SIEMENS

Background and System Description• 09/2015

Guide for Migrating SIMATIC S7-300/S7-400 to SIMATIC S7-1500 and TIA Portal

Boundary Conditions and Procedure for Migrating Hardware and Software

https://support.industry.siemens.com/cs/ww/en/view/109478811

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1 Introduction

The new SIMATIC S7-1500 controller generation has an up-to-date system architecture and, together with TIA Portal, offers new and efficient programming and configuration options.

This document contains recommendations and notes on a generation change for users who are currently using SIMATIC S7-300/S7-400 automation systems and plan to migrate to the new SIMATIC controller generation S7-1500.

1.1 Purpose of this document

The objective of this document is to support plant migration to a modern controller generation and cover the most important questions that may arise in this context.

This document does not claim to cover all conceivable plant configurations and SIMATIC S7-300/S7-400 components used.

Migration means changing software and hardware and transferring data from one environment to another largely using existing technological infrastructure. Migration goes beyond a simple update or upgrade and refers to a fundamental change of the system.

Note This document is not valid with SIMATIC S7-400 in combination with PCS 7.

2 Planning a Plant Migration

2.1 General procedure

In the run-up to plant migration, there is **considerable need for clarification**. Therefore, it is all the more important to develop a detailed comprehensive **concept for planning and implementing** the pending migration.

Each plant has **different requirements** for the migration process. Depending on the complexity of the plant control system, acceptable machine downtimes and production flexibility, the required preparation, procedure and depth of migration may differ.

It is always necessary to think out and plan migration of the **entire plant**, even if only a partial migration is considered. The question is not “how do I migrate a controller?” but “what should the plant look like at the end of migration and which migration steps are necessary?”.

Considerations and issues to be dealt with before migration:

- **Which plant parts should be migrated?**
  - Even a partial migration requires that the entire plant be considered.
- **Which components are affected?**
  - Stand-alone solutions or complex plant configuration
  - Communication with third-party systems
  - Existing special hardware or software components
- **Which considerations are important for planning the migration time?**
  - Schedule non-production times
  - 24/7 production
  - Produce in advance to buffer downtimes
  - Temporarily shift production
- **Fall-back strategies**
  - Allow quick migration back to previous hardware/software platform
  - Sufficient time buffers
  - Comprehensive tests up to the "point of no return"
  - New communication cabling even despite potential continued use of existing communication connections
- **Minimizing risk**
  - Accurately capture the actual plant
  - Detailed planning of each individual trade
  - Identify and consider dependencies
  - Gradual migration
  - Separate migration of centralized / distributed
  - Retain the cabling
  - Partial acceptances
  - Preliminary tests in the laboratory
  - Test connections to the control systems
- **Plant operation after migration**

- Timely training of operating and maintenance staff
- Implement changed/improved processes
- Different cycle times of the plant
- Schedule spare parts planning for future plant expansion and improvements

2.2 Partial or complete migration

What is decisive for the migration scope?

- Complexity of the control solution
  - Single controller or multiple networked controllers
  - Connection to control system/third-party systems
  - Controllers, operator control and monitoring equipment used
  - Special functions such as positioning, PID, counter modules
  - Which bus systems, centralized/distributed I/Os
  - Communication modules/protocols
- Know-how of the existing plant
  - Core functions and communication
  - Processes
  - Connection of control systems
  - Original suppliers
  - Existing documentation and project software
- Components that cannot be replaced (directly)
  - H systems
  - Special drives
  - Control systems, special SCADA systems
- Allowed production downtime
  - 24/7 production
  - Holiday shutdown
  - Produce in advance
  - Shift (parts of) production
- Available budget and time frame
- Applicable standards and regulations
- Production flexibility
- Modernization and improvement
  - Quicker cycle times, higher production quantities
  - Improved product quality
  - Lower energy and production costs
  - Higher availability, faster corrective maintenance times
- Upgrades and expansions planned for the future

In the end, all these influencing factors determine the decision on the type of migration that can be implemented:

- Complete migration
- Complete migration in phases
- Partial migration
- New version

Table 2-1

Type	Purpose	Advantages	Disadvantages
Partial migration	Replacement of devices due to end of product life cycle Increased productivity with new devices	Investment protection, low effort	Two systems, if necessary
System expansion	Expansion of an existing plant	Protection of investment	Two systems
Complete migration	Exchanging the hardware, migration of software	Innovative products, advantages of the new system are used completely	High workload

2.3 Planning the migration phases

The transition to new technology requires careful planning to avoid problems and ensure maximum use of new functions and capabilities. For these reasons, it is important to the take time to plan the objectives and required steps before the start of the migration process.

The following table provides a brief description of how to implement the required phases.

Phase	Designation	Description
1	Plant audit	**Identifying the status quo of the plant/machine** Identification and documentation of all control and plant components.
2	Analysis	**Analyzing the installed base** Analysis of all components, incl. third-party systems, communication types and their dependencies in the system. Definition of contributory trades.
3	Strategy	**Developing options** Consideration of all options, followed by the identification of potential obstacles.
4	Review	**Defining solutions, products, standards** Decision on the solutions, products and standards to be used.
5	Specification	**Checking the specifications** Detailed analysis of all specifications relating to the basic and additional functions.
6	Planning	**Defining the implementation plan** Technical and schedule planning of the individual migration phases.
7	Migration	**Implementing the migration project** Active project support with the aid of the entire Service and Support portfolio.
8	Service	**Integration and planning of maintenance and service** Early planning of the service concept, spare parts procurement, operating concepts and training

2.4 Advantages of modernization

The S7-1500 system supplements the previous S7-300/S7-400 systems. The S7-300, S7-400 and S7-1500 systems are marketed parallel within the next years. Phasing out S7-300/S7-400 is not scheduled before 2020. Thereafter, the components of both systems are available for another 10 years.

Note For more information, please refer to the delivery release of the S7-1500 controller.

https://support.industry.siemens.com/cs/ww/en/view/67856446

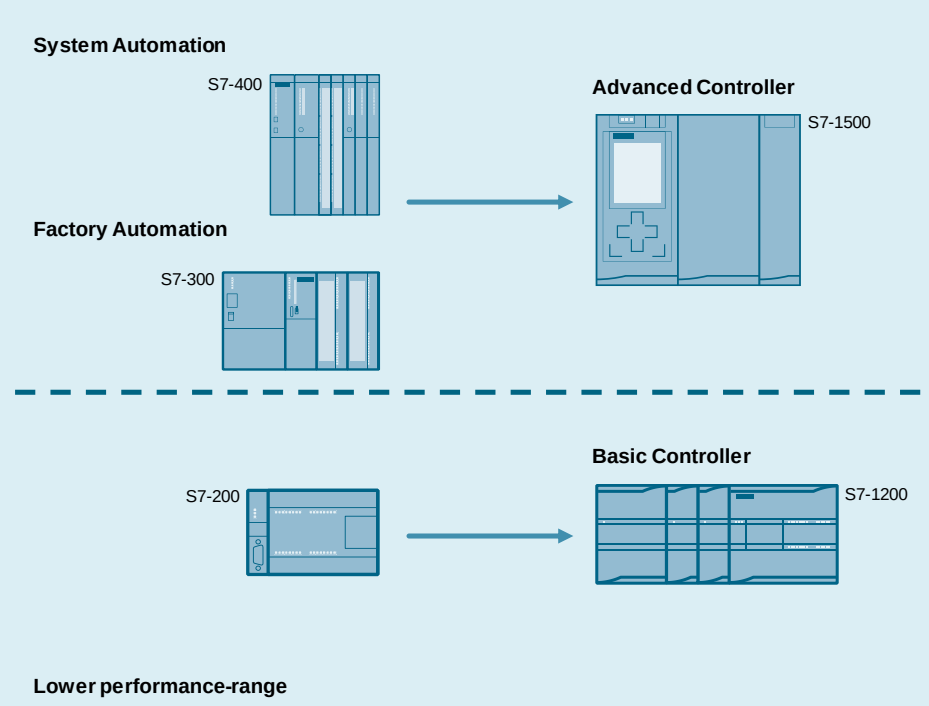
Meanwhile, mechanisms and technologies have changed. A modern SIMATIC automation system such as the S7-1500 can offer you the following technical and financial benefits:

- Increased productivity
- Reduced total production costs by means of integrated system diagnostics and a resulting increased plant availability, for example.
- Increased utilization of machines
- Compliance with new regulations, for example: Security, protection against contemporary hazards
- Improved product quality and process control
- Greater flexibility in production and production planning
- Support of future integration and expansion of your plants
- Support of state-of-the-art manufacturing technology
- Access to a pool of employees familiar with state-of-the-art automation technology and capable of maintaining modernized plants
- The risk for old plants increases continuously due to the difficult spare parts supply situation

3 SIMATIC S7-300/S7-400 and SIMATIC S7-1500 System Architecture

3.1 SIMATIC S7-300/S7-400

Figure 3-1 Automation systems SIMATIC S7-300/S7-400 and S7-1500



3.1.1 Information on the SIMATIC S7-300 automation system

The SIMATIC S7-300 automation system is a programmable logic controller for factory automation/machine manufacturing in the field of OEM. S7-300 is a system with modular design and consists of the individual components:

- Power supply modules
- Central processing units
- Input and output modules
- Signal preprocessing modules
- Communications processors
- Function modules

These SIMATIC S7 components are mounted to an aluminum rack. This rack is used to mechanically fasten all modules. To enable communication with the following modules, the bus connectors are used on the backplane.

Expansion options

If necessary, the connection capacity of the central rack can be increased by expansion devices (IM 360 S, IM 361 R, 365 S-R). Appropriate interface modules connect the central controller to the expansion racks.

Memory concept

The S7-300 is programmed using the STEP 7 Siemens programming software. The control program can be transferred to the central processing unit (CPU) via a programming unit.

The user program is stored in the load memory of the CPU. Since the CPU does not have an internal load memory, a memory card (MMC) is used here. Since the program is not stored volatile on the MMC, a buffer battery is not necessary. The Micro Memory Card is necessary for operating the CPU. The size of the internal program memory varies depending on the CPU type.

Note The 1st generation of S7-300 CPUs had worked with a memory card. It was necessary to provide a buffer battery for the CPU to maintain the program in the event of a power failure.

Note Information on the S7-300 automation system is described: https://support.industry.siemens.com/cs/ww/en/view/8859629

3.1.2 Information on the SIMATIC S7-400 automation system

Note This document is not valid with SIMATIC S7-400 in combination with PCS 7.

The SIMATIC S7-400 automation system is a programmable logic controller for plant automation. In the field of process automation, redundancy concepts are often used for increased plant availability. The CPUs S7-400H and recently S7-410H are used here. This particular new controller type will also be further developed in the future.

Its modular design allows you to variably equip a central controller with modules and adapt it to the respective automation task.

The possible configuration of the S7-400 includes the following different module types:

- Power supply modules
- Central processing units
- Input and output modules
- IM modules
- Communications processors
- Function modules

These SIMATIC S7 components are mounted to a module rack. It is also used for mechanically fixing all modules and contains the bus PCB that electrically and logically interconnects the modules.

Expansion options

If necessary, the connection capacity of the central rack can be increased by expansion devices (IM 460 S, IM 461 R). Appropriate interface modules connect the central controller to the expansion racks.

Memory concept

Programming the S7-400 is performed in STEP 7. The user program can be transferred to the central processing unit (CPU) via a programming unit and is stored in the load memory of the CPU. The integrated main memory is used here for processing. The memory capacity depends on the CPU type used. Memory cards (RAM type) can be used here for expanding the load memory. In this case, the data is only stored volatile, i.e. if a buffer battery is not used in the power supply, the data will be lost after switching off. As soon as the memory card (RAM type) is pulled from the CPU, data will also be lost. If a memory card (flash type) is used, data (the entire user program or service data) cannot be stored volatile.

Note Information on the automation device S7-400 is available in the SIMATIC S7-400 manual.
https://support.industry.siemens.com/cs/ww/en/view/44444467

3.2 SIMATIC S7-1500

3.2.1 CPU

Compared to the SIMATIC S7-300/S7-400 programmable controllers, the available CPU types of the new controller generation S7-1500 show considerable differences and functions.
Features and functions of the available CPU types of the S7-1500.

- Communication via Ethernet
- Communication via PROFIBUS/PROFINET
- HMI communication
- Integrated web server
- Integrated technology
- Integrated system diagnostic
- Integrated industrial security functions
- Safety mode (all S7-1500 CPUs are also available as an F-version)

3.2.2 Information on the SIMATIC S7-1500 automation system

Together with the Totally Integrated Automation Portal (TIA Portal), SIMATIC S7-1500 offers you numerous new options to further increase the productivity of your machines and make the engineering process more efficient.

Thanks to the integration of numerous new performance features, the S7-1500 automation system provides the user with excellent operating capabilities and maximum performance.

The new performance features are:

- Increased system performance
- Integrated motion control functionality
- PROFINET IO IRT
- Integrated display for local operator control and diagnostics
- STEP 7 language innovations while retaining proven functions

Field of application

The S7-1500 automation system provides the flexibility and performance required for the broad range of control applications in machinery and plant engineering.

The S7-1500 complies with IP20 degree of protection and is intended for installation in a control cabinet.

Design and function

The S7-1500 automation system is mounted onto a DIN rail and can centrally consist of up to 32 modules. The modules are interconnected via multi-pin and shielded U connectors.

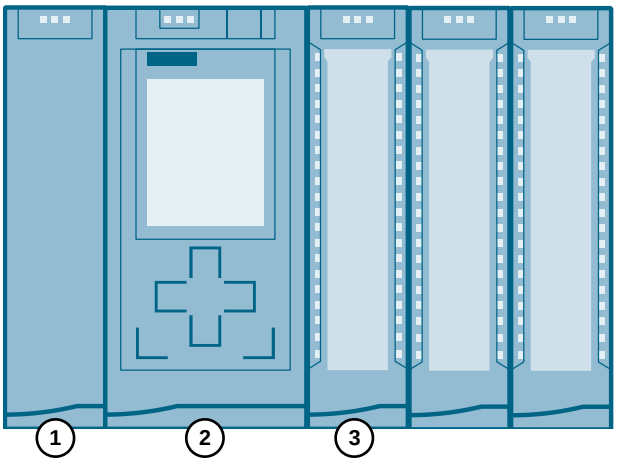
The scalable design allows you to tailor your controller to the local requirements.

The system power supply is a power supply module with diagnostics capability that is connected to the backplane bus via a U connector.

The CPU executes the user program and the integrated system power supply supplies the electronics of the modules used via the backplane bus.

The I/O modules form the interface between the controller and the process.
Figure 3-2 shows a sample configuration of an S7-1500 automation system.

Figure 3-2 SIMATIC S7-1500



1. System power supply module, e.g. PM1507
2. CPU S7-1500, e.g. CPU 1516
3. I/O modules, function modules, communication modules

Memory concept

As the program memory, the S7-1500 automation system uses a SIMATIC Memory Card. The SIMATIC Memory Card is a preformatted memory card that is compatible with the Windows file system. The memory card is available in various sizes and can be used for the following purposes:

- Portable storage medium
- Program card (external load memory for the CPU)
- Firmware update card
- Service data cards

For writing on/reading from the SIMATIC memory card, a standard SD card reader installed in the SIMATIC field PG and most PCs is sufficient.
The SIMATIC Memory Card is mandatory for operating the CPU.

Note The SIMATIC S7-1500 system manual provides information on the S7-1500 automation system.

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

4 Hardware Migration

4.1 General information on migrating the hardware

4.1.1 Reasons for a migration

- Modernization
- Protection of investment
- Migration to current engineering (more efficient working, increased flexibility)
- Basis for future modifications
- Shorter product introduction times
- Reduced operational costs

4.1.2 Support, aids

Siemens and its certified partners facilitate migration by providing:

- Check tool
  - Readiness Check Tool (https://support.industry.siemens.com/cs/ww/en/view/60162195)
- Conversion tools
  - Already integrated in STEP 7 (TIA Portal)
  - Migration Tool (enables migration: without installed TIA Portal)
- Guides for step-by-step implementation, including the associated technical documentation
- Training for the migration from SIMATIC S7-300/S7-400 to S7 1500
  - from STEP 7 V5.x to STEP 7 TIA Portal
  - Guide for replacing the recommended hardware
- Documents in the internet (www.siemens.de/tia-migration) and in the Service Portal (https://support.industry.siemens.com)

4.2 Selecting the CPU

Like SIMATIC S7-300/S7-400, SIMATIC S7-1500 also provides a selection of CPUs with different performance levels.

For reference, the Appendix provides an overview table that compares the S7-300/S7-400 CPU to the recommended S7-1500 CPUs.
(Chapter 7.1.1 CPU modules)

As - aside from criteria such as processing speed, internal memory, number of interfaces and communication connections, etc. - there are other plant-dependent selection criteria, the tables only provide a rough guide for selecting the CPU.

Examples of other plant-dependent selection criteria:

- Does the S7-300/S7-400 CPU still have reserves or is it already operated in the limit range of the automation task (terminal-terminal response time, cycle time, memory requirements, …)?
- Should plant parts that belong together logically or logistically and that have previously been separated on the controller side be combined to one shared control area? Keyword: Plant redesign

4.3 Centralized and distributed I/O

4.3.1 Centralized I/O

The basic design of the centralized I/O of the SIMATIC S7-300/S7-400 differs only insignificantly from the one of the S7-1500. Both systems share the same design where the CPU and the centralized I/O are connected via an appropriate backplane bus. Module connectors are used to connect the systems to the plant I/O.

4.3.2 Expansion racks in S7-300/S7-400

SIMATIC S7-300/S7-400 provided the option to expand the centralized I/O by more I/O modules with the aid of expansion units (module racks 1-3). The expansion racks are connected to the central unit by means of the respective interface modules IM 36x or IM 46x (module rack 0).

Table 4-1

Central unit interface	Expansion unit interface	Maximum number of expansion units
IM 360 S	IM 361 R	3
IM 365 S-R	IM 365 S-R	1

Table 4-2

Central unit interface	Expansion unit interface	Maximum number of expansion units	Power supply
IM 460-0 S	IM 461-0	4	Feed in EU
IM 460-1 S	IM 461-1	4	Feed in EU
IM 460-3 S	IM 461-3	1	Transferred during connection
IM 460-4 S	IM 461-4	4	Feed in EU

For S7 1500, these particular interface modules are not necessary, since up to 32 modules can be plugged side by side in the central configuration.

In comparison, the following 2 maximum configurations are listed:

Table 4-3

Smallest maximum configuration	Largest maximum configuration
PS+CPU1511/1513+modules with 25mm 870 mm	PS+CPU1517/1518+modules with 35mm 1370mm

If the control cabinet does not provide the necessary width for a central configuration, there is the option of connecting a distributed station in the control cabinet via PROFINET.

Note Further information on the S7-400 automation system is available in the manual S7-400, M7-400 Programmable Controllers Module Specifications.
https://support.industry.siemens.com/cs/ww/en/view/19539653

4.3.3 Distributed I/O

For S7-300/S7-400 as well as S7-1500, distributed I/Os can be connected via PROFIBUS or PROFINET, for example, ET200SP, ET200MP, ET200AL, ET200pro, ET200eco or ET200iSP. How and which I/O is used depends on some factors (e.g. quantity framework/number of inputs and outputs, environmental conditions). The I/O may be maintained during migration.

Table 4-4 Connections for ET200 I/Os

ET200 Type	PB connection	PN connection	Integrated in TIA Portal
ET200SP	Yes	yes	yes
ET200MP	Yes	yes	yes
ET200S	Yes	yes	yes
ET200M	Yes	yes	yes
ET200pro	Yes	yes	yes
ET200iSP	Yes	no	yes
ET200eco	Yes	yes	yes
ET200AL	Yes	yes	yes
ET200R	Yes	no	yes
ET200L	Yes	no	yes

Table 4-5 Properties of the ET200 I/Os

ET200 Type	Properties
ET200SP	Control cabinet, IP20, compact size, fine modular
ET200MP	Control cabinet, IP20, multi-channel
ET200S	Control cabinet, IP20, small size, fine modular
ET200M	Control cabinet, IP20, modular, for hazardous area 2/21
ET200pro	Without control cabinet, IP6x, M12 connection, modular,
ET200iSP	Hazardous area zone 1, 2, 21, 22,
ET200eco	Without control cabinet, IP6x, M12, block I/O
ET200AL	Without control cabinet, IP6x, M8 / M12 connection, flexible mounting through front or cross-type screwing, typical for handling and mounting applications
ET200R	Digital input/output module for robots
ET200L	IP20, block I/O

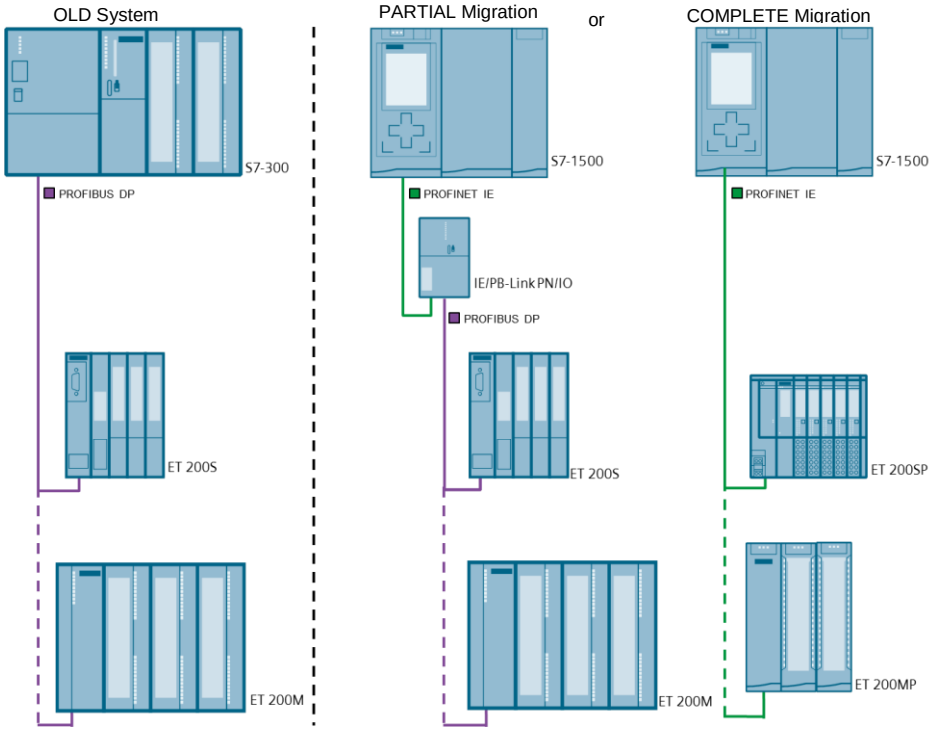
Complete migration of plants with ET 200 stations

It is possible to leave the I/O complete during migration (if it is compatible with the CPU).

If the existing system is based on PROFIBUS, the connections could be exchanged for all stations to migrate to PROFINET. Alternatively, an S7-1500 with PROFIBUS can be employed, or a gateway (IE/PB link) which forwards signals centrally from PROFIBUS to PROFINET.

Aside from the central controller, the complete migration to S7-1500 involves migrating the complete I/O to the new control components. For this purpose, the complete ET 200 I/O portfolio is available to you. For example, ET 200SP, ET 200MP, ET 200AL, etc.

Figure 4-1 Migration of distributed plants



Note

Even if the partial migration allows direct connection to the OLD I/O, it is recommended to implement the complete migration to ET 200MP/SP/AL/etc. and the connection via PROFINET. When the basic functionality of the plant has been migrated, this can also be done in a second migration step.
For example, advantages result from: Improved system diagnostics, faster bus, state-of-the-art technology and relatively easy migration and connection to the existing I/O.

4.4 Communication and networks

In SIMATIC S7-300/S7-400 there are a number of options for communication. These were expanded with S7-1500.

- System-internal communication
- With external communication partners
- Numerous communications protocols

An overview provides you with the compendium “CPU-CPU communication”.
https://support.industry.siemens.com/cs/ww/en/view/78028908

Note | Communication will be discussed in greater detail in a later version of this guide.

4.5 Operator control and monitoring

Various devices for visualization tasks are available in different versions. The panels formerly used in combination with S7-300/S7-400 are discontinued. It is therefore recommended to migrate Operator Panels (OP), Touch Panels (TP), Multi or Mobile Panels (MP) to Basic Panels or Comfort Panels.

4.5.1 HMI hardware

When replacing the hardware, please note the requirements for the visualization unit:

- Display size/orientation (format change from 4:3 to 16:9, 4“,7“,9“,12“,15“,19“,22“ and horizontal/vertical)
- Installation dimensions/cut
- Housing material (possibly special environmental conditions)
- Type/number of interfaces (MPI, PROFIBUS, PROFINET, USB)
- Data storage/storage options/memory size

Note A detailed guideline for migrating older panels to Comfort Panels is available at: https://support.industry.siemens.com/cs/ww/en/view/49752044

4.5.2 HMI software

Migrating the project which is part of the panel is possible. The project muss here be available for WinCC flexible 2008 SP2/SP3, otherwise, migration is not possible. If an older version of the project is available, you must first upgrade to reach this standard. It is also possible to migrate a ProTool project in WinCC TIA Portal. This requires an intermediate step. Das ProTool project must first be migrated to WinCC flexible 2008. Then an upgrade to WinCC (TIA Portal) can be performed.

Note Further information on the topic of migrating WinCC flexible to WinCC (TIA Portal) is available in the respective guideline:

https://support.industry.siemens.com/cs/en/view/77430539

5 Software Conversion

5.1 General information on software conversion

Generally, you can migrate ALL of your STEP 7 V5.x programs to STEP 7 (TIA Portal)!

However, depending on the STEP 7 commands used or special blocks, it may be necessary to make adjustments after migration.

This chapter explains the most important differences between the two software platforms. In addition, we introduce you to a number of tools. They are intended to provide the best possible support for migration and any adjustments that may be required.

Nevertheless, there may be reasons which make it advisable to rebuild certain programs or programs parts: Examples of such reasons:

- Simpler code
- Additional functions
- Improved diagnostic capability
- Creation of standard functions and libraries capable of meeting future requirements
- Migration effort same as or higher than rebuilding
- Achievement of higher throughputs due to increase in performance
- And many more

Note For a general programming guide for SIMATIC S7-1500, refer to the following entry ID:

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

5.1.1 Programming languages

STEP 7 V5.x

In SIMATIC STEP 7 V5.x, the following standard programming languages were available:

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

Following languages can additionally be used as option package:

- Structured Control Language (SCL)
- Continuous Function Chart (CFC)
- S7-GRAPH
- Hi-GRAPH

Note Please note, that between a mere STEP 7 V5.5 and a PCS7 installation, there may be differences since for PCS7 options are already contained.

STEP 7 (TIA Portal)

In SIMATIC STEP 7 (TIA Portal) the following programming languages are available:

- Ladder diagram (LAD)
- Function block diagram (FBD)
- Statement list (STL) (not for S7-1200)
- Structured Control Language (SCL)
- S7-GRAPH (not for S7-1200)

Note S7-SCL is a high-level-type programming language. Using S7-SCL, particularly more comprehensive functions can be implemented easily and conveniently. Therefore, we recommend that functions such as data handling, search algorithms, copy functions, comparison functions, etc. be converted to S7-SCL when migrating STEP 7 V5.x to STEP 7 (TIA Portal).

Note For an overview of the statements available to you for S7-1500, please use the following link:
https://support.industry.siemens.com/cs/ww/en/view/86630375

5.1.2 Option packages and expansions

For STEP 7 V5.x there are various expansions or option packages, some of them are listed below.

The TIA Portal already provides a wide basis for engineering, since many expansions which still needed to be installed separately in STEP 7 V5.x are now available already integrated.

Table 5-1

STEP 7 V5.x	TIA Portal
WinCC Flexible WinCC	WinCC in TIA Portal (various variants)
Distributed Safety	STEP 7 Safety
SINAMICS MICROMASTER STARTER	Startdrive
Teleservice	Integrated
Easy Motion Control	For S7-300/S7-400/WinAC existing in TIA Portal, for S7-1500 the functionality is mapped via integrated TO (technology objects)
Modular PID Standard PID PID Selftuner	For S7-300/S7-400/WinAC existing as PID Professional, for S7-1500, the base functionality can be mapped via integrated TO (technology objects) integrated
S7 Technology	
Different Sirius engineering software	Partly available, for example SIMOCODE ES

Note If options or expansions are used in the installation scope of TIA Portal, these must have the same version as STEP 7.

5.1.3 Versions of the TIA Portal

When installing TIA Portal, please note the following versions:

Table 5-2

STEP 7	Device
STEP 7 Basic	S7-1200
STEP 7 Professional	S7-300, S7-400, S7-1200, S7-1500, WinAC RTX, Open Controller

Table 5-3

WinCC	Device
WinCC Basic	Basic Panels
WinCC Comfort	Comfort Panels, Mobile Panels
WinCC Advanced	PC single-user station
WinCC Professional	SCADA

Table 5-4

STEP 7Safety	Device
STEP 7 Safety Basic	S7-1200
STEP 7 Safety Advanced	S7-300,S7-400,S7-1500, WinAC RTX

5.1.4 Requirements Licensing

Migrating the STEP 7 V5.x project (only the STEP 7 part) it is necessary that the software is installed and the license valid:

- STEP 7 V5.4 SP5 or higher + STEP 7 V13SP1 (possible as combo license)

If the project contains a WinCC flexible part, licenses are also necessary for this:

- WinCC flexible 2008 SP2 or higher + WinCC V13 SP1 (possible as combo license)

Any further option requiring licenses that is part of the STEP 7 V5.x project must also be available with a valid license.

Note The TIA selection tool supports you in migrating licenses and suggests the most cost-efficient variant:
http://www.siemens.en/tia-selection-tool

5.1.5 Programming environment

To be able to install TIA Portal STEP 7 V13SP1, you need one of the following operating system versions:

- Windows 7 Prof./Enterprise/Ultimate in 32/64Bit
- Windows 8 Professional/Enterprise
- Windows Server 2008 R2 Std SP1
- Windows Server 2012

Furthermore, it is possible to use TIA Portal in the following virtualization environments:

- VMware Player 6
- VMware Workstation 10
- VMware vSphere Hypervisor ESX(i) 5.5 (as of UPD2)
- Microsoft Windows Server 2012 R2 Hyper-V

Note Statements regarding compatibility of the individual SIMATIC packages is available at https://support.industry.siemens.com/cs/ww/en/view/64847781

As the hardware platform, we recommend:

- SIMATIC Field PG M4 Premium or Premium Plus

  (for example, article number: 6ES7716-1CB10-0CE4 or 6ES7716-2CB10-0EC4)

  Important features:
  - Intel Core I5 or I7
  - Internal PG interface for S7 memory cards
    Dual boot operating system: Windows XP Prof. and Windows 7 Ult. 64 bit
  - Preloaded software and licenses for STEP 5, STEP 7 Prof. 2010, STEP 7 Prof. V13SP1, WinCC flex. 2008, WinCC Adv. V13SP1, Startdrive V13SP1

Note The TIA Selection Tool allows you to easily configure your field PG to suit your needs.

However, always select at least one of the important features listed above.

Link to TIA Selection Tool: www.siemens.de/tia-selection-tool

Note We explicitly advise against using a standard PC or notebook computer!
The reasons for this include:

- Non-existing or wrong interfaces
- Complex setup of a dual-boot partition
- Installation of the complete software packages (time and costs)

Note A promotion package for field PGs is available which is intended especially for migrations performed with the migration tool: The package comprises no STEP 7 V5.x or WinCC flexible licenses. The article number is as follows: 6ES7716-2CA10-0CD4

5.2 Migrating the project

5.2.1 Preparatory steps

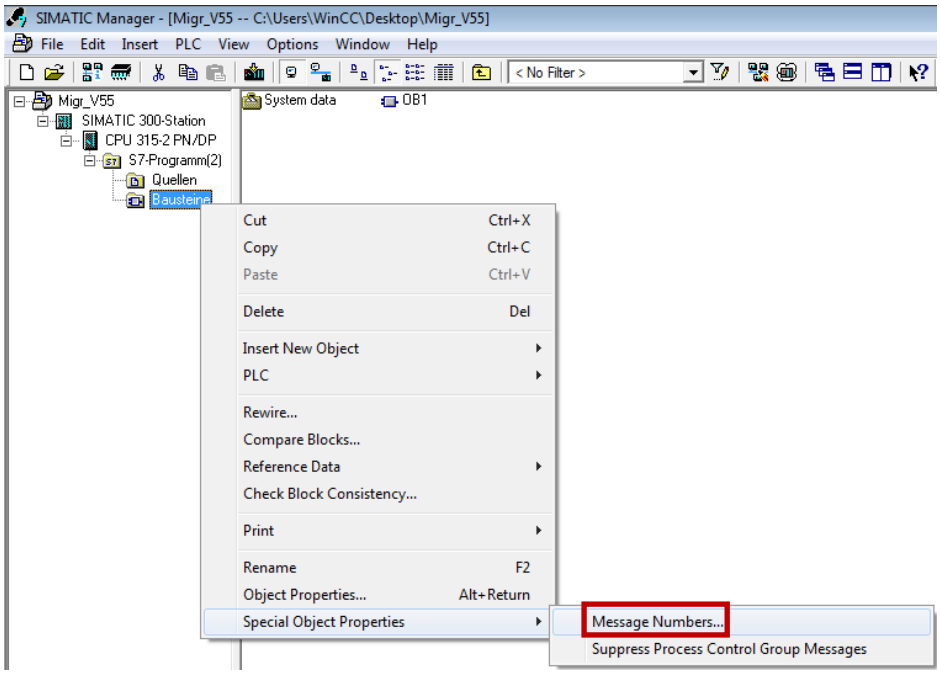
Before the actual migration of the project can be performed, some points must be checked and changed, if necessary.

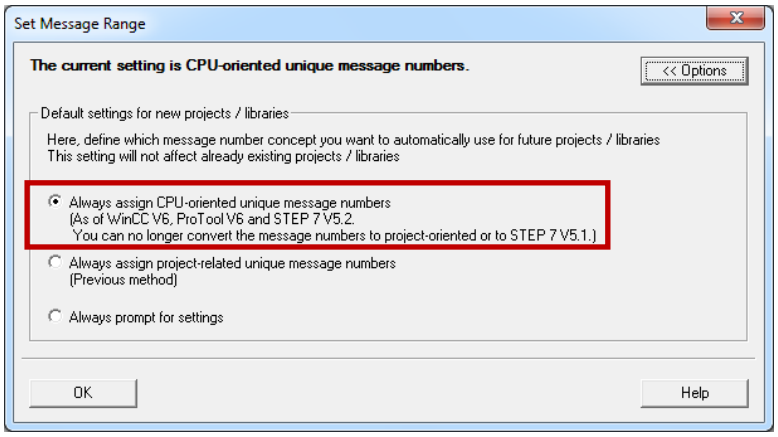
Note Migrating a project is only possible as of STEP 7 V5.4 SP5. Nevertheless, it is possible to convert projects that were created with an older version. Open the project with STEP 7 V5.4 SP5 or higher and perform a consistency check of the blocks including compilation.

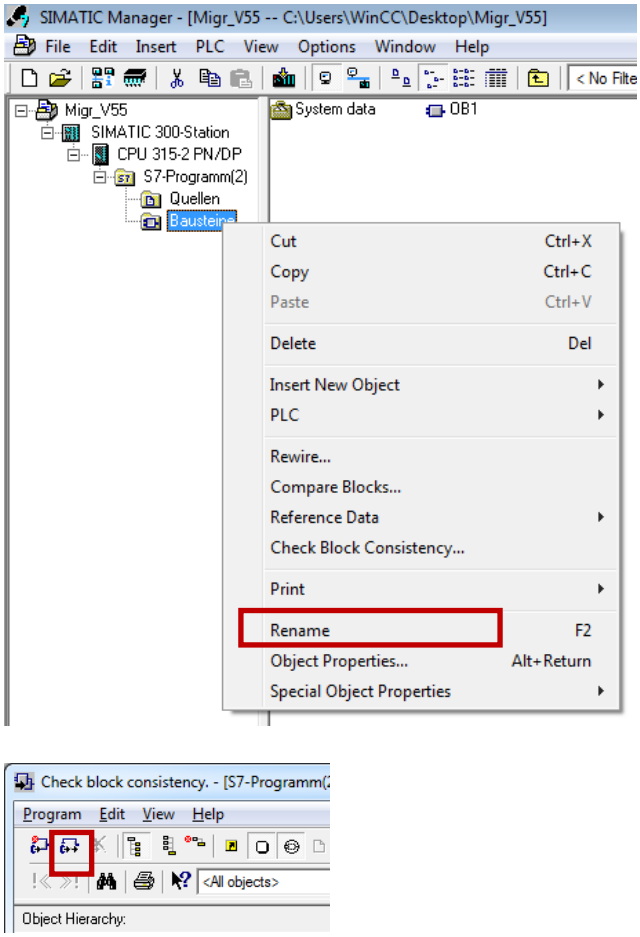
Table 5-5

Step	Instruction
1.	Check whether the required software packages for STEP 7 V5.x or TIA Portal have been installed and licensed. See Chapter 5.1.2
2.	Verify the project structure of your STEP 7 V5.x project. Multi-projects cannot be migrated as a whole. The respective individual project must be used for this.
3.	Verify whether the project contains WinCC flexible or the WinCC stations. If only the STEP 7 fraction shall be migrated, the other stations need to be removed from the project.
4.	Check whether the components contained in the STEP 7 V5.x project can be migrated. Use the readiness check tool. Note: Modules/stations connected via GSD file were connected and can be migrated in any case, since GSD files are automatically installed in TIA Portal.

Step	Instruction
5.	Then check which message number procedure was used in the project. If “project-wide” is set, the migration is cancelled.





Step	Instruction
6.	Check whether the output project is available in consistent form. 

Note

For information on how to check your project for consistency, refer to the following entry:
https://support.industry.siemens.com/cs/ww/en/view/5416540

Note

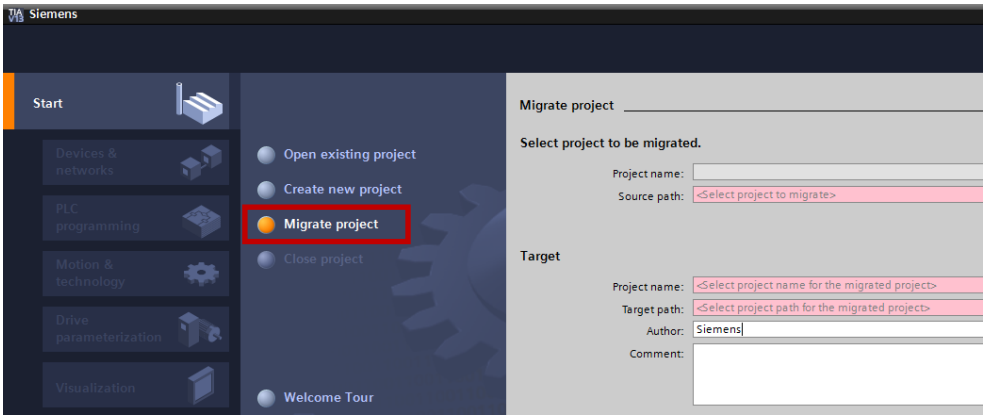
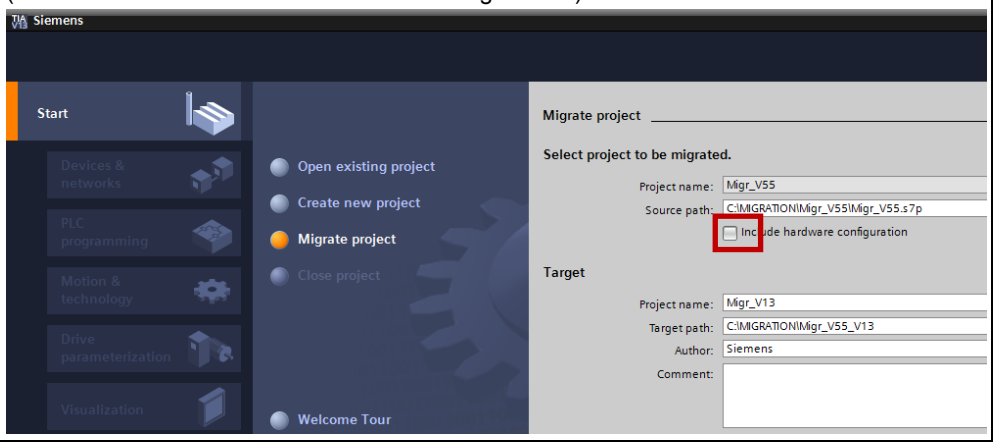
The components in the TIA Portal have the due date 1st Oct 2007. Any projects no longer released after this date are not included.
To verify the hardware that occurs in the STEP 7 V5.x project, the readiness check tool can be used.
https://support.industry.siemens.com/cs/ww/en/view/60162195
If the Readiness Check Tool finds modules that cannot be migrated directly, there is the option in most cases to still set a successor module in STEP 7 V5.x that is contained in TIA Portal.
This behavior does not affect devices that were integrated via GSD file.

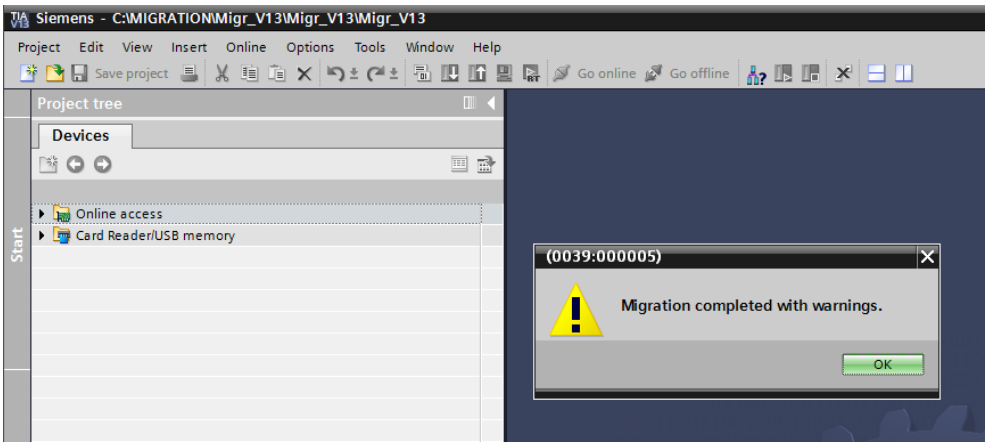
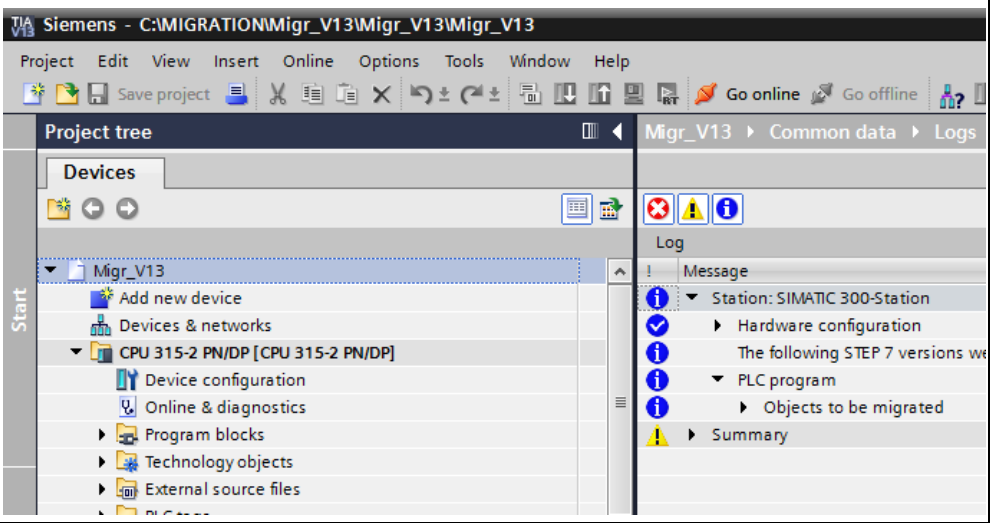
5.2.2 Migration from STEP 7 V5.x to STEP 7 (TIA Portal)

Option 1: Migration with TIA Portal

To migrate a project from STEP 7 V5.x to STEP 7 (TIA Portal) V13 SP1 (both software packages are located on one computer), please perform the following steps:

Table 5-6

Step	Instruction
1.	Open the TIA Portal.
2.	In the Portal view, you open the menu item “Migrate project”. 
3.	Select the appropriate output project. (note the checkmark “Include hardware configuration”) 

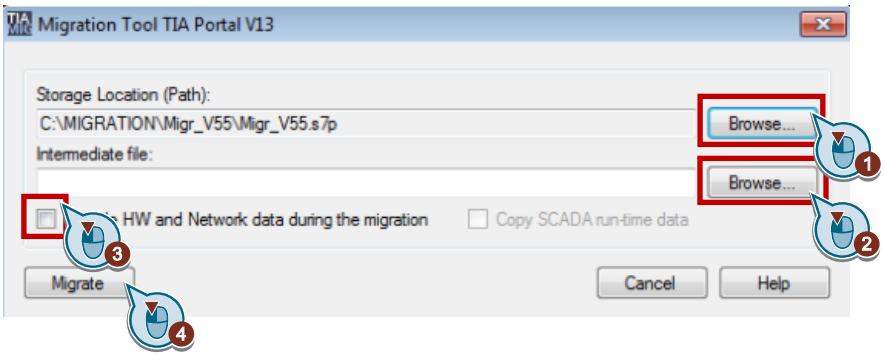
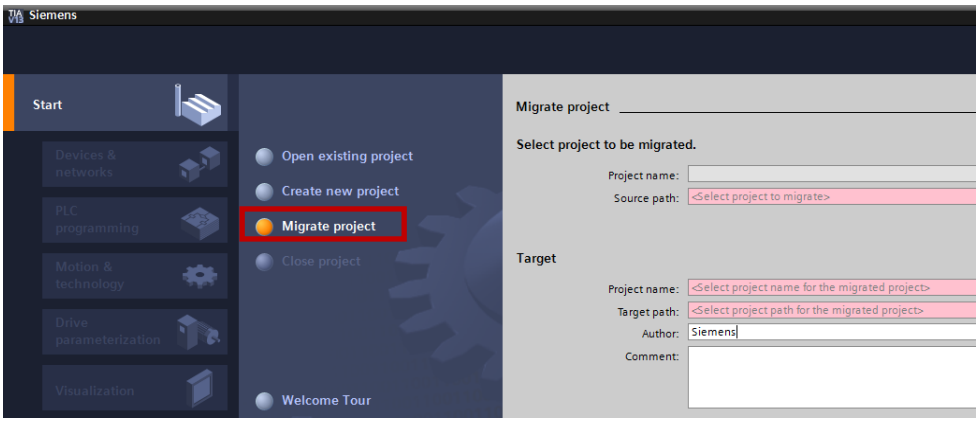
Step	Instruction
4.	Check the result of the migration process; a migration protocol is available here.  
5.	If necessary, adjust the project.
6.	Compile the migrated project.
7.	If necessary, repair any errors.
8.	Execute continuing steps if necessary.

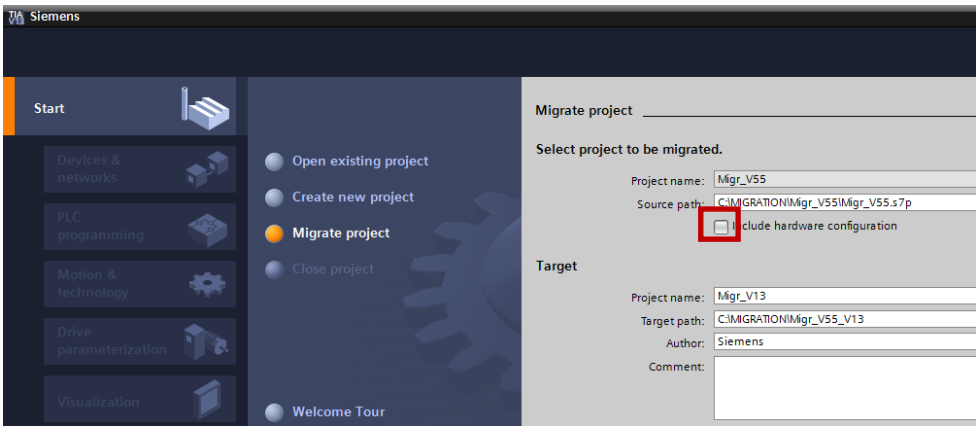
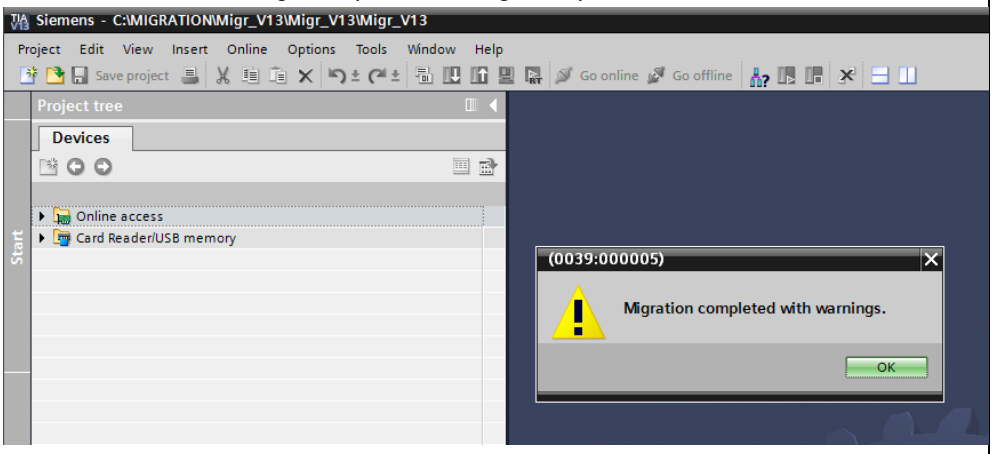
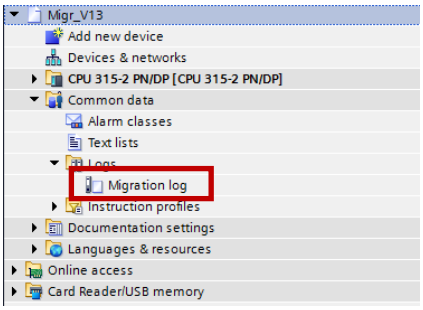
Option 2: Migration with the migration tool

If STEP 7 V5.x and STEP 7 (TIA Portal) are installed on 2 different systems, there is an alternative way in which the migration can still be performed. Execute the following steps:

Note The migration tool is available on any installation DVD of STEP 7 (TIA Portal) or in the following entry (for the most recent version of the TIA Portal): https://support.industry.siemens.com/cs/ww/en/view/58638200

Table 5-7

Step	Instruction
1.	Open the Tool TIA V13 migration tool.
2.	For “Storage Location” you select the source project with “Browse”. Enter the destination path for “Intermediate file” via “Browse”  Set the checkmark at “Include HW and Network data during the migration” if you do not only wish to migrate the software but also the hardware.
3.	Press on “Migrate” to start the migration. After completion, “intermediate.am13” is selected in the target directory.
4.	Copy the file to the target system installed on the TIA Portal.
5.	Open the TIA Portal.
6.	In the portal view you open the menu item “Migrate project” 

Step	Instruction
7.	Select the appropriate output project. (note the checkmark “Include hardware configuration”) 
8.	Check the result of the migration process; a migration protocol is available here.  
9.	If necessary, adjust the project.
10.	Compile the migrated project.
11.	If necessary, repair any errors.

5.2.3 Migrating projects with safety program

Without compilation

When converting a project that contains a fail-safe CPU, you can execute the migration in the same way as for a standard program. You receive a complete STEP 7 safety project which maintains the program structure of Distributed Safety as well as the overall structure.

Note The acceptance expression generated with S7 Distributed Safety V5.4 SP5 remains valid!

With translation

The migrated project only receives the new program structures and new overall signature after it has been recompiled with STEP 7 Safety Advanced V13.

Note The safety program is only compiled if the password for the F program is entered! Without entering the password, only the standard user program will be compiled!

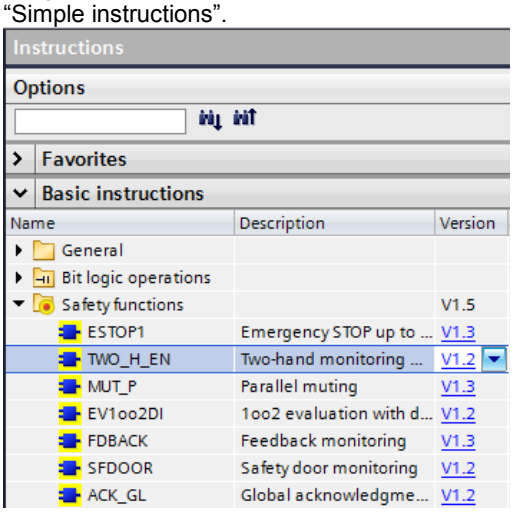
Verification or reworking necessary

If you wish to migrate a project that contains a safety program created with Distributed Safety, the following points should be checked or noted.

In the first step of migrating the STEP 7 V5.5 project to TIA Portal, alarms do not yet occur. The process is only cancelled with respective error message(s) when migrating the CPU to S7-1500 if certain instructions occur.

Table 5-8

Problem	Remedy/note
Currently, STEP 7 Safety does not support any runtime group communication	Restructure the F runtime groups already in the STEP 7 V5.5 project
When migrating to S7-1500 the names of the I/O DBs are changed	STEP 7 Safety changes the names as well as the number of the I/O DBs. Adjust the usage locations in the program manually
Replacing F_GLOBDB.VKE0/1 with FALSE/TRUE for S7-1500	Adjust the usage locations in the program manually
Replacing QBAD_I_xx or QBAD_O_xx with the value status	This change applies for the ET200SP/ET200MP I/Os and others that support the “RIOforFA-Safety” profile. Adjust the usage locations in the program manually

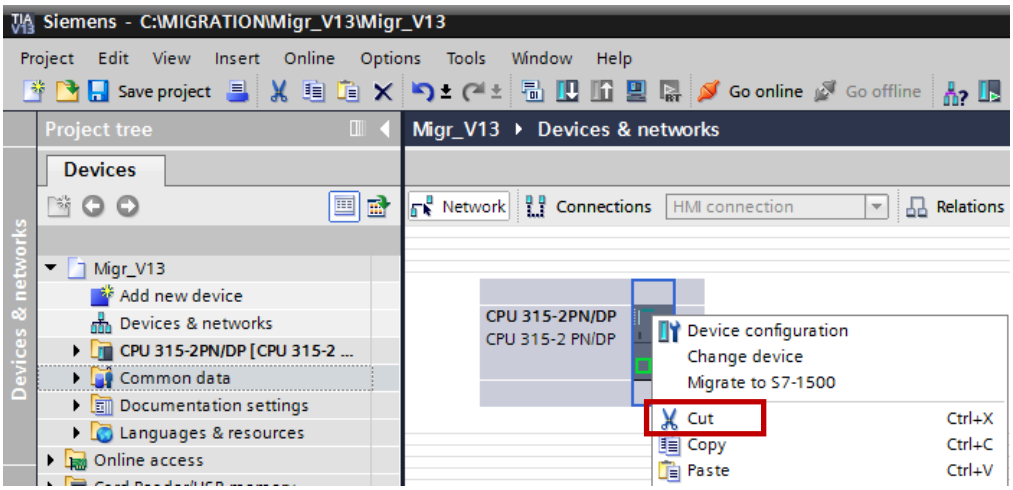
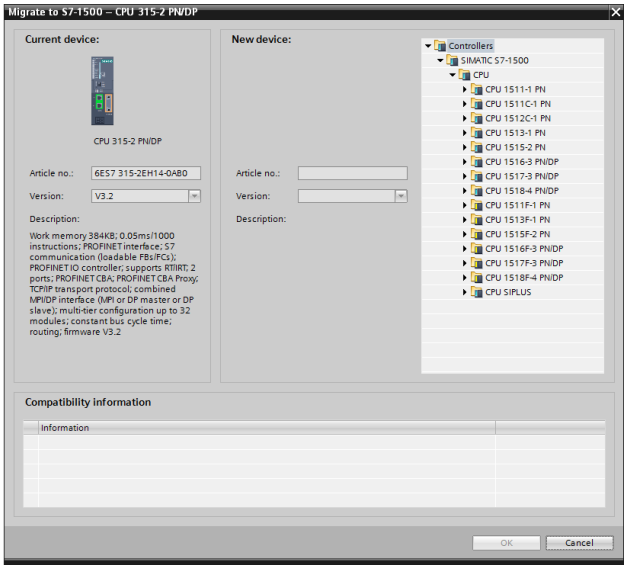
Problem	Remedy/note
The following instructions are not supported by the S7-1500: - OV - MUTING - TWO_HAND - WR_FDB - RD_FDB - OPN - SENDS7 - RCVS7	Delete the instructions in the STEP 7 V5.5 project and add it again in the TIA Portal project. Drag the blocks from the “Instructions” -> “Simple instructions”.  Note the version of the inserted blocks.

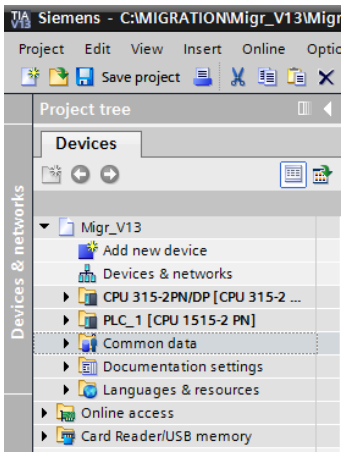
Note Further notes on STEP 7 Safety are available in the manual: https://support.industry.siemens.com/cs/en/view/54110126

5.2.4 Continuing steps - Migrating the CPU S7-300/S7-400 to S7-1500

After the project is now available in the TIA Portal, you still need to make further adjustments. The CPU not automatically migrated to S7-1500 during the migration process.

Table 5-9

Step	Instruction
1.	Migrate the S7-300/S7-400 to an S7-1500 by selecting the menu item “Migrating to S7-1500”. 
2.	Select the suitable CPU.  <u>Important:</u> When migrating to the CPU S7-1500, only the CPU is adjusted. If further modules should be plugged in at the central configuration of the S7-300, these need to be manually supplemented when migrating to S7-1500. Note: You can import the HW configuration from your STEP 7 V5.x project into the TIA selection tool. If you now wish to migrate the station to an S7-1500, the central modules are also converted, as much as possible.

Step	Instruction
3.	After completion, both CPUs are contained in the project. 
4.	The program should now be optimized.

5.2.5 Optimizing the TIA Portal project

With the created TIA Portal project the full migration is not yet completed. If the migration protocol itself does not contain any further information, and if no errors have occurred after compilation, it will become necessary in most cases to perform another optimization. The command sets and command structures between S7-300/S7-400 and S7-1500 are different. In an S7-300, commands are possibly processed differently. This may cause a migrated program to run slower in an S7-1500 than in an S7-300/S7-400, even though the technical data clearly favor the S7-1500.

Amongst other things, the following points should be considered during optimization:

- Optimized blocks
- Block sizes
- New data types
- New instructions
- Symbolism
- Library concept
- Integrated blocks (library)

Optimized blocks

The TIA Portal works with optimized blocks; non-optimized blocks only exist for compatibility reasons. For optimized blocks, the declared data elements in the available memory area of the block are automatically aligned so its capacity is fully used and access can be performed with optimal performance. Large data types are stored at the beginning, smaller ones at the end. Bits are stored as byte, the controller needs not execute any masking or conversion.

The data is structured and stored in a way ideal for accessing this data in the used CPU. In the declaration, the data elements only receive a symbolic name used for addressing the tag within the block. This increases the performance of the CPU.

Access errors, for example from the HMI, are not possible in this way.
For S7-300 and S7-400, the maximum size of a data block is restricted to 64 Kbytes. An S7-1500 can process data blocks up to 10 Mbytes - for optimized block access. Non-optimized blocks can be accessed in the standard way (direct addressing); however, this causes a restriction in the performance. Both variants should therefore not be mixed in the user program.

Furthermore, optimized blocks have a memory reserve which enables loading during runtime.

Quantity framework

Overall, the S7-1500 causes an increase of the quantity framework – amongst other things, the number of usable blocks, the size of all blocks and the new SIMATIC memory card with up to 32 Gbytes usable memory has increased. This all favors usability for the user but also the size of the user program.

Table 5-10

Block type	S7-300/S7-400	S7-1500
DB	64 Kbytes	Optimized up to 10 Mbytes (depending on the CPU type), non-optimized 64 Kbytes
OB	64 Kbytes	Optimized up to 512 Kbytes, depending on the CPU type
FB	64kbyte	Optimized up to 512 Kbytes, depending on the CPU type
FC	64kbyte	Optimized up to 512 Kbytes, depending on the CPU type
Memory card	Up to 8 Mbytes/up to 64 Mbytes	Up to 32 Gbytes

Symbolism

The TIA Portal works entirely on a symbolic layer. The user needs not be concerned with numbering his blocks.

The consistent framework of the TIA Portal enables tags created in STEP 7 to be used in the visualization part. Symbolic programming facilitates handling and readability, but also maintenance of the program. Use Drag and Drop to move elements/tags from the Devices & Networks view directly into the program.

A symbol table as in STEP 7 V5.x is no longer available in the TIA Portal. Symbols are now referred to as PLC tags and are summarized in the tag table. The user can structure it into logic groups in sub-tables.

Note In the TIA Portal, the former tag tables are now referred to as watch tables.

New data types

For programming in TIA Portal, some new data types are introduced, which also include 64-bit data types. This enables processing much larger and more precise values.

Table 5-11

Data type	Size	Range of values
USInt	8 bit	0 .. 255
SInt	8 bit	-128 .. 127
UInt	16 bit	0 .. 6535
UDInt	32 bit	0 .. 4.3 million
ULInt	64 bit	0 .. 18.4 quintillion (10^{18})
Lint	64 bit	-9.2 quintillion .. 9.2 quintillion
LWord	64 bit	16#0000 0000 0000 0000 up to 16# FFFF FFFF FFFF FFFF
LReal	64 bit	-1.79e+308 .. 1.79e+308
Time data types		
DTL	Reads the current system time (division into: YEAR,MONTH,DAY, WEEKDAY, HOUR,MINUTE,SECOND,NANSECOND)	
LTime	64 bit	LT#-106751d23h47m16s854ms775us808ns up to LT#+106751d23h47m16s854ms775us807ns
LTIME_OF_DAY	64 bit	LTOD#00:00:00.000000000 up to LTOD#23:59:59.999999999
Unicode data types		
WCHAR	2 bytes	Any Unicode characters
WSTRING	(4+2*n)bytes	Preset value: 254 characters Max. Value: 16382 characters
Pointer data type		
VARIANT	A parameter of the VARIANT type is a pointer that can point to tags of different data types. In contrast to the ANY pointer the VARIANT is a pointer with type test. I.e. the target structure and source structure are checked at runtime and have to be identical.	

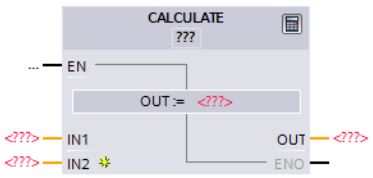
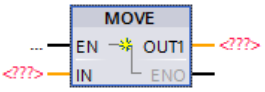
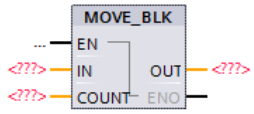
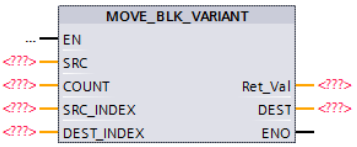
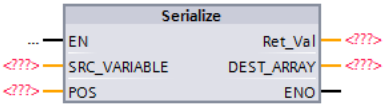
PLC data type

A new feature are the so-called PLC data types. Like the UDTs in STEP 7 V5.x, a separate data type can be designed that can be reused in the overall program, typically in data blocks, but also in interfaces of function blocks. A change can hence be performed centrally and is automatically updated at all usage locations.

New instructions

New instructions enable setting up the programming in a very convenient way. Below, there is a small selection of newer instructions:

Table 5-12

Name	Usage	Appearance
CALCULATE	Performing calculations independent of the data type	
MOVE	Copy value Copy the area	
MOVE_BLK	Copy the area (if parts of arrays with known data type shall be copied)	
UMOVE_BLK	Copy array without interruption	
MOVE_BLK_ VARIANT	Copy the area (if parts of arrays whose data type is only known during program runtime shall be copied)	
Serialize	Converts structured data into a byte array	
Deserialize	Converts bytes from a byte array into one or several structures	

Libraries

With the TIA Portal you can create independent libraries from different project elements that can be easily reused.

Using libraries offers the following advantages:

- Simple storage for the data configured in the TIA Portal
- Cross-project exchange
- Central update function of library elements
- Versioning library elements
- Fewer error sources when using control blocks through system-supported consideration of dependencies

Note Further recommendations on how to optimize the user program are available in the S7-1200/S7-1500 programming guideline.
https://support.industry.siemens.com/cs/ww/en/view/90885040

Note After the hardware and software has been fully migrated, optimized and downloaded, a test of all functions shall be performed!

5.3 Program structure and standard functions

5.3.1 Organization blocks (OB)

Organization blocks are located in the firmware of the SIMATIC CPU and called by the CPU's operating system when specific events occur. They are the interface between the system program and the user program and can be programmed by the user. For the S7-300/S7-400 CPUs as well as the S7-1500 CPUs there are organization blocks. In some cases, the available OBs differ between the two SIMATIC platforms.

OBs are processed on a priority-controlled basis. When there are multiple simultaneous OB requests, the highest priority OB is processed first. When an event occurs whose priority is higher than the one of the currently active OB, this OB is interrupted.

The most important OBs are listed below.

Cyclic program processing

Table 5-13

S7-300 CPUs/ S7-400 CPUs	S7-1500 CPUs	Description
OB 1	Main OB	Cyclic program processing For S7-1500, several cyclic OBs can be used which are executed successively in a cycle.

Time-controlled program processing (cyclic interrupts)

Table 5-14

S7-300 CPUs/ S7-400 CPUs	S7-1500 CPUs	Description
OB 32-35/ OB 30-38	Cyclic interrupt OB	Time-controlled program processing For program processing at periodic intervals.

SIMATIC S7-1500 provides 20 OBs you can use for time-controlled program processing. In contrast to S7-300/S7-400, the S7-1500 allows you to individually set the cycle clock for each cyclic interrupt OB and additionally set a phase shift. For S7-300/S7-400, it depends on the respective CPU, which OBs are available. For S7-400 CPUs, the priorities can be set, for S7-300 CPUs they can't.

Program processing during startup (restart)

Startup OBs are processed once when the CPU mode changes from STOP to RUN. When the startup OB has been processed, cyclic program processing starts.

In S7-300/S7-400, 3 different startup OBs can be used. Depending on the CPU startup type, the respective OB is then called by the operating system and processed once.

Table 5-15

S7-300 CPUs/ S7-400 CPUs	S7-1500 CPUs
OB100: Restart OB101: Restart OB102: Cold start (only for S7-400)	Up to 100, OB_Startup executed in succession within one call phase

OBs for error diagnostics

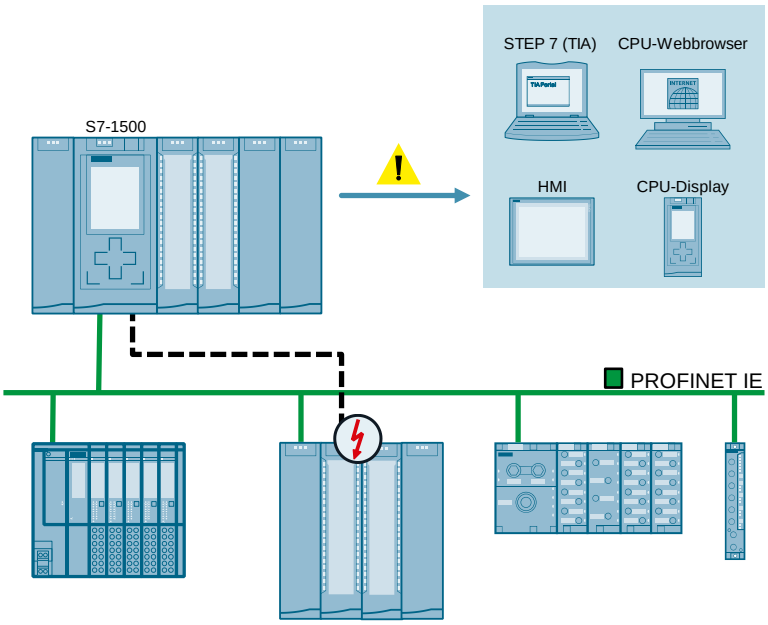
Since parts of the system architecture of S7-300/S7-400 and S7-1500 differ, errors are displayed and handled differently. Particularly in the field of hardware errors, the new S7-1500 control system offers very convenient system diagnostics options. While for S7-300/S7-400 the diagnostic blocks offered by the system (report system error, short SFM) are still selected by the user himself, diagnostics is automatically integrated in S7-1500. Due to the integration in the firmware of the CPU, information can also be displayed in STOP mode. For the user, the system now offers a uniform display concept, irrespective of whether in engineering, web server, on the panel, or on the display.

For information on system diagnostics, please refer to the following two entries:

https://support.industry.siemens.com/cs/ww/en/view/68011497

https://support.industry.siemens.com/cs/ww/en/view/98210758

Figure 5-1



Should other plant-specific programs still be necessary in the error OBs, this is of course also possible.

5.3.2 Function blocks and functions, data blocks

For compatibility reasons, STEP 7 V5.5 and STEP 7 TIA Portal does not differ with regards to basic functions, but in some details. These are describe in detail in the programming guideline.

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

Functions (FC)

For functions in STEP 7 (FCs), appropriate input and output signals can be declared and transferred to the FC when they are called. In addition, the FC can provide a direct return value of the function. Temporary variables can be declared in an FC.

Function blocks (FB)

For function blocks in STEP 7 (FBs), appropriate input and output signals can also be declared and transferred to the FB when they are called. During the call, an instance (possibly multi-instance) is assigned to each FB as a memory in which the values of its tags are stored for processing. Static and temporary local variables can be declared in a STEP 7 FB.

Data block (DB)

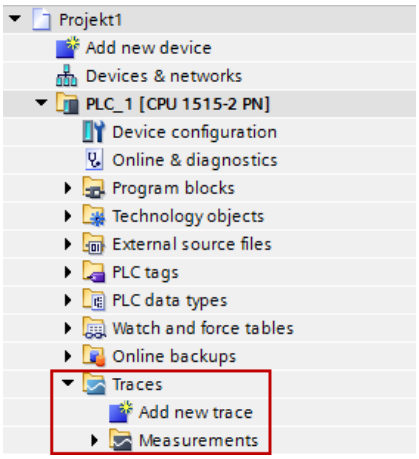
Data blocks are used for saving relevant data. In STEP 7 V5.5 as well as in STEP 7 TIA Portal there are global data blocks as well as instance data blocks. However, a major difference lies in using or handling the data blocks. While in STEP 7 V5.5, only DBs with up to 64 Kbytes can be used, blocks of up to 10 Mbytes size can be created and used in TIA Portal. This depends on the property of the blocks (optimized/non-optimized), the CPU and the available storage space.

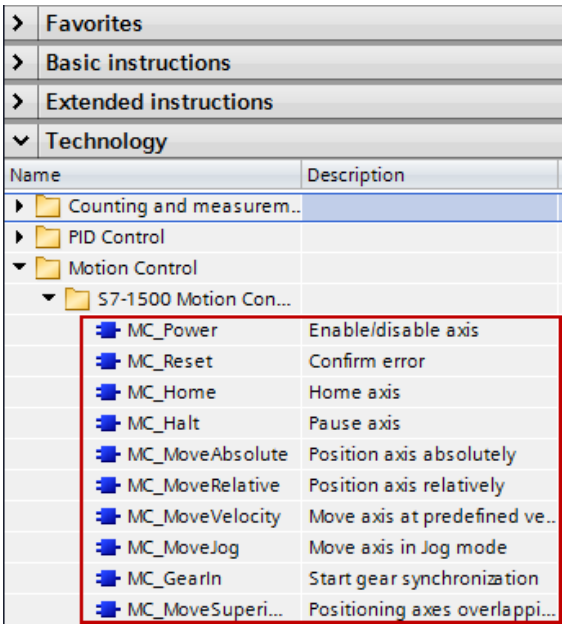
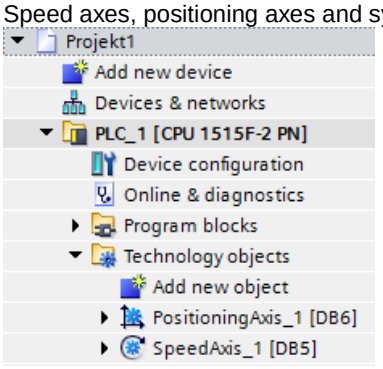
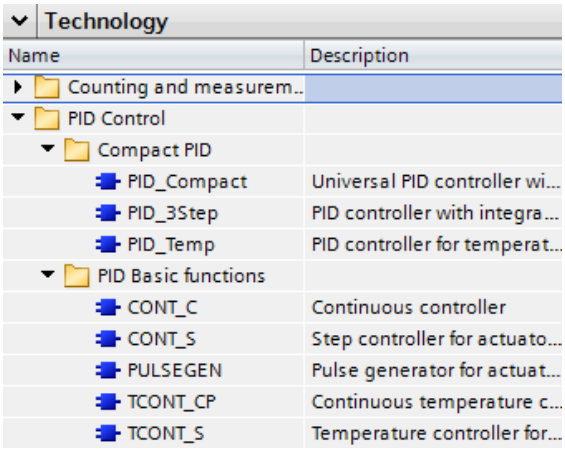
5.3.3 Differences between STEP 7 V5.5 and STEP 7 TIA Portal

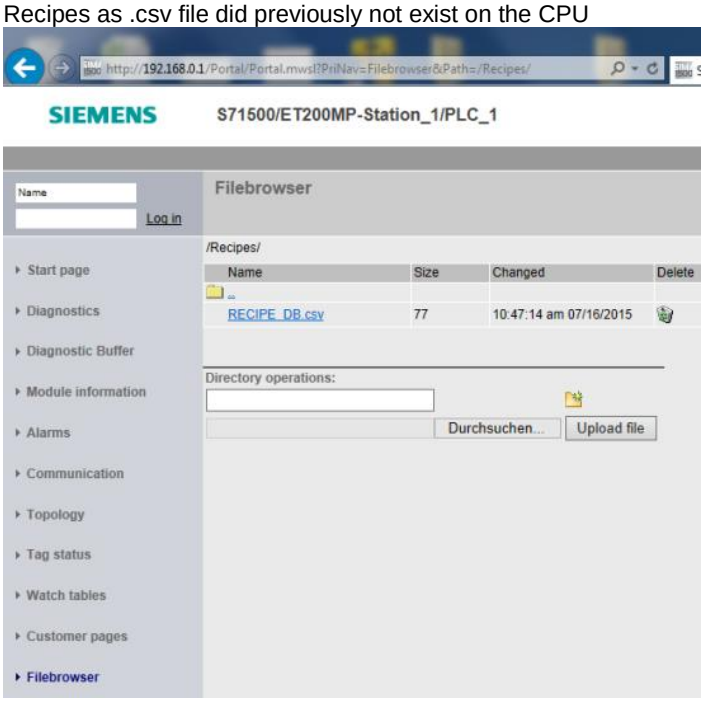
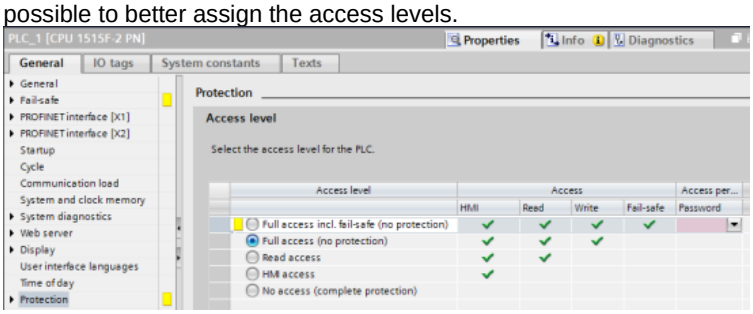
Basic functions are equal in STEP 7 V5.5 and STEP 7 TIA Portal. However, there are some improvements in the detail regarding handling and programming. Subsequently, there is an extract of some functions realized in the STEP 7 TIA Portal.

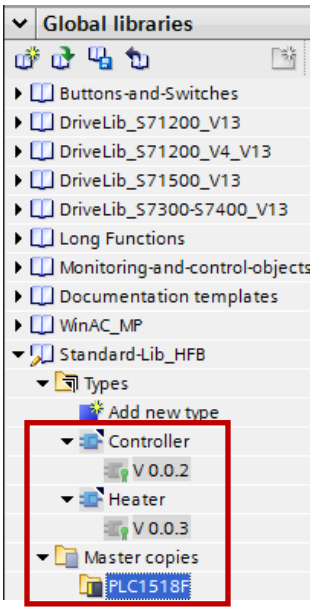
General functions

Table 5-16

STEP 7 TIA Portal	Description/advantage
Possibility of performing traces	Before, traces were only possible at great expense - with additional modules/additional wiring. Now the function is integrated in software and CPU-FW 

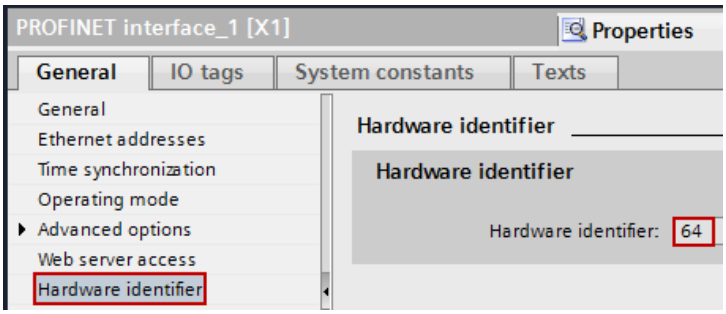
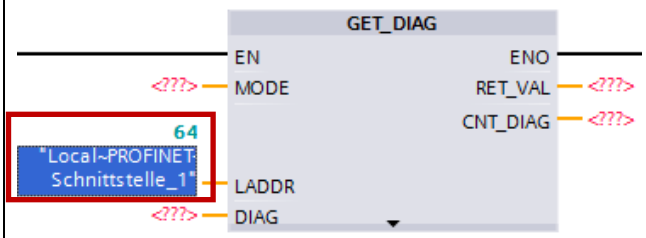
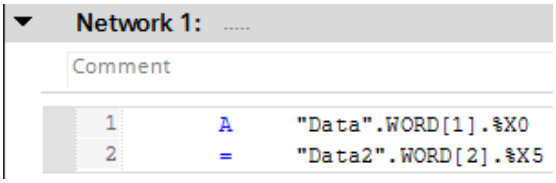
STEP 7 TIA Portal	Description/advantage
Motion functions integrated -> PLCopen blocks	Motion functions were previously not integrated in standard CPUs  Speed axes, positioning axes and synchronization axes are available. 
PID compact regulator integrated (PID_Compact, PID_3Step, PID_Temp) PID basic controller contained for compatibility reasons	

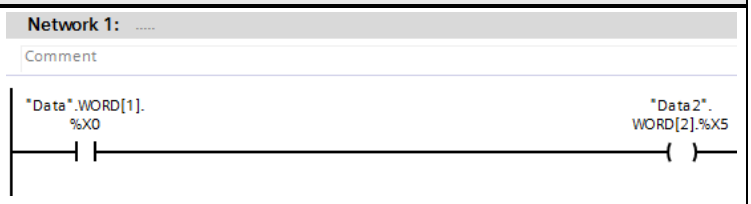
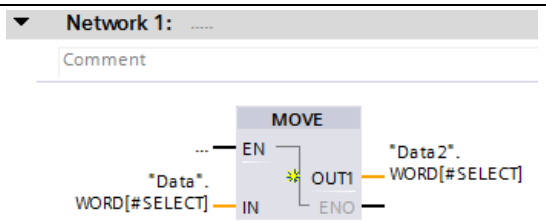
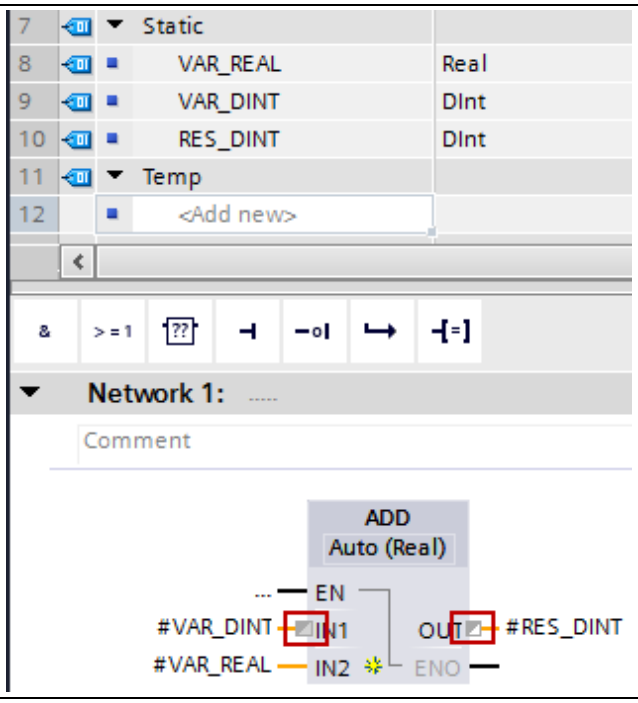
STEP 7 TIA Portal	Description/advantage
Recipes/archive as CSV file, via web server of the CPU	Recipes as .csv file did previously not exist on the CPU 
Security Integrated – more protection levels available	For S7-300/S7-400 there were only 2 protection levels. Now it is possible to better assign the access levels. 
Download in run (memory reserve existing), all changes activated at the same time	Download in run was previously also possible, however, the user needed to be aware of the order to prevent the CPU from going to STOP

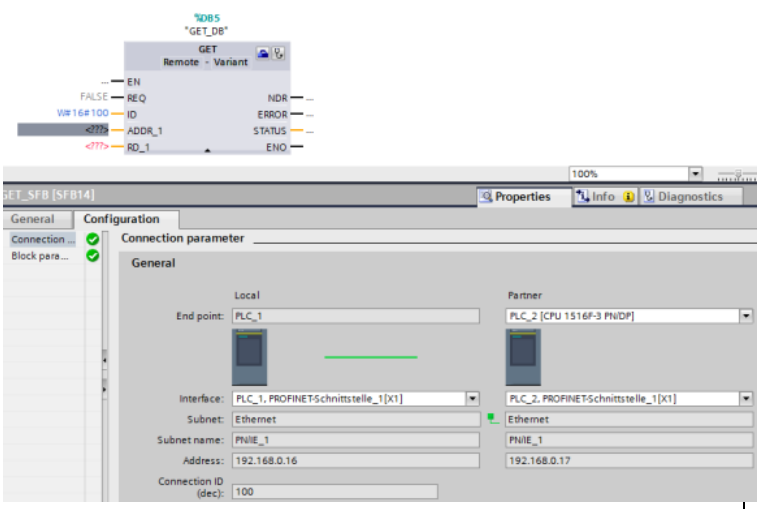
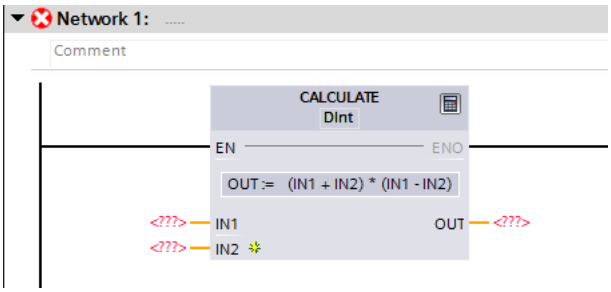
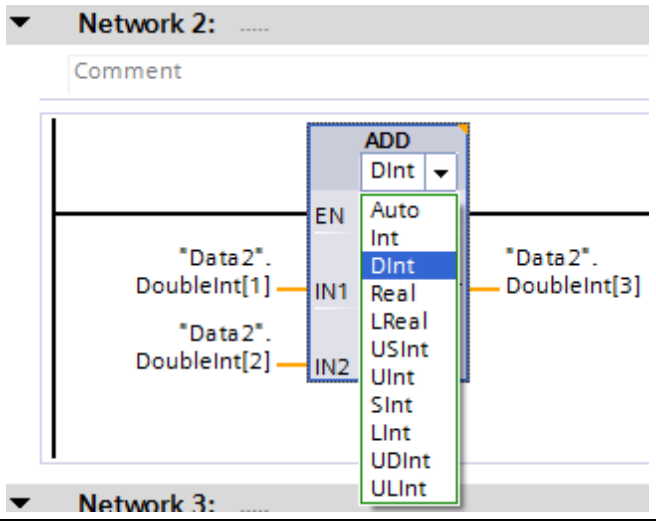
STEP 7 TIA Portal	Description/advantage
Library concept	Libraries were already possible for STEP 7 V5.5, however, without versioning. Blocks, data types, screens and entire stations can be stored. 
System status list (SSL) was replaced by a new system diagnostics	The diagnostic options for S7-1500 and TIA Portal were reworked entirely. System diagnostics has already been implemented. The user no longer needs to pay attention to blocks such as “Report system error”.

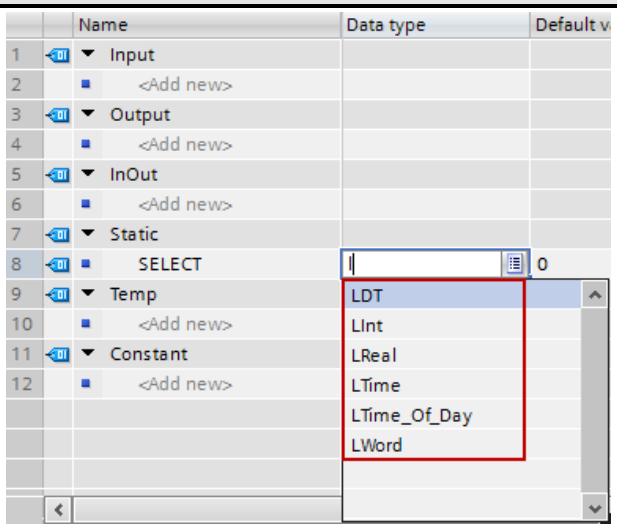
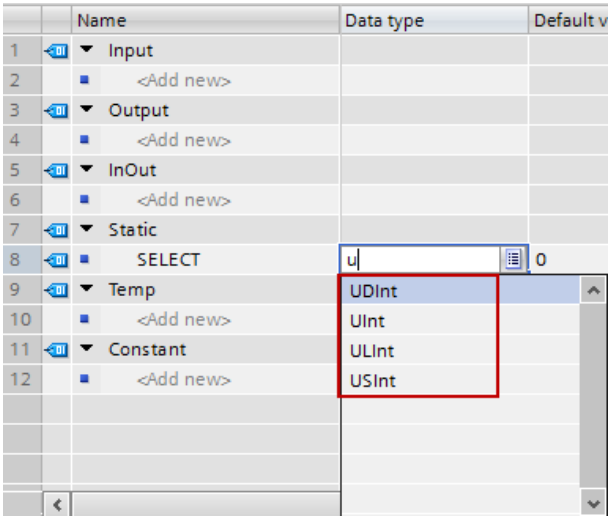
Programming

Table 5-17

STEP 7 TIA Portal	Description/advantage
All instructions exist in all programming languages	In STEP 7 V5.5, not all of the instructions were available in FBD/LAD
Same performance for all programming languages	In TIA Portal, all programming languages are directly compiled into machine code and therefore, they all provide the same performance.
Symbols and comments are saved in CPU -> Complete upload possible	Now it is possible to perform a complete system extraction
Hardware identifier and hardware constant – simplified handling of system functions	The reintroduced “Hardware Identifier” and hardware constants enable a symbolic programming without (logic) I/O addresses. Entry into the settings of the module  Entry of hardware constant into the tag table  Example interconnection at a block 
Several branches within one network	In order to use networks as logic units it is possible to insert several branches into a network
Slicing possible – access to elements of a larger data type	A slice access may look as follows, e.g: .%X0 for Bool, .%B0 for byte, .%W0 for word, .%D0 for double word 

STEP 7 TIA Portal	Description/advantage
Slicing is also possible in FBD / LAD / SCL – no programming necessary in STL	 The output tag is one WORD. One respective bit of the respective word is accessed here.
Indirect addressing also possible in FBD / LAD / SCL	
implied type conversion	

STEP 7 TIA Portal	Description/advantage
Simplified handling of Send/Receive communication by means of a wizard	
Simplified “Calculate”	
Simplified mathematical function (selectable data type)	

STEP 7 TIA Portal	Description/advantage
64bit data types available	
Short and unsigned data types available	
Variant instead of any pointer	Notes on application and examples are available in the Online help on the TIA Portal.
Integrated Modbus blocks	

5.3.4 Differences in the hardware of S7-300/S7-400 and S7-1500

Apart from many innovations in the internal processing (firmware) as well as the improved backplane bus, two hardware properties of S7-1500 need to be highlighted. At the front of the CPU, a display exists which can be taken off. Therefore, not only the LEDs are available at the CPU as rough status information, but a detailed display, for example for firmware versions, diagnostics, interface settings. The size of the display depends on the CPU – for the CPUs 1511 and 1513 there is a thin, and for CPUs 1515,1516,1517,1518 a wide display. Since the CPUs 1510, 1512 and the open controller are part of the ET200SP series, they come without display.

Figure 5-2 Displays of the CPUs 1511/1513 or 1515/1516/1517/1518

Another change between both S7-CPU generations is the SIMATIC memory card (SMC). While for S7-300 the micro memory card (MMC) could only be written to with a special prommer due to the SIMATIC file system (internal or external), a standard card reader can now be used for the SMC. Furthermore, the available memory has increased considerably - now cards up to 32 GB can be used which enables creating much more complex programs.

Note

You can delete and create folders on the SMC. However, do not format the card with the Windows card reader, otherwise, it becomes unusable for the CPU.

Further information regarding the SMC is available in the system manual on the S7-1500 in chapter “SIMATIC Memory Card” at:
https://support.industry.siemens.com/cs/ww/en/view/59191792

5.4 Programming sequential controls – GRAPH in STEP 7 V5.x and TIA Portal

Note Programming sequential controls – GRAPH will be described in a later version of this guide.

6 The most important Recommendations

6.1 Contacts in the region

Find a SIEMENS contact in your region:

www.siemens.de/yourcontact

6.2 Services offered by Siemens

Migration of obsolete control systems is the prerequisite for high availability over the entire life cycle of your plant.
Siemens offers comprehensive migration support for typical fields of application. We support you from the idea stage to planning and implementation. The scope of services includes migration or temporary support of your migration projects.

Your benefits at a glance:

- Cost and time savings in the implementation phase
- Optimum preparation of your migration
- High degree of planning reliability

Your path to the Technical Support

https://support.industry.siemens.com/sc/en/sc/3082

Services and overview

https://support.industry.siemens.com/sc/en/sc/3083

Furthermore on demand, we offer you personal, individual support – exactly tailored to your specific requirements:

- Clarifying in the run-up to migration and checking the core functionality via your Siemens personal contact: www.siemens.de/industry/contact
- Complete service from consultation to completing the project within the framework of our SIMATIC Migration Services:
  http://www.siemens.de/fa-services

6.3 Solution Partner

The Partner Finder allows you to find one of our qualified Solution Partners to solve your migration task.

Solution Partner Program
www.siemens.de/automation/solutionpartner

6.4 References and online documents

6.4.1 Important information

Table 6-1

Topic pages	Link
Migration topic page	83558085

Table 6-2

Manuals on S7-300	Link
SIMATIC S7-300 CPU 31xC and CPU 31x: Technical specifications	12996906
SIMATIC S7-300 CPU 31xC and CPU 31x: Installation	13008499
SIMATIC S7-300 Instruction list of S7-300-CPUs and ET 200-CPUs	31977679
SIMATIC S7-300 Module data	8859629

Table 6-3

Manuals on S7-400	Link
SIMATIC S7-400, S7-400 Automation System, Module Data	1117740
SIMATIC S7-400, S7-400 Automation System, CPU Specifications	53385241
Automation System S7-400 Hardware and Installation	1117849
Automation System S7-400 Configuration and Use	22586851

Table 6-4 – S7-1500 manuals and STEP 7 manuals in TIA Portal

S7-1500 manuals and STEP 7 manuals in TIA Portal	Link
SIMATIC Programming device SIMATIC Field PG M4	67463270
SIMATIC S7-1500, ET 200MP Automation System	59191792
SIMATIC S7-1500 / ET 200MP Manual Collection	86140384
Programming Guideline for S7-1200/S7-1500	81318674
SIMATIC S7-1200 / S7-1500 Comparison list for programming languages	86630375
SIMATIC S7-1500 Getting Started	71704272
SIMATIC S7-1500 Cycle and Response Times	59193558
TIA Selection Tool	Link
SIMATIC S7-1500 / ET 200MP Manual Collection	86140384
SIMATIC S7-1500 Structure and Use of the CPU Memory	59193101

7 Appendix

7.1 SIMATIC S7-300/S7-400, S7-1500 components and HMI in comparison

The following tables show the respective S7-1500 equivalent to the listed SIMATIC S7-300/S7-400 module in terms of content.

It is essential that you note the following:

Note

The content of this table is for reference only!

In addition to the technical features listed in the tables, the components have more technical properties which differ in some cases. Which technical features are important and relevant to the respective plant / plant part can only be identified through careful analysis of the installed base and must be determined in this migration phase. See also Planning the migration phases.

This means: The respectively mentioned SIMATIC S7-1500 hardware component must not automatically be considered as equal substitute for the mentioned SIMATIC S7-300/S7-400 component. It is the user's responsibility to consider the technical characteristics (e.g., limits) of the SIMATIC S7 module and to check whether these parameters are relevant to the customer application (plant) and complied with.

Examples of relevant technical parameters:

- Power supply
- Signal voltage
- Frequency
- Connection to common potential or channel separation
- Number of channels
- Load current
- Contact load
- Switching rate
- etc. ...

7.1.1 CPU modules

Note

The content of the following table is used for orientation only!

Please note the general information in this chapter:
SIMATIC S7-300/S7-400, S7-1500 components and HMI in comparison.

The TIA Selection Tool offers support for migrating S7-300/S7-400 to S7-1500:
http://www.siemens.de/tia-selection-tool

Table 7-1

S7-300	Description	S7-1500	Description
6ES7 312-1AE13-0AB0	CPU 312-1	6ES7 511-1AK01-0AB0	CPU 1511
6ES7 312-1AE14-0AB0	CPU 312-1	6ES7 511-1AK01-0AB0	CPU 1511
6ES7 312-5BE03-0AB0	CPU 312C	6ES7 215-1AG40-0XB0	CPU 1215C
6ES7 312-5BF04-0AB0	CPU 312C	6ES7 215-1AG40-0XB0	CPU 1215C
6ES7 313-5BF03-0AB0	CPU 313C	6ES7 511-1CK00-0AB0	CPU 1511C
6ES7 313-5BG04-0AB0	CPU 313C	6ES7 511-1CK00-0AB0	CPU 1511C
6ES7 313-6CF03-0AB0	CPU 313C-2DP	6ES7 511-1CK00-0AB0	CPU 1511C
6ES7 313-6CG04-0AB0	CPU 313C-2DP	6ES7 511-1CK00-0AB0	CPU 1511C
6ES7 313-6BF03-0AB0	CPU 313C-2PtP	6ES7 511-1CK00-0AB0	CPU 1511C
6ES7 313-6BG04-0AB0	CPU 313C-2PtP	6ES7 511-1CK00-0AB0	CPU 1511C
6ES7 314-1AG13-0AB0	CPU 314	6ES7 511-1AK01-0AB0	CPU 1511
6ES7 314-1AG14-0AB0	CPU 314	6ES7 511-1AK01-0AB0	CPU 1511
6ES7 314-6CG03-0AB0	CPU 314C-2DP	6ES7 512-1CK00-0AB0	CPU 1512C
6ES7 314-6CH04-0AB0	CPU 314C-2DP	6ES7 512-1CK00-0AB0	CPU 1512C
6ES7 314-6EH04-0AB0	CPU 314C-2PN/DP	6ES7 512-1CK00-0AB0	CPU 1512C
6ES7 314-6BG03-0AB0	CPU 314C-2Ptp	6ES7 512-1CK00-0AB0	CPU 1512C
6ES7 314-6BH04-0AB0	CPU 314C-2Ptp	6ES7 512-1CK00-0AB0	CPU 1512C
6ES7 315-2AG10-0AB0	CPU 315-2DP	6ES7 513-1AL01-0AB0	CPU 1513-1PN
6ES7 315-2AH10-0AB0	CPU 315-2DP	6ES7 513-1AL01-0AB0	CPU 1513-1PN
6ES7 315-2EH13-0AB0	CPU 315-2PNDP	6ES7 515-2AM01-0AB0	CPU 1515-2PN
6ES7 315-2EH14-0AB0	CPU 315-2PN/DP	6ES7 515-2AM01-0AB0	CPU 1515-2PN
6ES7 315-6FF01-0AB0	CPU 315F-2DP	6ES7 513-1FL01-0AB0	CPU 1513F-1PN
6ES7 315-6FF04-0AB0	CPU 315 F-2DP	6ES7 513-1FL01-0AB0	CPU 1513F-1PN
6ES7 315-2FH13-0AB0	CPU 315F-2PN/DP	6ES7 515-2FM01-0AB0	CPU 1515F-2PN
6ES7 315-2FJ14-0AB0	CPU 315F-2PN/DP	6ES7 515-2FM01-0AB0	CPU 1515F-2PN
6ES7 317-2AJ10-0AB0	CPU 317-2	6ES7 516-3AN01-0AB0	CPU 1516-3PN/DP
6ES7 317-2AK14-0AB0	CPU 317-2	6ES7 516-3AN01-0AB0	CPU 1516-3PN/DP
6ES7 317-2EK13-0AB0	CPU 317-2PN/DP	6ES7 516-3AN01-0AB0	CPU 1516-3PN/DP
6ES7 317-2EK14-0AB0	CPU 317-2PN/DP	6ES7 516-3AN01-0AB0	CPU 1516-3PN/DP
6ES7 317-6FF03-0AB0	CPU 317F-2	6ES7 516-3FN01-0AB0	CPU 1516F-3PN/DP
6ES7 317-6FF04-0AB0	CPU 317F-2	6ES7 516-3FN01-0AB0	CPU 1516F-3PN/DP
6ES7 317-2FK13-0AB0	CPU 317F-2PN/DP	6ES7 516-3FN01-0AB0	CPU 1516F-3PN/DP

S7-300	Description	S7-1500	Description
6ES7 317-2FK14-0AB0	CPU 317F-2PN/DP	6ES7 516-3FN01-0AB0	CPU 1516F-3PN/DP
6ES7 318-3EL00-0AB0	CPU 319-3PN/DP	6ES7 517-3AP00-0AB0	CPU 1517-3PN/DP
6ES7 318-3EL01-0AB0	CPU 319-3PN/DP	6ES7 517-3AP00-0AB0	CPU 1517-3PN/DP
6ES7 318-3FL00-0AB0	CPU 319F-3PN/DP	6ES7 517-3FP00-0AB0	CPU 1517F-3PN/DP
6ES7 318-3FL01-0AB0	CPU 319F-3PN/DP	6ES7 517-3FP00-0AB0	CPU 1517F-3PN/DP
6ES7 151-7AA20-0AB0	IM 151-7 CPU	6ES7510-1DJ01-0AB0	CPU 1510SP-1PN
6ES7 151-7AA21-0AB0	IM 151-7 CPU	6ES7510-1DJ01-0AB0	CPU 1510SP-1PN
6ES7 151-7AB00-0AB0	IM 151-7 CPU FO	6ES7512-1DK01-0AB0[1]	CPU 1510SP-1PN
6ES7 151-7FA20-0AB0	IM 151-7F-CPU	6ES7 510-1SJ01-0AB0	CPU 1510SP F-1PN
6ES7 151-7FA21-0AB0	IM 151-7F-CPU	6ES7 510-1SJ01-0AB0	CPU 1510SP F-1PN
6ES7 151-8AB00-0AB0	IM 151-8 PN/DP CPU	6ES7 512-1DK01-0AB0	CPU 1512SP-1PN
6ES7 151-8AB01-0AB0	IM 151-8 PN/DP CPU	6ES7 512-1DK01-0AB0	CPU 1512SP-1PN
6ES7 151-8FB00-0AB0	IM 151-8F PN/DP CPU	6ES7 512-1SK01-0AB0	CPU 1512SP F-1PN
6ES7 151-8FB01-0AB0	IM 151-8F PN/DP CPU	6ES7 512-1SK01-0AB0	CPU 1512SP F-1PN

Table 7-2

S7-400	Description	S7-1500	Description
6ES7 412-1XJ05-0AB0	CPU 412-1MPI/DP	6ES7 513-1AL01-0AB0	CPU 1513-1PN
6ES7 412-2XJ05-0AB0	CPU 412-2	6ES7 515-2AM01-0AB0	CPU 1515-2PN
6ES7 412-2EK06-0AB0	CPU 414-2PN/DP	6ES7 516-3AN01-0AB0	CPU 1516-3PN/DP
6ES7 414-2XK05-0AB0	CPU 414-2	6ES7 517-3AP00-0AB0	CPU 1517-3PN/DP
6ES7 414-3XM05-0AB0	CPU414-3	6ES7 518-4AP00-0AB0	CPU 1518-4PN/DP
6ES7 414-3EM05-0AB0	CPU 414-3PN/DP	6ES7 518-4AP00-0AB0	CPU 1518-4PN/DP
6ES7 414-3EM06-0AB0	CPU 414-3PN/DP	6ES7 518-4AP00-0AB0	CPU 1518-4PN/DP
6ES7 414-3FM06-0AB0	CPU 414F-3PN/DP	6ES7 518-4FP00-0AB0	CPU 1518F-4PN/DP
6ES7 416-2XN05-0AB0	CPU 416-2	6ES7 518-4AP00-0AB0	CPU 1518-4PN/DP
6ES7 416-3XR05-0AB0	CPU 416-3	6ES7 518-4AP00-0AB0	CPU 1518-4PN/DP
6ES7 416-3ER05-0AB0	CPU 416-3PN/DP	6ES7 518-4AP00-0AB0	CPU 1518-4PN/DP
6ES7 416-3ES06-0AB0	CPU 416-3PN/DP	6ES7 518-4AP00-0AB0	CPU 1518-4PN/DP
6ES7 416-2FN05-0AB0	CPU 416F-2DP	6ES7 518-4FP00-0AB0	CPU 1518F-4PN/DP
6ES7 416-3FR05-0AB0	CPU 416F-3PN/DP	6ES7 518-4FP00-0AB0	CPU 1518F-4PN/DP
6ES7 416-3FS06-0AB0	CPU 416F-3PN/DP	6ES7 518-4FP00-0AB0	CPU 1518F-4PN/DP
6ES7 417-4XT05-0AB0	CPU 417-4	6ES7 518-4AP00-0AB0	CPU 1518-4PN/DP

*) Please note the information in the „Selecting the CPU“ chapter, especially the different size of memory

[1] CPU 1512 can only be used in combination with suitable bus adapter

7.1.2 Comparison of software / hardware properties

The tables below give you an overview of the properties available in the individual CPU types

CPU hardware properties

Table 7-3

Property	S7-300/S7-400	S7-1500
Display	no	Yes, for 1511, 1513-1518
Display for fail-safe CPU shows - Safety mode activated/deactivated - Signature - Time stamp of last changes Safety program - Diagnostics	no	yes
Memory Card with standard file system	no	yes
PPI interface	no	no
MPI interface	yes	no
DP interface	yes	yes
DP interface with PROFIsafe	yes	yes
1.PN interface with base functions	yes	yes
1.PN interface with IRT	yes	yes
1.PN interface with PROFIsafe	yes	yes
2. PN interface with base functions	no	yes
3. PN interface with base functions	no	yes

CPU properties

Table 7-4

Property	S7-300/S7-400	S7-1500
Process image	yes	yes
Multi-process image	yes, S7-400	yes
Flexible number assignment for OBs	no	yes
Flexible number assignment F-OB	no	yes
OB1	yes	yes
OB1x	yes	yes
Up to 50 process alarm OBs	up to 40	yes
up to 20 cyclic interrupts with different priorities	no	yes
Clock synchronized OBs	yes	yes
Several cyclic, startup, process OBs	no	yes
Several F-OBs for better program structure	no	yes

CPU programming languages general

Table 7-5

Properties	S7-300/S7-400	S7-1500
Symbolic programming	yes	yes
STL	yes	yes
FUP / F-FBD	yes	yes
LAD / F-LAD	yes	yes
SCL	yes	yes
S7-GRAPH	yes	yes
HiGraph	yes	no
CFC	yes	no, scheduled
Same functions in all programming languages	no	yes
SFBs	yes	yes
SFCs	yes	yes
S7 timer	yes	yes
S7 F timer	yes	yes
ICE counter	yes	yes
S7 counter	yes	yes
Edge evaluation	yes	yes
Global DBs	yes	yes
Instance DB	yes	yes
FBs	yes	yes
FCs	yes	yes
System status list (SSL)	yes	entirely new solution
64bit data types	no	yes
Short/U short data types	no	yes
Implied type conversion	no	yes
Slice access	no	yes
Calculate box	no	yes
Indirect addressing FBD/LAD	no	yes

CPU programming languages FBD/LAD

Table 7-6

Property	S7-300/S7-400	S7-1500
Several branches within one network	no	yes
Expandable mathematic block – more than 2 inputs	no	yes
Expandable MOVE block – more than 2 outputs	no	yes
CALCULATE block for complex mathematical expressions	no	yes
Implied data type conversion	no	yes
Automatic switchover for mathematic block	no	yes
Deactivating ENO	no	yes
JMP_LIST	no	yes

Property	S7-300/S7-400	S7-1500
Concept for libraries with versioning	no	yes
Concept for F libraries with versioning	no	yes
Data type D-WORD for safety program	no	yes, with UDT
Data type D-INT for safety program	no	yes

CPU online functions

Table 7-7

Property	S7-300/S7-400	S7-1500
Consistent download of all changes	no	yes
Download in Run mode	yes	yes, activation of the modifications, actual values of the DBs are not overwritten
Upload of hardware	yes - restricted	yes
Upload of entire program	yes - restricted	yes
Trace	no	yes
Symbolic information saved in the CPU	no	yes

CPU security functions

Table 7-8

Property	S7-300/S7-400	S7-1500
Knowhow protection/block privacy STD blocks	yes	yes
Knowhow protection/block privacy F blocks	yes	yes
Copy protection	yes	yes
Access protection	no	yes
Additional F access protection	no	yes
Expanded access protection (protection layer) also for HMI	no	yes
Integrity check	no	yes

CPU communication

Table 7-9

Property	S7-300/S7-400	S7-1500
MODBUS TCP	no - separate library necessary	yes
MODBUS RTU	yes	yes

CPU diagnostic functions

Table 7-10

Property	S7-300/S7-400	S7-1500
Integrated system diagnostic	no	yes
Identical diagnostics at web server, HMI, display and engineering	no	yes

CPU web server

Table 7-11

Property	S7-300/S7-400	S7-1500
File explorer	no	yes
Archive and recipe handling via web server	no	yes

CPU technology functions

Table 7-12

Property	S7-300/S7-400	S7-1500
PID compact controller integrated	no	yes
Motion control integrated according to PLCopen	no	yes
Trace	no	yes

7.1.3 Digital modules S7-300

Note

The content of this table is for reference only!

Please note the general information in this chapter:

SIMATIC S7-300/S7-400, S7-1500 components and HMI in comparison

Table 7-13

S7-300	Description	S7-1500	Description
Digital input modules			
6ES7 321-1BH02-0AA0	16DE,DC24V	6ES7 521-1BH00-0AB0 or 6ES7 521-1BH10-0AA0	16DE,24VDC, HF 16DE,24VDC, BA
6ES7 321-1BH10-0AA0	16DE,DC24V	6ES7 521-1BH00-0AB0	16DE,24VDC, HF
6ES7 321-7BH01-0AB0	16DE,DC24V,DA,PA	6ES7 521-1BH00-0AB0	16DE,24VDC, BA
6ES7 321-1BH50-0AA0	16DE,DC24V	6ES7 521-1BH50-0AB0	16DE,24VDC, SRC BA
6ES7 321-1BL00-0AA0	32DE,DC24V	6ES7 521-1BL00-0AB0 or 6ES7 521-1BL10-0AA0	16DE,24VDC, HF or 32DE,24VDC, BA
6ES7 321-1FH00-0AA0	16DE,AC120/230V	6ES7 521-1FH00-0AA0	16DE,230VAC, BA
6ES7 321-1FF01-0AA0	8DE,AC120/230V	6ES7 521-1FH00-0AA0	16DE,230VAC, BA
6ES7 321-1FF10-0AA0	8DE,UC120/230V	6ES7 521-1FH00-0AA0	16DE,230VAC, BA
Digital output modules			
6ES7 322-1BH01-0AA0	16DA,DC24V/0.5A	6ES7 522-1BH01-0AA0 or 6ES7 522-1BH00-0AB0	16DA,24VDC/0.5A,BA or 16DA,24VDC/0.5A,ST
6ES7 322-8BF00-0AB0	8DA,DC24V/0.5A	6ES7 522-1BH00-0AB0	16DA,24VDC/0.5A,ST
6ES7 322-1BH10-0AA0	16DA,DC24V/0.5A High Speed	6ES7 522-1BH00-0AB0	16DA.24VDC/0.5A,ST
6ES7 322-1BL00-0AA0	32DA,DC24V/0.5A	6ES7 522-1BL00-0AB0 or 6ES7 522-1BL10-0AA0	32DA,24VDC/0.5A,ST
6ES7 322-7BH01-0AB0	8DA,DC24V,0.5A	6ES7 522-1BF00-0AB0	8DA,24VDC/2A HF
6ES7 322-1FH00-0AA0	16DA,AC120/230V	6ES7 522-5FF00-0AB0	8DA,230VAC/2A, ST
6ES7 322-1FF01-0AA0	8DA,AC120/230V	6ES7 522-5FF00-0AB0	8DA,230VAC/2A, ST
6ES7 322-5FF00-0AA0	8DA,AC120/230V	6ES7 522-5FF00-0AB0	8DA,230VAC/2A, ST
6ES7 322-1HH01-0AA0	16DA,AC120/230V,Relay	6ES7 522-5FF00-0AB0	8DA,230VAC/2A, ST
Digital input/output modules			
6ES7 323-1BL00-0AA0	16DE/16DA	6ES7 523-1BL00-0AA0	16DI,24VDC/16DA,24 VDC/0.5A BA
6ES7 323-1BH01-0AA0	8DE/8DO	6ES7 523-1BL00-0AA0	16DI,24VDC/16DA,24 VDC/0.5A BA

S7-300	Description	S7-1500	Description
Labeling strips for S7-300 and S7-1500			
6ES7 392-2AX10-0AA0 6ES7 392-2BX10-0AA0 6ES7 392-2CX10-0AA0 6ES7 392-2DX10-0AA0	petrol bright beige yellow red Labeling strip for 40-pin front connector	6ES7 592-2AX00-0AA0	Labeling sheets for 35mm wide S7-1500 modules
		6ES7 592-1AX00-0AA0	Labeling sheets for 25mm wide S7-1500 modules

* Unlike the 35mm wide modules whose delivery has already started, the 25mm wide modules feature no parameters and diagnostics.

7.1.4 Digital modules S7-400

Note The content of this table is for reference only!

Please note the general information in this chapter:

SIMATIC S7-300/S7-400, S7-1500 components and HMI in comparison

Table 7-14

S7-400	Description	S7-1500	Description
Digital input modules			
6ES7 421-7BH01-0AB0	16DE,DC24V,DA,PA	6ES7 521-1BH00-0AB0	16DI,24VDC, HF
6ES7 421-1BL01-0AA0	32DE,DC24V	6ES7 521-1BL10-0AA0	32DI,24VDC,BA
6ES7 421 1FH20-0AA0	16DE,UC120/230V	6ES7 521-1FH00-0AB0	16DI,230VAC, BA
Digital output modules			
6ES7 422-7DH00-0AB0	32DA,DC24V/0.5A	6ES7 522-1BH00-0AB0	16DA, 24VDC/0.5A, ST
6ES7 422-1BL00-0AA0	32DA,DC24V/0.5A	6ES7 522-1BL00-0AB0 or 6ES7 522-1BL10-0AA0	32DQ,24VDC/0.5A,ST or 32DQ,24VDC/0.5A,BA
6ES7 422-1BH11-0AA0	16DA,DC24V/AA	6ES7 522-1BF00-0AB0	8DA,24VDC/2A,HF
6ES7 422-1FH00-0AA0	16DA,AC120/230V/2A	6ES7 522 5FF00-0AB0	8DA,230VAC/2A (Triac)
6ES7 422-1HH00-0AA0	16RA,DC60V/230V	6ES7 522-5FF00-0AB0	8DA,230VAC/2A (Triac)

* Unlike the 35mm wide modules whose delivery has already started, the 25mm wide modules feature no parameters and diagnostics.

7.1.5 Analog modules S7-300

Note The content of this table is for reference only!

Please note the general information in this chapter:

SIMATIC S7-300/S7-400, S7-1500 components and HMI in comparison

Table 7-15

S7-300	Description	S7-1500	Description
Analog input modules			
6ES7 331-7KF02-0AB0	8AE,12Bit	6ES7 531-7KF00-0AB0	8AE,U/I/R/RTD/TC ST
6ES7 331-1KF01-0AB0	8AE,13Bit	6ES7 531-7KF00-0AB0	8AE,U/I/R/RTD/TC ST
6ES7 331-7HF01-0AB0	8AE,14Bit,cycle synchronous	6ES7 531-7KF00-0BA0	8AE,U/I/R/RTD/TC ST
6ES7 311-7KB02-0AB0	2AI,12Bit	6ES7 531-7QD00-0AB0	4AE,U/I/R/RTD/TC ST
6ES7 311-7NF00-0AB0	8AE,16Bit	6ES7 531-7NF10-0AB0	8AE,U/I HS 125µs
6ES7 311-7NF10-0AB0	8AE,16Bit	6ES7 531-7NF10-0AB0	8AE,U/I HS 125µs
6ES7 311-7HF01-0AB0	8AE,14Bit,cycle synchronous	6ES7 531-7NF10-0AB0	8AE,U/I HS 125µs
Analog output modules			
6ES7 332-5HD01-0AB0	4AA, 12Bit	6ES7 532-5HD00-0AB0	4AA,U/I ST
6ES7 322-5HB01-0AB0	2 AA,12Bit	6ES7 532-5NB00-0AB0	2AA,U/I ST
6ES7 322-5HF00-0AB0	4AA, 16Bit, cycle synchronous	6ES7 532-7NF10-0AB0	8AA,U/I HS 125µs
6ES7 334-0CE01-0AA0	4AE/2AA, 12Bit	6ES7 534-7QE00-0AB0	4AE, U/I/R/RTD/TC 2AA, U/I ST
6ES7 334-0KE00-0AB0	4AE/2AA, 12Bit	6ES7 534-7QE00-0AB0	4AE, U/I/R/RTD/TC 2AA, U/I ST

7.1.6 Analog modules S7-400

Note The content of this table is for reference only!

Please note the general information in this chapter:

SIMATIC S7-300/S7-400, S7-1500 components and HMI in comparison

Table 7-16

S7-400	Description	S7-1500	Description
Analog input modules			
6ES7 431-1KF00-0AB0	8AE,13Bit,240ms, U/I/R	6ES7 531-7KF00-0AB0 or 6ES7 531-7NF10-0AB0	8AE,U/I/R/RTD/TC ST
6ES7 431-1KF10-0AB0	8AE,13Bit,240ms, U/I/R/RTD/TC	6ES7 531-7KF00-0AB0 or 6ES7 531-7NF10-0AB0	8AE,U/I/R/RTD/TC ST
6ES7 431-0HH00-0AB0	16AE,13Bit,65ms,U/I	6ES7 531-7KF00-0AB0	8AE,U/I/R/RTD/TC ST
6ES7 431-7QH00-0AB0	16AE,16Bit,25ms,DA,PA, U/I/R/RTD/TC	6ES7 531-7NF100AB0	8AE,U/I, HS 125µs
6ES7 431-7KF00-0AB0	8AE,16Bit,DA,10..100ms,U/I/TC	6ES7 531-7NF100AB0	8AE,U/I, HS 125µs
6ES7 431-1KF20-0AB0	8AE,14Bit,640µs, U/I/R	6ES7 531-7NF100AB0	8AE,U/I, HS 125µs
Analog output modules			
6ES7 432-1HF00-0AB0	8AA,13Bit,0-10V/0-20mA,2ms, U/I	6ES7 532-7NF10-0AB0	8AE,U/I, HS 125µs

7.1.7 Communication modules S7-300

Note

The content of this table is for reference only!

Please note the general information in this chapter:

SIMATIC S7-300/S7-400, S7-1500 components and HMI in comparison

Table 7-17

Article number	Description	S7-1500	Article number
Communication modules			
6ES7 340-1AH02-0AE0	CP 340 RS232	6ES7 540-1AD00-0AA0	CM PtP RS232 BA
6ES7 340-1CH02-0AE0	CP 340 RS422/485	6ES7 540-1AB00-0AA0	CM PtP RS422/485 BA
6ES7 341-1AH02-0AE0	CP 341 RS232	6ES7 541-1AD00-0AB0	CM PtP RS232 HF
6ES7 341-1CH02-0AE0	CP 341 RS422/485	6ES7 541-1AB00-0AB0	CM PtP RS422/485 HF
6ES7 870-1AA01-0YA.	Modbus RTU master	6ES7 541-1AD00-0AB0 or 6ES7 541-1AB00-0AB0	CM PtP RS232 HF or CM PtP RS422/485 HF
6ES7 870-1AB01-0YA.	Modbus RTU slave	6ES7 541-1AD00-0AB0 or 6ES7 541-1AB00-0AB0	CM PtP RS232 HF or CM PtP RS422/485 HF

7.1.8 Function modules S7-300

Note The content of this table is for reference only!

Please note the general information in this chapter:

SIMATIC S7-300/S7-400, S7-1500 components and HMI in comparison

Table 7-18

Article number	Description	S7-1500	Description
6ES7 338-4BC01-0AB0	Signal module for reading position values for 3 SSI encoders	6ES7 551-1AB00-0AB0	TM PosInput 2 channels for incremental or SSI encoders for RS422 signals
6ES7 350-1AH03-0AE0	FM 350-1 counter module, up to 500KHz	6ES7 550-1AA00-0AB0	TM Count 2x24V channels for 24V incremental or pulse encoder
6ES7 350-2AH01-0AE0	FM 350-2, 8 channels, counter module, up to 20KHz,	6ES7 552-1AA00-0AB0	TM TimerDIDQ 16x24V, 16DE/16DA, time-controlled, PWM, over sampling or TM Count 2x24V
6ES7 351-1AH01-0AE0	FM 351, positioning module	6ES7 550-1AA00-0AB0 or 6ES7 551-1AB00-0AB0 + SW functions in the CPU	TM Count 2x24V or TM PosInput 2
6ES7 352-1AH02-0AE0	FM352, cam control unit	6ES7 552-1AA00-0AB0 + SW functions in the CPU	TM TimerDIDQ 16x24V, 16 DE/DA, time-controlled, PWM, over sampling
6ES7 354-1AH01-0AE0	FM 354, position control	Functions integrated in the CPU, I/O connection according to demand	
6ES7 355-1VH10-0AE0	FM 355 S 4 channel, step and pulse	Integrated compact controller + input output modules	No fuzzy controller, applicative controller structures possible
6ES7 355-0VH10-0AE0	FM 355 C 4 channels, continuous	Integrated compact controller + input output modules	No fuzzy controller, applicative controller structures possible
6ES7 355-2CH00-0AE0	FM 355-2 C 4 channels, continuous	Integrated compact controller + input output modules	applicative controller structures possible
6ES7 355-2SH00-0AE0	FM355-2 S 4 channel, step and pulse	Integrated compact controller + input output modules	applicative controller structures possible

This overview is only a simplified representation of the function modules. A complete migration of the hardware requires considering the entire application.

7.1.9 Function modules S7-400

Note The content of this table is for reference only!

Please note the general information in this chapter:

SIMATIC S7-300/S7-400, S7-1500 components and HMI in comparison

Table 7-19

Article number	Description	S7-1500	Description
6ES7 450-1AP00-0AE0	FM 450-1, counter module, 2 channels	6ES7 550-1AA00-0AB0	TM Count 2 channels for 24V incremental or pulse encoder
6ES7 451-3AL00-0AE0	FM 451, positioning module	6ES7 550-1AA00-0AB0 or 6ES7 551-1AB00-0AB0	TM Count 2x24V or TM PosInput 2 and SW functions in the CPU
6ES7 452-1AH00-0AE0	FM 452, cam control unit	6ES7 552-1AA00-0AB0	TM TimerDIDQ 16x24V, 16 DE/DA, time-controlled, PWM, over sampling, and SW functions in the CPU
6ES7 453-3AH00-0AE0	FM 453, positioning module	Functions integrated in the CPU, I/O connection according to demand	
6ES7 455-0VS00-0AE0	FM 455C, controller module, 16 channels, continuous	Integrated compact controller + input output modules	No fuzzy controller, applicative controller structures possible
6ES7 455-1VS00-0AE0	FM 455S, controller module, 16 channel, step and pulse	Integrated compact controller + input/output modules	No fuzzy controller, applicative controller structures possible

This overview is only a simplified representation of the function modules. Complete migration of the hardware requires considering the entire application.

Note The topic of function modules will be extended in a successor version of this guide.

7.1.10 Operator panels

Note The content of this table is for reference only!

Detailed information is available in the guide on migrating panels:

https://support.industry.siemens.com/cs/ww/en/view/49752044

Table 7-20

Predecessor device	MLFB / article number	Replacement	MLFB / article number
OP 77B	6AV6641-0CA01-0AX1	KP400 Comfort	6AV2124-1DC01-0AX0
TP 177B 4" Color	6AV6642-0BD01-3AX0	KTP400 Comfort	6AV2124-2DC01-0AX0
TP 177B Mono	6AV6642-0BC01-1AX1	TP700 Comfort	6AV2124-0GC01-0AX0
TP 177B Color	6AV6642-0BA01-1AX1		
TP 277	6AV6643-0AA01-1AX0		
MP 177	6AV6642-0EA01-3AX0		
OP 177B Mono	6AV6642-0DC01-1AX1	KP700 Comfort	6AV2124-1GC01-0AX0
OP 177B Color	6AV6642-0DA01-1AX1		
OP 277	6AV6643-0BA01-1AX0		
MP 277 8" Touch	6AV6643-0CB01-1AX1	TP900 Comfort	6AV2124-0JC01-0AX0
MP 277 8" Key	6AV6643-0DB01-1AX1	KP900 Comfort	6AV2124-1JC01-0AX0
MP 277 10" Touch	6AV6643-0CD01-1AX1	TP1200 Comfort	6AV2124-0MC01-0AX0
MP 277 10" Key	6AV6643-0DD01-1AX1	KP1200 Comfort	6AV2124-1MC01-0AX0
MP 377 12" Touch	6AV6644-0AA01-2AX0	TP1500 Comfort	6AV2124-0QC02-0AX0
MP 377 12" Key	6AV6644-0BA01-2AX1	KP1500 Comfort	6AV2124-1QC02-0AX0
MP 377 15" Touch	6AV6644-0AB01-2AX0	TP1900 Comfort	6AV2124-0UC02-0AX0
MP 377 19" Touch	6AV6644-0AC01-2AX1	TP2200 Comfort	6AV2124-0XC02-0AX0

Note Since the comfort panels use Widescreen as screen format, old and new operator panels can only be compared to a limited extend.

8 History

Table 8-1

Version	Date	Modifications
V1.0	09/2015	First version