SIEMENS

Reference manual

SIMATIC

S7-1200/S7-1500

Comparison list for programming languages based on international mnemonics

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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 use 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.

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Comparison list for S7-300, S7-400, S7-1200, S7-1500
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Contents of the comparison list

- 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 7)
- Comparison list for S7-300, S7-400 (not H-Systems), S7-1200, S7-1500 including CPU 150xS Software Controllers:
  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 measuring) 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. This ensures that "online monitoring" does not falsify the runtime. 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:

```
"Common_Data".opt.Last_Cycle := RUNTIME(#Tag_Memory); //Start of the runtime measurement,
LReal
         "speed test FB opt_DB"(ON_2:="i1",…);//Runtime measurement through RUNTIME
"Common_Data".opt.Last_Cycle := RUNTIME(#Tag_Memory); //End of the runtime measurement
```

The `Last_Cycle` tag contains the time that has passed from the preceding call to the current call of RUNTIME.

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 V4.0 or higher	S7-1500	S7-1200 V1.0 - 2.1	S7-1200 V2.2 - V3.0
Modified properties of hardware components	STOP	STOP, constraints in RUN	STOP	STOP	STOP	STOP
Added hardware components	STOP	STOP, constraints in RUN	STOP	STOP	STOP	STOP
New/revised text lists (alarms)	RUN	RUN	-	RUN	-	-
Load number of blocks	RUN (<17)	RUN (<57)	RUN (<21)	RUN	STOP	RUN (<11)
Reset work memory (MRES)	STOP (Reset)	STOP (Reset)	STOP (Reset)	STOP (Reset)	STOP (Reset)	STOP (Reset)
New OB	RUN	RUN	STOP	RUN	STOP	STOP
Modified OB: Code modifications, modification of comments	RUN	RUN	RUN	RUN	STOP	RUN

Modifications and blocks	S7-300	S7-400	S7-1200 V4.0 or higher	S7-1500	S7-1200 V1.0 - 2.1	S7-1200 V2.2 - V3.0
OB with modified properties (e.g. cycle time change)	STOP	RUN	STOP	RUN	STOP	STOP
Deleted OB	RUN	RUN	STOP	RUN	STOP	STOP
New FB/FC/DB/PLC data type (UDT)	RUN	RUN	RUN	RUN	STOP	RUN
Deleted FB/FC/DB/PLC data type (UDT)	RUN	RUN	RUN	RUN	STOP	RUN
Revised FB/FC: Code modification, modification of comments	RUN	RUN	RUN	RUN	STOP	RUN
Revised FB/FC: Interface change	STOP	STOP	RUN (Init)	RUN (Init)	STOP	STOP
Modified DB (no memory reserve configured): Name/type of tags modified, tags added or deleted	RUN (Init)	RUN (Init)	RUN (Init)	RUN (Init)	STOP	STOP
Modified DB (memory reserve configured): New tags added	--	--	RUN	RUN	--	--
Modified PLC data type (UDT)	STOP	STOP	RUN (Init)	RUN (Init)	STOP	STOP
Modified PLC tags (added, deleted, name or data type changed)	RUN	RUN	RUN	RUN	STOP	STOP
Modified retentivity settings (bit memory address area, DB area)	STOP	All objects retentive	STOP	STOP	STOP	STOP

Modifications and blocks	S7-300	S7-400	S7-1200 V4.0 or higher	S7-1500	S7-1200 V1.0 - 2.1	S7-1200 V2.2 - V3.0
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.

Comparison list

Validity and general conditions

- SIMATIC STEP 7 version 15 or higher
- The contents of the S7-1500 column also apply to SIMATIC S7-1500 Software Controller CPU 150xS
- SIMATIC S7-1200 firmware 4.2 or higher. SIMATIC S7-1200 only supports LAD, FBD and SCL.
- SIMATIC S7-1500 firmware 2.5 or higher
- STL: Some instructions have to be called via CALL.
- The special features of the S7-400 H-Systems are not taken into consideration.
- Some system state lists (SSLs) for SIMATIC S7-300/400 contain similar information such as function calls with the SIMATIC S7-1200/1500.

Structure of the comparison list

- Basic instructions
  Instructions that you use often, such as bit logic operations, timers, counters, mathematical functions
- Extended instructions
  Extended instructions for more possibilities such as date and time, interrupts, alarms, PROFIenergy
- Technological instructions (technology)
  Technological functions, such as PID control, motion control
- Instructions for communication (communication)
  Instructions for communication, such as S7 communication, Open User Communication

Legends

✔	Applicable
(✔)	Applicable with restrictions
nn	Not required, you can, for example, program with simple commands in SCL.
Grayed out	We recommend that you do not use the grayed out instructions in S7-1200 or S7-1500, because these instructions are not suitable for symbolic addressing or multiple instances. SIMATIC counters and timers are not recommended because they do not have multiple instance capability.
Xyz	New instruction as of SIMATIC STEP 7 V14. For this purpose, SIMATIC S7-1200 requires at least firmware 4.2 and SIMATIC S7-1500 at least firmware 2.0.
Xyz	New instruction as of SIMATIC STEP 7 V15. For this purpose, SIMATIC S7-1200 requires at least firmware 4.2 and SIMATIC S7-1500 at least firmware 2.5.
Xyz	Also available as fail-safe instruction in the Safety optional package in LAD and FBD.

Instructions in the section "Basic instructions"

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
General							
✓	✓	✓	✓	Insert network	✓	✓	nn
✓	✓	✓	✓	Insert empty box	✓	nn	nn
✓	✓	✓	✓	Open branch	✓	(	
✓	✓	✓	✓	Close branch	✓	)	
✓	✓	✓	✓	Insert input	-|	nn	nn
✓	✓	✓	✓	Invert Boolean result	-|NOT|- -o|	NOT	

Basic instructions				Extended instructions	Technology		Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD		STL (not S7-1200)	SCL
Bit logic operations								
✓	✓	✓	✓	AND logic operation	✓	&	O	&
✓	✓	✓	✓	OR logic operation	✓	>=1	O	OR
✓	✓	✓	✓	EXCLUSIVE OR logic operation	✓	X	X	XOR
✓	✓	✓	✓	Assignment	-( )-	-[=]	=	:=
		✓	✓	Negate assignment	-(/)-	-[/=]	NOT	
✓	✓	✓	✓	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	SR		nn	nn
✓	✓	✓	✓	Reset/set flip-flop	RS		nn	nn
✓	✓	✓	✓	Scan operand for positive signal edge	-|P|-		<Operand>; FP;	nn
✓	✓	✓	✓	Scan operand for negative signal edge	-|N|-		<Operand>; FN;	nn
		✓	✓	Set operand on positive signal edge	-(P)-		R_TRIG	
		✓	✓	Set operand on negative signal edge	-(N)-		F_TRIG	

Basic instructions				Extended instructions	Technology		Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD		STL (not S7-1200)	SCL
✓	✓	✓	✓	Scan Boolean result for positive signal edge	P_TRIG		FP	nn
✓	✓	✓	✓	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 laststate;`
				`laststate := not signal;`
					F_TRIG			

✓	✓	✓	✓	Normally open contact	-||-	nn	nn	nn
✓	✓	✓	✓	Normally closed contact	-|/|-	nn	nn	nn

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
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		
✓	✓			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: Protective 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		

Basic instructions				Extended instructions	Technology		Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD		STL (not S7-1200)	SCL
Times								
IEC timers					IEC timers are multi-instance capable.			
✓	✓	✓	✓	Generate pulse	TP		TP	
✓	✓	✓	✓	Generate on-delay	TON		TON	
✓	✓	✓	✓	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	
		✓	✓	Generate pulse	-(TP)-	-[TP]-	nn	TP
		✓	✓	Start on-delay timer	-(TON)-	-[TON]-	SD	S_ODT
		✓	✓	Start off-delay timer	-(TOF)-	-[TOF]-	SF	S_OFFDT
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*

Basic instructions				Extended instructions	Technology		Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD		STL (not S7-1200)	SCL
✓	✓		✓	*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					IEC counters are multi-instance capable.			
✓	✓	✓	✓	Count up	CTU		CTU	
✓	✓	✓	✓	Count down	CTD		CTD	
✓	✓	✓	✓	Count up and down	CTUD		CTUD	
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*

Basic instructions				Extended instructions	Technology		Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD		STL (not S7-1200)	SCL
✓	✓		✓	*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	=
✓	✓	✓	✓	Not equal	CMP <>		<> I/D/R	<>
✓	✓	✓	✓	Greater than or equal	CMP >=		>= I/D/R	>=
✓	✓	✓	✓	Less than or equal	CMP <=		<= I/D/R	<=
✓	✓	✓	✓	Greater than	CMP >		> I/D/R	>
✓	✓	✓	✓	Less than	CMP <		< I/D/R	<
		✓	✓	Value within range	IN_RANGE			nn
		✓	✓	Value outside range	OUT_RANGE			nn

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
		✓	✓	Check validity	-|OK|-		nn
		✓	✓	Check invalidity	-|NOT_OK|-		nn
				Variant			
		✓	✓	Check data type of a VARIANT tag			TypeOf
		✓	✓	Scan data type of an ARRAY element of a VARIANT tag			TypeOfElements
		✓	✓	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		*)
		✓	✓	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 then have the option of accessing 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		*)

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
		✓	✓	With a tag of TYPE DB_ANY, compare the data type of an indirectly addressed DB with a data type for EQUAL.	NE_TypeOfDB:		*)
		✓	✓	Check for EQUALS NULL pointer	IS_NULL		*)
		✓	✓	Check for UNEQUALS NULL pointer	NOT_NULL		*)

*) Application examples for SCL:

```
IF TypeOf(...) = INT THEN ... // corresponds to EQ_Type
IF TypeOfElements(...) = INT THEN ... // corresponds to EQ_ElemType
IF TypeOfDB(...) = INT THEN ... // corresponds to EQ_TypeOfDB
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	nn
Mathematical functions							
		✓	✓	Calculate	CALCULATE (SCL network in LAD/FBD)	nn	nn
✓	✓	✓	✓	Add	ADD	+	+
✓	✓	✓	✓	Subtract	SUB	-	-
✓	✓	✓	✓	Multiply	MUL	*	*

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓	✓	✓	Divide	DIV	/	/
✓	✓	✓	✓	Form absolute value Safety instruction only for S7-1200/1500	ABS	ABS	ABS
✓	✓	✓	✓	Return remainder of division	MOD		
✓	✓	✓	✓	Create twos complement	NEG	NEGI, NEGD	nn
✓	✓	✓	✓	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		
✓	✓	✓	✓	Form arcsine value	ASIN		
✓	✓	✓	✓	Form arccosine value	ACOS		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓	✓	✓	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		
(✓)		✓	✓	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		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
		✓	✓	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		
		✓	✓	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		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
			✓	Attempt assignment of a VARIANT to a reference (AssignmentAttempt): 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.	?=	AssignmentAttempt	?=
				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		
				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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				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*	
		✓	✓	*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*		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
		✓	✓	*Read field* *Recommendation: Indexed access to an array*	*FieldRead*		
		✓	✓	*Write field* *Recommendation: Indexed access to an array*	*FieldWrite*		
Conversion operations							
✓	✓	✓	✓	Convert value S7-1200/1500: Is carried out implicitly, therefore usually not necessary.	CONVERT	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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
			✓	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
		✓	✓	You can generally convert numerical formats and data types into other numerical formats and data types. You can find more detailed information in the information system of STEP 7	CONVERT		xxx_TO_yyy
✓	✓		✓	Create ones complement integer (16 bit) S7-1500: Conversion also done implicitly	nn	INVI	nn

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓		✓	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 floating-point number scaled in physical units between a low limit and high limit (scaling).	SCALE	*SCALE*	

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓		✓	*Unscale the floating-point number into physical units between a low limit and a high limit and convert it into 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…
✓	✓	✓	✓	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…

Basic instructions				Extended instructions	Technology		Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD		STL (not S7-1200)	SCL
✓	✓	✓	✓	Terminate running through the loop and start with the next run				CONTINUE
✓	✓	✓	✓	Exit loop immediately				EXIT
✓	✓	✓	✓	Exit block	RET		BEU	RETURN
		✓	✓	Organize program code				REGION… END_REGION
✓	✓		✓	Conditional block end			BEC	nn
✓	✓	✓	✓	Insert a comment section			//	//, (*…*)
			✓	Only SIMATIC S7-1500 Software Controller CPU 150xS: Shut down or restart Windows and the controller	SHUT_DWN			
				Jumps				
✓	✓	✓	✓	*Jump*				*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
✓	✓		✓	Unconditional jump			JU	nn

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓		✓	Jump if RLO = 1 and save RLO	nn	JCB	nn
✓	✓		✓	Jump if RLO = 0 and save RLO	nn	JNB	nn
✓	✓		✓	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
✓	✓		✓	Open instance data block S7-1500: only for "non-optimized" blocks		OPNI	nn

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓		✓	*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 S7-400: SFC 109 PROTECT	ENDIS_PW		
✓	✓	✓	✓	Restart cycle monitoring time	RE_TRIGR		
✓	✓	✓	✓	Exit program	STP		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
			✓	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		
Word logic operations							
✓	✓	✓	✓	Create ones complement	INV		NOT
✓	✓	✓	✓	Decode	DECO		
✓	✓	✓	✓	Encode	ENCO		
✓	✓	✓	✓	Select	SEL		

Basic instructions				Extended instructions	Technology	Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓	✓	✓	Multiplex S7-300/400: Only SCL	MUX	nn	MUX
		✓	✓	Demultiplex	DEMUX	nn	DEMUX
✓	✓	✓	✓	AND logic operation word by word	AND	AW	AND, &
✓	✓	✓	✓	OR logic operation word by word	OR	OW	OR
✓	✓	✓	✓	EXCLUSIVE OR logic operation word by word	XOR	XOW	XOR
✓	✓	✓	✓	AND logic operation double word by double word	AND	AD	AND, &
✓	✓	✓	✓	OR logic operation double word by double word	OR	OD	OR
✓	✓	✓	✓	EXCLUSIVE OR logic operation double word by double word	XOR	XOD	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

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓		✓	Rotate right double word by double word	SHR	RRD	SHR
✓	✓		✓	Rotate left double word by double word	SHL	RLD	SHL
✓	✓		✓	Rotate left by status bit CC 1		RLDA	nn
✓	✓		✓	Rotate right by status bit CC 1		RRDA	nn
				Loading and transferring the registers in STL			
				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*
✓	✓		✓	*Transfer AR1 to accumulator 1*		*TAR1*	*nn*

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓		✓	*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 7-segment display	SEG		
✓	✓		✓	Create tens complement	BCDCPL		
✓	✓		✓	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*

Basic instructions				Extended instructions	Technology		Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD		STL (not S7-1200)	SCL
✓	✓			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			
✓	✓			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"

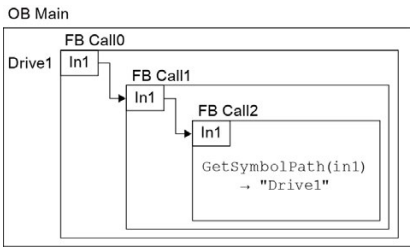
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
Date and time							
✓	✓		✓	Compare time tags	T_COMP*		
✓	✓	✓	✓	Convert times and extract	T_CONV*		
✓	✓	✓	✓	Add times	T_ADD*		
✓	✓	✓	✓	Subtract times	T_SUB*		
✓	✓	✓	✓	Time difference	T_DIFF*		
✓	✓		✓	Combine times	T_COMBINE*		

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

Basic instructions				Extended instructions	Technology	Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				Time-of-day 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		
				Local time			
✓	✓			Calculate local time	LOC_TIME		
✓	✓			Calculate local time from base time	BT_LT		
✓	✓			Calculate base time from local time	LT_BT		
✓	✓			Set time-of-day interrupt using local time	S_LTINT		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓			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	:=	
✓	✓		✓	Compare character strings	S_COMP	=	
✓	✓	✓	✓	Convert character string	S_CONV		
		✓	✓	Convert character string to numerical value	STRG_VAL	STRG_...	
		✓	✓	Convert numerical value to character string	VAL_STRG	..._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)*	*ATH*		
✓	✓	✓	✓	*Convert hexadecimal number to ASCII string*	*HTA*		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				Other instructions			
✓	✓	✓	✓	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		
✓	✓	✓	✓	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 name of a tag on the input parameter	GetSymbolName		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
		✓	✓	Read global name at beginning of a call path. Illustration:  	GetSymbolPath		
		✓	✓	Read out name of the block instance	GetInstanceName		
		✓	✓	Query the global name of block instance	GetInstancePath		
		✓	✓	Read out name of block in the block itself	GetBlockName		

Basic instructions				Extended instructions	Technology	Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				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		
✓	✓	✓	✓	Transfer process image area	SETIO_PART		
✓	✓	✓	✓	Receive interrupt	RALRM		
✓	✓	✓	✓	Disable/enable DP slaves	D_ACT_DP		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
			✓	Control configuration of a PROFINET IO system (options handling) Enable or disable devices in order to, for example, Flexibly run through or bypass production steps of a manufacturing process.	ReconfigIOSystem		
				Other 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		
				iDevice/iSlave			
✓		✓	✓	Receive data record	RCVREC		
✓		✓	✓	Make data record available	PRVREC		
✓				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		
✓	✓		✓	Determine topology for the DP master system	DP_TOPOL		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				ASi			
✓	✓			Control ASi master behavior	ASi_3422		
✓	✓		✓	Control ASi master behavior	ASI_CTRL		
				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		
✓		✓	✓	Generate PEM status as answer	PE_PEM_Status_RSP		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓		✓	✓	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		
				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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				Time-of-day interrupt			
✓	✓		✓	Set time-of-day interrupt	SET_TINT		
		✓	✓	Set time-of-day interrupt, local or system time 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		
✓	✓	✓	✓	Activate time-of-day interrupt	ACT_TINT		
✓	✓	✓	✓	Query status of time-of-day interrupt	QRY_TINT		
				Time-delay interrupt			
✓	✓	✓	✓	Start time-delay interrupt	SRT_DINT		
✓	✓	✓	✓	Cancel time-delay interrupt	CAN_DINT		
✓	✓	✓	✓	Query the status of a time-delay interrupt	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		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓	✓	✓	Delay execution of higher priority interrupts and asynchronous error events	DIS_AIRT		
✓	✓	✓	✓	Enable execution of higher priority interrupts and Enable asynchronous events	EN_AIRT		
	✓			Trigger multicomputing interrupt	MP_ALM		
Alarms							
			✓	Generate program alarm with associated values	Program_Alarm		
			✓	Output alarm status	Get_AlarmState		
		✓	✓	Generate user diagnostic alarms that are entered in the diagnostics buffer	Gen_UsrMsg		
			✓	Read pending alarms	Get_Alarm		
			✓	Acknowledging alarms	Ack_Alarms		
✓	✓			Write a user diagnostics event to the diagnostics buffer	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_SC		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				ALARM_SQ incoming alarm			
	✓			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		
				Other 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		
	✓			Determine current connection status	C_DIAG		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓			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	GetClockStatus		
			✓	Is time synchronization via NTP server enabled? Time synchronization missed? Is automatic adjustment for daylight saving time enabled?			
		✓	✓	Read module status information in an IO system	DeciveStates		
		✓	✓	Read module status information of a module	ModuleStates		
			✓	Generate diagnostics information	GEN_DIAG		
		✓	✓	Read diagnostics information	GET_DIAG		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				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	RecipeExport		
		✓	✓	Import recipe	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		
		✓	✓	Data log in new file	DataLogNewFile		
				Data block functions			
✓	✓			Create data block	CREAT_DB		
		✓	✓	Create data block	CREATE_DB		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓			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		
✓	✓			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		

Basic instructions				Extended instructions	Technology	Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
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		
		✓	✓	Determine hardware identifier from an IO address	IO2MOD		
		✓	✓	Determine the IO addresses from the hardware identifier	RD_ADDR		
Other 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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓		✓	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		
✓	✓		✓	S7-300/400: 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 an ASCII file from the memory card	FileReadC		
			✓	Write data to an ASCII file on the memory card	FileWriteC		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				R/H system			
			RH	Only S7-1500 R/H: 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		
				Other instructions			
				iSlave			
✓				Set own network address as DP iSlave	SET_ADDR		

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		
			✓	High-speed counter for counting and measuring	High_Speed_Counter		
			✓	Detect position with SSI absolute encoder	SSI_Absolut_Encoder		

Basic instructions				Extended instructions	Technology		Communication
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 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	PULSEGEN		
✓	✓		✓	Continuous temperature controller with pulse generator	TCONT_CP		
✓	✓		✓	Temperature controller for integrating actuators	TCONT_S		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓			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		
				Help 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		
		✓	✓	Converting input value into an output value	SplitRange		
		✓	✓	Limiting the change speed of a signal	RampFunction		

Basic instructions				Extended instructions	Technology		Communication
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		✓	
				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	
				Time-driven inputs/outputs			
			✓	Synchronize TIO modules		TIO_SYNC	
			✓	Read in process input signals with time stamps		TIO_IOLink_IN	
			✓	Read in edges at digital input and associated time stamps		TIO_DI	
			✓	Time-controlled output of process output signals		TIO_IOLink_OUT	

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
			✓	Output edges time-controlled at digital output	TIO_DQ		
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 at set velocity/speed	MC_MoveVelocity		
T		✓	✓	Move axis in jog mode	MC_MoveJog		
		✓		Run axis commands as motion sequence	MC_CommandTable		
		✓		Change dynamic settings of axis	MC_ChangeDynamic		
		✓		Write tag of positioning axis	MC_WriteParam		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
		✓		Continuously read motion data of a positioning axis	MC_ReadParam		
T			T	Set alternative encoder as active encoder	MC_SetSensor		
T			✓	Position axis overlapping	MC_MoveSuperImposed		
				Output cams, cam track, measuring input			
T			✓	Start one-time measuring	MC_MeasuringInput		
T			✓	Start cyclic measuring	S7-1500: MC_MeasuringInputCyclic S7-300T: MC_MeasuringInput		
T			✓	Cancel active measuring job	S7-1500: MC_AbortMeasuringInput S7-300T: MC_MeasuringInput		
T			✓	Activate/deactivate output cam	S7-1500: MC_OutputCam (position-based cams and time-based cams S7-300T: MC_CamSwitch (position-based cam) S7-300T: MC_CamSwitchTime (time-based cam)		
T			✓	Activate/deactivate cam track	MC_CamTrack		
				Gearing/camming			
T			✓	Start gearing	MC_GearIn		
T			T	Start gearing with specified synchronous positions	S7-1500T: MC_GearInPos S7-300T: MC_GearIn		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
T			T	Relative shift of master value on the following axis	S7-1500T: MC_PhasingRelative S7-300T: MC_Phasing		
T			T	Absolute shift of master value on the following axis	S7-1500T: MC_PhasingAbsolute S7-300T: MC_Phasing		
T			T	Start camming	MC_CamIn		
			T	Simulate synchronous operation	MC_SynchronizedMotionSimulation		
				Cam disc			
T			T	Interpolating a cam disc	MC_InterpolateCam		
T			T	Read master value of a cam	S7-1500T: MC_GetCamLeadingValue S7-300T: MC_GetCamPoint		
T			T	Read out slave value of a cam	S7-1500T: MC_GetCamFollowingValue S7-300T: MC_GetCamPoint		
				MotionIn			
			T	Set motion setpoints for velocity and acceleration	MC_MotionInVelocity		
			T	Set motion setpoints for position, velocity and acceleration	MC_MotionInPosition		

Basic instructions				Extended instructions	Technology		Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				Torque data	Force/torque limiting / fixed stop detection		
			✓	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		
				Motions (kinematics)			
			T	Interrupt execution of motion	MC_GroupInterrupt		
			T	Continue execution of motion	MC_GroupContinue		
			T	Stop motion	MC_GroupStop		
			T	Position kinematics absolutely with linear path motion	MC_MoveLinearAbsolute		
			T	Relative positioning of kinematics with linear path motion	MC_MoveLinearRelative		
			T	Position kinematics absolutely with circular path motion	MC_MoveCircularAbsolute		
			T	Relative positioning of kinematics with circular path motion	MC_MoveCircularRelative		

Basic instructions				Extended instructions	Technology	Communication
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				Zones			
			T	Define workspace zone	MC_DefineWorkspaceZone		
			T	Define kinematics zone	MC_DefineKinematicsZone		
			T	Activate workspace zone	MC_SetWorkspaceZoneActive		
			T	Deactivate workspace zone	MC_SetWorkspaceZoneInactive		
			T	Activate kinematics zone	MC_SetKinematicsZoneActive		
			T	Deactivate kinematics zone	MC_SetKinematicsZoneInactive		
				Toolbox			
			T	Re-define tool	MC_DefineTool		
			T	Change active tool	MC_SetTool		
				Coordinate systems			
			T	Redefine object coordinate systems	MC_SetOcsFrame		

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. TCP or ISO-on-TCP ensures the arrival of the data at the receiver through a transport acknowledgment. To ensure that the data has arrived completely in the application of the receiver, 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.

Basic instructions			Extended instructions		Technology	Communication
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. For example: Send data block with measured value logs to any network node.
	✓	✓	TSEND_C/TRCV_C (connection establishment and termination are integrated)				
	✓	✓		UDP	Fast, without acknowledgment		Distribute larger amounts of data **without** acknowledgment. For example: Distribute position data quickly to many devices. An exact calculation of the limits is available in the controller manuals.
(✓)	✓	✓	TUSEND/TURCV (not S7-300)			Integrated interface: Max. 1472 bytes CP on S7-300/400: Max. 2048 bytes	

S7 communication

Definition: SIMATIC-homogeneous data exchange between SIMATIC CPUs via **PROFIBUS** or **PROFINET/Industrial Ethernet**.

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.

Basic instructions			Extended instructions			Technology	Communication
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	S7-300: 160 bytes S7-400: 400 bytes S7-1200: 160 bytes S7-1500: 880 bytes	Accessing data in the target 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 target controller without any programming. For example, write parameters in a data block and change a recipe.	
✓			PUT_S					
✓		✓	BSEND/BRCV:	RUN		S7-300: 32768/ 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					

Instructions in the section "Communication"

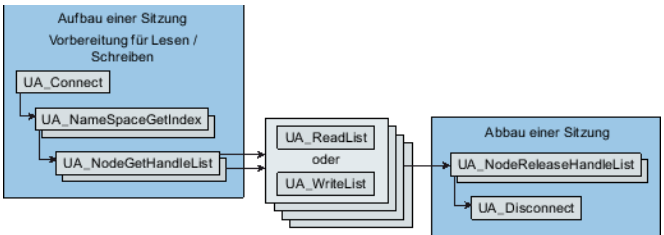
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
PROFINET and PROFIBUS							
✓	✓	✓	✓	Only Safety: Fail-safe sending of data via PROFIBUS DP/PROFINET IO	SENDDP		
✓	✓	✓	✓	Only Safety: Fail-safe receipt of data via PROFIBUS DP/PROFINET IO	RCVDP		
S7 communication							
✓	✓	✓	✓	*Read data from a remote CPU*	*GET*		
✓	✓	✓	✓	*Write data to a remote CPU*	*PUT*		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓		✓	Send data uncoordinated	USEND		
✓	✓		✓	Receive data uncoordinated	URCV		
✓	✓		✓	Send data in segments	BSEND		
✓	✓		✓	Receive data in segments	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		
✓				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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				Other 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	TSEND_C		
		✓	✓	Manage communication connection and receive data via Ethernet	TRCV_C		
		✓	✓	Manage communication connection and transfer email	TMAIL_C		
				Other instructions			
✓	✓	✓	✓	Establish communication connection	TCON		
✓	✓	✓	✓	Terminate communication connection	TDISCON		
✓	✓	✓	✓	Send data via communication connection	TSEND		
✓	✓	✓	✓	Receive data via communication connection	TRCV		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
		✓	✓	Resetting the connection	T_RESET		
		✓	✓	Check the connection	T_DIAG		
		✓	✓	Configure interface	T_CONFIG		
✓	✓			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		
				OPC UA			
				OPC UA server			
			✓	Query to operating system whether the serve method was called. If the server method was called, the instruction provides the input parameters for the server method.	OPC_UA_ServerMethodPre		
			✓	Information to operating system that the server method was called and that the values of the output parameters are valid.	OPC_UA_ServerMethodPost		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
OPC UA: CP 443-1 OPC UA							
	✓			Establish connection for a session with an OPC UA server	UA_Connect		
	✓			Fetching namespace index of a namespace URL	UA_NamespaceGetIndex		
	✓			Registering node IDs on the connected server and fetching node handles in the form of a list	UA_NodeGetHandleList		
	✓			Reading out the data from nodes of the connected server using the list of node handles	UA_ReadList		
	✓			Writing the data in nodes of the connected server using the list of node handles	UA_WriteList		
	✓			On the server, enable the node handles of the list used	UA_NodeReleaseHandleList		
	✓			Terminate connection of a current session with an OPC UA server	UA_Disconnect		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				Schematic flow: 			
				Web server			
✓	✓	✓	✓	Synchronize user-defined web pages	WWW		
				Fail-safe HMI panels			
✓	✓	✓	✓	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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓		✓	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_ Mobile		
✓	✓	✓	✓	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	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		

Basic instructions				Extended instructions	Technology	Communication	
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		
✓	✓	✓	✓	Get extended functions	Get_Features		
✓	✓	✓	✓	Set extended functions	Set_Features		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				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		
				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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
		✓		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		
				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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				Point-to-point connection: CP 340			
✓	✓			Receive data	P_RCV		
✓	✓			Send data	P_SEND		
✓	✓			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 232 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 232 interface	V24_SET		
				Point-to-point connection: CP 440			
✓	✓			Receive data	RECV_440		
✓	✓			Send data	SEND_440		
✓	✓			Delete receive buffer	RES_RECV		

Basic instructions				Extended instructions	Technology	Communication	
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 232 interface	V24_SET_441		
	✓			Send data to printer	PRINT		
				MODBUS slave (RTU)			
✓	✓			Modbus slave instruction for CP 341	MODB_341		
✓	✓			Modbus slave instruction for CP 441	MODB_441		
				MODBUS: CP 443			
✓	✓			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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				ET 200S serial interface	Note: S stands for serial		
✓	✓		✓	Receive data	S_RCV		
✓	✓		✓	Send data	S_SEND		
✓	✓		✓	Read accompanying signals at the RS 232 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		
✓	✓			Locks data exchange via a connection with FETCH/WRITE	AG_LOCK		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓			Connection diagnostics	AG_UNLOCK		
✓	✓			Connection diagnostics	AG_CNTRL		
✓	✓			Connection diagnostics, connection establishment, ping request	AG_CNTEX		
✓	✓			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 diagnostic 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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓			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		
				PROFIenergy			
✓	✓			Triggering or ending an energy saving pause	PE_START_END_CP		
✓	✓			Extended triggering or ending of an energy saving pause	PE_CMD_CP		
✓	✓			Processing of the commands of 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		
				Other instructions			
✓	✓			Use of a logical trigger for ERPC communication	LOGICAL_TRIGGER		
✓	✓			Setup of FTP connections from and to an FTP server	FTP_CMD		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				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		
		✓		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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				Communication with iSlave			
✓	✓			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		
✓	✓			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		

Basic instructions				Extended instructions	Technology	Communication	
S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
				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		
				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		
				Extended functions			
✓	✓	✓		Load the configuration data to the reader	Config_Download		
✓	✓	✓		Back up configuration data from the reader	Config_Upload		
✓	✓	✓		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		

S7-300	S7-400	S7-1200	S7-1500	Description	LAD/FBD	STL (not S7-1200)	SCL
✓	✓	✓	✓	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		
✓	✓	✓	✓	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		

Appendix Optional instructions

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

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Änderungen vorbehalten.
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