SIEMENS

Reference manual

SIMATIC

S7-300/S7-400/S7-1200/S7-1500

Comparison list for programming languages

Edition 05/2021

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Comparison list for S7-300, S7-400, S7-1200, S7-1500
Reference Manual

Legal information

Warning notice system

This manual includes notices you have to observe to ensure your personal safety and to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a hazard alert symbol; notices referring only to property damage have no hazard alert symbol. Depending on the degree of danger, warnings are displayed in a descending order as follows.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
indicates that minor personal injury may result if proper precautions are not taken.

NOTICE
indicates that damage to property may result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a hazard alert symbol may also include a warning relating to property damage.

Qualified personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper usage of SIMATIC products

Note the following:

⚠ **WARNING**
Siemens products may only be used for the applications described in the catalog and the associated technical documentation. If third-party products and components are used, these have to be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation, and maintenance are required to ensure that the products operate safely and without any problems. The permitted ambient conditions must be adhered to. Notes in the respective documentation must be observed.

Trademarks

Disclaimer

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. However, since deviations cannot be ruled out entirely, we cannot guarantee full consistency. The information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Digital Industries
Postfach 48 48
90026 NUREMBERG

Content of the comparison list for S7-300, S7-400, S7-1200, S7-1500 (05/2021)

- Measuring program runtimes –see below
- Load objects to the CPU: Which modifications and which modified blocks you load to the CPU in which operating mode – next page.
- Overview, requirements, general conditions and legend for the comparison list (Page 6)
- Comparison list for S7-300, S7-400 (without H systems), S7-1200, S7-1500 including Software Controller CPU 150xS: Which instructions and functions you can use for which controller family – as of Page 8 .
- Instructions for SIMATIC Ident and SIMATIC Energy Suite – Appendix.

Measuring program runtimes

The runtime of parts of the user program depends on many factors. A listing of runtimes of individual instructions in a table is thus not possible.
The **RUNTIME** (runtime measurement) instruction is used to measure the runtime of the entire program, individual blocks or command sequences. The runtime measurement begins with the first call of the **RUNTIME** instruction and ends with the second call. Use an OB priority >15 for runtime measurement.
You can find more detailed information in the SIMATIC STEP 7 online help. Enter "RUNTIME" in the search and select "S7-1200", "S7-1500" or "S7-1500T" as validity identifier.

Programming examples in SCL:

```
#tempLastCycle := RUNTIME(#statRuntimeMemory); // Start of runtime measurement
// instance call where the time measurement takes place:
"instSpeedTest"(enable:="true",…);
#tempLastCycle := RUNTIME(#statRuntimeMemory);  // End of runtime measurement
```

The `#tempLastCycle` tag contains the time that has passed from the preceding call to the current call of **RUNTIME**. Record the tag with "Trace". Do not use "Monitor".

Load objects to the CPU

The table shows which modifications and which modified blocks you can download in which operating mode. Very complex programs can prevent downloading in RUN mode.

Solution approaches:

- Use a memory card with sufficient capacity.
- Select a CPU with sufficient work memory.
- Reduce the number of modified used blocks, constants, PLC tags or data types.

You can find information about the behavior of the F-CPU for fail-safe blocks in the "SIMATIC Safety – Configuring and Programming manual".

Modifications and blocks	S7-300	S7-400	S7-1200 V2.2 - V3.0	S7-1200 V4.0 and higher	S7-1500
Modified properties of hardware components	STOP	STOP, with restrictions in RUN	STOP	STOP	STOP
Added hardware components	STOP	STOP, with restrictions in RUN	STOP	STOP	STOP
New/revised text lists (messages)	RUN	RUN	—	—	RUN
Load number of blocks	RUN (<17)	RUN (<57)	RUN (<11)	RUN (<21)	RUN
Reset work memory (MRES)	STOP (Reset)	STOP (Reset)	STOP (Reset)	STOP (Reset)	STOP (Reset)
New OB	RUN	RUN	STOP	STOP	RUN
Modified OB: Code modifications, modification of comments	RUN	RUN	RUN	RUN	RUN
OB with modified properties (e.g., cycle time change)	STOP	RUN	STOP	STOP	RUN

Modifications and blocks	S7-300	S7-400	S7-1200 V2.2 - V3.0	S7-1200 V4.0 and higher	S7-1500
Deleted OB	RUN	RUN	STOP	STOP	RUN
New FB/FC/DB/PLC data type (UDT)	RUN	RUN	RUN	RUN	RUN
Deleted FB/FC/DB/PLC data type (UDT)	RUN	RUN	RUN	RUN	RUN
Revised FB/FC: Code modification, modification of comments	RUN	RUN	RUN	RUN	RUN
Revised FB/FC: Change to interface	STOP	STOP	STOP	RUN (Init)	RUN (Init)
Modified DB (no memory reserve configured): Name/type of tags modified, tags added or deleted	RUN (Init)	RUN (Init)	STOP	RUN (Init)	RUN (Init)
Modified DB (memory reserve configured): New tags added	—	—	—	RUN	RUN
Modified PLC data type (UDT)	STOP	STOP	STOP	RUN (Init)	RUN (Init)
Modified PLC tags (added, deleted, name or data type changed)	RUN	RUN	STOP	RUN	RUN
Modified retentivity settings (bit memory address area, DB area)	STOP	All objects retentive	STOP	STOP	STOP
Motion Control technology objects: Changes to MC Servo cycle clock, change from free-running to cyclical (and vice versa). Changes to the hardware interface of the TO	--	--	--	--	STOP

(init) means that the CPU overwrites the actual values of the DBs with start values during downloading.

Validity and general conditions

- SIMATIC STEP 7 version 17 or higher
- The contents of the S7-1500 column also apply to SIMATIC S7-1500 Software Controller CPU 150xS
- SIMATIC S7-1200 firmware 4.4 or higher. SIMATIC S7-1200 only supports LAD, FBD and SCL.
- SIMATIC S7-1500 firmware 2.9 or higher
- STL: Some instructions have to be called via CALL.
- The special features of SIMATIC S7-400H systems are not taken into consideration.
- The instructions of the SIMATIC S7-300T controller are only taken partly into account.
- Some system state lists (SSLs) for SIMATIC S7-300/400 contain similar information such as function calls with the SIMATIC S7-1200/1500.

Legends

✔	Applicable
(✔)	Applicable with restrictions
☑	Not yet available for SIMATIC CPU S7-1500R/H
nn	Not required, you can, for example, replace many instructions with simple commands in SCL.
gray italics	We recommend that you do not use the grayed-out instructions in S7-1200 or S7-1500. The instructions are not suitable for symbolic addressing or multiple instances. Avoid SIMATIC counters and timers because they do not have multiple instance capability.
Xyz	New instruction as of SIMATIC STEP 7 V17. For this purpose, SIMATIC S7-1200 requires at least firmware 4.4 and SIMATIC S7-1500 at least firmware 2.9.
Xyz	Also available as fail-safe instruction in LAD and FBD.

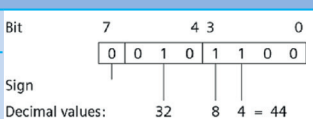
Structure of the comparison list

- Overview of the data types
- Instructions

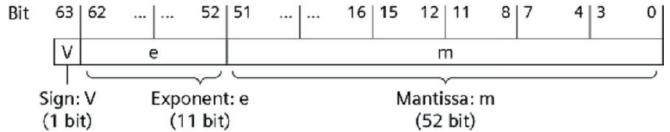
Overview of the instructions

- Basic instructions
  Instructions that you use often, e.g. bit logic operations, timers, counters, mathematical functions
- Extended instructions
  Extended instructions for more possibilities, e.g. date and time, interrupts, alarms, PROFIenergy
- Technological instructions (technology)
  Technological functions and Motion Control, e.g. PID control, kinematics
- Instructions for communication
  Brief overview and basics of communication and
  Instructions for communication, such as S7 communication, Open User Communication
- Optional instructions
  Optional instructions, e.g. for SINAMICS or SIMATIC Ident
- CEM
  Instruction of the Cause Effect Matrix

Overview of data types

S7-300	S7-400	S7-1200	S7-1500	Data type	Bit length	Value range	Examples, comments
Binary							
✔	✔	✔	✔	**BOOL**	1	TRUE, FALSE	varBool := (var1 AND var2) BOOL#0, BOOL#1
Binary numbers and character strings							
Decimal, binary, octal or hexadecimal							
✔	✔	✔	✔	**BYTE**	8	0 ... 255	varByte := 2#0011_1010
✔	✔	✔	✔	**WORD**	16	0 ... 65 535	varWord := 16#6B0F
✔	✔	✔	✔	**DWORD**	32	0 ... 4 294 967 295	varDword := 50_000
			✔	**LWORD**	64	0 ... 18 446 744 073 709 551 615	varLword := 16#F2F6_FA9F_FBFF_FBFF
Integer numbers							
Decimal, binary, octal or hexadecimal When an integer number is not in decimal format, the most significant bit, MSB, determines the sign: 0 = positive, 1 = negative							
	✔	✔		**SINT**	8	-128 ... +127	varSint := -42

S7-300	S7-400	S7-1200	S7-1500	Data type	Bit length	Value range	Examples, comments
✔	✔	✔	✔	**INT**	16	-32 768 ... +32 767	varInt := 16#0EC9
✔	✔	✔	✔	**DINT**	32	-2 147 483 648 ... +2 147 483 647	varDint := +125_790
			✔	**LINT**	64	-9 223 372 036 854 775 808 ... +9 223 372 036 854 775 807	varLint := 16#0000_8C5B_C5F0_F79F
Integer numbers without sign							
Decimal, binary, octal or hexadecimal							
		✔	✔	**USINT**	8	0 ... 255	varUsint := 2#0100_1110
		✔	✔	**UINT**	16	0 ... 65 535	varUint := 65_295
		✔	✔	**UDINT**	32	0 ... 4 294 967 295	varUdint := 8#360_7417_0360
		✔	✔	**ULINT**	64	0 ... 18 446 744 073 709 551 615	varUlint := 16#0000_8C5B_C5F0_F79F

S7-300	S7-400	S7-1200	S7-1500	Data type	Bit length	Value range	Examples, comments
Floating-point numbers							
Floating-point numbers correspond to the standard IEEE 754-1985							
							
✔	✔	✔		**REAL**	32	-3.402823e+38 ... -1.175 495e-38 ±0 +1.175 495e-38 ... +3.402823e+38	varReal := 1.0e-5 Mantissa: 23 bits, Exponent: 8 bits, Sign 1 bit
		✔	✔	**LREAL**	64	-1,7976931348623158e+308 ... -2,2250738585072014e-308 ±0 +2.2250738585072014e-308 ... +1.7976931348623158e+308	varLreal := 20.0e-15 Mantissa: 52 bits, Exponent: 11 bits, Sign: 1 bit
Timer							
✔			✔	**S5TIME**	16	0 ms ... 2 h 46 m 30 s 0 ms	varS5time := S5T#10s
✔	✔	✔	✔	**TIME**	32	-24 d 20 h 31 m 23 s 648 ms ... +24 d 20 h 31 m 23 s 647 ms	varTime := T#10d20h30m20s630ms

S7-300	S7-400	S7-1200	S7-1500	Data type	Bit length	Value range	Examples, comments
			✔	LTIME	64	-106 751 d 23 h 47 m 16 s 854 ms 775 µs 808 ns ... +106 751 d 23 h 47 m 16 s 854 ms 775 µs 807 ns	varLtime := LT#11350d20h25m14s830ms 652us315ns
Date and time							
✔	✔	✔		DATE	16	01.01.1990 ... 31.12.2168	varDate := D#2009-12-31
✔	✔	✔		TIME_OF_DAY (TOD)	32	00:00:00.000 ... 23:59:59.999	varTod := TOD#10:20:30.400
			✔	LTOD (LTIME_OF_DAY)	64	00:00:00.000000000 ... 23:59:59.999999999	varLtod := LTOD#10:20:30.400_365_215
✔			✔	DT (DATE_ AND_TIME)	64	01.01.1990--0:0:0 ... 31.12.2089--23:59:59.999	varDt := DT#2008-10-25-8:12:34.567
			✔	LDT	64	01.01.1970--0:0:0.000000000 ... 11.04.2262--23:47:16.854775807	varLdt := LDT#2008-10-25-8:12:34.567
		✔	✔	DTL	96	01.01.1970--00:00:00.0 ... 31.12.1554--23:59:59.999999999	varDtl := DTL#2008-12-16-20:30:20.250

S7-300	S7-400	S7-1200	S7-1500	Data type	Bit length	Value range	Examples, comments
Character string							
An operand of the STRING data type occupies two bytes more than the specified maximum length in the memory. An operand of the WSTRING data type occupies two words (4 bytes) more than the specified maximum length in the memory. You can specify the length of a character string by adding a definition. E.G.: STRING[254]							
✔		✔	✔	**CHAR**	8	ASCII character set	varChar := 'A'
		✔	✔	**WCHAR**	16	Unicode character set	varWchar := 'A'
✔		✔	✔	**STRING**	n+2 (bytes)	0 ... 254 ASCII characters Default length: 254 CHAR + 2 bytes	varString := 'Name'
		✔	✔	**WSTRING**	n+2 (Word)	0 ... 16382 Unicode characters Default length: 254 WCHAR + 2 words	varWstring := 'Hello World'
Pointer							
✔			✔	**POINTER**	48	Area-internal pointer, Cross-area pointer, DB pointer, Zero pointer	Symbolic: "MyDB"."MyTag" Absolute: P#20.0, P#DB10.DBX20.0
✔			✔	**ANY**	80	P#MemoryArea DataAddress Type Number, P#Zero value	Symbolic: "MyDB".StructVariable.Component1" Absolute: P#DB11.DBX20.0 INT 10

S7-300	S7-400	S7-1200	S7-1500	Data type	Bit length	Value range	Examples, comments
		✔	✔	**VARIANT**	0	*Symbolic* operand, DataBlock.Operant.Component, *Absolut* operand, DataBlockNumber.Operand Type Length, NULL pointer	Symbolic: "DataBlockl".StructVariable.Variable1" Absolute: %MW10, P#DB10.DBX10.0 INT 12

Instructions in the section "Basic instructions"

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
Additional instructions for S7 GRAPH									
		✔	✔	Monitoring entire duration of a step (greater than step activation time)	CMP >T				
		✔	✔	Monitoring entire duration of a step minus interferences (greater than uninterrupted step activation time)	CMP >U				
		✔	✔	Monitoring entire duration of a step (greater than maximum step activation time)	CMP >T_MAX				
		✔	✔	Monitoring duration of a step and output a warning when time is exceeded (greater than warning time)	CMP >T_WARN				

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
General									
✔	✔	✔	✔	Insert network	✔		✔	nn	
✔	✔	✔	✔	Insert empty box	✔		nn	nn	
✔	✔	✔	✔	Open branch	✔		(		
✔	✔	✔	✔	Close branch	✔		)		
✔	✔	✔	✔	Insert input	-|		nn	nn	
✔	✔	✔	✔	Invert Boolean result	-|NOT|-	-o|	NOT		
Bit logic operations									
✔	✔	✔	✔	AND logic operation	✔	&	O	&	-I&I-
✔	✔	✔	✔	OR logic operation	✔	>=1	O	OR	-I>=1I-
✔	✔	✔	✔	EXCLUSIVE OR logic operation	✔	X	X	XOR	-IXORI-
✔	✔	✔	✔	Assignment	-( )-	-[=]	=	:=	
		✔	✔	Negate assignment	-(/)-	-[/=]	NOT		
✔	✔	✔	✔	Invert input					--oI

Basic instructions | Extended instructions | Technology | Communication

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	Reset output	-(R)	-[R]	R	nn	
✔	✔	✔	✔	Set output	-(S)	-[S]	S	nn	
		✔	✔	*Set bit field* *S7-400: SFC 79 SET*	*SET_BF*		*nn*	*nn*	
		✔	✔	*Reset bit field* *S7-400: SFC 89 RSET*	*RESET_BF*		*nn*	*nn*	
✔	✔	✔	✔	Set/reset flip-flop CFC: set dominant	SR		nn	nn	SR
✔	✔	✔	✔	Reset/set flip-flop CFC: reset dominant	RS		nn	nn	RS
✔	✔	✔	✔	Scan operand for positive signal edge	-(P)-	-|P|-	<Operand>; FP;	nn	
✔	✔	✔	✔	Scan operand for negative signal edge	-(N)-	-|N|-	<Operand>; FN;	nn	
		✔	✔	Set operand on positive signal edge	-(P)-	-|P|-	R_TRIG		
		✔	✔	Set operand on negative signal edge	-(N)-	-|N|-	F_TRIG		
✔	✔	✔	✔	Scan Boolean result for positive signal edge	P_TRIG		FP	nn	

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	Scan Boolean result for negative signal edge	N_TRIG		FN	nn	

		✔	✔	Detect positive signal edge
				SCL: Programming with two instructions is more effective:
				`posFlanke := signal and not laststate;`
				`laststate := signal;`
					R_TRIG				

		✔	✔	Detect negative signal edge
				SCL: Programming with two instructions is more effective:
				`negFlanke := not signal and not last-state;`
				`laststate := not signal;`
					F_TRIG				

✔	✔	✔	✔	Normally open contact	-||-	nn	nn	nn	
✔	✔	✔	✔	Normally closed contact	-|/|-	nn	nn	nn	
Safety functions									
✔	✔	✔	✔	Only Safety: EMERGENCY STOP up to Stop Category 1	ESTOP1				
✔	✔			Only Safety: Two-hand monitoring	TWO_HAND				
✔	✔	✔	✔	Only Safety: Two-hand monitoring with enable	TWO_H_EN				

Basic instructions				Extended instructions	Technology		Communication		
S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔			Only Safety: parallel muting with two or four muting sensors	MUTING				
✔	✔	✔	✔	Only Safety: parallel muting with two or four muting sensors	MUT_P				
✔	✔	✔	✔	Only Safety: 1oo2 evaluation of two single-channel encoders combined with a discrepancy analysis	EV1oo2DI				
✔	✔	✔	✔	Only Safety: Feedback monitoring	FDBACK				
✔	✔	✔	✔	Only Safety: Safety door monitoring	SFDOOR				
✔	✔	✔	✔	Only Safety: Acknowledgment for simultaneous reintegration of all F-I/O/channels of the F-I/O of an F-runtime group after communication errors or F-I/O/channel errors	ACK_GL				
Timers									
IEC timers									
✔	✔	✔	✔	Generate pulse	TP		TP		
✔	✔	✔	✔	Generate on-delay	TON		TON		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	Generate off-delay	TOF		TOF		
		✔	✔	Time accumulator	TONR				
		✔	✔	Time accumulator (start timer)	-(TONR)-	-[TONR]-	nn	nn	
		✔	✔	Reset timer	-(RT)-	-[RT]-	RESET_TIMER		
		✔	✔	Load time duration	-(PT)-	-[PT]-	PRESET_TIMER		
		✔	✔	Start pulse timer	-(TP)-	-[TP]-	nn	nn	
		✔	✔	Start on-delay timer	-(TON)-	-[TON]-	SD	nn	
		✔	✔	Start off-delay timer	-(TOF)-	-[TOF]-	SF	nn	
SIMATIC timers legacy									
✔	✔		✔	*Assign pulse timer parameters and start*	*S_PULSE*		*nn*	*S_PULSE*	
✔	✔		✔	*Assign extended pulse timer parameters and start*	*S_PEXT*		*nn*	*S_PEXT*	
✔	✔		✔	*Assign on-delay timer parameters and start*	*S_ODT*		*nn*	*S_ODT*	
✔	✔		✔	*Assign retentive on-delay timer parameters and start*	*S_ODTS*		*nn*	*S_ODTS*	
✔	✔		✔	*Assign off-delay timer parameters and start*	*S_OFFDT*		*nn*	*S_OFFDT*	

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S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔		✔	*Start pulse timer*	*-(SP)*	*-[SP]*	*SP*	*nn*	
✔	✔		✔	*Start extended pulse timer*	*-(SD)*	*-[SD]*	*SD*	*nn*	
✔	✔		✔	*Enable timer*			*FR*	*nn*	
✔	✔		✔	*Load timer value*			*L*	*nn*	
✔	✔		✔	*Load BCD-coded timer value*			*LC*	*nn*	
✔	✔		✔	*Reset timer*	*-(R)*	*-[R]*	*R*	*nn*	
✔	✔		✔	*Start off-delay timer*	*-(SF)*	*-[SF]*	*SF*	*nn*	
✔	✔		✔	*Start on-delay timer*	*-(SD)*	*-{SD]*	*SD*	*nn*	
✔	✔		✔	*Start retentive on-delay timer*	*-(SS)*	*-[SS]*	*SS*	*nn*	
Counters									
IEC counters									
✔	✔	✔	✔	Count up	CTU		CTU		
✔	✔	✔	✔	Count down	CTD		CTD		
✔	✔	✔	✔	Count up and down	CTUD		CTUD		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
				SIMATIC counters legacy					
✔	✔		✔	*Assign parameters and count up*	*S_CU*		*nn*	*S_CU*	
✔	✔		✔	*Assign parameters and count down*	*S_CD*		*nn*	*S_CD*	
✔	✔		✔	*Assign parameters and count up/down*	*S_CUD*		*nn*	*S_CUD*	
✔	✔		✔	*Set initial counter value*	*-(SC)*	*- [SC]*	*nn*	*nn*	
✔	✔		✔	*Count up*	*-(CU)*	*-[CU]*	*CU*	*nn*	
✔	✔		✔	*Count down*	*-(CD)*	*-[CD]*	*CD*	*nn*	
✔	✔		✔	*Enable counter*			*FR*	*nn*	
✔	✔		✔	*Load counter value*			*L*	*nn*	
✔	✔		✔	*Load BCD-coded counter value*			*LC*	*nn*	
✔	✔		✔	*Reset counter*			*R*	*nn*	
✔	✔		✔	*Set counter*			*S*	*nn*	
				Comparator operations					
✔	✔	✔	✔	Equal	CMP ==		== I/D/R	=	CMP ==
✔	✔	✔	✔	Not equal	CMP <>		<> I/D/R	<>	CMP <>

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S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	Greater than or equal	CMP >=		>= I/D/R	>=	CMP >=
✔	✔	✔	✔	Less than or equal	CMP <=		<= I/D/R	<=	CMP <=
✔	✔	✔	✔	Greater than	CMP >		> I/D/R	>	CMP >
✔	✔	✔	✔	Less than	CMP <		< I/D/R	<	CMP <
		✔	✔	Value within range	IN_RANGE			nn	
		✔	✔	Value outside range	OUT_RANGE			nn	
		✔	✔	Check validity	-|OK|-			nn	
		✔	✔	Check invalidity	-|NOT_OK|-			nn	
Variant									
		✔	✔	Check data type of a VARIANT tag				TypeOf	
		✔	✔	Check data type of an ARRAY element of a VARIANT tag				TypeO-fElements	
		✔	✔	Compare data type for EQUAL with the data type of a tag	EQ_Type			*)	
		✔	✔	Compare data type of an ARRAY element for EQUAL with the data type of a tag	EQ_ElemType			*)	

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
		✔	✔	With a tag of type DB_ANY, compare the data type of an indirectly addressed DB with a data type for EQUAL. Identify any data block with DB_ANY. You access a data block that is not yet available during programming.	EQ_TypeOfDB:			*)	
		✔	✔	Compare data type for UNEQUAL with the data type of a tag	NE_Type			*)	
		✔	✔	Compare data type of an ARRAY element for UNEQUAL with the data type of a tag	NE_ElemType			*)	
		✔	✔	With a tag of TYPE DB_ANY, compare the data type of an indirectly addressed DB with a data type for NOT EQUAL.	NE_TypeOfDB:			*)	
		✔	✔	Check for EQUALS NULL pointer	IS_NULL			*)	
		✔	✔	Check for UNEQUALS NULL pointer	NOT_NULL			*)	

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)

***) Application examples for SCL:**
`IF TypeOf(...) = INT THEN ... // corresponds to EQ_Type`
`IF TypeOfElements(...) = INT THEN ... // corresponds to EQ_ElemType`
`IF ... <> NULL THEN ... // corresponds to NOT_NULL`
Instead of "=", you can also use other operators, e.g.: "<>".
Instead of "INT", you can also use any other data types or data types that you have defined, e.g.: "REAL", "Recipe".									

		✔	✔	Check for ARRAY	IS_ARRAY				
			✔	Compare tag structured data types			CompType	=	
Mathematical functions									
		✔	✔	Calculate	CALCULATE (SCL network in LAD/FBD)		nn	nn	
✔	✔	✔	✔	Add	ADD		+	+	
✔	✔	✔	✔	Subtract	SUB		-	-	
✔	✔	✔	✔	Multiply	MUL		*	*	
✔	✔	✔	✔	Divide	DIV		/	/	
✔	✔	✔	✔	Form absolute value Safety instruction only for S7-1200/1500	ABS		ABS		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	Return remainder of division	MOD				
✔	✔	✔	✔	Create twos complement	NEG		NEGI, NEGD	nn	NEG
✔	✔	✔	✔	Create ones complement	nn		INVI, INVD	NOT	
✔	✔	✔	✔	Increment	INC			nn	
✔	✔	✔	✔	Decrement	DEC			nn	
✔	✔	✔	✔	Get minimum	MIN				
✔	✔	✔	✔	Get maximum	MAX				
✔	✔	✔	✔	Set limit value	LIMIT				
✔	✔	✔	✔	Form square	SQR				
✔	✔	✔	✔	Form square root	SQRT				
✔	✔	✔	✔	Form natural logarithm	LN				
✔	✔	✔	✔	Form exponential value	EXP				
✔	✔	✔	✔	Form sine value	SIN				
✔	✔	✔	✔	Form cosine value	COS				
✔	✔	✔	✔	Form tangent value	TAN				

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S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	Form arcsine value	ASIN				
✔	✔	✔	✔	Form arccosine value	ACOS				
✔	✔	✔	✔	Form arctangent value	ATAN				
		✔	✔	Return fraction	FRAC			FRAC	
		✔	✔	Exponentiate	EXPT		**	**	
Move									
(✔)	(✔)	✔	✔	Move value S7-300/400: Only LAD and FBD	MOVE		MOVE	:=	
✔	✔			Only Safety: Write value indirectly to an F-DB	WR_FBD				
✔	✔			Only Safety: Read value indirectly from an F-DB	RD_FBD				
			✔	Only Safety: Read value from INT F-Array	RD_ARRAY_I				
			✔	Only Safety: Read value from DINT F-Array	RD_ARRAY_DI				
		✔	✔	Move data type from ARRAY of BYTE (Deserialize)	Deserialize				
		✔	✔	Move data type to ARRAY of BYTE (Serialize)	Serialize				

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
		✔	✔	Move block S7-400: SFC 20 BLKMOV	MOVE_BLK				
		✔	✔	Move block not interruptible S7-400: SFC 81 UBLKMOV	UMOVE_BLK				
		✔	✔	Move block	MOVE_BLK_VARIANT				
		✔	✔	Fill block	FILL_BLK				
		✔	✔	Fill block not interruptible	UFILL_BLK				
		✔	✔	Disassemble a tag bit string data type BYTE, WORD, DWORD or LWORD into individual bits (= scatter)	SCATTER				
		✔	✔	Disassemble an ARRAY of BYTE, WORD, DWORD or LWORD into individual bits	SCATTER_BLK				
		✔	✔	Merge all bits from an ARRAY of BOOL, an anonymous STRUCT or a PLC data type exclusively with Boolean elements into a bit string data type BYTE, WORD, DWORD or LWORD (= gather)	GATHER				

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
		✔	✔	Merge individual bits into multiple elements of an ARRAY of BOOL, an anonymous STRUCT or a PLC data type exclusively with Boolean elements	GATHER_BLK				
		✔	✔	Swap	SWAP				
✔			✔	With "AssignmentAttempt", you attempt to assign a VARIANT tag to a reference tag. The data type of a reference tag is specified at the time of the declaration, the data type of a VARIANT tag is determined during runtime.	?=				
ARRAY DB									
		✔	✔	Read from ARRAY data block	ReadFromArrayDB				
		✔	✔	Write to ARRAY data block	WriteToArrayDB				
		✔	☑	Read from ARRAY data block in load memory	ReadFromArrayDBL				
		✔	☑	Write to ARRAY data block in load memory	WriteToArrayDBL				

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
Variant									
		✔	✔	Read out VARIANT tag value	VariantGet				
		✔	✔	Write VARIANT tag value	VariantPut				
		✔		Get number of ARRAY elements	CountOfElements				
ARRAY [*]									
		✔	✔	Read out ARRAY low limit	LOWER_BOUND				
		✔	✔	Read out ARRAY high limit	UPPER_BOUND				
Read/write access Recommendation: Symbolic programming.									
		✔	✔	Read data in little endian format			READ_LITTLE		
		✔	✔	Write data in little endian format			WRITE_LITTLE		
		✔	✔	Read data in big endian format			READ_BIG		
		✔	✔	Write data in big endian format			WRITE_BIG		
		✔	✔	*Read memory address*			*PEEK*		
		✔	✔	*Read memory bit*			*PEEK_BOOL*		

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S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
		✔	✔	*Write memory address*			*POKE*		
		✔	✔	*Write memory bit*			*POKE_BOOL*		
		✔	✔	*Write memory area*			*POKE_BLK*		
				Legacy Recommendation: Symbolic programming					
✔	✔		✔	*Move block*	*BLKMOV*				
✔	✔		✔	*Move block not interruptible*	*UBLKMOV*				
✔	✔		✔	*Fill block*	*FILL*				
		✔	✔	*Read field; recommendation: Indexed access to an array*	*FieldRead*				
		✔	✔	*Write field; recommendation: Indexed access to an array*	*FieldWrite*				

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
Conversion operations									
✔	✔	✔	✔	Convert value S7-1200/1500: You can convert numerical formats and data types to other numerical formats and data types. You can find more detailed information in the information system of STEP 7.	CONVERT		xxx_TO_yyy		CONVERT
✔	✔	✔	✔	Only Safety: Convert data of data type BOOL into data of data type WORD	BO_W				
✔	✔	✔	✔	Only Safety: Convert data of data type WORD into data of data type BOOL	W_BO				
✔	✔	✔	✔	Round numerical value	ROUND		RND	ROUND	
✔	✔	✔	✔	Generate next higher integer from floating-point number	CEIL		RND+	CEIL	
✔	✔	✔	✔	Generate next lower integer from floating-point number	FLOOR		RND-	FLOOR	
✔	✔	✔	✔	Truncate numerical value	TRUNC				
✔	✔	✔	✔	Scale	SCALE_X				
		✔	✔	Normalize	NORM_X				

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
			✔	Create a reference to a tag: "REF()" is used to specify to which tag a previously declared reference should point.	nn		nn	REF	
✔	✔	✔	✔	Convert BCD to integer (16 bit)	nn		BTI	BCD16_TO_INT	
✔	✔	✔	✔	Convert integer (16 bit) to BCD	nn		ITB	INT_TO_BCD16	
✔	✔	✔	✔	Convert BCD to integer (32 bit)	nn		BTD	BCD32_TO_INT	
✔	✔	✔	✔	Convert integer (32 bit) to BCD	nn		DTB	DINT_TO_BCD32	
✔	✔	✔	✔	Convert integer (16 bit) to integer (32 bit) S7-1500: Conversion also done implicitly	nn		ITD	INT_TO_DINT	
✔	✔	✔	✔	Convert integer (32 bit) to floating-point number S7-1500: Conversion also done implicitly	nn		DTR	DINT_TO_REAL	
✔	✔		✔	Create ones complement integer (16 bit) S7-1500: Conversion also done implicitly	nn		INVI	nn	

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔		✔	Create ones complement double integer (32 bit) S7-1500: Conversion also done implicitly	nn		INVD	nn	
✔	✔		✔	Negate integer (16 bit)	nn		NEGI	nn	
✔	✔		✔	Negate integer (32 bit)	nn		NEGD	nn	
✔	✔		✔	Negate floating-point number	nn		NEGR	nn	
✔	✔		✔	*Switch bytes in the right word of accumulator 1*	*nn*		*CAW*	*nn*	
✔	✔		✔	*Switch all bytes in accumulator 1*	*nn*		*CAD*	*nn*	
Variant instructions									
		✔	✔	Convert VARIANT to DB_ANY			VARIANT_TO_DB_ANY		
		✔	✔	Convert DB_ANY to VARIANT			DB_ANY_TO_VARIANT		
Legacy Recommendation: Symbolic programming									
✔	✔	✔	✔	Convert the integer to a physical unit between a low limit and high limit (scaling). Standard CPU: INT in REAL F-CPU: INT in INT	SCALE		*SCALE*		

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S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
		✔	✔	Convert the integer to a physical unit between a low limit and high limit (scaling). F-CPU: INT in DINT	SCALE_D				
✔	✔		✔	*Unscale the floating-point number into physical units between a low limit and a high limit and convert it io an integer (unscaling).*	*UNSCALE*				
Program control operations									
✔	✔	✔	✔	Branch conditionally			JC	IF... THEN... ELSE...	
✔	✔	✔	✔	Branch conditionally multiple times				IF... THEN... ELSIF...	
✔	✔	✔	✔	Branch to a list element			SPL	CASE... OF...	
✔	✔	✔	✔	Run in counting loop				FOR... TO... DO...	

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	Run in counting loop with step width				FOR... TO... BY... DO...	
✔	✔	✔	✔	Run if condition is met, the CPU checks the condition at the start of the loop			JC	WHILE... DO...	
✔	✔	✔	✔	Run if condition is not met. The CPU checks the condition at the end of the loop, i.e. the CPU runs the loop at least once.			LOOP	REPEAT... UNTIL...	
✔	✔	✔	✔	Terminate running through the loop and start with the next run				CON-TINUE	
✔	✔	✔	✔	Exit loop immediately				EXIT	
✔	✔	✔	✔	Exit block	RET		BEU	RETURN	
		✔	✔	Organize source code				REGION... END_ REGION	
✔	✔		✔	Conditional block end			BEC	nn	

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S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	Insert a comment section Multilingual comments: (/*...*/)	nn		//	//, (*...*), (/*...*/)	
			✔	Only SIMATIC S7-1500 Software Controller CPU 150xS: Shut down or restart Windows and the controller	SHUT_DOWN				
Jumps									
✔	✔	✔	✔	*Jump*	nn		JU	*GOTO...*	
✔	✔	✔	✔	Jump if RLO = 1	-(JMP)	-[JMP]	JC	nn	
✔	✔	✔	✔	Jump if RLO = 0	-(JMPN)	-[JMPN]	JCN	nn	
✔	✔	✔	✔	Jump label	LABEL		:	nn	
		✔	✔	Define jump list	JMP_LIST		JL	nn	
		✔	✔	Jump distributor	SWITCH			nn	
✔	✔	✔	✔	Return	-(RET)	-[RET]		nn	
✔	✔			Only Safety: Open global data block	-(OPN)	-[OPN]		nn	
✔	✔		✔	Jump if RLO = 1 and save RLO	nn		JCB	nn	
✔	✔		✔	Jump if RLO = 0 and save RLO	nn		JNB	nn	

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔		✔	Jump if BR = 1	nn		JBI	nn	
✔	✔		✔	Jump if BR = 0	nn		JNBI	nn	
✔	✔		✔	Jump if OV = 1	nn		JO	nn	
✔	✔		✔	Jump if OS = 1	nn		JOS	nn	
✔	✔		✔	Jump if the result is zero	nn		JZ	nn	
✔	✔		✔	Jump if the result is not zero	nn		JN	nn	
✔	✔		✔	Jump if the result is greater than zero	nn		JP	nn	
✔	✔		✔	Jump if the result is less than zero	nn		JM	nn	
✔	✔		✔	Jump if the result is greater than or equal to zero	nn		JPZ	nn	
✔	✔		✔	Jump if the result is less than or equal to zero	nn		JMZ	nn	
✔	✔		✔	Jump if the result is invalid	nn		JUO	nn	
✔	✔		✔	Loop	nn		LOOP	nn	
Data blocks									
✔	✔		✔	Open global data block S7-1500: only for "non-optimized" blocks			OPN	nn	

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S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔		✔	Open instance data block S7-1500: only for "non-optimized" blocks			OPNI	nn	
✔	✔		✔	*Swap data block register*			*CDB*	*nn*	
✔	✔		✔	*Load the length of a global data block into accumulator 1*			*L DBLG*	*nn*	
✔	✔		✔	*Load the number of a global data block into accumulator 1*			*L DBNO*	*nn*	
✔	✔		✔	*Load the length of an instance data block into accumulator 1*			*L DILG*	*nn*	
✔	✔		✔	*Load the number of an instance data block into accumulator 1*			*L DINO*	*nn*	
Code blocks									
✔	✔		✔	Call block LAD/FBD: Only for S7-300/400	CALL			nn	
✔	✔		✔	*Conditional block call*			*CC*	*nn*	
✔	✔		✔	*Unconditional block call*			*UC*	*nn*	
Runtime control									
		✔	✔	Limit and enable password legitimation	ENDIS_PW				

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	Restart cycle monitoring time	RE_TRIGR				
✔	✔	✔	✔	Exit program	STP				
			✔	Only SIMATIC S7-1500 software controller CPU 150xS: Shut down or restart Windows and the controller	SHUT_DOWN				
		✔	✔	Get error locally	GET_ERROR				
		✔	✔	Get error ID locally	GET_ERR_ID				
✔	✔			Compress CPU memory	COMPRESS				
✔	✔			Control CiR process	CiR				
		✔	✔	Initialize all retain data	INIT_RD				
✔	✔	✔	✔	Program time delay	WAIT				
✔	✔			Change protection level	PROTECT				
		✔	✔	Runtime measurement with nanosecond accuracy	RUNTIME				
✔	✔	✔	✔	Only Safety: Fail-safe acknowledgment from an operator control and monitoring system	F_ACK_OP				

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S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
Word logic operations									
✔	✔	✔	✔	Create ones complement	INVERT			NOT	INV (NOT)
✔	✔	✔	✔	Decode: set a specified bit	DECO				
✔	✔	✔	✔	Encode: Output bit number of least significant bit set in the input value	ENCO				
✔	✔	✔	✔	Select: Output a parameter as result depending on a BOOL value	SEL				
(✔)	(✔)	✔	✔	Multiplexing S7-300/400: Only SCL	MUX		nn	MUX	
		✔	✔	Demultiplex	DEMUX		nn	DEMUX	
✔	✔	✔	✔	AND logic operation word by word	AND		AW	&, AND	AND
✔	✔	✔	✔	OR logic operation word by word	OR		OW	OR	OR
✔	✔	✔	✔	EXCLUSIVE OR logic operation word by word	XOR		XOW	XOR	XOR
✔	✔	✔	✔	AND logic operation double word by double word	AND		AD	&, AND	AND
✔	✔	✔	✔	OR logic operation double word by double word	OR		OD	OR	OR

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	EXCLUSIVE OR logic operation double word by double word	XOR		XOD	XOR	XOR
Shift and rotate									
✔	✔	✔	✔	Rotate right	ROR				
✔	✔	✔	✔	Rotate left	ROL				
✔	✔	✔	✔	Shift right word by word	SHR		SRW	SHR	
✔	✔	✔	✔	Shift left word by word	SHL		SLW	SHL	
✔	✔		✔	Shift word by word with sign			SSI	nn	
✔	✔		✔	Shift double word by double word with sign			SSD	nn	
✔	✔		✔	Shift right double word by double word			SRD	nn	
✔	✔		✔	Shift left double word by double word			SLD	nn	
✔	✔		✔	Rotate right double word by double word	SHR		RRD	SHR	
✔	✔		✔	Rotate left double word by double word	SHL		RLD	SHL	

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔		✔	Rotate left by status bit CC 1			RLDA	nn	
✔	✔		✔	Rotate right by status bit CC 1			RRDA	nn	
Information on S7-400: The controllers have four accumulators. You will find only the instructions for two accumulators in the list below.									
Loading									
✔	✔		✔	Loading	nn		L	nn	
✔	✔		✔	*Load status word in accumulator 1*			*L STW*	*nn*	
✔	✔		✔	*Load AR1 with contents of accumulator 1*			*LAR1*	*nn*	
✔	✔		✔	*Load AR1 with double word or area pointer*			*LAR1 <D>*	*nn*	
✔	✔		✔	*Load AR1 with contents of AR2*			*LAR1 AR2*	*nn*	
✔	✔		✔	*Load AR2 with contents of accumulator 1*			*LAR2*	*nn*	
✔	✔		✔	*Load AR2 with double word or area pointer*			*LAR2 <D>*	*nn*	
Transfer									
✔	✔		✔	Transfer	nn		T	nn	
✔	✔		✔	*Transfer accumulator 1 to status word*			*T STW*	*nn*	
✔	✔		✔	*Switch AR1 and AR2*			*CAR*	*nn*	

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔		✔	*Transfer AR1 to accumulator 1*			*TAR1*	*nn*	
✔	✔		✔	*Transfer AR1 to double word*			*TAR1 <D>*	*nn*	
✔	✔		✔	*Transfer AR1 to AR2*			*TAR1 AR2*	*nn*	
✔	✔		✔	*Transfer AR2 to accumulator 1*			*TAR2*	*nn*	
✔	✔		✔	*Transfer AR2 to double word*			*TAR2 <D>*	*nn*	
Legacy									
✔	✔		✔	Implement sequencer	DRUM				
✔	✔			Implement sequencer	DRUM_X				
✔	✔		✔	Discrete control time interrupt	DCAT				
✔	✔		✔	Motor control time interrupt	MCAT				
✔	✔		✔	Compare input bits with the bits of a mask	IMC				
✔	✔		✔	Matrix scanner	SMC				
✔	✔		✔	Lead and lag algorithm	LEAD_LAG				
✔	✔		✔	Create bit pattern for seven-segment display	SEG				
✔	✔		✔	Create tens complement	BCDCPL				

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S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔		✔	Count number of set bits	BITSUM				
✔	✔			Time accumulator	TONR_X				
✔	✔			Save data to shift register	WSR				
✔	✔			Shift bit to shift register	SHRB				
✔	✔			*Get status bit*	*Status -||-*		*A 0V*	*nn*	
✔	✔			*Call block*	*-(CALL)*	*-[CALL]*	*UC*	*nn*	
✔	✔			*Save RLO in BR bit*	*-(SAVE)*	*-[SAVE]*	*SAVE*	*nn*	
✔	✔			*Open MCR ranges*	*-(MCR<)*	*-[MCR<]*	*MCR(*	*nn*	
✔	✔			*Close MCR ranges*	*-(MCR>)*	*-[MCR>]*	*)MCR*	*nn*	
✔	✔			*Enable MCR range*	*-(MCRA)*	*-[MCRA]*	*MCRA*	*nn*	
✔	✔			*Disable MCR range*	*-(MCRD)*	*-[MCRD]*	*MCRD*	*nn*	
✔	✔			*Set bit array*	*SET*				
✔	✔			*Set byte array*	*SETI*				
✔	✔			*Reset bit array*	*RESET*				
✔	✔			*Reset byte array*	*RESETI*				

S7-300	S7-400	S7-1200	S7-1500	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔			*Enter substitute value*	*REPL_VAL*				
✔	✔		✔	*Swap content of accumulators 1 and 2*	*nn*		*TAK*	*nn*	
✔	✔		✔	*Shift contents to the next highest accumulator*	*nn*		*PUSH*	*nn*	
✔	✔		✔	*Shift contents to the next lowest accumulator*	*nn*		*POP*	*nn*	
✔	✔		✔	*Add accumulator 1 to AR1*	*nn*		*+AR1*	*nn*	
✔	✔		✔	*Add accumulator 1 to AR2*	*nn*		*+AR2*	*nn*	
✔	✔		✔	*Program display (null instruction)*	*nn*		*BLD*	*nn*	
✔	✔		✔	*Null instruction*	*nn*		*NOP 0*	*nn*	
✔	✔		✔	*Null instruction*	*nn*		*NOP 1*	*nn*	

Instructions in the section "Extended instructions"

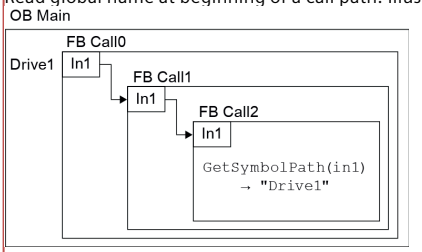
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
Date and time							
✔	✔		✔	Compare time tags	T_COMP*		
✔	✔	✔	✔	Convert times and extract	T_CONV*		
✔	✔	✔	✔	Add times	T_ADD*		
✔	✔	✔	✔	Subtract times	T_SUB*		
✔	✔	✔	✔	Time difference	T_DIFF*		
✔	✔		✔	Combine times	T_COMBINE*		

* SCL: Use conversion functions x_TO_y (e.g. TIME_TO_DINT), or comparator and arithmetic operators (e.g. +, -, >, <).

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
Clock functions							
✔	✔	✔	✔	Set time-of-day (STEP 7 V 5x: SET_CLK)	WR_SYS_T		
✔	✔	✔	✔	Read time-of-day (STEP 7 V 5x: READ_CLK)	RD_SYS_T		
		✔	✔	Read local time	RD_LOC_T		
		✔	✔	Write local time	WR_LOC_T		
	✔		☑	Synchronize slave clocks	SNC_RTCB		
✔	✔		✔	Read system time	TIME_TCK		
		✔	☑	Set time zone	SET_TIMEZONE		
✔	✔	✔	✔	Runtime meters	RTM		
✔	✔			Set runtime meters	SET_RTM		-
✔	✔			Start and stop runtime meters	CTRL_RTM		-
✔	✔			Read runtime meters	READ_RTM		-
	✔			Set time-of-day and time-of-day status	SET_CLKS		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
Local time							
✔	✔			Calculate local time	LOC_TIME		-
✔	✔			Calculate local time from base time	BT_LT		-
✔	✔			Calculate base time from local time	LT_BT		-
✔	✔			Time-of-day interrupt, local time	S_LTINT		-
✔	✔			Set daylight saving time/standard time without time-of-day status	SET_SW		-
✔	✔			Transfer time-stamped alarms	TIMESTMP		-
	✔			Set daylight saving time/standard time with time-of-day status	SET_SW_S		-
String and Character							
		✔	✔	Move character string	S_MOVE	:=	S_MOVE
✔	✔		✔	Compare character strings	S_COMP	=	S_COMP
✔	✔	✔	✔	Convert character string	S_CONV		-
		✔	✔	Convert character string to numerical value	STRG_VAL	STRG_...	STRG_VAL

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
		✔	✔	Convert numerical value to character string	VAL_STRG	..._STRG	VAL_STRG
		✔	✔	Convert character string to Array of CHAR	Strg_TO_Chars		-
		✔	✔	Convert Array of CHAR to character string	Chars_TO_Strg		-
		✔	✔	Determine the length of a character string	MAX_LEN		-
			✔	Join multiple character strings	JOIN		-
			✔	Split character array in multiple character strings	SPLIT		-
✔	✔	✔	✔	*Convert ASCII string to hexadecimal number (conversion is contained in the converting functions, e.g.: CHAR_TO_WORD)*	*HTA*		-
✔	✔	✔	✔	*Convert hexadecimal number to ASCII string*	*HTA*		-
✔	✔	✔	✔	Determine the length of a character string	LEN		
✔	✔	✔	✔	Connect character strings	CONCAT		
✔	✔	✔	✔	Read the left characters of a character string	LEFT		
✔	✔	✔	✔	Read the right characters of a character string	RIGHT		
✔	✔	✔	✔	Read the middle characters of a character string	MID		
✔	✔	✔	✔	Delete characters in a character string	DELETE		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	Insert characters in a character string	INSERT		
✔	✔	✔	✔	Replace characters in a character string	REPLACE		
✔	✔	✔	✔	Find characters in a character string	FIND		
Runtime information							
		✔	✔	Read out a tag on the input parameter	GetSymbolName		-
		✔	✔	Read global name at beginning of a call path. Illustration: 	GetInstanceName		-
		✔	✔	Read out name of the block instance	GetSymbolPath		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
		✔	✔	Query composed global name of block instance	GetInstancePath		-
		✔	✔	Read out name of block in the block itself	GetBlockName		-
Process image							
	✔		✔	Update the process image inputs	UPDAT_PI		
	✔		✔	Update the process image outputs	UPDAT_PO		
✔	✔		☑	Synchronize the process image inputs	SYNC_PI		
✔	✔		☑	Synchronize the process image outputs	SYNC_PO		
Distributed I/O							
DP and PROFINET							
✔	✔	✔	✔	Read data record	RDREC		
✔	✔	✔	✔	Write data record	WRREC		
✔	✔	✔	✔	Read process image	GETIO		
✔	✔	✔	✔	Transfer process image	SETIO		
✔	✔	✔	✔	Read process image area	GETIO_PART		

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S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	✔	Transfer process image area	SETIO_PART		
✔	✔	✔	✔	Receive interrupt	RALRM		
✔	✔	✔	☑	Enable/disable DP slaves	D_ACT_DP		
			☑	Control configuration of a PROFINET IO system (option handling) Enable or disable devices in order to, for example, Flexibly run through or bypass production steps of a manufacturing process.	ReconfigIOSystem		
Additional instructions							
✔	✔		☑	Read data record from I/O	RD_REC		-
✔	✔		☑	Write data record to I/O	WR_REC		
✔	✔	✔	✔	Read consistent data of a DP standard slave	DPRD_DAT		-
✔	✔	✔	✔	Write consistent data of a DP standard slave	DPWR_DAT		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
iDevice/iSlave							
✔		✔	☑	Receive data record	RCVREC		
✔		✔	☑	Make data record available	PRVREC		
			☑	Disable/enable DP slaves or I-devices	D_ACT_DP		-
✔				Send interrupt	SALRM		-
PROFIBUS							
✔	✔			Trigger hardware interrupt from DP standard slave	DP_PRAL		-
✔	✔		☑	Synchronize DP slaves/Freeze inputs	DPSYC_FR		
✔	✔	✔	☑	Read diagnostics data from a DP slave	DPNRM_DG		-
✔	✔		☑	Discover topology for the DP master system	DP_TOPOL		-
ASi							
✔	✔			Control ASi master behavior	ASi_3422		-
✔	✔		✔	Control ASi master behavior	ASI_CTRL		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
PROFIenergy							
IO controller							
✔	✔		✔	Start and exit energy-saving mode	PE_START_END		-
✔	✔		✔	Start and exit energy-saving mode/Read out status information	PE_CMD		-
✔	✔		✔	Set switching behavior of power modules	PE_DS3_WRITE_ET200S		-
✔	✔		☑	Starting and stopping energy-saving mode via WakeOnLan	PE_WOL		-
iDevice/iSlave							
✔		✔	☑	Control PROFIenergy commands in the iDevice	PE_I_DEV		-
✔		✔	✔	Generate negative answer to command	PE_Error_RSP		-
✔		✔	✔	Generate answer to command at start of pause	PE_Start_RSP		-
✔		✔	✔	Generate answer to command at end of pause	PE_End_RSP		-
✔		✔	✔	Generate queried energy savings modes as answer	PE_List_Modes_RSP		-
✔		✔	✔	Generate scanned energy saving data as answer	PE_Get_Mode_RSP		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔		✔	✔	Generate PEM status as answer	PE_PEM_Status_RSP		-
✔		✔	✔	Number of PROFIenergy commands	PE_Identify_RSP		-
✔		✔	✔	Generate supported PROFIenergy commands as answer	PE_Measurement_List_RSP		-
✔		✔	✔	Generate queried measured values as answer	PE_Measurement_Value_RSP		-
Module parameter assignment							
✔	✔		✔	Read module data record (predefined parameters)	RD_DPAR		-
✔			✔	Read data record of a module asynchronously (predefined parameters)	RD_DPARA		-
✔	✔			Transfer module data records	PARM_MOD		-
	✔		✔	Read data record from configured system data (predefined parameters)	RD_DPARM		-
✔	✔			Write module data record (dynamic parameters)	WR_PARM		-
✔	✔		☑	Transfer data record (predefined parameters)	WR_DPARM		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
Interrupts							
		✔	☑	Assign an OB to an interrupt event	ATTACH		-
		✔	☑	Detach an OB from an interrupt event	DETACH		-
Cyclic interrupt							
		✔	✔	Set cyclic interrupt parameters	SET_CINT		-
		✔	✔	Query cyclic interrupt parameters	QRY_CINT		-
Time-of-day interrupt							
✔	✔		✔	Set time-of-day interrupt	SET_TINT		-
		✔	✔	Set time-of-day interrupt LOCAL: Refer SDT to local or system time. ACTIVATE: When does the OB apply the settings.	SET_TINTL		-
✔	✔	✔	✔	Cancel time-of-day interrupt	CAN_TINT		-
✔	✔	✔	✔	Enable time-of-day interrupt	ACT_TINT		-
✔	✔	✔	✔	Query status of time-of-day interrupt	QRY_TINT		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
Time-delay interrupt							
✔	✔	✔	✔	Start time-delay interrupt	SRT_DINT		-
✔	✔	✔	✔	Cancel time-delay interrupt	CAN_DINT		-
✔	✔	✔	✔	Query time-delay interrupt status	QRY_DINT		-
Synchronous error events							
✔	✔		✔	Mask synchronous error events	MSK_FLT		-
✔	✔		✔	Unmask synchronous error events	DMSK_FLT		-
✔	✔		✔	Read out event status register	READ_ERR		-
Asynchronous error event							
✔	✔		✔	Disable interrupt event	DIS_IRT		-
✔	✔		✔	Enable interrupt event	EN_IRT		-
✔	✔	✔	✔	Delay execution of higher priority interrupts and asynchronous error events	DIS_AIRT		-
✔	✔	✔	✔	Enable execution of higher priority interrupts and asynchronous error events	EN_AIRT		-
	✔			Trigger multicomputing interrupt	MP_ALM		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
Alarms							
			✔	Generate program alarm with associated values	Program_Alarm		-
			✔	Output alarm status	Get_AlarmState		-
			✔	Read pending alarms	Get_Alarm		-
			✔	Determine the number of alarms for which your CPU currently has sufficient memory.	Get_AlarmResources		-
			✔	Acknowledge alarms	Ack_Alarms		-
		✔	✔	Generate user diagnostic alarms that are entered in the diagnostics buffer	Gen_UsrMsg		-
✔	✔			Write a user diagnostics event to the diagnostics buffer and send to logged on participants	WR_USMSG		-
✔	✔			*Generate alarm messages*	*ALARM_S*		-
✔	✔			Generate alarm message with acknowledgment	ALARM_SQ		-
✔	✔			Create permanently acknowledged PLC alarms	ALARM_D		-
✔	✔			Create acknowledgeable PLC alarms	ALARM_DQ		-
✔	✔			Determine acknowledgment status of the last ALARM_SQ incoming alarm	ALARM_SC		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
	✔			Report up to eight signal changes	NOTIFY_8P		-
	✔			Create PLC alarms without associated values for eight signals	ALARM_8		-
	✔			Create PLC alarms with associated values for eight signals	ALARM_8P		-
	✔			Report a signal change	NOTIFY		-
	✔			Create PLC alarms with acknowledgment display	ALARM		-
	✔			Send archive data	AR_SEND		-
Additional instructions							
✔	✔			Read out dynamically assigned system resources	READ_SI		-
✔	✔			Delete dynamically assigned system resources	DEL_SI		-
	✔			Enable PLC alarms	EN_MSG		-
	✔			Disable PLC alarms	DIS_MSG		-
Diagnostics							
✔	✔		✔	Read current OB start information	RD_SINFO		-
			✔	Read runtime statistics	RT_INFO		
	✔			Determine OB program runtime	OB_RT		-

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S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
	✔			Determine current connection status	C_DIAG		-
✔	✔			Read system status list	RDSYSST		-
		✔	✔	Read LED status	LED		-
		✔	✔	Reading identification and maintenance data	Get_IM_Data		
		✔	✔	Read out name of a module	Get_Name		
		✔	✔	Read information of an IO device	GetStationInfo		
		✔	✔	Read out checksum	GetChecksum		-
		✔	✔	Read out information about the memory card	GetSMCinfo		-
			✔	Read out status of the CPU clock • Is time synchronization via NTP server enabled? • Time synchronization missed? • Is automatic adjustment for daylight saving time enabled?	GetClockStatus		-
		✔	☑	Read module status information in an IO system	DeviceStates		-
		✔	✔	Read module status information of a module	ModuleStates		-
			✔	Generate diagnostics information	GEN_DIAG		-
		✔	✔	Read diagnostics information	GET_DIAG		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
Pulse							
		✔		Pulse width modulation	CTRL_PWM		-
		✔		Pulse train output, output a pulse sequence with specified frequency	CTRL_PTO		-
Recipes & data logging							
Recipe functions							
		✔	✔	Export recipe, as of V17 also for R/H system	RecipeExport		-
		✔	✔	Import recipe, as of V17 also for R/H system	RecipeImport		-
Data logging							
		✔	☑	Create data log	DataLogCreate		-
		✔	☑	Open data log	DataLogOpen		-
		✔	☑	Write data log	DataLogWrite		-
		✔	☑	Empty data log	DataLogClear		-
		✔	☑	Close data log	DataLogClose		-
		✔	☑	Delete data log	DataLogDelete		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
		✔	☑	Data log in new file	DataLogNewFile		-
Data block functions							
✔	✔			Create data block	CREAT_DB		-
		✔	☑	Create data block	CREATE_DB		-
✔	✔			Create data block in the load memory	CREA_DBL		-
✔	✔	✔	☑	Read from data block in the load memory	READ_DBL		-
✔	✔	✔	☑	Write to data block in the load memory	WRIT_DBL		-
		✔	✔	Read data block attributes	ATTR_DB		-
✔	✔			Delete data block	DEL_DB		-
		✔	☑	Delete data block	DELETE_DB		-
✔	✔			Test data block	TEST_DB		-
Table functions							
✔	✔			Add value to table	ATT		-
✔	✔			Output first value of the table	FIFO		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔			Find value in table	TBL_FIND		-
✔	✔			Output last value in table	LIFO		-
✔	✔			Execute table instruction	TBL		-
✔	✔			Run value from table	TBL_WRD		-
✔	✔			Link value logically with table element and save	WRD_TBL		-
✔	✔			Calculate standard deviation	DEV		-
✔	✔			Correlated data tables	CDT		-
✔	✔			Link tables	TBL_TBL		-
✔	✔			Collect/distribute table data	PACK		-
Addressing							
		✔	✔	Determine hardware identifier from slot	GEO2LOG		-
		✔	✔	Determine slot from the hardware identifier	LOG2GEO		-
			✔	Determine the hardware identifier from addressing of STEP 7 V5.5 SPx	LOG2MOD		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
		✔	✔	Determine hardware identifier from an IO address	IO2MOD		-
		✔	✔	Determine the IO addresses from the hardware identifier	RD_ADDR		-
Additional instructions for addressing							
✔	✔		✔	*S7-300/400: Determine start address from slot* *S7-1500: Determine hardware identifier from slot. Exists only for compatibility reasons, not recommended*	*GEO_LOG*		-
✔	✔		✔	*S7-300/400: Determine slot from a logical address* *S7-1500: Determine slot from the hardware identifier. Exists only for compatibility reasons, not recommended*	*LOG_GEO*		-
✔	✔		✔	*S7-300/400: Determine all logical addresses from a logical address* *S7-1500: Determine the logical addresses from the hardware identifier*	*RD_LGADR*		-
✔	✔		✔	*S7-300/400: Determine logical basic address from slot and offset in the user data address area* *S7-1500: Determine hardware identifier from slot and offset in the user data address area*	*GADR_LGC*		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔		✔	*S7-300/400: Determine slot and offset in the user database from a logical address S7-1500: Determine slot from the hardware identifier. Exists only for compatibility reasons, not recommended*	*LGC_GADR*		-
File operations (file handling)							
		✔	☑	Read data from a binary file from the memory card, the binary file has a serialized format/bye array	FileReadC		-
		✔	☑	Write data to a binary file on the memory card	FileWriteC		-
			✔	Delete existing file on the memory card	FileDelete		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
R/H system							

			RH	Only S7-1500 R/H:
				• Request system state "SYNCUP"
				• Make backup CPU to primary CPU.
				• Set backup CPU to "STOP".
				• Enable or disable the SYNCUP system state. The lock applies:
				  • Until you disable the lock again
				  • Until the S7-1500R/H goes to STOP
					RH_CTRL	-

			RH	Specify redundancy ID of the primary CPU 1 = The CPU with redundancy ID 1 is the primary CPU. 2 = The CPU with redundancy ID 2 is the primary CPU.	RH_GetPrimaryID		-

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
Additional instructions							
iSlave							
✔				Set own network address as DP iSlave	SET_ADDR		-
Safety extensions							
		✔	✔	Acknowledge warning message for exceeding the F-cycle time	ACK_FCT_WARN		-

Instructions in the section "Technology"

T in the S7-300 column means: Instruction for the S7-300 Technology CPU S7-31xT. The operating principle of the instructions can differ between S7-300 and S7-1500. Instructions solely for the S7-31xT are not listed in the table. The Technology CPU S7-31xT cannot be programmed in the TIA Portal.

T in the S7-1500 column means: Instruction for the Technology CPU S7-15xyT.

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
Counting (and measuring)					
		✔		Control high-speed counters	CTRL_HSC
		✔		Extended high-speed counters Period duration measurement with system data type 331	CTRL_HSC_EXT
			✔	High-speed counter for counting and measuring	High_Speed_Counter
			✔	Detect position with SSI absolute encoder	SSI_Absolut_Encoder

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
PID Control					
Compact PID					
		✔	✔	Universal PID controller with integrated tuning for proportional-action actuators	PID_Compact
		✔	✔	PID controller with integrated self-optimization for valves and actuators	PID_3Step
		✔	✔	Temperature controller with integrated optimization for temperature processes	PID_Temp
PID basic function					
✔	✔		✔	Continuous-action controller	CONT_C
✔	✔		✔	Step controller for integrating actuators	CONT_S
✔	✔		✔	Pulse generator for proportional-acting actuators S7-1500: also as CFC instruction	PULSEGEN
✔	✔		✔	Continuous temperature controller with pulse generator	TCONT_CP

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
✔	✔		✔	Temperature controller for integrating actuators	TCONT_S
✔	✔			Automatic optimization for a continuous-action controller	TUN_EC
✔	✔			Automatic optimization for a step controller	TUN_ES
				Integrated system functions	
✔				Continuous-action controller	CONT_C_SF
✔				Step controller for integrating actuators	CONT_S_SF
✔				Pulse generator for proportional-acting actuators	PULSGEN_SF
				Auxiliary functions	
		✔	✔	Mapping an input value to an output value using a characteristic curve. The characteristic curve is a polyline with maximum 50 interpolation points with linear interpolation.	Polyline
		✔	✔	Distribute input value to multiple output areas	SplitRange
		✔	✔	Limiting the change speed of a signal	RampFunction

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
✔		✔	✔	First-order proportional transfer element Application: - Low-pass filter - Delay element for smoothing signal jumps - Process simulation block for a closed control circuit within a CPU Parameter: Gain, Lag	Filter_PT1
✔		✔	✔	Second-order proportional transfer element Application: - Low-pass filter - Delay element for smoothing signal jumps - Process simulation block for a closed control circuit within a CPU Parameter: Gain, TimeConstant, Damping	Filter_PT2
✔		✔	✔	First-order differentiator Application: - High-pass filter - Differentiator to calculate the derivative of a signal - Feedforward control Parameter: Td, Lag	Filter_DT1

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
Motion Control					
T		✔	☑	Release/lock axis/technology	MC_Power
T		✔	☑	Acknowledge interrupts, restart axis/technology object	MC_Reset
T		✔	☑	Home axis/technology objects, set home position	MC_Home
T		✔	☑	Pause axis	MC_Halt
T		✔	☑	Position axis absolutely	MC_MoveAbsolute
T		✔	☑	Position axis relatively	MC_MoveRelative
T		✔	☑	Move axis with velocity/speed setpoint	MC_MoveVelocity
		✔	☑	Move axis in jog mode	MC_MoveJog
		✔		Run axis commands as movement sequence	MC_CommandTable
		✔		Change Dynamics settings for the axis	MC_ChangeDynamic
		✔		Write tag of positioning axis	MC_WriteParam
		✔		Continuously read motion data of a positioning axis	MC_ReadParam
T			☑	Position axis overlapping	MC_MoveSuperImposed
T			T	Set alternative encoder as active encoder	MC_SetSensor

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
T			☑	Stop axis and prevent new motion jobs Stop all motions of an axis and prevent new motion jobs. The axis brakes to a standstill and remains switched on.	MC_STOP
			☑	Set bits in the control words (STW) 1 and/or 2 of the PROFIdrive telegram.	MC_SetAxisSTW
T			☑	Enable and disable hardware limit switches during runtime. The changed state is effective immediately and remains effective until the next restart of the technology object.	MC_WriteParameter
T				Read parameters from technology object	MC_ReadParameter
Output cams, cam track, measuring input					
T			☑	Start measuring once	MC_MeasuringInput
			☑	Start cyclic measuring	MC_MeasuringInputCyclic
			☑	Cancel active measuring job	MC_AbortMeasuringInput

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
T			☑	Activate/deactivate output cam	S7-1500: MC_OutputCam (distance output cams and time-based output cams S7-300T: MC_CamSwitch (distance output cam) S7-300T: MC_CamSwitchTime (time-based output cam)
T			☑	Activate/deactivate cam track	MC_CamTrack
Synchronous motion - Gearing/camming					
T			☑	Start gearing	MC_GearIn
T			T	Desynchronize gearing	MC_GearOut
T			T	Start gearing with specified synchronous positions	S7-1500T: MC_GearInPos S7-300T: MC_GearIn
T			T	Relative shift of leading value on the following axis	S7-1500T: MC_PhasingRelative S7-300T: MC_Phasing
T			T	Absolute shift of leading value on the following axis	S7-1500T: MC_PhasingAbsolute S7-300T: MC_Phasing

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
			T	Relative shift of following value on the following axis	MC_OffsetRelative
			T	Absolute shift of following value on the following axis	MC_OffsetAbsolute
			T	Start camming	MC_CamIn
			T	Simulate synchronous operation	MC_SynchronizedMotionSimulation
T			T	Desynchronize camming	MC_CamOut
			T	Specify additive leading value, active leading value + additive leading value = effective leading value	MC_LeadingValueAdditive
Cam disc					
T			T	Interpolating a cam disc	S7-1500T: MC_InterpolateCam S7-300T: MC_CamInterpolate
T			T	Read out leading value of a cam	S7-1500T: MC_GetCamLeadingValue S7-300T: MC_GetCamPoint

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
T			T	Read out following value of a cam	S7-1500T: MC_GetCamFollowingValue S7-300T: MC_GetCamPoint
			T	Copy calculated cam elements to a cam	MC_CopyCamData
MotionIn					
			T	Set motion setpoints for velocity and acceleration	MC_MotionInVelocity
			T	Set motion setpoints for position, velocity and acceleration	MC_MotionInPosition
Torque data					
			☑	Specify additive torque	MC_TorqueAdditive
			☑	Set high and low torque limits	MC_TorqueRange
T			☑	Activate and deactivate force/torque limit / fixed stop detection	MC_TorqueLimiting

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
Motion (kinematics)					
T			T	Interrupt motion execution	MC_GroupInterrupt
T			T	Continue motion execution	MC_GroupContinue
T			T	Stop motion	MC_GroupStop
T			T	Position kinematics absolutely with linear path motion	MC_MoveLinearAbsolute
T			T	Relative positioning of kinematics with linear path motion	MC_MoveLinearRelative
T			T	Position kinematics absolutely with circular path motion	MC_MoveCircularAbsolute
T			T	Relative positioning of kinematics with circular path motion	MC_MoveCircularRelative
			T	Absolute positioning of kinematics in synchronous "point-to-point" motion	MC_MoveDirectAbsolute
			T	Relative positioning of kinematics in synchronous "point-to-point" motion	MC_MoveDirectRelative
			T	Enable conveyor tracking Take along object coordinate system (OCS) with a technology object positioning axis/external sensor/leading axis proxy	MC_TrackConveyorBelt

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
T			T	Motion of a kinematics with interconnected axes that are not enabled and exit simulation mode.	S7-1500T: MC_Kinematics-MotionSimulation S7-300T: MC_GroupSyncConveyorBelt
Zones					
T			T	Define workspace zone	S7-1500T: MC_DefineWorkspaceZone S7-300T: MC_ZoneCheck
T			T	Define kinematics zone	S7-1500T: MC_DefineKinematicsZone S7-300T: MC_ZoneCheck
T			T	Activate workspace zone	S7-1500T: MC_SetWorkspaceZoneActive S7-300T: MC_ZoneCheck
T			T	Deactivate workspace zone	S7-1500T: MC_SetWorkspaceZoneInactive S7-300T: MC_ZoneCheck

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
T			T	Activate kinematics zone	S7-1500T: MC_SetKinematicsZoneActive S7-300T: MC_ZoneCheck
T			T	Deactivate kinematics zone	S7-1500T: MC_SetKinematicsZoneInactive S7-300T: MC_ZoneCheck
Toolbox					
			T	Re-define tool	MC_DefineTool
			T	Change active tool	MC_SetTool
Coordinate systems					
			T	Redefine object coordinate systems	MC_SetOcsFrame
T			T	Transforming axis coordinates (position, speed, acceleration) to Cartesian coordinates (speed and acceleration of the tool center point) - without moving kinematics.	S7-1500T: MC_KinematicsTransformation S7-300T: MC_SetCartesianTransform
			T	Transform Cartesian coordinates to axis coordinates - without moving kinematics.	MC_InverseKinematicsTransformation

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
Time-driven inputs/outputs					
HSP	HSP		☑	Synchronize TIO modules	TIO_SYNC
HSP	HSP		☑	Read in process input signals with time stamps	TIO_IOLink_IN
HSP	HSP		☑	Read in edges at digital input and associated time stamps	TIO_DI
HSP	HSP		☑	Time-controlled output of process output signals	TIO_IOLink_OUT
HSP	HSP		☑	Output edges time-controlled at digital output	TIO_DQ
S7-300C functions					
✔				Position with analog output	ANALOG
✔				Position with digital output	DIGITAL
✔				Control counter	COUNT
✔				Control frequency measurement	FREQUENC
✔				Control pulse width modulation	Pulse

S7-300	S7-400	S7-1200	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
Function modules					
✔	✔			Diverse instructions for FM modules Counting/Positioning/Cam Control/PID Control/Temp Control	✔

The following pages provide an overview of the details and usage of important functions of open communication and S7 communication.

Open communication

Definition: Open exchange of data via PROFINET/Industrial Ethernet between SIMATIC controllers or between SIMATIC controllers and third-party devices. Example of suitable interfaces:

- Integrated PROFINET/Industrial Ethernet interfaces of controllers
- PROFINET/Industrial Ethernet interfaces of communication modules

Due to the open and flexible communication, the size of a sent data package is not automatically known to the receiver.

Connection-oriented with TCP or ISO-on-TCP

With TCP or ISO-on-TCP you establish a connection between the communication partners. TCP or ISO-on-TCP ensures the arrival of the data at the receiver through a transport acknowledgment. In the event of data loss the controller automatically resends the data.

To ensure that the data has arrived completely in the application of the receiver with TCP, you must determine:

1. Determine the size of the data package in the sender.
2. Transfer the size of the data package to the receiver.
3. Evaluate the information in the receiver.

Connection-free with UDP

You send data packets to recipients via UDP without establishing a dedicated connection. The controller cannot detect data loss. UDP offers the following transmission options:

- Transfer to a specific partner - Unicast
- Transfer to a specific group of partners - Multicast; e.g. Multicast via defined Multicast addresses 224.0.1.0.
- Transfer to all - Broadcast

S7-300/400	S7-1200	S7-1500	Instruction	Logs	Property of the data transfer	Data package size	Application and application example
✔	✔	✔	TSEND/TRCV	TCP or ISO-on-TCP	Reliable with acknowledgment	<= 64 KB Exception S7-1200: <= 8 KB	Exchange large data volumes with acknowledgment. E.g. Send data block with measured value logs to any network node. Secure connections by means of exchange of certificates. Implementation of TCP-based protocols, e.g. FTP(s), MQTT, HTTP(S). Application examples: HTTP: https://support.industry.siemens.com/cs/document/109763879/library-for-http-communication-(lhttp)?dti=0&lc=en-AE MQTT: https://support.industry.siemens.com/cs/ww/en/view/109748872
	✔	✔	TSEND_C/TRCV_C (Connection establishment and termination are integrated)				
	✔	✔		UDP	Fast, without acknowledgment		Distribute data without acknowledgment. E.g. Distribute position data quickly to many devices. An exact calculation of the limits is available in the controller manuals.
(✔)	✔	✔	TUSEND/TURCV (not S7-300)			Max. 2048 bytes	

S7 communication

Definition: SIMATIC-homogeneous data exchange between SIMATIC CPUs via PROFIBUS or PROFINET/Industrial Ethernet. The S7 communication can route data between PROFINET and PROFIBUS through a controller. With S7 communication, you connect existing S7-300/400 to S7-1200/1500 or migrate existing systems to S7-1200/1500. Recommendation: Use open communication for data exchange between S7-1200/1500 and thus the possibilities of common Ethernet standards.

Coordinated data transmission with BSEND and BRCV

BSEND sends data to an instruction of the type BRCV in a partner controller. Since BSEND and BRCV coordinate the data transfer, BSEND/BRCV transport the largest amount of data of all the configured S7 connections. BSEND segments the data area to be sent and sends each segment individually to the partner. BRCV acknowledges the acceptance of the sent segment. When BRCV has acknowledged the receipt of the complete data area, you can start a new send job BSEND.

Uncoordinated data transmission with USEND and URCV

USEND sends data to an instruction of the type URCV in a partner controller. URCV does not acknowledge the receipt of the data. The data transfer is not coordinated with the partner controller. This means that USEND can overwrite received data before URCV has written all the data to the target area. If USEND overwrites data, the receiver outputs an error message.

S7-300/400	S7-1200	S7-1500	Instruction	Operating state of partner controller	Property of the data transfer	Guaranteed user data size for specified partner controller	Application	Notes
✔	✔	☑	GET	RUN or STOP	Reliable with acknowledgment	<= 64 KB S7-300: 160 bytes S7-400: 400 bytes S7-1200: 160 bytes S7-1500: 880 bytes Exception S7-1200: <= 8 KB	Accessing data in the partner controller without any programming. For example, read operating data.	You have to use data blocks with absolute addressing. Symbolic addressing is not possible. You must also enable this service in the CPU configuration in the "Protection" area.
✔			GET_S					
✔	✔	☑	PUT				Changing data in the partner controller without any programming. For example, write parameters in a data block and change a recipe.	
✔			PUT_S					
✔		☑	BSEND/BRCV:	RUN		S7-300 CPs: 32768 S7-300: 65534 bytes S7-400: 65534 bytes S7-1500: 65534 bytes, optimized: 65535 bytes	Exchange large amounts of data. For example, send data block with measured value logs to a SCADA system for further evaluation.	Coordinated transmission (See above)
✔		☑	USEND/URCV		Fast, without acknowledgment	S7-300: 160 bytes S7-400: 440 bytes S7-1500: 920 bytes	Control multiple controllers, or send data to multiple controllers. For example, distribute actual values of a sensor to several controllers.	Uncoordinated transmission (See above)
✔			USEND_S/ URCV_S					

Overview of connection types

Automatic connections

For basic communication, e.g. controller for the programming device for engineering or for the HMI, the system automatically reserves connections.

Programmed connections

Programmed connections are very flexible. Use TSEND_C and TRCV_C for communication. The system automatically establishes and terminates the connection. Alternatively, for SIMATIC S7-300/400 use the TCON, TDISCON, TSEND, and TRCV instructions. Use programmed connections, e.g.for sporadic connections.

- Communication resources are free again after the connection establishment.
- Establish and terminate programmed connections in the user program in RUN.

Configured connections

If the connection is interrupted, the controller automatically restores the connection. Create the connection in the network view of SIMATIC STEP 7 and configure the connection.

- Connection resources remain permanently occupied.
- Connection establishment in STOP

The table shows you the dependency of the connection type on the protocol.

Connection type	PG	HMI	TCP	ISO-on-TCP	UDP	ISO	Modbus TCP	FDL	S7 Communication
Automatic	X	X	-	-	-	-	-	-	-
Programmed	-	-	X	X	X	-	X	-	-
Configured	-	X	X	X	X	X	X	X	X

Instructions in the section "Communication"

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
PROFINET and PROFIBUS							
✔	✔	✔	✔	Only Safety: Fail-safe sending of data via PROFIBUS DP/PROFINET IO	SENDDP		
✔	✔	✔	✔	Only Safety: Fail-safe receipt of data via PROFIBUS DP/PROFINET IO	RCVDP		
S7 communication							
✔	✔	✔	☑	*Read data from a remote CPU Example of an application: Integrating SIMATIC S7-1500 into an already existing system with SIMATIC S7-300.*	*GET*		
✔	✔	✔	☑	*Write data to a remote CPU Example of an application: Integrating SIMATIC S7-1500 into an already existing system with SIMATIC S7-300.*	*PUT*		

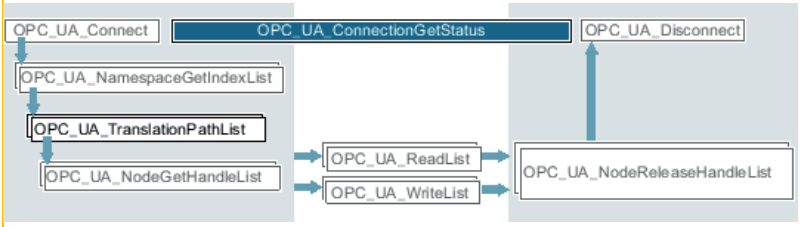
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✔	✔		☑	Send data uncoordinated to a partner (URCV) S7-1500: also as CFC instruction	USEND		
✔	✔		☑	Receive data uncoordinated from a partner (USEND) S7-1500: also as CFC instruction	URCV		
✔	✔		☑	Send data in segments to a partner (BRCV) S7-1500: also as CFC instruction	BSEND		
✔	✔		☑	Receive data in segments from a partner (BSEND) S7-1500: also as CFC instruction	BRCV		
	✔			Initiate a warm or cold restart in a remote device	START		
	✔			Transition a remote device to STOP state	STOP		
	✔			Initiate a restart in a remote device.	RESUME		
	✔			Query the status of a remote partner	STATUS		
	✔			Receive remote device status change	USTATUS		
	✔			Query the status of connection that belongs to an SFB instance	CONTROL		
	✔			Send data to printer	PRINT		

Basic instructions				Extended instructions	Technology	Communication		
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✔				Query connection status	C_CNTRL		
✔	✔			Only Safety: Fail-safe sending of data via S7 connections	SENDS7		
✔	✔			Only Safety: Fail-safe receipt of data via S7 connections	RCVS7		
				Additional instructions	Note: "S" stands for short since only one parameter is possible		
✔	✔			Read data from a remote CPU	GET_S		
✔	✔			Write data to a remote CPU	PUT_S		
✔	✔			Send data uncoordinated	USEND_S		
✔	✔			Receive data uncoordinated	URCV_S		
Open User Communication							
Compact instructions (..._C) Connect and Disconnect are integrated							
		✔	✔	Manage communication connection and send data via Ethernet or Profibus S7-1500: also as CFC instruction	TSEND_C		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
		✔	✔	Manage communication connection and receive data via Ethernet or Profibus S7-1500: also as CFC instruction	TRCV_C		
		✔	☑	Manage communication connection and transfer email S7-1500R/H: Possible up to and including V 4.0.	TMAIL_C		
			☑	Modify NTP server address, read and modify communication parameters: - DNS Hostname, DNS Domainname, DNS Server Addresses - DHCP ClientId - IP Suite (IP Address, Subnet Mask, Default Gateway or Default Router)	CommConfig		
Additional instructions							
✔	✔	✔	✔	Establish communication connection S7-1500: also as CFC instruction	TCON		
✔	✔	✔	✔	Terminate communication connection S7-1500: also as CFC instruction	TDISCON		
✔	✔	✔	✔	Send data via communication connection S7-1500: also as CFC instruction	TSEND		

Basic instructions | Extended instructions | Technology | Communication

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✔	✔	✔	✔	Receive data via communication connection S7-1500: also as CFC instruction	TRCV		
		✔	✔	Resetting the connection S7-1500: also as CFC instruction	T_RESET		
		✔	✔	Check the connection S7-1500: also as CFC instruction	T_DIAG		
		✔	☑	Configure interface S7-1500: also as CFC instruction	T_CONFIG		
		✔	✔	Preparing and changing the communication connection. E.G.: Request connection ID, specify connection properties.	TCONSettings		
✔	✔			Program-controlled IP and connection configuration via SEND/RECEIVE	IP_CONFIG		
✔	✔	✔	✔	Send data via Ethernet (UDP)	TUSEND		
✔	✔	✔	✔	Receive data via Ethernet (UDP)	TURCV		
✔	✔			Change IP configuration parameters	IP_CONF		
✔	✔			Swap data using FETCH and WRITE via TCP	FW_TCP		
✔	✔			Swap data using FETCH and WRITE via ISO-on-TCP	FW_IOT		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
OPC UA							
OPC UA server							
		✔	☑	Query to operating system whether the serve method was called and provision of the input parameters for processing the method.	OPC_UA_ServerMethodPre		
		✔	☑	Transferring information to the operating system about the status of method execution and whether the output parameters of the method are valid.	OPC_UA_ServerMethodPost		
OPC UA client							
				Schematic flow:			
							

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
Preparing data exchange, establishing a session							
			☑	Establish connection.	OPC_UA_Connect		
			☑	Request the current indexes of the namespaces in an OPC UA server	OPC_UA_NamespaceGetIndexList		
			☑	Register PLC tags with an OPC UA server, get handles for read and write access	OPC_UA_NodeGetHandleList		
			☑	Determine NodeIds (node parameters) from tag names (BrowseName)	OPC_UA_TranslatePathList		
			☑	Register OPC UA method with an OPC UA server	OPC_UA_MethodGetHandleList		
Data exchange/data access							
			☑	Read values from PLC tags	OPC_UA_ReadList		
			☑	Writing new values in PLC tags	OPC_UA_WriteList		
			☑	Call method	OPC_UA_MethodCall		
			☑	Set up session and read values from PLC tags	OPC_UA_ReadList_C		
			☑	Set up session and write values to PLC tags	OPC_UA_WriteList_C		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
			☑	Set up session and call method	OPC_UA_MethodCall_C		
Ending data exchange, ending a session							
			☑	Terminate connection to the OPC UA server	OPC_UA_Disconnect		
			☑	Enable handles for read and write access	OPC_UA_NodeReleaseHandleList		
			☑	Enable handles for method calls	OPC_UA_MethodReleaseHandleList		
Diagnostics							
			☑	Read connection status and determine quality of a connection	OPC_UA_ConnectionGetStatus		
OPC UA: CP 443-1 OPC UA							
	✔			Establish connection.	UA_Connect		
	✔			Request the current indexes of the namespaces in an OPC UA server	UA_NamespaceGetIndex		
	✔			Register PLC tags with an OPC UA server, get handles for read and write access	UA_NodeGetHandleList		
	✔			Reading out the data from nodes of the connected server using the list of node handles	UA_ReadList		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
	✔			Writing the data in nodes of the connected server using the list of node handles	UA_WriteList		
	✔			Register PLC tags with an OPC UA server, get handles for read and write access	UA_NodeReleaseHandleList		
	✔			Terminate connection to the OPC UA server	UA_Disconnect		
Web server							
✔	✔	✔	☑	Synchronize user-defined web pages	WWW		
Fail-safe HMI Panels (only in the safety program)							
✔	✔	✔	✔	For Mobile Panel 277 F IWLAN: Communication with connected device via PROFIsafe	F_FB_MP		
✔	✔	✔	✔	For Mobile Panel 277 F IWLAN: Managing of up to 4 panels in the effective range	F_FB_RNG_4		
✔	✔		✔	For Mobile Panel 277 F IWLAN: Managing of up to 16 panels in the effective range	F_FB_RNG_16		
✔	✔	✔	✔	For Mobile Panels of the second generation: Communication with connected device via PROFIsafe	F_FB_KTP_		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✔	✔	✔	✔	For Mobile Panels of the second generation: Managing of panels in the effective range	F_FB_ KTP_RNG		
Modbus TCP							
		✔	✔	Communicate via PROFINET as Modbus TCP client Also supports the Modbus function 23: Write data to the Modbus server and read data from the Modbus server.	MB_CLIENT		
		✔	✔	Communicate via PROFINET as Modbus TCP server	MB_SERVER		
		✔	✔	Communicate redundantly via PROFINET as MODBUS TCP client	MB_RED_CLIENT		
		✔	✔	Communicate redundantly via PROFINET as a MODBUS TCP server	MB_RED_SERVER		
✔	✔			Establish communication between a CPU with integrated PN interface and a partner that supports the Modbus/TCP protocol.	MODBUSPN		
✔	✔			Connection management	TCP_COMM		
✔	✔			Communicate via Ethernet as Modbus TCP client	MOD_CLI		
✔	✔			Communicate via Ethernet as Modbus TCP server	MOD_SRV		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
Communications processors Not for S7-1500 Software Controller CPU 150xS							
Point-to-Point or PtP communication S7-300/400: Commands for ET 200SP CM PtP							
✔	✔	✔	✔	Configure PtP communication port S7-300/400: Only if ET 200SP CM PtP is used	Port_Config		
✔	✔	✔	✔	Configure PtP sender	Send_Config		
✔	✔	✔	✔	Configure PtP recipient	Receive_Config		
✔	✔	✔	✔	Configure 3964 (R) protocol	P3964_Config		
✔	✔	✔	✔	Send data	Send_P2P		
✔	✔	✔	✔	Receive data	Receive_P2P		
✔	✔	✔	✔	Delete receive buffer	Receive_Reset		
✔	✔	✔	✔	Read status	Signal_Get		
✔	✔	✔	✔	Set accompanying signals	Signal_Set		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✔	✔	✔	✔	Get advanced functions	Get_Features		
✔	✔	✔	✔	Set advanced functions	Set_Features		
				Instructions with lower memory requirements, but also less functional scope.	Recommendation: Use the instructions specified above. You cannot apply the instructions decentrally in an ET 200.		
		✔		Configure communication parameters dynamically	PORT_CFG		
		✔		Configure serial transmission parameters dynamically	SEND_CFG		
		✔		Configure serial receive parameters dynamically	RCV_CFG		
		✔		Transmit send buffer data	SEND_PTP		
		✔		Enable receive messages	RCV_PTP		
		✔		Delete receive buffer	RCV_RST		
		✔		Query RS 232 signals	SGN_GET		
		✔		Set RS 232 signals	SGN_SET		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
USS communication S7-300/400: Commands for ET200SP CM PtP							
		✔		Edit communication via USS network	USS_PORT		
✔	✔	✔	✔	Communication via USS network (16 drives)	USS_Port_Scan		
			✔	Communication via USS network (31 drives)	USS_Port_Scan_31		
		✔		Prepare and display data for the drive	USS_Drive		
✔	✔	✔	✔	Data exchange with the drive (16 drives)	USS_Drive_Control		
			✔	Data exchange with the drive (31 drives)	USS_Drive_Control_31		
		✔		Read out parameters from the drive	USS_RPM		
✔	✔	✔	✔	Read data from drive (16 drives)	USS_Read_Param		
			✔	Read data from drive (31 drives)	USS_Read_Param_31		
		✔		Change parameters in the drive	USS_WPM		
✔	✔	✔	✔	Change data in drive (16 drives)	USS_Write_Param		
			✔	Change data in drive (31 drives)	USS_Write_Param_31		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
MODBUS (RTU)							
S7-300/400: Commands for ET200SP CM PtP							
✔	✔	✔	✔	Configure communication module for Modbus	Modbus_Comm_Load		
✔	✔	✔	✔	Communicate as Modbus master	Modbus_Master		
✔	✔	✔	✔	Communicate as Modbus slave	Modbus_Slave		
				Instructions with lower memory requirements, but also less functional scope.	Recommendation: Use the instructions specified above. You cannot apply the instructions decentrally with a CM or in an ET 200.		
		✔		Configure port on the PtP module for Modbus RTU	MB_COMM_LOAD		
		✔		Communicate via the PtP port as Modbus master	MB_MASTER		
		✔		Communicate via the PtP port as Modbus slave	MB_SLAVE		
Point-to-point connection: CP 340							
✔				Receive data	P_RCV		
✔				Send data	P_SEND		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✔				Output alarm text with up to 4 tags to printer	P_PRINT		
✔				Delete receive buffer	P_REST		
✔				Read accompanying signals at the RS 232 interface	V24_STAT_340		
✔				Write accompanying signals at the RS 232C interface	V24_SET_340		
Point-to-point connection: CP 341							
✔				Receive or provide data	P_RCV_RK		
✔				Send or fetch data	P_SND_RK		
✔				Output alarm text with up to 4 tags to printer	P_PRT341		
✔				Read accompanying signals at the RS 232 interface	V24_STAT		
✔				Write accompanying signals at the RS 232C interface	V24_SET		
Point-to-point connection: CP 440							
	✔			Receive data	RECV_440		
	✔			Send data	SEND_440		
	✔			Delete receive buffer	RES_RECV		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
Point-to-point connection: CP 441							
	✔			Read accompanying signals at the RS 232 interface	V24_STAT_441		
	✔			Write accompanying signals at the RS 232C interface	V24_SET_441		
MODBUS slave (RTU)							
✔	✔			Modbus slave instruction for CP 341	MODB_341		
✔	✔			Modbus slave instruction for CP 441	MODB_441		
MODBUS: CP 343-1, CP 443-1							
✔	✔			Establish communication between a CP and a partner that supports the OPEN MODBUS/TCP protocol	MODBUSCP		
✔	✔			Communicate as Modbus client	MB_CPCLI		
✔	✔			Communicate as Modbus server	MB_CPSRV		
ET 200S serial interface ("S_" stands for "serial")							
✔	✔		✔	Receive data	S_RCV		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✔	✔		✔	Send data	S_SEND		
✔	✔		✔	Read accompanying signals at the RS 232C interface	S_VSTAT		
✔	✔		✔	Write accompanying signals at the RS 232C interface	S_VSET		
✔	✔		✔	Set data flow control using XON/XOFF	S_XON		
✔	✔		✔	Set data flow control using RTS/CTS	S_RTS		
✔	✔		✔	Configure data flow control via automatic Configure operation of the RS 232C accompanying signals	S_V24		
✔	✔		✔	Modbus slave instruction for ET 200S 1SI	S_MODB		
✔	✔		☑	Send data to a USS slave	S_USST		
✔	✔		☑	Receive data from a USS slave	S_USSR		
✔	✔		☑	Initialize USS	S_USSI		
SIMATIC NET CP							
Open User Communication							
✔	✔			Passes data to the CP for transfer via a configured connection	AG_SEND		
✔	✔			Passes jobs to the CP for accepting received data	AG_RECV		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✔	✔			Locks data exchange via a connection with FETCH/WRITE	AG_LOCK		
✔	✔			Enable external access to user memory areas of the controller. Data exchange is then possible with FETCH/WRITE.	AG_UNLOCK		
✔	✔			Connection diagnostics	AG_CNTRL		
✔	✔			Connection diagnostics, connection establishment, ping request	AG_CNTEX		
PROFIBUS DP							
✔	✔			Data transfer to the CP as DP master or DP slave	DP_SEND		
✔	✔			Data receipt from CP as DP master or DP slave	DP_RECV		
✔	✔			Request of diagnostics information	DP_DIAG		
✔	✔			Transfer of control information to the PROFIBUS CP	DP_CTRL		
PROFINET IO							
✔	✔			Data passing to the CP as IO controller or IO device	PNIO_SEND		
✔	✔			Data receipt from CP as IO controller or IO device	PNIO_RECV		
✔	✔			Read data record or write data record in IO controller	PNIO_RW_REC		
✔	✔			Alarm evaluation through CP343-1 as IO controller	PNIO_ALARM		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				PROFIenergy			
✔	✔			Triggering or ending an energy saving pause	PE_START_END_CP		
✔	✔			Extended triggering or ending of an energy saving pause	PE_CMD_CP		
✔	✔			Handling of commands from the IO controller in the PROFIenergy device	PE_I_DEV_CP		
✔	✔			Transfer of the switch setting from power modules to ET 200S	PE_DS3_Write_ET200_CP		
				Additional instructions			
✔	✔			Use of a logical trigger for ERPC communication	LOGICAL_TRIGGER		
✔	✔		☑	Setup of FTP connections from and to an FTP server	FTP_CMD		
✔	✔			Transfer connection data from configurations DB to CP	IP_CONFIG		
				GPRSComm: CP 1242-7			
		✔		Establish connection via GSM network	TC_CON		
		✔		Terminate connection via GSM network	TC_DISCON		
		✔		Send data via the GSM network	TC_SEND		
		✔		Receive data via the GSM network	TC_RECV		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
		✔		Transfer configuration data to CP	TC_CONFIG		
S7-300C functions							
ASCII, 3964®							
✔				Send data (ASCII, 3964(R))	SEND_PTP_300C		
✔				Fetch data (ASCII, 3964(R))	RCV_PTP_300C		
✔				Reset input buffer (ASCII, 3964(R))	RES_RCVB_300C		
RK 512							
✔				Send data (RK 512)	SEND_RK_300C		
✔				Fetch data (RK 512)	FETCH_RK_300C		
✔				Receive and provide data (RK 512)	SERVE_RK_300C		
Communication with iSlave/iDevice							
✔	✔			Read data from a communication partner within the local S7 station	I_GET		
✔	✔			Write data to a communication partner within the local S7 station	I_PUT		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✔	✔			Abort a connection to a communication partner within the local S7 station	I_ABORT		
PROFINET CBA							
✔	✔			Update the inputs of the user program interface	PN_IN		
✔	✔			Update the outputs of the user program interface	PN_OUT		
✔	✔			Release DP interconnections	PN_DP		
MPI communication							
Note: "X" stands for the MPI interface							
✔	✔			Send data to a communication partner outside the local S7 station	X_SEND		
✔	✔			Receive data from a communication partner outside the local S7 station	X_RCV		
✔	✔			Read data from a communication partner outside the local S7 station	X_GET		
✔	✔			Write data to a communication partner outside the local S7 station	X_PUT		
✔	✔			Abort an existing connection to a communication partner outside the local S7 station	X_ABORT		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
TeleService							
		✔		Transfer email	TM_MAIL		
✔	✔			Establish remote connection to programming device/PC	PG_DIAL		
✔	✔			Establish remote connection to AS	AS_DIAL		
✔	✔			Send text (SMS) message	SMS_SEND		
✔	✔			Transfer email	AS_MAIL		

Appendix "Optional instructions"

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
SIMATIC Ident							
✔	✔	✔	✔	Read data from transponder	Read		
✔	✔	✔	✔	Read out data from code reading system	Read_MV		
✔	✔	✔	✔	Reset reader	Reset_Reader		
✔	✔	✔	✔	Set program at code reading system	Set_MV_Program		
✔	✔	✔	✔	Write data to the transponder	Write		
Status queries							
✔	✔	✔	✔	Read out status of the reader	Reader_Status		
✔	✔	✔	✔	Read out status of the transponder	Tag_Status		
Advanced functions							
✔	✔	✔	✔	Load the configuration data to the reader	Config_Download		
✔	✔	✔	✔	Back up configuration data from the reader	Config_Upload		

Optional instructions

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✔	✔	✔	✔	Detect transponder population	Inventory		
✔	✔	✔	✔	Read out data of the TID memory of a transponder	Read_TID		
✔	✔	✔	✔	Read out UID of an HF transponder	Read_UID		
✔	✔	✔	✔	Switch on/off antenna of RF300 readers	Set_ANT_RF300		
✔	✔	✔	✔	Set UHF parameters in the reader	Set_Param		
✔	✔	✔	✔	Write EPC ID of a UHF transponder	Write_EPC_ID		
✔	✔	✔	✔	Ident function for trained users with command transfer in a data structure	Advanced_CMD		
✔	✔	✔	✔	Complex Ident function for experts with all commands and possibilities	Ident_Profile		
Legacy							
✔	✔	✔		Read out data of the EPC memory of a transponder	Read_EPC_Mem		
✔	✔	✔	✔	Write EPC memory of a UHF transponder	Write_EPC_Mem		
✔	✔	✔	✔	Switch on/off antennas of RF620R/RF630R	Set_ANT_RF600		

Optional instructions

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✔	✔	✔	✔	Reset MOBY D reader	Reset_MOBY_D		
✔	✔	✔	✔	Reset MOBY U reader	Reset_MOBY_U		
✔	✔	✔	✔	Reset MV code reading device	Reset_MV		
✔	✔	✔	✔	Reset RF200 reader	Reset_RF200		
✔	✔	✔	✔	Reset RF300 reader	Reset_RF300		
✔	✔	✔	✔	Reset RF600 reader	Reset_RF600		
✔	✔	✔	✔	Reset function for experts allows universally adjustable parameters	Reset_Univ		
Energy Suite							
		✔	✔	Calculate operating-mode-related energy data of machines and systems for uniform efficiency evaluation according to measuring regulation	EnS_EEm_Calc		
		✔	✔	Create efficiency protocol in CSV format on the SIMATIC memory card of the CPU according to measuring regulation	EnS_EEm_Report		

Optional instructions

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
SINAMICS							
		✔	✔	Cyclic control of SINAMICS as basic positioner	TO_BasicPos		
		✔	✔	Cyclic control of SINAMICS as basic positioner with standard telegram 1111; Position-controlled axis	SinaPos		
		✔	✔	Cyclic control of SINAMICS with standard telegram 1; speed-controlled axis	SinaSpeed		
		✔	✔	Acyclic read/write of max. 16 parameters from/on the SINAMICS inverter	SinaPara		
		✔	✔	Acyclic read/write a parameter from/on the SINAMICS inverter	SinaParaS		
		✔	✔	Control feed unit of a SINAMICS S120 via standard telegram 370	SinaInfeed		

Cause Effect Matrix

S7-1200	S7-1500	Description	CEM
General			
✔	✔	Add output	✔
✔	✔	Add input	✔
✔	✔	Invert pin	✔
Cause instructions			
Bit logic operations			
✔	✔	AND logic operation	&
✔	✔	OR logic operation	>=1
✔	✔	EXCLUSIVE OR logic operation	X
✔	✔	Assignment	=
Comparator operations			
✔	✔	Equal	CMP ==
✔	✔	Not equal	CMP <>
✔	✔	Greater than or equal	CMP >=

Cause Effect Matrix

S7-1200	S7-1500	Description	CEM
✔	✔	Less than or equal	CMP <=
✔	✔	Greater than	CMP >
✔	✔	Less than	CMP <
		Timers	
✔	✔	Delay activation	OnDelay
✔	✔	Delay deactivation	OffDelay
✔	✔	Activate for a limited time	Pulse
		Effect instructions	
✔	✔	With "Assignment" you set an operand	✔
✔	✔	Set output	S
✔	✔	Reset output	R

Cause Effect Matrix

S7-1200	S7-1500	Description	CEM
Intersection actions			
✔	✔	Set as long as the cause is active	✔
✔	✔	Set permanently to 1	S
✔	✔	Set permanently to 0	R

Siemens AG
Digital Industries
Postfach 48 48
90026 Nuremberg
GERMANY

https://www.siemens.com/automation

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A5E33285102-AH