

SIEMENS

SIMATIC

S7-1500
CPU 1511-1 PN
(6ES7511-1AK00-0AB0)

Manual

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Legal information

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

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
 CAUTION
indicates that minor personal injury can result if proper precautions are not taken.
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indicates that property damage can result if proper precautions are not taken.

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

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

Preface

Purpose of the documentation

This device manual supplements the system manual of the S7-1500 automation system and the function manuals. All cross-system functions are described in the system manual.

The information provided in this device manual and the system manual enables you to commission the CPU 1511-1 PN.

Conventions

Please also observe notes marked as follows:

Note

A note contains important information on the product described in the documentation, on the handling of the product and on the section of the documentation to which particular attention should be paid.

Note on IT security

Siemens offers IT security mechanisms for its automation and drive product portfolio in order to support the safe operation of the plant/machine. We recommend that you inform yourself regularly on the IT security developments regarding your products. You can find information on this on the Internet (<http://support.automation.siemens.com>).

You can register for a product-specific newsletter here.

For the safe operation of a plant/machine, however, it is also necessary to integrate the automation components into an overall IT security concept for the entire plant/machine, which corresponds to the state-of-the-art IT technology. You can find information on this on the Internet (<http://www.siemens.com/industrialsecurity>).

Products used from other manufacturers should also be taken into account here.

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Documentation guide

Introduction

The documentation of the SIMATIC products has a modular structure and covers a range of topics concerning your automation system.

The complete documentation for the S7-1500 system consists of a system manual, function manuals and device manuals.

The STEP 7 information system (Online Help) also helps you to configure and program your automation system.

Overview of the documentation for CPU 1511-1 PN

The following table lists additional documents which supplement this description of CPU 1511-1 PN and are available on the Internet.

Table 1- 1 Documentation for CPU 1511-1 PN

Topic	Documentation	Most important contents
System description	S7-1500 Automation System (http://support.automation.siemens.com/WW/view/en/59191792) system manual	• Application planning • Installation • Wiring • Commissioning
Properties of the modules	Power supplies (http://support.automation.siemens.com/WW/view/en/57251228) device manual	• Wiring • Parameter assignment/ addressing • Interrupts, diagnostics, error, and system messages • Technical specifications • Dimensional drawing
	Signal modules (http://support.automation.siemens.com/WW/view/en/59174020) device manual	
System diagnostics	System diagnostics (http://support.automation.siemens.com/WW/view/en/59192926) function manual	• Overview • Hardware/software diagnostic evaluation

Topic	Documentation	Most important contents
Communication	Communication (http://support.automation.siemens.com/WW/view/en/59192925) function manual	• Overview
	PROFINET with STEP 7 V12 (http://support.automation.siemens.com/WW/view/en/49948856) function manual	• PROFINET basics • PROFINET functions • PROFINET diagnostics
	Web server (http://support.automation.siemens.com/WW/view/en/59193560) function manual	• Function • Operation
Designing interference-free controllers	Designing interference-free controllers (http://support.automation.siemens.com/WW/view/en/59193566) function manual	• Basics • Electromagnetic compatibility • Lightning protection • Housing selection
Memory concept	Structure and use of the CPU memory (http://support.automation.siemens.com/WW/view/en/59193101) function manual	• Setup • Function principle • Use
Cycle and response times	Cycle and response times (http://support.automation.siemens.com/WW/view/en/59193566) function manual	• Basics • Calculations
Analog value processing	Analog value processing (http://support.automation.siemens.com/WW/view/en/59193559) function manual	• Wiring options • Tables of measured values

SIMATIC manuals

All current manuals for SIMATIC products are available for download free of charge from the Internet (<http://www.siemens.com/automation/service&support>).

Product overview

2.1 Properties

Order number

6ES7511-1AK00-0AB0

View of the module

The following figure shows a CPU 1511-1 PN.



Figure 2-1 CPU 1511-1 PN

Properties

The module has the following technical properties:

- Communication:
 - Interfaces

The CPU 1511-1 PN has a PROFINET interface with two ports. The two ports have the same IP address and form the interface to the fieldbus level (switch functionality).
 - Integrated Web server

The CPU status query is independent of a software installation. Graphically visualized process variables and user-defined websites facilitate information acquisition.
- Trace functionality
 - All CPUs of the S7-1500 automation system support trace functionality. Trace functionality is independent of the technology and supports you in debugging/optimizing the user program. It is particularly useful for Motion Control and control applications.
- Integrated technology:
 - Standard Motion Control

PLC Open blocks for programming motion functionality by means of PROFINET IO IRT and PROFIdrive interface.

The functionality supports speed-controlled axes, positioning axes and external encoders.
 - Integrated control functionality

Universal PID controllers or 3-point controllers with integrated tuning.

Integrated temperature controller
- Integrated system diagnostics:
 - System diagnostics is automatically generated and consistently displayed.
- Integrated security:
 - Know-how protection

User programs can be securely protected against unauthorized access and modification.
 - Copy protection

User program blocks are linked to the serial number of the SIMATIC memory card or of the module. User programs cannot run without the corresponding SIMATIC memory card or module.
 - Access protection

Extended access protection provides comprehensive protection against unauthorized configuration changes. Authorization levels can be used to assign separate rights to different user groups.
 - Integrity protection

The system protects the data transferred to the CPU from unauthorized manipulation. Altered or external transmission of engineering data is reliably detected by the CPU.

- Other special features:
 - Color display
 - Short OB cycles ($\leq 500 \mu\text{s}$)

The module supports the following functions:

- Firmware update
- Integrated system diagnostics
- PROFINET IO RT
- PROFINET IO IRT
- PROFinergy
- Media redundancy
- I-device
- IO controller
- Web server
- Trace
- Isochronous mode
- Integrated controller
- Standard Motion Control

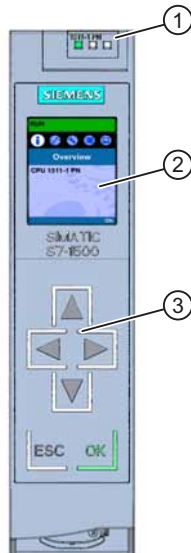
Reference

You can find additional information on "Integrated security/access protection" under "Protection" in the S7-1500 Automation System system manual (<http://support.automation.siemens.com/WW/view/en/59191792>).

2.2 Operating and display elements

2.2.1 Front view of the module with front panel

The following figure shows the front panel of CPU 1511-1 PN with integrated display.



- ① LED displays for the current operating mode and diagnostic status of the CPU
- ② Display
- ③ Operator control buttons

Figure 2-2 View of the CPU 1511-1 PN (with front panel) - front

Note

Removing and fitting the front panel

The front panel can be removed and replaced during runtime without affecting operation.

Note

Temperature range for display

To increase the service life of the display, the display switches itself off before the permitted operating temperature is reached. When the display cools down again it automatically switches itself on again. The status of the CPU continues to be indicated by the LEDs when the display is switched off.

For more information on temperatures at which the display switches itself on and off, refer to the Technical Specifications (Page 29).

Reference

For more information about "Displays" refer to the S7-1500 Automation System (<http://support.automation.siemens.com/WW/view/en/59191792>) System Manual, CPU display chapter. Removing and replacing the front cover is described in the section on handling the front cover.

Locking the front cover

You can lock the front cover to protect your CPU against unauthorized access.

You can attach a security seal or a padlock with a diameter of 3 mm to the front cover.

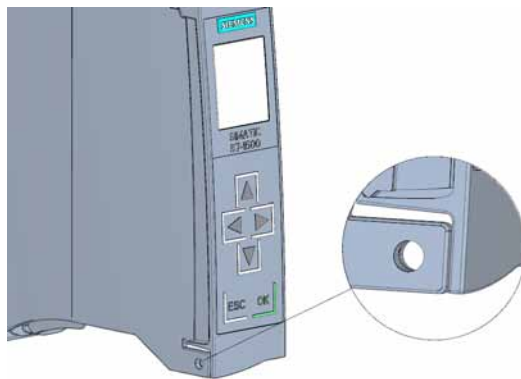
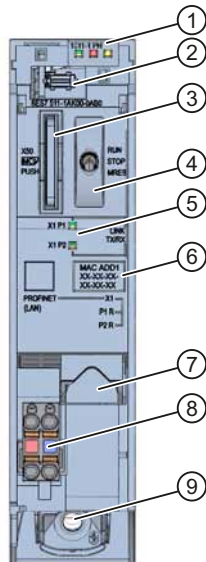


Figure 2-3 Locking latch on the CPU

2.2.2 Front view of the module without front panel

The following figure shows the operator control and connection elements of the CPU 1511-1 PN behind the front panel.



- ① LEDs for the current operating mode and diagnostic status of the CPU
- ② Display connection
- ③ Slot for the SIMATIC memory card
- ④ Mode selector switch
- ⑤ LEDs for the 2 ports of the PROFINET interface X1
- ⑥ MAC address
- ⑦ PROFINET interface (X1) with 2-port switch
- ⑧ Connection for power supply
- ⑨ Fixing screw

Figure 2-4 View of the CPU 1511-1 PN (without front panel) - front

2.2.3 Rear view of the module

The following figure shows the connection elements on the back of the CPU 1511-1 PN.

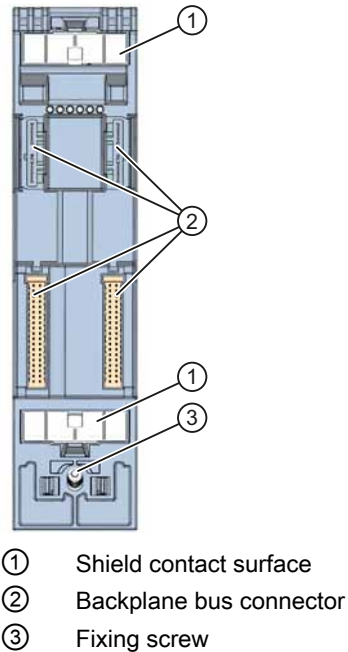


Figure 2-5 View of the CPU 1511-1 PN - back

2.3 Mode selector switch

Use the mode selector to set the CPU operating mode.

The following table shows the position of the switch and the corresponding meaning.

Table 2- 1 Mode selector switch settings

Position	Meaning	Explanation
RUN	RUN mode	The CPU is executing the user program.
STOP	STOP mode	The CPU is not executing the user program.
MRES	Memory reset	Position for CPU memory reset.

2.4 Functions

2.4.1 PROFINET IO

PROFINET is a fieldbus standard of the PROFIBUS user organization that defines a cross-vendor communication and engineering model.

Within the context of PROFINET, PROFINET IO is a communication concept for the implementation of modular, distributed applications. PROFINET IO IRT enables defined response times and high-precision system behavior.

The PROFINET IO controller operating mode enables direct access to IO devices via Industrial Ethernet.

The PROFINET IO device operating mode enables the operation of S7 stations as "intelligent" PROFINET IO devices on Industrial Ethernet.

UDP and RT or IRT are used to configure the cyclic IO data traffic for PROFINET IO communication.

General properties of PROFINET IO

PROFINET IO has the following properties and functions:

- Real-time communication
- Isochronous real-time communication
- Media redundancy
- Prioritized startup
- Device replacement without exchangeable medium
- I-device
- IO controller
- Isochronous mode

Reference

You will find additional information on "PROFINET IO" in the STEP 7 online help and in the PROFINET System Description (<http://support.automation.siemens.com/WW/view/en/19292127>) manual.

2.4.2 PROFlenergy

PROFlenergy

PROFlenergy (for PROFINET) reduces the energy consumption by using PROFlenergy commands during the production-free time.

Additional information

- System manual: PROFINET System Description (<http://support.automation.siemens.com/WW/view/en/19292127>)
- Additional information on PROFlenergy is available on the Internet (<http://www.profibus.com>) under Common Application Profile PROFlenergy; Technical Specification for PROFINET; Version 1.0; January 2010; Order no: 3.802.

2.4.3 Memory reset

Apart from a few exceptions, a "memory reset" involves clearing all internal memories and then reading the data from the SIMATIC memory card.

Options

You have the following options for resetting the memory of the CPU:

- Using the mode selector switch
- Using the display
- Using STEP 7 V12

Procedure using the mode selector switch

Proceed as follows to reset the CPU memory using the mode selector switch:

1. Set the mode selector switch to STOP.

Initial result: The RUN/STOP LED lights up yellow.

2. Set the mode selector switch to the MRES position. Hold the switch in this position until the RUN/STOP LED lights up in yellow for the 2nd time and remains lit (this takes three seconds). After this, release the switch.
3. Within the next three seconds, return the mode selector switch to the MRES position, and then back to STOP again.

Result: The CPU executes a memory reset, during which time the RUN/STOP LED flashes yellow. The RUN/STOP LED switches to yellow when the CPU has completed the memory reset.

Procedure using the display

You can reach the "Memory reset" menu command by successively selecting the following menu command and confirming each step with "OK".

- Settings → Reset → Memory reset

Result: The CPU performs a memory reset.

Procedure using STEP 7

Proceed as follows to reset the CPU memory in STEP 7:

1. Open the "Online Tools" task card of the CPU.
2. Click the "MRES" button in the "CPU control panel" pane.
3. Click "OK" to confirm the security prompt.

Result: The CPU is set to STOP mode and the CPU memory reset is performed.

Memory object response to memory reset

The following table gives an overview of which memory objects are retained and which are initialized upon memory reset.

Table 2- 2 Retentive characteristics of the memory objects

Memory object	Contents
Actual values of the data blocks, instance data blocks	Initialized
Bit memories, timers and counters	Initialized
Certain retentive tags from technology objects (e.g. adjustment values of absolute encoders)	Retained
Diagnostic buffer entries (retentive area)	Retained
Diagnostic buffer entries (non-retentive area)	Initialized
Operating hours counter	Retained
Time	Retained

Reference

For more information about "Memory reset", refer to the Memory reset chapter in the S7-1500 Automation System
(<http://support.automation.siemens.com/WW/view/en/59191792>) System Manual.

2.4.4 Restoring the factory settings of the CPU

The "Reset to factory settings" function restores the CPU to the "delivery state". This means that all data that was stored in internal CPU memory is deleted.

Recommendation:

Always reset a PROFINET CPU to the factory state if you want to store it or remove it for use at a different location with a different program. Make sure that the Reset to factory settings also deletes the IP address parameters.

Options

There are three ways to reset the CPU to the factory state:

- Using the mode selector switch
- Using the display
- Using STEP 7 V12

Procedure using the mode selector switch

Make sure that there is no SIMATIC memory card in the CPU and that the CPU is in STOP mode (RUN/STOP LED lights up yellow).

Perform a reset to factory settings when there is no SIMATIC memory card inserted, as follows:

1. Set the mode selector switch to STOP.
Initial result: The RUN/STOP LED lights up yellow.
2. Set the mode selector switch to the MRES position. Hold the mode selector switch in this position until the RUN/STOP LED lights up in yellow for the 2nd time and remains lit (this takes three seconds). After this, release the switch.
3. Within the next three seconds, return the mode selector switch to the MRES position, and then back to STOP again.

Result: The CPU executes the "Reset to factory settings"; the RUN/STOP LED flashes yellow. The yellow state of the RUN/STOP LED indicates that the CPU is reset to factory settings and in STOP mode. The "Reset to factory settings" event is entered in the diagnostics buffer.

Note

Make sure to set the CPU to factory state when you remove a PROFINET CPU and use it elsewhere or put it in storage. Make sure that the Reset to factory settings also deletes the IP address parameters.

Procedure using the display

Make sure that the CPU is in STOP mode (RUN/STOP LED lights up yellow).
If a SIMATIC memory card is plugged in, make sure to remove this.

You can reach the "Factory settings" menu command by successively selecting the following menu commands and confirming each step with "OK".

- Settings → Reset → Factory settings

Result: The CPU executes the "Reset to factory settings"; the RUN/STOP LED flashes yellow. The yellow state of the RUN/STOP LED indicates that the CPU is reset to factory settings and in STOP mode. The "Reset to factory settings" event is entered in the diagnostics buffer.

Procedure using STEP 7

Make sure there is an online connection to the CPU that is to be reset to the factory settings.

1. Open the Online and Diagnostics view of the CPU.
2. In the "Functions" folder, select the "Reset to factory settings" group.
3. Select the "Retain IP address" option button to retain the IP address, or the "Reset IP address" option button to delete the IP address.
4. Click "Reset".
5. Click "OK" to confirm the security prompt.

Result: The CPU is set to STOP mode and is reset to factory settings.

Retentive characteristics of the memory objects

The properties of the CPU are set to the following values:

Table 2- 3 Properties of the CPU objects in the delivery state

Memory object	Contents
Actual values of the data blocks, instance data blocks	Initialized
Bit memories, timers and counters	Initialized
Certain retentive tags from technology objects (for example, adjustment values of absolute encoders)	Initialized
Diagnostics buffer entries (retentive area)	Initialized
Diagnostics buffer entries (non-retentive area)	Initialized
Operating hours counter	Initialized
Time	Initialized

Reference

For more information about "Reset to factory settings", refer to the Structure and use of CPU memory (<http://support.automation.siemens.com/WW/view/en/59193101>) Function Manual in the Memory areas and retentivity chapter, as well as to the STEP 7 Online Help.

Wiring

This section provides information on the terminal assignment of the individual interfaces and the block diagram of the CPU 1511-1 PN.

24 V DC power supply(X80)

The connector for the power supply is inserted in the factory state of the CPU.

The following table shows the terminal assignment for a 24 V DC power supply.

Table 3- 1 Terminal assignment 24 V DC power supply

View	Signal name*	Pin assignment
	1L+	24 V DC
	2L+	24 V DC **
	1M	Ground
	2M	Ground **
* 1L+ and 2L+ and 1M and 2M are jumpered internally.		
** Make sure that the current is limited to 10 A.		

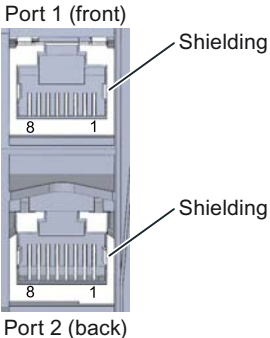
If the CPU is supplied by a system power supply, the 24 V supply connection is not required.

The 2L+ and 2M connections can be used to loop-through the 24 V supply.

PROFINET interface (X1) with 2-port switch (X1 P1 and X1 P2)

The following table shows the terminal assignment for the PROFINET interface with 2-port switch. The assignment corresponds to the Ethernet standard for a RJ45 plug.

Table 3-2 Terminal assignment of PROFINET interface with 2-port switch

View	Signal name		Pin assignment
	1	TD	Transmit data +
	2	TD_N	Transmit data -
	3	RD	Receive data +
	4	GND	Ground
	5	GND	Ground
	6	RD_N	Receive data -
	7	GND	Ground
	8	GND	Ground

Reference

You can find additional information on the topics of "Connecting the CPU" and "Accessories (RJ45 plug)" in the system manual S7-1500 Automation System (<http://support.automation.siemens.com/WW/view/en/59191792>).

Assignment of MAC addresses

The CPU 1511-1 PN has a PROFINET interface with two ports. The PROFINET interface itself has a MAC address, and each of the two PROFINET ports has its own MAC address. There are therefore three MAC addresses in total for the CPU 1511-1 PN.

The MAC addresses of the PROFINET ports are needed for the LLDP protocol, for example for the proximity detection function.

The number range of the MAC addresses is sequential. The first and last MAC address is lasered on the right of each CPU 1511-1 PN.

The table below sets out the MAC address assignment.

Table 3-3 Assignment of MAC addresses

	Assignment	Labeling
MAC address 1	PROFINET interface X1 (visible in STEP 7 for accessible devices)	- Front, lasered - Right-hand side, lasered (start of number range)
MAC address 2	X1 P1 port (needed for LLDP, for example)	Front and right-hand side, not lasered
MAC address 3	X1 P2 port (needed for LLDP, for example)	- Front, not lasered - Right-hand side, lasered (end of number range)

Block diagram

Below is the block diagram of CPU 1511-1 PN.

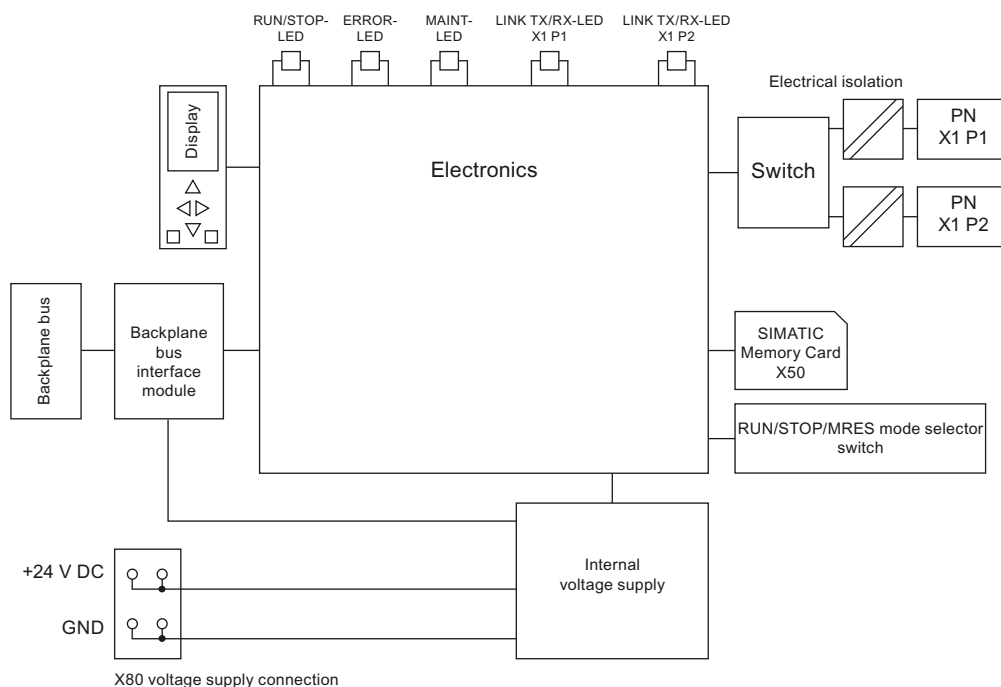


Figure 3-1 Block diagram CPU 1511-1 PN

Interrupts, diagnostics, error, and system messages

The status and error displays of the CPU 1511-1 PN are described below.

You will find additional information on "Interrupts" in the STEP 7 online help.

You will find additional information on "Diagnostics" and "System messages" in the System diagnostics (<http://support.automation.siemens.com/WW/view/en/59192926>) function manual.

4.1 Status and error display of the CPU

LED display

The figure below shows the CPU 1511-1 PN LEDs.

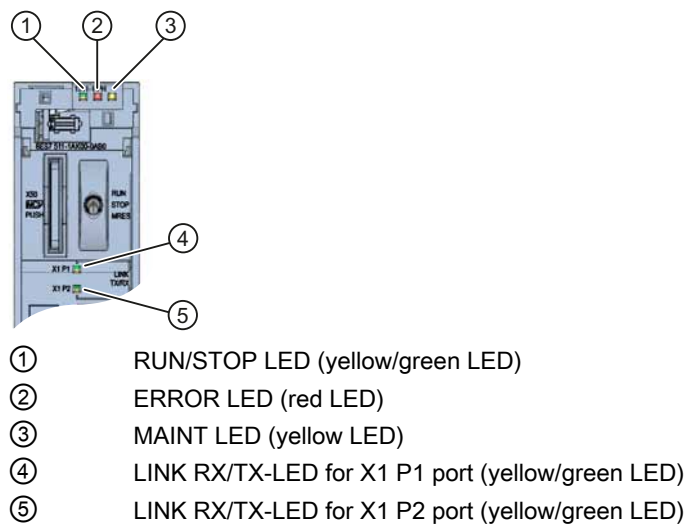


Figure 4-1 CPU 1511-1 PN LEDs (without front panel)

4.1 Status and error display of the CPU

Meaning of the RUN/STOP, ERROR and MAINT LED

CPU 1511-1 PN has three LEDs to signal the current operating status and diagnostic status. The following table shows the meaning of the various combinations of colors for the RUN/STOP, ERROR and MAINT LEDs.

Table 4- 1 Meaning of the LEDs

RUN/STOP LED	ERROR LED	MAINT LED	Meaning
 LED off	 LED off	 LED off	Missing or insufficient power supply on the CPU.
 LED off	 LED flashes red	 LED off	An error has occurred.
 LED green	 LED off	 LED off	CPU is in RUN mode.
 LED green	 LED flashes red	 LED off	A diagnostic event is pending.
 LED green	 LED off	 LED yellow	Maintenance demanded for the plant. The affected hardware must be replaced within a short period of time.
 LED green	 LED off	 LED flashes yellow	Maintenance required for the plant. The affected hardware must be replaced within a reasonable time period.
			Firmware update successfully completed.
 LED yellow	 LED off	 LED off	CPU is in STOP mode.
 LED yellow	 LED flashes red	 LED flashes yellow	The program on the SIMATIC memory card is causing an error.
			CPU defective
 LED flashes yellow	 LED off	 LED off	CPU is performing internal activities during STOP, e.g. ramp-up after STOP.
			Loading the user program
 LED flashes yellow/green	 LED off	 LED off	Startup (transition from RUN → STOP)
 LED flashes yellow/green	 LED flashes red	 LED flashes yellow	Startup (CPU booting)
			Test of LEDs during startup, inserting a module.
			LED flashing test

Meaning of LINK RX/TX-LED

Each port has a LINK RX/TX-LED. The table below shows the various "LED scenarios" of ports for the CPU 1511-1 PN.

Table 4- 2 Meaning of the LED

LINK TX/RX-LED	Meaning
 LED off	There is no Ethernet connection between the PROFINET interface of the PROFINET device and the communication partner. No data is currently being sent/received via the PROFINET interface. There is no LINK connection.
 LED flashes green	The "LED flashing test" is performed.
 LED green	There is no Ethernet connection between the PROFINET interface of your PROFINET device and a communication partner.
 LED flickers yellow	Data is currently being received from a communication partner on Ethernet via the PROFINET interface of the PROFINET device.

4.1 Status and error display of the CPU

Technical specifications

	6ES7511-1AK00-0AB0
Product type designation	CPU 1511-1 PN
General information	
Hardware version	E01
Firmware version	V1.0.0
Engineering with STEP 7 TIA Portal can be configured/integrated as of version	V12.0
Display	
• Screen diagonal (cm)	3.45 cm
Control and display elements	
• Number of buttons	6
• Mode selector switch	1
Installation type/mounting	
• Rail mounting possible	Yes
• Wall/direct mounting possible	No
Supply voltage	
Type of supply voltage	24 V DC
• Low limit of permitted range (DC)	19.2 V
• High limit of permitted range (DC)	28.8 V
• Reverse polarity protection	Yes
Input current	
• Current consumption (rated value)	0.7 A
• Inrush current, max.	1.9 A; rated value
• I^2t	0.34 A ² s
Power	
• Power consumption from the backplane bus (balanced)	5.5 W
• Incoming power to the backplane bus	10 W
Power loss	
• Power loss, typ.	5.7 W

	6ES7511-1AK00-0AB0
Memory	
Work memory	
• Integrated (for program)	150 KB
• Integrated (for data)	1 MB
Load memory	
• Plug-in (SIMATIC memory card), max.	2 GB
Buffering	
• Maintenance-free	Yes
CPU processing time	
• For bit operations, typ.	60 ns
• For word operations, typ.	72 ns
• For fixed-point arithmetic, typ.	96 ns
• For floating-point arithmetic, typ.	384 ns
CPU blocks	
• Number of blocks (total)	2000
DB	
• Number, max.	2000; number range: 1 to 65535
• Size, max.	1 MB
FB	
• Number, max.	1998; number range: 1 to 65535
• Size, max.	150 KB
FC	
• Number, max.	1999; number range: 1 to 65535
• Size, max.	150 KB
OB	
• Size, max.	150 KB
• Number of free-cycle OBs	100
• Number of time-of-day interrupt OBs	20
• Number of time-delay interrupt OBs	20
• Number of cyclic interrupt OBs	20
• Number of hardware interrupt OBs	50
• Number of DPV1 interrupt OBs	3
• Number of isochronous mode OBs	1
• Number of technology synchronization interrupt OBs	2
• Number of restart OBs	100

	6ES7511-1AK00-0AB0
- Number of asynchronous error OBs - Number of synchronous error OBs - Number of diagnostic interrupt OBs	4 2 1
Nesting depth	
Per priority class	24
Timers/counters and their retentivity	
S7 counters	
Quantity	2048
Retentivity	
Adjustable	Yes
IEC counters	
Quantity	Unlimited (limited only by work memory)
Retentivity	
Adjustable	Yes
S7 timers	
Quantity	2048
Retentivity	
Adjustable	Yes
IEC timers	
Quantity	Unlimited (limited only by work memory)
Retentivity	
Adjustable	Yes
Data areas and their retentivity	
Total retentive data area (including timers, counters, bit memories), max.	128 KB; for bit memories, timers, counters, DBs and technological data (axes), usable retentive memory: 88 KB
Bit memory	
- Number, max. - Number of clock memories	16 KB 8; 8 clock memory bits, summarized in one clock memory byte
Data blocks	
Retentivity adjustable	Yes
Retentivity preset	No
Local data	
Per priority class, max.	64 KB max. 16 KB per block
Address area	
Number of I/O modules	1024

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I/O address area	
• Inputs	32 KB; all inputs are in the process image
• Outputs	32 KB; all outputs are in the process image
Of which per IO subsystem	
• Inputs (volume)	8 KB
• Outputs (volume)	8 KB
Of which per CM/CP	
• Inputs (volume)	8 KB
• Outputs (volume)	8 KB
Process image partitions	
• Number of process image partitions, max.	32
Address space per module	
• Number of I/O submodules	5
Hardware configuration	
• Modules per rack, max.	32; CPU + 31 modules
• Rack, number of rows, max.	1
Number of DP masters	
• Via CM	4; a maximum of 4 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total
Number of IO controllers	
• Integrated	1
PtP CM	
• Number of PtP CMs	The number of PtP CMs you can connect is only limited by the available slots
Time	
Clock	
Type	Hardware clock
• Deviation per day, max.	10 s; typ.: 2 s
• Buffered period	6 wk; at 40 °C ambient temperature, typ.
Time synchronization	
• Supported	Yes
• in AS, Master	Yes
• in AS, Slave	Yes
• On Ethernet via NTP	Yes

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Interfaces	
• Number of PROFINET interfaces	1
1. Interface	
Interface hardware	
• Number of ports	2
• Integrated switch	Yes
• RJ 45 (Ethernet)	Yes
Protocols	
• PROFINET IO controller	Yes
• PROFINET IO device	Yes
• SIMATIC communication	Yes
• Open IE communication	Yes
• Web server	Yes
• Media redundancy	Yes
Interface hardware	
RJ 45 (Ethernet)	
• 100 Mbps	Yes
• Autonegotiation	Yes
• Autocrossing	Yes
• Industrial Ethernet status LED	Yes
Number of connections	
• Number of connections, max.	96
• Number of connections reserved for ES/HMI/Web	10
• Number of connections via integrated interfaces	64
Protocols	
PROFINET IO controller	
Services	
• PG/OP communication	Yes
• S7 routing	Yes
• Isochronous mode	Yes
• Open IE communication	Yes
• IRT	Yes
• MRP	Yes; as MRP redundancy manager and/or MRP client; max. number of devices in the ring: 50

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• PROFIenergy • Prioritized startup • Number of connectable IO devices, max. • Number of IO devices that you can connect for RT, max. • Of which are in line, max. • Number of IO devices with IRT and the "high performance" option, max. • Number of IO devices that can be activated/deactivated simultaneously, max. • Number of IO devices per tool, max.	Yes Yes; max. 32 PN devices 128; a maximum of 256 distributed I/O devices can be connected by means of CPs/CMs via PROFIBUS or PROFINET. 128 128 64 8 8
Update times	The minimum value of the update time also depends on the communication component set for PROFINET IO, on the number of IO devices, and on the quantity of configured user data.
with RT	
• for send cycle of 250 µs • for send cycle of 500 µs • for send cycle of 1 ms • for send cycle of 2 ms • for send cycle of 4 ms	250 µs to 128 ms 500 µs to 256 ms 1 ms to 512 ms 2 ms to 512 ms 4 ms to 512 ms
with IRT and "high performance" option	
• for send cycle of 250 µs • for send cycle of 500 µs • for send cycle of 1 ms • for send cycle of 2 ms • for send cycle of 4 ms	250 µs to 4 ms 500 µs to 8 ms 1 ms to 16 ms 2 ms to 32 ms 4 ms to 64 ms
For IRT with the "high performance" option and parameter assignment for so-called "odd-numbered" send cycles	Update time = set "odd-numbered" send cycle (any multiple of 125 µs: 375 µs, 625 µs to 3.875 µs)
PROFINET IO device	
Services	
• PG/OP communication • S7 routing • Isochronous mode • Open IE communication • IRT, supported	Yes Yes Yes Yes Yes

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MRP, supported	Yes
PROFInergy	Yes
SIMATIC communication	
S7 communication as server	Yes
S7 communication as client	Yes
User data per job, max.	See online help (S7 communication, user data size)
Open IE communication	
TCP/IP	Yes
Data length, max.	64 KB
ISO-on-TCP (RFC1006)	Yes
Data length, max.	64 KB
UDP	Yes
Data length, max.	1472 bytes
DHCP	No
SNMP	Yes
DCP	Yes
LLDP	Yes
Web server	
HTTP	Yes; standard and user-defined pages
HTTPS	Yes; standard and user-defined pages
Media redundancy	
Changeover time on line interruption, typ.	200 ms
Number of ring nodes, max.	50
Slots	
SIMATIC Memory Card required	Yes
Isochronous mode	
Isochronous mode (application synchronized up to terminal)	Yes
Constant bus cycle time	Yes
S7 signaling functions	
Number of stations that can be logged in for message functions, max.	32
Block-related alarms	Yes
Number of configurable interrupts, max.	5000
Number of simultaneously active interrupts	500

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Test/commissioning functions	
Status/modify	Yes
Status/modify tag	Inputs, outputs, memory bits, DBs, timers, counters
Tags	200; per job
- Of which are status tags, max. - Of which are modify tags, max.	200; per job
Force	Inputs, outputs
Forcing, tags	200
- Number of tags, max. - Status block - Single-step	Yes; up to 8 at the same time No
Diagnostic buffer	Yes
- Available - No. of entries, max. - Of which are power failure-proof	1000 250
Interrupts/diagnostics/status information	
Diagnostic indicator LED	Yes
- RUN/STOP LED - ERROR LED - MAINT LED - Connection display LINK TX/RX	Yes Yes Yes Yes
Supported technology objects	
- Motion - Speed-controlled axis - Number of speed-controlled axes, max. - Positioning axis - Number of positioning axes, max. - External encoder - Number of external encoders, max. - Controller - PID_Compact	Yes 6; a total of up to 6 axes (speed-controlled axis, positioning axis, external encoders) are supported 6; a total of up to 6 axes (speed-controlled axis, positioning axis, external encoders) are supported 6; a total of up to 6 axes (speed-controlled axis, positioning axis, external encoders) are supported Yes; universal PID controller with integrated optimization

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• PID_3Step • Counting and measuring • High-speed counter	Yes; PID controller with integrated optimization for valves Yes
Ambient conditions	
Operating temperature	
• Horizontal installation, min. • Horizontal installation, max. • Vertical installation, min. • Vertical installation, max.	0 °C 60 °C; display: 50 °C, the display is switched off at an operating temperature of typically 50 °C 0 °C 40 °C; display: 40 °C, the display is switched off at an operating temperature of typically 40 °C
Configuring	
Programming	
Programming language	
• LAD • FBD • STL • SCL	Yes Yes Yes Yes
Know-how protection	
• User program protection • Copy protection • Block protection	Yes Yes Yes
Access protection	
• Password for display • Protection level: Read-only • Protection level: Read/write protection • Protection level: Complete protection	Yes Yes Yes Yes
Cycle-time monitoring	
• Low limit • High limit	Adjustable minimum cycle time Adjustable maximum cycle time
Dimensions	
• Width • Height • Depth	35 mm 147 mm 129 mm
Weights	
• Weight, approx.	430 g

Dimensional drawing

This section includes a dimensional drawing of the module on a mounting rail and a dimensional drawing with the front panel open. Always observe the specified dimensions for installation in cabinets, control rooms, etc.

Dimensional drawings for CPU 1511-1 PN

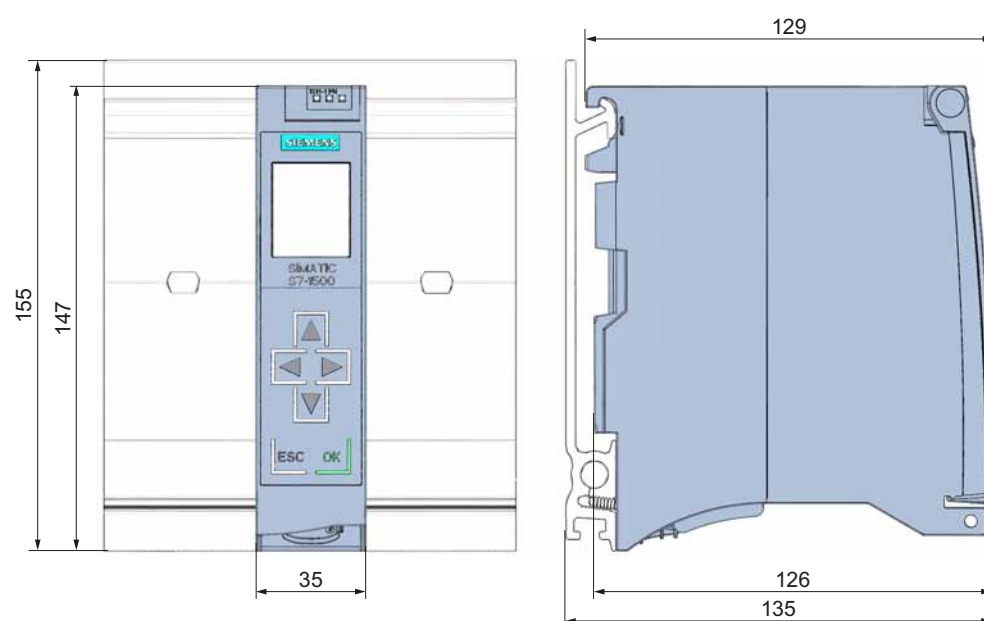


Figure A-1 Dimensional drawing of CPU 1511-1 PN, front and side views

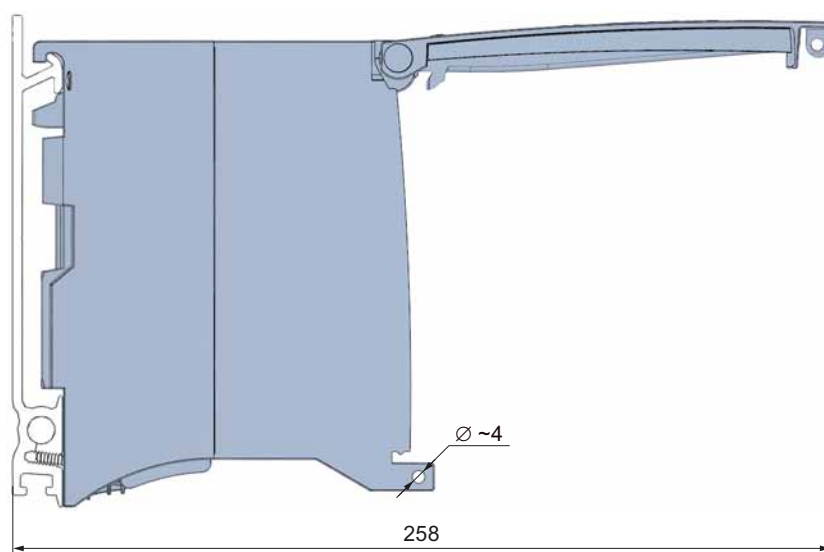


Figure A-2 Dimensional drawing of CPU 1511-1 PN, side view with front panel open