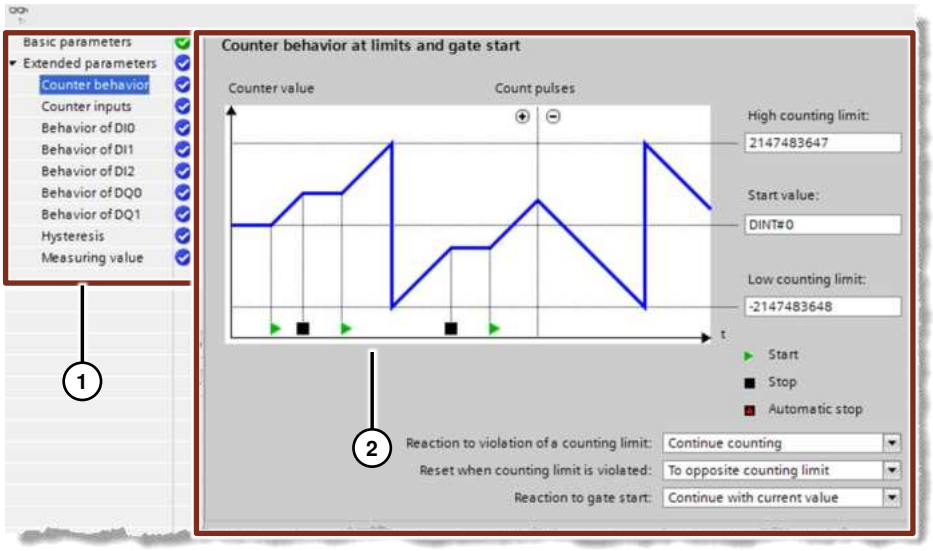
Figure 8-1: Inserting a block



You can set many parameters offline and online (1):

- the counting behavior (2)
  (count limits, start value, behavior at count start and counter overflow, ...)
- the type of counting inputs
  (signal type / encoder type, signal evaluation, filter frequency, sensor type, ...)
- behavior of the digital outputs
  (Function, replacement value, ...)
- the hysteresis properties
  (Hysteresis range for the digital outputs for comparison functions)
- the measuring value properties
  (further parameters for the respective measurement function)

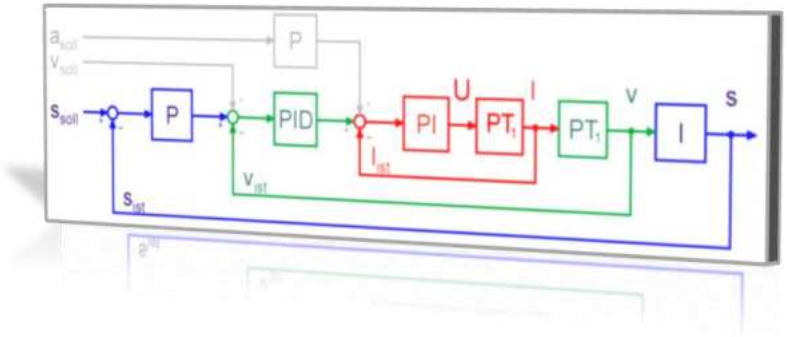
Figure 8-2: Setting the parameters



8.3 PID control

For S7-1500 controllers, the TIA Portal offers easily configurable modules for automatic optimization of the control parameters for optimum control quality.

Figure 8-3

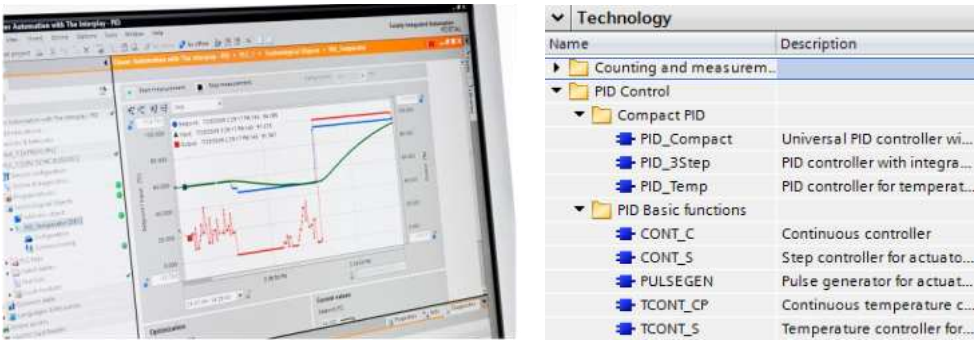


The following controllers are available:

- **PID Compact**
  Continuous PID controller[40] with an analog or PWM output
- **PID 3 Step**
  An integrated step controller for actuators (e.g. valves)
- **PID Temp**
  One temperature controller for heating and cooling with two actuators
- **PID Basic functions**
  Simple PID instruction for continuous or discrete control tasks

[40] https://support.industry.siemens.com/cs/ww/en/view/79047707

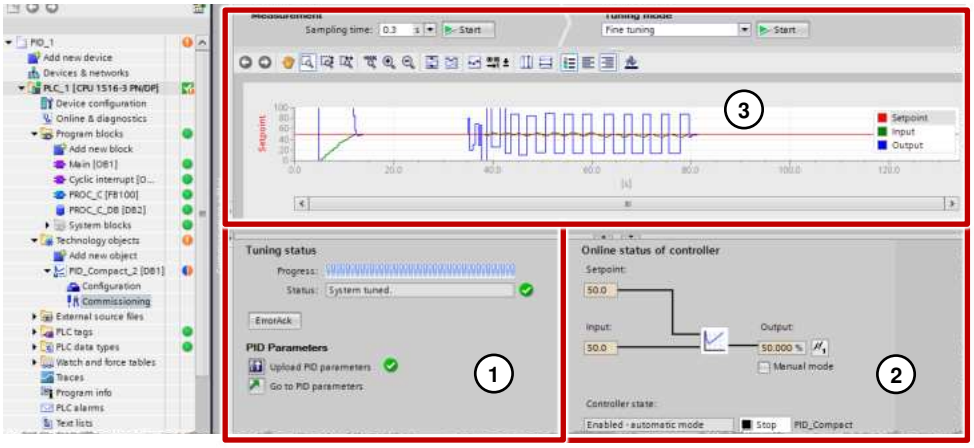
Figure 8-4



Properties of all PID controllers are:

- Automatic determination and optimization of control parameters (1)
- Configuration in clear and uniform masks (2)
- In the commissioning screen integrated Trace function (3)

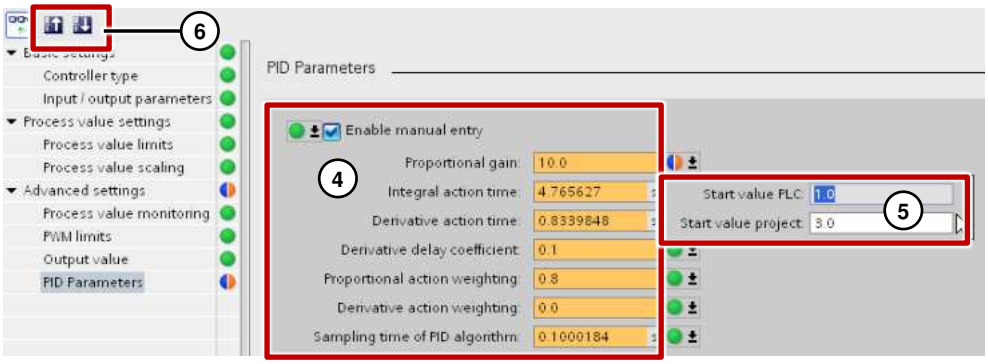
Figure 8-5



The TIA Portal offers the following options for controller parameterization:

- Direct online change of actual values (4),
- Comparison of the offline with the online start values (5),
- Acceptance of a snapshot of the actual values as start values or loading the start values of the project - directly into the actual values on the controller (6).

Figure 8-6



Further information on the use of PID controllers can be found in the function manual "SIMATIC S7-1200, S7-1500 PID control[41]".

8.4 SIMATIC Ident

The technology object for SIMATIC Ident products enables simple parameterization of an Ident system in the TIA portal. It creates an easily parameterizable interface between the configured hardware and the function blocks in the "SIMATIC Ident" library.

You can use the "Configuration" object to select a configured device, determine the channel / reading point and, if necessary, define the connected Ident system. The technology object thus automatically determines all the parameters required for operation.

The "Diagnostics" object displays the last 5 error messages signaled by the Ident device to the function blocks. In addition to this for every error message an error description and detailed information about the executed command are displayed.

8.5 Motion Control

8.5.1 Overview

Motion Control is already integrated with the software controller. This can basically be divided into "Standard Motion Control", available with the standard controllers, and "Advanced Motion Control", available with the technology versions of the software controller, e.g. the CPU 1505SP T(F).

Table 8-2: Technologies comparison

Technology	CPU 1505SP (F) CPU 1507S (F) CPU 1508S (F)	CPU 1505SP T(F)
Single axis motion functions	Yes	Yes
Gearing	Restricted	Yes
Cam disk synchronization	No	Yes
Cams and cam tracks	Yes	Yes
Probes	Yes	Yes
External encoders	Yes	Yes
Hydraulic axes	Applicative	Applicative

[41] https://support.industry.siemens.com/cs/ww/en/view/108210036

8.5.2 Areas of application

The table shows examples of Motion Control applications.

Table 8-3

Motion Control function	Application examples
Speed setting	• Pumps, fans, mixers • Conveyor belts • Auxiliary drives
positioning	• Lifting platforms, vertical conveyors • Feeding and palletizing equipment • Gate controllers
Coordination (relative/absolute synchronism, cam discs)	• Synchronized axes • Cross cutter • Flying shears
Path curves	• Cartesian portals • Delta pickers • Scara robots

8.5.3 Functionality and integration

With the TIA Portal you create a project, configure **technology objects** and load the configuration into the CPU. The Motion Control functionality is processed in the CPU.

You control the technology objects with the **standard and advanced motion control instructions** in your user program.

The TIA Portal provides additional functions for commissioning, configuration, optimization and diagnostics.

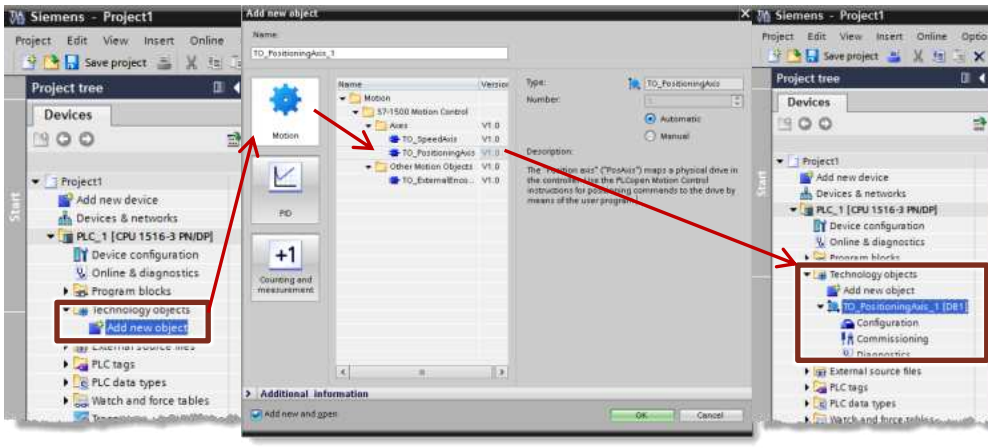
Technology objects

Technology objects represent real objects (e.g. a drive) in the control system. You call up the functions of the technology objects via Motion Control instructions in your user program. The technology objects control or regulate the movement of the real objects and report status information (e.g. the current position).

The configuration of the technology objects represents the properties of the real object. The configuration data is stored in a technology data block.

In the product tree folder "Technology objects" of your controller, you can find the existing technology objects and create new technology objects.

Figure 8-7: Creating technology objects



Technology data block

The properties of real objects are configured via the technology objects and stored in a technology data block. The technology data block contains all configuration data, setpoints and actual values as well as status information of the technology object. The TIA Portal automatically generates the technology data block when the technology object is created. You access the data of the technology data block via your user program.

Motion Control instructions

The Motion Control instructions are used to execute the desired functionality on the technology objects. The motion control instructions are available in the TIA Portal under "Instructions > Technology > Motion Control > S7-1500 Motion Control".

Figure 8-8 Example: Four of the Motion Control blocks

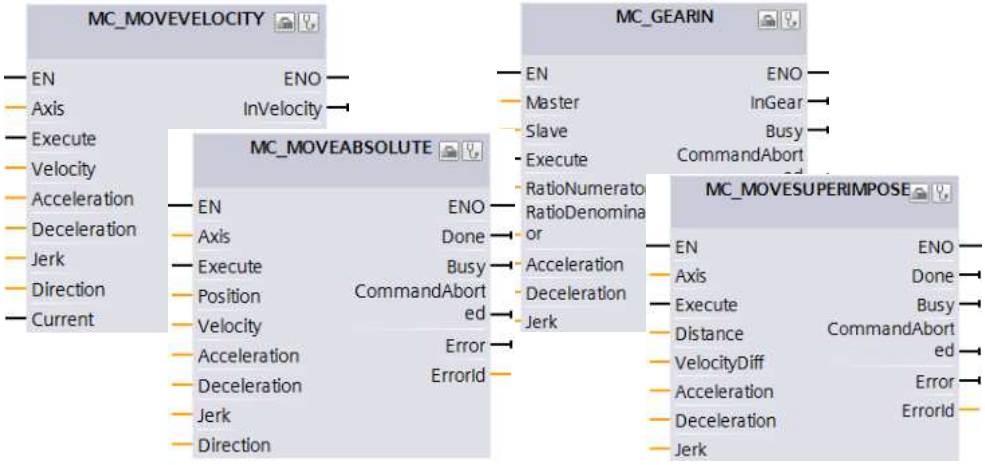
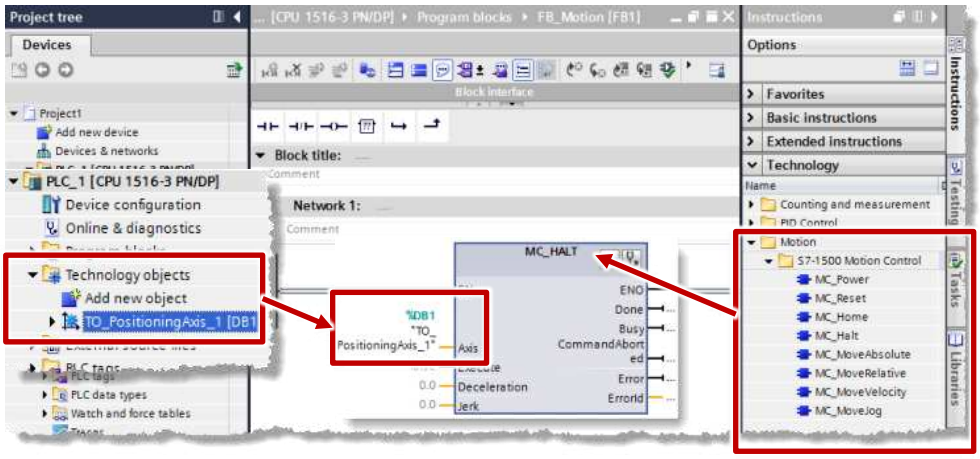


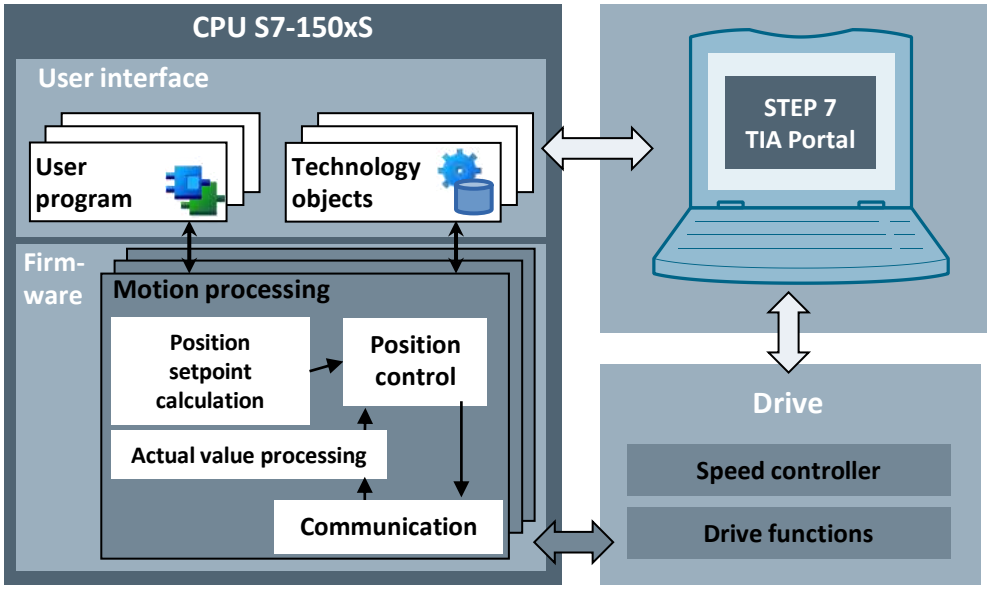
Figure 8-9: Interaction of technology object and motion control instruction in the project



User program

The motion control instructions and the technology data block represent the programming interfaces for the technology objects. With the Motion Control instructions you start motion control jobs to technology objects in your user program. You can track the status of running jobs via the output parameters of the motion control instructions. You use the technology data block to retrieve status information of the technology object and change certain configuration parameters at runtime.

Figure 8-10



Encoders and Drives

Drives ensure the movement of the axis. They are included in the hardware configuration.

When you execute a Motion Control job in your user program, the technology object controls the drive and reads in the values from position encoders.

PROFIdrive-capable drives and encoders are connected via PROFIdrive telegrams. The following connections are possible:

- PROFINET IO
- PROFIBUS DP
- Technology module (TM)

Drives with analog setpoint interface are connected via an analog output (AQ) and an optional enable signal. Analog inputs and outputs are provided via corresponding I/O modules.

8.5.4 Standard Motion Control

The following standard Motion Control instructions are available for the S7-1500 Software Controller CPU 1505SP (F), CPU 1507S (F), CPU 1508S (F):

Technology objects

- **Technology object speed axis**

  The technology object speed axis ("TO_SpeedAxis") is used to specify the speed for a drive. You program the movement of the axis using motion control instructions.

- **Technology object positioning axis**

  The positioning axis technology object ("TO_PositioningAxis") is used for position-controlled positioning of a drive. With Motion Control instructions, you assign positioning jobs to the axis via your user program.

- **Technology object synchronization axis**

  The technology object synchronous axis ("TO_SynchronousAxis") contains all functions of the technology object positioning axis. In addition, you can connect the axis with a conductance so that the axis follows the position change of a master axis in synchronism.

- **Technology object external encoder**

  The technology object External encoder ("TO_ExternalEncoder") detects a position and makes it available to the controller. The determined position can be evaluated in the user program.

- **Technology object cams**
  The technology object "Cam" (TO_OutputCam) generates switching signals depending on the nominal or actual position of an axis or an external encoder. The switching signals can be evaluated in the user program or output via digital outputs. The switching signals of several cams can be interconnected via AND or OR links.

- **Technology object cam track**
  The technology object "cam track" (TO_CamTrack) combines up to 32 individual cams into one cam track.
  The start and end positions of the individual cams are freely selectable. Further parameters apply to all individual cams.

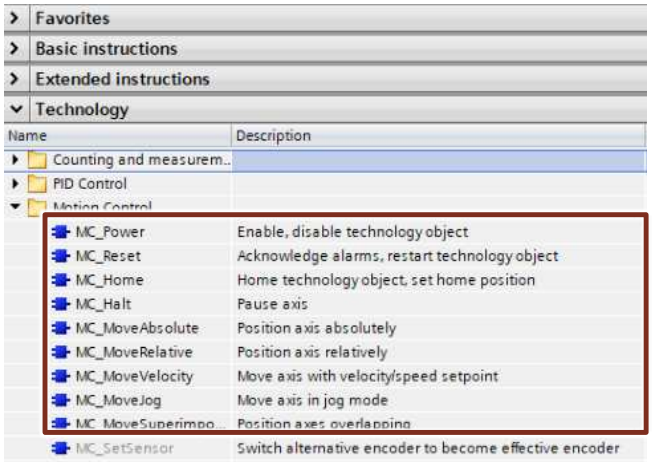
- **Technology object measuring input**
  The technology object "Touch Probe" (TO_MeasuringInput) records the actual position of an axis or an external encoder with event accuracy.
  The measurement is triggered with a rising or falling edge of a digital input. The measurement results can be evaluated in the user program.

Instructions

With the standard S7-1500 software controller, the standard motion functionalities are already integrated:

- S7-1500 Standard Motion Control supports the controlled positioning and movement of axes and is an integrated component of the S7-1500 Software Controller.

Figure 8-11: Standard Motion Control Instructions



- PROFIdrive-capable drives and drives with analog setpoint interface are quickly connected and controlled via standardized Motion Control instructions according to PLCopen.
- The axis control panel and the extensive online and diagnostic functions support you in the simple commissioning and optimization of drives.
- S7-1500 Motion Control is continuously integrated into the system diagnostics of the S7-1500 Software Controller.

8.5.5 Advanced motion control

For the S7-1500 Software Controller CPU 1505SP T(F) the following Advanced Motion Control functions are available in addition to the standard Motion Control instructions listed above:

Technology objects

- **Cam technology object**

  The technology object "cam disk" (TO_Cam) defines a transfer function y = f(x). In this transfer function, the dependency of an output variable on an input variable is described in a unit-neutral manner. A technology object cam disc can be applied several times to other technology objects.

- **Kinematics technology object**
  The technology object "Kinematics" (TO_Kinematics) controls and coordinates the axes belonging to the kinematics during a path movement.
  It contains the functionality that is necessary for the motion specification and execution of kinematic movements.

Instructions

In addition to the instructions of the Standard Motion Control, the S7-1500 Software Controller CPU 1505SP T(F) provides the Advanced Motion Control

instruction "MC_SetSensor" for switching "alternative encoders as effective encoders".

8.5.6 Motion control resources

The following table lists the Motion Control resources provided for some CPUs. The provided resources depend on the used hardware version of the CPU and the used firmware version.

Table 8-4: Motion control resources provided

CPU type	Software version	MC Resources (other than cams)
CPU 1505SP	V2.6	2400
CPU 1505SP T	V2.6	2400
CPU 1507S	V2.6	4800
CPU 1508S	V2.6	4800

The resource consumption of the technology objects is listed below:

Table 8-5: Motion Control resource consumption by Technology objects

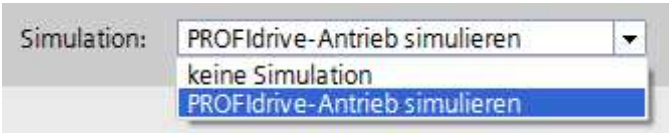
Technology object	Version	MC Resources
Speed axis	V3.0	40
Positioning axis	V3.0	80
Synchronous axis	V3.0	160
External encoder	V3.0	80
Probes	V3.0	40
Cams	V3.0	20
Cam track	V3.0	160

Note The exact values for the Motion Control resources provided by a CPU can be found in the technical data or in the manual of the corresponding CPU.

8.6 Simulation

The simulation of the drives in the CPU makes it possible to run axes in simulation mode without real hardware.

Figure 8-12: Settings for simulation



This allows tests to be carried out at the desk, without moving machines and without completely existing drive technology. You can also simulate high quantity structures.

You can set the simulation individually for each axis. A mixture of real and simulated drives is possible. The simulation can be used for PROFIdrive drives and you can access the full PLC functionality, such as trace, messages and control panel. The drives are simulated with real behaviour, e.g. the actual value follows the setpoint with a delay.

9 HMI Migration

Engineering with TIA Portal offers synchronous project planning and a uniform operating concept for controllers, HMI and drives. It integrates all future hardware components into the framework, enables common data storage and ensures data consistency throughout the entire project.

Visualization on PC systems can be performed with the following software:

- SIMATIC WinCC Runtime Advanced (for single-user systems, machine-oriented)
- SIMATIC WinCC Runtime Professional (distributed multi-user systems, SCADA system).

Depending on the runtime, the following engineering software is used:

- SIMATIC WinCC Advanced
- SIMATIC WinCC Professional (also includes SIMATIC WinCC Advanced functionality)

Migration from WinCC flexible 2008 to WinCC Advanced (TIA Portal)

Migrate your WinCC flexible project with the help of the HMI migration guidelines[42].

In the HMI section of the application example "PC-based Automation: Simple migration[43] from S7-300/S7-400 - Projects to S7-1500 Software Controller or WinAC RTX in the TIA Portal" an example of a WinCC flexible project is migrated to WinCC Runtime Advanced.

Hardware migration

If the display size or display format changes as a result of replacing the display, refer to the notes in the Migration Guide for Panel Migration[44], section 3.3 "Switching the Screen from 4:3 to Widescreen".
Also note that the installation sections may change.

[42] https://support.industry.siemens.com/cs/ww/en/view/77430539
[43] https://support.industry.siemens.com/cs/ww/en/view/67121011
[44] https://support.industry.siemens.com/cs/ww/en/view/49752044

10 Communication

SIMATIC WinAC RTX offers numerous communication options. These have been extended with the S7-1500 Software Controller.

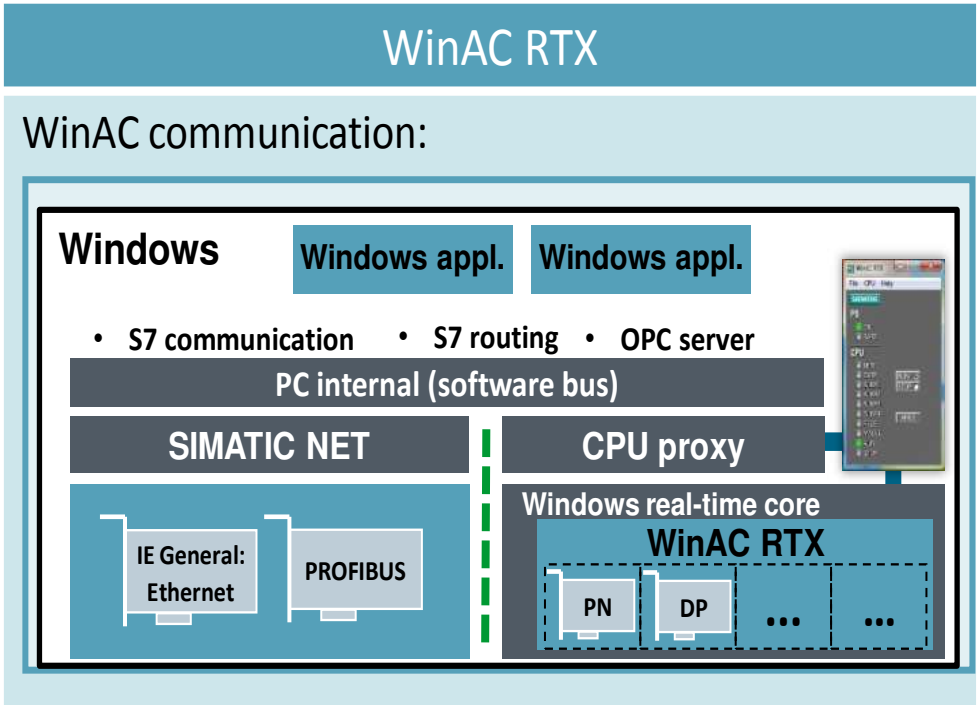
- Internal system communication
- Communication with external communication partners
- Numerous communication protocols

The compendium provides an overview "CPU-CPU communication"[45].

10.1 PC internal communication

The S7-1500 Software Controller communicates with the Windows environment (applications) via an internal software bus (PC internal software bus). Equivalent for WinAC RTX:

Figure 10-1: WinAC RTX communication

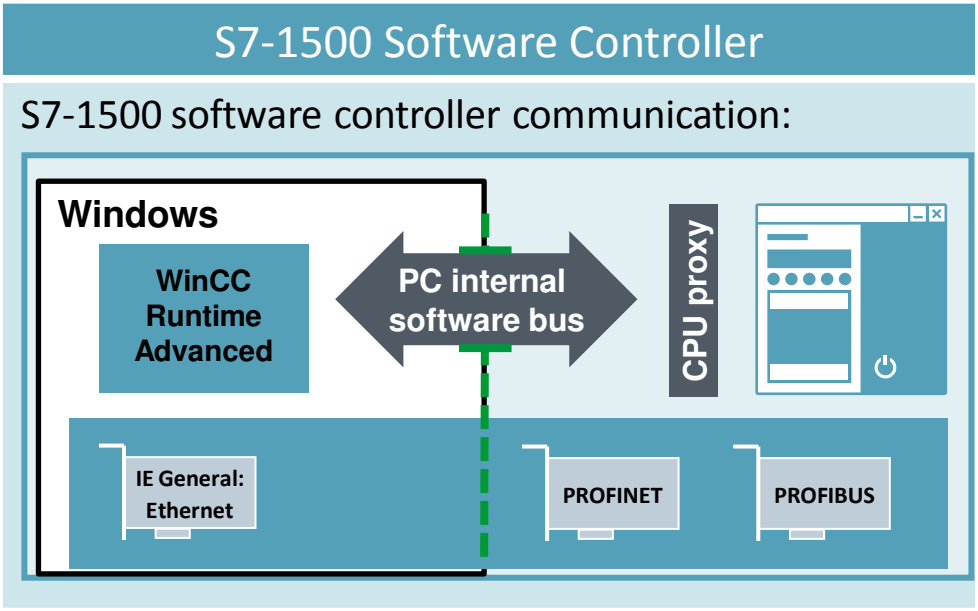


The difference to the S7-1500 software controller is that the controller is no longer in the Windows environment, but completely self-contained. Thus the internal communication mechanisms are completely different. However, the handling (engineering) for the user remains unchanged.

The installation of SIMATIC NET on the IPC of the software controller is no longer necessary or possible.

[45] https://support.industry.siemens.com/cs/ww/en/view/78028908

Figure 10-2: S7-1500 software controller communication:



10.2 Communication functions

The following table shows the differences between the communication functions of WinAC RTX and S7-1500 Software Controller.

Table 10-1 Interfaces

WinAC RTX		S7-1500 Software Controller	
Windows Interface & SIMATIC NET	**WinAC Submodules**	**Windows Interface**	**Exclusive interface**
Windows communication	PROFINET IO PROFIBUS DP PROFINET CBA	Windows communication	PROFINET IO PROFIBUS DP
×	Web server (HTTP)	Web server (HTTP / HTTPS)	Web server (HTTP / HTTPS)
ES/HMI access S7 communication S7 routing	ES/HMI access S7 communication (PBK) S7 routing	ES/HMI access S7 communication (with S7-1500 CPUs and SIMATIC NET OPC) S7 routing	ES/HMI access S7 communication (PBK) with S7-1500, S7-300, S7-400 S7 routing
OUC* (TCP / UDP / ISOonTCP) requires IP Driver Add-On	OUC* (TCP / UDP) Modbus TCP requires S7-OpenModbusTCP PN CPU Software	OUC* (TCP / UDP) OPC UA Modbus TCP TMail	OUC* (TCP / UDP / ISOonTCP) OPC UA Modbus TCP TMail

*OUC (Open User Communication)

10.3 OPC and S7-1500 Software Controller

The SIMATIC NET OPC Server cannot be installed on the same PC as the software controller. If the OPC server is installed on a separate PC, data can be exchanged with the S7-1500 software controller (including optimized components).

If a WinCC RT Advanced is installed on the PC of the S7-1500 Software Controller, the integrated OPC UA server function of the HMI can be used.

As of firmware V2.6, an S7-1500 CPU is additionally equipped with an OPC UA client. The TIA Portal contains standardized instructions (PLCopen function blocks) that can be used to create a user program that reads data from an OPC UA server as an OPC UA client or writes data to an OPC UA server. Furthermore, methods can also be called from an OPC UA server. STEP 7 (TIA Portal) helps you to create user programs with an editor for client interfaces and parameterization for OPC UA connections.

Note Further information can be found in the manual of the S7-1500[46]

[46] https://support.industry.siemens.com/cs/ww/en/view/86140384

11 Diagnosis

11.1 Integrated diagnostics

The diagnostic options for the S7-1500 and TIA Portal have been completely revised.

The system status list (SZL) has been replaced by a new system diagnosis. System diagnostics is an integral part of STEP 7 and does not require an additional license. No manual configuration of the system diagnostics is required, the user no longer has to worry about blocks such as "Report system error". System diagnostics is activated by default for SIMATIC S7-1500 controllers.

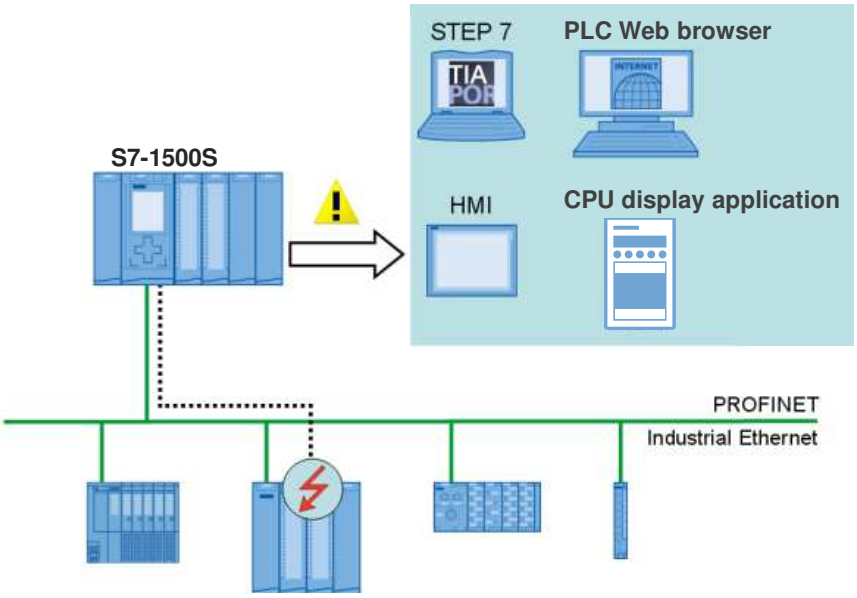
The system diagnosis displays all relevant information on pending errors in the system. This information is automatically packaged in messages, which comprise the following elements:

- Module
- Message text
- alarm status is constant

The uniform display concept always displays error messages in the same way. Error messages are always displayed as plain text information, regardless of whether they are displayed in the:

- TIA Portal
- HMI
- Web server
- Display of the S7-1500 CPU

Figure 11-1



This enables transparent status messages for controllers, peripherals and drives (motion control messages) and thus efficient error analysis and fast error localization.

If the hardware configuration is changed, for example after the integration of new hardware, the diagnostic information is automatically updated via the engineering system.

System diagnostics for S7-1500 controllers is also available in STOP mode.

Trace-Funktion

All CPUs support the Trace function[47].

The real-time trace function for the controllers and drives enables user programs and motion applications to be diagnosed with great precision and the drives to be optimized.

The visualization of the entire process with real-time trace makes it easy to identify sporadic events in the system during commissioning and service.

The recordings take place independently in the control system and can then be graphically displayed and evaluated in the TIA portal. Measurements can be exported and used for documentation or diagnosis. Different trigger conditions are available to control the recording. Recording is started, for example, when a variable leaves the specified value range. It can be defined how many measurement events are stored before the trigger time.

Figure 11-2

Further information on diagnostics and an interactive simulation can be found on the TIA Portal & SIMATIC S7-1500 information page "Getting Started SIMATIC S7-1500 / TIA Portal" [48] under "Further Topics > Diagnostics".

[47] https://www.industry.siemens.com/topics/global/de/tia-portal/videos/Seiten/clip-trace.aspx
[48] http://www.automation.siemens.com/salesmaterial-as/interactive-manuals/getting-started_simatic-s7-1500/_content/DE/content_de.html

11.2 Available Diagnostics Tool

Various software solutions are available for monitoring and diagnosing SIMATIC industrial PCs:

- SIMATIC IPC DiagBase
- SIMATIC IPC DiagMonitor

Note The diagnostic tool "PCDiagBridge", which reads diagnostic information from SIMATIC IPCs, SITOP UPSs and WinAC RTX (F), will not be further developed. Among other things, it is not executable under the Windows 7 64Bit operating system. Use the "SIMATIC IPC DiagMonitor" instead.

11.2.1 SIMATIC IPC DiagBase

The SIMATIC IPC DiagBase software is included as standard on all SIMATIC IPCs with a pre-installed operating system. You can also install the software afterwards.

The software is available as a free download.

Project planning and diagnostic message paths are integrated into the system in a user-friendly manner. System diagnostics is activated with a click.

Note Further information on the topic can be found in the following article:

https://support.industry.siemens.com/cs/ww/en/view/29316343

11.2.2 SIMATIC IPC DiagMonitor

The use of the "SIMATIC IPC DiagMonitor" signalling and diagnostic software allows early detection of possible faults with SIMATIC IPC.

SIMATIC IPC DiagMonitor is a software with costs and can be purchased as a single license (order number 6ES7648-6CA04-4YX0).

Note Further information on the topic can be found in the following articles:

https://support.industry.siemens.com/cs/ww/en/view/109763202

https://support.industry.siemens.com/cs/ww/en/view/109478242

12 Related literature

Table 12-1

	Subject area	Title
\0\	Download page for the entry	https://support.industry.siemens.com/cs/ww/en/view/109478804
\1\	Product page S7-1500 Software Controller	http://w3.siemens.com/mcms/programmable-logic-controller/de/software-controller/s7-1500-software-controller/Seiten/Default.aspx
\2\	Industry Mall S7-1500 Software Controller	https://mall.industry.siemens.com/mall/ww/de/Catalog/Products/10268313
\3\	Migration guide: SIMATIC S7-300/ S7-400 to S7-1500	https://support.industry.siemens.com/cs/ww/en/view/109478811
\4\	PC-based automation Easy migration from S7-300/S7-400 projects to S7-1500 Software Controller	https://support.industry.siemens.com/cs/ww/en/view/67121011
\5\	HMI Migration guide: Support for the migration from WinCC flexible to WinCC (TIA Portal)	https://support.industry.siemens.com/cs/ww/en/view/77430539
\6\	Video EWF	https://www.youtube.com/watch?v=xpoHgPDtCKo
\7\	Entry Security settings	https://support.industry.siemens.com/cs/ww/en/view/109475014
\8\	TIA Selection Tool	http://www.siemens.de/tia-selection-tool
\9\	SIMATIC IPC Bundle offers	https://w3.siemens.com/mcms/pc-based-automation/de/embedded-bundles/Seiten/Default.aspx
\10\	I-Device functionality	https://w3.siemens.com/mcms/automation/en/industrial-communications/profinet/Documents/articles/de/profinet-innovations-2010-2.html
\11\	Manual "SIMATIC ET 200SP Open Controller CPU 1515SP PC"	https://support.industry.siemens.com/cs/ww/en/view/109248384/71288553995
\12\	Released operating systems for WinCC RT Advanced	http://www.industry.siemens.com/topics/global/de/tia-portal/hmi-sw-tia-portal/wincc-tia-portal-rt/Seiten/default.aspx?tabcardname=systemanforderungen
\13\	TIA Selection Tool	http://www.siemens.de/tia-selection-tool
\14\	Industry Mall SIMATIC IPC	https://mall.industry.siemens.com/mall/de/en/Catalog/Products/5109999
\15\	Product page SIMATIC IPC	https://new.siemens.com/global/en/products/automation/pc-based.html
\16\	TIA Readiness Check Tool	https://support.industry.siemens.com/cs/ww/en/view/60162195
\17\	TIA Selection Tool	http://www.siemens.de/tia-selection-tool
\18\	Industry Online Support: Product support	https://support.industry.siemens.com/cs/ww/en/ps/dl
\19\	Support Packages for the Hardware Catalog in the TIA Portal (HSP)	https://support.industry.siemens.com/cs/ww/en/view/72341852
\20\	Manual SIMATIC WinCC Advanced V15.1	https://support.industry.siemens.com/cs/ww/en/view/109755202
\21\	How can the mouse and keyboard be activated during the boot process of an ET 200SP Open Controller?	https://support.industry.siemens.com/cs/ww/en/view/109479209
\22\	Simulation of a SIMATIC S7-1500 Display	http://www.automation.siemens.com/salesmaterial-as/interactive-manuals/getting-started_simatic-s7-1500/_content/DE/content_de.html
\23\	Security for SIMATIC S7-Controller SIMATIC S7-300/400/WinAC/1200/1500	https://support.industry.siemens.com/cs/ww/en/view/90885010

	Subject area	Title
\24\	Manual SIMATIC S7-1500 Webserver	https://support.industry.siemens.com/cs/ww/en/view/59193560
\25\	Migration guide: SIMATIC S7-300/ S7-400 to S7-1500	https://support.industry.siemens.com/cs/ww/en/view/109478811
\26\	SMX Driver	https://support.industry.siemens.com/cs/ww/en/view/109741583
\27\	PC-based automation Easy migration from S7-300/S7-400 projects to S7-1500 Software Controller	https://support.industry.siemens.com/cs/ww/en/view/67121011
\28\	SIMATIC S7-1200 / S7-1500 Comparison list for programming languages	https://support.industry.siemens.com/cs/ww/en/view/86630375
\29\	Programming Guide for S7-1200/1500	https://support.industry.siemens.com/cs/ww/en/view/81318674
\30\	SIMATIC ODK 1500S Manuals	https://support.industry.siemens.com/cs/ww/en/view/109752683
\31\	SIMATIC ODK 1500S Examples	https://support.industry.siemens.com/cs/ww/en/view/106192387
\32\	SIMATIC ODK 1500S product information	https://support.industry.siemens.com/cs/ww/en/view/109062891
\33\	SIMATIC ODK 1500S Manuals	https://support.industry.siemens.com/cs/ww/en/ps/13914/man
\34\	SIMATIC ODK 1500S Application examples	https://support.industry.siemens.com/cs/ww/en/ps/13912/ae
\35\	Manual STEP 7 Professional V15.1	https://support.industry.siemens.com/cs/ww/en/view/109755202
\36\	Topic page SIMATIC technology	https://support.industry.siemens.com/cs/ww/en/view/109751049
\37\	Migration guide S7-31xT to S7-1500 (T)	https://support.industry.siemens.com/cs/ww/en/view/109743136
\38\	TIA Portal & SIMATIC S7 1500 Getting Started SIMATIC S7-1500 / TIA Information Page	http://www.automation.siemens.com/salesmaterial-as/interactive-manuals/getting-started_simatic-s7-1500/_content/DE/content_de.html
\39\	SIMATIC S7-1500 S7-1500 Motion Control V4.0 in TIA Portal V15	https://support.industry.siemens.com/cs/ww/en/view/109749262
\40\	Control of simulated controlled systems in the S7-1500 with PID_Compact V2	https://support.industry.siemens.com/cs/ww/en/view/79047707
\41\	Function manual SIMATIC S7-1200, S7-1500 PID control	https://support.industry.siemens.com/cs/ww/en/view/108210036
\42\	HMI Migration guide: Support for the migration from WinCC flexible to WinCC (TIA Portal)	https://support.industry.siemens.com/cs/ww/en/view/77430539
\43\	PC-based automation Easy migration from S7-300/S7-400 projects to S7-1500 Software Controller	https://support.industry.siemens.com/cs/ww/en/view/67121011
\44\	SIMATIC HMI operator interfaces migration guide Comfort Panels	https://support.industry.siemens.com/cs/ww/en/view/49752044
\45\	Operating Instructions CPU-CPU Communication with SIMATIC Controllers	https://support.industry.siemens.com/cs/ww/en/view/78028908
\46\	SIMATIC S7-1500/ET 200MP Manual Collection	https://support.industry.siemens.com/cs/ww/en/view/86140384
\47\	Video: Integrated trace function	https://www.industry.siemens.com/topics/global/de/tia-portal/videos/Seiten/clip-trace.aspx
\48\	Information page "Getting Started SIMATIC S7-1500 / TIA Portal" Topic diagnostics	http://www.automation.siemens.com/salesmaterial-as/interactive-manuals/getting-started_SIMATIC-s7-1500/_content/DE/content_de.html

	Subject area	Title
\49\	SIMATIC IPC DiagBase Download and information	https://support.industry.siemens.com/cs/ww/en/view/29316343
\50\	Product note: SIMATIC IPC DiagMonitor V4.5 (Software)	https://support.industry.siemens.com/cs/ww/en/view/109477200
\51\	Application example "Diagnostics tool for IPC"	https://support.industry.siemens.com/cs/ww/en/view/109478242
\52\	Siemens Industry Online Support start page	https://support.industry.siemens.com

13 Document history

Table 13-1

Version	Date	Change
V1.0	12/2015	First version
V2.0	02/2019	Update to CPU 1505SP

14 Service and support

Industry Online Support

Do you have any questions or need assistance?

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

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Industry Online Support app

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https://support.industry.siemens.com/cs/ww/en/sc/2067