



SIEMENS
Ingenuity for life

SIMATIC S7-1500: The Most Advanced Controller in the World!

Jim Wilmot, Siemens Digital Factory

معرفی پی ال سی ۱۵۰۰ S7-1500 زیمنس

© Siemens AG 2016

usa.siemens.com/s7-1500

Table of Contents



- Positioning within SIMATIC portfolio
- Hardware Overview
- Typical applications
- Innovative Features/Benefits
- Option – smaller form factor
- Summary

Table of content



- **Positioning within SIMATIC portfolio**
- Hardware Overview
- Typical applications
- Innovative Features/Benefits
- Option – smaller form factor
- Summary

SIMATIC Controllers Overview

The innovative solution for all automation tasks

SIMATIC Modular Controllers

- Long term available
- Ready to use
- Modular
- Expandable
- Scalable



*Includes Safety



SIMATIC PC-based Automation

- Latest/greatest PC tech.
- Integrates to C++ control
- Integrates to Excel, etc...



*Includes Safety



One Engineering Software: SIMATIC STEP 7

→ Reusability of existing programs, higher flexibility, with or without safety functionality

- Minimize engineering time with a common engineering environment across controllers
- Minimize downtime with simplified, fully integrated communications & system diagnostics
- Lower initial & operating costs using one common system for standard & safety related automation

SIMATIC New Controller Generation

Always the appropriate Controller performance with comprehensive functionalities!

and Safety Integrated!

SIEMENS

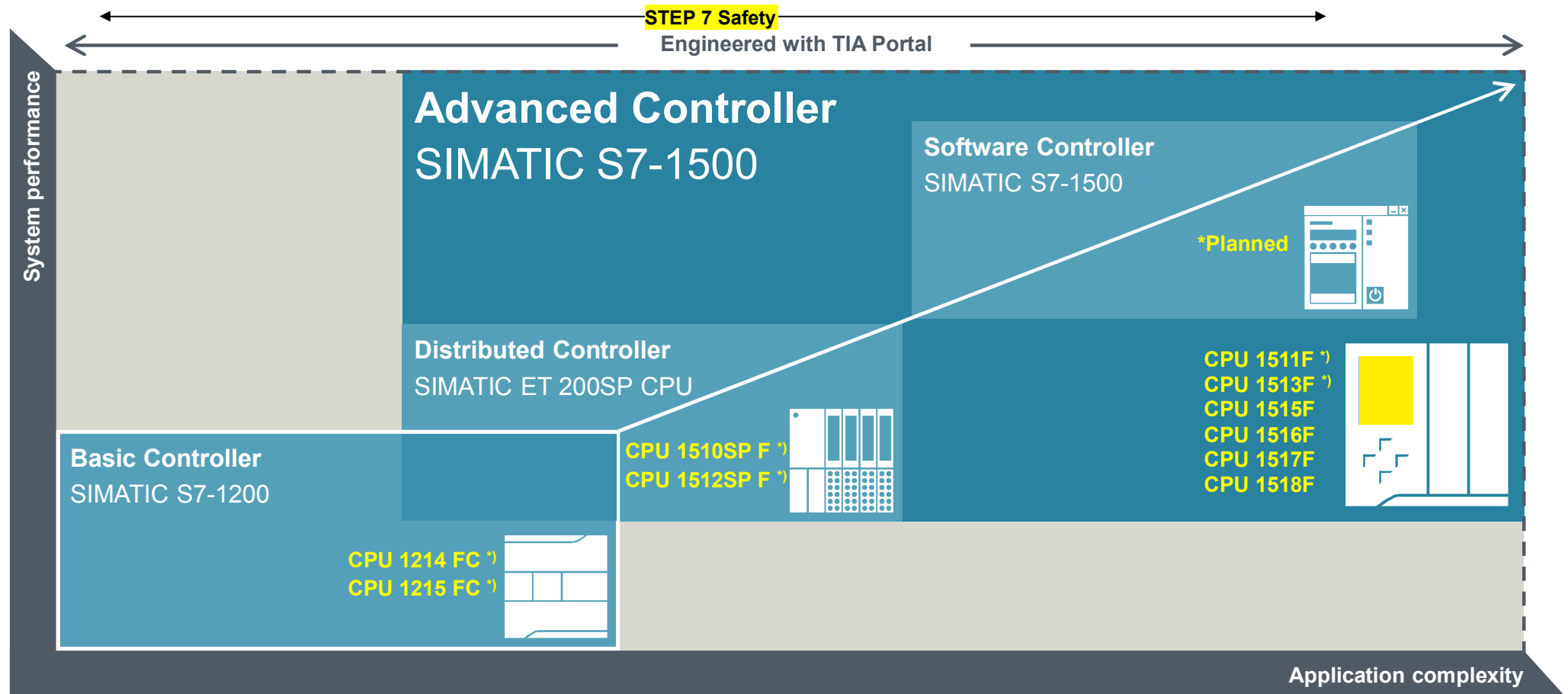


Table of content



- Positioning within SIMATIC portfolio
- **Hardware Overview**
- Typical applications
- Innovative Features/Benefits
- Option – smaller form factor
- Summary

SIMATIC S7-1500 CPU

- Standard / Failsafe Portfolio

SIEMENS



CPU1511C
CPU1512C



CPU 1511



CPU 1513



CPU 1515



CPU 1516



CPU 1517



CPU 1518

Prog. Memory

150 kB

300 kB

500 kB

1 MB

2 MB

3 MB

(*Safety CPU)

(225 kB)

(450 kB)

(750 kB)

(1.5 MB)

(3 MB)

(4.5 MB)

Data Memory

1 MB

1.5 MB

3 MB

5 MB

8 MB

10 MB

Bit perf.

60 ns

40 ns

30 ns

10 ns

2 ns

1 ns

1

1

1

1

1

2

1

1

2

1

1

2

1

1

2

1

3

SIMATIC S7-1500 Compact Controllers

Firmware V1.8 – Advanced Controller now in compact design

SIEMENS

Features

- 1 Compact design
- 2 Integrated I/Os (digital / analog) and Technology, 100Hz - 6x HSC & **4x PTO/PWM**
- 3 Front connectors included
- 4 Same expansion options as the modular CPUs



Customer benefits

Space savings of up to 25% compared to S7-00 CPUs

+

Cost benefits of up to 70% compared to modular design

+

Reduced spare parts inventory

+

SIMATIC S7-1500 Hands-On

S7-1500 – Portfolio Overview, Interface modules and IO

See brochure
for details...

SIEMENS



Interface modules

ET 200MP

PROFINET

IM 155-5 PN ST

IM 155-5 PN HF

PROFIBUS

IM 155-5 DP ST (incl. PROFIBUS connector)



TOP connect wiring system (optional)

- Flexible type
- Modular type



IO modules

35-mm wide modules (without front connector)

DI 16x 24 V DC HF

DI 32x 24 V DC HF

DI 16x 24 V DC SRC BA

DI 16x 230 V AC BA

DO 16x 24 V DC/0.5 A ST

DO 32x 24 V DC/0.5 A ST

DO 8x 24 V DC/2 A HF

DO 8x 230 V AC/2 A ST

DO 8x 230 V AC/5 A ST

DO 16x 230 V AC/1 A ST (Triac)

DO 16x 230 V AC/2 A ST (Relay)

AI 8x U/I/RTD/TC ST *

AI 8x U/I HS

AO 4x U/I ST

AO 8x U/I HS

F-DI 16x 24 V DC PROFIsafe

F-DQ 8x 24 V DC / 2 A PPM PROFIsafe

25-mm wide modules (incl. front connector)

DI 16x 24 V DC BA

DI 32x 24 V DC BA

DO 16x 24 V DC/0.5 A ST

DO 32x 24 V DC/0.5 A ST

DI 16x 24 V DC/DO 16x 24 V DC/0.5 A BA

AI 4x U/I/RTD/TC ST *

AO 2x U/I ST

AI/AO 4x U/I/RTD/TC / 2x U/I ST *

* Half of channels for RTD



SIMATIC S7-1500 Hands-On

S7-1500 – Portfolio Overview, Communication Modules

See brochure
for details...

SIEMENS

Communication Modules

- Point to Point
- PROFIBUS
- PROFINET
- Security Module
 - *Modbus TCP/IP
 - *OPC UA (August)



Communication	
PtP	
CM PtP, RS232 BA	
CM PtP, RS232 HF	
CM PtP, RS422/485 BA	
CM PtP, RS422/485 HF	
Communication modules for point-to-point or multipoint communication with the protocols Freeport, 3964(R), Modbus RTU or USS. Transfer rates up to 115.2 kbit/s are supported.	
PROFIBUS	
CM 1542-5 PROFIBUS communication module	
CP 1542-5 PROFIBUS communications processor	
Communication modules for PROFIBUS with DP master or DP slave function (CP/CM) and larger quantity structure, as well as dataset routing (CM).	
Ethernet	
CP 1543-1, Ethernet security	
CM 1542-1, PROFINET communications processor	
Communication modules for Industrial Ethernet with Security Integrated by means of VPN and firewall (CP), or for additional PROFINET interfaces (CM).	

SIMATIC S7-1500

Communication Options

SIEMENS

Identical PROFINET function on every CPU

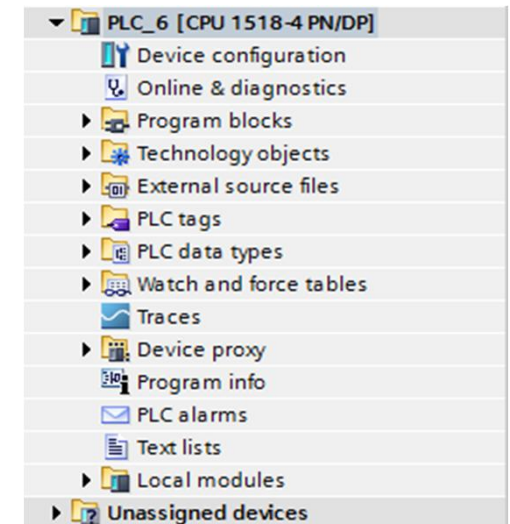
- PROFINET as standard interface
- PROFINET IO IRT (incl. isochronous mode)
- iDevice, Shared Device / Shared iDevice
- Multiple IP address's available
- Web server with user-programmable websites

Optimum integration of PROFIBUS and PROFINET communication modules

- Direct transfer of I/O data to the CPU process image
- Uniform SEND /RECEIVE function blocks for CPU local interfaces and communication module interfaces

MODBUS TCP for CPU and communication modules

- For communication with devices as Modbus master or slave



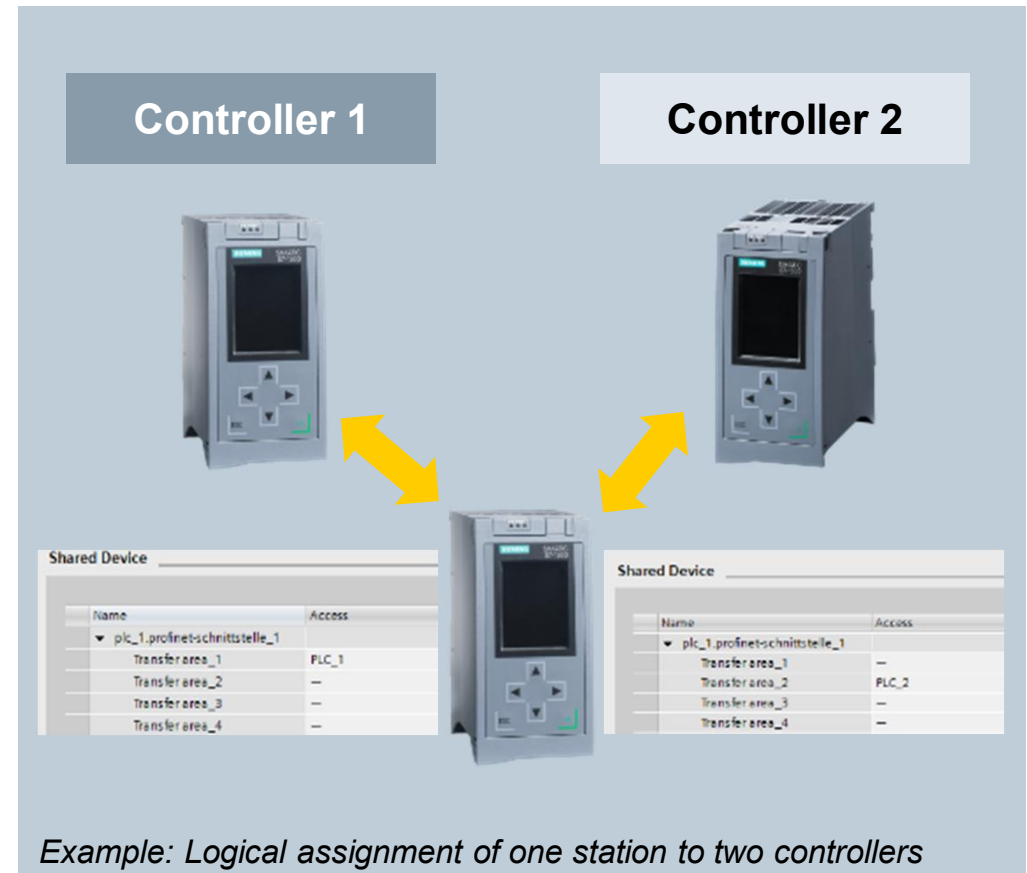
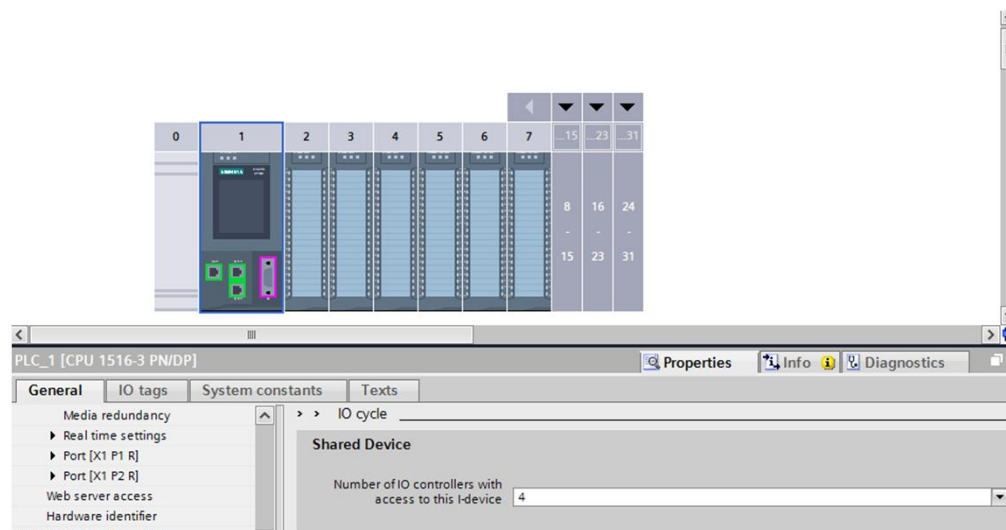
SIMATIC S7-1500

Shared I-Device – Functionality

SIEMENS

Shared I-Device

- Access as I-Device by up to 4 controllers
- Rapid data exchange in realtime between CPUs
- Integration under PROFINET 3rd-party controllers



Example: Logical assignment of one station to two controllers

SIMATIC S7-1500 Hands-On

S7-1500 – Portfolio Overview, Technology Modules, and Load/Sys Power

SIEMENS

Technology Modules

- High speed encoder inputs



Technology modules

Technology modules

TMs

TM Count 2x24V

TM PosInput 2

TM Timer DIDQ 16x24V

Modules for counter functions up to 200 kHz or 1 MHz, with measuring functions for frequency, period duration or speed, for position detection with incremental or absolute encoders as well as for implementing cam controllers and especially precise response times.

See brochure
for details...

Power Modules

- PM – for module load power
- PS – for S7-1500 rack extension



Power supply and system wiring

PM load current supply

PM 70 W, 120/230 V AC

PM 190 W, 120/230 V AC

The load current supply (PM) provides 24 V power for SIMATIC S7-1500 modules such as CPU, system power supplies, IO circuits of the peripheral modules and, where required, sensors and actuators.

PS system power supply

System power supply 25 W, 24 V DC

System power supply 60 W, 24/48/60 V DC

System power supply 60 W, 120/230 V AC/DC

The system power supply (PS) provides the power for the S7-1500 modules via the backplane bus.

Advanced Controller - SIMATIC S7-1500 T-CPU

Scalable Motion Control within Advanced Controller

SIEMENS

V14



CPU 1511T-1 PN



CPU 1515T-2 PN

CPU 1517T-3 PN/DP
CPU 1517TF-3 PN/DP



Feature / Function

- Enhanced Motion Control functions like gearing and camming
- Integrated Cam Editor for a easy definition
- Consistent functionality and programming from S7-1500 up to S7-1500 T-CPU
- S7-1500 TF-CPU also with Safety-PLC

Benefit

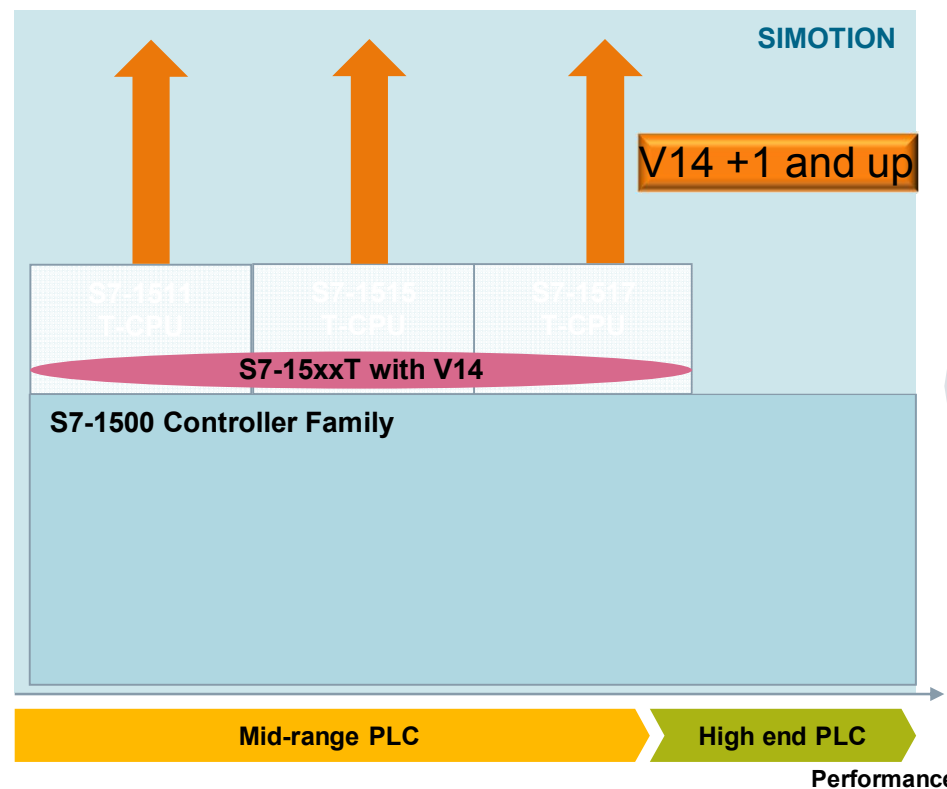
- Sophisticated Motion Control functions within the well-known SIMATIC environment for high machine flexibility
- High engineering efficiency within the TIA Portal trough graphical or tabular definition and optimization of camming axis
- Seamless enhancement of Standard PLC Motion Control functionalities
- Motion Control and Safety Functions on one controller

SIMATIC STEP 7 in TIA Portal

Controller Motion Improvements - S7-1500T

SIEMENS

	High-end applications	S7-1500 T
	Distributed Motion	
	Interpolation/Handling	
	Camming	
	Gearing (absolute)	
	Gearing (relative)	S7-1500
	Output cams Measuring input	
	Positioning	
	Speed control	



Goal of S7-1500 T

- **Leverage** additional **mid range** business and **capture share** in **price sensitive markets**
- **Close the gap** between SIMOTION and S7-1500 Motion Control performance
- **Close the gap** to **midrange competitors** with **scalable systems**
- **Well known usability** for OEM's used to SIMATIC

ET 200PRO: CPU 1516pro-2 PN

V14



Feature

- S7-1500 Controller
- 2 PROFINET Interfaces with 4 Ports
- Programming interface RJ45
- Safety Integrated version available

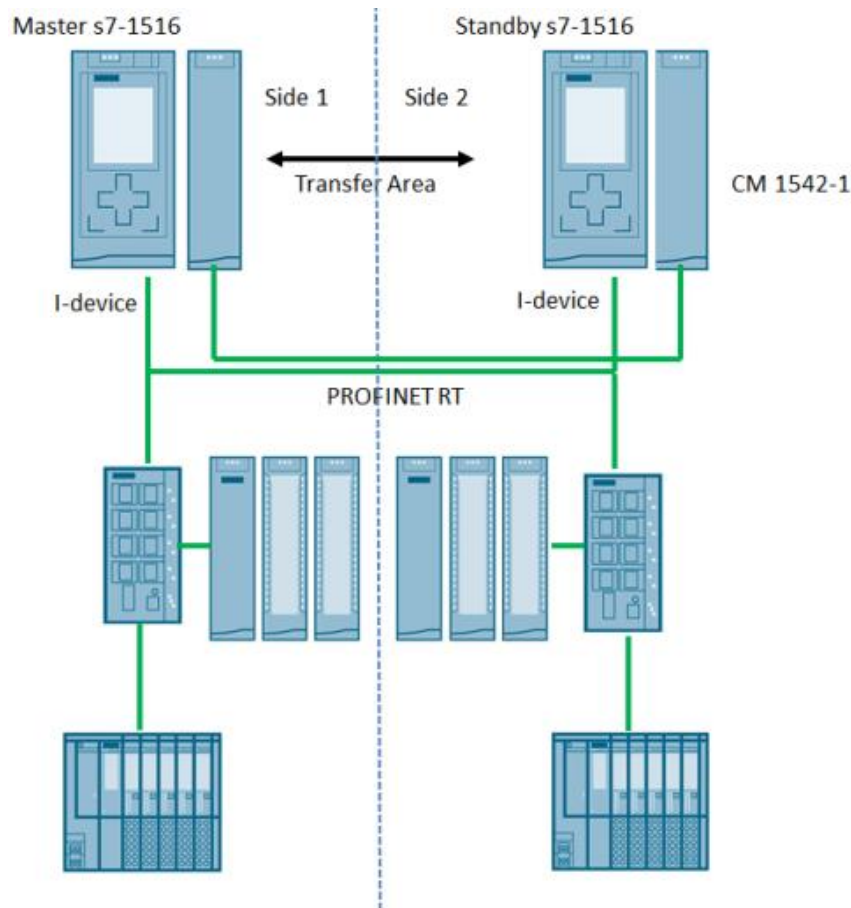
Benefit

- Use the advantages of the S7-1500 directly in IP65
- Network separation for an easy integration into the plant network
- Direct possibility to download the PLC project
- Controller and IO can cover Safety applications up to performance Level e


SIMATIC S7-1500

SIMATIC S7-1500 “SR” engineered solution, U.S.

SIEMENS



Further Details...

- Available now! (True S7-1500H product solution ~2018)
- Engineered solution, support by Siemens App group
-  **2 customers currently working with this concept in O&G!**
 - BOP application – using SIPLUS CPUs
 - PID control for hydraulic valve – using standard CPUs
- **Pros:**
 - Works in TIA Portal
 - Works with various CPUs in S7-1500 family
- **Cons:**
 - Not “bumpless” like S7-400H
 - Engineered solution – not a standard “product”
 - Cannot do “safety rated” applications

SIPLUS extreme

Additional protections for Harsh Environments!



SIEMENS



Recent Updates w/ SIPLUS

- Expanding SIPLUS product line in general
- Additional Ratings – IECeX, railway certifications – S7-1500(F), S7-1200, ET200SP, etc...**Marine – “certificate of declaration”*
- More competitive pricing

SIPLUS Extreme

- For harsh environments



SIEMENS

<i>Ambient conditions</i>	SIMATIC	SIPLUS extreme
Climatic	0 °C to 60 °C ¹⁾	-40/-25 °C to +60/+70 °C ¹⁾
Relative humidity	from 10 to 95 % with out condensation	100 % Condensation and Icing allowed
Chemically active substances	ISA S71.04 G3 SO ₂ 0,5 ppm H ₂ S 0,1 ppm	EN60721-3-3 3C4 and ISA S71.04 G1, G2, G3, GX continuous load limit ²⁾ SO ₂ 4,8 ppm 14,8 ppm H ₂ S 9,9 ppm 49,7 ppm Cl 0,2 ppm 1,0 ppm HCl 0,66 ppm 3,3 ppm HF 0,12 ppm 2,4 ppm NH ₃ 49 ppm 247 ppm O ₃ 0,1 ppm 1,0 ppm NO _x 5,2 ppm 10,4 ppm
Salt mist	Not allowed	Salt mist test (EN 60068-2-52), severity level 3
Mechanically active substances • dust (suspended solids) • dust (deposition)	EN60721-3-3 3S2 0,2 mg/m ³ 1,5 mg/m ³ Without sand	EN60721-3-3 3S4 4,0 mg/m ³ 40 mg/m ³ Sand included
Biologically active substances	Not tested	EN60721-3-3 3B2 Growth of mold, sponge except fauna

¹⁾ For certain product ranges ²⁾ 30 min/day

A plus for extreme requirements

System- / multi-value topics



Energy Efficiency



Due to the robustness of the devices no additional cooling / heating is required, this reduces energy costs and protects the environment.

Engineering Efficiency



A seamless integration of SIPLUS products in TIA Portal offers all the advantages of an innovative framework in engineering.

Usability



The use of proven standard tools guarantees comprehensive project design and commissioning of automation. This saves time and enables a fast and error-free engineering and guarantees long-term use of the system under changing environmental conditions.

Table of content

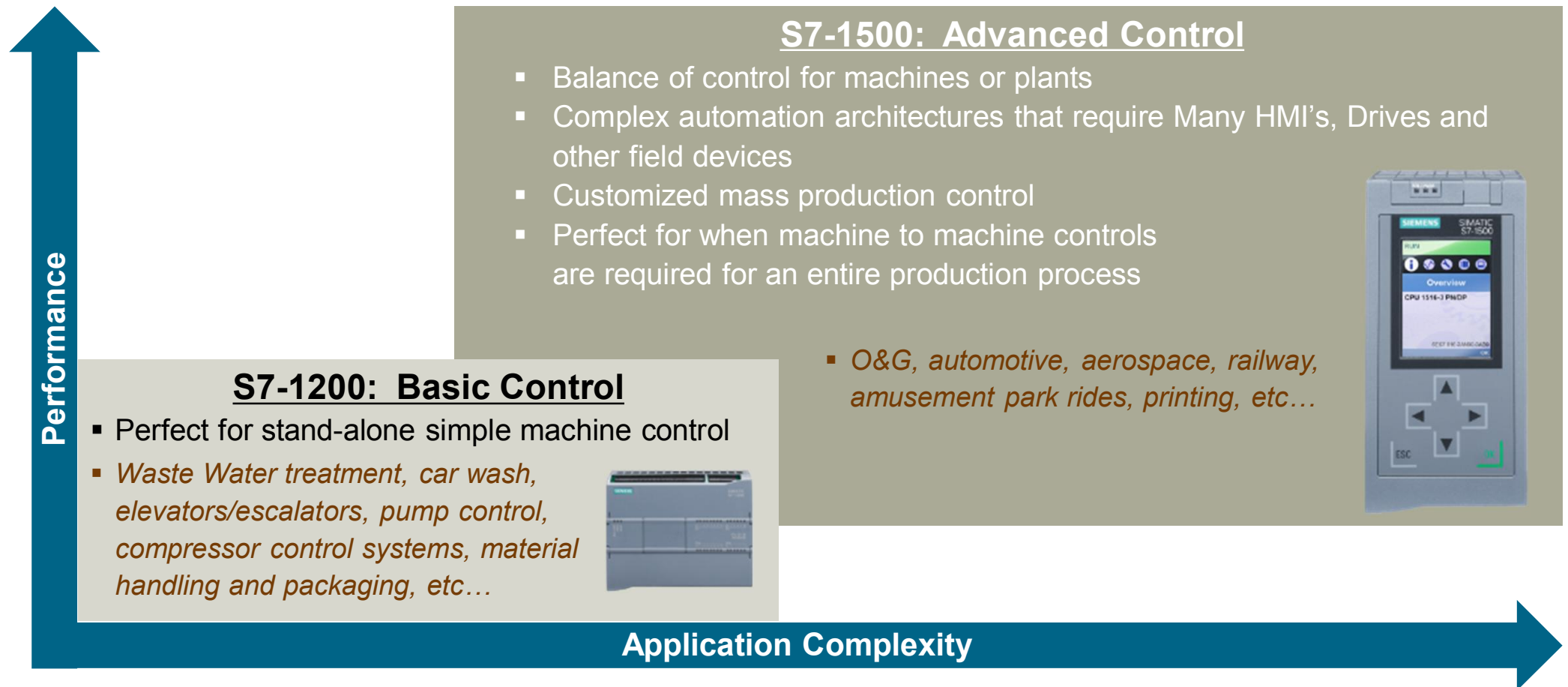


- Positioning within SIMATIC portfolio
- Hardware Overview
- **Typical applications**
- Innovative Features/Benefits
- Option – smaller form factor
- Summary

SIMATIC New Controller Generation

Controller scalability that meets all requirements

SIEMENS



SIMATIC S7-1500 Reference Applications

Industries across the board!



SIEMENS

- ✓ **O&G, Blow Out Preventer (BOP) control**



- ✓ **Rubber Ind., Automation of Rubber Mixing Room**



- ✓ **HVAC Ind., Fin Press Machine**



- ✓ **Appliance Ind., Tub Production – Washing Machines**



- ✓ **Gas/Steam Ind., Automation of Natural Gas Compressor**



- ✓ **Aluminum Man. Ind., assembly machine**



- ✓ **Printing Ind., Cooling Water Re-circulation System**



- ✓ **Waste Water Ind., Plant Automation**



Table of content



- Positioning within SIMATIC portfolio
- Hardware Overview
- Typical applications
- **Innovative Features/Benefits**
- Option – smaller form factor
- Summary

SIMATIC S7-1500 Hands-On Overview – Customer Value

SIEMENS

Security Integrated

- ✓ Block, copy, access, & manipulation protection
 - + Protects intellectual property and investment
 - + Protects against unauthorized project changes

Control Integrated

- ✓ Standard motion control & drives integrated
- ✓ TRACE function running on CPU
 - + Integration saves money, time, and panel space

Performance

- ✓ 400MB backplane, CPUs down to 1ms bit scan!
 - + Increased productivity by shortened cycle times

Design and Retrofit

- ✓ Display, optimized components, integrated DIN rail, jumpers, etc...
 - + Simple assembly saves time & costs
 - + Easy to maintain due to flexible wiring

Integrated system diagnosis

- ✓ Built in, plain text diagnostic messages
- ✓ No programming required!
- ✓ Local and remote stations, drives, etc...
- ✓ Available even in CPU-STOP Mode!

High I/O with diagnosis


- ✓ Integrated drives/HMI/controller, libraries, scalable HW, etc...
 - + Efficient implementation & service saves time and costs


SIMATIC S7-1500 Hands-On Consistent display of diagnostics

Integrated system
diagnosis

SIEMENS

+efficiency

RUN 

 **Coming** 8:34:44 AM
3/3/2012

Single channel error: Low
limit violated
HW_ID= 00263, Input channel
number 00006

ESC



Minimize Downtime!



Simplify Troubleshooting!

SIEMENS SIMATIC HMI

TOUCH

Diagnostic Buffer

No.	Date and time	Event
1	5/3/2012 9:21:53.806 AM	Communic
2	5/3/2012 9:21:53.791 AM	Communic
3	5/3/2012 9:21:53.381 AM	Low limit vi
4	5/3/2012 9:21:51.095 AM	Communic
5	5/3/2012 9:21:25.350 AM	Communic
6	5/3/2012 9:21:25.336 AM	Communic
7	5/3/2012 9:21:23.057 AM	Low limit vi
8	5/3/2012 9:21:22.654 AM	Communic
9	1/1/1994 1:07:29.667 AM	Communic

PLC 1

DI 32x24VDC/0.5...
DO 32x24VDC/0.5...
AI 8x12bit/12bit ST...
AQ 4x12bit ST...
TM CTR 1
PS 1
CP 1543-1.1

tail_0

0 1 2 3 4 5 6 7 8 9

0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000

SIEMENS S71500 Station_1IFLC_1

Diagnostic Buffer

No.	Date and time	Event
1	5/3/2012 9:21:53.806 AM	Communic
2	5/3/2012 9:21:53.791 AM	Communic
3	5/3/2012 9:21:53.381 AM	Low limit vi
4	5/3/2012 9:21:51.095 AM	Communic
5	5/3/2012 9:21:25.350 AM	Communic
6	5/3/2012 9:21:25.336 AM	Communic
7	5/3/2012 9:21:23.057 AM	Low limit vi
8	5/3/2012 9:21:22.654 AM	Communic
9	1/1/1994 1:07:29.667 AM	Communic

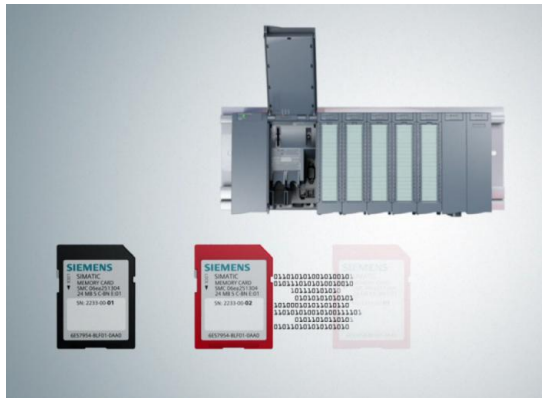
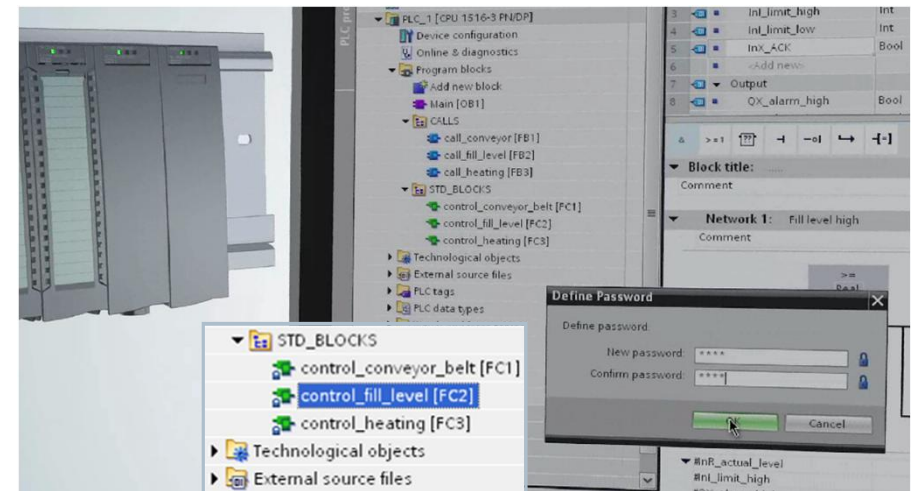
SIMATIC S7-1500 Hands-On Security Integrated

Security
Integrated

SIEMENS

+ Security Integrated

- + Block protection
- + Copy protection
- + Access protection
- + Manipulation protection



Unrestricted © Siemens 2016

SIMATIC S7-1500 Hands-On Design & Handling

Design and
Handling

SIEMENS

+ Design and handling

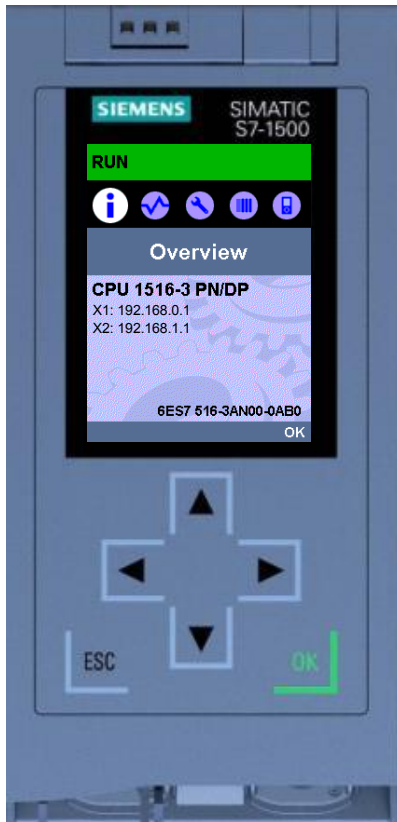
- + Display: Information and adjustment
- + Integrated DIN rail
- + Scalability
- + Uniform front connector
- + Prewiring position
- + Integrated shielding
- + Integrated potential bridges, coding elements



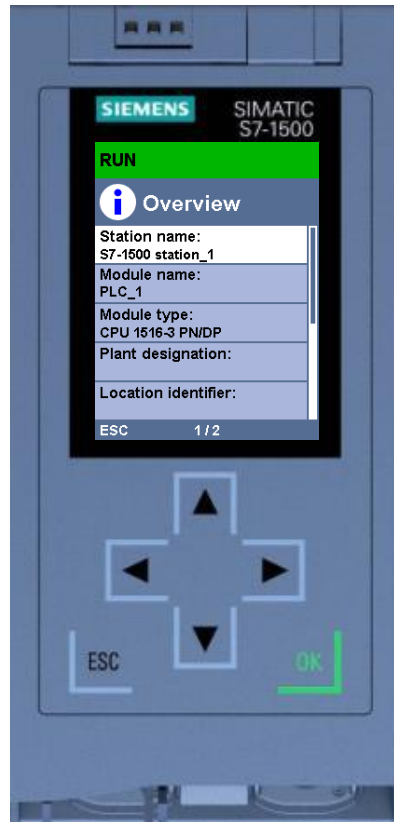
SIMATIC S7-1500

Onboard Display

SIEMENS



Start screen



Status



Diagnostics



Fail-safe

SIMATIC S7-1500 Onboard Display

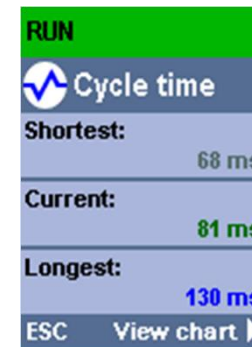
Main Advantages of Display:

- ✓ **Reduced downtimes** through diagnostics alarms in plain text
- ✓ Changing of the interface settings on site, without programming device
- ✓ Simple access to CPU information, no tools required

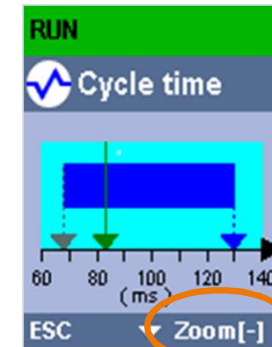


SIEMENS

Cycle time



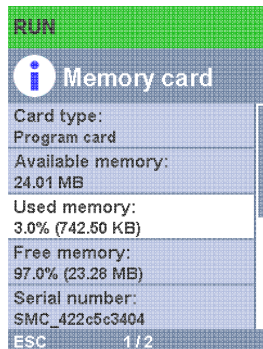
Zoom-In



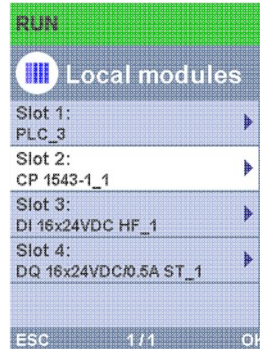
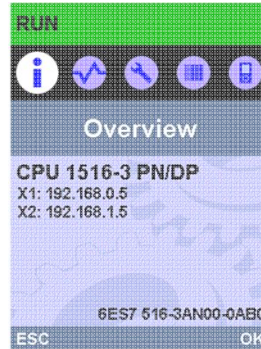
Over-Cycle



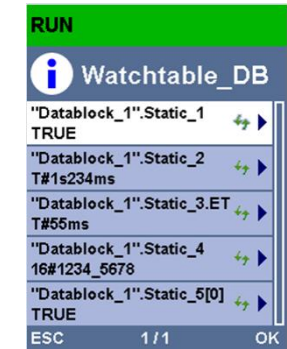
Memory Usage



Setting IP Address



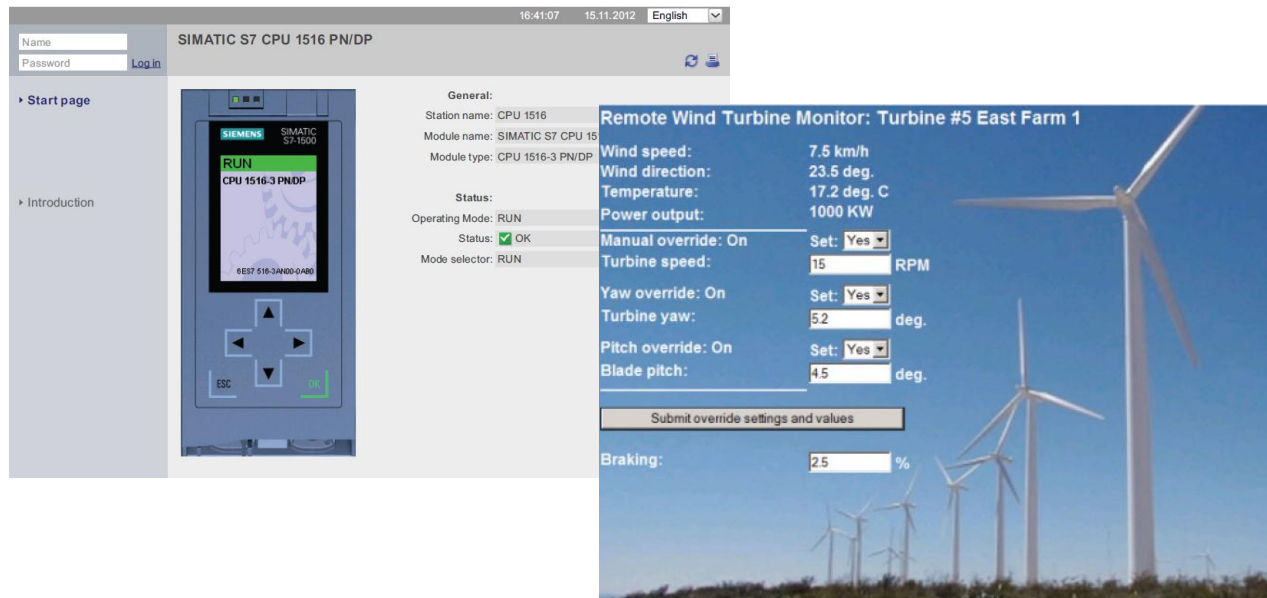
Watch tables at the display



SIMATIC Webserver

Built in...on board all CPUs as standard!

SIEMENS



S7-1500



S7-1200



ET200SP

- ✓ General info on CPU, Actions - Run/Stop, LED flash, update FW
- ✓ Diagnostic Buffer, alarm messages, module information
- ✓ Tags - monitor / modify, watch tables, custom web pages
- ✓ File Browser, print function

Allows customers to do this.....

Remote access to your PLC using standard web browser! Over intranet or internet...

TIA Portal

Integrated within the TIA Portal

SIEMENS

Save projects > saving incomplete software is also possible

Centralized data management > validation of all engineering data

Simulation > integrated as a standard feature

Online/offline comparison > quickly visualize differences

Cross-references > project-wide overview using tags and objects

IntelliSense > easy object selection

Project tree > conveniently organized project structure with all objects

Diverse wizards > adding CPUs, HMI panels, drives, and technology objects quickly and in structured fashion

Devices and networks > graphic network overview of all hardware components based on PROFIBUS, PROFINET, and AS-i

Safety Administration Editor > for central visualization, configuration and change of safety parameters

Structured program setup > conveniently organized program structure

Tag definitions > immediately available in all editors once defined

Consistent symbols > program with symbolic names within the whole project as object

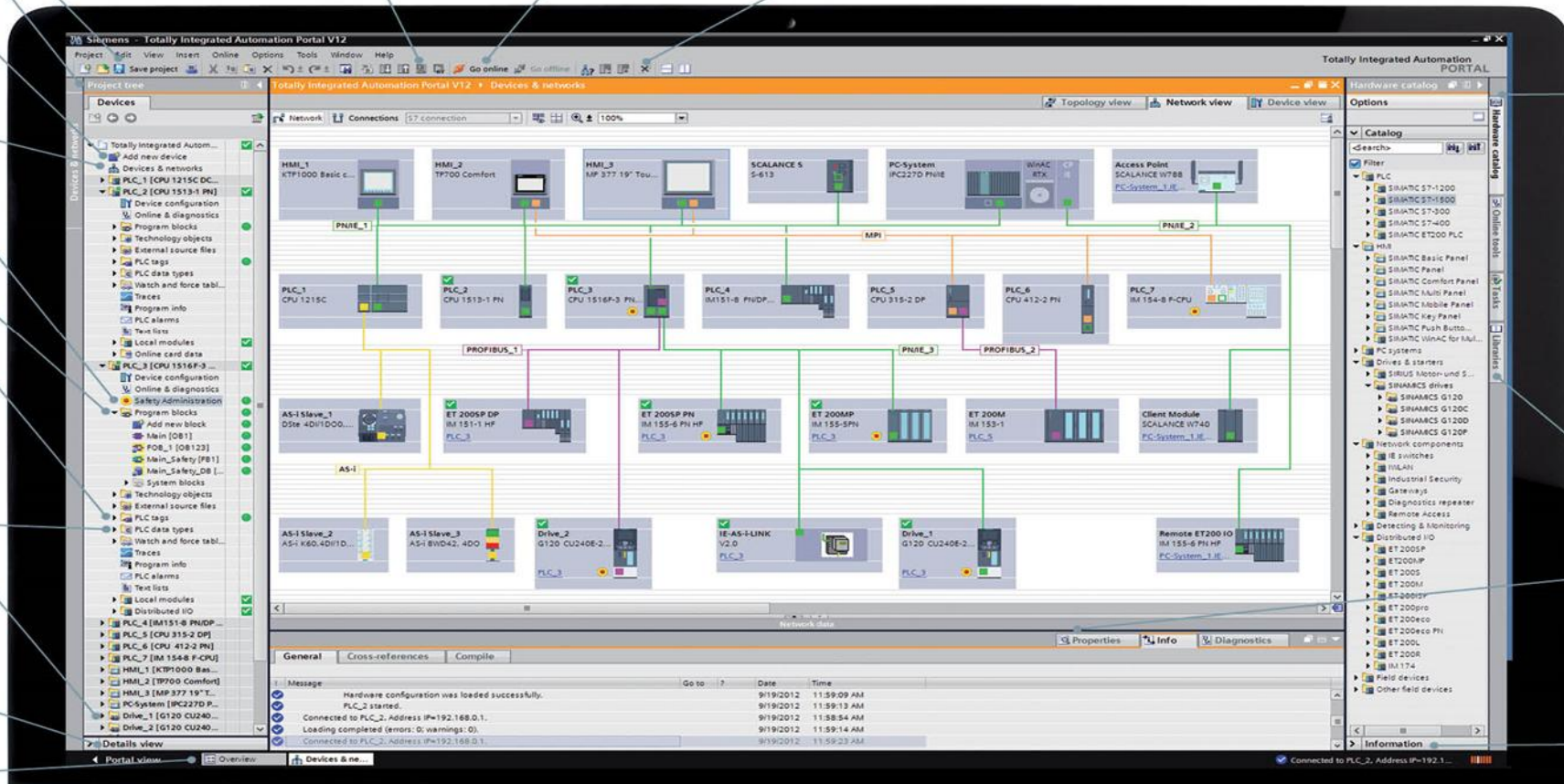
PLC Data Types > conveniently arranged display of user-defined types

Drives integration > consistently configurable

Drag & Drop > easy data handling from one editor to another

Detail window > displays all details from selected object of the project tree

Window switcher > to switch between opened editors



Intuitive tab pages > follows the selected editor

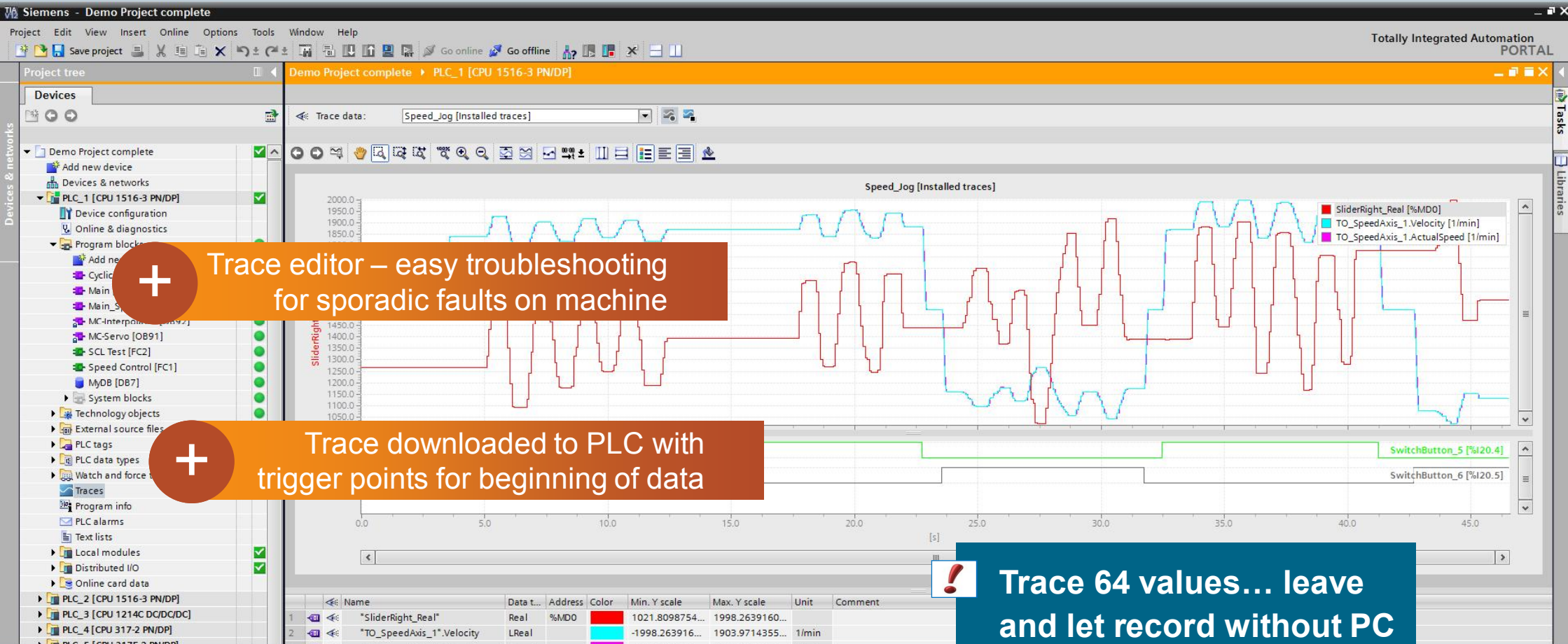
Global Library concept > reusing of project parts

Property window > displays all relevant parameters of the selected object

Information window > displays detailed information of the selected object in the tab accordingly

Minimize Downtime Troubleshooting

SIEMENS



Unrestricted © Siemens 2016

Table of content



- Positioning within SIMATIC portfolio
- Hardware Overview
- Typical applications
- Innovative Features/Benefits
- **Option – smaller form factor**
- Summary

SIEMENS

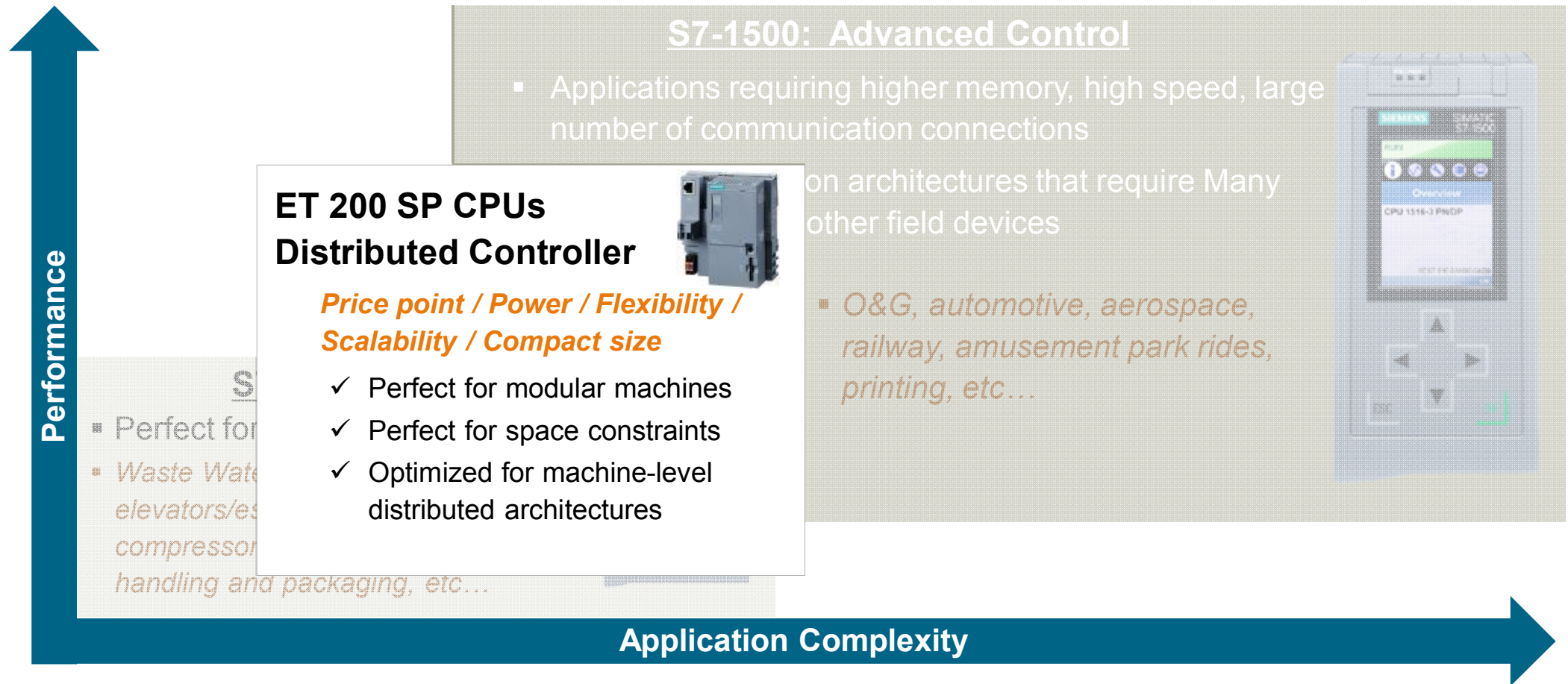
Engineering
with
TIA Portal

SIMATIC ET 200SP CPU

SIMATIC New Controller Generation

Controller scalability that meets all requirements

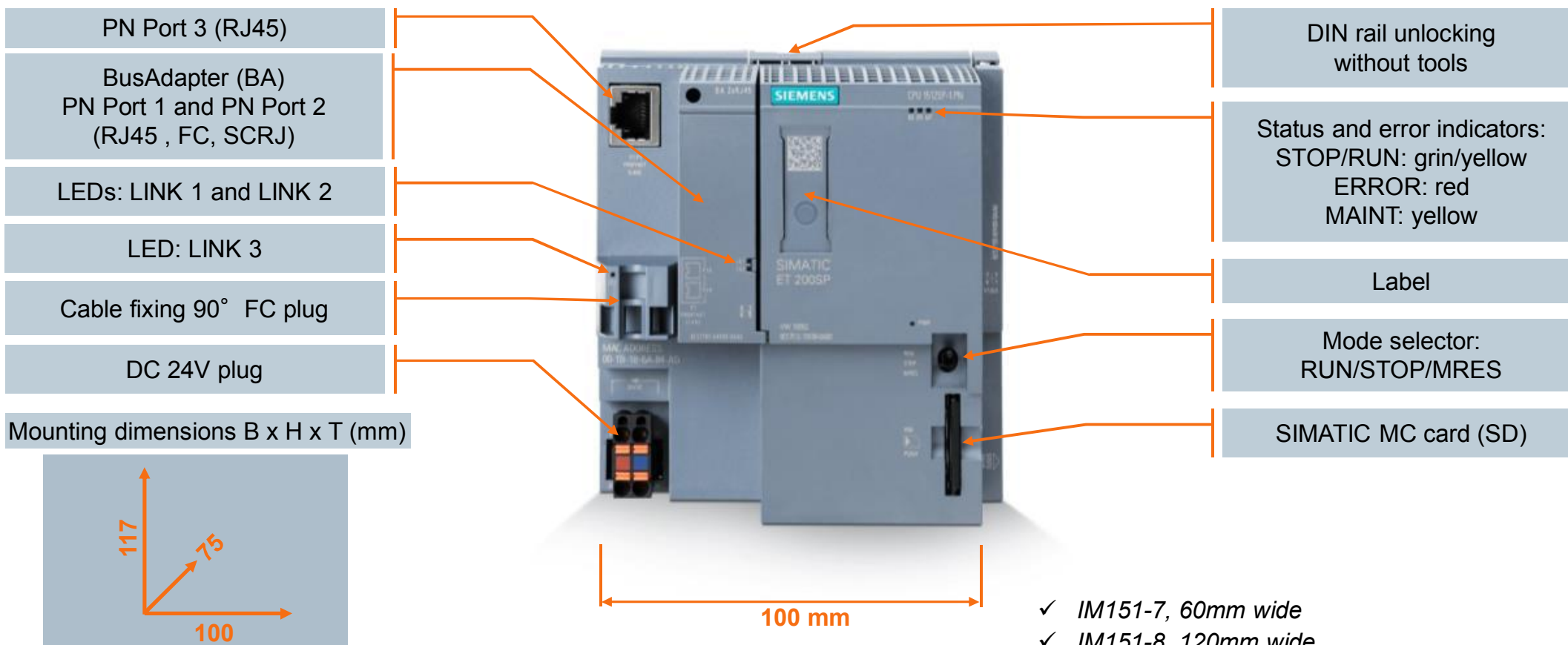
SIEMENS



SIMATIC ET 200 SP CPUs

ET200SP CPUs - Operator controls and indicators

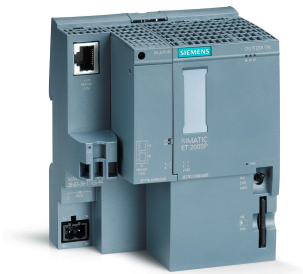
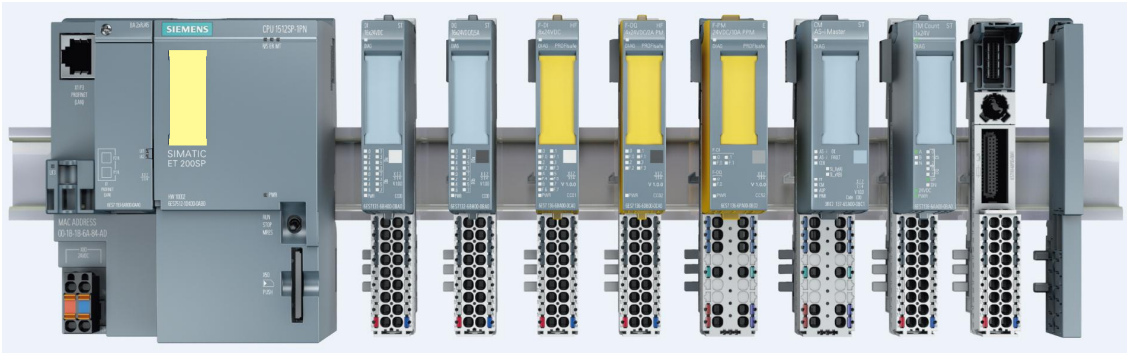
SIEMENS



Unrestricted © Siemens 2016

SIMATIC S7-1500 CPU

- Standard / Failsafe Portfolio



CPU 1510

CPU 1512



Prog. Memory	100 kB	200 kB
(*Safety CPU)	(150 kB)	(300 kB)
Data Memory	750 kB	1 MB
Bit perf.	72 ns	48 ns

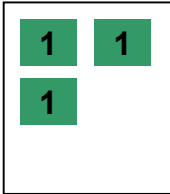
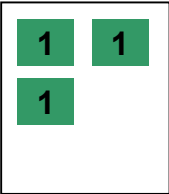


Table of content



- Positioning within SIMATIC portfolio
- Hardware Overview
- Typical applications
- Innovative Features/Benefits
- Option – smaller form factor
- **Summary**

Summary

SIMATIC S7-1500 Controllers –

- S7-1500 is our flagship controller line for mid to advanced control applications
- Scalable with our other controllers – TIA!
- Pre-wired connectors available, complete line of accessory modules
- Multi-industry applications
- Expanding / improving our SIPLUS line for “Harsh Environments”
- S7-1500H on roadmap
- Feature rich product line – HW, SW, innovations
 - Diagnostics, Performance, Security, “Black box” TRACE, Design and Handling innovations, built in color display
- ET200SP form factor available



S7-1500: The most advanced controller in the world!



Jim Wilmot
Product Marketing Manager
Factory Automaton – Digital Factory

5300 Triangle Parkway
Norcross, GA 30092

Phone: +1 770 871-3940

E-mail:
james.wilmot@siemens.com

siemens.com