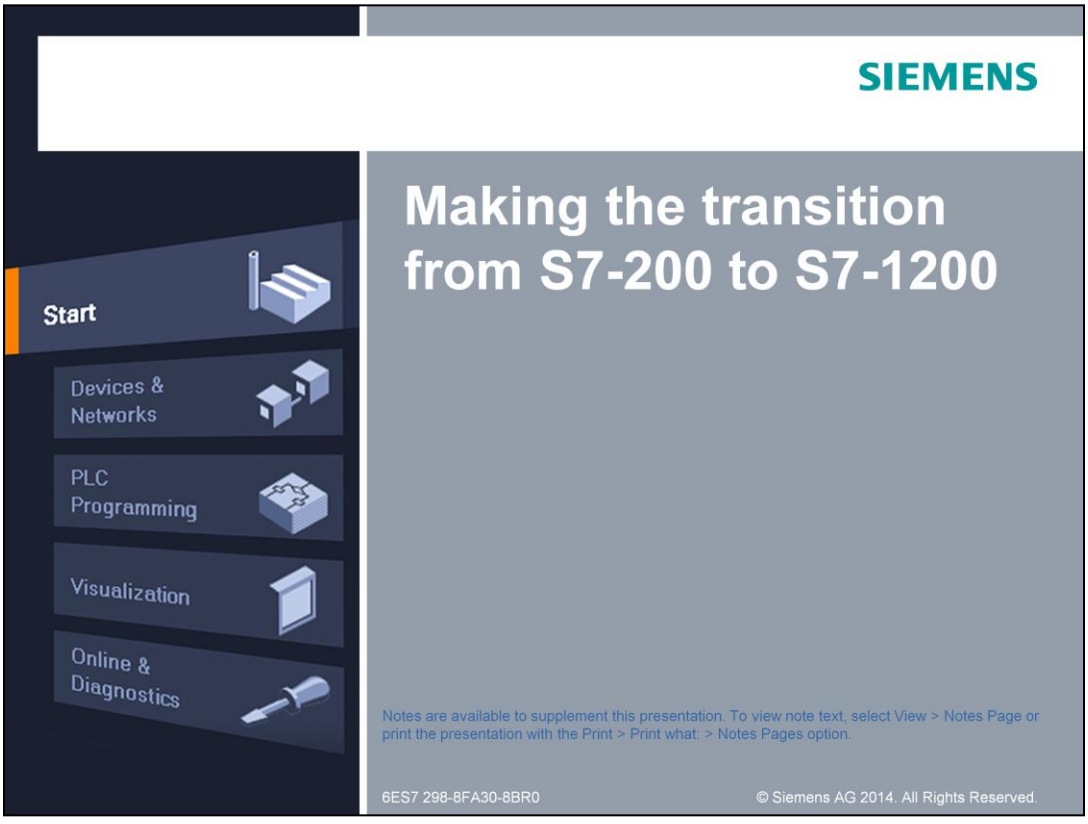


S7-1200 and TIA portal software

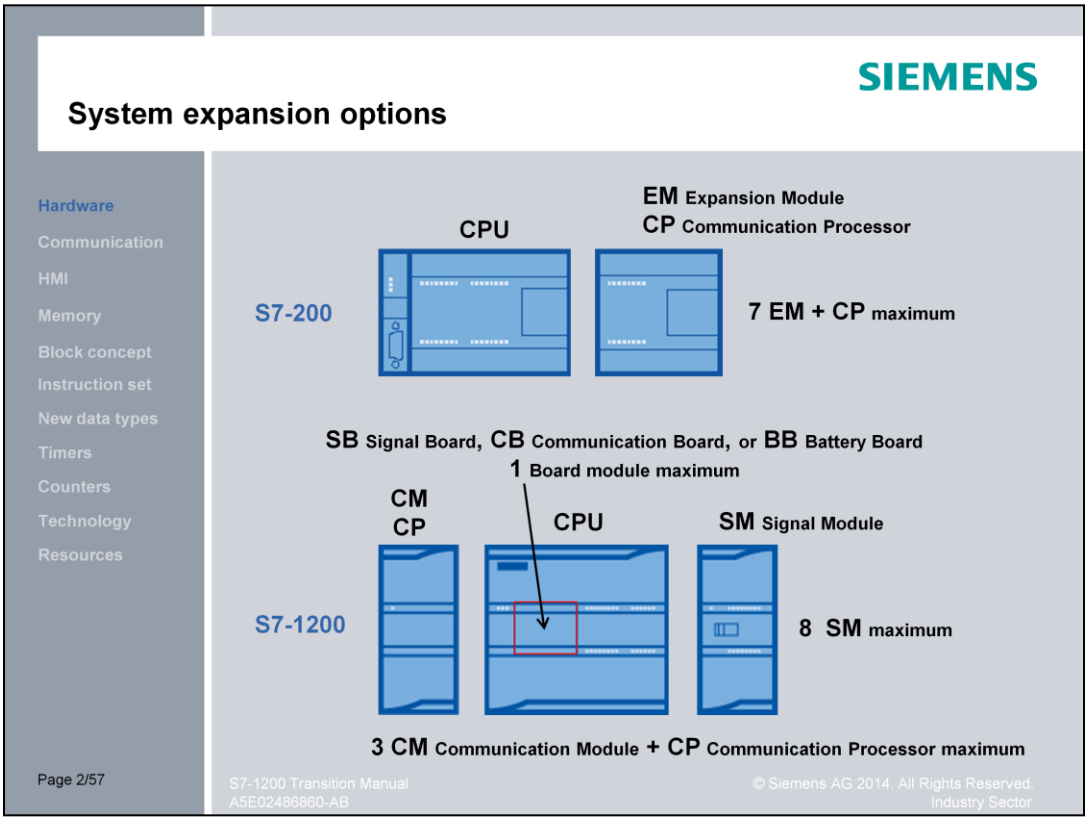
- The S7-1200 is the successor of the S7-200. The S7-1200 is designed for and sold in the world-wide marketplace.
- The SIMATIC S7-200 products are declared phased-out products effective 10/01/2013. With their phase-out declaration, the products will still be available as new components for another year until 10/01/2014. After that, the products can be obtained as spare parts for an additional 9 years. For new applications, it is recommended to employ SIMATIC S7-1200 products with the configuration software STEP 7 Basic.
- The TIA portal with STEP 7 Basic programming (ordered separately from the hardware) is used for programming the S7-1200.
  - Provides LAD (Ladder diagram, FBD (Function Block Diagram), and SCL (Structured Control Language) programming editors.
  - STL (Statement List) programming is not supported.
  - Includes WinCC Basic for configuring HMI Basic panels.
  - No separate USB license stick is required. The software is automatically activated when installed.
- To move project files from one PC to another PC, use the Windows explorer and file compression to copy the project directory structure.

S7-1200 Agency approvals

- S7-1200 hardware has the necessary approvals for the US and European market.
- The S7-1200 has cFMus approval for hazardous locations:

The Factory Mutual Research FM): Approval Standard Class Number 3600 and 3611
Approved for use in:
- Class I, Division 2, Gas Group A, B, C, D, Temperature Class T3C, Ta = 60° C
- Class I, Zone 2, IIC, Temperature Class T3 , Ta = 60° C

- The S7-1200 hardware has cULus and CE approvals.



S7-1200	CPU Digital I/O	CPU Analog I/O	CPU Power and I/O type
CPU 1211C	6 IN - 4 OUT	2 IN	Available in three options of CPU power / input type / output type. • DC / DC / DC • AC / DC / Relay • DC / DC / Relay
CPU 1212C	8 IN – 6 OUT	2 IN	
CPU 1214C	14 IN -10 OUT	2 IN	
CPU 1215C	14 IN -10 OUT	2 IN - 2 OUT	
CPU 1217C	10 IN Sink/source 4 IN 1.5V differential 6 OUT MOSFET sourcing 4 OUT 1.5V differential	2 IN - 2 OUT	Available as DC / DC / DC only

S7-1200 communication options
On-board PROFINET network connection
CB 1241 RS485
CM 1241 RS232
CM 1241 RS485
CM 1241 RS422/485
CP 1242-7 GPRS
CM 1242-5 PROFIBUS slave
CM 1243-5 PROFIBUS master
CM 1243-1 DNP3 Ethernet WAN
CM 1243-1 IEC Ethernet WAN
CP 1243-1 Ethernet WAN (firewall and VPN)
CM 1243-2 AS-I master
RF120C RFID
TS Adapter and TS adapter modular for SIMATIC Teleservice

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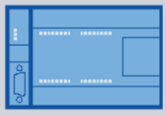
CPU built-in and SB I/O options

Hardware
Communication
HMI
Memory
Block concept
Instruction set
New data types
Timers
Counters
Technology
Resources

		S7-200 CPU 224XP	S7-1200				
			1211C	1212C	1214C	1215C	1217C
DI Digital Input	CPU	14	6	8	14	14	14
	SB		4	4	4	4	4
DO Digital Output	CPU	10	4	6	10	10	10
	SB		4	4	4	4	4
AI Analog Input	CPU	2	2	2	2	2	2
	SB		1	1	1	1	1
AO Analog Output	CPU	1				2	2
	SB		1	1	1	1	1
PWM / PTO Pulse Output (uses CPU or SB outputs)		2	4	4	4	4	4
HSC High-Speed Counter (uses CPU or SB inputs)		6	6	6	6	6	6



SB, CB, and BB modules expand S7-1200 capability without increasing the footprint area

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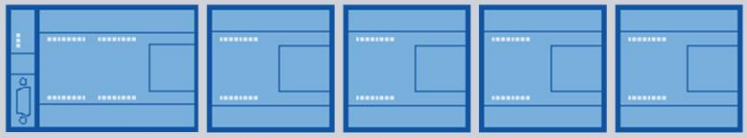
S7-1200 Transition Manual
A5E02486860-AB

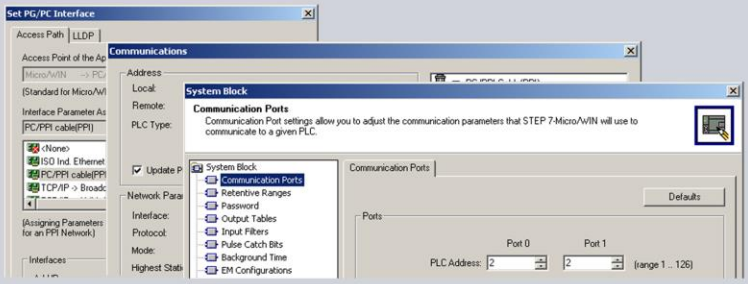
S7-1200 I/O options		
Digital and analog signal modules	SM 1221 digital IN	DI 8 x 24 VDC
		DI 16 x 24 VDC
	SM 1222 digital OUT	DQ 8 x Relay
		DQ 8 x Relay NO/NC contacts
		DQ 8 x 24 VDC
		DQ 16 x Relay
		DQ 16 x 24 VDC
	SM 1223 digital IN/OUT	DI 8 x 24 VDC / DQ 8 x Relay
		DI 16 x 24 VDC / DQ 16 x Relay
		DI 8 x 24 VDC / DQ 8 x 24 VDC
		DI 16 x 24 VDC / DQ 16 x 24 VDC
		DI 8 x 120/230 VAC / DQ 8 x Relay
	SM 1231 analog IN	AI 4 x 13 bit, AI 8 x 13, AI 4 x 16
	SM 1232 analog OUT	AQ 2 x 14 bit, AQ 4 x 14
	SM 1234 analog IN/OUT	AI 4 x 13 bit / AQ 2 x 14 bit
Thermocouple and RTD signal modules	SM 1231 thermocouple IN	AI 4 x 16 bit TC, AI 8 x 16 TC
	SM 1231 RTD	AI 4 x RTD x 16 bit, AI 8 x RTD x 16
Digital signal boards	SB 1221 digital IN	DI 4 x 24 VDC, 200 kHz
		DI 4 x 5 VDC, 200 kHz
	SB 1222 digital OUT	DQ 4 x 24 VDC, 200 kHz
		DQ 4 x 5 VDC, 200 kHz
	SB 1223 digital IN/OUT	DI 2 x 24 VDC / DQ 2 x 24 VDC, 200 kHz
		DI 2 x 5 VDC / DQ 2 x 5 VDC, 200 kHz
Analog signal boards	SB 1231 analog IN	AI 1 x 12 bit
	SB 1231 analog OUT	AQ 1 x 12 bit
Thermocouple and RTD signal boards	SB 1231 Thermocouple IN	AI 1 x 16 bit TC
	SB 1231 RTD IN	AI 1 x 16 bit RTD
IO-Link technology	SM 1278 4xIO-Link Master	DI 4x24 VDC or DQ 4x 24 VDC
Weighing technology	SIWAREX	WP231, WP241

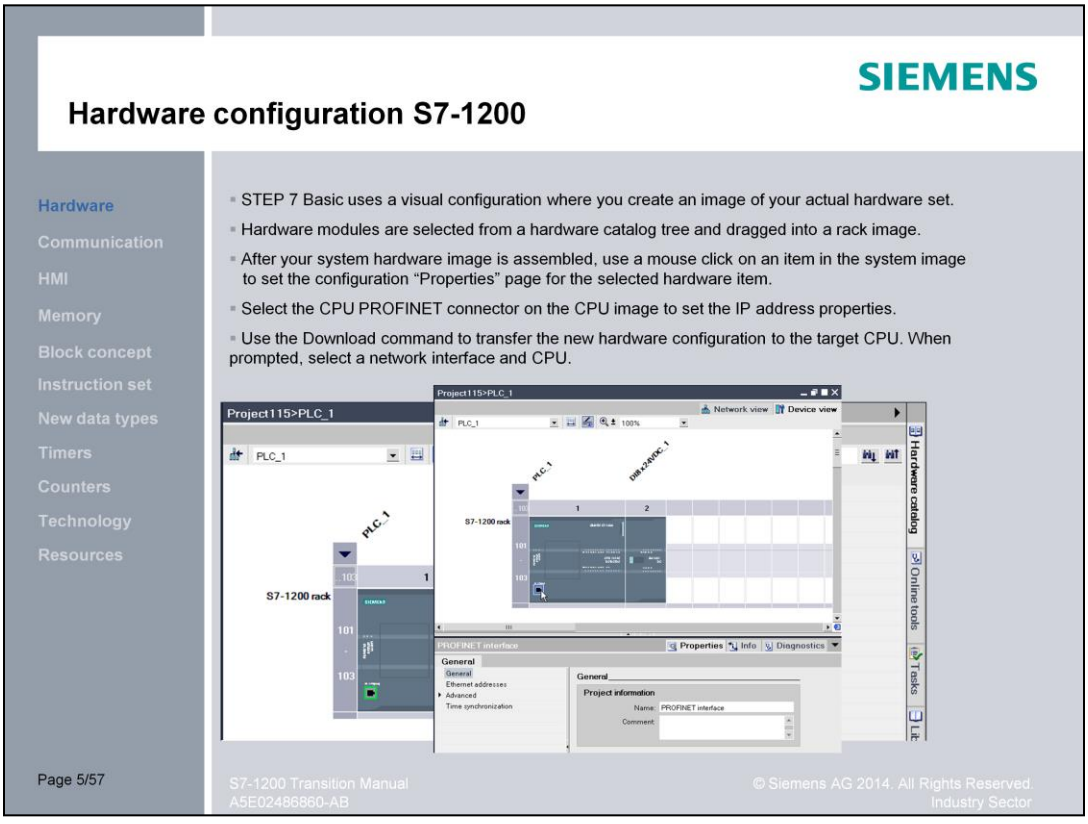
SIEMENS

Hardware configuration S7-200



- Expansion modules are automatically recognized when connected and powered
- STEP 7-Micro/WIN “SET PG/PC Interface” window configures the communication driver
- STEP 7-Micro/WIN “Communications” uses the selected driver to scan and connect CPU stations
- STEP 7-Micro/WIN “System Block” window configures CPU parameters
- A System Block download operation transfers the new hardware configuration into the target CPU



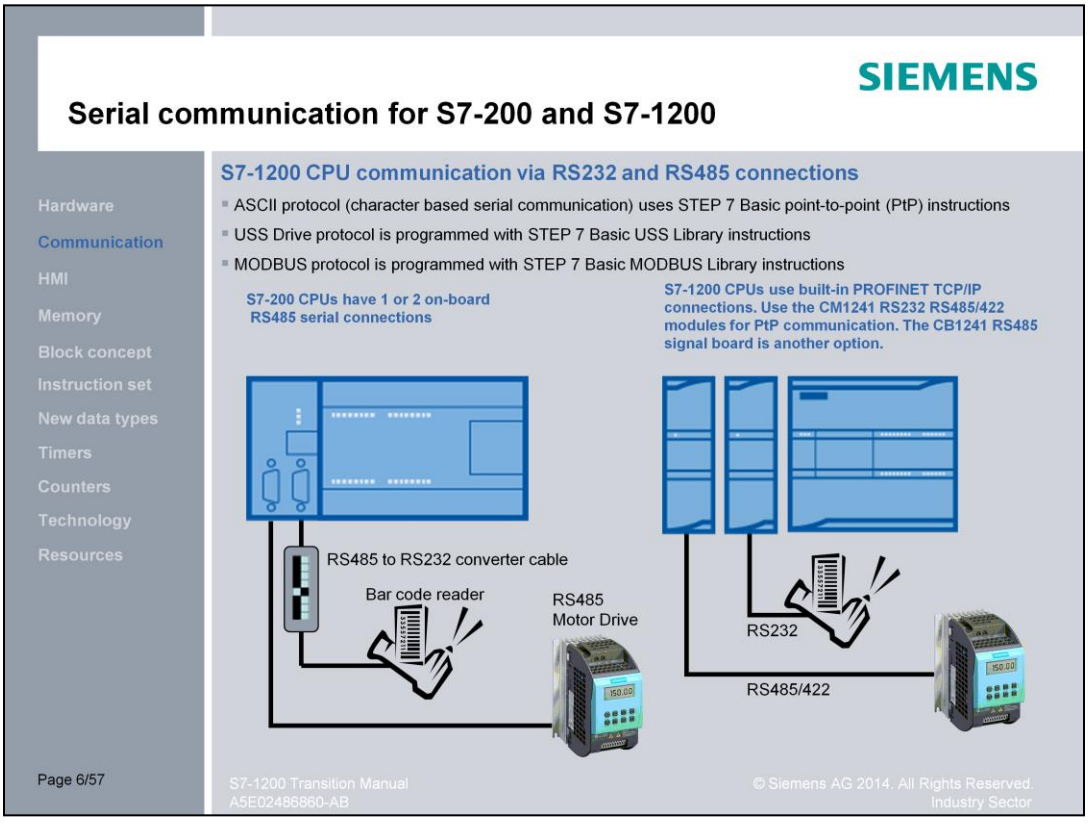


Password protection

- S7-200: Off-line block protection passwords provide know-how protection that prevents unauthorized access to your code blocks.
  The S7-200 on-line password level is assigned in the system block . There are no restrictions on any on-line password level to read/write user data, stop/start/restart the CPU, and read/write the time-of-day clock.
  - Level 1 full access: No protection
  - Level 2 restricted access: A password is required to download to a CPU, view STL status, delete user program/data/configuration, force program data, copy to the memory cartridge, and write to the outputs in STOP mode.
  - Level 3 restricted access: In addition to the level 2 restrictions, a password is also required to upload the user program, data, and the CPU configuration.
- S7-1200: Off-line block protection passwords provide know-how protection that prevents unauthorized access to your code blocks.
  The S7-1200 on-line password level is assigned in the CPU device configuration properties.
  - Level 1 full access: No protection
  - Level 2 read access: The CPU allows HMI access and all forms of PLC-to-PLC communications without password protection. Password is required for modifying (writing to) the CPU and for changing the CPU mode (RUN/STOP).
  - Level 3 HMI access: The CPU allows HMI access and all forms of PLC-to-PLC communications without password protection. Password is required for reading the data in the CPU, for modifying (writing to) the CPU, and for changing the CPU mode (RUN/STOP).
  - Level 4 No access: The CPU allows no access without password protection. A password is required for HMI access, reading the data in the CPU, for modifying (writing to) the CPU, and for changing the CPU mode (RUN/STOP).

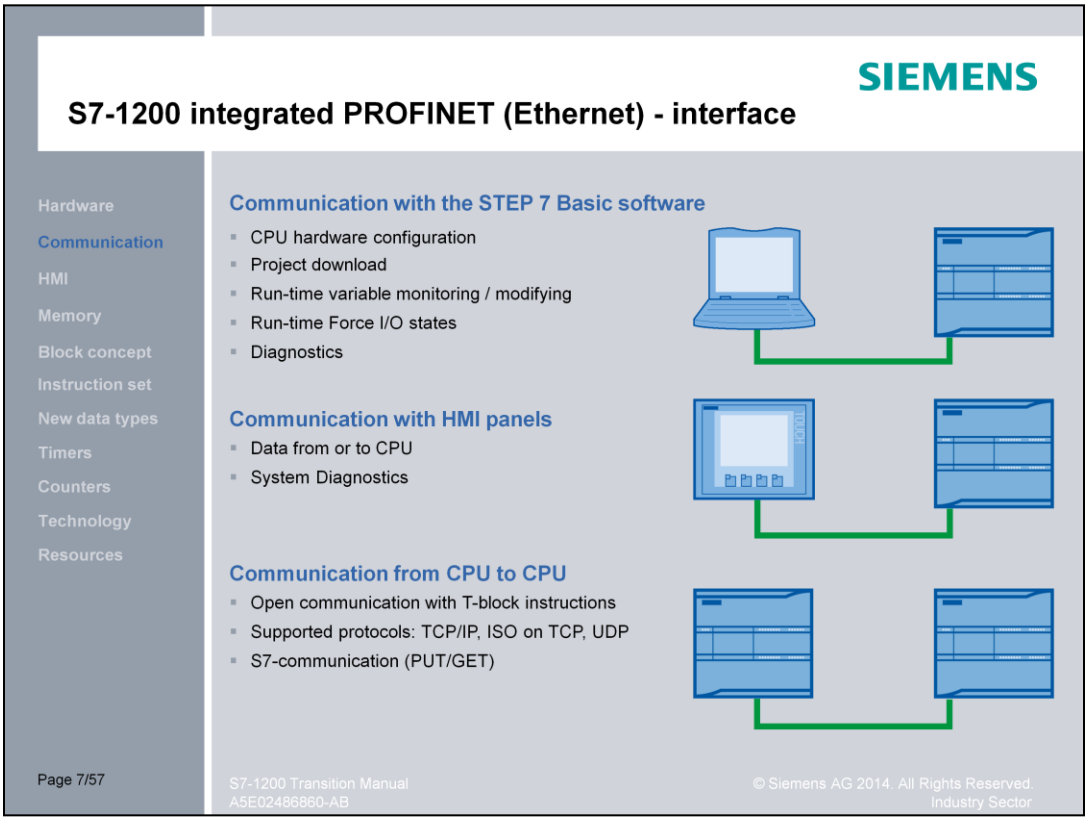
I/O address assignment

- S7-200 : I/O addresses are automatically fixed by the CPU operating system according to module location.
- S7-1200: The default I/O assignment can be modified by Device configuration properties.



S7-1200 serial communication

- MODBUS RTU is possible on both RS485/422 and RS232 signal modules.
- The USS library is supported on the RS485 port and is included with STEP 7 Basic.
- The CM 1241 RS232 module supports handshaking.
- The S7-1200 RS232 and RS485/422 modules have electrically isolated ports.

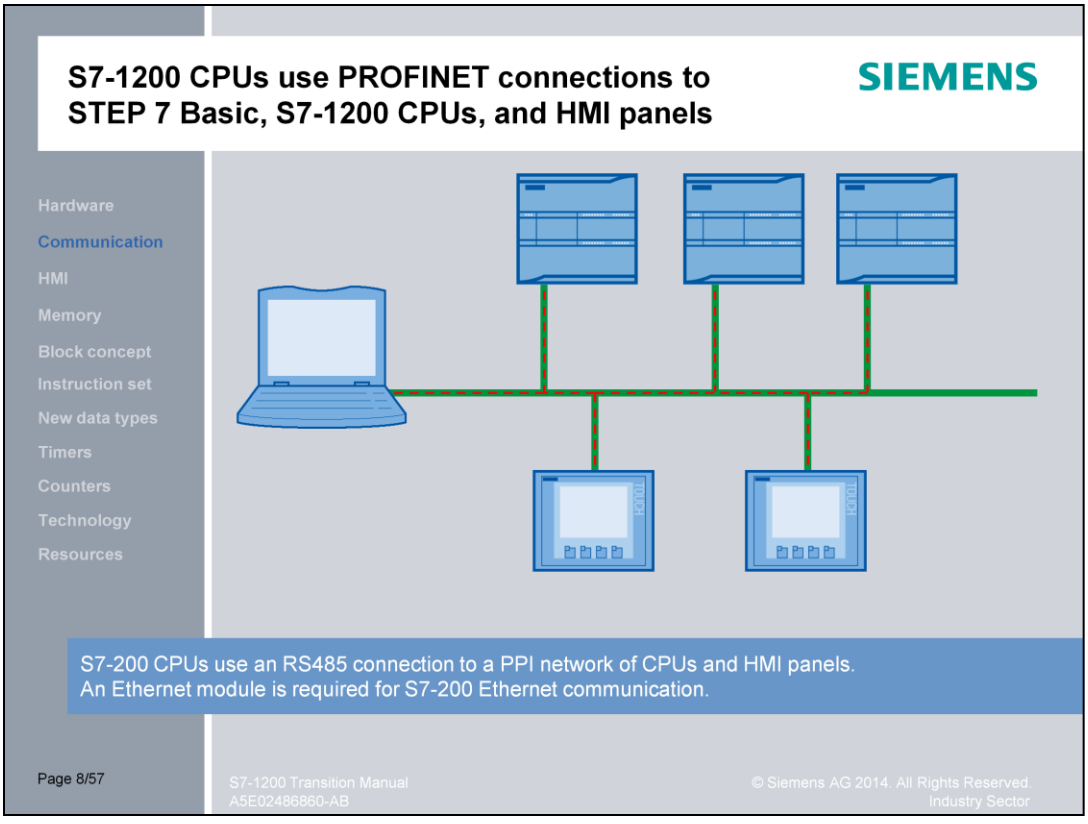


S7-1200 Ethernet communication

- The PROFINET port on the CPU supports simultaneous communication connections:

	Programming terminal (PG)	Human Machine Interface (HMI)	GET/PUT client/server	Open User Communications	Web browser
Maximum number of connection resources	**3** guaranteed to support 1 PG device	**12** guaranteed to support 4 HMI devices	**8**	**8**	**30** guaranteed to support 3 web browsers

- OPC server (Object Linking and Embedding – OLE) for Process Control server. OPC functionality is possible using the SIMATIC NET OPC Server.
- PROFINET functionality including controller and device
- The S7-1200 Ethernet interfaces are designated as PROFINET which supports PROFINET IO and iDevices.
- Communication with 3rd party devices via the Ethernet is supported. The S7-1200 has "Native" Ethernet TCP/IP protocol available ("FreePort" for Ethernet) for custom development of this functionality. It is possible to communicate with 3rd party PLCs as long as they support the same open Ethernet connectivity as the S7-1200.

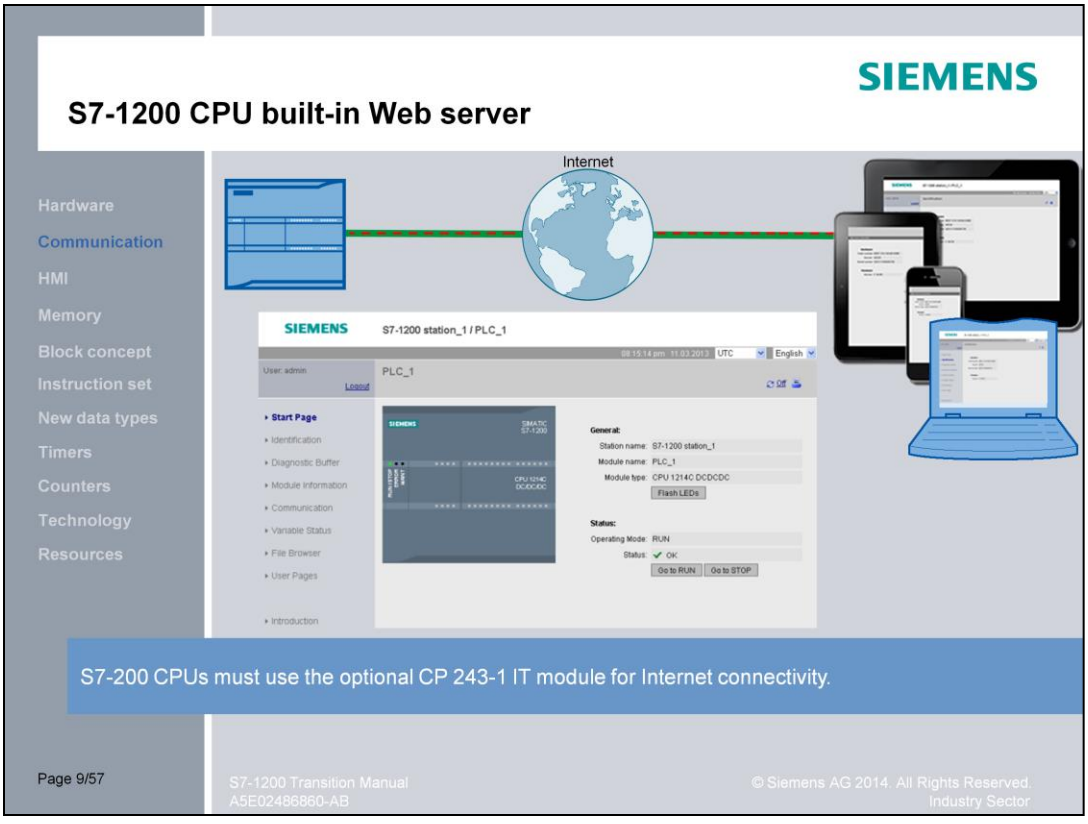


S7-1200 HMI general

- HMI Basic Panels can communicate with up to four S7-1200 CPUs.
- Compatibility with current HMI Ethernet devices
- MP277 and 377 (discontinued panels) can communicate with the S7-1200. Use WinCC flexible for programming and select the S7-300 communication channel (Rack 0 - Slot 0) at the start.

HMI update rate

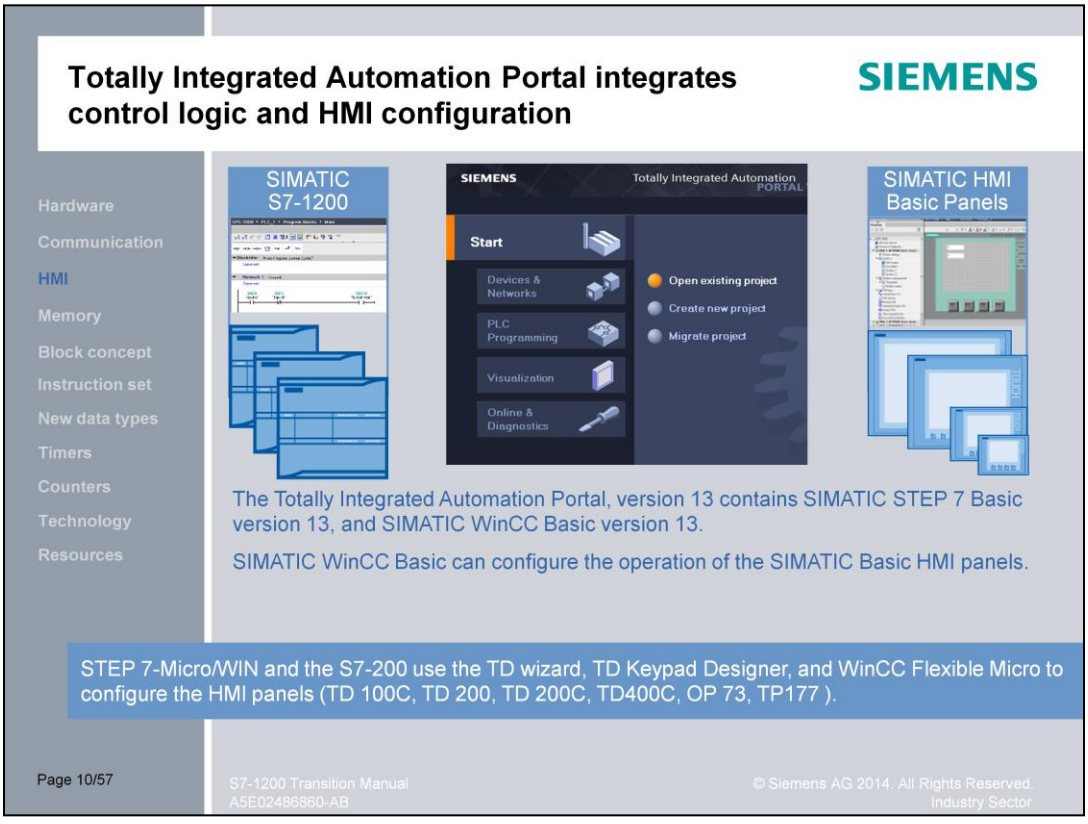
- S7-200: HMI data update occurs at end of the program scan and is therefore scan rate limited.
- S7-1200: HMI data update occurs asynchronously during the program scan. You must ensure that data variables are buffered from change, during program processing where new HMI data values are generated.



Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

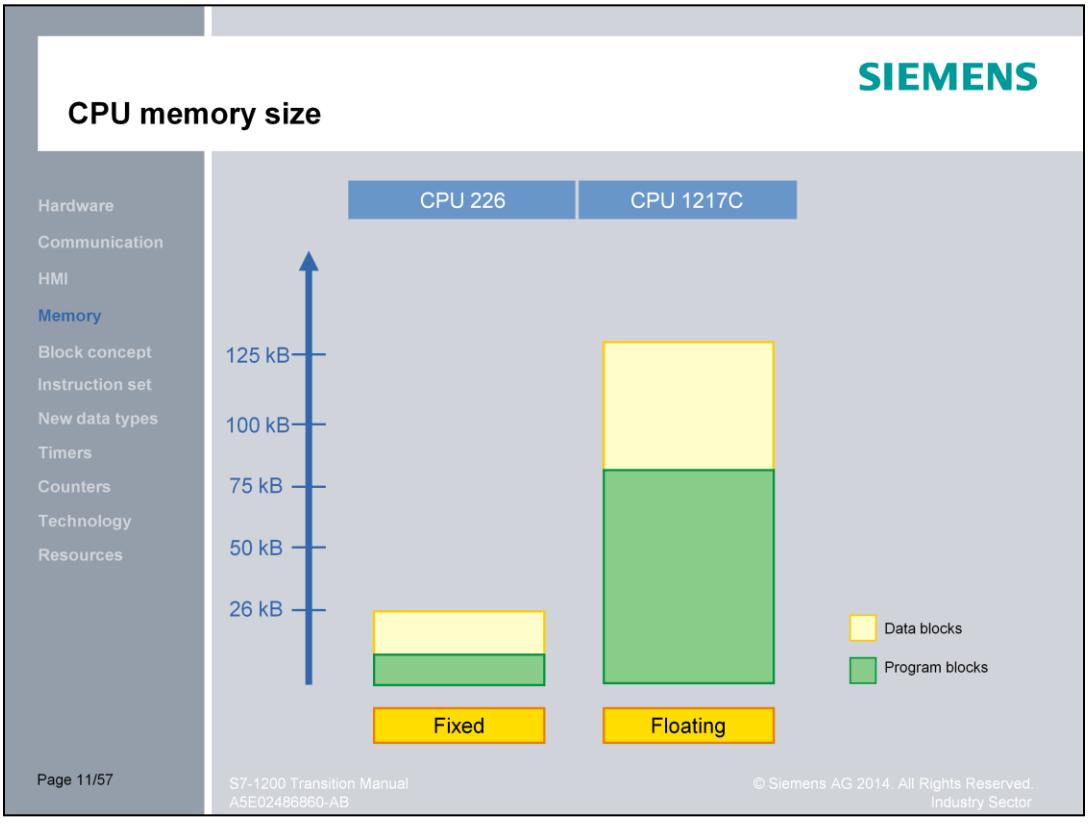
For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. You can find more information about industrial security on the Internet **(http://www.siemens.com/industrialsecurity**).

To stay informed about product updates as they occur, sign up for a product-specific newsletter. You can find more information on the Internet **(http://support.automation.siemens.com)**.



- HMI Basic panels require a PC for a download operation. They do not have memory cards.
- WinCC Flexible Micro will be available as long as HMI Micro panels (for the S7-200) are sold. At this time there are no plans for discontinuing the micro panel.
- Library graphics are created in WinCC Flexible.
- It is not possible to migrate any library items directly from WinCC Flexible to WinCC Basic. However, you can copy all the elements from the library to an HMI screen in a project and then migrate the resulting project into WinCC Basic.
- Changing from WinCC flexible to WinCC Basic: A firmware update is not necessary in the case of WinCC flexible 2008 and WinCC Basic.
- The S7-1200 does not support Sm@RtAccess or Sm@rtService.
- The TIA Portal provides the tools for managing and configuring the devices in your project, such as PLCs and HMI devices. As a component of the TIA Portal, STEP 7 Basic provides three programming languages (LAD, FBD, and SCL). The TIA Portal also provides the tools for creating and configuring the HMI devices in your project.

BASIC HMI panels supported by S7-1200 CPUs
1st gen: KP300 BASIC MONO PN, 3” monochrome LCD, 10 keys
1st gen: KP400 Basic COLOR PN, 4” -256 colors , 4 keys
1st gen: KTP400 BASIC MONO PN and COLOR PN, 4”-256 colors , touch, 4 keys
2nd gen: KTP 400 BASIC 4”- 65536 colors, touch, 4 keys
1st gen: KTP600 BASIC MONO PN, COLOR PN, and COLOR DP, 6”-256 colors, touch, 6 keys
2nd gen: KTP700 BASIC, 7”- 65536 colors, PROFINET, 8 keys
2nd gen: KTP900 BASIC, 9”- 65536 colors, PROFINET, 8 keys
1st gen: KTP1000 BASIC COLOR PN and COLOR DP, 10“-256 colors, touch, 8 keys,
1st gen: TP1500 BASIC COLOR PN 15“-256 colors, touch



STEP 7 Basic program objects in S7-1200 CPU memory

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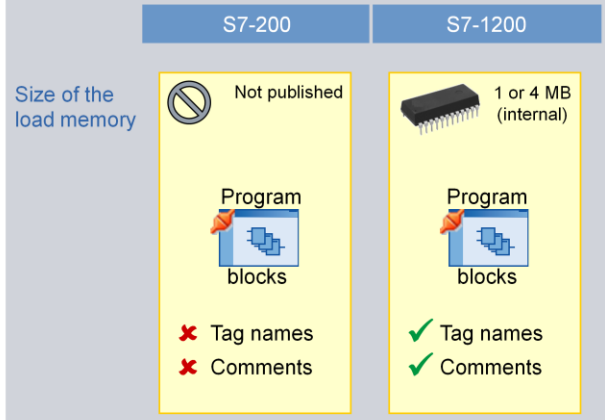
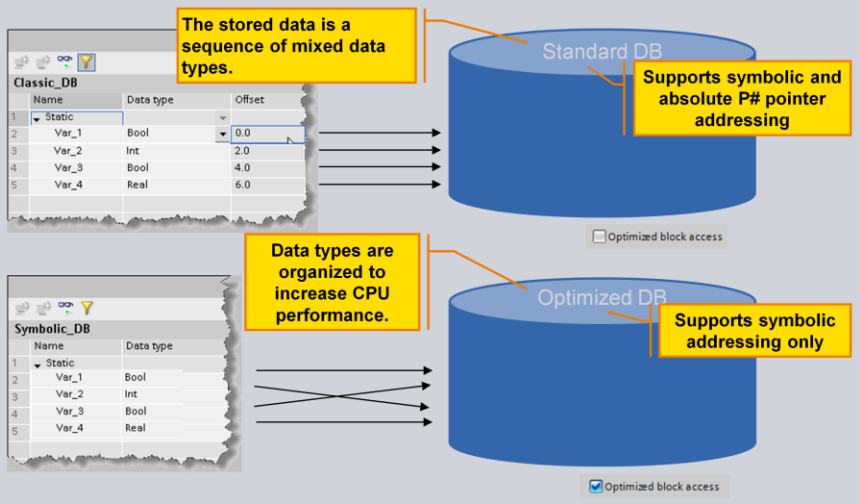


Program tag names and comments are stored in S7-1200 CPU memory and are available online. For STEP 7-Micro/WIN and S7-200 CPUs, you must have the original .mwp project file to associate symbolic tag names and comments with the online program logic.

Step 7 Basic supports standard and optimized Data Block formats

SIEMENS

- Hardware
- Communication
- HMI
- Memory
- Block concept
- Instruction set
- New data types
- Timers
- Counters
- Technology
- Resources



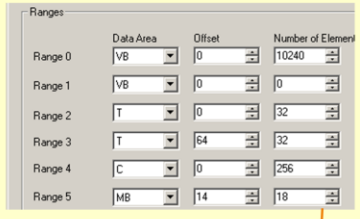
By default, the “Optimized block access” block property is enabled. This property can be disabled to support the standard block format, for legacy code.

Retentive memory assignments preserve data during CPU power interruptions

SIEMENS

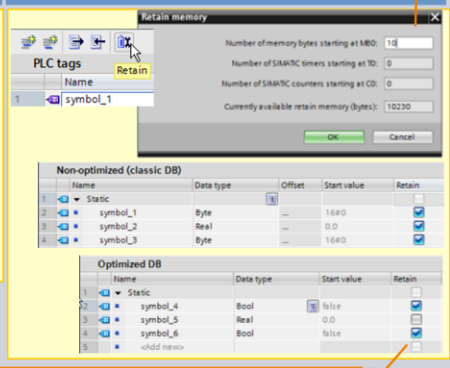
The PLC Tag table button can assign a range of M memory as retentive.

S7-200



S7-200 system block settings can assign 6 retentive ranges in V, T and C actual values, or M.

S7-1200



An optimized DB can select individual data elements for retention. If "Optimized block access" is not enabled, then only a block of DB data can be retentive. The available retentive memory is shared between M and DB memory.

The S7-1200 CPU automatically stores retained data in internal flash memory.
The S7-200 retains data in RAM by using a supercapacitor and optional battery cartridge. Also, 14 bytes of M memory and data specified in programmed write operations can be saved in flash memory.

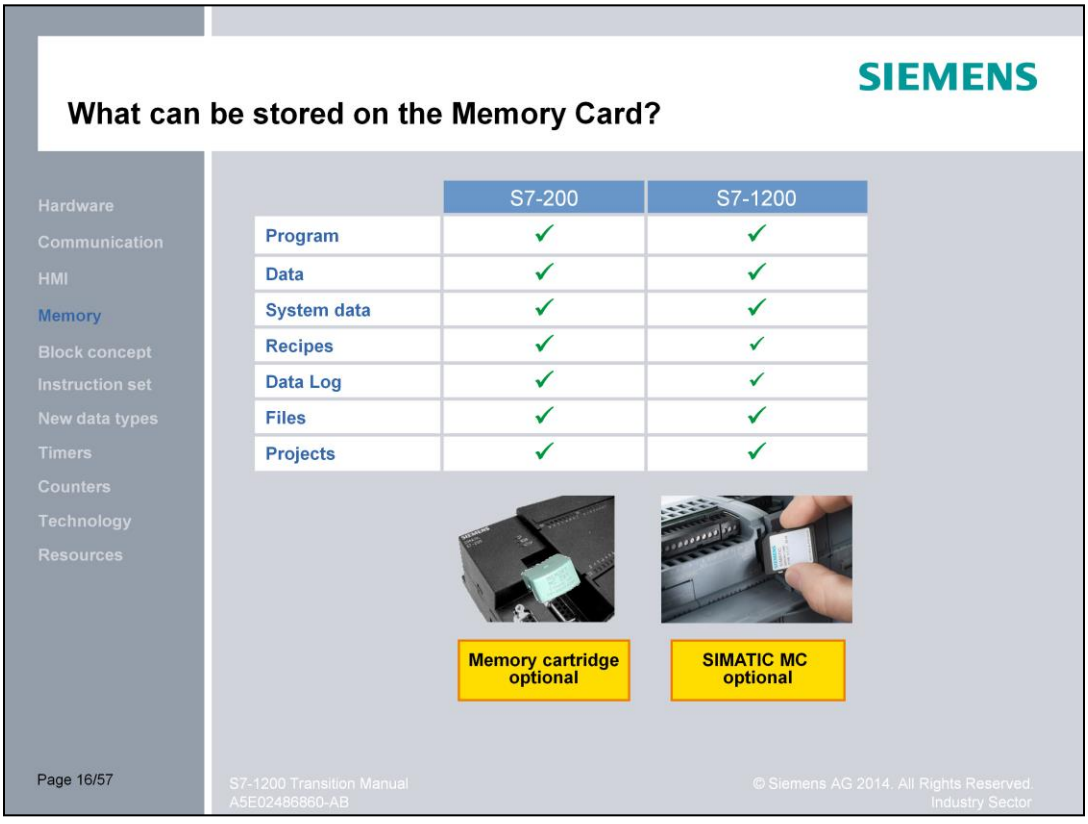
Optional Memory Card capacity

SIEMENS

- Hardware
- Communication
- HMI
- Memory
- Block concept
- Instruction set
- New data types
- Timers
- Counters
- Technology
- Resources

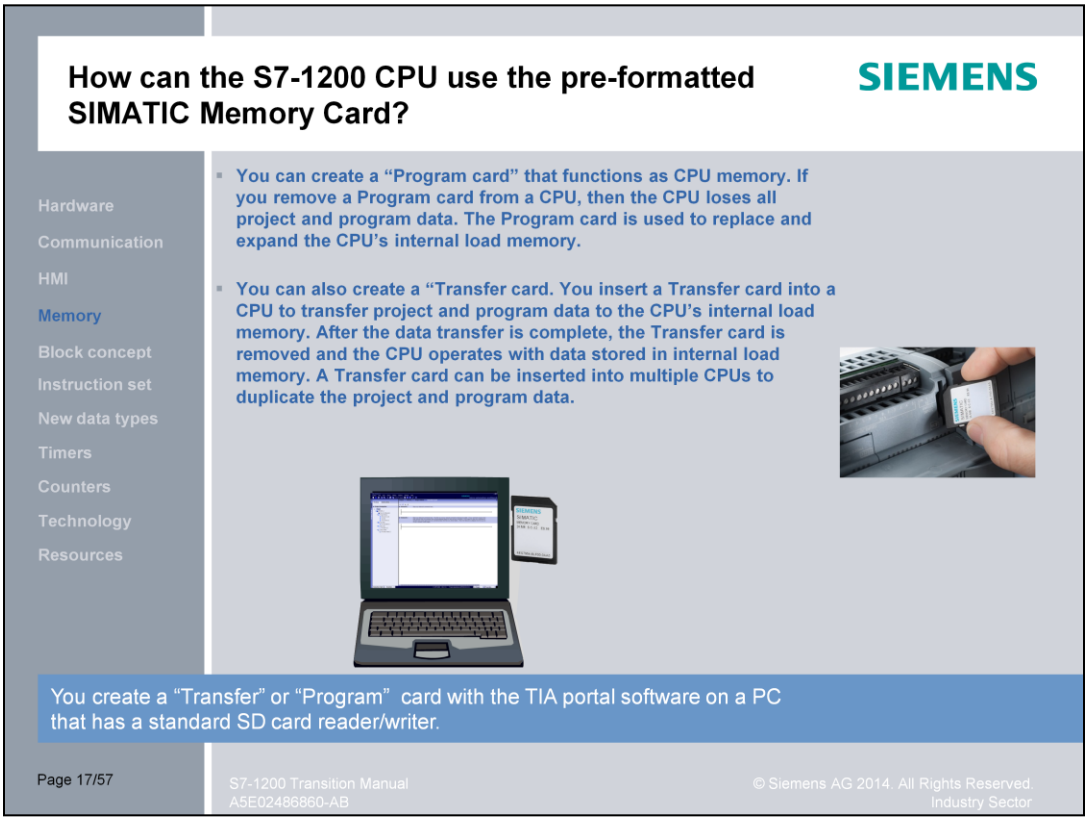
S7-200 Memory cartridge sizes
64 KB
256 KB

S7-1200 SIMATIC memory card sizes
4 MB
12 MB
24 MB
256 MB
2 GB



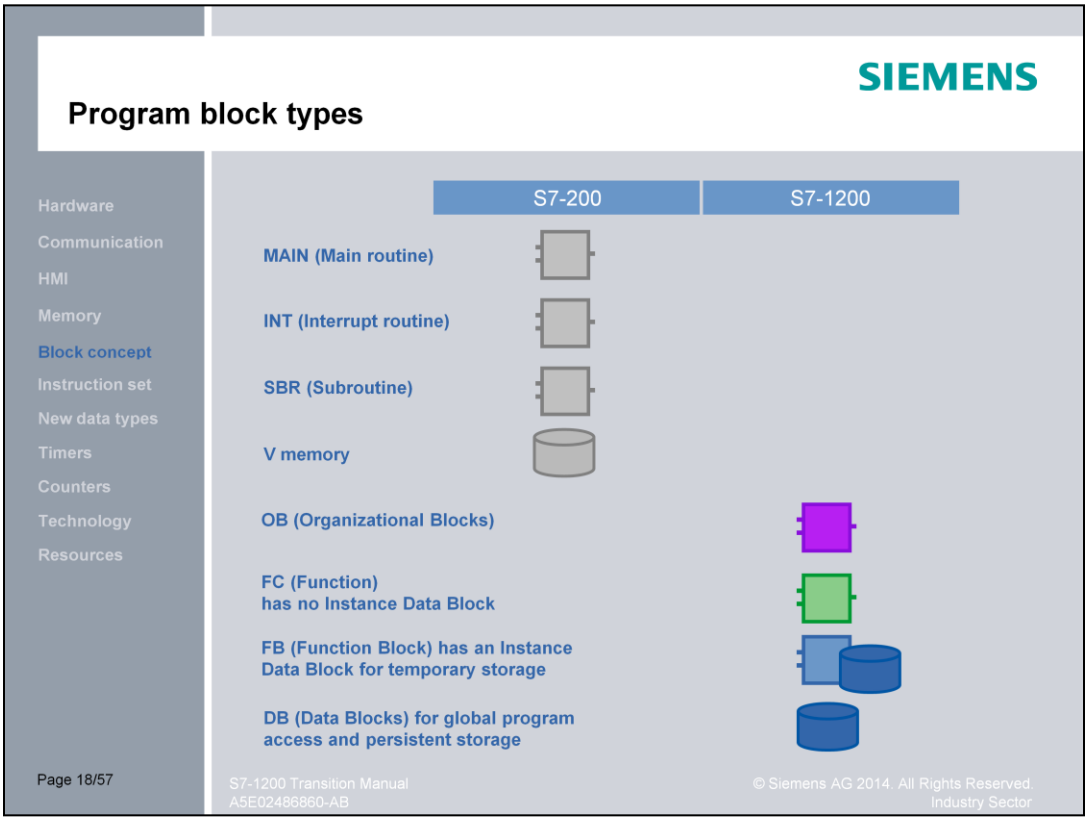
S7-1200 memory cards

SIMATIC memory cards have a Windows file system and comply with the necessary industrial requirements. The memory card can be written to and read in a PC with standard SD slot and then used again for operation in a CPU.



S7-1200 SIMATIC memory card usage

- Before programming a memory card, be sure there is a valid network configuration in your project so that it can connect to the PLC after installing the card.
- SIMATIC memory cards are pre-formatted with a SIMATIC memory format that must be preserved. Do not use a PC to delete the two hidden files __log__ (system file) and crdinfo.bin (bin file). Do not use a PC to reformat the memory card or the card will become unusable.
- Refer to the S7-1200 Programmable controller system manual for details on how to create and use a “Program” card and “Transfer” card.



S7-1200 Organization Block (OB) types:

- Program cycle OB1
- Startup OB100 series
- Time delay interrupt OB200 series
- Cyclic interrupt OB200 series
- Hardware interrupt OB200 series
- Time error interrupt OB80
- Diagnostic error interrupt OB82
- Pull or plug of modules OB83
- Rack or station failure OB86
- Time of day OB10
- Status OB55
- Update OB56
- Profile OB57

Non-fatal error handing

- S7-200: By default, continue RUN mode
- S7-1200: By default, go to STOP mode
  - If OB80 or OB82 error OB blocks exist in your program, then continue RUN mode.
  - OB80 and OB82 may be empty or contain your programmed error reaction.

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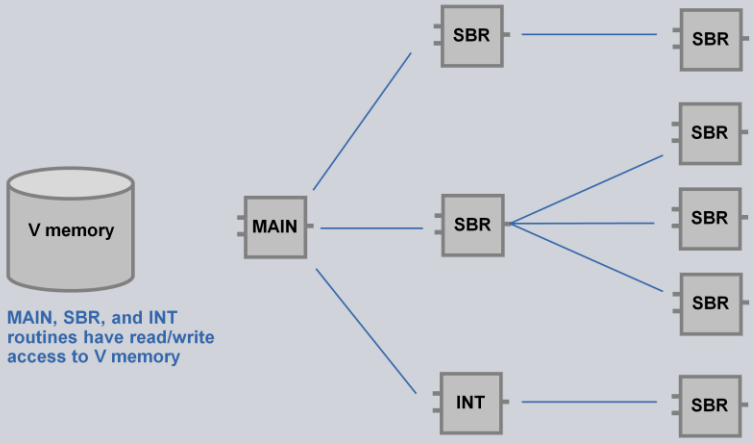
S7-200 program structure in STEP 7-Micro/WIN

Hardware
Communication
HMI
Memory
Block concept
Instruction set
New data types
Timers
Counters
Technology
Resources



MAIN, SBR, and INT routines have read/write access to V memory

The maximum nesting depth for subroutines from the Main is 8, and from an Interrupt routine is 1.

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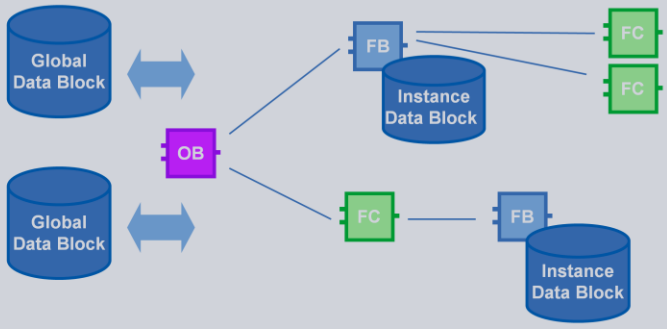
SIEMENS

S7-1200 program structure in STEP 7 Basic



The maximum nesting depth is 16

STEP 7 Basic has the same block architecture used by the S7-300

- Modularization and reuse is easier
- Technology objects (for example, PID control) can be standardized and called multiple times
- Symbolic reference is possible

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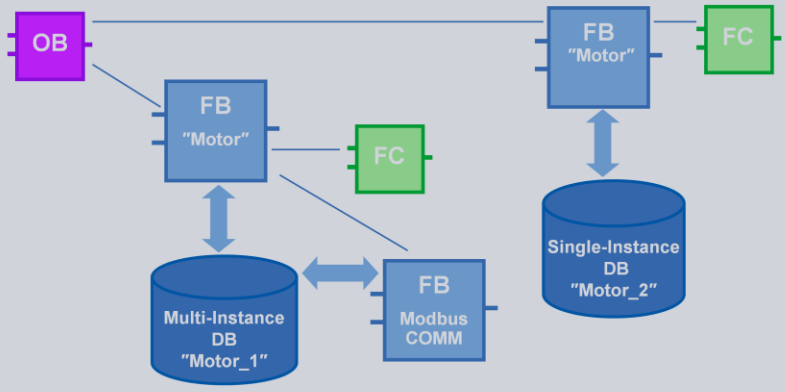
S7-1200 Instance Data Block types

Hardware
Communication
HMI
Memory
Block concept
Instruction set
New data types
Timers
Counters
Technology
Resources



STEP 7 Basic can use single-instance and multi-instance Data Blocks

- A function block (FB) can be called multiple times
- One FB type (for example, FB "Motor") can control several drives
- The actual data of the different drives can be stored in different single-instance or multi-instance DBs

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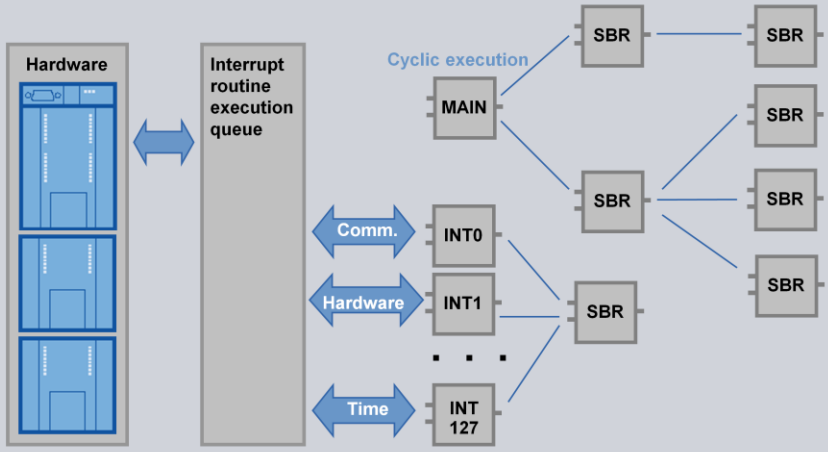
SIEMENS

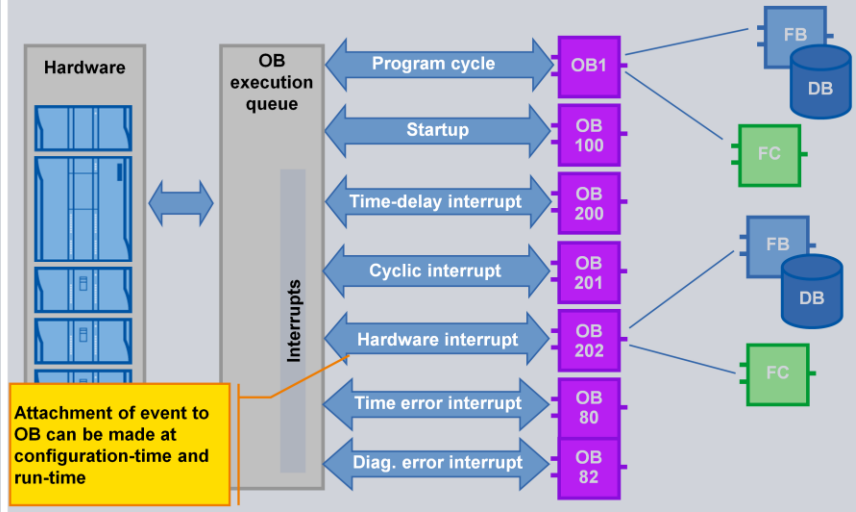
Interrupt structure S7-200

- Hardware
- Communication
- HMI
- Memory
- Block concept
- Instruction set
- New data types
- Timers
- Counters
- Technology
- Resources



Interrupt events are attached and detached to interrupt routines at program run-time only

Interrupt structure S7-1200



All OBs are interruptible by default, but you can set all OBs (except OB1) as non-interruptible

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Bit Logic instructions

What's different?

Set/Reset instructions

- S7-200: S (Set) and R (Reset)
- S7-1200: S (Set) and R (Reset) for single point, SET_BF (Set Bit Field), and RESET_BF (Reset Bit Field) for multiple points

Immediate instructions

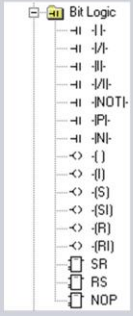
- S7-200: I (Immediate), SI (Set Immediate), and RI (Reset Immediate)
- S7-1200: Direct (Immediate) peripheral address (example, Q0.0:P or I0.0:P)

Edge Detection instructions

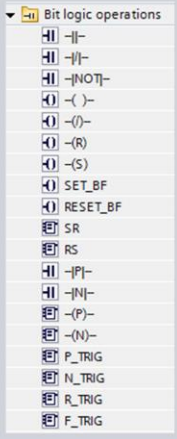
- S7-200: P (Positive Transition) and N (Negative Transition)
- S7-1200: -|P|- (Scan operand for positive signal edge)
  -|N|- (Scan operand for negative signal edge)
  -(P)- (Set operand on positive signal edge)
  -(N)- (Set operand on negative signal edge)
  P_TRIG (Scan RLO for positive signal edge)
  N_TRIG (Scan RLO for negative signal edge)
  F_TRIG (Set tag on positive signal edge)
  R_TRIG (Set tag on negative signal edge)

Bit Logic

S7-200



S7-1200



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S7-1200 Transition Manual
A5E02486860-AB

Timer instructions

SIEMENS

What's new?

Timers can use a box or coil version. For example, both the TON box and –(TON)– coil create an on-delay timer.

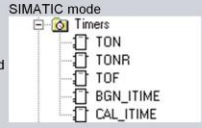
What's different?

- S7-200: A timer number selection sets a 1ms, 10ms, or 100ms time resolution. The resolution value is multiplied by the WORD size time current value, for preset and elapsed times.
- S7-1200: All timers are 1ms timers that use a DWORD size Time data type, for the preset and elapsed time values.
- S7-200: STEP 7-Micro/WIN has a SIMATIC and IEC programming mode. In SIMATIC mode, a T-bit and T-current value corresponding to the timer number provide the timeout condition and the current value (elapsed time).
- S7-1200: In STEP 7 Basic, all timers are IEC style timers that have a Q output bit that signals the timeout condition and an ET output that gives the elapsed time.

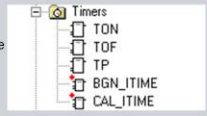
Timers

S7-200

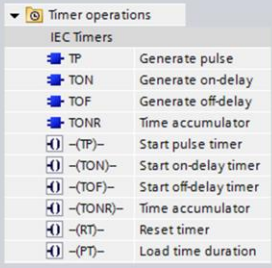
SIMATIC mode



IEC mode



S7-1200



Time value updates

- S7-200: 1 ms timers update every 1 ms. The update cycle is asynchronous to the PLC scan cycle.
  10 ms timers update at the beginning of each PLC scan. The time value and timer bit remain constant throughout each PLC scan.
  100 ms timers update only when the timer instruction is executed and are executed once for each PLC scan cycle.
- S7-1200: All timers are 1 ms timers that update every 1 ms. The update cycle is asynchronous to the PLC scan cycle.

Interval timing

- S7-200: BGN_ITIME (Begin Interval Time), CAL_ITIME (Calculate Interval Time)
- S7-1200: Use Clock instructions RD_SYS_T (read system time) and T_SUB (time difference) to calculate system time intervals.

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Counter instructions

SIEMENS

What's different?

Counter instructions

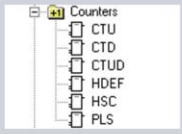
- S7-200: STEP 7-Micro/WIN has a SIMATIC and IEC programming mode. In SIMATIC mode, a C-bit and C-current value corresponding to the counter number signal the count condition and the current count value.
- S7-1200: In STEP 7 Basic, all counters are IEC style counters with a Q output bit that signals the count condition and a CV output that gives the current count value.

High-Speed Counter instructions

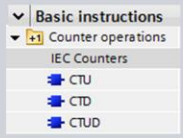
- S7-200: HDEF (High-Speed Counter Definition)
  HSC (High-Speed Counter)
- S7-1200: CTRL_HSC (Control high-speed counter)

Counters

S7-200



S7-1200



- S7-200: Special memory assignments (SM addresses) are used to configure and operate high-speed counters. HSC input point assignments are fixed.
- S7-1200: High-speed counters are set up in the PLC Device configuration properties. The operating parameters are available as inputs and outputs of the CTRL_HSC instruction. All HSC inputs are sink/source (IEC Type 1 sink) except for CPU 1217 which has sink/source and 1.5V differential inputs. HSC input point assignments are configurable.

SIEMENS

Compare instructions

What's new?

The Compare instructions support the 64 bit LREAL data type.

New Compare instructions:

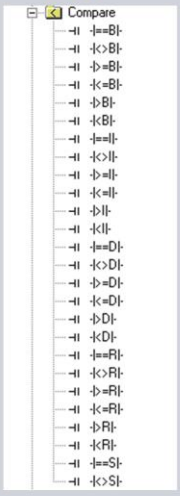
- IN_RANGE tests whether an input value is in a specified value range.
- OUT_RANGE tests whether an input value is out of a specified value range.
- -|OK|- tests whether an input data reference is a real number.
- -|NOT_OK|- tests whether an input data reference is not a real number.

What's different?

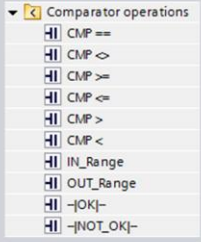
- S7-200: The instruction name determines the data type.
- S7-1200: The data type is selected after placing the instruction in your program.

Compare

S7-200



S7-1200



Math instructions

SIEMENS

What's new?

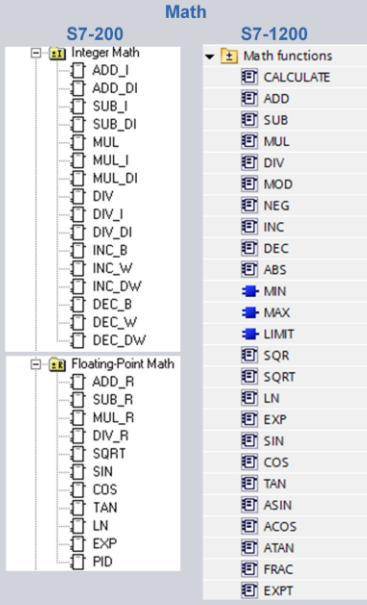
You can use the S7-1200 CALCULATE instruction to define a complex math equation directly in algebraic notation. This instruction simplifies math programming by replacing a programmed sequence of basic math instructions with a single CALCULATE instruction.

S7-1200 Floating Point Math instructions support the 64 bit LREAL data type.

What's different?

Math instructions

- S7-200: The instruction name determines the data type.
- S7-1200: The data type is selected after placing the instruction in your program.



SIEMENS

Move instructions

What's new?

The MOVE instructions now support the 64 bit LREAL data type.

New Move instructions

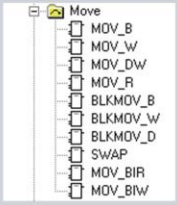
- FieldRead (Read array element)
- FieldWrite (Write array element)
- UMOVE_BLK (uninterruptible move block)
- UFILL_BLK (uninterruptible fill block)

FieldRead and FieldWrite

STEP 7 Basic V10.5 **does not support** a variable reference as an array index or multi-dimensional arrays. The FieldRead and FieldWrite instructions are used to provide variable array index operations for a one-dimensional array. STEP 7 V11 and greater **do support** a variable as an array index and multi-dimensional arrays. FieldRead and FieldWrite are included in STEP 7 V11 and greater, for backward compatibility with programs that used these instructions.

Move

S7-200



S7-1200

What's different?

Move instructions

- S7-200: The instruction name determines the data type.
- S7-1200: The data type is selected after placing the instruction in your program.

Convert instructions

SIEMENS

What's new?.

- The Convert instructions (except SCALE_X and NORM_X) now support the 64 bit LREAL data type
- CEIL (ceiling) converts a real number to the next higher integer
- FLOOR converts a real number to the next lower integer
- SCALE_X scales a normalized real parameter value
- NORM_X normalizes a parameter value

What's different?

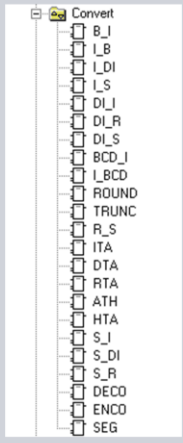
- S7-200: The instruction name determines the data type.
- S7-1200: The data type is selected after placing the instruction In your program.

String Convert instructions

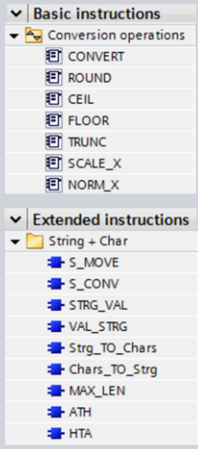
- S7-200: S_I, S_DI, S_R, I_S, DI_S, R_S, ITA, DTA, and RTA
- S7-1200: S_MOVE, S_CONV, STRG_VAL, VAL_STRG, Strg_TO_Chars, Chars_TO_Strg, MAX_LEN, ATH, HTA
- The S7-200 instruction **SEG** (7-segment display control) is not supported by the S7-1200.

Convert

S7-200



S7-1200



SIEMENS

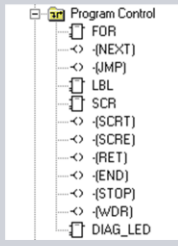
Program Control instructions

What's new?

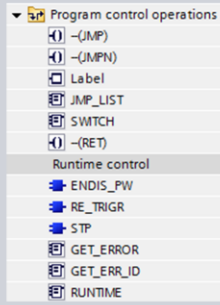
- JMPN jumps to label, if the JMPN coil has no power flow.
- JMP_LIST defines conditional jumps and continues program execution in a specific network, depending on the value of the K parameter.
- SWITCH is a jump distributor instruction that defines multiple program jumps that are executed depending on the result of one or more comparison instructions.
- ENDIS_PW can enable and disable CPU passwords.
- STP puts CPU in STOP mode.
- GetError gets information about program block execution errors.
- GetErrorID gets the ID of an execution error.
- RUNTIME measure program execution time.

Program Control

S7-200



S7-1200



What's different?

Re-Trigger Cycle Time Monitoring

- S7-200: WDR Watchdog reset
- S7-1200: RE_TRIGR

Terminate execution of current block

- S7-200: END/RET
- S7-1200: RET

Execution control

- S7-200: FOR-NEXT loop instructions are not supported on the S7-1200. For LAD and FBD programs, this function must be created from Jump, Add, and Compare instructions. FOR, WHILE-DO, and REPEAT-UNTIL loops are supported in S7-1200 SCL programs .
- S7-1200: Sequence Control Relay instructions (SCR, SCRT, SCRE) are not supported in the S7-1200. The DIAG_LED Diagnostic LED instruction is not supported.

Word logic instructions

SIEMENS

What's new?

- SEL selects one of two inputs.
- MUX selects one of multiple inputs.
- DEMUX sends the input value to one of multiple outputs.

What's different?

- S7-200: The instruction selection determines the data type.
- S7-1200: The data type is selected after placing the instruction in your program.

AND instruction

- S7-200: WAND_B, WAND_W, WAND_DW
- S7-1200: AND

OR instruction

- S7-200: WOR_B, WOR_W, WOR_DW
- S7-1200: OR

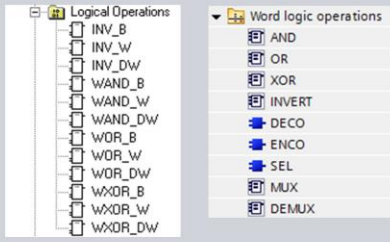
XOR instructions

- S7-200: WXOR_B, WXOR_W, WXOR_DW
- S7-1200: XOR

Invert instruction

- S7-200: INV_B, INV_W, INV_DW
- S7-1200: INVERT

Word logic operations



Shift and rotate instructions

SIEMENS

What's different?

- S7-200: The instruction selection determines the data type.
- S7-1200: The data type is selected after placing the instruction in your program.

Shift Right instruction

- S7-200: SHR_B, SHR_W, SHR_DW
- S7-1200: SHR

Shift Left instruction

- S7-200: SHL_B, SHL_W, SHL_DW
- S7-1200: SHL

Rotate Right instructions

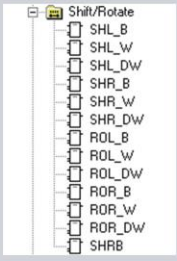
- S7-200: ROR_B, ROR_W, ROR_DW
- S7-1200: ROR

Rotate Left instructions

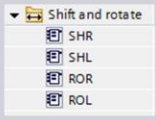
- S7-200: ROL_B, ROL_W, ROL_DW
- S7-1200: ROL

Shift and rotate

S7-200



S7-1200



SIEMENS

Date and time-of-day instructions

What's new?

- New TIME and DTL (Date and time long) data types
- T_CONV converts the data type of time values.
- T_ADD adds TIME and DTL values.
- T_SUB subtracts TIME and DTL values.
- T_DIFF provides difference between two DTL values as a TIME value.
- T_COMBINE combines a Date value and a Time_and_Date value to create a DTL value.
- RD_LOC_T reads local CPU time with time zone offset.
- WR_LOC_T writes local CPU time with time zone offset.
- SET_TIMEZONE sets local time zone transformation rules.
- RTM sets, starts, stops, and starts CPU runtime hour meters.

What's different?

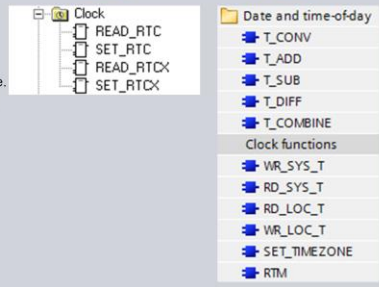
Write system time instructions

- S7-200: SET_RTC, SET_RTCX
- S7-1200: WR_SYS_T (Set time-of-day clock),

Read system time instructions

- S7-200: READ_RTC, READ_RTCX
- S7-1200: RD_SYS_T

Clock and calendar



String instructions

SIEMENS

What's new?

String data format

- S7-200: Length byte followed by character bytes
- S7-1200: Maximum length byte followed by the actual length byte and character bytes

What's different?

String operations

- S7-200: STR_LEN, STR_CAT
- S7-1200: MAX_LEN, LEN, CONCAT, MID, LEFT, RIGHT, DELETE, INSERT

FIND substring or character in string

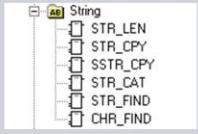
- S7-200: STR_FIND, CHR_FIND
- S7-1200: FIND, REPLACE

Copy strings

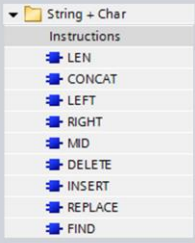
- S7-200: STR_CPY, SSTR_CPY
- S7-1200: S_MOVE.

String + Char

S7-200



S7-1200



SIEMENS

Distributed I/O instructions

What's different?

- S7200: The Micro/WIN programming package uses wizards that produce subroutines that you can use for basic distributed I/O read/write functions.
  - The NETR/NETW wizard provides PPI master read/write support through the RS485 CPU port.
  - The AS-i wizard provides read/write support through the optional AS-interface master module.
  - The Ethernet wizard allows the optional CP 243-1 Ethernet module to act as a client or server with read/write support.
- S7-1200: Program instructions for PROFINET, PROFIBUS DP master, and AS-I master are included in the Distributed I/O instruction group.

S7-1200

Distributed I/O	
DP & PROFINET	
RDREC	Read data record
WRREC	Write data record
RALRM	Receive interrupt
Others	
DPRD_DAT	Read consistent data of a DP standard slave
DPWR_DAT	Write consistent data of a DP standard slave
PROFIBUS	
DPNRM_DG	Read diagnostics data from a DP slave

Interrupt instructions

What's different?

I/O transition and high-speed counter interrupts

- S7-200: ATCH and DTCH (events 0-33)
- S7-1200: Device configuration settings plus ATTACH, and DETACH instructions

Cyclic interrupts

- S7-200: ATCH and DTCH (events 0 and 1)
- S7-1200: SET_CINT, QRY_CINT

Time of day interrupts

- S7-200: Not supported
- S7-1200: SET_TINT, CAN_TINT, ACT_TINT, and QRY_DINT

Time delay interrupts

- S7-200: ATCH and DTCH (events 21 and 22)
- S7-1200: SRT_DINT, CAN_DINT, QRY_DINT

Interrupt control

- S7-200: ENI and DISI (Enable or disable interrupt events)
- S7-1200: DIS_AIRT, EN_AIRT (Delay or enable interrupt events)

Terminate execution of current interrupt block

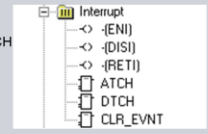
- S7-200: RETI
- S7-1200: RET

Clear queued Interrupt events

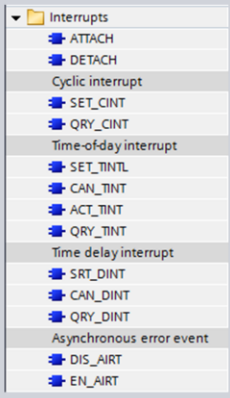
- S7-200: CLR_EVENT
- S7-1200: Current and queued events are cleared by the DETACH instruction

Interrupt

S7-200



S7-1200



Diagnostics instructions

What's new?

- S7200: A program can use the DIAG_LED instruction, illuminate the CPU LED labeled "SF/DIAG", and indicate a fault to an operator. In addition, the system block configuration allows the CPU system software to illuminate the SF/DIAG LED when an element is forced and the program cannot control that element , or when a module has an I/O error.
- S7-1200: Program instructions in the Diagnostics instruction group can pass detailed diagnostic information to your program which can initiate a programmed response.

S7-1200 Diagnostics

Diagnostics	
LED	Read LED status
DeviceStates	Read module status information of an IO system
ModuleStates	Read module status information of a module
GET_DIAG	Read diagnostic information

SIEMENS

Recipes and data logging

What's different?

Recipes

- S7-200: Recipe data is entered in the Recipe wizard which creates program subroutines. Execute a RCPx_READ subroutine to copy a recipe from memory cartridge to V memory. New recipe definitions and recipe value assignments can be entered directly in the Recipe Wizard. Later changes to recipe data can be made by re-running the Recipe Wizard or programmatically with the RCPx_WRITE subroutine.

- S7-1200: You create a recipe data type that establishes a recipe record structure and then create a recipe DB with data rows based on the recipe data type. The data assignments for all recipe variations are entered directly in the DB editor.
The READ_DBL instruction is used to move one recipe record from the recipe DB in PLC load memory to work memory where the data is accessible to your program logic. The WRITE_DBL instruction is used to move recipe data that was adjusted during a production run from work memory to the recipe DB in load memory.
The RecipeExport instruction exports the recipe DB data to standard .csv format compatible with windows applications. The RecipeImport instruction imports recipe data from a .csv file to a recipe DB in load memory.

Recipe and Data logging

S7-200	S7-1200
Recipe wizard subroutines RCPx_READ RCPx_WRITE	Recipe and data logging Recipe functions. RecipeExport RecipeImport Data Logging DataLogCreate DataLogOpen DataLogWrite DataLogClose DataLogNewFile
Data log wizard subroutines DATx_WRITE	

Data logs

- S7-200: The Data Log wizard defines a data record and creates a DATx_WRITE subroutine. Executing the DATx_WRITE subroutine transfers run-time values to a log file stored in a memory cartridge.
- S7-1200 : The DATA and HEADER parameters of the DataLogCreate instruction assign the data type and the column header description of all data elements in a log record. The DataLogOpen and DataLogClose instructions manage multiple log files. The DataLogWrite instruction transfers runtime values to a data log file. The DataLogNewFile instruction creates a new log file by copying the structure of an existing log file.

Transferring recipe and log data to your PC in .csv file format

- S7-200: The S7 Explorer application is used to access log data in .csv format. Recipe data transfer in .csv format is not supported.
- S7-1200 : The integrated CPU web server provides local and remote access to Data log and recipe .csv files. Also, the Windows explorer can access these files when a SIMATIC memory card is removed from a CPU and inserted in your PC's SD card slot.

Data block control, I/O address, and Table instructions

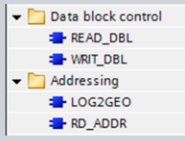
SIEMENS

What's new?

Data block control

- S7-200: Not supported
- S7-1200: READ_DBL copies DB start values or part of the values from **load** memory to a target DB in **work** memory. WRITE DBL copies DB current values or part of the values from **work** memory to a target DB in **load** memory.

S7-1200



I/O address identification

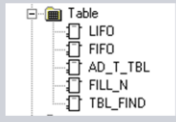
- S7-200: Not supported
- S7-1200: LOG2GEO determines the module slot associated with a hardware identifier. RD_ADDR reads the I/O addresses associated with a hardware identifier.

What's different?

S7-200

Table operations

- S7-200: LIFO, FIFO, AD_T_TBL, FILL_N, TBL_FIND
- S7-1200 : Not supported



SIEMENS

PID loop control instructions

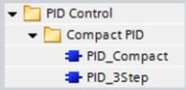
What's different?

- S7-200: PID loop control is usually operated with subroutines generated by the PID wizard. The PID instruction can also be programmed directly. The PID Tune Control Panel is used to optimize loop parameters.
- S7-1200: PID_Compact instruction provides a universal PID controller with integrated tuning. The PID_3Step instruction provides PID controller with tuning for valves.

PID Loop control

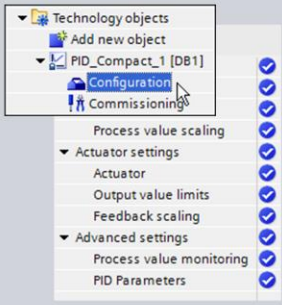
S7-200

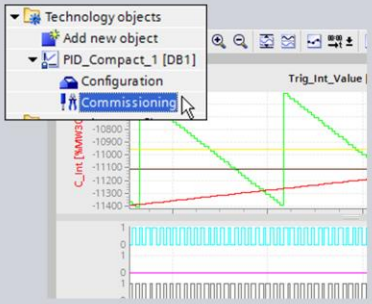
S7-1200

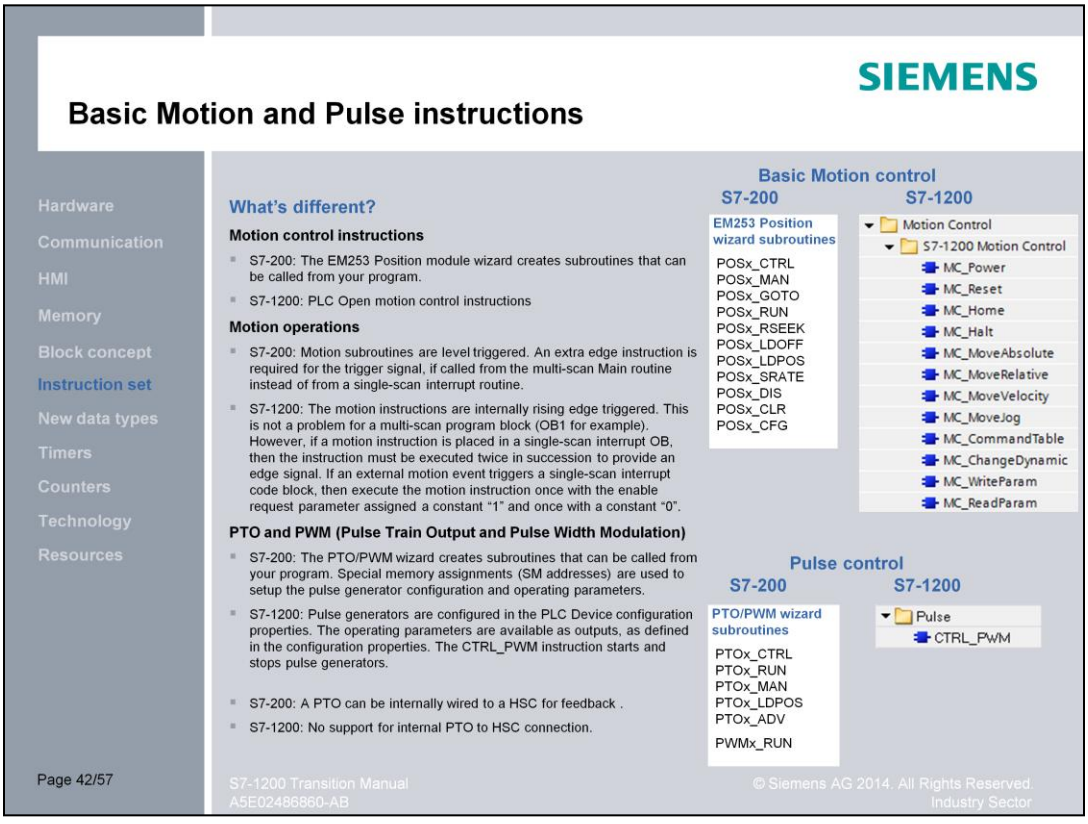


Using S7-1200 and TIA Portal PID technology objects

- The PID instruction box and the project tree Technology objects folder provide access to PID loop configuration settings and dynamic PID tuning, for the commissioning process.







S7 peer to peer and open user communication

SIEMENS

What's different?

CPU communication ports

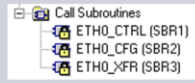
- S7-200: Integrated RS485 serial PPI port
- S7-1200: Integrated PROFINET TCP/IP port

Ethernet CPU to CPU communication paths

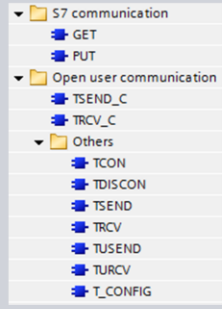
- S7-200: A CP243-1 Ethernet module is required . The Ethernet wizard creates subroutines to read from or write through an Ethernet network.
- S7-1200: For an S7-1200 connected to multiple S7-1200/S7-300/S7-400 CPUs, all partner programs can execute T-block instructions or GET/PUT to read from and write to each other.

Communications

S7-200



S7-1200



PROFINET (Open Ethernet) communication

- S7-200: The Ethernet wizard generates subroutines that you use to operate the Ethernet module.
- S7-1200: The CPU has integrated PROFINET (Ethernet) ports and uses T-BLOCK instructions for network communication. T_CONFIG can change the station name, IP address, subnet mask , and router address. For TCP (Transport Control Protocol), the TSEND_C and TRCV_C simplify use of the TCON, TDISCON, TSEND, and TRCV instructions. For UDP (User Datagram Protocol), use TUSEND and TURCV T_CONFIG instructions.

MODBUS communication

SIEMENS

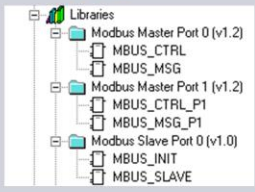
What's different?

MODBUS RTU protocol

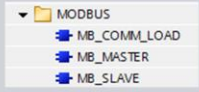
- S7-200: Add-on software library provides subroutines for MODBUS RTU operation through the integrated RS485 port.
- S7-1200: Add a CM or CB 1241 module for serial communication. The communication processor group MODBUS instructions provide simplified MODBUS RTU operations.
  MB_COMM_LOAD provides first pass initialization for master and slave operations.
  MB_MASTER and MB_SLAVE control the message and port assignments.

Modbus RTU

S7-200



S7-1200



MODBUS TCP protocol

- S7-200: Not supported.
- S7-1200: Open user communication MODBUS TCP instructions use the CPU's integrated PROFINET port.

Modbus TCP S7-1200 only

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SIEMENS

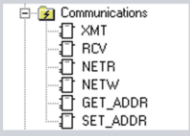
PtP (Point-to-Point) serial communication

What's different?

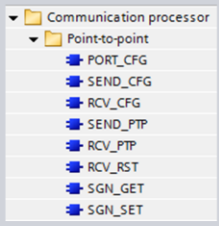
- S7-200: Freeport mode communication uses the XMT and RCV instructions with configuration provided by special memory data.
  Multi-station PPI serial network communication is programmed using the NETR/NETW wizard or directly with the NETR, NETW, GET_ADDR, and SET_ADDR instructions.

Communications

S7-200



S7-1200



- S7-1200: The PtP instructions provide communication from an S7-1200 system to one serial communication partner similar to the S7-200 Freeport mode. Communication on a multi-station serial PPI network is not supported. PROFINET TCP/IP communication is used for S7-1200 multi-station networks. You must add a CM 1241 module or the CB 1241 board for serial communication.

S7-1200 PtP hardware options	Signaling type
CM 1241 RS232	Full-duplex single-ended
CM 1241 RS485, CB 1241 RS485	Half-duplex differential level
CM 1241 RS422/485	Full-duplex differential level

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USS drive communication

What's different?

PZD parameters

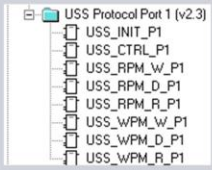
- S7-200: Two fixed PZD parameters (control and speed)
- S71-1200: Up to eight user-defined PZD parameters

Update rate

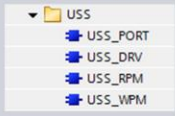
- Update rate fixed (as fast as possible)
- Place instruction in a cyclic interrupt OB which provides a user-defined update rate.

USS

S7-200



S7-1200



Drive support

- S7-200: Support for a maximum of 32 drives
- S7-1200: Support for maximum of 15 drives for each CM (Communication Module)

- S7-200: Support for Siemens MM3 (MicroMaster) drives
- S7-1200: No support for MM3 drives

- S7200: Support for logging out missing drives
- S7-1200: No support for logging out missing drives

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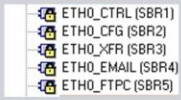
Web server, GPRS, and TeleService communication

What's different?

Web server

- S7-200: Uses the CP 243-IT module and Internet wizard subroutines for Ethernet data transfer, FTP server, and email
- S7-1200: WWW instruction enables the built-in Web server . Pre-defined standard web pages are provided in English, German, French, Spanish, Italian , and simplified Chinese.

S7-200



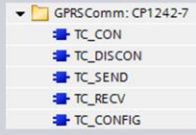
S7-1200

User–defined web page support

- S7-200: Provides standard web browser support for user-defined HTML/JAVA web pages
- S7-1200: Provides standard web browser support for user-defined HTML/JAVA web pages for PC and mobile device viewing. The required HTML format is different from the S7-200 HTML format. The S7-1200 web server provides pre-defined AWP (Automation Web Programming) commands that are used to embed PLC run-time data in the web pages that you create.

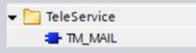
GPRS (General Packet Radio Service) with CP1242-7 module

- S7-200: No support
- S7-1200: Provides five TC-blocks similar to T-block instructions for open Ethernet communication.



Teleservice email

- S7-200: No support
- S7-1200: SMTP email via TS Adapter with TM_MAIL instruction



New elementary data types for the S7-1200

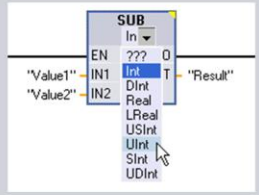
Short integer data types can save resources

- **SInt** Byte -128 to 127

Unsigned data types increase the positive number range

- **USInt** Byte 0 to 255
- **Uint** Word 0 to 65,535
- **Udint** - Dword 0 to 4,294,967,295

STEP 7 Basic uses drop list data type selectors



Long Real for greater floating-point precision

- **LReal** Dword +/-2.2250738585072020 × 10^{-308} to +/-1.7976931348623157 × 10^{308}

Time and Date data types		Example entry
Time	Dword	T#-24d_20h_31m_23s_648ms to T# 24d_20h_31m_23s_647ms
Date	Word	D#1990-1-1 to D#2168-12-31
Time_of_Day	Dword	TOD#0:0:0.0 to TOD#23:59:59.999

Character data types		Example entry
Char -	Dword	'A', 't', '@'
String	n + 2 bytes, n = (0 to 254 character bytes)	'ABC'

New complex data types for the S7-1200 DTL, Array, and Struct

SIEMENS

DTL (Date and Time Long) data type

DTL 12 bytes min. DTL#1970-01-01-00:00:00.0
max. DTL#2554-12-31-23:59:59.999 999 999

Array data type

ex.1 **ARRAY**[1..20] of REAL ex.2 **ARRAY**[1..2, 3..4] of CHAR

To create an array from the block interface editor, name the array and choose data type in "Array [lo .. hi] of type", then edit "lo", "hi", and "type".

- All array elements must be the same data type.
- The index can be negative, but the lower limit must be less than or equal to the upper limit.
- Arrays can have one to six dimensions.
- Multi-dimensional index min..max declarations are separated by comma characters.
- Nested arrays, or arrays of arrays, are not allowed.
- The memory size of an array = (size of one element * total number of elements in array).

Data structure data type

You can use the data type "**Struct**" to define a structure of data consisting of other data types. The struct data type can be used to handle a group of related process data as a single data unit. A Struct data type is named and the internal data structure is defined in the data block editor or a block interface editor.

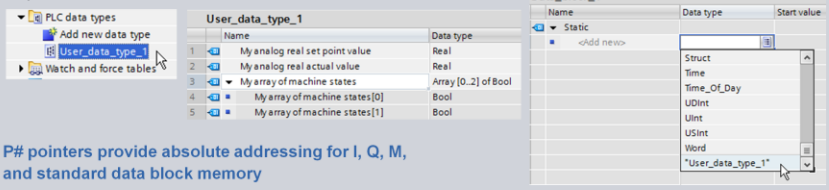
Arrays and structures can also be assembled into a larger data structure. A structure can be nested up to eight levels deep. For example, you can create a structure of structures that contain arrays.

New complex data types for the S7-1200 PLC data type and Pointers

SIEMENS

PLC data type

The PLC data type editor lets you define data structures that you can use many times in your program. You create a PLC data type by opening the "PLC data types" branch of the project tree and double-clicking the "Add new data type" item. If a new PLC data type is created, then the new type name appears in the data type drop-lists for the DB editor and code block interface editor.



P# pointers provide absolute addressing for I, Q, M, and standard data block memory

6-byte Pointer types	Format	Example
Area-internal pointer	P#Byte.Bit	P#20.0
Area-crossing pointer	P#Memory_area_Byte.Bit	P#M20.0
DB pointer	P#Data_block.Data_element	P#DB10.DBX20.0

10-byte Any pointer formats	Example	Description
P#Data_block.Memory_area. Data_address Type Number	P#DB 11.DBX 20.0 INT 10	10 words in global DB 11 starting from DBB 20.0
P#Memory_area Data_address Type Number	P#M 20.0 BYTE 10	10 bytes starting from MB 20.0
	P#I 1.0 BOOL 1	Input I1.0

Indirect addressing

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S7-200 indirect addressing

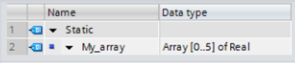
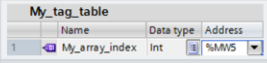
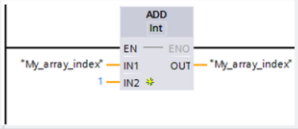
S7-200 programs use indirect address pointers to access data elements in a block of stored data. The example show this method using STL instructions. You must control the number of pointer increment operations (0, 2, 4, 6, 8, …) to program which word data element is processed. The S7-200 does not support an array data type.

Step	S7-200 STL instructions
1. Create pointer by "&" syntax	MOVD &VB200, AC1
2. Move word value pointed to by "*" syntax to AC0	MOVW *AC1, AC0
3. Increment pointer twice to access the next word location	INCD AC1 INCD AC1
4. Move next word value to AC0	MOVW *AC1, AC0

S7-1200 indirect adressing

You can use the SCL program editor's Peek and Poke instructions with a standard (non-optimized DB) to emulate the method of the S7-200 example.

A simpler solution is to use data arrays. S7-1200 single and multi-dimensional arrays have an index variable that provides programmable access to array elements. The example shows how to access array data.

Step	S7-1200 array example
1. Create an array of 5 real values in DB editor for Data_block_1.	
2. Create a tag name for the index as an Int (integer) data type.	
3. Symbolic address to access the value of an array element	"Data_block_1".My_array["My_array_index"]
4. Add My_array_index + 1 to increment the index value for access to the next array element .	

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Timer operation
S7-200 and S7-1200

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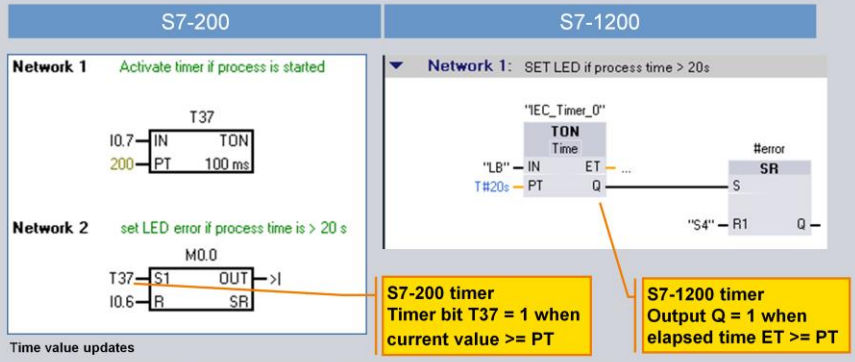
- Hardware
- Communication
- HMI
- Memory
- Block concept
- Instruction set
- New data types
- Timers
- Counters
- Technology
- Resources



Time value updates

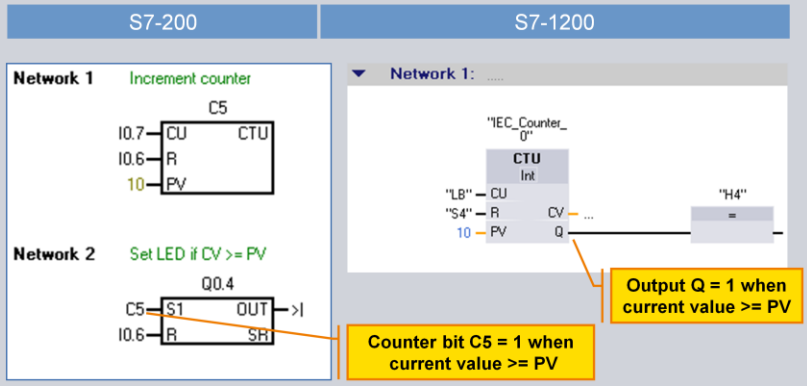
- S7-200: 1 ms timers update every 1 ms. The update cycle is asynchronous to the PLC scan cycle.
  10 ms timers update at the beginning of each PLC scan. The time value and timer bit remain constant throughout each PLC scan.
  100 ms timers update only when the timer instruction is executed and are executed once for each PLC scan cycle.
- S7-1200: All timers are 1 ms timers that update every 1 ms. The update cycle is asynchronous to the PLC scan cycle.

For S7-200, the preset time and current time are entered as a number to be multiplied by a time base (1 / 10 / 100 ms) depending on the selected timer number.

For S7-1200, all timers are have a 1 ms time base and a time value can be entered directly.

Counter operation
S7-200 and S7-1200

SIEMENS



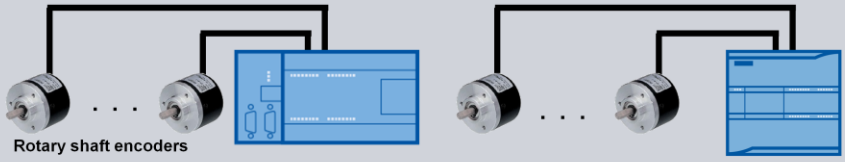
S7-200
SIMATIC counter
Count range: 0 to 32767

S7-1200
IEC counter
Count range: selectable data type from SINT to UDINT
SINT -128 to 127
UDINT 0 to 4,294,967,295

For the S7-1200, you can assign the count value integer type.
An unsigned integer can count down to 0 and up to the number range limit.
A signed integer can count down to the negative range limit and up to the positive range limit.

SIEMENS

Count and measure with high-speed counters (HSC)



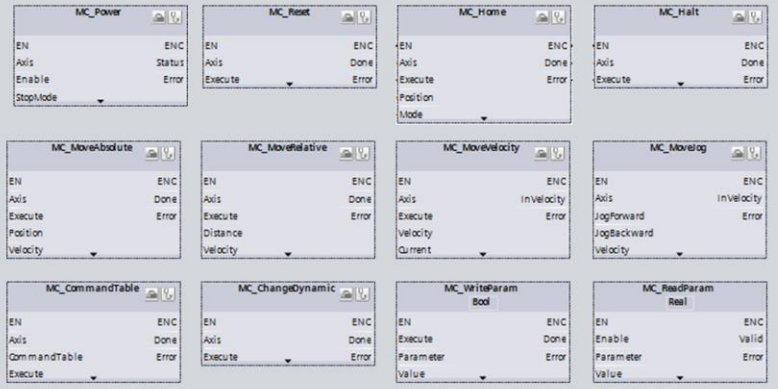
	S7-200 CPU 224XP	S7-1200 CPUs 1214C	S7-1200 CPUs 1217C
HSC devices total allowed	6 single-phase or 4 quadrature	6	6
1 MHz. max. single-phase	0	0	4
1 MHz. max. quadrature	0	0	2
100kHz. max. single-phase	2	6	6
80kHz. max. quadrature	1	3	3
30kHz. max. single-phase	4	4	4
20kHz. max. quadrature	3	2	2

The two-phase or quadrature encoder is the most widely used of all rotary encoders due to better precision

SIEMENS

S7-1200 Axis Technology Object

- S7-200 and STEP 7-Micro/WIN use a Position module and motion control wizard for motion control. You must rerun the wizard to make configuration changes.
- S7-1200 and STEP 7 Basic use integrated pulse outputs and Axis Technology Object configuration for control of stepper motors and servo drives. PLCopen standard instructions are placed in your program.



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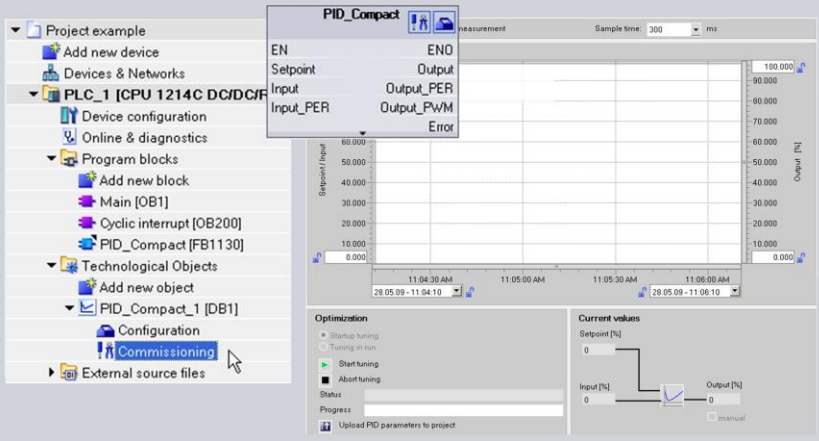
S7-1200 PID controller Technology Objects

- Hardware
- Communication
- HMI
- Memory
- Block concept
- Instruction set
- New data types
- Timers
- Counters
- Technology
- Resources

- S7-200 and STEP 7-Micro/WIN use a PID wizard and PID tune control panel tool for controlling up to eight PID loops.
- S7-1200 and STEP 7 Basic use PID controller Technology objects for up to 16 PID control loops. The PID_Compact object (universal PID with integrated tuning) and the PID_3Step object (PID controller for valves) are available.



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SIMATIC resources

Hardware
Communication
HMI
Memory
Block concept
Instruction set
New data types
Timers
Counters
Technology
Resources

Refer to the SIMATIC S7-1200 and S7-200 documentation on the Internet:
http://www.siemens.com/automation/service&support

Useful links for migrating your automation system
Plant migration: http://support.automation.siemens.com/WW/view/en/83557459
Entire system migration: http://support.automation.siemens.com/WW/view/en/83558085
Controller migration: http://support.automation.siemens.com/WW/view/en/83557459
Visualization migration: http://support.automation.siemens.com/WW/view/en/76878921
Communication migration: http://support.automation.siemens.com/WW/view/en/56314851
Project migration: http://support.automation.siemens.com/WW/view/en/56314851

Contact your Siemens distributor or sales office for assistance in answering any technical questions, for training, or for ordering S7 products.

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