

SIMATIC S7-1500, CPU 1511-1 PN, CENTRAL PROCESSING UNIT WITH WORKING MEMORY 150 KB FOR PROGRAM AND 1 MB FOR DATA, 1. INTERFACE: PROFINET IRT WITH 2 PORT SWITCH, 60 NS BIT-PERFORMANCE, SIMATIC MEMORY CARD NECESSARY



General information	
Product type designation	CPU 1511-1 PN
HW functional status	FS01
Firmware version	V2.5
Engineering with	
<ul style="list-style-type: none"> <li>STEP 7 TIA Portal configurable/integrated as of version</li> </ul>	V15
Configuration control	
via dataset	Yes
Display	
Screen diagonal [cm]	3.45 cm
Control elements	
Number of keys	8
Mode buttons	2
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
<b>Mains buffering</b>	
<ul style="list-style-type: none"> <li>• Mains/voltage failure stored energy time</li> </ul>	5 ms
<ul style="list-style-type: none"> <li>• Repeat rate, min.</li> </ul>	1/s
<b>Input current</b>	
Current consumption (rated value)	0.7 A
Current consumption, max.	0.95 A
Inrush current, max.	1.9 A; Rated value
$I^2t$	0.02 A <sup>2</sup> ·s
<b>Power</b>	
Infeed power to the backplane bus	10 W
Power consumption from the backplane bus (balanced)	5.5 W
<b>Power loss</b>	
Power loss, typ.	5.7 W
<b>Memory</b>	
Number of slots for SIMATIC memory card	1
SIMATIC memory card required	Yes
<b>Work memory</b>	
<ul style="list-style-type: none"> <li>• integrated (for program)</li> </ul>	150 kbyte
<ul style="list-style-type: none"> <li>• integrated (for data)</li> </ul>	1 Mbyte
<b>Load memory</b>	
<ul style="list-style-type: none"> <li>• Plug-in (SIMATIC Memory Card), max.</li> </ul>	32 Gbyte
<b>Backup</b>	
<ul style="list-style-type: none"> <li>• maintenance-free</li> </ul>	Yes
<b>CPU processing times</b>	
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
<b>CPU-blocks</b>	
Number of elements (total)	2 000; Blocks (OB, FB, FC, DB) and UDTs
<b>DB</b>	
<ul style="list-style-type: none"> <li>• Number range</li> </ul>	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
<ul style="list-style-type: none"> <li>• Size, max.</li> </ul>	1 Mbyte; For non-optimized block accesses, the max. size of the DB is 64 KB
<b>FB</b>	
<ul style="list-style-type: none"> <li>• Number range</li> </ul>	0 ... 65 535

• Size, max.	150 kbyte
<b>FC</b>	
• Number range	0 ... 65 535
• Size, max.	150 kbyte
<b>OB</b>	
• Size, max.	150 kbyte
• 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 500 µs
• Number of process alarm OBs	50
• Number of DPV1 alarm OBs	3
• Number of isochronous mode OBs	1
• Number of technology synchronous alarm OBs	2
• Number of startup OBs	100
• Number of asynchronous error OBs	4
• Number of synchronous error OBs	2
• Number of diagnostic alarm OBs	1
<b>Nesting depth</b>	
• per priority class	24
<b>Counters, timers and their retentivity</b>	
<b>S7 counter</b>	
• Number	2 048
<b>Retentivity</b>	
— adjustable	Yes
<b>IEC counter</b>	
• Number	Any (only limited by the main memory)
<b>Retentivity</b>	
— adjustable	Yes
<b>S7 times</b>	
• Number	2 048
<b>Retentivity</b>	
— adjustable	Yes
<b>IEC timer</b>	
• Number	Any (only limited by the main memory)
<b>Retentivity</b>	
— adjustable	Yes
<b>Data areas and their retentivity</b>	
Retentive data area (incl. timers, counters, flags), max.	128 kbyte; In total; available retentive memory for bit memories, timers, counters, DBs, and technology data (axes): 88 KB

Extended retentive data area (incl. timers, counters, flags), max.	1 Mbyte; When using PS 60W 24/48/60V DC HF
<b>Flag</b>	
• Number, max.	16 kbyte
• Number of clock memories	8; 8 clock memory bit, grouped into one clock memory byte
<b>Data blocks</b>	
• Retentivity adjustable	Yes
• Retentivity preset	No
<b>Local data</b>	
• per priority class, max.	64 kbyte; max. 16 KB per block
<b>Address area</b>	
Number of IO modules	1 024; max. number of modules / submodules
<b>I/O address area</b>	
• Inputs	32 kbyte; All inputs are in the process image
• Outputs	32 kbyte; All outputs are in the process image
<b>per integrated IO subsystem</b>	
— Inputs (volume)	8 kbyte
— Outputs (volume)	8 kbyte
<b>per CM/CP</b>	
— Inputs (volume)	8 kbyte
— Outputs (volume)	8 kbyte
<b>Subprocess images</b>	
• Number of subprocess images, max.	32
<b>Hardware configuration</b>	
Number of distributed IO systems	32; 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)
<b>Number of DP masters</b>	
• Via CM	4; A maximum of 4 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total
<b>Number of IO Controllers</b>	
• integrated	1
• Via CM	4; A maximum of 4 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total
<b>Rack</b>	
• Modules per rack, max.	32; CPU + 31 modules
• Number of lines, max.	1
<b>PtP CM</b>	
• Number of PtP CMs	the number of connectable PtP CMs is only limited by the number of available slots
<b>Time of day</b>	

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
Clock synchronization	
• supported	Yes
• in AS, master	Yes
• in AS, slave	Yes
• on Ethernet via NTP	Yes
Interfaces	
Number of PROFINET interfaces	1
1. Interface	
Interface types	
• Number of ports	2
• integrated switch	Yes
• RJ 45 (Ethernet)	Yes; X1
Protocols	
• IP protocol	Yes; IPv4
• PROFINET IO Controller	Yes
• PROFINET IO Device	Yes
• SIMATIC communication	Yes
• Open IE communication	Yes
• Web server	Yes
• Media redundancy	Yes; MRP Automanager according to IEC 62439-2 Edition 2.0
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
— MRPD	Yes; Requirement: IRT
— PROFlenergy	Yes
— Prioritized startup	Yes; Max. 32 PROFINET devices
— Number of connectable IO Devices, max.	128; In total, up to 256 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.	128
— of which in line, max.	128
— 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 IRT

— for send cycle of 250 $\mu$ s	250 $\mu$ s to 4 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 625 $\mu$ s of the isochronous OB is decisive
— for send cycle of 500 $\mu$ s	500 $\mu$ s to 8 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 625 $\mu$ s of the isochronous OB is decisive
— for send cycle of 1 ms	1 ms to 16 ms
— for send cycle of 2 ms	2 ms to 32 ms
— for send cycle of 4 ms	4 ms to 64 ms
— With IRT and parameterization of "odd" send cycles	Update time = set "odd" send clock (any multiple of 125 $\mu$ s: 375 $\mu$ s, 625 $\mu$ s ... 3 875 $\mu$ s)

#### Update time for RT

— for send cycle of 250 $\mu$ s	250 $\mu$ s to 128 ms
— for send cycle of 500 $\mu$ s	500 $\mu$ s to 256 ms
— for send cycle of 1 ms	1 ms to 512 ms
— for send cycle of 2 ms	2 ms to 512 ms
— for send cycle of 4 ms	4 ms to 512 ms

#### PROFINET IO Device

##### Services

— PG/OP communication	Yes
— S7 routing	Yes
— Isochronous mode	No
— Open IE communication	Yes
— IRT	Yes
— MRP	Yes
— MRPD	Yes; Requirement: IRT
— PROFIenergy	Yes
— Shared device	Yes
— Number of IO Controllers with shared device, max.	4
— Asset management record	Yes; Per user program

#### Interface types

RJ 45 (Ethernet)

- 100 Mbps
- Autonegotiation
- Autocrossing
- Industrial Ethernet status LED

Yes  
Yes  
Yes  
Yes

## Protocols

Number of connections	
• Number of connections, max.	96; 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	64
• Number of S7 routing paths	16

## PROFINET IO Controller

Services	
— PG/OP communication	Yes
— S7 routing	Yes
— Isochronous mode	Yes
— Open IE communication	Yes
— IRT	Yes
— PROFINergy	Yes
— Prioritized startup	Yes; Max. 32 PROFINET devices
— Number of connectable IO Devices, max.	128; In total, up to 256 distributed I/O devices can be connected via AS-i, PROFIBUS or PROFINET
— Of which IO devices with IRT, max.	64
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— of which in line, max.	128
— 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

## Redundancy mode

• MRP	Yes; As MRP redundancy manager and/or MRP client; max. number of devices in the ring: 50
• MRPD	Yes; Requirement: IRT

## 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
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— 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	No
• SNMP	Yes
• DCP	Yes
• LLDP	Yes
<b>Web server</b>	
• HTTP	Yes; Standard and user pages
• HTTPS	Yes; Standard and user pages
<b>OPC UA</b>	
• Runtime license required	Yes
• OPC UA server	Yes; Data access (read, write, subscribe), method call, custom address space
— Application authentication	Yes
— Security policies	Available security policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256
— User authentication	"anonymous" or by user name & password
— Number of sessions, max.	32
— Number of accessible variables, max.	50 000
— Number of registerable nodes, max.	10 000
— Number of subscriptions per session, max.	20
— Sampling time, min.	100 ms
— Send time, min.	500 ms
— Number of server methods, max.	20
— Number of inputs/outputs per server method, max.	20
— Number of monitored items, max.	1 000; For 1 s sampling interval and 1 s send interval
— Number of server interfaces, max.	10
— Number of nodes for user-defined server interfaces, max.	1 000
<b>Further protocols</b>	
• MODBUS	Yes; MODBUS TCP
<b>Media redundancy</b>	
• Switchover time on line break, typ.	200 ms; For MRP, bumpless for MRPD
• Number of stations in the ring, max.	50
<b>Isochronous mode</b>	



Isochronous operation (application synchronized up to terminal)	Yes; With minimum OB 6x cycle of 625 µs
Equidistance	Yes

### S7 message functions

Number of login stations for message functions, max.	32
Program alarms	Yes
Number of configurable program messages, max.	5 000; Program messages are generated by the "Program_Alarm" block, ProDiag or GRAPH
Number of loadable program messages in RUN, max.	2 500
Number of simultaneously active program alarms <ul style="list-style-type: none"> <li>• Number of program alarms</li> <li>• Number of alarms for system diagnostics</li> <li>• Number of alarms for motion technology objects</li> </ul>	300 100 80

### Test commissioning functions

Joint commission (Team Engineering)	Yes; Parallel online access possible for up to 5 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"> <li>• Status/control variable</li> <li>• Variables</li> </ul>	Yes Inputs/outputs, memory bits, DBs, distributed I/Os, timers, counters
<ul style="list-style-type: none"> <li>• Number of variables, max.</li> <li>— of which status variables, max.</li> <li>— of which control variables, max.</li> </ul>	200; per job 200; per job

### Forcing

<ul style="list-style-type: none"> <li>• Forcing, variables</li> <li>• Number of variables, max.</li> </ul>	Peripheral inputs/outputs 200
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### Diagnostic buffer

<ul style="list-style-type: none"> <li>• present</li> <li>• Number of entries, max.</li> <li>— of which powerfail-proof</li> </ul>	Yes 1 000 500
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### Traces

<ul style="list-style-type: none"> <li>• Number of configurable Traces</li> </ul>	4; Up to 512 KB of data per trace are possible
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### Interrupts/diagnostics/status information

Diagnostics indication LED <ul style="list-style-type: none"> <li>• RUN/STOP LED</li> <li>• ERROR LED</li> <li>• MAINT LED</li> </ul>	Yes Yes Yes
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- STOP ACTIVE LED Yes
- Connection display LINK TX/RX Yes

### Supported technology objects

Motion Control	Yes; Note: The number of axes affects the cycle time of the PLC program; selection guide via the TIA Selection Tool or SIZER
<ul style="list-style-type: none"> <li>• Number of available Motion Control resources for technology objects (except cam disks) 800</li> <li>• Required Motion Control resources <ul style="list-style-type: none"> <li>— per speed-controlled axis 40</li> <li>— per positioning axis 80</li> <li>— per synchronous axis 160</li> <li>— per external encoder 80</li> <li>— per output cam 20</li> <li>— per cam track 160</li> <li>— per probe 40</li> </ul> </li> <li>• Positioning axis <ul style="list-style-type: none"> <li>— Number of positioning axes at motion control cycle of 4 ms (typical value) 5</li> <li>— Number of positioning axes at motion control cycle of 8 ms (typical value) 10</li> </ul> </li> </ul>	
Controller	<ul style="list-style-type: none"> <li>• PID_Compact Yes; Universal PID controller with integrated optimization</li> <li>• PID_3Step Yes; PID controller with integrated optimization for valves</li> <li>• PID-Temp Yes; PID controller with integrated optimization for temperature</li> </ul>
Counting and measuring	
<ul style="list-style-type: none"> <li>• High-speed counter Yes</li> </ul>	

### Ambient conditions

Ambient temperature during operation	
<ul style="list-style-type: none"> <li>• horizontal installation, min. 0 °C</li> <li>• horizontal installation, max. 60 °C; Display: 50 °C, at an operating temperature of typically 50 °C, the display is switched off</li> <li>• vertical installation, min. 0 °C</li> <li>• vertical installation, max. 40 °C; Display: 40 °C, at an operating temperature of typically 40 °C, the display is switched off</li> </ul>	
Ambient temperature during storage/transportation	
<ul style="list-style-type: none"> <li>• min. -40 °C</li> <li>• max. 70 °C</li> </ul>	

### Configuration

Programming	
Programming language	
<ul style="list-style-type: none"> <li>— LAD Yes</li> </ul>	

— FBD	Yes
— STL	Yes
— SCL	Yes
— GRAPH	Yes
<b>Know-how protection</b>	
• User program protection/password protection	Yes
• Copy protection	Yes
• Block protection	Yes
<b>Access protection</b>	
• Password for display	Yes
• Protection level: Write protection	Yes
• Protection level: Read/write protection	Yes
• Protection level: Complete protection	Yes
<b>Cycle time monitoring</b>	
• lower limit	adjustable minimum cycle time
• upper limit	adjustable maximum cycle time
<b>Dimensions</b>	
Width	35 mm
Height	147 mm
Depth	129 mm
<b>Weights</b>	
Weight, approx.	405 g
<b>last modified:</b>	08/24/2018