

SIEMENS



Manual

SIMATIC

S7-1500

CPU 1516T-3 PN/DP (6ES7516-3TN00-0AB0)

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SIMATIC

S7-1500 CPU 1516T-3 PN/DP (6ES7516-3TN00-0AB0)

Equipment Manual

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Warning notice system

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. |
| NOTICE |
| 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.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

| |
|--|
|  WARNING |
| Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed. |

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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 manual supplements the system manual of the S7-1500 automation system/ET 200MP distributed I/O system as well as the function manuals. This manual contains a description of the module-specific information. The system-related functions are described in the system manual. All system-spanning functions are described in the function manuals.

The information provided in this manual and the system manual enables you to commission the CPU 1516T-3 PN/DP.

Conventions

STEP 7: In this documentation, "STEP 7" is used as a synonym for all versions of the configuration and programming software "STEP 7 (TIA Portal)".

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 or on the section of the documentation to which particular attention should be paid.

Recycling and disposal

For environmentally friendly recycling and disposal of your old equipment, contact a certified electronic waste disposal company and dispose of the equipment according to the applicable regulations in your country.

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit (<https://www.siemens.com/industrialsecurity>).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customers' exposure to cyber threats.

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You can find current information on the following topics quickly and easily here:

- **Product support**

All the information and extensive know-how on your product, technical specifications, FAQs, certificates, downloads, and manuals.

- **Application examples**

Tools and examples to solve your automation tasks – as well as function blocks, performance information and videos.

- **Services**

Information about Industry Services, Field Services, Technical Support, spare parts and training offers.

- **Forums**

For answers and solutions concerning automation technology.

- **mySupport**

Your personal working area in Industry Online Support for messages, support queries, and configurable documents.

This information is provided by the Siemens Industry Online Support in the Internet (<https://support.industry.siemens.com>).

Industry Mall

The Industry Mall is the catalog and order system of Siemens AG for automation and drive solutions on the basis of Totally Integrated Automation (TIA) and Totally Integrated Power (TIP).

You can find catalogs for all automation and drive products on the Internet (<https://mall.industry.siemens.com>).

See also

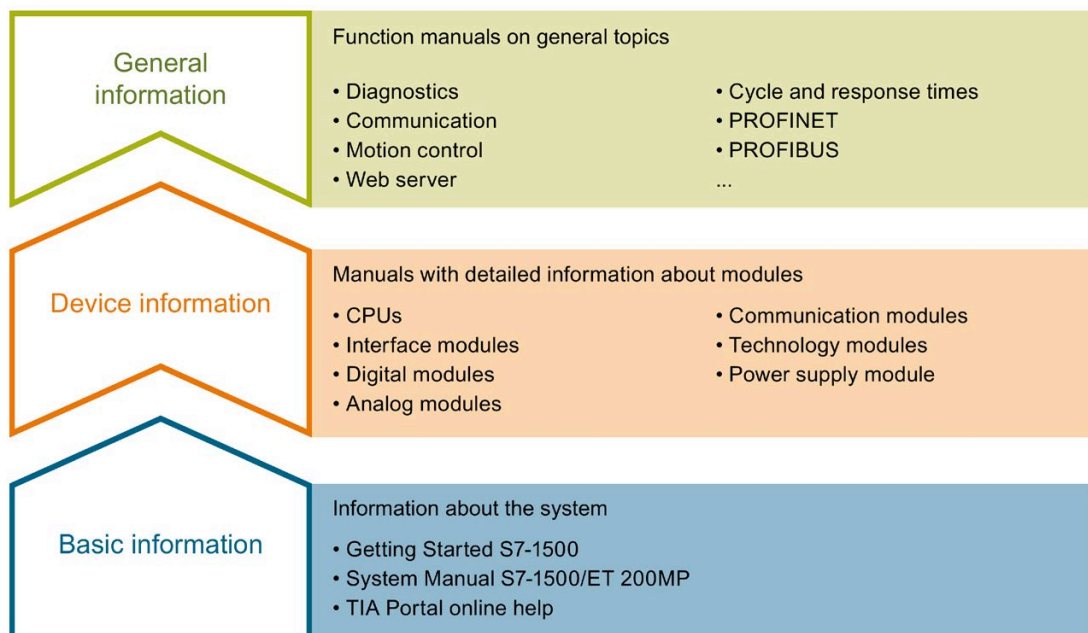
Info Center (<https://www.siemens.com/automation/infocenter>)

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Documentation guide

The documentation for the SIMATIC S7-1500 automation system and the SIMATIC ET 200MP distributed I/O system is arranged into three areas.
This arrangement enables you to access the specific content you require.



Basic information

The System Manual and Getting Started describe in detail the configuration, installation, wiring and commissioning of the SIMATIC S7-1500 and ET 200MP systems. The STEP 7 online help supports you in the configuration and programming.

Device information

Product manuals contain a compact description of the module-specific information, such as properties, wiring diagrams, characteristics and technical specifications.

General information

The function manuals contain detailed descriptions on general topics regarding the SIMATIC S7-1500 and ET 200MP systems, e.g. diagnostics, communication, motion control, Web server, OPC UA.

You can download the documentation free of charge from the Internet (<https://support.industry.siemens.com/cs/ww/en/view/109742691>).

Changes and supplements to the manuals are documented in a Product Information.

You can download the product information free of charge from the Internet (<https://support.industry.siemens.com/cs/us/en/view/68052815>).

Manual Collection S7-1500/ET 200MP

The Manual Collection contains the complete documentation on the SIMATIC S7-1500 automation system and the ET 200MP distributed I/O system gathered together in one file.

You can find the Manual Collection on the Internet
(<https://support.industry.siemens.com/cs/ww/en/view/86140384>).

SIMATIC S7-1500 comparison list for programming languages

The comparison list contains an overview of which instructions and functions you can use for which controller families.

You can find the comparison list on the Internet
(<https://support.industry.siemens.com/cs/ww/en/view/86630375>).

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With "mySupport", your personal workspace, you make the best out of your Industry Online Support.

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You must register once to use the full functionality of "mySupport".

You can find "mySupport" on the Internet (<https://support.industry.siemens.com/My/ww/en>).

Application examples

The application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus on individual products.

You will find the application examples on the Internet
(<https://support.industry.siemens.com/cs/ww/en/ps/ae>).

Product overview

2.1 New functions

This section contains an overview of the most important firmware functions of the CPU assigned to your firmware version.

New functions of the CPU in firmware version V2.9

| New functions | Applications | Customer benefits |
|--|---|--|
| Communication of the CPU | | |
| OPC UA: Alarms & Conditions | OPC UA clients from any manufacturer can subscribe to alarms of the CPU via OPC UA Alarms & Conditions. | Without further measures, alarms created once via OPC UA are available as events and alarms. The alarms can be displayed by any display device with corresponding OPC UA client functionality. |
| OPC UA: Certificate management via Global Discovery Server (GDS) | Via GDS push management functions: <ul style="list-style-type: none"> Automated update of OPC UA certificates of an S7-1500 CPU Transfer of updated certificates and lists in RUN operating state of the CPU | The automation of the certificate management eliminates any manual work required for reconfiguring the CPU, for example, after a certificate has expired, and a new download to the CPU. |
| MRP interconnection in PROFINET networks | <ul style="list-style-type: none"> The MRP interconnection procedure is an extension of MRP. MRP interconnection enables the redundant coupling of two or more rings with MRP in PROFINET networks. | There is no limit to the maximum number of 50 devices in a ring when setting up redundant network topologies. Monitoring of larger topologies with ring redundancy |
| DHCP (Dynamic Host Configuration Protocol) | The CPU can use the DHCP communication protocol to assign the network configuration via a DHCP server. The CPU uses a client ID for identification on the DHCP server. The following parameters can be obtained: <ul style="list-style-type: none"> IP Suite DNS server NTP server The CPU can also send its host name to the DHCP server. | With DHCP, you can integrate the CPU into an existing IT network without having to make additional changes to the PROFINET interface. |

2.1 New functions

| New functions | Applications | Customer benefits |
|---|---|---|
| Web server of the CPU | | |
| Web applications that can be loaded by the user | <ul style="list-style-type: none"> Additional methods to manage web applications via Web API You can use all available Web API methods within the web application | <p>Web applications are also available in STOP mode of the CPU</p> <p>Reduced development times of web server user pages</p> |
| New Web API methods | <ul style="list-style-type: none"> Reading and changing the CPU operating state via Web API Ticket methods for transferring large amounts of data outside of the JSON RPC protocol | Additional applications for the web server |
| Optimizations to the DNS (Domain Name System) functionality with OPC UA/Open User Communication and on the web server | <p>The feedback messages of the OPC UA server with the "Application Name" can be sent via DNS.</p> <p>The NTP client of the CPU can address its relevant NTP servers via DNS.</p> <p>The web server can be consistently reached via DNS addressing. DNS is taken into account during certificate handling.</p> | A pool of NTP servers can be addressed. |
| Diagnostic information on motion control | <p>Diagnostic information is available for all technology objects</p> <p>Improved display and grouping of the tags</p> | Comprehensive diagnostic options by means of motion control applications are possible via the web server. |
| Technology functions of the CPU | | |
| Axis functions | <ul style="list-style-type: none"> Backlash compensation Linear motor | <p>The repeat accuracy of a movement is increased by compensation for the mechanical play of the real axis.</p> <p>Easier control of highly dynamic linear motors.</p> |
| Synchronous operation functions (S7-1500T) | <ul style="list-style-type: none"> A cross-PLC synchronous operation between technology objects with different technology versions on CPUs with different firmware versions is possible. Desynchronization of gearing or camming at specified positions Leading value or following value shift in gearing or camming Cam with 10,000 points Diagnostics of the cam | <ul style="list-style-type: none"> More flexibility in modular machines and multi-axis machines (e.g. printing machines) More synchronous operation functions By shifting leading and following values, it is possible, for example, to correct print marks synchronously to the leading value. More interpolation points allow for a more precise design of complex cams. Detailed diagnostics of cams, both configured offline and created or modified online. |
| Kinematics functions (S7-1500T) | <ul style="list-style-type: none"> Calibrating zones Dynamic adaptation in the kinematics control panel Simulation of kinematics motions | The functions expand the possibilities for realizing complex motion control applications with 2D, 3D and 4D kinematics. |

New functions of the CPU in firmware version V2.8

| New functions | Applications | Customer benefits |
|---|--|---|
| IP forwarding | IP forwarding forwards IP data through the CPU from one IP subnet to another IP subnet. During IP forwarding, the CPU automatically creates an IP route table from the IP configuration in STEP 7. | <ul style="list-style-type: none"> Simplified integration of devices for remote access, e.g. for diagnostics during remote maintenance or firmware update Simple access from the control level to the field level for configuration and parameter assignment of devices <p>Example: You can access the web server of a drive connected to the X1 interface of the CPU from a computer connected to the X2 interface of the CPU.</p> |
| Direct data exchange | In the case of direct data exchange, an S7-1500 CPU provides cyclic user data from the I/O area to one or more partners. | The "Direct data exchange" function enables deterministic, isochronous I/O communication between multiple S7-1500 CPUs. |
| API (Application Programming Interface) | <p>The CPU has a web-based API (Application Programming Interface) as an interface for reading and writing CPU data.</p> <p>The API supports all conventional browsers and command line programs, such as cURL and Wget.</p> | <ul style="list-style-type: none"> Established standard mechanisms for creating web pages: Automation Web Programming commands (AWP commands) are no longer required for output of CPU data No dependency between custom web pages and CPU program: No synchronization between user program and web server required by the SFC 99 instruction Lower communication load: A smaller data packet is transferred between server and client (JSON instead of HTML of the custom web page generated by the CPU). This improves the communication performance. The CPU needs less runtime to generate the information and make it available. Secure data traffic: API exclusively supports the "HTTPS" transfer protocol |
| Technology functions of the CPU | | |
| Axis functions | Organization block MC-PreInterpolator "MC_Stop" instruction | <p>You can call motion control instructions at the same time as the MC_Interpolator.</p> <p>You can stop an axis and prevent new jobs to the axis.</p> |

2.1 New functions

| New functions | Applications | Customer benefits |
|--|--|---|
| Cross-PLC synchronous operation (S7-1500T) | <p>Leading and following axes can be distributed over multiple controllers.</p> <p>Isochronous coupling between the leading axis and the following axis via PROFINET IO with IRT.</p> <p>Compensation of delay times for communication and different clock rates.</p> | <ul style="list-style-type: none"> • Distribution of high axis configuration limits over different CPUs • Use on modular machines and multi-axis machines (e.g. printing machines) • Highly precise synchronous operation across devices |
| Kinematics functions | <ul style="list-style-type: none"> • Scara 2D is supported as predefined kinematics • New instructions for synchronous point-to-point movements, conveyor tracking, and calculation of the forward and backward transformation • Proactive motion preparation | The functions expand the possibilities for realizing complex motion control applications with 2D, 3D and 4D kinematics. |
| Project trace | <p>Coordination of traces on different devices</p> <ul style="list-style-type: none"> • Support of multiple CPUs • Support of different device types <p>Visualization in a shared chart</p> <p>Support of alternative trigger sources</p> | <ul style="list-style-type: none"> • Extensive trigger options for faster localization of sporadically occurring errors • Simple combination of related traces |

New functions of the CPU in firmware version V2.6

| New functions | Applications | Customer benefits |
|----------------------------------|--|--|
| OPC UA client | <p>In addition to the OPC UA server, an OPC UA client is integrated in the CPU.</p> <p>Using the corresponding OPC UA communication instructions, you can:</p> <ul style="list-style-type: none"> • Call methods • Read and write data | You can perform, for example, vertical communication to MES systems/cloud services or IO controller-IO controller communication. |
| Isochronous mode for central I/O | <p>Isochronous mode is also possible for modules that are inserted next to the CPU in a centralized configuration.</p> <p>In this way, you can implement the following functions, for example:</p> <ul style="list-style-type: none"> • Dynamic control tasks • Measuring input • Output cam • Dosing processes, high-speed analog value acquisition with oversampling | <ul style="list-style-type: none"> • Optimized controls through constant, calculable dead times • Determinism, reliable reproducibility of response times • Consistent (simultaneous) reading in of input data • Consistent (simultaneous) output of output data |

New functions of the CPU in firmware version V2.5

| New functions | Applications | Customer benefits |
|--|---|---|
| New technology object, kinematics | Controlling of kinematics, such as <ul style="list-style-type: none"> • Cartesian portals • Roller pickers • Delta pickers • SCARA Motion specification of paths Individual motions and motion sequences Kinematics 2D, 3D, with and without orientation axis | You can realize complex Motion Control applications for controlling 2D, 3D and 4D kinematics. |
| Additional instructions for torque control | You can apply an additives setpoint torque in the drive. You can predetermine torque limits in the drive cyclically. The torque actual value of the drive can be evaluated directly in the TO-DB of the axis. | You can pre-control the torque precisely for the axes, for example at winders (predetermine traction torque and additionally torque limits in order to prevent tearing of the material). You can take the dynamic model of the kinematics into consideration, pre-control the torque to be expected for each axis and thus improve the precision. |
| Data adaption for SINAMICS S210 | You can also use data adaption for the new drive SINAMICS S210. | You gain time during the configuration of the technology objects and the drives. |
| MotionIn | Through additional instructions motion setpoints can be specified cyclically via the application. | This means that specific technological motion specifications are possible via the application (for example at winders). |
| Testing with breakpoints | Testing SCL and STL program code with the help of breakpoints. When testing with breakpoints, you execute a program from one breakpoint to another. | <ul style="list-style-type: none"> • Localization of logic errors step by step • Simple and quick analysis of complex programs prior to actual commissioning • Recording of current values within individual executed loops • Use of breakpoints for program validation also possible in SCL/STL networks within LAD/FBD blocks |
| Arithmetic functions for trace | In the case of completed measurements, you can combine the measured signals mathematically with each other and thus generate signals that were not recorded. | <ul style="list-style-type: none"> • Generation of unavailable information • Post-processing of measurements • Measurement of signal paths (e.g. mean value) |

| New functions | Applications | Customer benefits |
|-------------------------------------|--|--|
| Importing and exporting ASCII files | <p>Using the FileReadC function, you can read out a binary file (ASCII file) in the user program which was stored on the SIMATIC memory card of the CPU via the web server.</p> <p>Using the FileWriteC function, you can store a binary file (ASCII file) on the memory card of the CPU using the user program; this file can be read via the web server.</p> | <p>Complex file structures are used in free ASCII format on the SIMATIC memory card, e.g. to:</p> <ul style="list-style-type: none">• Read in recipes for which CSV is not flexible enough• Read in complex parameter assignments or configuration files• Output complex files for documentation |
| Sending encrypted emails | It is possible to send encrypted emails via the integrated interfaces of the CPU | High security through encrypted transmission of data |

Reference

You can find an overview of all new functions, improvements and revisions in the respective firmware versions on the Internet

(<https://support.industry.siemens.com/cs/ww/en/view/109478459>).

2.2 Applications of the S7-1500 CPU

Area of application

SIMATIC S7-1500 is the modular control system for a wide variety of automation applications in discrete automation.

The modular and fanless design, simple implementation of distributed structures, and user-friendly operation make SIMATIC S7-1500 the economic and convenient solution for a variety of tasks.

Areas of application of the SIMATIC S7-1500 are, for example:

- Special-purpose machines
- Textile machinery
- Packaging machines
- General mechanical engineering
- Controller engineering
- Machine tool engineering
- Installation engineering
- Electrical industry and crafts
- Automobile engineering
- Water/waste water
- Food & Beverage

Additional areas of application of the SIMATIC S7-1500T with extended Motion Control functions are, for example:

- Packaging machines
- Converting application
- Assembly automation

Several CPUs with various levels of performance and a comprehensive range of modules with many convenient features are available. Fail-safe CPUs enable use in fail-safe applications. The modular design allows you to use only the modules that you need for your application. The controller can be retrofitted with additional modules at any time to expand its range of tasks.

High industrial capability from the high resistance to EMC, shock and vibration enable universal use of the SIMATIC S7-1500.

Performance segments of standard CPUs

The CPUs can be used for smaller and mid-range applications, as well as for the high-end range of machine and plant automation.

Table 2- 1 Standard CPUs

| CPU | Performance segment | PROFIBUS interfaces | PROFINET IO RT/IRT interfaces | PROFINET IO RT interface | PROFINET basic functionality | Work memory | Processing time for bit operations |
|----------------------|--|---------------------|-------------------------------|--------------------------|------------------------------|-------------|------------------------------------|
| CPU 1511-1 PN | Standard CPU for small to mid-range applications | -- | 1 | -- | -- | 1.15 MB | 60 ns |
| CPU 1513-1 PN | Standard CPU for mid-range applications | -- | 1 | -- | -- | 1.8 MB | 40 ns |
| CPU 1515-2 PN | Standard CPU for mid-range to large applications | -- | 1 | 1 | -- | 3.5 MB | 30 ns |
| CPU 1516-3 PN/DP | Standard CPU for high-end applications and communication tasks | 1 | 1 | 1 | -- | 6 MB | 10 ns |
| CPU 1517-3 PN/DP | Standard CPU for high-end applications and communication tasks | 1 | 1 | 1 | -- | 10 MB | 2 ns |
| CPU 1518-4 PN/DP | Standard CPU for high-performance applications, demanding communication tasks and very short reaction times | 1 | 1 | 1 | 1 | 24 MB | 1 ns |
| CPU 1518-4 PN/DP MFP | Standard CPU for high-performance applications, demanding communication tasks, very short reaction times and C/C++ blocks for the user program | 1 | 1 | 1 | 1 | 74* MB | 1 ns |

Performance segments of compact CPUs

The compact CPUs can be used for smaller to mid-range applications and have an integrated analog and digital on-board I/O as well as integrated technology functions.

Table 2- 2 Compact CPUs

| CPU | Performance segment | PROFIBUS interfaces | PROFINET IO RT/IRT interfaces | PROFINET IO RT interface | PROFINET basic functionality | Work memory | Processing time for bit operations |
|----------------|---|---------------------|-------------------------------|--------------------------|------------------------------|-------------|------------------------------------|
| CPU 1511C-1 PN | Compact CPU for small to mid-range applications | -- | 1 | -- | -- | 1.175 MB | 60 ns |
| CPU 1512C-1 PN | Compact CPU for mid-range applications | -- | 1 | -- | -- | 1.25 MB | 48 ns |

The following table shows the specific properties of the Compact CPUs.

| | CPU 1511C-1 PN | CPU 1512C-1 PN |
|-------------------------------------|------------------------|------------------------|
| Integrated analog inputs/outputs | 5 inputs/2 outputs | 5 inputs/2 outputs |
| Integrated digital inputs/outputs | 16 inputs/16 outputs | 32 inputs/32 outputs |
| High-speed counters | 6 | 6 |
| Frequency meters | 6 (max. 100 kHz) | 6 (max. 100 kHz) |
| Period duration measurement | 6 channels | 6 channels |
| Pulse width modulation (PWM output) | Max. 4 (up to 100 kHz) | Max. 4 (up to 100 kHz) |
| Pulse Train Output (PTO output) | Max. 4 (up to 100 kHz) | Max. 4 (up to 100 kHz) |
| Frequency output | Up to 100 kHz | Up to 100 kHz |

Performance segments of technology CPUs

The technology CPUs can be used for low and mid-range applications, as well as for the high-end range of machine and plant automation. Because of their extended motion control functions, they are primarily used for drive control.

Table 2- 3 Technology CPUs

| CPU | Performance segment | PROFIBUS interfaces | PROFINET IO RT/IRT interfaces | PROFINET IO RT interface | PROFINET basic functionality | Work memory | Processing time for bit operations |
|--|--|---------------------|-------------------------------|--------------------------|------------------------------|-------------|------------------------------------|
| CPU 1511T-1 PN | Technology CPU for small to mid-range motion control applications | -- | 1 | -- | -- | 1.225 MB | 60 ns |
| CPU 1515T-2 PN | Technology CPU for mid-range to large motion control applications | -- | 1 | 1 | -- | 3.75 MB | 30 ns |
| CPU 1516T-3 PN/DP | Technology CPU for high-end motion control applications and communication tasks | 1 | 1 | 1 | -- | 6.5 MB | 10 ns |
| CPU 1517T-3 PN/DP | Technology CPU for high-end motion control applications and communication tasks | 1 | 1 | 1 | -- | 11 MB | 2 ns |
| CPU 1518T-4 PN/DP | Technology CPU for high-performance motion control applications with large quantities, demanding communication tasks and very short reaction times | 1 | 1 | 1 | 1 | 60 MB | 1 ns |
| CPU 1511TF-1 PN CPU 1515TF-2 PN CPU 1516TF-3 PN/DP CPU 1517TF-3 PN/DP CPU 1518TF-4 PN/DP | These CPUs are described in the fail-safe CPUs. | | | | | | |

Performance segments of fail-safe CPUs

The fail-safe CPUs are intended for users who want to implement demanding standard and fail-safe applications both centrally and decentrally.

These fail-safe CPUs allow the processing of standard and safety programs on a single CPU. This allows fail-safe data to be evaluated in the standard user program. The integration thereby provides the system advantages and the extensive functionality of SIMATIC for fail-safe applications.

The fail-safe CPUs are certified for use in safety mode up to:

- Safety class (Safety Integrity Level) SIL 3 according to IEC 61508:2010
- Performance Level (PL) e and Category 4 according to ISO 13849-1:2006 or according to EN ISO 13849-1:2008

Additional password protection for F-configuration and F-program is set up for IT security.

Table 2- 4 Fail-safe CPUs

| CPU | Performance segment | PROFIBUS interfaces | PROFINET IO RT/IRT interfaces | PROFINET IO RT interface | PROFINET basic functionality | Work memory | Processing time for bit operations |
|--------------------|---|---------------------|-------------------------------|--------------------------|------------------------------|-------------|------------------------------------|
| CPU 1511F-1 PN | Fail-safe CPU for small to mid-range applications | -- | 1 | -- | -- | 1.225 MB | 60 ns |
| CPU 1511TF-1 PN | Fail-safe technology CPU for small to mid-range applications | -- | 1 | -- | -- | 1.225 MB | 60 ns |
| CPU 1513F-1 PN | Fail-safe CPU for mid-range applications | -- | 1 | -- | -- | 1.95 MB | 40 ns |
| CPU 1515F-2 PN | Fail-safe CPU for mid-range to large applications | -- | 1 | 1 | -- | 3.75 MB | 30 ns |
| CPU 1515TF-2 PN | Fail-safe technology CPU for demanding applications and communication tasks | -- | 1 | 1 | -- | 3.75 MB | 30 ns |
| CPU 1516F-3 PN/DP | Fail-safe CPU for demanding applications and communication tasks | 1 | 1 | 1 | -- | 6.5 MB | 10 ns |
| CPU 1516TF-3 PN/DP | Fail-safe technology CPU for demanding applications and communication tasks | 1 | 1 | 1 | -- | 6.5 MB | 10 ns |
| CPU 1517F-3 PN/DP | Fail-safe CPU for demanding applications and communication tasks | 1 | 1 | 1 | -- | 11 MB | 2 ns |
| CPU 1517TF-3 PN/DP | Fail-safe technology CPU for demanding applications and communication tasks | 1 | 1 | 1 | -- | 11 MB | 2 ns |

2.2 Applications of the S7-1500 CPU

| CPU | Performance segment | PROFIBUS interfaces | PROFINET IO RT/IRT interfaces | PROFINET IO RT interface | PROFINET basic functionality | Work memory | Processing time for bit operations |
|-----------------------|--|---------------------|-------------------------------|--------------------------|------------------------------|-------------|------------------------------------|
| CPU 1518F-4 PN/DP | Fail-safe CPU for high-performance applications, demanding communication tasks and very short reaction times | 1 | 1 | 1 | 1 | 26 MB | 1 ns |
| CPU 1518F-4 PN/DP MFP | Fail-safe CPU for high-performance applications, demanding communication tasks, very short reaction times and C/C++ blocks for the user program | 1 | 1 | 1 | 1 | 76* MB | 1 ns |
| CPU 1518TF-4 PN/DP | Technology CPU for high-performance motion control applications with large quantities, demanding communication tasks and very short reaction times | 1 | 1 | 1 | 1 | 60 MB | 1 ns |

* 50 MB of the integrated work memory is reserved for the function library of CPU runtime

In addition to the CPUs, further components such as SINAMICS drives dispose of integrated safety functions. Additional information about integrated safety functions in drives can be found in the manuals for the respective products.

Design and handling

All CPUs of the SIMATIC S7-1500 product series feature a display with plain text information. The display provides the user with information on the order numbers, firmware version, and serial number of all connected modules. In addition, the IP address of the CPU and other network settings can be adapted locally without a programming device. Error messages are immediately shown on the display in plain text. In the case of servicing, plant downtimes are minimized by quick access to diagnostics alarms. Detailed information about this and a multitude of other display functions is available in the SIMATIC S7-1500 Display Simulator (<https://support.industry.siemens.com/cs/ww/en/view/109761758>).

Uniform front connectors for all modules and integrated potential bridges for flexible formation of potential groups simplifies storage. Additional components such as circuit breakers, relays, etc., can be installed quickly and easily, since a DIN rail is implemented in the rail of the S7-1500. The CPUs of the SIMATIC S7-1500 product series can be expanded centrally and in a modular fashion with signal modules. Space-saving expansion enables flexible adaptation to each application.

The system cabling for digital signal modules enables fast and clear connection to sensors and actuators from the field (fully modular connection consisting of front connector modules, connection cables and I/O modules), as well as easy wiring inside the control cabinet (flexible connection consisting of front connectors with assembled single conductors).

System diagnostics and alarms

Integrated system diagnostics is activated by default for the CPUs. The different types of diagnostics are configured instead of programmed. System diagnostics information is shown uniformly and in plain text on the display of the CPU, in STEP 7, on the HMI and on the web server, even for alarms related to drives. This information is available in RUN mode, but also in STOP mode of the CPU. The diagnostic information is updated automatically when you configure new hardware components.

The CPU is available as a central interrupt server in up to three project languages. The HMI takes over the display in the project languages specified for the CPU. If you require message texts in additional languages, you can load these via the configured connection to your HMI. The CPU, STEP 7 and your HMI guarantee data consistency without additional engineering steps. The maintenance work is easier.

2.3 Hardware properties

Article number

6ES7516-3TN00-0AB0

View of the module

The following figure shows the CPU 1516T-3 PN/DP.



Figure 2-1 CPU 1516T-3 PN/DP

Note

Protective film

Note that a protective film is attached to the display of the CPU when shipped from the factory. Remove the protective film if necessary.

Properties

The CPU 1516T-3 PN/DP has the following properties:

| Property | Description | Additional information |
|--|--|---|
| CPU display | All CPUs of the SIMATIC S7-1500 product series feature a display with plain text information. The display provides information on order numbers, firmware version and serial numbers of all connected modules. In addition, you can set the IP address of the CPU and carry out further network settings. The display shows occurring error messages directly in plain text. In addition to the functions listed here, a multitude of other functions that are described in the SIMATIC S7-1500 Display Simulator are shown on the display. | <ul style="list-style-type: none">S7-1500, ET 200MP system manual (https://support.automation.siemens.com/WW/view/en/59191792)SIMATIC S7-1500 Display Simulator (https://support.industry.siemens.com/cs/ww/en/view/109761758) |
| Supply voltage | The 24 V DC supply voltage is supplied via a 4-pole connection plug that is located at the front of the CPU. | <ul style="list-style-type: none">Chapter Connecting up (Page 33)S7-1500, ET 200MP system manual (https://support.automation.siemens.com/WW/view/en/59191792) |
| PROFIBUS DP | | |
| PROFIBUS interface (X3) | The interface serves to connect to a PROFIBUS network. | PROFIBUS function manual (https://support.industry.siemens.com/cs/ww/en/view/59193579) |
| Operation of the CPU as DP master | In the role as a DP master, the CPU addresses the connected DP slaves. The CPU cannot assume the role of a DP slave. | |
| PROFINET IO | | |
| PROFINET interface (X1 P1 R, X1 P2 R) | The interface has two ports. In addition to basic PROFINET functionality, its also supports PROFINET IO RT (real time) and IRT (isochronous real time). | PROFINET function manual (https://support.industry.siemens.com/cs/ww/en/view/49948856) |
| PROFINET interface (X2 P1) | The interface has two ports. In addition to basic PROFINET functionality, its also supports PROFINET IO RT (real time). | |
| Operation of the CPU as <ul style="list-style-type: none">IO controllerI-device | <ul style="list-style-type: none">IO controller: As an IO controller the CPU addresses the connected IO devicesI-device: As an I-device (intelligent IO device) the CPU is assigned to a higher-level IO controller and is used in the process as an intelligent pre-processing unit of sub-processes | |

Accessories

You can find information on "Accessories/spare parts" in the S7-1500, ET 200MP system manual (<https://support.automation.siemens.com/WW/view/en/59191792>).

2.4 Firmware functions

Functions

The CPU supports the following functions:

| Function | Description | Additional information |
|---------------------------------------|--|--|
| Integrated system diagnostics | The system automatically generates the messages for the system diagnostics and outputs these messages via a programming device/PC, HMI device, the web server or the integrated display. System diagnostics information is also available when the CPU is in STOP mode. | Diagnostics function manual (https://support.automation.siemens.com/WW/view/en/59191792) |
| Integrated web server | The web server lets you access the CPU data by means of a network. Evaluations, diagnostics, and modifications are thus possible over long distances. Monitoring and evaluation is possible without STEP 7; all you need is a web browser. Make sure that you take appropriate measures (e.g. limiting network access, using firewalls) to protect the CPU from being compromised. | <ul style="list-style-type: none"> Web server function manual (https://support.automation.siemens.com/WW/view/en/59193560) Security with SIMATIC S7 controllers system manual (https://support.industry.siemens.com/cs/ww/en/view/90885010) |
| Integrated trace functionality | <p>Trace functionality supports you in troubleshooting and/or optimizing the user program.</p> <p>You record device tags and evaluate the recordings with the trace and logic analyzer function. Tags are, for example, drive parameters or system and user tags of a CPU.</p> <p>The device saves the recordings. You can read out and permanently save the recordings with the configuration system (ES), if required. The trace and logic analyzer function is therefore suitable for monitoring highly dynamic processes.</p> <p>The trace record can also be displayed through the web server.</p> <p>With the project trace, you record the variables of multiple devices within a project, for example, a controller and a drive.</p> | Using the trace and logic analyzer function function manual (https://support.automation.siemens.com/WW/view/en/64897128) |
| OPC UA | <p>With OPC UA, you can exchange data via an open and manufacturer-neutral communication protocol. The CPU can act as OPC UA server. The CPU acting as the OPC UA server can communicate with OPC UA clients.</p> <p>The OPC UA Companion Specification allows methods to be specified uniformly and independently of the manufacturer. Using these specified methods, you can easily integrate devices from various manufacturers into your plants and production processes.</p> | Communication function manual (https://support.industry.siemens.com/cs/ww/en/view/59192925) |
| Configuration control | You can use configuration control to operate different real hardware configurations with a configured maximum configuration of the hardware. This means that, in series machine manufacturing in particular, you have the option of operating/configuring different configuration variants of a machine with a single project. | S7-1500, ET 200MP system manual (https://support.automation.siemens.com/WW/view/en/59191792) |

| Function | Description | Additional information |
|--|---|--|
| PROFINET IO | | |
| RT (real time) | RT prioritizes PROFINET IO telegrams over standard telegrams. This ensures the required determinism in the automation technology. In this process the data is transferred via prioritized Ethernet telegrams. | PROFINET function manual (https://support.automation.siemens.com/WW/view/en/49948856) |
| IRT (isochronous real time) | A reserved bandwidth within the send clock is available for IRT data. The reserved bandwidth ensures that the IRT data can be transmitted in time-synchronized intervals, unaffected by other high network loading (e.g. TCP/IP communication or additional real time communication). Update times with maximum determinism can be realized through IRT. Isochronous applications are possible with IRT. | |
| Isochronous mode | The Isochronous mode system property acquires measured values and process data and processes the signals in a fixed system clock. Isochronous mode thus contributes to high control quality and hence to greater manufacturing precision. Isochronous mode reduces possible fluctuations of the process reaction times to a minimum. Time-assured processing makes higher machine cycles possible. | |
| MRP (Media Redundancy Protocol) | It is possible to establish redundant networks via the Media Redundancy Protocol. Redundant transmission links (ring topology) ensure that an alternative communication path is made available if a transmission link fails. The PROFINET devices that are part of this redundant network form an MRP domain. RT operation is possible with the use of MRP. | |
| MRPD (Media Redundancy with Planned Duplication) | The advantage of the MRP extension MRPD is that, in the event of a failure of a device or a line in the ring, all other devices continue to be supplied with IO data without interruption and with short update times. MRPD is based on IRT and MRP. To realize media redundancy with short update times, the PROFINET devices participating in the ring send their data in both directions. The devices receive this data at both ring ports so that there is no reconfiguration time. | |
| Shared device | The "Shared device" function allows you to divide the modules or submodules of an IO device up among different IO controllers. Numerous IO controllers are often used in larger or widely distributed systems. Without the "Shared device" function, each I/O module of an IO device is assigned to the same IO controller. If sensors that are physically close to each other must provide data to different IO controllers, several IO devices are required. The "Shared device" function allows the modules or submodules of an IO device to be divided up among different IO controllers, thus allowing flexible automation concepts. You can, for example, combine I/O modules that are physically close to each other in one IO device. | |
| PROFInergy | PROFInergy is a PROFINET-based data interface for switching off consumers centrally and with full coordination during pause times regardless of the manufacturer or device type. Through this, the process should only be provided with the energy that is absolutely required. The majority of the energy is saved by the process; the PROFINET device itself only contributes a few watts of savings potential. | |

| Function | Description | Additional information |
|--|---|---|
| Integrated technology | | |
| Motion Control | <p>All CPUs support the S7-1500 Motion Control functions via the technology objects speed axes, positioning axes, synchronized axes, external encoders, cams, cam tracks and measuring inputs.</p> <ul style="list-style-type: none"> • Speed-controlled axis for controlling a drive with speed specification • Positioning axis for position-controlled positioning of a drive • Synchronous axis to interconnect with a master value. The axis is synchronized to the master axis position. • External encoder for detecting the actual position of an encoder and its use as a master value for synchronous operation • Cams, cam track for position-dependent generation of switching signals • Measuring input for fast, accurate and event-dependent sensing of actual positions <p>You program the technology objects with Motion Control instructions according to PLCOpen.</p> | Motion Control topic page |
| Extended Motion Control functions | <p>The technology CPUs of the SIMATIC S7-1500 also support extended Motion Control functions with the additional technology objects cam, leading axis proxy and kinematics:</p> <ul style="list-style-type: none"> • Advanced synchronization functions <ul style="list-style-type: none"> – Synchronization with specification of the synchronous position – Actual value coupling – Leading value or following value shift in gearing or camming – Camming – Synchronization to specified positions – Cross-PLC synchronous operation • Up to 4 encoders or measuring systems as actual position for position control • Controlling of kinematics, such as <ul style="list-style-type: none"> – Cartesian portals – Roller pickers – Delta pickers – SCARA | Motion Control topic page |
| Integrated closed-loop control functionality | <ul style="list-style-type: none"> • PID Compact (continuous PID controller) • PID 3Step (step controller for integrating actuators) • PID Temp (temperature controller for heating and cooling with two separate actuators) | PID control function manual (https://support.industry.siemens.com/cs/ww/en/view/108210036) |

| Function | Description | Additional information |
|--------------------------|--|---|
| Integrated safety | | |
| Know-how protection | The know-how protection protects user blocks against unauthorized access and modifications. | S7-1500, ET 200MP system manual (https://support.automation.siemens.com/WW/view/en/59191792) |
| Copy protection | Copy protection links user blocks to the serial number of the SIMATIC memory card or to the serial number of the CPU. User programs cannot run without the corresponding SIMATIC memory card or CPU. | |
| Access protection | Extended access protection provides high-quality protection against unauthorized configuration changes. You can use authorization levels to assign separate rights to different user groups. | |
| Integrity protection | The CPUs dispose of integrity protection by default. Integrity protection identifies possible manipulations of engineering data on the SIMATIC memory card or during data transfer between TIA Portal and CPU. Integrity protection also checks the communication from a SIMATIC HMI system to the CPU for possible manipulations of engineering data. If integrity protection identifies the manipulation of engineering data, the user receives a corresponding message. | |
| Password provider | As an alternative to manual password input you can connect a password provider to STEP 7. A password provider offers the following advantages: <ul style="list-style-type: none"> • Convenient handling of passwords. STEP 7 reads the password automatically for the blocks. This saves you time. • Optimum block protection because the users do not know the password itself. | |

See also

S7-1500 Motion Control function manual

(<https://support.automation.siemens.com/WW/view/en/109749262>)

S7-1500T Motion Control function manual

(<https://support.industry.siemens.com/cs/ww/en/view/109781854>)

S7-1500T Kinematics (<https://support.industry.siemens.com/cs/ww/en/view/109766463>)

Axis functions function manual

(<https://support.industry.siemens.com/cs/ww/en/view/109766462>)

Measuring input and cam functions function manual

(<https://support.industry.siemens.com/cs/ww/en/view/109766466>)

Synchronous operation functions function manual

(<https://support.industry.siemens.com/cs/ww/en/view/109766464>)

2.5 Operating and display elements

2.5.1 Front view of the CPU with closed front panel

The figure below shows the front view of the CPU 1516T-3 PN/DP.



- ① LEDs for the current operating mode and diagnostics status of the CPU
- ② Display
- ③ Operator control buttons

Figure 2-2 View of the CPU 1516T-3 PN/DP (with front panel) – front

Note

Temperature range for display

To increase its service life, the display switches off at a temperature below the permitted operating temperature of the device. When the display cools down, it automatically switches itself on again. When the display is switched off, the LEDs continue to show the status of the CPU.

For more information on the temperatures at which the display switches itself on and off, refer to the Technical specifications (Page 41).

Removing and attaching the front panel with display

You can remove and attach the front panel with display during operation.

! WARNING

Personal injury and damage to property may occur

If you pull or plug the front panel of an S7-1500 automation system during operation, personal injury or damage to property can occur in zone 2 hazardous areas.

Before you remove or fit the front panel, always switch off the power supply to the S7-1500 automation system in hazardous area zone 2.

Locking the front panel

You can lock the front panel 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 panel.

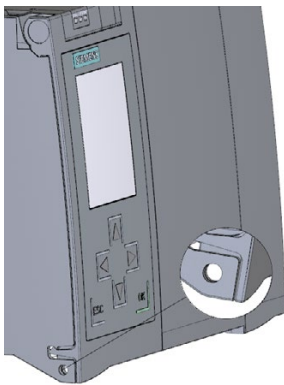


Figure 2-3 Locking latch on the CPU

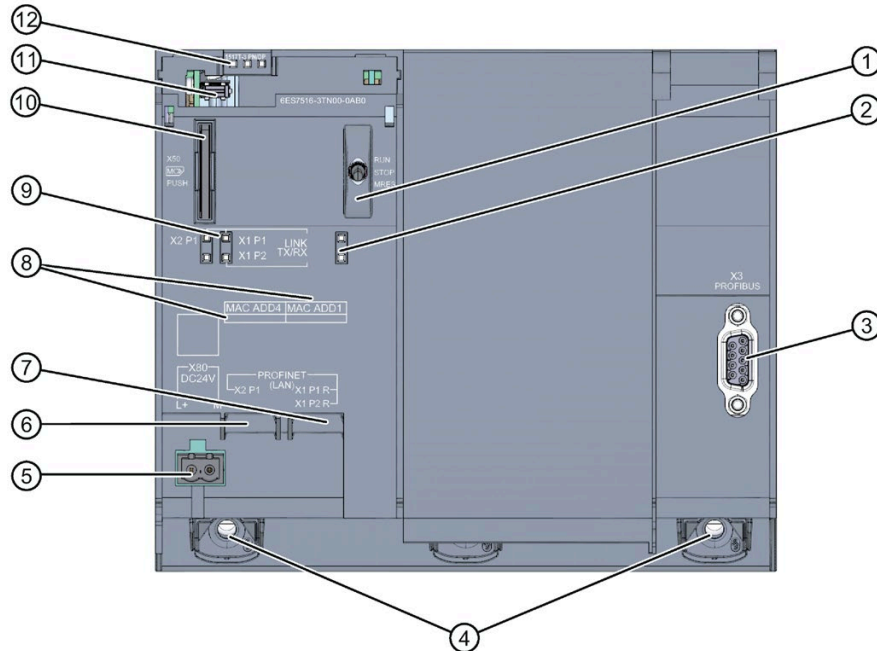
In addition to the mechanical lock, you can also block access to a password-protected CPU on the display (local lock) and assign a password for the display. You can find additional information on the display, configurable protection levels and local locks in the S7-1500/ET 200MP (<https://support.automation.siemens.com/WW/view/en/59191792>) system manual.

Reference

You can find detailed information on the individual display options, a training course and a simulation of the available menu commands in the SIMATIC S7-1500 Display Simulator (<https://support.industry.siemens.com/cs/ww/en/view/109761758>).

2.5.2 Front view of the CPU without front flap

The figure below shows the operator controls and connection elements of the CPU 1516T-3 PN/DP.

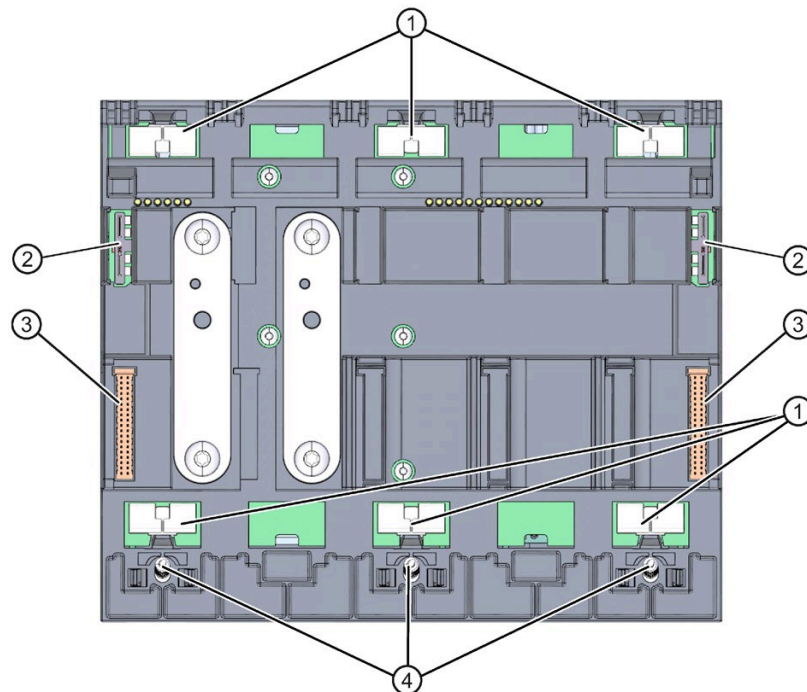


- ① Mode selector
- ② No function
- ③ PROFIBUS interface (X3)
- ④ Fixing screws
- ⑤ Connector for power supply
- ⑥ PROFINET IO interface (X2) with 1 port
- ⑦ PROFINET IO interface (X1) with 2 ports
- ⑧ MAC addresses of the interfaces
- ⑨ LEDs for the 3 ports of the PROFINET interfaces X1 and X2
- ⑩ Slot for the SIMATIC memory card
- ⑪ Display connection
- ⑫ LEDs for the current operating mode and diagnostics status of the CPU

Figure 2-4 View of the CPU 1516T-3 PN/DP (without front panel) – front

2.5.3 Rear view of the CPU

The following figure shows the connection elements on the back of the CPU 1516T-3 PN/DP.



- ① Shield contact surfaces
- ② Plug-in connection for power supply
- ③ Plug-in connection for backplane bus
- ④ Fixing screws

Figure 2-5 View of the CPU 1516T-3 PN/DP – rear

2.6 Mode selector switch

You use the mode switches to set the operating mode of the CPU.

The following table shows the meaning of the corresponding operation of the operating mode buttons.

Table 2- 5 Meaning of the mode switches

| Operation of the mode switch | Meaning | Explanation |
|------------------------------|--------------|--|
| RUN | RUN mode | The CPU is executing the user program. |
| STOP | STOP mode | The user program is not being executed. (STOP ACTIVE LED lights up). |
| MRES | Memory reset | Position for CPU memory reset. |

Connecting up

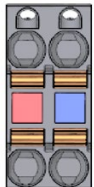
This section provides information on the pin assignment of the individual interfaces and the block diagram of the CPU 1516T-3 PN/DP.

24 V DC supply voltage (X80)

The connector for the power supply is plugged in when the CPU ships from the factory.

The following table shows the signal names and the descriptions of the pin assignment of the 24 V DC supply voltage.

Table 3- 1 Pin assignment 24 V DC supply voltage

| View | Signal name ¹⁾ | | Description |
|--|---------------------------|-----|--|
| Connector | | | |
|  | 1 | 1L+ | + 24 V DC of the supply voltage |
| | 2 | 1M | Ground of the supply voltage |
| | 3 | 2M | Ground of the supply voltage for loop-through ²⁾ |
| | 4 | 2L+ | + 24 V DC of the supply voltage for loop-through ²⁾ |

¹⁾ 1L+ and 2L+ as well as 1M and 2M are bridged internally

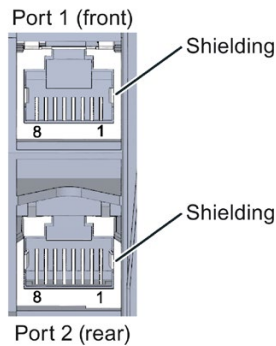
²⁾ Maximum 10 A permitted

If the CPU is supplied by a system power supply, it is not necessary to connect the 24 V supply.

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

The assignment corresponds to the Ethernet standard for an RJ45 plug.

- When autonegotiation is deactivated, the RJ45 socket is allocated as a switch (MDI-X).
- When autonegotiation is activated, autocrossing is in effect and the RJ45 socket is allocated either as data terminal equipment (MDI) or a switch (MDI-X).



PROFINET interface X2 with 1 port (X2 P1)

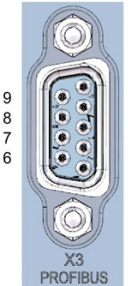
The assignment corresponds to the Ethernet standard for an RJ45 plug.

Autocrossing is always active on X2. This means the RJ45 socket is allocated either as data terminal equipment (MDI) or a switch (MDI-X).

PROFIBUS interface X3

The table below shows the pin assignment of the PROFIBUS interface. The assignment corresponds to the standard assignment of an RS485 interface.

Table 3- 2 PROFIBUS interface pin assignment

| View | Signal name | | Description |
|---|-------------|-----------|---|
|  | 1 | - | - |
| | 2 | - | - |
| | 3 | RxD/TxD-P | Data line B |
| | 4 | RTS | Request to send |
| | 5 | M5V2 | Data reference potential (from station) |
| | 6 | P5V2 | Supply plus (from station) |
| | 7 | - | - |
| | 8 | RxD/TxD-N | Data line A |
| | 9 | - | - |

Note

Supply of I/O devices

The CPU 1516T-3 PN/DP does not provide a 24 V DC power supply on the PROFIBUS interface. I/O devices (for example, PC adapter USB 6ES7972-0CB20-0XA0) are only operational on the interface in conjunction with a plug-in power supply set for external power supply.

The innovative successor product, PC adapter USB A2, receives the required power supply via the USB port. This means it does not need a 24 V DC supply voltage and can be operated **without** a plug-in power supply set for external power supply.

Reference

You can find additional information on the topics of "Connecting the CPU" and "Accessories/spare parts" in the S7-1500, ET 200MP (<https://support.automation.siemens.com/WW/view/en/59191792>) system manual.

Assignment of the MAC addresses

CPU 1516T-3 PN/DP has two PROFINET interfaces, with the first interface having two ports. The PROFINET interfaces each have a MAC address, and each of the PROFINET ports has its own MAC address. The CPU 1516T-3 PN/DP therefore has five MAC addresses in total.

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

The number range of the MAC addresses is sequential. The first and last MAC addresses are lasered on the rating plate on the right side of each CPU 1516T-3 PN/DP.

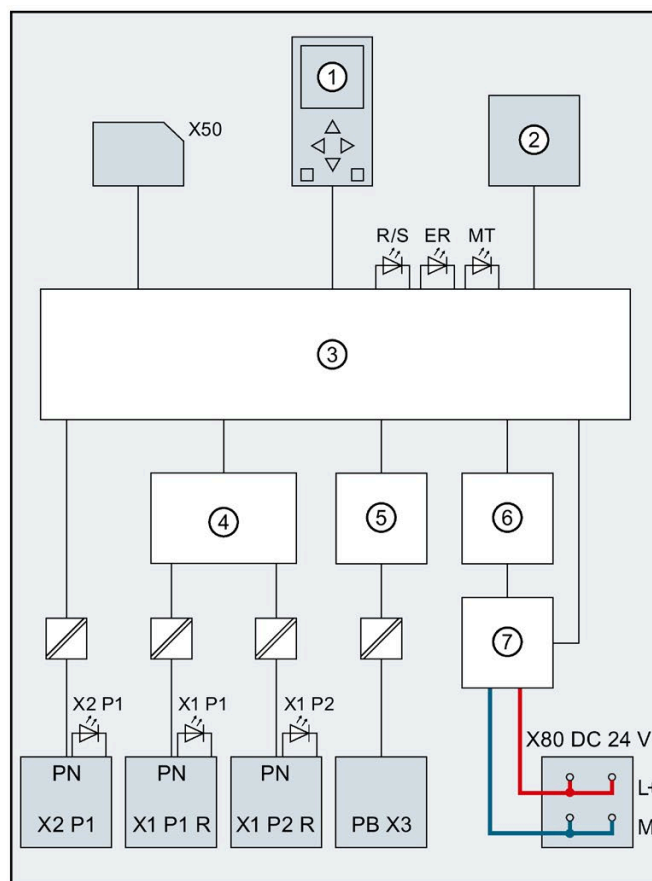
The table below shows how the MAC addresses are assigned.

Table 3- 3 Assignment of the MAC addresses

| | Assignment | Labeling |
|----------------------|---|--|
| MAC address 1 | PROFINET interface X1 (visible in STEP 7 for accessible devices) | <ul style="list-style-type: none">• Front, lasered• Right side, lasered (start of number range) |
| MAC address 2 | Port X1 P1 R (required for LLDP, for example) | <ul style="list-style-type: none">• Front and right side, not lasered |
| MAC address 3 | Port X1 P2 R (required for LLDP, for example) | <ul style="list-style-type: none">• Front and right side, not lasered |
| MAC address 4 | PROFINET interface X2 (visible in STEP 7 for accessible devices) | <ul style="list-style-type: none">• Front, lasered• Right side, not lasered |
| MAC address 5 | Port X2 P1 (required for LLDP, for example) | <ul style="list-style-type: none">• Front, not lasered• Right side, lasered (end of number range) |

Block diagram

The figure below shows the block diagram of the CPU 1516T-3 PN/DP.



| | | | |
|-------------|-----------------------------|---------------------|------------------------------|
| ① | Display | PN X1 P1 R | PROFINET interface X1 Port 1 |
| ② | RUN/STOP/MRES mode selector | PN X1 P2 R | PROFINET interface X1 Port 2 |
| ③ | Electronics | PN X2 P1 | PROFINET interface X2 Port 1 |
| ④ | PROFINET 2-port switch | PB X3 | PROFIBUS interface X3 |
| ⑤ | PROFIBUS DP driver | L+ | 24 V DC supply voltage |
| ⑥ | Backplane bus interface | M | Ground |
| ⑦ | Internal supply voltage | R/S | RUN/STOP LED (yellow/green) |
| X50 | SIMATIC memory card | ER | ERROR LED (red) |
| X80 24 V DC | Infeed of supply voltage | MT | MAINT LED (yellow) |
| | | X1 P1, X1 P2, X2 P1 | LED Link TX/RX |

Figure 3-1 Block diagram of the CPU 1516T-3 PN/DP

Interrupts, error messages, diagnostics and system alarms

4

The status and error displays of the CPU 1516T-3 PN/DP are described below.

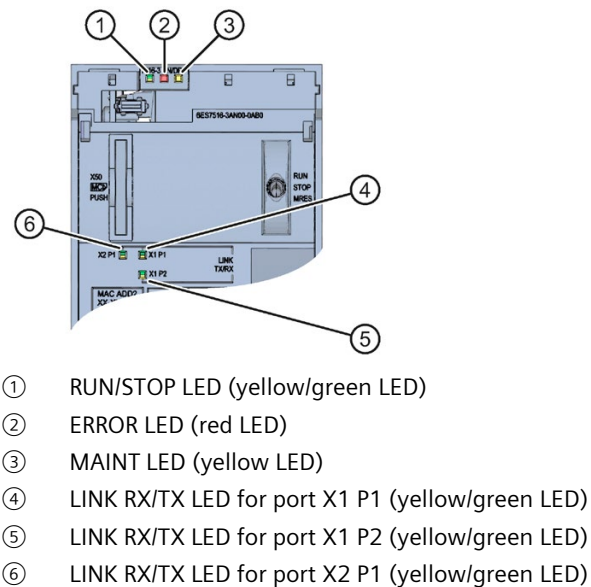
You will find additional information on "Interrupts" in the STEP 7 online help.

You can find additional information on the topics of "Diagnostics" and "System alarms" in the Diagnostics (<https://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 LED displays of the CPU 1516T-3 PN/DP.










































- ① RUN/STOP LED (yellow/green LED)
- ② ERROR LED (red LED)
- ③ MAINT LED (yellow LED)
- ④ LINK RX/TX LED for port X1 P1 (yellow/green LED)
- ⑤ LINK RX/TX LED for port X1 P2 (yellow/green LED)
- ⑥ LINK RX/TX LED for port X2 P1 (yellow/green LED)

Figure 4-1 LED display of the CPU 1516T-3 PN/DP (without front panel)

Meaning of the RUN/STOP, ERROR and MAINT LEDs

The CPU 1516T-3 PN/DP has three LEDs to signal the current operating status and diagnostics 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 lit green |  LED off |  LED off | CPU is in RUN mode. There are no events, requirements, errors, etc. |
|  LED lit green |  LED flashes red |  LED off | A diagnostics event is pending. |
|  LED lit green |  LED off |  LED lit yellow | Maintenance demanded for the plant. The affected hardware must be checked/replaced within a short period of time. |
| | | | Active Force job |
|  LED lit green |  LED off |  LED flashes yellow | Bad configuration |
|  LED lit yellow |  LED flashes red |  LED off | A diagnostics event is pending. |
|  LED lit yellow |  LED off |  LED flashes yellow | Firmware update successfully completed. |
|  LED lit yellow |  LED off |  LED off | CPU is in STOP mode. |
|  LED lit yellow |  LED flashes red |  LED flashes yellow | The program on the SIMATIC memory card is causing an error. |
| | | | Firmware update using SIMATIC memory card has failed. |
| | | | The CPU has detected an error state. Additional information is available via the CPU diagnostic buffer. |
|  LED flashes yellow |  LED off |  LED off | CPU is performing internal activities during STOP, e.g. startup after STOP. |
| | | | Download of the user program from the SIMATIC memory card |
| | | | CPU carries out a program with active breakpoint. |
|  LED flashes yellow/green |  LED off |  LED off | Startup (transition from STOP → RUN) |
|  LED flashes yellow/green |  LED flashes red |  LED flashes yellow | Startup (CPU booting) |
| | | | Test of LEDs during startup, inserting a module. |
| | | | LED flashing test |

4.1 Status and error display of the CPU

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 1516T-3 PN/DP.

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 being performed. |
|  LED lit green | There is an Ethernet connection between the PROFINET interface of your PROFINET device and a communication partner. |
|  LED flashes yellow/green | Data is currently being received from or sent to a communications partner on Ethernet via the PROFINET interface of the PROFINET device. |

Note**"LED" instruction**

You can read the status (e.g. "On" or "Off") of LEDs of a CPU or a module using the "LED" instruction. Note, however, that it is not possible to read the LED status of the LINK RX/TX LEDs on all S7-1500 CPUs.

You can find additional information on the "LED" instruction in the STEP 7 online help.

Technical specifications

The following table shows the technical specifications as of 12/2017. You can find a data sheet including daily updated technical specifications on the Internet (<https://support.industry.siemens.com/cs/ww/en/pv/6ES7516-3TN00-0AB0/td?dl=en>).

| | |
|--|---|
| Article number | 6ES7516-3TN00-0AB0 |
| General information | |
| Product type designation | CPU 1516T-3 PN/DP |
| HW functional status | FS10 |
| Firmware version | V2.9 |
| Product function | |
| • I&M data | Yes; I&M0 to I&M3 |
| • Isochronous mode | Yes; Distributed and central; with minimum OB 6x cycle of 375 µs (distributed) and 1 ms (central) |
| Engineering with | |
| • STEP 7 TIA Portal configurable/integrated from version | V17 (FW V2.9) / V15 (FW V2.5) or higher |
| Configuration control | |
| via dataset | Yes |
| Display | |
| Screen diagonal [cm] | 6.1 cm |
| Control elements | |
| Number of keys | 6 |
| Mode selector switch | 1 |
| Supply voltage | |
| Type of supply voltage | 24 V DC |
| permissible range, lower limit (DC) | 19.2 V |
| permissible range, upper limit (DC) | 28.8 V |
| Reverse polarity protection | Yes |
| Mains buffering | |
| • Mains/voltage failure stored energy time | 5 ms |
| • Repeat rate, min. | 1/s |
| Input current | |
| Current consumption (rated value) | 1.2 A |
| Current consumption, max. | 1.55 A |
| Inrush current, max. | 2.4 A; Rated value |
| I^2t | 0.02 A ² ·s |
| Power | |
| Infeed power to the backplane bus | 12 W |
| Power consumption from the backplane bus (balanced) | 30 W |
| Power loss | |
| Power loss, typ. | 24 W |

| | |
|--|---|
| Article number | 6ES7516-3TN00-0AB0 |
| Memory | |
| Number of slots for SIMATIC memory card | 1 |
| SIMATIC memory card required | Yes |
| Work memory | |
| • integrated (for program) | 1.5 Mbyte |
| • integrated (for data) | 5 Mbyte |
| Load memory | |
| • Plug-in (SIMATIC Memory Card), max. | 32 Gbyte |
| Backup | |
| • maintenance-free | Yes |
| CPU processing times | |
| for bit operations, typ. | 10 ns |
| for word operations, typ. | 12 ns |
| for fixed point arithmetic, typ. | 16 ns |
| for floating point arithmetic, typ. | 64 ns |
| CPU-blocks | |
| Number of elements (total) | 8 000; Blocks (OB, FB, FC, DB) and UDTs |
| DB | |
| • Number range | 1 ... 60 999; subdivided into: number range that can be used by the user: 1 ... 59 999, and number range of DBs created via SFC 86: 60 000 ... 60 999 |
| • Size, max. | 5 Mbyte; For DBs with absolute addressing, the max. size is 64 KB |
| FB | |
| • Number range | 0 ... 65 535 |
| • Size, max. | 1 Mbyte |
| FC | |
| • Number range | 0 ... 65 535 |
| • Size, max. | 1 Mbyte |
| OB | |
| • Size, max. | 1 Mbyte |
| • Number of free cycle OBs | 100 |
| • Number of time alarm OBs | 20 |
| • Number of delay alarm OBs | 20 |
| • Number of cyclic interrupt OBs | 20; With minimum OB 3x cycle of 250 µs |
| • Number of process alarm OBs | 50 |
| • Number of DPV1 alarm OBs | 3 |
| • Number of isochronous mode OBs | 3 |
| • Number of technology synchronous alarm OBs | 2 |
| • Number of startup OBs | 100 |

| | |
|---|---|
| Article number | 6ES7516-3TN00-0AB0 |
| <ul style="list-style-type: none"> Number of asynchronous error OBs Number of synchronous error OBs Number of diagnostic alarm OBs | 4 2 1 |
| Nesting depth | |
| <ul style="list-style-type: none"> per priority class | 24 |
| Counters, timers and their retentivity | |
| S7 counter | |
| <ul style="list-style-type: none"> Number | 2 048 |
| Retentivity | |
| – adjustable | Yes |
| IEC counter | |
| <ul style="list-style-type: none"> Number | Any (only limited by the main memory) |
| Retentivity | |
| – adjustable | Yes |
| S7 times | |
| <ul style="list-style-type: none"> Number | 2 048 |
| Retentivity | |
| – adjustable | Yes |
| IEC timer | |
| <ul style="list-style-type: none"> Number | Any (only limited by the main memory) |
| Retentivity | |
| – adjustable | Yes |
| Data areas and their retentivity | |
| Retentive data area (incl. timers, counters, flags), max. | 512 kbyte; In total; available retentive memory for bit memories, timers, counters, DBs, and technology data (axes): 472 KB |
| Extended retentive data area (incl. timers, counters, flags), max. | 5 Mbyte; When using PS 6 0W 24/48/60 V DC HF |
| Flag | |
| <ul style="list-style-type: none"> Size, max. Number of clock memories | 16 kbyte 8; 8 clock memory bit, grouped into one clock memory byte |
| Data blocks | |
| <ul style="list-style-type: none"> Retentivity adjustable Retentivity preset | Yes No |
| Local data | |
| <ul style="list-style-type: none"> per priority class, max. | 64 kbyte; max. 16 KB per block |
| Address area | |
| Number of IO modules | 8 192; max. number of modules / submodules |

| | |
|-------------------------------------|---|
| Article number | 6ES7516-3TN00-0AB0 |
| I/O address area | |
| • Inputs | 32 kbyte; All inputs are in the process image |
| • Outputs | 32 kbyte; All outputs are in the process image |
| per integrated IO subsystem | |
| – Inputs (volume) | 8 kbyte |
| – Outputs (volume) | 8 kbyte |
| per CM/CP | |
| – Inputs (volume) | 8 kbyte |
| – Outputs (volume) | 8 kbyte |
| Subprocess images | |
| • Number of subprocess images, max. | 32 |
| Hardware configuration | |
| Number of distributed IO systems | 64; A distributed I/O system is characterized not only by the integration of distributed I/O via PROFINET or PROFIBUS communication modules, but also by the connection of I/O via AS-i master modules or links (e.g. IE/PB-Link) |
| Number of DP masters | |
| • integrated | 1 |
| • Via CM | 8; A maximum of 8 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total |
| Number of IO Controllers | |
| • integrated | 2 |
| • Via CM | 8; A maximum of 8 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total |
| Rack | |
| • Modules per rack, max. | 32; CPU + 31 modules |
| • Number of lines, max. | 1 |
| PtP CM | |
| • Number of PtP CMs | the number of connectable PtP CMs is only limited by the number of available slots |
| Time of day | |
| Clock | |
| • Type | Hardware clock |
| • Backup time | 6 wk; At 40 °C ambient temperature, typically |
| • Deviation per day, max. | 10 s; Typ.: 2 s |
| Operating hours counter | |
| • Number | 16 |

| | |
|---|--|
| Article number | 6ES7516-3TN00-0AB0 |
| Clock synchronization | |
| • supported | Yes |
| • to DP, master | Yes |
| • in AS, master | Yes |
| • in AS, slave | Yes |
| • on Ethernet via NTP | Yes |
| Interfaces | |
| Number of PROFINET interfaces | 2 |
| Number of PROFIBUS interfaces | 1 |
| 1. Interface | |
| Interface types | |
| • RJ 45 (Ethernet) | Yes; X1 |
| • Number of ports | 2 |
| • integrated switch | Yes |
| Protocols | |
| • IP protocol | Yes; IPv4 |
| • PROFINET IO Controller | Yes |
| • PROFINET IO Device | Yes |
| • SIMATIC communication | Yes |
| • Open IE communication | Yes; Optionally also encrypted |
| • Web server | Yes |
| • Media redundancy | Yes |
| PROFINET IO Controller Services | |
| – PG/OP communication | Yes |
| – Isochronous mode | Yes |
| – Direct data exchange | Yes; Requirement: IRT and isochronous mode (MRPD optional) |
| – IRT | Yes |
| – PROFINergy | Yes; per user program |
| – Prioritized startup | Yes; Max. 32 PROFINET devices |
| – Number of connectable IO Devices, max. | 256; In total, up to 1 000 distributed I/O devices can be connected via AS-i, PROFIBUS or PROFINET |
| – Of which IO devices with IRT, max. | 64 |
| – Number of connectable IO Devices for RT, max. | 256 |
| – of which in line, max. | 256 |
| – Number of IO Devices that can be simultaneously activated/deactivated, max. | 8; in total across all interfaces |

| Article number | 6ES7516-3TN00-0AB0 |
|---|---|
| <ul style="list-style-type: none"> Number of IO Devices per tool, max. Updating times | <p>8</p> <p>The minimum value of the update time also depends on communication share set for PROFINET IO, on the number of IO devices, and on the quantity of configured user data</p> |
| Update time for IRT | |
| <ul style="list-style-type: none"> 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 With IRT and parameterization of "odd" send cycles | <p>250 µs to 4 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 375 µs of the isochronous OB is decisive</p> <p>500 µs to 8 ms</p> <p>1 ms to 16 ms</p> <p>2 ms to 32 ms</p> <p>4 ms to 64 ms</p> <p>Update time = set "odd" send clock (any multiple of 125 µs: 375 µs, 625 µs ... 3 875 µs)</p> |
| Update time for RT | |
| <ul style="list-style-type: none"> 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 | <p>250 µs to 128 ms</p> <p>500 µs to 256 ms</p> <p>1 ms to 512 ms</p> <p>2 ms to 512 ms</p> <p>4 ms to 512 ms</p> |
| PROFINET IO Device Services | |
| <ul style="list-style-type: none"> PG/OP communication Isochronous mode IRT PROFInergy Shared device Number of IO Controllers with shared device, max. activation/deactivation of I-devices Asset management record | <p>Yes</p> <p>No</p> <p>Yes</p> <p>Yes; per user program</p> <p>Yes</p> <p>4</p> <p>Yes; per user program</p> <p>Yes; per user program</p> |
| 2. Interface | |
| Interface types | |
| <ul style="list-style-type: none"> RJ 45 (Ethernet) Number of ports integrated switch | <p>Yes; X2</p> <p>1</p> <p>No</p> |

| | |
|---|--|
| Article number | 6ES7516-3TN00-0AB0 |
| Protocols | |
| • IP protocol | Yes; IPv4 |
| • PROFINET IO Controller | Yes |
| • PROFINET IO Device | Yes |
| • SIMATIC communication | Yes |
| • Open IE communication | Yes; Optionally also encrypted |
| • Web server | Yes |
| • Media redundancy | No |
| PROFINET IO Controller | |
| Services | |
| – PG/OP communication | Yes |
| – Isochronous mode | No |
| – Direct data exchange | No |
| – IRT | No |
| – PROFlenergy | Yes; per user program |
| – Prioritized startup | No |
| – Number of connectable IO Devices, max. | 32; In total, up to 1 000 distributed I/O devices can be connected via AS-i, PROFIBUS or PROFINET |
| – Number of connectable IO Devices for RT, max. | 32 |
| – of which in line, max. | 32 |
| – Number of IO Devices that can be simultaneously activated/deactivated, max. | 8; in total across all interfaces |
| – Number of IO Devices per tool, max. | 8 |
| – Updating times | The minimum value of the update time also depends on communication share set for PROFINET IO, on the number of IO devices, and on the quantity of configured user data |
| Update time for RT | |
| – for send cycle of 1 ms | 1 ms to 512 ms |
| PROFINET IO Device | |
| Services | |
| – PG/OP communication | Yes |
| – Isochronous mode | No |
| – IRT | No |
| – PROFlenergy | Yes; per user program |
| – Prioritized startup | No |
| – Shared device | Yes |
| – Number of IO Controllers with shared device, max. | 4 |
| – activation/deactivation of I-devices | Yes; per user program |
| – Asset management record | Yes; per user program |

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|---|--|
| Article number | 6ES7516-3TN00-0AB0 |
| 3. Interface | |
| Interface types | |
| • RS 485 | Yes; X3 |
| • Number of ports | 1 |
| Protocols | |
| • PROFIBUS DP master | Yes |
| • PROFIBUS DP slave | No |
| • SIMATIC communication | Yes |
| PROFIBUS DP master | |
| • Number of connections, max. | 48; for the integrated PROFIBUS DP interface |
| • Number of DP slaves, max. | 125; In total, up to 1 000 distributed I/O devices can be connected via AS-i, PROFIBUS or PROFINET |
| Services | |
| – PG/OP communication | Yes |
| – Equidistance | Yes |
| – Isochronous mode | Yes |
| – Activation/deactivation of DP slaves | Yes |
| Interface types | |
| RJ 45 (Ethernet) | |
| • 100 Mbps | Yes |
| • Autonegotiation | Yes |
| • Autocrossing | Yes |
| • Industrial Ethernet status LED | Yes |
| RS 485 | |
| • Transmission rate, max. | 12 Mbit/s |
| Protocols | |
| Number of connections | |
| • Number of connections, max. | 256; via integrated interfaces of the CPU and connected CPs / CMs |
| • Number of connections reserved for ES/HMI/web | 10 |
| • Number of connections via integrated interfaces | 128 |
| • Number of S7 routing paths | 16 |

| | |
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| Article number | 6ES7516-3TN00-0AB0 |
| Redundancy mode | |
| • H-Sync forwarding | Yes |
| Media redundancy | |
| – Media redundancy | only via 1st interface (X1) |
| – MRP | Yes; MRP Automanager according to IEC 62439-2 Edition 2.0, MRP Manager; MRP Client |
| – MRP interconnection, supported | Yes; as MRP ring node according to IEC 62439-2 Edition 3.0 |
| – MRPD | Yes; Requirement: IRT |
| – Switchover time on line break, typ. | 200 ms; For MRP, bumpless for MRPD |
| – Number of stations in the ring, max. | 50 |
| SIMATIC communication | |
| • PG/OP communication | Yes; encryption with TLS V1.3 pre-selected |
| • S7 routing | Yes |
| • Data record routing | Yes |
| • 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 kbyte |
| – several passive connections per port, supported | Yes |
| • ISO-on-TCP (RFC1006) | Yes |
| – Data length, max. | 64 kbyte |
| • UDP | Yes |
| – Data length, max. | 2 kbyte; 1 472 bytes for UDP broadcast |
| – UDP multicast | Yes; Max. 5 multicast circuits |
| • DHCP | Yes |
| • DNS | Yes |
| • SNMP | Yes |
| • DCP | Yes |
| • LLDP | Yes |
| • Encryption | Yes; Optional |
| Web server | |
| • HTTP | Yes; Standard and user pages |
| • HTTPS | Yes; Standard and user pages |

| Article number | 6ES7516-3TN00-0AB0 |
|--|---|
| OPC UA | |
| <ul style="list-style-type: none"> Runtime license required | Yes; "Medium" license required |
| <ul style="list-style-type: none"> OPC UA Client | Yes |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Application authentication | Yes |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Security policies | Available security policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> User authentication | "anonymous" or by user name & password |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of connections, max. | 10 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of nodes of the client interfaces, max. | 2 000 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of elements for one call of OPC-UA_NodeGetHandleList/OPC-UA_ReadList/OPC-UA_WriteList, max. | 300 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of elements for one call of OPC-UA_NameSpaceGetIndexList, max. | 20 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of elements for one call of OPC-UA_MethodGetHandleList, max. | 100 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of simultaneous calls of the client instructions per connection (except OPC-UA_ReadList, OPC-UA_WriteList, OPC-UA_MethodCall), max. | 1 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of simultaneous calls of the client instructions OPC-UA_ReadList, OPC-UA_WriteList and OPC-UA_MethodCall, max. | 5 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of registerable nodes, max. | 5 000 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of registerable method calls of OPC-UA_MethodCall, max. | 100 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of inputs/outputs when calling OPC-UA_MethodCall, max. | 20 |
| <ul style="list-style-type: none"> OPC UA Server | Yes; Data access (read, write, subscribe), method call, custom address space |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Application authentication | Yes |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Security policies | Available security policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> User authentication | "anonymous" or by user name & password |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> GDS support (certificate management) | Yes |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of sessions, max. | 48 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of accessible variables, max. | 100 000 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of registerable nodes, max. | 20 000 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Number of subscriptions per session, max. | 20 |
| <ul style="list-style-type: none"> <ul style="list-style-type: none"> Sampling interval, min. | 100 ms |

| | |
|--|---|
| Article number | 6ES7516-3TN00-0AB0 |
| <ul style="list-style-type: none"> – Publishing interval, min. – Number of server methods, max. – Number of inputs/outputs per server method, max. – Number of monitored items, max. – Number of nodes for user-defined server interfaces, max. • Alarms and Conditions <ul style="list-style-type: none"> – Number of program alarms – Number of alarms for system diagnostics | 200 ms 50 20 2 000; for 1 s sampling interval and 1 s send interval 5 000 Yes 200 100 |
| Further protocols | |
| <ul style="list-style-type: none"> • MODBUS | Yes; MODBUS TCP |
| Isochronous mode | |
| Equidistance | Yes |
| S7 message functions | |
| Number of login stations for message functions, max. | 64 |
| Program alarms | Yes |
| Number of configurable program messages, max. | 10 000; Program messages are generated by the "Program_Alarm" block, ProDiag or GRAPH |
| Number of loadable program messages in RUN, max. | 5 000 |
| Number of simultaneously active program alarms | |
| <ul style="list-style-type: none"> • Number of program alarms • Number of alarms for system diagnostics • Number of alarms for motion technology objects | 1 000 200 480 |
| Test commissioning functions | |
| Joint commission (Team Engineering) | Yes; Parallel online access possible for up to 8 engineering systems |
| Status block | Yes; Up to 8 simultaneously (in total across all ES clients) |
| Single step | No |
| Number of breakpoints | 8 |
| Status/control | |
| <ul style="list-style-type: none"> • Status/control variable • Variables • Number of variables, max. <ul style="list-style-type: none"> – of which status variables, max. – of which control variables, max. | Yes Inputs/outputs, memory bits, DBs, distributed I/Os, timers, counters 200; per job 200; per job |

| | |
|--|---|
| Article number | 6ES7516-3TN00-0AB0 |
| Forcing | |
| • Forcing | Yes |
| • Forcing, variables | Peripheral inputs/outputs |
| • Number of variables, max. | 200 |
| Diagnostic buffer | |
| • present | Yes |
| • Number of entries, max. | 3 200 |
| – of which powerfail-proof | 500 |
| Traces | |
| • Number of configurable Traces | 4; Up to 512 KB of data per trace are possible |
| Interrupts/diagnostics/status information | |
| Diagnostics indication LED | |
| • RUN/STOP LED | Yes |
| • ERROR LED | Yes |
| • MAINT LED | Yes |
| • Connection display LINK TX/RX | Yes |
| Supported technology objects | |
| Motion Control | Yes; Note: The number of technology objects affects the cycle time of the PLC program; selection guide via the TIA Selection Tool |
| • Number of available Motion Control resources for technology objects | 6 400 |
| • Required Motion Control resources | |
| – per speed-controlled axis | 40 |
| – per positioning axis | 80 |
| – per synchronous axis | 160 |
| – per external encoder | 80 |
| – per output cam | 20 |
| – per cam track | 160 |
| – per probe | 40 |
| • Number of available Extended Motion Control resources for technology objects | 192 |
| • Required Extended Motion Control resources | |
| – per cam (1 000 points and 50 segments) | 2 |
| – per cam (10 000 points and 50 segments) | 20 |
| – for each set of kinematics | 30 |
| – Per leading axis proxy | 3 |

| | |
|--|--|
| Article number | 6ES7516-3TN00-0AB0 |
| <ul style="list-style-type: none"> Positioning axis <ul style="list-style-type: none"> Number of positioning axes at motion control cycle of 4 ms (typical value) Number of positioning axes at motion control cycle of 8 ms (typical value) | 55 80 |
| Controller | |
| <ul style="list-style-type: none"> PID_Compact PID_3Step PID-Temp | Yes; Universal PID controller with integrated optimization Yes; PID controller with integrated optimization for valves Yes; PID controller with integrated optimization for temperature |
| Counting and measuring | |
| <ul style="list-style-type: none"> High-speed counter | Yes |
| Standards, approvals, certificates | |
| Suitable for safety functions | No |
| Ambient conditions | |
| Ambient temperature during operation | |
| <ul style="list-style-type: none"> horizontal installation, min. horizontal installation, max. vertical installation, min. vertical installation, max. | 0 °C 60 °C; Display: 50 °C, at an operating temperature of typically 50 °C, the display is switched off 0 °C 40 °C; Display: 40 °C, at an operating temperature of typically 40 °C, the display is switched off |
| Ambient temperature during storage/transportation | |
| <ul style="list-style-type: none"> min. max. | -40 °C 70 °C |
| Altitude during operation relating to sea level | |
| <ul style="list-style-type: none"> Installation altitude above sea level, max. | 5 000 m; Restrictions for installation altitudes > 2 000 m, see manual |
| Configuration | |
| Programming | |
| Programming language | |
| <ul style="list-style-type: none"> LAD FBD STL SCL GRAPH | Yes Yes Yes Yes Yes |

| | |
|---|-------------------------------|
| Article number | 6ES7516-3TN00-0AB0 |
| Know-how protection | |
| • User program protection/password protection | Yes |
| • Copy protection | Yes |
| • Block protection | Yes |
| Access protection | |
| • protection of confidential configuration data | Yes |
| • Password for display | Yes |
| • Protection level: Write protection | Yes |
| • Protection level: Read/write protection | Yes |
| • Protection level: Complete protection | Yes |
| Cycle time monitoring | |
| • lower limit | adjustable minimum cycle time |
| • upper limit | adjustable maximum cycle time |
| Dimensions | |
| Width | 175 mm |
| Height | 147 mm |
| Depth | 129 mm |
| Weights | |
| Weight, approx. | 1 978 g |

General technical specifications

You can find information on the general technical specifications, such as standards and approvals, electromagnetic compatibility, protection class, etc., in the S7-1500, ET 200MP system manual (<https://support.automation.siemens.com/WW/view/en/59191792>).

Dimensional drawing

The dimensional drawing of the module on the mounting rail, as well as a dimensional drawing with open front cover, are provided in this section. Always observe the specified dimensions for installation in cabinets, control rooms, etc.

Dimensional drawings of the CPU 1516T-3 PN/DP

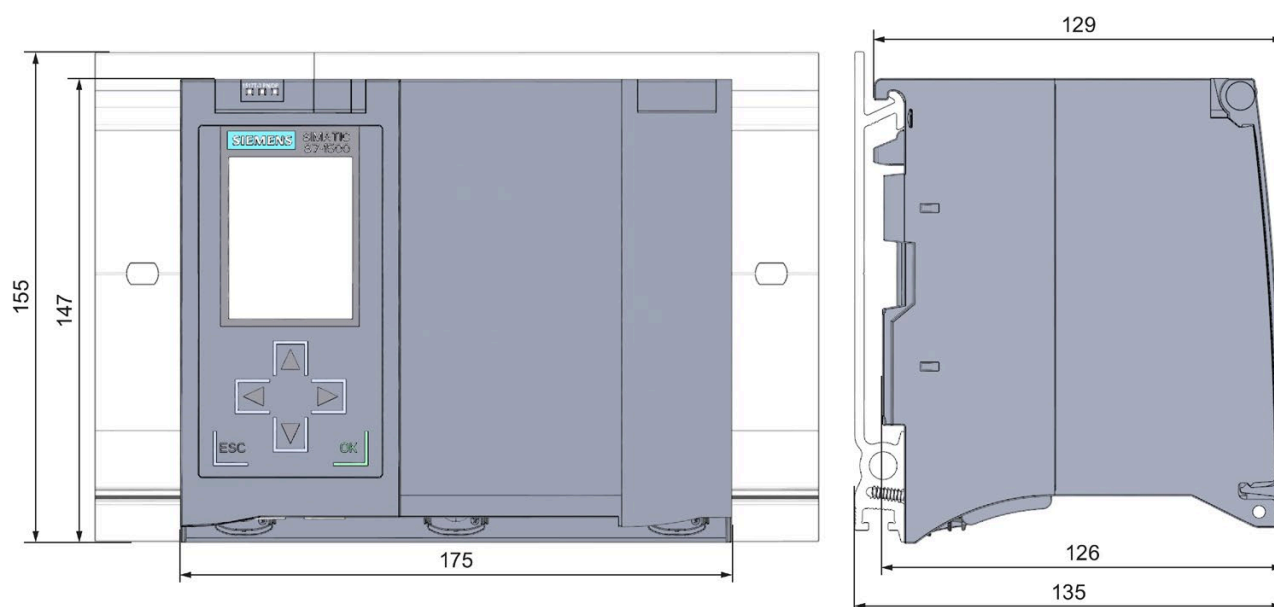


Figure A-1 Dimensional drawing of the CPU 1516T-3 PN/DP, front and side view

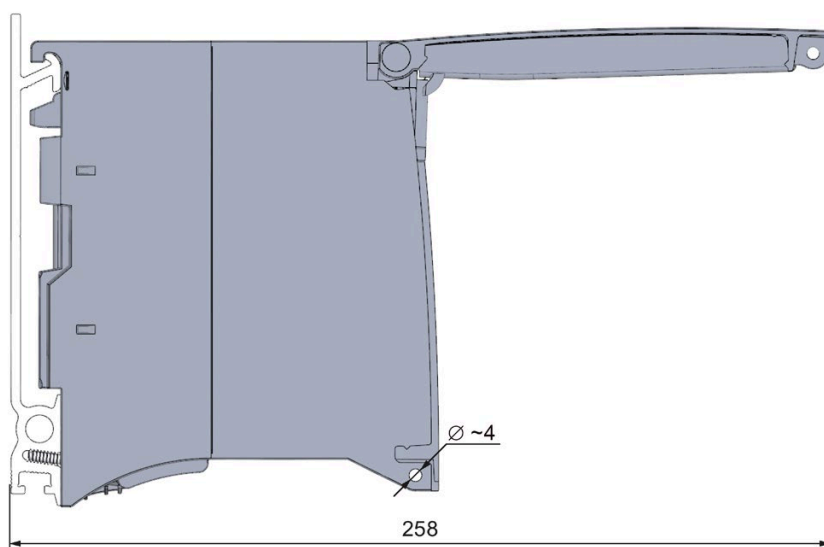


Figure A-2 Dimensional drawing of the CPU 1516T-3 PN/DP, side view with open front panel