SIEMENS

## Data sheet 6ES7511-1AK02-0AB0


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 | V2.6 |
| Product function | |
| • I&M data | Yes; I&M0 to I&M3 |
| **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 |
| Mains buffering | |
| • Mains/voltage failure stored energy time | 5 ms |
| • Repeat rate, min. | 1/s |
| **Input current** | |
| 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 $A^2 \cdot s$ |
| **Power** | |
| Infeed power to the backplane bus | 10 W |
| Power consumption from the backplane bus (balanced) | 5.5 W |
| **Power loss** | |
| Power loss, typ. | 5.7 W |
| **Memory** | |
| Number of slots for SIMATIC memory card | 1 |
| SIMATIC memory card required | Yes |
| Work memory | |
| • integrated (for program) | 150 kbyte |
| • integrated (for data) | 1 Mbyte |
| Load memory | |
| • Plug-in (SIMATIC Memory Card), max. | 32 Gbyte |
| Backup | |
| • maintenance-free | Yes |
| **CPU processing times** | |
| for bit operations, typ. | 60 ns |
| for word operations, typ. | 72 ns |
| for fixed point arithmetic, typ. | 96 ns |
| for floating point arithmetic, typ. | 384 ns |
| **CPU-blocks** | |
| Number of elements (total) | 2 000; 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. | 1 Mbyte; For DBs with absolute addressing, the max. size is 64 KB |
| FB | |
| • Number range | 0 ... 65 535 |
| • Size, max. | 150 kbyte |

| | |
|---|---|
| FC | |
| • Number range | 0 ... 65 535 |
| • Size, max. | 150 kbyte |
| OB | |
| • 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 | 2 |
| • 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 |
| Nesting depth | |
| • per priority class | 24 |

| Counters, timers and their retentivity | |
|---|---|
| S7 counter | |
| • Number | 2 048 |
| Retentivity | |
| — adjustable | Yes |
| IEC counter | |
| • Number | Any (only limited by the main memory) |
| Retentivity | |
| — adjustable | Yes |
| S7 times | |
| • Number | 2 048 |
| Retentivity | |
| — adjustable | Yes |
| IEC timer | |
| • Number | Any (only limited by the main memory) |
| Retentivity | |
| — adjustable | Yes |

| Data areas and their retentivity | |
|---|---|
| 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 6 0W 24/48/60 V DC HF |

| | |
|---|---|
| Flag | |
| • Number, max. | 16 kbyte |
| • Number of clock memories | 8; 8 clock memory bit, grouped into one clock memory byte |
| Data blocks | |
| • Retentivity adjustable | Yes |
| • Retentivity preset | No |
| Local data | |
| • per priority class, max. | 64 kbyte; max. 16 KB per block |
| **Address area** | |
| Number of IO modules | 1 024; max. number of modules / submodules |
| 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 | 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) |
| Number of DP masters | |
| • Via CM | 4; A maximum of 4 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total |
| Number of IO Controllers | |
| • integrated | 1 |
| • Via CM | 4; A maximum of 4 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 |
| 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 |
| — PROFIenergy | 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 µs | 250 µs to 4 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 625 µs of the isochronous OB is decisive |
| — for send cycle of 500 µs | 500 µs to 8 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 625 µs 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 µs: 375 µs, 625 µs ... 3 875 µs) |
| Update time for RT | |
| — for send cycle of 250 µs | 250 µs to 128 ms |
| — for send cycle of 500 µs | 500 µs 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; As MRP redundancy manager and/or MRP client; max. number of devices in the ring: 50 |
| — 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 | Yes |

| | |
|---|---|
| • Autonegotiation | Yes |
| • Autocrossing | Yes |
| • Industrial Ethernet status LED | 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 |
| **Redundancy mode** | |
| • H-Sync forwarding | Yes |
| **SIMATIC communication** | |
| • S7 communication, as server | Yes |
| • S7 communication, as client | Yes |
| • User data per job, max. | See online help (S7 communication, user data size) |
| **Open IE communication** | |
| • TCP/IP | Yes |
| — Data length, max. | 64 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 |
| **Web server** | |
| • HTTP | Yes; Standard and user pages |
| • HTTPS | Yes; Standard and user pages |
| **OPC UA** | |
| • Runtime license required | Yes |
| • OPC UA client | Yes |
| — Application authentication | Yes |
| — Security policies | Available security policies: None, Basic128Rsa15, Basic256Rsa15, Basic256Sha256 |
| — User authentication | "anonymous" or by user name & password |
| — Number of connections, max. | 4 |

| | |
|---|---|
| — Number of nodes of the client interfaces, max. | 1 000 |
| — Number of elements for one call of OPC_UA_NodeGetHandleList/OPC_UA_ReadList/OPC_UA_WriteList, max. | 300 |
| — Number of elements for one call of OPC_UA_NameSpaceGetIndexList, max. | 20 |
| — Number of elements for one call of OPC_UA_MethodGetHandleList, max. | 100 |
| — Number of simultaneous calls of the client instructions per connection (except OPC_UA_ReadList,OPC_UA_WriteList,OPC_UA_MethodCall), max. | 1 |
| — Number of simultaneous calls of the client instructions OPC_UA_ReadList,OPC_UA_WriteList and OPC_UA_MethodCall, max. | 5 |
| — Number of registerable nodes, max. | 5 000 |
| — Number of registerable method calls of OPC_UA_MethodCall, max. | 100 |
| — Number of inputs/outputs when calling OPC_UA_MethodCall, max. | 20 |
| • 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 |
| Further protocols | |
| • MODBUS | Yes; MODBUS TCP |
| Media redundancy | |

| | |
|---|---|
| • Switchover time on line break, typ. | 200 ms; For MRP, bumpless for MRPD |
| • Number of stations in the ring, max. | 50 |
| **Isochronous mode** | |
| Isochronous operation (application synchronized up to terminal) | Yes; Distributed and central; with minimum OB 6x cycle of 625 µs (distributed) and 1 ms (central) |
| 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 | |
| • Number of program alarms | 300 |
| • Number of alarms for system diagnostics | 100 |
| • Number of alarms for motion technology objects | 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 | |
| • Status/control variable | Yes |
| • Variables | Inputs/outputs, memory bits, DBs, distributed I/Os, timers, counters |
| • Number of variables, max. | |
| — of which status variables, max. | 200; per job |
| — of which control variables, max. | 200; per job |
| Forcing | |
| • Forcing, variables | Peripheral inputs/outputs |
| • Number of variables, max. | 200 |
| Diagnostic buffer | |
| • present | Yes |
| • Number of entries, max. | 1 000 |
| — 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 |
| • 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 |
| • Number of available Motion Control resources for technology objects (except cam disks) | 800 |
| • 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 |
| • Positioning axis | |
| — Number of positioning axes at motion control cycle of 4 ms (typical value) | 5 |
| — Number of positioning axes at motion control cycle of 8 ms (typical value) | 10 |
| Controller | |
| • PID_Compact | Yes; Universal PID controller with integrated optimization |
| • PID_3Step | Yes; PID controller with integrated optimization for valves |
| • PID-Temp | Yes; PID controller with integrated optimization for temperature |
| Counting and measuring | |
| • High-speed counter | Yes |

## Ambient conditions

### Ambient temperature during operation

| | |
|---|---|
| • horizontal installation, min. | 0 °C |
| • horizontal installation, max. | 60 °C; Display: 50 °C, at an operating temperature of typically 50 °C, the display is switched off |
| • vertical installation, min. | 0 °C |
| • vertical installation, max. | 40 °C; Display: 40 °C, at an operating temperature of typically 40 °C, the display is switched off |

### Ambient temperature during storage/transportation

| | |
|---|---|
| • min. | -40 °C |
| • max. | 70 °C |

## Configuration

| | |
|---|---|
| **Programming** | |
| Programming language | |
| — LAD | Yes |
| — FBD | Yes |
| — STL | Yes |
| — SCL | Yes |
| — GRAPH | Yes |
| **Know-how protection** | |
| • User program protection/password protection | Yes |
| • Copy protection | Yes |
| • Block protection | Yes |
| **Access protection** | |
| • 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 | 35 mm |
| Height | 147 mm |
| Depth | 129 mm |

| **Weights** | |
|---|---|
| Weight, approx. | 405 g |

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