

MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

SIEMENS SIMATIC S7

6ES7511-1FK02-0AB0

CPU 1511F-1 PN FAILSAFE CONTROLLER

Applicable product family: SIMATIC S7-1500F automation systems

OFFICIAL SOURCE

6ES7511-1FK02-0AB0.pdf

The following pages are selected from the supplied manufacturer document and retain their original page content.



*** spare part *** SIMATIC S7-1500F, CPU 1511F-1 PN, central processing unit with work memory 225 KB for program and 1 MB for data, 1st interface: PROFINET IRT with 2-port switch, 60 ns bit performance, SIMATIC Memory Card required

General information	
Product type designation	CPU 1511F-1 PN
HW functional status	FS03
Firmware version	V2.8
Product function	
• I&M data	Yes; I&M0 to I&M3
• Isochronous mode	Yes; Distributed and central; with minimum OB 6x cycle of 625 µs (distributed) and 1 ms (central)
Engineering with	
• STEP 7 TIA Portal configurable/integrated from version	V16 (FW V2.8) / V15 (FW V2.5) or higher; with older TIA Portal versions configurable as 6ES7511-1FK01-0AB0
Configuration control	
via dataset	Yes
Display	
Screen diagonal [cm]	3.45 cm
Control elements	
Number of keys	8
Mode buttons	2
Supply voltage	
Rated value (DC)	24 V
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 ·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
Storage	
Number of slots for SIMATIC memory card	1
SIMATIC memory card required	Yes

Work memory	
• integrated (for program)	225 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; Up to 8 possible for F-blocks
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 timer	
• Number	2 048
Retentivity	
— adjustable	Yes
IEC timer	
• Number	Any (only limited by the main memory)
Retentivity	
— can be set	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	
• Size, 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, device	Yes
• on Ethernet via NTP	Yes
Interfaces	
Number of PROFINET interfaces	1
1. Interface	
Interface types	
• RJ 45 (Ethernet)	Yes; X1
• Number of ports	2
• integrated switch	Yes
Protocols	

• IP protocol • PROFINET IO Controller • PROFINET IO Device • SIMATIC communication • Open IE communication • Web server • Media redundancy	Yes; IPv4 Yes Yes Yes Yes; Optionally also encrypted Yes Yes; MRP Automanager according to IEC 62439-2 Edition 2.0
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
— 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
— Isochronous mode	No
— IRT	Yes
— PROFINergy	Yes; per user program
— Shared device	Yes
— Number of IO Controllers with shared device, max.	4
— Asset management record	Yes; per user program
2. Interface	
PROFINET IO Device	
Services	
— PG/OP communication	Yes
— Isochronous mode	No
— IRT	No
— PROFINergy	Yes; per user program
— Prioritized startup	No
— 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

PROFIsafe Yes

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

Media redundancy

- MRP Yes; as MRP redundancy manager and/or MRP client; max. number of devices in the ring: 50
- 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

- S7 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
 - Data length, max. 64 kbyte
 - several passive connections per port, supported Yes
- ISO-on-TCP (RFC1006)
 - Data length, max. 64 kbyte
- UDP
 - 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
 - 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, recommended 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 1

instructions for session management, per connection, max.	
— Number of simultaneous calls of the client instructions for data access, per connection, 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 interval, min.	100 ms
— Publishing interval, min.	500 ms
— Number of server methods, max.	20
— Number of inputs/outputs per server method, max.	20
— Number of monitored items, recommended 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
Isochronous mode	
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	600
• 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; without fail-safe
• Variables	inputs/outputs, bit memories, DBs, peripheral I/Os (without fail-safe), times, counters
• Number of variables, max.	
— of which status variables, max.	200; per job
— of which control variables, max.	200; per job
Forcing	
• Forcing	Yes; without fail-safe
• Forcing, variables	peripheral inputs/outputs (without fail-safe)
• 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 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	15 360
• 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	512
• 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
• Positioning axis	
— Number of positioning axes at motion control cycle of 4 ms (typical value)	140
— Number of positioning axes at motion control cycle of 8 ms (typical value)	192
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
Standards, approvals, certificates	
Highest safety class achievable in safety mode	
• Performance level according to ISO 13849-1	PLe
• SIL acc. to IEC 61508	SIL 3
Probability of failure (for service life of 20 years and repair time of 100 hours)	
— Low demand mode: PFDavg in accordance with SIL3	< 2.00E-05
— High demand/continuous mode: PFH in accordance with SIL3	< 1.00E-09
Ambient conditions	
Ambient temperature during operation	
• horizontal installation, min.	-25 °C; No condensation
• horizontal installation, max.	60 °C; Display: 50 °C, at an operating temperature of typically 50 °C, the display is switched off
• vertical installation, min.	-25 °C; No condensation
• 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
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	5 000 m; Restrictions for installation altitudes > 2 000 m, see manual

Configuration			
Programming			
Programming language			
— LAD	Yes; incl. failsafe		
— FBD	Yes; incl. failsafe		
— 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; Specific write protection both for Standard and for Failsafe		
• Protection level: Read/write protection	Yes		
• Protection level: Write protection for Failsafe	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		
Classifications			
		Version	Classification
	eClass	16	27-24-22-07
	eClass	14	27-24-22-07
	eClass	12	27-24-22-07
	eClass	9.1	27-24-22-07
	eClass	9	27-24-22-07
	eClass	8	27-24-22-07
	eClass	7.1	27-24-22-07
	eClass	6	27-24-22-07
	ETIM	10	EC000236
	ETIM	9	EC000236
	ETIM	8	EC000236
	ETIM	7	EC000236
	IDEA	4	3565
	UNSPSC	15	32-15-17-05
Approvals / Certificates			
General Product Approval			
Miscellaneous	Manufacturer Declaration		
		EG-Konf.	
			Miscellaneous
General Product Approval		EMV	For use in hazardous locations



[Manufacturer Declaration](#)

[China RoHS](#)



For use in hazardous locations

[FM](#)

[CCC-Ex](#)



[Type Examination Certificate](#)

[Miscellaneous](#)

For use in hazardous locations

Functional Safety

Maritime application

[CCC-Ex](#)

[Type Examination Certificate](#)

[TUEV](#)

[TUEV](#)

[Type Examination Certificate](#)



Maritime application



[NK / Nippon Kaiji Kyokai](#)



[CCS \(China Classification Society\)](#)

Maritime application

other

Industrial Communication

[KR \(Korean Register of Shipping\)](#)

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