SIEMENS

SIMATIC

S7-300/S7-1200/S7-1200 G2/S7-1500

Comparison list for programming languages

SIEMENS

Comparison list for S7-300, S7-1200, S7-1200 G2, 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. Notices referring to your personal safety are highlighted in the manual by a safety alert symbol; notices referring to property damage only have no safety alert symbol. Depending on the hazard level, the warnings are displayed in descending order as follows.

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

⚠ WARNING
Indicates that death or severe bodily 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 multiple hazard levels may occur, the warning is always displayed with the highest possible level.
A notice warning of injury to persons with a safety 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 information. 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

Please 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.
Correct, reliable operation of the products requires proper transport, storage, positioning, assembly, installation, commissioning and operation, as well as careful maintenance. The permitted ambient conditions must be adhered to. Notes in the respective documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG.
The remaining names in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

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.

Contents of the comparison list for S7-300, S7-1200, S7-1200 G2, S7-1500

- 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, S7-1200, S7-1200 G2, 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 list of runtimes of individual instructions in a table is thus not possible.

S7-1200

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.
You can find more detailed information in the SIMATIC STEP 7 online help. Enter "RUNTIME" in the search and select "S7-1200" 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".

S7-1200 G2 and S7-1500

Use the **Profiling** instruction. More information can be found here:
https://support.industry.siemens.com/cs/ww/en/view/109750245

Load objects to the CPU

The table shows which modifications and which modified blocks you can download in which operating state. 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	S7-1200 V2.2 - V3.0	S7-1200 V4.0 and higher	S7-1200 G2	S7-1500
Modified properties of HW components	STOP	STOP	STOP	STOP	STOP
Added hardware components	STOP	STOP	STOP	STOP	STOP
New/revised text lists (messages)	RUN	—	—	RUN	RUN
Load number of blocks	RUN (<17)	RUN (<11)	RUN (<21)	RUN (<21)	RUN
Reset work memory (MRES)	STOP (Reset)	STOP (Reset)	STOP (Reset)	STOP (Reset)	STOP (Reset)
New OB	RUN	STOP	STOP	RUN	RUN
Modified OB: Code modifications, modification of comments	RUN	RUN	RUN	RUN	RUN
OB with modified properties (e.g., cycle time change)	STOP	STOP	STOP	RUN	RUN
Deleted OB	RUN	STOP	STOP	RUN	RUN
New FB/FC/DB/PLC data type (UDT)	RUN	RUN	RUN	RUN	RUN

Modifications and blocks	S7-300	S7-1200 V2.2 - V3.0	S7-1200 V4.0 and higher	S7-1200 G2	S7-1500
Deleted FB/FC/DB/PLC data type (UDT)	RUN	RUN	RUN	RUN	RUN
Modified FB/FC: Code modification, modification of comments	RUN	RUN	RUN	RUN	RUN
Modified FB/FC: Change to interface	STOP	STOP	RUN (Init)	RUN (Init)	RUN (Init)
Modified DB (no memory reserve configured): Name/type of tags modified, tags added or deleted	RUN (Init)	STOP	RUN (Init)	RUN (Init)	RUN (Init)
Modified DB (memory reserve configured): New tags added	—	—	RUN	RUN	RUN
Modified PLC data type (UDT)	STOP	STOP	RUN (Init)	RUN (Init)	RUN (Init)
Modified PLC tags (added, deleted, name or data type changed)	RUN	STOP	RUN	RUN	RUN
Modified retentivity settings (bit memory address area, DB area)	STOP	STOP	STOP	STOP	STOP
Motion Control: Changes to the MC Servo cycle time, changes to the HW interface of the technology objects	--	--	STOP	STOP	STOP

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

Validity and general setup

- SIMATIC STEP 7 version 20 or higher
- The contents of the S7-1500 column also apply to SIMATIC S7-1500 Software Controller CPU 150xS
- SIMATIC S7-1200 firmware 4.6 or higher, SIMATIC S7-1200 only supports LAD, FBD and SCL.
- SIMATIC S7-1200 G2 firmware 1.0 or higher
- SIMATIC S7-1500 firmware 4.0 or higher
- STL: Some instructions have to be called via CALL.
- The instructions of the SIMATIC S7-300T controller are only taken partly into account.
- Some system state lists (SSLs) for SIMATIC S7-300 contain similar information such as function calls with the SIMATIC S7-1200/1500.

Legend

✔	Applicable
(✔)	Applicable with restrictions
☑	Not yet available for SIMATIC CPU S7-1500R/H
nn	Not required; in SCL, for example, you can replace many instructions with simple commands.
1500	Only available with S7-1500
T	Only available with a technology CPU
gray italics	We recommend that you do not use the grayed-out instructions in S7-1200 or S7-1500. The grayed-out 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 V20. For this purpose, SIMATIC S7-1200 requires at least firmware 4.6 and SIMATIC S7-1500 at least firmware 4.0. The firmware 4.0 supports technology version 7.0 to 9.0, depending on the CPU.
Xyz	Also available as fail-safe safety 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-of-day, 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	S7-1200	S7-1500 / S7-1200 G2	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	Integers: 0 ... 255 or -128 ... 127	varByte := 2#0011_1010
✔	✔	✔	**WORD**	16	Integers: 0 ... 65 535 or -32 738 ... 32 767	varWord := 16#6B0F
✔	✔	✔	**DWORD**	32	Integers: 0 ... 4 294 967 295 or -2 147 483 648 ... 2 147 483 647	varDword := 50_000

S7-300	S7-1200	S7-1500 / S7-1200 G2	Data type	Bit length	Value range	Examples, comments
		✔	LWORD	64	Integers: 0 ... 18 446 744 073 709 551 615 or -9 223 372 036 854 775 808 ... 9 223 372 036 854 775 807	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

Bit   7   4 3   0
[0 0 1 0 1 1 0 0]
Sign
Decimal values: 32   8   4 = 44
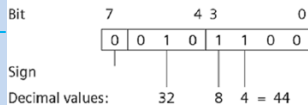
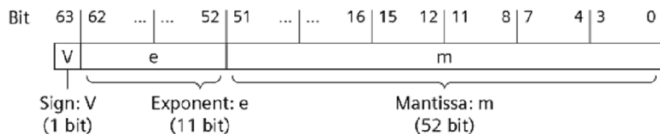| S7-300	S7-1200	S7-1500 / S7-1200 G2	Data type	Bit length	Value range	Examples, comments
	✔	✔	SINT	8	-128 to +127	varSint := -42
✔	✔	✔	INT	16	-32 768 ... +32 767	varInt := 16#0EC9
✔	✔	✔	DINT	32	-2 147 483 648 ... +2 147 483 647	varDint := +125_790
		✔	LINT	64	-9 223 372 036 854 775 808 ... +9 223 372 036 854 775 807	varLint := 16#0000_8C5B_C5F0_F79F
Integer numbers without sign						
Decimal, binary, octal or hexadecimal						
	✔	✔	USINT	8	0 ... 255	varUsint := 2#0100_1110

S7-300	S7-1200	S7-1500 S7-1200 G2	Data type	Bit length	Value range	Examples, comments
	✔	✔	**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
Floating-point numbers						
Floating-point numbers correspond to the standard IEEE 754-1985						

Bit 63 | 62 ... | ... 52 | 51 ... | ... 16 | 15 12 | 11 8 | 7 4 | 3 0

V   e   m

Sign: V (1 bit)   Exponent: e (11 bit)   Mantissa: m (52 bit)

S7-300	S7-1200	S7-1500 S7-1200 G2	Data type	Bit length	Value range	Examples, comments
✔	✔	✔	**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-bit, Sign 1 bit

S7-300	S7-1200	S7-1500 S7-1200 G2	Data type	Bit length	Value range	Examples, comments
	✔	✔	LREAL	64	-1,7976931348623158e+308 ... -2,2250738585072014e-308 ±0 +2.2250738585072014e-308 ... +1.7976931348623158e+308	varLreal := 20.0e-15 Mantissa: 52 bits, Exponent: 11-bit, Sign: 1-bit
Timer						
✔		1500	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
		✔	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

S7-300	S7-1200	S7-1500 / S7-1200 G2	Data type	Bit length	Value range	Examples, comments
		✔	**LTOD (LTIME_OF_ DAY)**	64	00:00:00.000000000 ... 23:59:59.999999999	varLtod := LTOD#10:20:30.400_365_215
✔		1500	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 ... 31.12.2554--23:59:59.999999999	varDtl := DTL#2008-12-16-20:30:20.250
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. FOR EXAMPLE: 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'

S7-300	S7-1200	S7-1500 S7-1200 G2	Data type	Bit length	Value range	Examples, comments
	✔	✔	**WSTRING**	n+2 (Word)	0 ... 16382 Unicode characters Default length: 254 WCHAR + 2 words	varWstring := 'Hallo Welt'
Pointer						
✔		1500	**POINTER**	48	Area-internal pointer, Cross-area pointer, DB pointer, Zero pointer	Symbolic: "MyDB"."MyTag" Absolute: P#20.0, P#DB10.DBX20.0
✔		1500	**ANY**	80	P#MemoryArea DataAddress Type Number, P#Zero value	Symbolic: "MyDB".StructVariable.Component1 Absolute: P#DB11.DBX20.0 INT 10
	✔	✔	**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	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
			Additional Instructions for S7-GRAPH					
	✔	1500	Monitor entire duration of a step (greater than step activation time)	CMP >T				
	✔	1500	Monitor entire duration of a step minus interferences (greater than uninterrupted step activation time)	CMP >U				
	✔	1500	Monitor entire duration of a step (greater than maximum step activation time)	CMP >T_MAX				
	✔	1500	Monitor duration of a step and output a warning when time is exceeded (greater than warning time)	CMP >T_WARN				

			Basic instructions	Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1500 S7-1200 G2	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	✔	&	A U	&	-I&I-
✔	✔	✔	OR logic operation	✔	>=1	O	OR	-I>=1I-
✔	✔	✔	EXCLUSIVE OR logic operation		X	X	XOR	-IXORI-
✔	✔	✔	Assignment	-( )-	-[=]	=	:=	

S7-300	S7-1200	S7-1500	S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
	✔	✔		Negate assignment	-(/)-	-[/=]	NOT		
✔	✔	✔		Invert input	-|/|-	-o|			--o|
✔	✔	✔		Reset output	-(R)	-[R]	R	nn	
✔	✔	✔		Set output	-(S)	-[S]	S	nn	
	✔	✔		Set bit field	SET_BF		nn	nn	
	✔	✔		Reset bit field	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	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	Scan operand for negative signal edge	-|N|-	-|N|-	<Operand>; FN;	nn	
	✔	✔	Set operand on positive signal edge	-(P)-	-|P|-	R_TRIG		
	✔	1500	Set operand on negative signal edge	-(N)-	-|N|-	F_TRIG		
✔	✔	✔	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				

Basic instructions				Extended instructions		Technology		Communication		

S7-300	S7-1200	S7-1500	S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔		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				
✔				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				

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	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				
Times								
IEC timers								
✔	✔	✔	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		

Basic instructions				Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
	✔	✔	Load time duration	-(PT)-	-[PT]-	PRESET_TIMER		
	✔	✔	Start pulse timer	-(TP)-	-[TP]-	nn	nn	
	✔	✔	Start on-delay timer	-(TON)-	-[TON]-	SE	nn	
	✔	✔	Start off-delay timer	-(TOF)-	-[TOF]-	SA	nn	
SIMATIC timers legacy								
✔		1500	*Assign pulse timer parameters and start*	*S_PULSE S_IMPULS*		*nn*	*S_PULSE*	
✔		1500	*Assign extended pulse timer parameters and start*	*S_PEXT S_VIMP*		*nn*	*S_PEXT*	
✔		1500	*Assign on-delay timer parameters and start*	*S_ODT S_EVERZ*		*nn*	*S_ODT*	
✔		1500	*Assign retentive on-delay timer parameters and start*	*S_ODTS S_SEVERZ*		*nn*	*S_ODTS*	
✔		1500	*Assign off-delay timer parameters and start*	*S_OFFDT S_AVERZ*		*nn*	*S_OFFDT*	
✔		1500	*Start pulse timer*	*-(SP)- -(SI)-*	*-[SP]- -[SI]-*	*SP SI*	*nn*	

Basic instructions			Extended instructions		Technology		Communication	

S7-300	S7-1200	S7-1500	S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔		1500		*Start extended pulse timer*	*-(SD)* *-(SV)*	*-[SD]* *-[SV]*	*SD* *SV*	*nn*	
✔		1500		*Enable timer*			*FR*	*nn*	
✔		1500		*Load timer value*			*CH*	*nn*	
✔		1500		*Load BCD-coded timer value*			*LC*	*nn*	
✔		1500		*Reset timer*	*-(R)*	*-[R]*	*R*	*nn*	
✔		1500		*Start off-delay timer*	*-(SF)* *-(SE)*	*-[SF]* *-[SE]*	*SF* *SE*	*nn*	
✔		1500		*Start on-delay timer*	*-(SD) (SA)*	*-[SD]* *-[SA]*	*SD* *SA*	*nn*	
✔		1500		*Start retentive on-delay timer*	*-(SS)*	*-[SS]*	*SS*	*nn*	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
			Counters					
			IEC counters					
✔	✔	✔	Count up	CTU		CTU		
✔	✔	✔	Count down	CTD		CTD		
✔	✔	✔	Count up and down	CTUD		CTUD		
			SIMATIC counters legacy					
✔		1500	*Assign parameters and count up*	*S_CU Z_VORW*	*nn*		*S_CU*	
✔		1500	*Assign parameters and count down*	*S_CD Z_RUECK*	*nn*		*S_CD*	
✔		1500	*Assign parameters and count up / down*	*S_CUD ZAEHLER*	*nn*		*S_CUD*	
✔		1500	*Set counter value*	*-(SC) -(SZ)*	*- [SC] -[SZ]*	*nn*	*nn*	
✔		1500	*Count up*	*-(CU) -(ZV)*	*-[CU] -[ZV]*	*CU ZV*	*nn*	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔		1500	*Count down*	*-(CD)* *-(ZR)*	*-[CD]* *-[ZR]*	*CD* *ZR*	*nn*	
✔		1500	*Enable counter*			*FR*	*nn*	
✔		1500	*Load counter value*			*CH*	*nn*	
✔		1500	*Load BCD-coded counter value*			*LC*	*nn*	
✔		1500	*Reset counter*			*R*	*nn*	
✔		1500	*Set counter*			*S*	*nn*	
Comparator operations								
✔	✔	✔	Equal	CMP ==		== I/D/R	=	CMP ==
✔	✔	✔	Not equal	CMP <>		<> I/D/R	<>	CMP <>
✔	✔	✔	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 >

Tabs: Basic instructions | Extended instructions | Technology | Communication

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	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				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			*)	

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
	✔	✔	Compare data type of an indirectly addressed DB with a data type for EQUAL with a tag of type DB_ANY. 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			*)	
	✔	✔	Compare data type of an indirectly addressed DB with a data type for NOT EQUAL with a tag of TYPE DB_ANY	NE_TypeOfDB			*)	
	✔	✔	Check for EQUALS NULL pointer	IS_NULL			*)	
	✔	✔	Check for UNEQUALS NULL pointer	NOT_NULL			*)	
	✔	✔	Check for ARRAY	IS_ARRAY				
		1500	Compare tag structured data types			CompType	=	

Basic instructions	Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
Math 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		
✔	✔	✔	Return remainder of division	MOD				
✔	✔	✔	Create twos complement	NEG		NEGI, NEGD	nn	NEG
✔	✔	✔	Create ones complement	nn		INVI, INVD	NOT	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
	✔	✔	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		

Tabs: Basic instructions | Extended instructions | Technology | Communication

Basic instructions				Extended instructions		Technology		Communication	

S7-300	S7-1200	S7-1500 / S7-1200 G2	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: 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				

Basic instructions			Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
	✔	✔	Move data type from ARRAY of BYTE (Deserialize)	Deserialize				
	✔	✔	Move data type to ARRAY of BYTE (Serialize)	Serialize				
	✔	✔	Move block	MOVE_BLK				
	✔	✔	Move block not interruptible	UMOVE_BLK				
	✔	✔	Move block	MOVE_BLK_VARIANT				
	✔	✔	Fill block	FILL_BLK				
	✔	✔	Fill block not interruptible	UFILL_BLK				
	✔	✔	Disassemble a tag of a 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				

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
	✔	✔	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		
✔		✔	Attempt assignment to a reference tag. The data type of a reference tag is determined at the time of declaration.			?= STL: AssignmentAttempt		
ARRAY DB								
		1500	Read from ARRAY data block			ReadFromArrayDB		
		1500	Write to ARRAY data block			WriteToArrayDB		
		1500	Read from ARRAY data block in load memory			ReadFromArrayDBL		

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
		1500	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		
			Symbolic move					
	✔	✔	Resolve multiple symbolic tag names. Result: References to the tags.			ResolveSymbols		
	✔	✔	Write value into resolved symbol: Read the value of a tag and write it to target tag referenced by a resolved symbol			MoveToResolvedSymbol		
	✔	✔	Read value from resolved symbol: Read the value of a tag referenced by a resolved symbol and write it to the target tag			MoveFromResolvedSymbol		
	✔	✔	Read values from resolved symbols and write them into a memory area (Array of BYTE).			MoveResolvedSymbolsToBuffer		

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
			Basic instructions	**Extended instructions**		**Technology**		**Communication**
	✔	✔	Read values from a memory area (array of BYTE) and write them into the resolved symbols	MoveResolvedSymbolsFromBuffer				
			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*		
	✔	✔	*Write memory address*			*POKE*		

Basic instructions	Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
	✔	✔	*Write memory bit*				*POKE_BOOL*	
	✔	✔	*Write memory area*				*POKE_BLK*	
Legacy								
Recommendation: Symbolic programming								
✔		1500	*Move block*			*BLKMOV*		
✔		1500	*Move block not interruptible*			*UBLKMOV*		
✔		1500	*Fill block*			*FILL*		
	✔	1500	*Read field; recommendation: Indexed access to an array*	*FieldRead*				
	✔	1500	*Write field; recommendation: Indexed access to an array*	*FieldWrite*				

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
			Conversion operations					
✔	✔	✔	Convert value S7-1200/1500: 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				

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
Basic instructions					Extended instructions		Technology	Communication
	✔	✔	Normalize	NORM_X				
		✔	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	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔		✔	Create ones complement integer (16-bit) S7-1500: Conversion also done implicitly	nn		INVI	nn	
✔		✔	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*	

For more conversion options, see library of general functions (LGF) https://support.industry.siemens.com/cs/ww/en/view/109479728

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
			Variant instructions					
	✔	✔	Convert VARIANT to DB_ANY				VARIANT_TO_DB_ANY	
	✔	✔	Convert DB_ANY to VARIANT				DB_ANY_TO_VARIANT	
			Legacy					
			Recommendation: Symbolic programming					
✔		1500	*Convert the integer to a physical unit between a low limit and high limit (scaling). Standard CPU: INT to REAL F-CPU: INT to INT*	SCALE			*SCALE*	
	✔	1500	*Convert the integer to a physical unit between a low limit and high limit (scaling). F-CPU: INT to DINT*	SCALE_D				
✔		1500	*Unscale the floating-point number into physical units between a low limit and a high limit and convert it to an integer (unscaling).*		*UNSCALE*			

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
			Program control operations					
✔	✔	✔	Branch conditionally	Pre-wiring -(JMP) See below		JC	IF... THEN... ELSE...	
✔	✔	✔	Branch conditionally multiple times	SWITCH			IF... THEN... ELSIF...	
✔	✔	✔	Branch to a list element	JMP_LIST		SPL	CASE... OF...	
✔	✔	✔	Run in counting loop	nn			FOR... TO... DO...	
✔	✔	✔	Run in counting loop with step width	nn			FOR... TO... BY... DO...	
✔	✔	✔	Run if condition is met, the CPU checks the condition at the start of the loop	nn		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.	nn		LOOP	REPEAT... UNTIL...	

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	Terminate running through the loop and start with the next run	nn			CONTINUE	
✔	✔	✔	Exit loop immediately	nn			EXIT	
✔	✔	✔	Exit block	RET		BEU	RETURN	
	✔	✔	Organize source code	nn			REGION... END_RE-GION	
✔	✔	✔	Conditional block end	Pre-wiring -(RET)		BEB	nn	
✔	✔	✔	Insert a comment section Multilingual comments: (/*...*/)	nn		//	//, (*...*), (/*...*/)	
		1500	Only SIMATIC S7-1500 Software Controller CPU 150xS: Shut down or restart Windows and the controller	SHUT_DOWN				
Jumps								
✔	✔	✔	*Jump*	nn		JU SPA	*GOTO...*	
✔	✔	✔	Jump if RLO = 1	-(JMP)	-[JMP]	JC SPB	nn	

A5E33285102-AK

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	Jump if RLO = 0	-(JMPN)	-[JMPN]	JCN SPBN	nn	
✔	✔	✔	Jump label	LABEL		:	nn	
	✔	✔	Define jump list	JMP_LIST		JL	nn	
	✔	✔	Jump distributor	SWITCH			nn	
✔	✔	✔	Return (BEB conditional/BE unconditional)	-(RET)	-[RET]	BEB/BE	nn	
✔			Only Safety: Open global data block	-(OPN)	-[OPN]	OPN AUF	nn	
✔		✔	Jump if RLO = 1 and save RLO	nn		JCB SPBB	nn	
✔		✔	Jump if RLO = 0 and save RLO	nn		JNB SPBNB	nn	
✔		✔	Jump if BR = 1	nn		JBI SPBI	nn	
✔		✔	Jump if BR = 0	nn		JNBI SPBIN	nn	
✔		✔	Jump if OV = 1	nn		JO SPO	nn	

S7-300	S7-1200	S7-1500	S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔			✔	Jump if OS = 1	nn		JOS SPS	nn	
✔			✔	Jump if the result is zero	-|=0|--(JMP)		JZ SPZ	nn	
✔			✔	Jump if the result is not zero	-|<>0|--(JMP)		JN SPN	nn	
✔			✔	Jump if the result is greater than zero	-|>0|--(JMP)		JP SPP	nn	
✔			✔	Jump if the result is less than zero	-|<0|--(JMP)		JM SPM	nn	
✔			✔	Jump if the result is greater than or equal to zero	-|>=0|--(JMP)		JPZ SPPZ	nn	
✔			✔	Jump if the result is less than or equal to zero	-|<=0|--(JMP)		JMZ SPMZ	nn	
✔			✔	Jump if the result is invalid	-|OV|--(JMP)		JUO SPU	nn	
✔			✔	Loop	nn		LOOP	nn	
Data blocks									
✔		1500		Open global data block S7-1500: only for non-optimized blocks	-(OPN)		OPN AUF	nn	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔		✔	*Open instance data block* *S7-1500: only for non-optimized blocks*	*-(OPN)*		*OPNI* *AUFDI*	*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: With S7-300 only	CALL			nn	
✔		✔	*Conditional block call*			*CC*	*nn*	
✔		✔	*Unconditional block call*			*UC*	*nn*	

| Basic instructions | | | | Extended instructions | Technology | | Communication |

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
			Runtime control					
	✔	✔	Locking and unlocking passwords of the CPU access levels. In addition to ENDIS_PW, you can also lock or release the passwords of the individual access levels on the display for the S7-1500 CPUs with display.			ENDIS_PW		
✔	✔	✔	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		

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	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	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: Only SCL	MUX		nn	MUX	
	✔	✔	Demultiplex	DEMUX		nn	DEMUX	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	AND logic operation word by word	AND		AW UW	&, AND UND	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 UD	&, AND UND	AND
✔	✔	✔	OR logic operation double word by double word	OR		OD	OR	OR
✔	✔	✔	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	SHR		SSI	nn	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔		✔	Shift double word by double word with sign	SHL		SSD	nn	
✔		✔	Shift right double word by double word	SHR		SRD	nn	
✔		✔	Shift left double word by double word	SHL		SLD	nn	
✔		✔	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	nn		RLDA	nn	
✔		✔	Rotate right by status bit CC 1	nn		RRDA	nn	
Load								
✔		✔	Load	nn		CH	nn	
✔		1500	*Load status word in accumulator 1*			*L STW*	*nn*	
✔		1500	*Load AR1 with contents of accumulator 1*			*LAR1*	*nn*	
✔		1500	*Load AR1 with double word or area pointer*			*LAR1 <D>*	*nn*	
✔		1500	*Load AR1 with contents of AR2*			*LAR1 AR2*	*nn*	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔		1500	*Load AR2 with contents of accumulator 1*			*LAR2*	*nn*	
✔		1500	*Load AR2 with double word or area pointer*			*LAR2 <D>*	*nn*	
Transfer								
✔		✔	Transfer	nn		T	nn	
✔		1500	*Transfer accumulator 1 to status word*			*T STW*	*nn*	
✔		1500	*Switch AR1 and AR2*			*TAR*	*nn*	
✔		1500	*Transfer AR1 to accumulator 1*			*TAR1*	*nn*	
✔		1500	*Transfer AR1 to double word*			*TAR1 <D>*	*nn*	
✔		1500	*Transfer AR1 to AR2*			*TAR1 AR2*	*nn*	
✔		1500	*Transfer AR2 to accumulator 1*			*TAR2*	*nn*	
✔		1500	*Transfer AR2 to double word*			*TAR2 <D>*	*nn*	
Legacy								
✔		1500	Implement sequencer			DRUM		
✔			Implement sequencer			DRUM_X		
✔		1500	Discrete control time interrupt			DCAT		

S7-300	S7-1200	S7-1500	S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔		1500		Motor control time interrupt	MCAT				
✔		1500		Compare input bits with the bits of a mask	IMC				
✔		1500		Matrix scanner	SMC				
✔		1500		Lead and lag algorithm	LEAD_LAG				
✔		1500		Create bit pattern for seven-segment display	SEG				
✔		1500		Create tens complement	BCDCPL				
✔		1500		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	

Basic instructions	Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔			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		
✔		1500	Swap content of accumulators 1 and 2		nn	TAK	nn	
✔		1500	Shift contents to the next highest accumulator		nn	PUSH	nn	
✔		1500	Shift contents to the next lowest accumulator		nn	POP	nn	
✔		1500	Add accumulator 1 to AR1		nn	+AR1	nn	
✔		1500	Add accumulator 1 to AR2		nn	+AR2	nn	

			Basic instructions	Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD	FBD	STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔		1500	*Program display (null instruction)*		*nn*	*BLD*	*nn*	
✔		1500	*Null instruction*		*nn*	*NOP 0*	*nn*	
✔		1500	*Null instruction*		*nn*	*NOP 1*	*nn*	

Instructions in the section "Extended instructions"

S7-300	S7-1200	S7-1500	S7-1200 G2	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*	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔		✔	Combine times	T_COMBINE*		
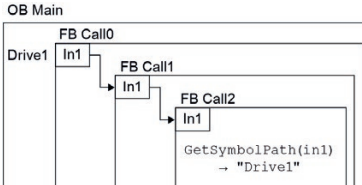
* SCL: Use conversion functions x_TO_y (e.g. TIME_TO_DINT), or comparator and arithmetic operators (e.g. +, -, >, <).

			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
		☑ 1500	Synchronize slave clocks	SNC_RTCB
✔		✔	Read system time	TIME_TCK
	✔	✔	Set time zone	SET_TIMEZONE
✔	✔	✔	Runtime meter	RTM

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔			Set runtime meter		SET_RTM	-
✔			Start and stop runtime meter		CTRL_RTM	-
✔			Read runtime meter		READ_RTM	-
✔			WinAC only: 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	-
✔			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	-

	Basic instructions		Extended instructions		Technology	Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
			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
	✔	✔	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 maximum length of a character string	MAX_LEN		-
		✔	Join multiple character strings	JOIN		-
		✔	Split character array in multiple character strings	SPLIT		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	*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		
✔	✔	✔	Insert characters in a character string	INSERT		
✔	✔	✔	Replace characters in a character string	REPLACE		
✔	✔	✔	Find characters in a character string	FIND		

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
			Runtime information			
	✔	✔	Read out local name of a tag at the input parameter		GetSymbolName	-
	✔	✔	Read local name at beginning of a call path.		GetInstanceName	-
	✔	✔	Read out global name of the block instance. Illustration:		GetSymbolPath	-
	✔	✔	Query composed global name of block instance		GetInstancePath	-
	✔	✔	Read out name of block in block itself		GetBlockName	-

Basic instructions		Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
		✔	Determine the name of an indirectly addressed object, i.e. an object that is addressed via a referencing data type	GetSymbolForReference		-
Process image						
		✔	Update process image input	UPDAT_PI		
		✔	Update process image output	UPDAT_PO		
✔		☑	Synchronize process image input	SYNC_PI		
✔		☑	Synchronize process image output	SYNC_PO		
Distributed I/O						
DP and PROFINET						
✔	✔	✔	Read data record	RDREC		
✔	✔	✔	Write data record	WRREC		
✔	✔	✔	Read process image	GETIO		

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	Transfer process image		SETIO	
✔	✔	✔	Read process image area		GETIO_PART	
✔	✔	✔	Transfer process image area		SETIO_PART	
✔	✔	✔	Receive interrupt		RALRM	
✔	✔	☑	Enable/disable DP slaves		D_ACT_DP	
		☑ 1500	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	
		☑ 1500	Define manual or automatic synchronization type between PROFINET IRT interfaces		InitIOSystemSync	
		☑ 1500	Start manual synchronization of PROFINET IRT interfaces		StartIOSystemSync	

			Basic instructions	Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
		☑ 1500	Determine status information for synchronization between PROFINET interfaces	GetIOSystemSync		
		☑ 1500	Determine synchronization cycle of an isochronous PROFINET interface	GetPNWorkingClock		
Other instructions						
✔		☑ 1500	Read data record from I/O	RD_REC		-
✔		☑ 1500	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	S7-1200	S7-1500 / S7-1200 G2	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		-
✔		☑ 1500	Synchronize DP slaves/Freeze inputs	DPSYC_FR		
✔	✔	☑ 1500	Read diagnostics data of a DP slave	DPNRM_DG		-
✔		☑ 1500	Determine topology for DP master system	DP_TOPOL		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
			ASi			
✔			Control ASi master behavior	ASi_3422		-
✔		☑ 1500	Control ASi master behavior	ASI_CTRL		-
			PROFIenergy			
			IO controller			
✔		✔	Start and end energy-saving mode	PE_START_END		-
✔		✔	Start and end energy-saving mode / Read out status information	PE_CMD		-
✔		✔	Set switching behavior of power modules	PE_DS3_WRITE_ET200S		-
✔		☑	Start and end energy-saving mode via WakeOnLan	PE_WOL		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
			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		-
✔	✔	✔	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		-

Basic instructions		Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
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 OB to interrupt event	ATTACH		-
	✔	✔	Detach OB from interrupt event	DETACH		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
			Cyclic interrupt			
	✔	✔	Set cyclic interrupt parameters		SET_CINT	-
	✔	✔	Query cyclic interrupt parameters		QRY_CINT	-
			Time-of-day interrupt			
✔		☑ 1500	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	-

Basic instructions		Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1500	S7-1200 G2	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		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔	✔	✔	Enable execution of higher priority interrupts and asynchronous error events	EN_AIRT		-
			Trigger multicomputing interrupt	MP_ALM		-
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 diagnostic buffer and send to logged on participants	WR_USMSG		-
✔			*Generate alarm messages*	*ALARM_S*		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔			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		-
			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	INTERRUPT		-
			Send archive data	AR_SEND		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
			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		-
		✔	Record the runtimes start/stop. The following entry describes how to analyze and evaluate the runtime behavior of the user program in SIMATIC S7-1500 and SIMATIC 1200 G2: https://support.industry.siemens.com/cs/ww/en/view/109750245	Profiling		
		✔	Read runtime statistics	RT_INFO		
			Determine OB program runtime	OB_RT		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	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 the 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		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
		✔	Generate diagnostic information	GEN_DIAG		-
	✔	✔	Read diagnostic information	GET_DIAG		-
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	RecipeExport		-
	✔	✔	Import recipe, as of V17	RecipeImport		-
Data logging						
	✔	✔	Create data log	DataLogCreate		-
	✔	✔	Open data log	DataLogOpen		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
	✔	✔	Write data log		DataLogWrite	-
	✔	✔	Clear 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	-
✔			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 attribute		ATTR_DB	-
✔			Delete data block		DEL_DB	-

Basic instructions		Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
	✔	✔	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		-

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔			Collect/distribute table data	PACK		-
Addressing						
	✔	✔	Determine hardware identifier from slot	GEO2LOG		-
	✔	✔	Determine slot from 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						
✔		1500	S7-300: Determine start address from slot S7-1500: Determine hardware identifier from slot. Exists only for compatibility reasons, not recommended	GEO_LOG		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
✔		1500	*S7-300: Determine slot from a logical address* *S7-1500: Determine slot from hardware identifier. Exists only due to compatibility, not recommended*	*LOG_GEO*		*-*
✔		1500	*S7-300: Determine all logical addresses from a logical address* *S7-1500: Determine the logical addresses from the hardware identifier*	*RD_LGADR*		*-*
✔		1500	*S7-300: 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*		*-*
✔		1500	*S7-300: Determine slot and offset in the user database from a logical address* *S7-1500: Determine slot from hardware identifier. Exists only due to compatibility, not recommended*	*LGC_GADR*		*-*

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
			File operations (file handling)			
	✔	✔	Read data from a binary file from the memory card, the binary file has a serialized format/byte array	FileReadC		-
	✔	✔	Write data to a binary file on the memory card	FileWriteC		-
		✔	Delete existing file on the memory card	FileDelete		-
			R/H system			
		RH	Lock or release SYNCUP for the redundant S7-1500R/H system	RH_CTRL		-
		RH	Specify redundancy ID of the primary CPU	RH_GetPrimaryID		-

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD STL (not S7-1200)	SCL	CFC (S7-1500 only)
			Other 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	S7-1200	S7-1200 G2	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

	Basic instructions		Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1200 G2	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
✔			✔	Temperature controller for integrating actuators	TCONT_S

Basic instructions	Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1200 G2	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
Auxiliary functions					
	✔	✔	✔	Map 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

	Basic instructions			Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1200 G2	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
	✔	✔	✔	Implement time-dependent profile	RampSoak
	✔	✔	✔	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 Parameters: 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 Parameters: Gain, TimeConstant, Damping	Filter_PT2

Basic instructions				Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1200 G2	S7-1500	**Description**	**LAD / FBD / STL (not S7-1200) / SCL**
	✔	✔	✔	First-order differentiator Application: - High-pass filter - Differentiator to calculate the derivative of a signal - Feedforward control Parameters: Td, Lag	Filter_DT1
		✔	✔	Configurable 1st to 10th order filter Specific frequency components of a signal let through or attenuated. Application: - High-pass filter - Low-pass filter - Bandpass filter - Band rejection filter	Filter_Universal

S7-300	S7-1200	S7-1200 G2	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
				Motion Control SIMATIC S7-1200 G2 only supports servo axes in V20	
T	✔	✔	☑	Enable/disable axis/technology object	MC_Power
T	✔	✔	☑	Acknowledge interrupts, restart axis/technology object	MC_Reset
T	✔	✔	☑	Home axis/technology object, 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
	✔	✔	☑	Move axis in jog mode	MC_MoveJog
	✔			Run axis commands as movement sequence	MC_CommandTable
	✔			Change Dynamics settings for the axis	MC_ChangeDynamic

Basic instructions	Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1200 G2	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
	✔			Write tag of the positioning axis	MC_WriteParam
	✔			Continuously read motion data of a positioning axis	MC_ReadParam
T			☑	Position axis overlapping	MC_MoveSuperImposed
			☑	Pause superimposed motions on the axis	MC_HaltSuperimposed
T		✔	T	Set alternative encoder as active encoder	MC_SetSensor
T		✔	☑	Pause 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			☑	Write parameter	MC_WriteParameter
		✔	T	Save absolute encoder adjustment for device replacement	MC_SaveAbsoluteEncoderData

Basic instructions		Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1200 G2	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
Output cam, cam track, measuring input					
T		✔	☑	Start one-time measuring	MC_MeasuringInput
		✔	☑	Start cyclic measuring	MC_MeasuringInputCyclic
		✔	☑	Cancel active measuring job	MC_AbortMeasuringInput
T		✔	☑	Enable/disable output cam	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		✔	☑	Enable/disable cam track	MC_CamTrack
Synchronous motion - Gearing/camming					
T		✔	☑	Start gearing	MC_GearIn
			T	Start velocity synchronous operation	MC_GearInVelocity

	Basic instructions		Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1200 G2	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
T			T	Start gearing with specified synchronous positions	MC_GearInPos S7-300: MC_GearIn
T		✔	T	Relative shift of master value on the following axis	MC_PhasingRelative S7-300: MC_Phasing
T		✔	T	Absolute shift of master value on the following axis	MC_PhasingAbsolute S7-300: MC_Phasing
			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 gearing	MC_GearOut
T		✔	T	Desynchronize camming	MC_CamOut

S7-300	S7-1200	S7-1200 G2	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
			T	Specify additive leading value, active leading value + additive leading value = effective leading value	MC_LeadingValueAdditive
Cam					
T		✔	T	Interpolate cam	MC_InterpolateCam S7-300: MC_CamInterpolate
T		✔	T	Read master value of a cam	MC_GetCamLeadingValue S7-300: MC_GetCamPoint
T		✔	T	Read out slave value of a cam	MC_GetCamFollowingValue S7-300: MC_GetCamPoint
			T	Cyclically read out following value of a cam	MC_GetCamFollowingValueCyclic
			T	Copy calculated cam elements	MC_CopyCamData

Basic instructions	Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1200 G2	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
				MotionIn	
			T	Set motion setpoints for velocity and acceleration	MC_MotionInVelocity
			T	Set motion setpoints for position, velocity and acceleration	MC_MotionInPosition
			T	Specify superimposed motion setpoints	MC_MotionInSuperimposed
				Torque data	
			☑	Specify additive torque	MC_TorqueAdditive
			☑	Set high and low torque limits	MC_TorqueRange
T			☑	Enable and disable force/torque limit / fixed stop detection	MC_TorqueLimiting
				Motion (kinematics)	
T		✔	T	Interrupt motion execution	MC_GroupInterrupt
T		✔	T	Continue motion execution	MC_GroupContinue

Basic instructions		Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1200 G2	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
T		✔	T	Stop motion	MC_GroupStop
T		✔	T	Position kinematics absolutely with linear path motion	MC_MoveLinearAbsolute
T		✔	T	Position kinematics relatively with linear path motion	MC_MoveLinearRelative
T		✔	T	Position kinematics absolutely with circular path motion	MC_MoveCircularAbsolute
T		✔	T	Position kinematics relatively 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.	MC_TrackConveyorBelt
T			T	Start/end simulation of kinematics	MC_KinematicsMotionSimulation S7-300: MC_GroupSyncConveyorBelt

S7-300	S7-1200	S7-1200 G2	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
				Zones	
T			T	Define workspace zone	MC_DefineWorkspaceZone S7-300: MC_ZoneCheck
T			T	Define kinematics zone	MC_DefineKinematicsZone S7-300: MC_ZoneCheck
T			T	Activate workspace zone	MC_SetWorkspaceZoneActive S7-300: MC_ZoneCheck
T			T	Deactivate workspace zone	MC_SetWorkspaceZoneInactive S7-300: MC_ZoneCheck
T			T	Activate kinematics zone	MC_SetKinematicsZoneActive S7-300: MC_ZoneCheck
T			T	Deactivate kinematics zone	MC_SetKinematicsZoneInactive S7-300: MC_ZoneCheck
				Tools	
			T	Re-define tool	MC_DefineTool
			T	Change active tool	MC_SetTool

					Description	LAD / FBD / STL (not S7-1200) / SCL
Basic instructions			Extended instructions		Technology	Communication
S7-300	S7-1200	S7-1200 G2	S7-1500			
Coordinate systems						
			T	Redefine object coordinate systems		MC_SetOcsFrame
			T	Transform axis coordinates to Cartesian coordinates		MC_KinematicsTransformation
			T	Transform Cartesian coordinates to axis coordinates		MC_InverseKinematicsTransformation
Interpreter						
			T	Load/unload the Interpreter program		MC_LoadProgram
			T	Start execution of the Interpreter program		MC_RunProgram
			T	Stop execution of the Interpreter program		MC_StopProgram
Time-driven inputs/outputs						
HSP		✔	☑	Synchronize TIO modules		TIO_SYNC
HSP			☑	Read in process input signals with time stamps		TIO_IOLink_IN
HSP		✔	☑	Read in edges at digital input and associated time stamps		TIO_DI

S7-300	S7-1200	S7-1200 G2	S7-1500	Description	LAD / FBD / STL (not S7-1200) / SCL
HSP			☑	Time-controlled output of process output signals	TIO_IOLink_OUT
HSP		✔	☑	Output edges time-controlled at digital output	TIO_DQ
HSP		✔	☑	Read in edges at digital input and associated time stamps once	TIO_DI_ONCE
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
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	Protocols	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) | | | | 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/sending-and-receiving-messages-with-messenger-services-as-demonstrated-with-telegram-?dti=0&lc=en-DE MQTT: https://support.industry.siemens.com/cs/document/109748872/use-the-simatic-controller-as-an-mqtt-client?dti=0&lc=en-DE |
| | ✔ | ✔ | TUSEND/TURCV (not S7-300) | UDP | Fast, without acknowledgment | Max. 2048 bytes | Distribute data without acknowledgment. FOR EXAMPLE: Distribute position data quickly to many devices.

An exact calculation of the limits is available in the controller manuals. |
| (✔) | ✔ | ✔ | | | | | |

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
Automatically	X	X	-	-	-	-	-	-	-
Programmed	-	-	X	X	X	-	X	-	-
Configured	-	X	X	X	X	X	X	X	X

Instructions in the section "Communication"

S7-300	S7-1200	S7-1500 / S7-1200 G2	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		

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
			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*	
✔		☑	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	

					Basic instructions		Extended instructions		Technology		Communication	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
			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	
✔			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		

S7-300	S7-1200	S7-1500 / S7-1200 G2	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						
	✔	✔	Manage communication connection and send data via Ethernet or Profibus S7-1500: also as CFC instruction		TSEND_C	
	✔	✔	Manage communication connection and receive data via Ethernet or Profibus S7-1500: also as CFC instruction		TRCV_C	

Basic instructions		Extended instructions	Technology		Communication	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
	✔	✔	Manage communication connection and transfer email		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	
Other 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	
✔	✔	✔	Receive data via communication connection S7-1500: also as CFC instruction		TRCV	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
	✔	✔	Reset connection S7-1500: also as CFC instruction		T_RESET	
	✔	✔	Check 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. FOR EXAMPLE: 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	

			Description	LAD / FBD	STL (not S7-1200)	SCL
S7-300	**S7-1200**	**S7-1500 / S7-1200 G2**				
✔			Swap data using FETCH and WRITE via ISO-on-TCP		FW_IOT	
OPC UA						
OPC UA server						
	✔	✔	Query to operating system whether the server 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	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
			OPC UA client			
			Schematic flow:			
			Preparing data exchange, establishing a session			
	☑ 1500		Establish connection.		OPC_UA_Connect	
	☑ 1500		Request the current indexes of the namespaces in an OPC UA server		OPC_UA_NamespaceGetIndexList	
	☑ 1500		Register PLC tags with an OPC UA server, get handles for read and write access		OPC_UA_NodeGetHandleList	

				Communication

Basic instructions	Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
		☑ 1500	Determine NodeIds (node parameters) from tag names (Browse-Name).	OPC_UA_TranslatePathList		
		☑ 1500	Register OPC UA method with an OPC UA server	OPC_UA_MethodGetHandleList		
Data exchange/data access						
		☑ 1500	Read values from PLC tags	OPC_UA_ReadList		
		☑ 1500	Writing new values in PLC tags	OPC_UA_WriteList		
		☑ 1500	Call method	OPC_UA_MethodCall		
		☑ 1500	Set up session and read values from PLC tags	OPC_UA_ReadList_C		
		☑ 1500	Set up session and write values to PLC tags	OPC_UA_WriteList_C		

Basic instructions			Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
		☑ 1500	Set up session and call method		OPC_UA_MethodCall_C	
			Ending data exchange, ending a session			
		☑ 1500	Terminate connection to the OPC UA server		OPC_UA_Disconnect	
		☑ 1500	Enable handles for read and write access		OPC_UA_NodeReleaseHandleList	
		☑ 1500	Enable handles for method calls		OPC_UA_MethodReleaseHandleList	
			Diagnostics			
		☑ 1500	Read connection status and determine quality of a connection		OPC_UA_ConnectionGetStatus	
			Web server			
✔	✔	☑	Synchronizing user-defined web pages		WWW	

| Basic instructions | Extended instructions | Technology | Communication |

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
			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_		
✔	✔	✔	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		

Basic instructions		Extended instructions	Technology		Communication

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
	✔	✔	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	S7-1200	S7-1500 / S7-1200 G2	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: Commands for ET 200SP CM PtP			
✔	✔	✔	Configure PtP communication port S7-300: 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	

Basic instructions			Extended instructions		Technology	Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
✔	✔	✔	Set accompanying signals		Signal_Set	
✔	✔	✔	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	

				Basic instructions	Extended instructions	Technology	Communication

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
	✔		Query RS-232 signals		SGN_GET	
	✔		Set RS-232 signals		SGN_SET	
USS communication						
S7-300: 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	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
		✔	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: 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	

S7-300	S7-1200	S7-1500 / S7-1200 G2	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 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		
✔			Output alarm text with up to 4 tags to printer	P_PRINT		
✔			Delete receive buffer	P_REST		
✔			Read accompanying signals at the RS232C interface	V24_STAT_340		

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
✔			Write accompanying signals at the RS232C 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 RS232C interface		V24_STAT	
✔			Write accompanying signals at the RS232C interface		V24_SET	
MODBUS slave (RTU)						
✔			Modbus slave instruction for CP 341		MODB_341	
✔			Modbus slave instruction for CP 441		MODB_441	

Basic instructions		Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1500 S7-1200 G2	**Description**	**LAD / FBD**	**STL (not S7-1200)**	**SCL**
MODBUS: CP 343-1
✔			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
✔		✔	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

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
✔		✔	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	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
✔			Enable external access to user memory areas of the controller. Data exchange is then possible with FETCH/WRITE.		AG_UNLOCK	
✔			Diagnostics of connections		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	

Basic instructions		Extended instructions		Technology	Communication	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
			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	
			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 I/O 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	

Basic instructions		Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
			Other 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	
	✔		Transfer configuration data to CP		TC_CONFIG	

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
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	

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
✔			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	
MPI communication						
Note: "X_" stands for the MPI interface 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	

Basic instructions		Extended instructions		Technology		Communication

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
✔			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	S7-1200	S7-1500 / S7-1200 G2	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	

S7-300	S7-1200	S7-1500 / S7-1200 G2	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	

Table header: Optional instructions

S7-300	S7-1200	S7-1500 / S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
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	

S7-300	S7-1200	S7-1500 S7-1200 G2	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	
			SINAMICS			
	✔	1500	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	

S7-300	S7-1200	S7-1500 S7-1200 G2	Description	LAD / FBD	STL (not S7-1200)	SCL
	✔	✔	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	

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 <>

Cause Effect Matrix			
S7-1200	**S7-1500**	**Description**	**CEM**
✔	✔	Greater than or equal	CMP >=
✔	✔	Less or equal	CMP <=
✔	✔	Greater than	CMP >
✔	✔	Less than	CMP <
		Times	
✔	✔	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

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