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S7-1200 CPU firmware overview

SIMATIC S7-1200

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Table of content

1 CPU features matrix 3

1.1 CPU firmware V2.2 and earlier features matrix (6ES721x-1xx30-0XB0) 3
1.2 CPU firmware V3.0 features matrix (6ES721x-1xx31-0XB0) 4
1.3 CPU firmware >V4.0 features matrix (6ES721x-1xx40-0XB0) 5

2 Firmware (FW) feature details listing 8

2.1 Firmware V2 8
2.1.1 Firmware V02.00.02 8
2.1.2 Firmware V02.01.02 9
2.1.3 Firmware V02.02.00 9
2.2 Firmware V3 10
2.2.1 Firmware V03.00.00 10
2.2.2 Firmware V03.00.01 10
2.2.3 Firmware V03.00.02 11
2.3 Firmware V4 11
2.3.1 Firmware V04.00.00 11
2.3.2 Firmware V04.00.01 12
2.3.3 Firmware V04.01.00 12
2.3.4 Firmware V04.01.01 14

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1 CPU features matrix

1.1 CPU firmware V2.2 and earlier features matrix (6ES721x-1xx30-0XB0)

CPU	Memory			Number of		Number of communication modules (left side of CPU)	Number of expansion modules (right side of CPU)	Number of PB slaves, PN devices[1]	Number of communication connections (Open User, GET/PUT server, GET/PUT client, HMI, PG)
	Work	Load	Reten-tive	HSC	PTO				
1211C DC/DC/DC	25 KB	1 MB	2 KB	3 w/o SB 5 w SB	2	3	0	16, 8	8, 3, 8, 3, 1
1211C DC/DC/RLY	25 KB	1 MB	2 KB	3 w/o SB 5 w SB	0 w/o SB 2 w SB	3	0	16, 8	8, 3, 8, 3, 1
1211C AC/DC/RLY	25 KB	1 MB	2 KB	3 w/o SB 5 w SB	0 w/o SB 2 w SB	3	0	16, 8	8, 3, 8, 3, 1
1212C DC/DC/DC	25 KB	1 MB	2 KB	4 w/o SB 6 w SB	2	3	2	16, 8	8, 3, 8, 3, 1
1212C DC/DC/RLY	25 KB	1 MB	2 KB	4 w/o SB 6 w SB	0 w/o SB 2 w SB	3	2	16, 8	8, 3, 8, 3, 1
1212C AC/DC/RLY	25 KB	1 MB	2 KB	4 w/o SB 6 w SB	0 w/o SB 2 w SB	3	2	16, 8	8, 3, 8, 3, 1
1214C DC/DC/DC	50 KB	2 MB	2 KB	6	2	3	8	16, 8	8, 3, 8, 3, 1
1214C DC/DC/RLY	50 KB	2 MB	2 KB	6	0 w/o SB 2 w SB	3	8	16, 8	8, 3, 8, 3, 1
1214C AC/DC/RLY	50 KB	2 MB	2 KB	6	0 w/o SB 2 w SB	3	8	16, 8	8, 3, 8, 3, 1

[1] 16 total PROFINET/PROFIBUS devices per CPU

NOTE Refer to the S7-1200 Programmable Controller System Manual, 11/2011, for further information.

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1.2 CPU firmware V3.0 features matrix (6ES721x-1xx31-0XB0)

CPU	Memory			Number of		Number of communication modules (left side of CPU)	Number of expansion modules (right side of CPU)	Number of PB slaves, PN devices[2]	Number of communication connections (Open User, GET/PUT server, GET/PUT client, HMI, PG)
	Work	Load[1]	Reten-tive	HSC	PTO				
1211C DC/DC/DC	30 KB	1 MB	10 KB	3 w/o SB 5 w SB	4	3	0	32, 16	8, 3, 8, 3, 1
1211C DC/DC/RLY	30 KB	1 MB	10 KB	3 w/o SB 5 w SB	0 w/o SB 4 w SB	3	0	32, 16	8, 3, 8, 3, 1
1211C AC/DC/RLY	30 KB	1 MB	10 KB	3 w/o SB 5 w SB	0 w/o SB 4 w SB	3	0	32, 16	8, 3, 8, 3, 1
1212C DC/DC/DC	50 KB	1 MB	10 KB	4 w/o SB 6 w SB	4	3	2	32, 16	8, 3, 8, 3, 1
1212C DC/DC/RLY	50 KB	1 MB	10 KB	4 w/o SB 6 w SB	0 w/o SB 4 w SB	3	2	32, 16	8, 3, 8, 3, 1
1212C AC/DC/RLY	50 KB	1 MB	10 KB	4 w/o SB 6 w SB	0 w/o SB 4 w SB	3	2	32, 16	8, 3, 8, 3, 1
1214C DC/DC/DC	75 KB	4 MB	10 KB	6	4	3	8	32, 16	8, 3, 8, 3, 1
1214C DC/DC/RLY	75 KB	4 MB	10 KB	6	0 w/o SB 4 w SB	3	8	32, 16	8, 3, 8, 3, 1
1214C AC/DC/RLY	75 KB	4 MB	10 KB	6	0 w/o SB 4 w SB	3	8	32, 16	8, 3, 8, 3, 1
1215C DC/DC/DC	100 KB	4 MB	10 KB	6	4	3	8	32, 16	8, 3, 8, 3, 1

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CPU	Memory			Number of		Number of communication modules (left side of CPU)	Number of expansion modules (right side of CPU)	Number of PB slaves, PN devices[2]	Number of communication connections (Open User, GET/PUT server, GET/PUT client, HMI, PG)
	Work	Load[1]	Reten-tive	HSC	PTO				
1215C DC/DC/RLY	100 KB	4 MB	10 KB	6	0 w/o SB 4 w SB	3	8	32, 16	8, 3, 8, 3, 1
1215C AC/DC/RLY	100 KB	4 MB	10 KB	6	0 w/o SB 4 w SB	3	8	32, 16	8, 3, 8, 3, 1

1 Expandable up to SD card size

2 32 PROFINET/PROFIBUS devices per channel: 3 PROFIBUS channels supported, 1 PROFINET channel supported

NOTE Refer to the S7-1200 Programmable Controller System Manual, 04/2012, for further information.

1.3 CPU firmware >V4.0 features matrix (6ES721x-1xx40-0XB0)

CPU	Memory			Number of		Number of communication modules (left side of CPU)[4]	Number of expansion modules (right side of CPU)	Number of PB slaves, PN devices[5]	Number of communication connections (Open User, GET/PUT server, GET/PUT client, HMI, PG)
	Work	Load[1]	Reten-tive	HSC[2]	PTO[3]				
1211C DC/DC/DC	50 KB	1 MB	10 KB	6	4	3	0	32, 16	8, 3, 8, 4, 1
1211C DC/DC/RLY	50 KB	1 MB	10 KB	6	0 w/o SB 4 w SB	3	0	32, 16	8, 3, 8, 4, 1
1211C AC/DC/RLY	50 KB	1 MB	10 KB	6	0 w/o SB 4 w SB	3	0	32, 16	8, 3, 8, 4, 1
1212C DC/DC/DC	75 KB	1 MB	10 KB	6	4	3	2	32, 16	8, 3, 8, 4, 1
1212C DC/DC/RLY	75 KB	1 MB	10 KB	6	0 w/o SB 4 w SB	3	2	32, 16	8, 3, 8, 4, 1

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1 CPU features matrix

CPU	Memory			Number of		Number of communication modules (left side of CPU)[4]	Number of expansion modules (right side of CPU)	Number of PB slaves, PN devices[5]	Number of communication connections (Open User, GET/PUT server, GET/PUT client, HMI, PG)
	Work	Load[1]	Reten-tive	HSC[2]	PTO[3]				
1212C AC/DC/RLY	75 KB	1 MB	10 KB	6	0 w/o SB 4 w SB	3	2	32, 16	8, 3, 8, 4, 1
1214C DC/DC/DC	100 KB	4 MB	10 KB	6	4	3	8	32, 16	8, 3, 8, 4, 1
1214C DC/DC/RLY	100 KB	4 MB	10 KB	6	0 w/o SB 4 w SB	3	8	32, 16	8, 3, 8, 4, 1
1214C AC/DC/RLY	100 KB	4 MB	10 KB	6	0 w/o SB 4 w SB	3	8	32, 16	8, 3, 8, 4, 1
1215C DC/DC/DC	125 KB	4 MB	10 KB	6	4	3	8	32, 16	8, 3, 8, 4, 1
1215C DC/DC/RLY	125 KB	4 MB	10 KB	6	0 w/o SB 4 w SB	3	8	32, 16	8, 3, 8, 4, 1
1215C AC/DC/RLY	125 KB	4 MB	10 KB	6	0 w/o SB 4 w SB	3	8	32, 16	8, 3, 8, 4, 1
1217C DC/DC/DC	150 KB	4 MB	10 KB	6	4	3	8	32, 16	8, 3, 8, 4, 1
1214FC DC/DC/DC	125 KB	4 MB	10 KB	6	4	3	8	32, 16	8, 3, 8, 4, 1
1214FC DC/DC/RLY	125 KB	4 MB	10 KB	6	0 w/o SB 4 w SB	3	8	32, 16	8, 3, 8, 4, 1
1215FC DC/DC/DC	150 KB	4 MB	10 KB	6	4	3	8	32, 16	8, 3, 8, 4, 1

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1 CPU features matrix

CPU	Memory			Number of		Number of communication modules (left side of CPU)[4]	Number of expansion modules (right side of CPU)	Number of PB slaves, PN devices[5]	Number of communication connections (Open User, GET/PUT server, GET/PUT client, HMI, PG)
	Work	Load[1]	Reten-tive	HSC[2]	PTO[3]				
1215FC DC/DC/RLY	150 KB	4 MB	10 KB	6	0 w/o SB 4 w SB	3	8	32, 16	8, 3, 8, 4, 1

1 Expandable up to SD card size
2 As of V 4.0, HSCs can be configured to use any built-in or Signal Board (SB) inputs
3 As of V 4.0, PTOs can be configured to use any built-in or Signal Board (SB) solid state outputs
4 PROFIBUS, AS-i, RS485/RS232, GPRS, CANopen, or WANCP modules
5 32 PROFINET/PROFIBUS devices per channel: 3 PROFIBUS channels supported, 1 PROFINET channel supported

NOTE Refer to the S7-1200 Programmable Controller System Manual, 01/2015, for further information.

2 Firmware (FW) feature details listing

2.1 Firmware V2

2.1.1 Firmware V02.00.02

These are the changes in this firmware:

- Block limit is only limited by the size of load memory to a maximum of 1024 blocks.
- The system clock is compared to the real-time clock (RTC) hourly to maintain the accuracy of the system clock to within the RTC specification.
- The CPU responds to a download in the following ways:
  - In Firmware V1.0, the CPU internally forces a cold restart on the first STOP/RUN transition if any block is downloaded.
  - In Firmware V2.0, the default always performs a warm restart unless the project is loaded with STEP 7 V10.5, then the behavior is the same as a Firmware V1.0 CPU.
- The scheduling of the cyclic OBs matches the S7-1500 in that the first execution of the cyclic OB is sometime within the configured cycle time. The first cyclic OB execution is exactly the configured cycle time in Firmware V1.0.
- The setting of daylight saving time is configured in local time instead of in system time as in Firmware V1.0.
- The T-Block instructions only assert their outputs (DONE, ERROR, and STATUS) for one execution of the instruction. Firmware V1.0 asserts the outputs as long as the REQ input is active. The T-Block instructions' ENO output shows a failure only when the ERROR output is TRUE. Ad-hoc mode allows all byte-size data types.
- The PtP (Point-to-Point) instructions only assert their outputs (DONE, ERROR, and STATUS) for one execution of the instruction. Firmware V1.0 asserts the outputs as long as the REQ input is active. The STRING data type transmits the characters, but not the length fields.
- Instruction errors in call sequences abort the call. Instructions set outputs to zero in case of execution errors.
- MUX (Multiplex) and JMP_LIST (Define Jump List) instructions support 256 operands.
- String instructions support zero length strings and all possible overlaps.

These are the features added in this firmware:

- Support for binding a program to a CPU or SD (Secure Digital) card
- Web server support for standard web pages, user-defined web pages, login for password-protected pages, data log access, secure web pages (HTTPS-selected access), and ability to change operating mode
- User Data Log functionality
- GET/PUT functionality
- Support for ten runtime meters
- Distributed I/O communications
- Additional diagnostic support

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- Ability to change the IP address from the user program
- Interrupt OB control functions to set and query time delay and cyclic interrupts
- Conversions for STRING data type to/from LREAL (64-bit Real or floating-point value)
- Conversions for STRING data type to/from character arrays
- The S7-1200 decentralized I/O system (combined PROFINET and PROFIBUS) supports a maximum of 16 devices or 256 modules (whichever comes first).
- Support for the PROFIBUS slave module
- Support for the PROFIBUS master module up to the limits of the decentralized I/O system
- PROFINET controller functionality for up to 8 devices or 128 modules (whichever comes first) and subject to limits of the decentralized I/O system
- Support for new signal boards: 1AI, 1RTD, 1TC, RS485

2.1.2 Firmware V02.01.02

These are the features added in this firmware:

- New BMC (Basic Motion Control) version
- Support for the GPRS module

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2.1.3 Firmware V02.02.00

These are the features added in this firmware:

- DLiR (Limited Download in Run)
- Support for AS-i decentralized I/O system module

These are the behavior changes in this firmware:

- If "Reaction without OB" configuration is STOP and OB80 is missing, then the CPU goes to STOP on the first overrun, not the second overrun.
- A user program can only execute the RE_TRIGR (Restart cycle monitoring time) instruction a maximum of ten times within a single scan.
- When the "Program card" is pulled, the CPU keeps its IP address.
- WRIT_DBL (Write to data block (DB) in load memory) increments the runtime-modified timestamp of the DB by 100ns.
- READ_DBL (Read from data block (DB) in load memory) and WRIT_DBL(Write to data block (DB) in load memory) work only when the destination and the source are of the same type (classic or typesafe).

NOTE Refer to the Delivery Release: SIMATIC S7-1200 Firmware Version 2.2, for further information.

2.2 Firmware V3

2.2.1 Firmware V03.00.00

These are the features added in this firmware:

- New and improved CPUs:
  - CPU 1215C DC/DC/DC, CPU 1215C DC/DC/Relay, and CPU 1215C AC/DC/Relay:
    - - 100 Kbytes of work memory
    - - Dual Ethernet
    - - Analog output
  - CPU 1211C, CPU 1212C, and CPU 1214C:
    - - Faster processing time
    - - Support for a maximum of four PTO (Pulse Train Output) (requires a signal board)
    - - Increased retentive memory (10240 bytes)
    - - Increased time-of-day hold-up time (20 days)
- Support for the battery board (BB 1297)
- Standard web page for performing a CPU firmware update
- Capability to configure up to three PROFIBUS or AS-I CM master modules
- Capability to connect up to three Comfort HMIs (allows six total Comfort HMI connections)
- Support for 32 PROFIBUS devices per PROFIBUS master
- Support for 16 PROFINET devices
- BMC (Basic Motion Control) support for a maximum of four PTO (Pulse Train Output)
- BMC (Basic Motion Control) does not require an HSC (High Speed Counter)

These are the behavior changes in this firmware:

- Security improvements
- Web server number of data logs decreased from 40 to 35.
- Increased the number of diagnostic buffer (ASLog) entries retentively saved to 50.

NOTE Refer to the Delivery Release for Innovated SIMATIC S7-1200 with Firmware Version 3.0, for further information.

2.2.2 Firmware V03.00.01

These are the behavior changes in this firmware:

- Web server: Created a variable page displaying incorrect value for MD0

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2.2.3 Firmware V03.00.02

These are the behavior changes in this firmware:

- Web server can log into a password-protected CPU.
- Security updates

2.3 Firmware V4

2.3.1 Firmware V04.00.00

These are the behavior changes in this firmware:

- New CPU 1217C DC/DC/DC:
  - 125 KB main memory
  - 85 ns execution time for Boolean operations
  - Integrated 1.5V DC differential inputs and outputs (line driver I/O)
  - 6 integrated HSCs (high speed counters) – with up to 1 MHz
  - 4 integrated PTOs (pulse train counters) for the control of up to 4 stepper motors simultaneously – with up to 1 MHz
- Secure PLC
  Protection against unauthorized code or process value changes; which helps to facilitate increased operational availability.
- Support for new Organization Blocks (OBs) with differences in priority levels and interrupts
- Support for the display of standard Web pages and user defined pages
- Web pages from a mobile device as well as from a PC. The standard Web pages are available in English, German, French, Spanish, Italian, and Simplified Chinese with this release.
- The "Download in Run" feature supports a maximum of twenty blocks that you can download in RUN mode. You can also add tags and modify tags in existing data blocks and function blocks and download the modified data blocks in RUN mode.
- The online and diagnostic tools of STEP 7 provide the means to perform a firmware update of your CPU, signal modules, communication modules, and attached signal or communication board.
- STEP 7 includes a trace and logic analyzer function that you can use with the V4.0 S7-1200 CPUs. With this feature, you can configure specific data that you want to trace and record when the CPU meets a trigger condition that you define. The CPU stores the recorded data, and STEP 7 provides tools for retrieving and analyzing the recorded data.
- New programming instructions:
  - Set tag on signal edge: R_TRIG, F_TRIG
  - Write local time: WR_LOC_T
  - String maximum length: MAX_LEN
  - Time of day interrupts: SET_TINTL, CAN_TINT, ACT_TINT, QRY_TINT

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- Process recipes: RecipeExport, RecipeImport
- Address handling: LOG2GEO, RD_ADDR
- Motion control: MC_WriteParam, MC_ReadParam
- Enable / disable password: ENDIS_PW

- HSC improvements to allow any HSC instruction input or output to be assigned to any built-in or SB digital input
- PTO/PWM improvements to allow any PTO/PWM instruction input or output to be assigned to any built-in or SB digital output
- Enhanced library features, including versioning

NOTE Refer to the Sales/Delivery Release: S7-1200 CPU V4.0, CPU 1217C and IO-Link Master SM 1278, for further information.

2.3.2 Firmware V04.00.01

These are the features added in this firmware:

- Released only the XL units:
  - Support for period measurement using High-Speed Counters (HSC)
  - Support for the B-Release of the 32GB memory card

2.3.3 Firmware V04.01.00

These are the features added in this firmware:

- You can now implement functional safety, using the hardware and firmware of the S7-1200 fail-safe CPUs and signal modules (SM) in conjunction with the safety program downloaded by the software (ES).
  Refer to the *S7-1200 Functional Safety Manual* (http://support.automation.siemens.com/WW/view/en/104547552) for further information.
- Simulation of S7-1200 CPUs with firmware version V4.0 and higher:
  - S7-PLCSIM V13 SP1 enables you to test your PLC programs on a simulated PLC without requiring actual hardware.
  - S7-PLCSIM is a separately installed application that operates in conjunction with STEP 7 in the TIA Portal.
  - You can configure your PLC and any associated modules in STEP 7, program your application logic, and then download the hardware configuration and program to S7-PLCSIM. You can then use the tools of S7-PLCSIM to simulate and test your program.
  - Refer to the online help for S7-PLCSIM for complete documentation.
  - Note that you cannot simulate fail-safe CPUs.
- Configuration control (option handling):
  - You can configure the hardware for a maximum machine configuration including modules that you might not actually use during operation.

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  - The configuration and designation of these flexible modules is new with this release of STEP 7 and the S7-1200.
  - Modules that you so designate do not cause error conditions if they are absent.
- The Web server now supports access through the IP address of selected (communications processor) modules in the local rack as well as through the IP address of the S7-1200 CPU.
- Enhanced motion functionality:
  - Analog and PROFIdrive connections
  - Modulo and control loop extended parameters
- Period measurement using High-Speed Counters (HSC)
- Performance improvements to the SCL compiler
- Dynamic copy protection binding of program blocks with a mandatory password
- Enhanced PROFINET functionality, including support for shared devices.
- New programming instructions:
  - EQ_Type, NE_Type, EQ_ElemType, NE_ElemType
  - IS_NULL, NOT_NULL
  - IS_ARRAY
  - Deserialize, Serialize
  - VariantGet, VariantPut, CountOfElements
  - Variant_to_DB_Any, DB_Any_To_Variant
  - GET_IM_DATA
  - RUNTIME
  - GEO2LOG, IO2MOD
  - ReadLittle, WriteLittle, ReadBig, WriteBig (SCL only)
  - T_RESET, T_DIAG, and TMAIL_C
  - PID_Temp
  - New Modbus instructions
  - New Point-to-point (PtP) instructions
  - New USS instructions
- New Industrial Remote Communication modules expand the power of the S7-1200 CPU and provide flexibility: You can use these CPs as communication modules with the S7-1200 V4.1 CPU:
  - CP 1242-7 GPRS, V2.1 (6GK7 242-7KX31-0XE0)
  - CP 1243-7 LTE, V2.1 (6GK7 243-7KX30-0XE0)
- Four fail-safe CPUs and three fail-safe signal modules (SM) (in conjunction with the S7-1200 V4.1 or later release) expand the power of the S7-1200 CPU and provide flexibility:
  - CPU 1214FC DC/DC/DC (6ES7 214-1AF40-0XB0)
  - CPU 1214FC DC/DC/RLY (6ES7 214-1HF40-0XB0)
  - CPU 1215FC DC/DC/DC (6ES7 215-1AF40-0XB0)
  - CPU 1215FC DC/DC/RLY (6ES7 215-1HF40-0XB0)
  - SM 1226 F-DI 16 x 24 VDC (6ES7 226-6BA32-0XB0)

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- SM 1226 F-DQ 4 x 24 VDC (6ES7 226-6DA32-0XB0)
- SM 1226 F-DQ 2 x Relay (6ES7 226-6RA32-0XB0)

- You can use the S7-1200 standard signal modules (SM), communication modules (CM), and signal boards (SB) in the same system with fail-safe SMs to complete your application control functions that do not require a functional safety rating. Standard SMs that are supported for use with fail-safe SMs have the article numbers (6ES7 --- ---32-0XB0) or later.

NOTE Refer to the Delivery Release for Fail-Safe SIMATIC S7-1200 CPU with Firmware 4.1 for further information.

2.3.4 Firmware V04.01.01

The following defects were corrected:

- In V4.1.0, upon execution, the "MC_WriteParam" instruction correctly writes the value to the destination; however, the instruction overwrites the source byte. The first three bits of the source byte can be changed to "1", and the remainder of the byte is set to "0".
- In V4.1.1, the "MC_WriteParam" instruction writes the Boolean value correctly to the destination and does not clear the source byte.
- Webserver: Duplicate SSL Certificate Serial Numbers

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