“Main Datasheets”
Rev. A

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1. Main Datasheets

CPUs - CPU 414-5H for S7-400H/F/FH

Overview

- CPU for SIMATIC S7-400H and S7-400F/FH.
- Can be used in high availability S7-400H systems
- Can be used with F-runtime license and F-compatible CPU in failsafe S7-400F/FH systems
- With integrated PROFIBUS DP master interface
- With 2 slots for sync modules

Application

The CPU 417-4H is the most powerful CPU for the SIMATIC S7-400H and S7-400F/FH. It allows a fault-tolerant S7-400H system to be configured. It can also be used for the failsafe S7-400F/FH automation system in conjunction with an F-runtime license.

The integrated PROFIBUS DP interface supports direct connection to the PROFIBUS DP fieldbus as master.

Design

The CPU 417-4H includes:

- Powerful processor:
  The CPU achieves command execution times of as low as 30 ns per binary command.
- 20 MB working memory (10 MB for program, 10 MB for data):
  Load memory for user programs and parameterization data of the S7-400H programmable controller; high-speed memory for critical parts of the user program.
- Memory card:
  For expanding the integral load memory. The information stored in the load memory includes S7-400H parameterization data in addition to the program and therefore requires twice as much memory space. The result is:
  - Integral load memory is not sufficient for large programs, so a memory card is frequently necessary.
    RAM and FEPROM cards are available (FEPROM can also be used for storage in the de-energized state).
    Note:
    The RAM memory cards **6ES7 955-...** can only be used in combination with the CPU **6ES7 417-4HL01-...** .
- Flexible expansion capability:
  Max. 128 K digital, 8 K analog inputs/outputs.
- Multipoint interface MPI:
  The MPI can be used to set up a simple network with up to 32 stations and a data transmission rate of 187.5 Kbit/s. The CPU can establish up to 64 connections to stations on the communications bus (C bus) and the MPI.
  Note:
  If PROFIBUS DP and the MPI interface are used simultaneously, the following bus connectors must be plugged into the MPI interface:
  - With a socket: **6ES7 972-0BB41-0XA0**
  - Without a socket: **6ES7 972-0BA41-0XA0**

- Mode selector:

  Designed as keyswitch. Access rights to user data can be limited with the removable mode selector.
- Diagnostics buffer:

  The last 120 fault and interrupt events are saved in a ring buffer for diagnostic purposes.
- Real-time clock:

  Diagnostics messages from the CPU are tagged with the date and time.
- PROFIBUS DP interface:

  The CPU 417-4H with PROFIBUS DP master interface supports a high-speed, distributed automation configuration with easy handling. From the user's point of view, the distributed I/O is treated as central I/O (same configuring, addressing and programming).

  Note:

  If PROFIBUS DP and the MPI interface are used simultaneously, the following bus connectors must be plugged into the MPI interface:
  - With a socket: **6ES7 972-0BB41-0XA0**
  - Without a socket: **6ES7 972-0BA41-0XA0**

Function

- Block protection:

  A password concept also protects the user program from unauthorized access as well as the keyswitch.
- Integrated HMI services:

  The user only has to specify the source and destination of the data with HMI devices. The data are then transported cyclically and automatically by the system.
- Integrated communication functions:
  - PG/OP communication
  - Expanded communication (simple and high-availability)

Configurable Attributes

The STEP 7 "hardware configuration" tool and the installed S7-400H options package are used to configure the features and response of the S7-400H, including the CPUs, for example:

- Multipoint interface MPI:
  - Definition of node addresses
  - Startup/cycle behavior
  - Stipulation of the maximum cycle time and communication load

- Address allocation:

  Addressing of I/O modules
- Retentive area:

  Definition of the number of retentive bit memories, counters, timers, data blocks, and clock memories
- Protection level:

  Definition of access authorizations to program and data
- System diagnostics:

  Definition of the handling and scope of diagnostics messages
- Timed interrupts:

  Setting of periods
- Configuration of H stations

Safety-related functions

The F-runtime license can be used to compile the failsafe F user program and run it on the CPU. A license is required for each S7-400F/FH system. 2 TÜV stickers are included.

Reporting functions

- Status and fault indicators:

  LEDs indicate internal and external errors and operating modes such as RUN, STOP, Startup, "Master" mode, redundancy error, test function, etc.
- Test functions:

  The PG can be used to display signal states in program execution, modify process tags irrespective of the user program, read out the contents of stack memories, run separate program steps and inhibit program components.
- Information functions:

  The PG can be used to provide the user with information about the memory capacity and operating mode of the CPU, and the current utilization of the working and load memories.

Technical specifications (MyMMP)

	417-4HL04-0AB0 6ES7
voltages Supply value Rated • V 24 DC	Yes
currents and Voltages	

CPU to voltage buffer external of Feeding	DC V 15 to 5
consumption Current	
max. V, 5 DC bus backplane from	1.7 A
typ. loss, Power	6 W
battery Backup	
• typ. current, Buffer	600 µA
• max. current, Buffer	1,810 µA
Memory	
Memory	
• RAM	
• expandable	No
• memory Load	
• FEPROM expandable	(FLASH) card Memory with Yes;
• max. FEPROM, expandable	64 MByte
• max. RAM, integrated	256 KByte
• RAM expandable	(RAM) Card Memory with Yes;
• max. RAM, expandable	16 MByte
Backup	
• present	Yes
• battery with	data all Yes;
• battery without	No
CPU/blocks	
DB	
• max. Number,	reserved 0 DB 8,192;
FB	

• max. Number,	6,144
• max. Size,	64 KByte
FC	
• max. Number,	6,144
• max. Size,	64 KByte
OB	
• max. Size,	64 KByte
depth Nesting	
• class priority per	24
• OB error an within additional	2
times CPU/processing	
min. operations, bit for	0.03 µs
min. operations, word for	0.03 µs
min. arithmetic, point fixed for	0.03 µs
min. arithmetic, point floating for	0.09 µs
remanence their and Times/counters	
counter S7	
• Number	2,048
• Remanence	
◦ adjustable	Yes
◦ limit lower	0
◦ limit upper	2,047
◦ preset	7 Z to 0 Z From
• range Counting	

• limit lower	1
• limit upper	999
counter IEC	
• present	Yes
• Type	SFB
times S7	
• Number	2,048
• range Time	
• limit lower	10 ms
• limit upper	9,990 s
timer IEC	
• present	Yes
• Type	SFB
remanence their and areas Data	
Flag	
• max. Number,	16 KByte
• available Remanence	16383 MB to 0 MB Yes;
area Address	
area address I/O	
• Inputs	16 KByte
• Outputs	16 KByte
• distributed which, of	
• inputs MPI/DPinterface,	2 KByte

• outputs interface, MPI/DP	2 KByte
• inputs interface, DP	8 KByte
• outputs interface, DP	8 KByte
image Process	
• adjustable Inputs,	16 KByte
• adjustable Outputs,	16 KByte
• preset Inputs,	1,024 Byte
• preset Outputs,	1,024 Byte
images Subprocess	
• max. images, subprocess of Number	8
channels Digital	
• Inputs	131,072
• Outputs	131,072
• central which of Inputs,	131,072
• central which of Outputs,	131,072
channels Analog	
• Inputs	8,192
• Outputs	8,192
• central which of Inputs,	8,192
• central which of Outputs,	8,192
config. Hardware	
max. devices, Central	1
max. devices, Expansion	21

Multicomputing	No
IM	
• max. (total), IMs connectable of Number	6
• max. 460s, IM connectable of Number	6
• max. 463s, IM connectable of Number	463-2 IM 6;
masters DP of Number	
• integrated	2
• 467 IM via	0
• CP via	10
• permitted CP + IM mode Mixed	Ext. 443-5 CP with jointly used be cannot IM467 No;
• module interface via	0
(recommended) CPs and FMs operable of Number	
• FM	connections of number and slots of number to due limited 64;
• point-to-point CP,	connections of number and slots of number to due limited 64;
• LAN CP,	connections of number and slots of number to due limited 64;
Time	
Clock	
• clock) (real-time clock Hardware	Yes
• synchronized and backed Battery	Yes
counter hours Operating	
• Number	8
synchronization Clock	
• supports	Yes
functions message S7	

max. functions, message for stations login of Number	16
functions Communication	
communication PG/OP	Yes
communication data Global	
• supported	No
communication basic S7	
• supported	No
communication S7	
• supported	Yes
• server as	Yes
• client as	Yes
• max. job, per data Useful	64 KByte
communication S5-compatible	
• supported	FC loadable and CP via Yes;
• max. job, per data Useful	8 KByte
(FMS) communication Standard	
• supported	FB loadable and CP via Yes;
connections of Number	
• overall	64
interface 1st	
Physics	PROFIBUS / RS-485
isolated	Yes
Functionality	
• MPI	setting Default Yes;
• master DP	Yes
• slave DP	No

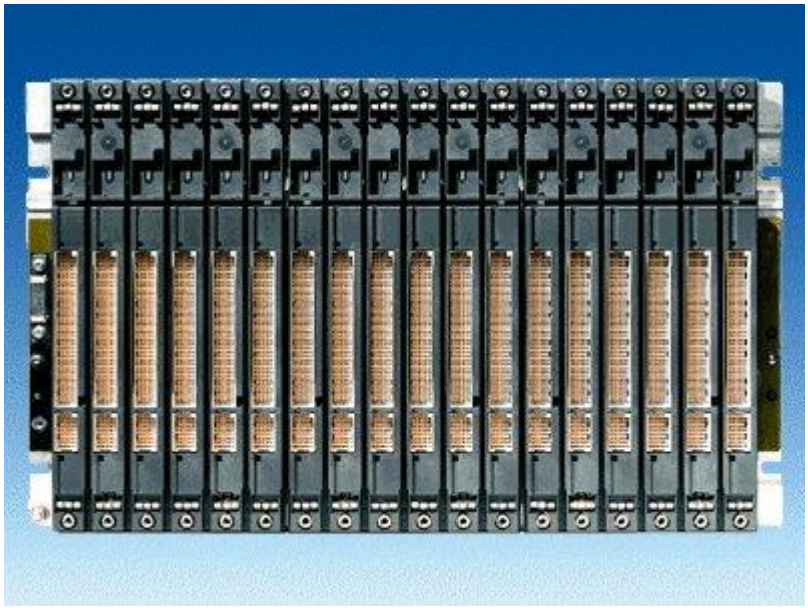
MPI	
• connections of Number	44
• Services	
• communication PG/OP	Yes
• communication data Global	No
• communication basic S7	No
• communication S7	Yes
• max. speeds, Transmission	12 Mbit/s
master DP	
• max. connections, of Number	32
• Services	
• communication PG/OP	Yes
• communication basic S7	No
• communication S7	No
• client as communication, S7	No
• server as communication, S7	No
• support equidistance	No
• slaves DP of Activation/deactivation	No
• traffic) (cross exchange data direct	No
• max. speeds, Transmission	12 Mbit/s
• max. slaves, DP of Number	512 max. slots, of Number 32;

• area Address	
• max. Inputs,	2 KByte
• max. Outputs,	2 KByte
• slave DP per data Useful	
• max. Inputs,	244 Byte
• max. Outputs,	244 Byte
interface 2nd	
Physics	PROFIBUS / RS-485
isolated	Yes
Functionality	
• master DP	Yes
• slave DP	No
• coupling Point-to-point	No
master DP	
• max. connections, of Number	16
• max. reserved), which (of connections of Number	OP for 1 PG, for 1
• Services	
• communication PG/OP	Yes
• communication basic S7	No
• communication S7	No
• client as communication, S7	No
• server as communication, S7	No

• support equidistance	No
• slaves DP of Activation/deactivation	No
• traffic) (cross exchange data direct	No
• max. speeds, Transmission	12 Mbit/s
• max. slaves, DP of Number	2048 max. slots, of Number 125;
• area Address	
• max. Inputs,	8 KByte
• max. Outputs,	8 KByte
• slave DP per data Useful	
• max. Inputs,	244 Byte
• max. Outputs,	244 Byte
CPU/programming	
language Programming	
• 7 STEP	SP2 V5.0 Yes;
• LAD	Yes
• FUP	Yes
• AWL	Yes
• SCL	Yes
• CFC	Yes
• GRAPH	Yes
• HiGraph®	Yes

protection protection/password program User	Yes
weight and Dimensions	
Width	50 mm
Height	290 mm
Depth	219 mm
slots Required	2
Weights	
approx. Weight,	1,070 g

S7-400/S7-400H/S7-400F/FH - Racks



Overview

- The basic mechanical framework of the SIMATIC® S7-400®/S7-400®H
- For accommodating the modules, supplying them with operating voltage and connecting them via the backplane bus
- Several versions for configuring central controllers and expansion units

Area of application

The racks form the basic mechanical structure of the SIMATIC® S7-400®. They perform the following tasks:

- They provide mechanical support for the modules
- They provide the power supply to the modules
- They link individual modules together by way of the backplane bus

The racks are designed for wall mounting and installing in frames and cabinets.

A number of racks are available for setting up the SIMATIC® S7-400®:

- UR1 and UR2 racks;
  for configuring central controllers and expansion units
- CR2 racks;
  for configuring segmented central controllers (parallel operation of two CPUs operating independently of each other in a single rack)
- CR3 racks;
  for configuring central controllers, optimized for decentralized automation solutions
- ER1 and ER2 racks;
  for configuring expansion units with signal modules

- UR2-H racks; for S7-400®H

UR1 (universal rack)

- For configuring central controllers and expansion units
- For up to 18 modules
- Also suitable for S7-400®H

UR2 (universal rack)

- For configuring central controllers and expansion units
- For up to 9 modules
- Also suitable for S7-400®H

CR2 (central rack)

- For configuring central controllers
- For up to 18 modules
- Segmented racks:
  For operating two independent S7-400 CPUs without S7-400 Multicomputing, but with communication between the CPUs via the backplane bus (K bus);
  Both CPUs can address local, separate I/O modules (segmented P bus)

CR3 (central rack)

- For configuring central controllers
- Optimized for decentralized automation tasks through support of up to 4 modules

UR2-H

- For setting up a complete S7-400®H system in a single mounting rack
- Also suitable for S7-400®:
  operation of 2 separate CPUs with their own I/O (own P and K bus)
- Can also be used as expansion rack
- For up to 18 modules

ER1 (expansion rack)

- For cost-effective configuration of expansion units
- For up to 18 modules with restricted functionality
- Also suitable for S7-400®H

ER2 (expansion rack)

- For cost-effective configuration of expansion units
- For up to 9 modules with restricted functionality
- Also suitable for S7-400®H

Design

All racks consist of the following:

- A mounting rail with threaded bolts for mounting the modules as well as lateral recesses for mounting the rack on a wall or other support
- Plastic guide pieces direct the module as it is being swung into place
- Connection for PE conductor
- Backplane bus with plug-in connectors

UR1 for central controllers

- Always required: a power supply module and a CPU.
- Can be expanded centrally (up to 5 m) and distributed (up to 600 m).
- Required for expansion:
  - Interface modules (send IMs); max. 6 plug-in interface modules
- Up to 21 expansion racks can be connected

UR2 for central controllers

- Always required: a power supply module and a CPU.
- Can be expanded centrally (up to 5 m) and distributed (up to 600 m).
- Required for expansion:
  - Interface modules (send IMs); max. 6 plug-in interface modules
- Up to 21 expansion racks can be connected

CR2 for central controllers

- Always required: a power supply module and 2 CPUs.
- Can be expanded centrally (up to 5 m) and distributed (up to 600 m).
- Required for expansion:
  - Interface modules (send IMs); max. 6 plug-in interface modules
- Up to 21 expansion racks can be connected
- 2 CPUs, each with its own I/O can be operated adjacently:
  2 P-bus segments with 10 or 8 slots for 1 CPU each with its own I/O modules
- Through-pass K bus: Access to the K bus stations is possible from both segments

CR3 for central controllers

- Always required: a power supply module (PS) and a CPU.
- Can be expanded centrally (up to 5 m) and distributed (up to 600 m).
- Required for expansion:
  - Interface module (send IM); max. 2 plug-in interface modules
- Up to 16 expansion racks can be connected
- Continuous K bus and P bus
- Cannot be used in conjunction with H systems

UR2-H

- Always required: 2 power supply modules (PS) and 2 CPUs

- Can be expanded centrally (up to 5 m) and distributed (up to 600 m).
- Required for expansion:
  - Interface modules (send IMs); max. 6 plug-in interface modules
- Up to 21 expansion racks can be connected
- 2 CPUs, each with its own I/O can be operated adjacently:
  2 P-bus and 2 C-bus segments, each with 9 slots for 1 CPU each with its own I/O
- Continuous K bus: Access to the K bus stations is possible from both segments

UR1 for expansion units

- Always required: interface module (receive IM)

UR2 for expansion units

- Always required: interface module (receive IM)

ER1 for expansion units

- Always required: interface module (receive IM)
- P bus with a limited range of functions:
  - No interrupt processing
  - No buffering of the modules plugged
  - No 24 V DC supply of the modules
- No K bus
- These include:
  - SM modules
  - Receive IM
  - Power supply module
  -

ER2 for expansion units

- Always required: interface module (receive IM)
- P bus with a limited range of functions:
  - No interrupt processing
  - No buffering of the modules plugged
  - No 24 V DC supply of the modules
- No K bus
- These include:
  - SM modules
  - Receive IM
  - Power supply module

Technical Specifications

Rack	UR1	UR2
Number of single-width slots	18	9
Buses	P, K	P, K
Dimensions (W x H x D) in mm	482.5 x 290 x 27.5	257.5 x 290 x 27.5
Weight, approx.	3 kg	1.5 kg

Rack	CR2	CR3
Number of single-width slots	18; 2 segments with 8 or 10 slots	4
Buses	P, K	P, K
Dimensions (W x H x D) in mm	482.5 x 290 x 27.5	130 x 290 x 27.5
Weight, approx.	3 kg	1.5 kg

Rack	UR2-H	ER1	ER2
Number of single-width slots	18	18	9
Buses	P, C	P	P
Dimensions (W x H x D) in mm	482.5 x 290 x 27.5	482.5 x 290 x 27.5	482.5 x 290 x 27.5
Weight, approx.	3 kg	2.5 kg	1.25 kg

CPUs - Sync module for linking CPU 41x-4H to S7-400H/F/FH

Overview

- For connecting the two CPUs 414-4H/417-4H in the subunits of the S7-400®H
- Suitable for direct plugging into the CPU

Area of application

The sync module is required for connecting the two CPUs 414-4H or 417-4H in the subunit of the S7-400®H.

Design

The sync module is plugged into the slot reserved for it on the CPU 414-4H/417-4H. Two sync modules are required for each CPU.

Modules in the subunits are connected by means of fiber-optic cable connecting cables.

Technical Specifications

Technical Data	Sync Module
Current consumption from 5 V DC (from CPU), max.	0.5 A
Power loss	2.5 W
Weight	0.06 kg

S7-400/S7-400H/S7-400F/FH - PS 405/407 power supply modules

Overview

- Power supplies for the SIMATIC ®S7-400®
- For conversion of AC or DC network voltages into the required 5 V and 24 V DC operating voltages
- Output current 4 A, 10 A and 20 A

Area of application

The power supply units supply the modules of the S7-400® with operating voltages of 5 V DC and 24 V DC via the backplane bus.

Power supplies are available for AC network voltages of 85 to 264 V and for DC voltages of 19.2 to 300 V.

Every rack requires a power supply module.

Exception:

For interfaces that include power transmission, the power supply module in the central controller also powers all modules in the expansion units.

Load voltage for sensors and actuators must be provided separately.

There are also power supply modules which allow both standard systems and fault-tolerant systems to be operated as failsafe systems).

Design

Power supply modules are mounted all the way to the left of the rack (beginning from slot 1). Depending on the design, they are assigned to slots 1 to 3. The modules are encapsulated and dissipate their heat by means of natural convection.

Located on the front panel of the modules are:

- LED displays;
  LEDs display internal faults,correct 5 V and 24 V DC output voltages, and correct backup battery voltage
- A fault acknowledgement button
- On/off switch for output voltages
- Back-up battery compartment
- Battery monitoring switch
- Network voltage selector switch (not applicable for wide-range power supplies)
- Supply connection

The backup battery is an option and must be ordered separately. For power supply modules from 10 A, two back-up batteries are recommended.

Technical Specifications

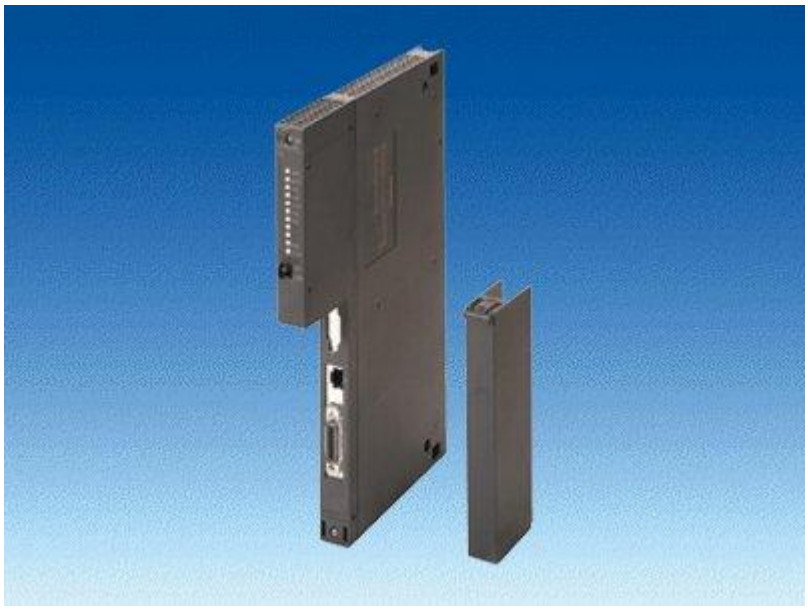
DC power supply units	4 A	10 A, wide-range	10 A redundant, wide-range	20 A wide-range
6ES7 405-	0DA01	0KA01	0KR00	0RA01
Input				
Input voltage				
• Rated value	24 V DC	24/48/60 V DC	24/48/60 V DC	24/48/60 V DC
• Permissible range	Static: 19.2 to 30 V Dyna-mic: 18.5 to 30.2 V	Static: 19.2 to 72 V Dyna-mic: 20.4 to 28.8 V	Static: 19.2 to 72 V Dyna-mic: 20.4 to 28.8 V	Static: 19.2 to 72 V Dyna-mic: 18.5 to 75.5 V
Mains buffering	4.5 ms +/- 0.5 ms	≥ 20 ms	≥ 20 ms	≥ 20 ms
Mains buffering time to NAMUR recommendation	No	Yes	Yes	Yes
Input current at rated value				
• 24/48/60 V DC	2/-/- A	4.5/2.1/1.7 A	4.5/2.1/1.7 A	7.3/3.45/2.75 A
Inrush current, max.	Peak value 27 A; half-value width 10 ms	Peak value 18 A; half-value width 20 ms	Peak value 18 A; half-value width 20 ms	Peak value 33 A; half-value width 1.5 ms
Output				
Output voltage				
• Rated values	5.1 V DC / 24 V DC	5.1 V DC / 24 V DC	5.1 V DC / 24 V DC	5.1 V DC / 24 V DC

Output currents				
• Rated values	5 V DC: 4 A (100 mA basic load required); 24 V DC: 0,5 A stable at no-load	5 V DC: 10 A (200 mA basic load required); 24 V DC: 1 A stable at no-load	5 V DC: 10 A (200 mA basic load required); 24 V DC: 1 A stable at no-load	5 V DC: 20 A (200 mA basic load required); 24 V DC: 1 A stable at no-load
Short- circuit protection	Yes	Yes	Yes	Yes
General specifications				
Degree of protection to IEC 60536	I, with protective ground conductor	I, with protective ground conductor	I, with protective ground conductor	I, with protective conductor
Temperature class to FM approval	Up to 40°C: T4; to 60 °C:T3C	Up to 40°C: T4;	Up to 40°C: T4;	Up to 40°C: T4;
Isolation	Yes	Yes	Yes	Yes
Power consumption, typ.	48 W	104 W	104 W	175 W
Power losses, typ.	16 W	29 W	29 W	51 W
Backup battery (optional)	1 x lithium AA 3.6 V/1.9 Ah	2 x lithium AA 3.6 V/1.9 Ah	2 x lithium AA 3.6 V/1.9 Ah	2 x lithium AA 3.6 V/1.9 Ah
Slots required	1	2	2	3
Dimensions (W x H x D) in mm	25 x 290 x 217	50 x 290 x 217	50 x 290 x 217	75 x 290 x 217
Weight, approx.	800 g	1400 g	1360 g	2200 g
Cable cross-section of the supply cables	3 x 1.5 mm^2; solid or stranded conductor; outer diameter 3 to 9 mm	3x, 3 x 1.5 mm^2; solid or stranded conductor; outer diameter 3 to 9 mm	3x, 3 x 1.5 mm^2; solid or stranded conductor; outer diameter 3 to 9 mm	3x, 3 x 1.5 mm^2; solid or stranded conductor; outer diameter 3 to 9 mm

AC and wide- range power supplies	4 A	10 A	10 A redundant	20 A
6ES7 407-	0DA01	0KA01	0KR00	0RA01
Input				
Input voltage				
• Rated value				
- DC	-	110/230 V	110/230 V	110/230 V
- AC	120/230 V	120/230 V	120/230 V	120/230 V
• Permissible range	85 to 132 V AC / 170 to 264 V AC	88 to 300 V DC 85 to 264 V AC	88 to 300 V DC 85 to 264 V AC	88 to 300 V DC 85 to 264 V AC
Mains frequency				
• Rated value	60/50 Hz	60/50 Hz, 0 Hz	60/50 Hz, 0 Hz	60/50 Hz, 0 Hz
• Permissible range	47 to 63 Hz	0 Hz; 47 to 63 Hz	0 Hz; 47 to 63 Hz	0 Hz; 47 to 63 Hz
Mains buffering	4.5 ms +/- 0.5 ms	≥ 20 ms	≥ 20 ms	≥ 20 ms
Mains buffering time to NAMUR	No	Yes	Yes	Yes

recommendation				
Input current / rated value				
• For 110/230 V DC	-	0.4/0.6 A	0.4/0.6 A	0.4/0.6 A
• At 120/230 V AC	0.4/0.6 A	0.4/0.6 A	0.4/0.6 A	0.4/0.6 A
Inrush current, max.	15 x input current rated value	15 x input current rated value	15 x input current rated value	Maximum value 48 A; half-value width1.5 ms
Output				
Output voltage				
• Rated values	5.1 V DC / 24 V DC	5.1 V DC / 24 V DC	5.1 V DC / 24 V DC	5.1 V DC / 24 V DC
Output currents				
• Rated values	5 V DC: 4 A (100 mA basic load required); 24 V DC: 0,5 A stable at no-load	5 V DC: 10 A (200 mA basic load required); 24 V DC: 1 A stable at no-load	5 V DC: 10 A (200 mA basic load required); 24 V DC: 1 A stable at no-load	5 V DC: 20 A (200 mA basic load required); 24 V DC: 1 A stable at no-load
Short- circuit protection	Yes	Yes	Yes	Yes
General specifications				
Degree of protection to IEC 60536	I, with protective ground conductor	I, with protective ground conductor	I, with protective ground conductor	I, with protective ground conductor
Compliance with standards EN 61000-3-2 and EN 61000-3-3 concerning system perturbations	No	Yes	Yes	Yes
Temperature class to FM approval	Up to 40°C: T4; to 60 °C:T3C	Up to 40°C: T4;	Up to 40°C: T4;	Up to 40°C: T4;
Isolation	Yes	Yes	Yes	Yes
Power consumption, typ.	46.5 W	105 W	97.5 W	168 W
Power losses, typ.	13.9 W	2.5 W	22.4 W	44 W
Backup battery (optional)	1 x lithium AA 3.6 V/1.9 Ah	2 x lithium AA 3.6 V/1.9 Ah	2 x lithium AA 3.6 V/1.9 Ah	2 x lithium AA 3.6 V/1.9 Ah
Slots required	1	2	2	3
Dimensions (W x H x D) in mm	25 x 290 x 217	50 x 290 x 217	50 x 290 x 217	75 x 290 x 217
Weight, approx.	800 g	1360 g	1360 g	2200 g
Cable cross-section of the supply cables	3 x 1.5 mm^2; solid or stranded conductor; outer diameter 3 to 9 mm	3 x 1.5 mm^2; solid or stranded conductor; outer diameter 3 to 9 mm	3 x 1.,5 mm^2; solid or stranded conductor; outer diameter 3 to 9 mm	3 x 1.5 mm^2; solid or stranded conductor; outer diameter 3 to 9 mm

Communication - CP 443-1



Overview

- Connection of SIMATIC S7-400 to Industrial Ethernet
  - 10/100 Mbit/s full/half duplex connection with autosensing for automatic switching
  - Universal connection options for ITP, RJ45 and AUI
  - Multiprotocol mode with ISO and TCP/IP transport protocol
  - Keep Alive function
- Communication services:
  - ISO and TCP/IP transport protocols
  - PG/OP communication
  - S7 communication
  - S5-compatible communication
- Multicast at UDP
- PG/OP communication between networks through S7 routing.
- Remote programming and commissioning through the network

Benefits

Designed for Industry

- Direct integration of S7-400 even in complex systems through Industrial Ethernet with 100 Mbit/s
- Investment protection for existing installations through integration of SIMATIC S7-400 using S5-compatible communication. Flexible in its application due to automatic media switching (AUI/ITP) and free choice of slots
- Remote programming through WAN property of TCP/IP, also using phone connections (e.g. ISDN).
- Commissioning directly through Industrial Ethernet, i.e. no on-site PG required
- Accessibility of many users through implementation of free UDP connections or multicast function
- Use of socket interface in partner system possible without RFC 1006.

Area of application

The CP 443-1 is the communications processor for the SIMATIC S7-400 for Industrial Ethernet. With its own processor, it relieves the CPU of communications tasks and facilitates additional connections.

Communication options for S7-400 through CP 443-1 with:

- Programming devices, processors, HMI devices
- Other SIMATIC S7 systems.
- SIMATIC S5 programmable controllers

Design

The CP 443-1 offers all the advantages of the SIMATIC S7-400 system design:

- Compact design;
  the rugged plastic housing contains, at its front:
  - 15-pin Sub-D socket with automatic switching between AUI and twisted pair interface;
  - RJ45 socket for connection to Industrial Ethernet FastConnect;
- Automatic transmission rate detection through autosensing.
- Simple connection:
  The CP 443-1 is mounted on the S7-400 subrack and connected to the other S7-400 modules through the backplane bus. There are no slot rules.
- The module can be exchanged without a PG.

Functions

The CP 443-1 independently handles data traffic over Industrial Ethernet. The module has its own processor. Layers 1 to 4 comply with international standards. Multi-protocol operation of transport protocols ISO and TCP/IP is possible.

For connection control (keep alive) it is possible to configure an adjustable time for all TCP transport connections for active and passive partners.
The CP 443-1 has a preset unique Ethernet address and can be put directly into operation through the network.

CP 443-1 works in multiprotocol operation for the following communication services:

PG/OP communication

PG/OP communication allows all the S7 stations connected to the network to be remotely programmed.

- S7 routing
  With S7 routing, PG/OP communication can be used across the whole network.

S7 communication

- For connection to
  S7-300 (server and client),
  S7-400 (server and client), HMI devices and
  PCs (CP 1613 with S7-1613 or SOFTNET-S7).

Communication takes place through the CP 443-1 without further configuration.

- H communication
  For redundant S7 communication, the CP 443-1 can also be used in the SIMATIC H system.
- Real-time synchronization
  The CP443-1 can transmit the time from the S7-400 CPU to the network. Conversely, the CP 443-1 can provide the S7-400 CPU with an existing time from the network.

This is also made available through the international NTP protocol (Network Time Protocol).

S5-compatible communication

Based on layer 4, this is a simple, optimized interface for data communication.

Up to 8 KB of data can be transmitted in one call.

The following can be used with this interface:

- ISO Transport connections
- TCP transport connections
  - TCP with RFC 1006
  - TCP without RFC 1006
- UDP
  - Multicast for UDP

S5-compatible communication is used for communication with SIMATIC S5, and computers/PCs. The required function calls form part of NCM S7 for Industrial Ethernet and should be integrated into the S7 user program.

S5-compatible communication with FETCH/WRITE allows direct access to the CPU data in the same way as in the CP 1430 is possible. This means existing HMI systems can still be used.
Implementing UDP as the transmission protocol for S5-compatible communication allows utilization of the multicast function to simultaneously send and receive data on configurable multicast circuits.

Diagnostics

Extensive diagnostics is provided, among other things, through NCM S7.others)

- Status mode of the CP
- General diagnostics and statistics functions
- Connection diagnostics
- LAN controller statistics
- Diagnostics buffer

Configuration

STEP 7 and NCM S7 for Industrial Ethernet are required for configuring the CP 443-1. NCM S7 is totally integrated into the STEP 7 environment.

The CP is available only after installation of NCM S7 for Industrial Ethernet in the STEP 7 hardware catalog.

NCM S7 for Industrial Ethernet is a component of STEP 7 (Version V5.0 and higher).

From Version V5 of STEP 7/ NCM S7 or higher the CP's configuration data can also be stored on the CPU. This enables modules to be exchanged without a programming device. Here, the memory size of the S7 CPU must be observed.

Configuration and programming of all SIMATIC S7 controllers which are connected to the network can be performed through the network.

All the function blocks (FBs) required for S5-compatible communication are included in the scope of supply of NCM S7 for Industrial Ethernet.

Technical Specifications

Technical specifications	
Data transfer rate	10/100 Mbit/s
Interfaces	
• Connection to Industrial Ethernet (10/100 Mbit/s)	15-pin Sub-D socket (automatic switching between AUI and ITP)
• Connection to 10BaseT, 100BaseTX	RJ45
Current consumption	
• From +5 V DC	approx. 1.4 A
• From 24 V DC	typ. 220 mA, max. 340 mA (depending on the interface used)
Power loss	8.6 W
Perm. ambient conditions	
• Operating temperature	0 °C to +60 °C
• Transport/storage temperature	-40 °C to +70 °C
• Relative humidity	max. 95% at +25 °C
Design	
• Module format	S7-400 compact module, single-width
• Dimensions (W x H x D) in mm	25 x 290 x 210
• Weight	approx. 700 g
Configuration software	NCM S7 for Industrial Ethernet (included in delivery of of STEP 7 V5.x)
Performance data	
S5-compatible communication (SEND/RECEIVE, FETCH/WRITE)	
• Sum of all simultaneously operable ISO/TCP/UDP connections	max. 64
• Number of useful data (ISO or TCP/IP)	max. 8 KB
S7 communication	
• Number of connections[1)]	max. 62
Multi-protocol operation	
• Sum of all simultaneously operable connections	max. 64

1) Depends on performance of used S7-CPU/FM

Network components - CP 1613

Overview

- PCI card with microprocessor for connecting PG/PC to Industrial Ethernet with 10/100 Mbit/s autosensing
- Communication services through
  - ISO or TCP/IP transport protocols
  - PG/OP communication
  - S7 communication
  - S5-compatible communication (SEND/RECEIVE)
  - TF protocol
- Delivery of the communication software includes the OPC servers.
- 15-pin AUI/ITP

- RJ45 connection
- ISO and TCP/IP transport protocol onboard
- Large quantity framework

Benefits

Designed for Industry

- Continuous data throughput through protocol processing on the CP.
- Can be connected to any Ethernet network through AUI/ITP or RJ45 ports on the module.
- Free computer capacity for further applications in the PC, e.g. HMI (ISO and TCP/IP transport onboard).
- Simple handling through plug & play and autosensing (10/100 Mbit/s).
- Operation of large network configurations with one card due to large number of connections.
- Can be used for redundant communication.
- OPC as standard interface.
- Uniform procedure and configuration functionality with NCM PC and STEP 7.

Area of application

The CP 1613® enables connection to Industrial Ethernet (10/100 Mbit/s) for SIMATIC PG/Industrial PC and PCs with PCI slot.

Design

The CP 1613 module (card with microprocessor) is plugged directly into a SIMATIC PG/PC or a PC and requires a short PCI slot.

Connections:

- 15-pin Sub-D connector for use in industrial applications
- RJ45 for connection in the office environment
- Automatic recognition and selection of the interface during power up (AUI, ITP or RJ45)

In the case of electrical networks

- the module is connected to the 727-0 bus through a 727-1 connecting cable/transceiver.
- for ITP through the ITP standard cable 9/15 to OSM/ESM/star coupler
- for optical networks through the Mini OTDE optical transceiver.

Mode of operation

The module independently processes the protocols up to and including level 4 (transport).

To permit a large quantity framework and high communication integrity, 16 MB of memory are provided.

The data exchange between module and host takes place in master mode. This means that the CP 1613 accesses the physical RAM of the host.

The data transfer between the host system and the CP 1613 is handled by a Windows driver.

The transfer rate is detected and automatically switched over (autosensing).

IT functionality results in combination with the Windows software of the PC.

Functions

User interfaces

- OPC interface
  The OPC server contained in the respective software package can be used as a standard programming interface for the protocols S7 communication and S5-compatible communication to connect automation applications to OPC-capable Windows applications (Office, HMI systems etc.).
- Programming interface through C library
  The programming interfaces for the protocols S7 communication, PG/OP communication, S5-compatible communication and TF protocol for existing applications are implemented as a Dynamic Link Library (DLL).

The following compilers can therefore be used in conjunction with the SIMATIC NET products:

- Microsoft Visual C/C++ V6.0
- Microsoft Visual Basic V6.0
- Other compilers can be implemented through the OPC server, however, the compiler must support the COM interface (Microsoft Component Object Model)

Software for PG/OP communication

This software permits programming of SIMATIC S5 and S7 PLCs through Industrial Ethernet in combination with STEP 5/STEP 7 automation systems.

It is contained in all CP 1613 software packages.

Software for S7 communication (S7-1613 or S7-REDCONNECT)

The S7 programming interface enables PG/PC applications (e.g. WinCC) and application programs access to SIMATIC S7/ system components.

Thus, easy and flexible access to the data of the SIMATIC S7/M7 is possible.

S7 communication provides:
Administrative services

- Link management
- Mini database
- Trace

Data transfer services

- Reading/writing of variables
- BSEND/BRECEIVE

With S7-REDCONNECT, communication with the high-availability S7-400H system is possible.

Software for S5-compatible communication (SEND/RECEIVE)

This layer 4 based interface is used for communication between

- PG/PC and SIMATIC S5
- PG/PC and SIMATIC S7
- PG/PC and PG/PC

S5-compatible communication (SEND/RECEIVE) provides the following services:

- Management services
- Connection establishment services
- Data transfer services

The software is contained in the products S7-1613 and TF-1613.

Software for TF protocol
(TF-1613)

The technological functions interface offers access to the MAP 3.0 open and well-proven automation protocol on Ethernet. The Technological Functions correspond in functionality to the international MMS services in accordance with ISO IS 9506.

MMS/TF services:

- Variable services
- Domain services
- Program invocation services
- General services for virtual devices
  (VMD support service)
- Services of TF link management
  (environment and general management services).

TF-1613 does not support Advanced PC Configuration

Configuration

- Configuration of S7 communication protocols and S5-compatible communication is executed in STEP 7/NCM PC, V5.1 SP2 or higher.
- The TF configuration is executed using COML TF.
- The configuring tools NCM PC and COML TF are included in delivery with the CP 1613 software packages.
- NCM PC is a component of Advanced PC Configuration.

For further information on Advanced PC Configuration and the previous versions of PC/Windows software products please visit us on the Internet.

Technical Specifications

Technical specifications	
Data transfer rate	10/100 Mbit/s
Interfaces Connection to Industrial Ethernet	
• AUI (10 Mbit/s) Half Duplex	15-pin Sub-D socket
• ITP (10/100 Mbit/s)	RJ45

Half Duplex Full Duplex	
• Connection to PG/PC	PCI (32 Bit)
Supply voltage	DC 5 V ±5% DC 12 V ±5%
Current consumption	
• From 5 V DC	600 mA
• From 12 V DC	500 mA
Power loss	4 W
Perm. ambient conditions	
• Operating temperature	+5 °C to +40 °C
• Transport/storage temperature	–20 °C to +60 °C
• Relative humidity	max. 95% at +25 °C
Design	
• Module format	PCI card
• Dimensions (W x D) in mm	107 x 167
• Weight	approx. 200 g
• Space required	1 x PCI slot
Performance data Single protocol mode	
S7 and PG/OP communication	
• No. of usable connections	
• - ISO	max. 120
• - TCP/IP	max. 120
S5-compatible communication (SEND/RECEIVE):	
• No. of usable connections	
• - ISO	max. 120
• - TCP/IP	max. 120
Sum of all configurable connections per PC station	max. 207

ET 200M - IM 153

Overview

- For connecting ET 200M as slave to PROFIBUS DP (via copper conductors)
- IM 153-2 can also be used in redundant PROFIBUS DP systems with the S7-400H, software redundancy and the S5-155H
- With time stamp functionality and time-of-day synchronization

Area of application

The interface module IM 153-1 / IM 153-2 / IM 153-2 HF is needed for connecting an ET 200M modular I/O station to the PROFIBUS DP field bus via copper conductors.

These headers can therefore be used in the widest possible range of applications.

Fault tolerant systems

In the main, fault tolerant systems are used where no plant stoppage is allowed, such as in energy generation, energy distribution, power stations or chemical engineering. In conjunction with the fault tolerant

S7-400H (redundant CPUs) the ET 200M can be connected in one-way mode (normal availability) or switched mode (increased availability).

Additionally the IM 153-2 can be used not only in applications with software redundancy but also with the S5-155H.

Fail-safe systems

When an error occurs, fail-safe PLCs go into a safe state and protect the safety of people, machines and the environment, for instance in the case of presses, automated systems or personal transport. Various ET 200M signal modules are available for the purpose of connecting fail-safe signals to the S7-300F or S7-400F/FH, and provide SIL 2 or SIL 3 depending on the type of connection.

Range exposed to explosion hazard

There are various digital and analog modules for use as intrinsically safe versions for the explosion hazard range, such as in chemical engineering and pharmaceuticals or on drilling platforms. They support the processing of signals carried on electrically isolated channels from Ex-zone 1. There are also analog modules with HART capability.

Highly dynamic production processes

Distributed solutions for controlling high speed machines in production and machining processes with high precision are becoming increasingly important, for instance for automatic speed control. In such cases the time between the capture of a signal by the decentralized I/O equipment and the corresponding reaction at the actuator must be as short as possible and precisely reproducible. Synchronous connection of a SIMATIC automation solution to the isochronous PROFIBUS in this way is known as "clock synchronization" and is supported by various ET 200M signal modules.

Design

- The IM 153-1/153-2 interface module is used as a header module of the ET 200M. Up to 8 I/O modules from the S7-300 programmable controller's module range can be connected to the interface.
- The interface module and the required I/O modules are mounted on a DIN rail for S7-300. For this purpose, bus connectors are used to connect the I/O modules to each other and to the IM 153 interface module.
- For redundant mode two IM 153-2s are mounted on the BM IM/IM bus module.
- Various types of I/O modules can be plugged in depending on the quantity framework of the master module.
- Can be operated without fans.
- Max. 8 S7-300 standard I/O modules can be driven per IM 153-2 FO No slot rules apply.

Functions

Features of the IM 153	IM 153-1AA03 (Basic) 6ES7 153-1AA03-0XB0	IM 153-2 (Standard) 6ES7 153-2AA02-0XB0	IM 153-2 (High Feature) 6ES7 153-2BA00-0XB0
RS 485 interface	Yes (copper)	Yes (copper)	Yes (copper)
Fiber-optic interface	No	No	No
Implementing the DP V1 standard	Yes	Yes	Yes
Module replacement during operation	Yes	Yes	Yes

FREEZE capability	Yes	Yes	Yes
SYNC capability	Yes	Yes	Yes
Pass on parameter assignment data from PG/PC (with S7 functionality; on S7 masters only)	No	Yes	Yes
Use of function modules (FM) and communication processors (CP)	Restricted	Yes	Yes
Time synchronization on PROFIBUS, time stamping of input signals 1)	No	Yes	Yes
Redundancy (software redundancy, S7-400H, S5-155H)	No	Yes	Yes
Change of configuration in the RUN 2)			
• In a redundant system	No	Yes	Yes
• In a non-redundant system	No	No	Yes
Identification data 3)	No	No	Yes
Support for isochrone mode 4)	No	No	Yes
Firmware update via bus / micro memory card	No	No	Yes
Direct data exchange	Yes	Yes	Yes
Extended diagnostics	Yes	Yes	Yes
Extended ambient conditions (outdoor)	Yes, with 6ES7 153-1AA83-0XB0	No	No
Certification for Ex-zone 2	Yes	Yes	Yes

1) Changes to digital inputs are in fact provided with a time stamp locally (in the IM 153 on the ET 200M) and transmitted to the CPU by means of a process interrupt.

2) Change of configuration in the RUN means that changes to the hardware configuration, such as reparameterizing or adding modules, can be carried out during operation with no adverse reaction.

3) Identification data refers to information such as an order number, version, installation date, plant identifier etc. stored in a module so as to identify that module uniquely and to be available online, typically to be used for purposes such as fault correction.

4) Isochrone mode means the synchronous connection of a distributed I/O and user program to the equidistant PROFIBUS. Thus the actual value acquisition and set point output take place synchronously and at uniform intervals with simultaneously consistent data images.

Operating mode

The IM 153 interface module completely takes over communication between the modular ET 200M I/O station and the higher level master connected to the PROFIBUS DP.

The inputs and outputs are assigned to the respective master during configuring.

The IM 153-2 interface module enables assembly of redundant PROFIBUS DP systems. If the active branch fails, the passive IM 153-2 assumes bumpless control of the relevant functions.

Signals can be monitored for change with a time stamp. Modules approved for time stamping must be used for this purpose (e.g. SM 321-7BH, etc.).

Parameter assignment

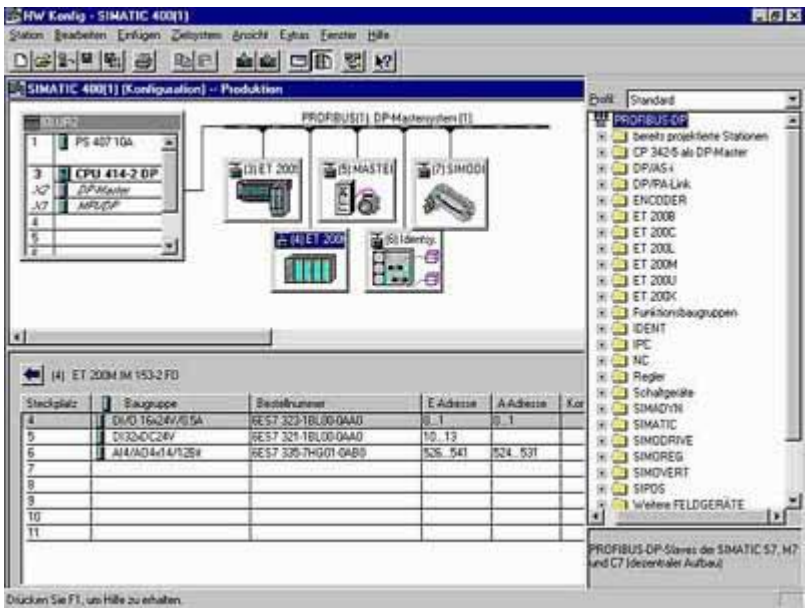
- STEP 7;
  configuration is carried out using HW configuration, by selecting the appropriate headend from the corresponding HW catalog. Configuration using modules is then likewise carried out from the appropriate HW catalog.
- COM PROFIBUS;
  from Version 5.0 onwards, configuration is carried out by entering the MLFB number.

- Third-party tools;
  interfacing to external masters and configuration using external tools are carried out using the GSD (device master data) file.

Technical Specifications

IM 153-1/153-2 interface module	
Transmission protocol	PROFIBUS DP to EN 50 170
Data transfer rate, max.	12 Mbit/s automatically recognizes the bus system transfer rate
Internode communication support	Yes, transmitter
Address space, max.	128 bytes for inputs 128 bytes for outputs
Number of modules, max.	8
Interfaces	
• Insulation voltage	500 V
• Connection to PROFIBUS	9-pin Sub-D connector
Output current, max.	90 mA (for PROFIBUS DP interface)
Supply voltage	
• Rated value	24 V DC
• Permissible range (including ripple)	20.4 to 28.8 V
Backup during power failure	5 ms
Current consumption 24 V DC	625 mA
Output voltage	5 V DC
Output current (at 5 V DC), max.	1 A (for backplane bus)
Degree of protection	IP20
Ambient temperature	0 to 60 °C, outdoor: -25 to 60 °C
Dimensions (W x H x D) in mm	40 x 125 x 120
Weight, approx.	0.35 kg

Distributed I/Os - STEP 7



Area of application

Prior to start-up, the PROFIBUS DP field bus and the individual nodes must be parameterized.

During configuration and parameterization the user is supported by user-friendly tools. For SIMATIC masters, all functions are integrated in the STEP 7 programming language. These tools enable the PROFIBUS DP fieldbus to be easily

- configured
- parameterized,
- documented,
- started up,
- tested and
- diagnosed.

For further information, please refer to "Industrial automation systems; SIMATIC Industrial Software; Software for SIMATIC S7/M7/C7; Standard Tools".

Functions

The STEP 7 programming software allows user-prompted parameterization of the distributed I/O as well as field devices on PROFIBUS DP. This includes primarily:

- Configuration of the field bus system
- Creation of an address list for the master module
- Adjustment of data transfer rate on the field bus
- Adjustment of the failure mode.

The STEP 7 programming software allows identical programming and configuring of centralized and distributed I/O modules.

The reference configuration of the PROFIBUS DP field bus is stored on the PROFIBUS DP master module.

Diagnostics

The diagnostics function can be used during start-up and normal operation to localize and rectify errors easily.

For this purpose, the programming device or PC is connected to PROFIBUS DP or direct to the relevant I/O device or field device.

GSD data

STEP 7 can also be used to parameterize field devices of other manufacturers. In order to facilitate easy and convenient programming, the product usually comes with GSD files which can be embedded in the parameterization tools.

For connection of distributed ET 200 I/O modules to masters of other manufacturers, the GSD files are also centrally available in the interface center These can be requested:

- via modem on Tel.: ++49 911/737972 or ++49 911/730983
- at the Internet address http://www.ad.siemens.de/csi/gsd

When ET 200 stations are connected to master modules which are not parameterized with COM PROFIBUS or STEP 7 (operation on third-party master modules), a fixed preassigned GSD file can be created with COM PROFIBUS. This file is then loaded into the configuration tool of the third-party manufacturer and can be used for simple parameter assignment of the station. This allows the use of the user-friendly plain-text parameterization feature of COM PROFIBUS; there is no need for hexadecimal code inputs in the third-party configuring tool.

SCADA System SIMATIC WinCC - SIMATIC WinCC

Overview

- PC-based operator control and monitoring system for visualizing and operating processes, production flows, machines and systems in all sectors - with the simple single-user station through to distributed multi-user systems with redundant servers and multi-site solutions with Web clients. WinCC is the information hub for corporation-wide vertical integration.
- The basic system configuration (WinCC basic software) includes functions meeting industrial requirements for signaling and acknowledging events, archiving of messages and measured values, logging of all process and configuration data, user administration and visualization.
- The WinCC basic software forms the core of a wide range of different applications. Building on the open programming interfaces, a wide range of WinCC options (from Siemens A&D) and WinCC add-ons have been developed (by Siemens-internal and external partners).
- Current versions:
  - SIMATIC WinCC V6.0:
    Executes under Windows 2000 / XP
  - SIMATIC WinCC V5.1:
    Executes under Windows NT 4.0 / 2000

New features of V6.0:

- Historian concept in the basic system with significantly enhanced archiving performance, integrated long-term archiving and optional evaluation functions; based on the Microsoft SQL Server 2000
- Customized expansion capability of the WinCC Graphics Designer by means of Visual Basic for Application (VBA)
- Easy, open and rugged Runtime Scripting with Visual Basic Scripting (VBScript)
- Expanded, system-wide scalability by increasing the number of servers (12) and clients (32) with enhanced functionality
- Extended Web functionality with WinCC clients as Web servers with access to all lower-level WinCC servers
- Further functional adaptation to the WebNavigator client on a WinCC client

- Enhancement of the reporting and logging system thanks to higher flexibility, greater openness and simple operation
- Executable under Windows XP (single-user station and client)
- New options:
  - WinCC/Dat@Monitor (display and analysis of current process states and historical data on office PCs)
  - WinCC/ConnectivityPack (OPC Alarms&Events / Historical Data Access, database access via WinCC OLE-DB)
  - WinCC/IndustrialDataBridge (connection of external databases)
  - FDA options: WinCC/Audit, SIMATIC Logon and SIMATIC Electronic Signature
  - WinCC/Client Access License (required for systems on which there is no WinCC license/installation. Licensing the access to WinCC data via the optional WinCC interfaces WinCC/ConnectivityPack and WinCC/Industrial DataBridge)

Benefits

- Integral component of Totally Integrated Automation (TIA):
  increases productivity, minimizes the engineering outlay, reduces the lifecycle costs
- All HMI functions are onboard (user administration, operating possibilities, graphical system, messaging system, archiving, reporting and logging system, diagnostics)
- Integration platform in the corporation thanks to the Historian functionality integrated into WinCC based on the Microsoft SQL Server and tools and clients for evaluation
- System-wide, scalable client/server structures with operator stations on the Web, distributed servers and data integrity due to redundancy
- Easily integrated thanks to standardized interfaces such as OPC (OLE for Process Control), OLE-DB, VBA, VBScript, C-API (ODK)
- For universal use thanks to solutions for all sectors (e.g. conforming to FDA 21 CFR Part 11) and multiple languages for worldwide use
- Modular expansion with options and add-ons as well as individual function expansions with VB Script, Visual Basic for Applications, C-API (ODK) and integration of ActiveX elements

Area of application

SIMATIC WinCC is designed for visualizing and operating processes, production flows, machines and plants. With its powerful process interfaces (to the SIMATIC range in particular) and secure data archiving, WinCC provides fault-tolerant solutions for instrumentation and control.

The non-sector-specific basic system can be implemented universally in all automation applications. Sector-specific solutions can be implemented, for example, using WinCC options (e.g. FDA options for the pharmaceuticals industry) and sector-specific add-ons (e.g. for water processing).

Design

SIMATIC WinCC is available as a complete package and as a runtime package with 128, 256, 1024 and 64K PowerTags (for WinCC V6 additionally: 8K PowerTags). The term PowerTags is applied only to process variables that have a process connection to the PLC. Up to 32 signals can be derived from one process variable. Furthermore, internal variables without a connection to the process are available as additional system performance.

Licenses for a multi-user configuration

The system software must be installed on the server with the required number of variables as well as the WinCC/Server option. In the basic configuration, an RT128 license is adequate for the clients. An RC128 license is, however, required for configuration on the clients.

Functions

The powerful configuration functions of SIMATIC WinCC contribute to reducing the engineering and training costs and result in greater personnel flexibility and operating reliability. If you are familiar with Microsoft Windows, you will have no problems with WinCC Explorer, the central control point of WinCC.

In conjunction with other SIMATIC components, the system also offers additional functions, such as process diagnostics and maintenance. All SIMATIC engineering tools interact when configuring the functions.

SIMATIC WinCC offers a complete base functionality for process visualization and operation. For this purpose, WinCC offers a range of editors and interfaces whose functionality allow individual configuration for the relevant application.

WinCC editors	Task/configurable runtime functionality
WinCC Explorer	Central project management for fast access to all project data and central settings
WinCC Graphics Designer	Graphics system for user-definable visualization and operation through pixel-graphic objects
WinCC Alarm Logging	Messaging system for acquiring and archiving events with operator control and display possibilities based on DIN 19235; freely selectable alarm classes, alarm display and logging
WinCC Tag Logging	Process archiving for measured value acquisition, compression and storage, e.g. for trend and tabular representation and further processing
WinCC Report Designer	Report and logging system for time- and event-controlled documentation of messages, operations and current process data in the form of user reports or project documentation in user-definable layout
WinCC User Administrator	Tool for convenient administration of users and access rights
WinCC Global Script	Processing functions with unlimited functionality through usage of VBScript and ANSI-C

Interfaces

	Task/configurable runtime functionality
Communications channels	For the communication to lower-level controls (SIMATIC logs, PROFIBUS DP, PROFIBUS FMS, DDE and OPC server included in delivery)
Standard interfaces	For the open integration of other Windows applications through WinCC, OLE-DB, ActiveX, OLE, DDE, OPC etc.)
Programming interfaces	For individual access to data and functions of WinCC and for the integration into user programs with VBA, VB Script, C-API (ODK)

Compatibility

WinCC version	Windows NT4.0 SP6a	Windows 2000 Professional SP2; Ser-	Windows 2000 Professional SP3; Ser-	Windows XP Professional	Windows XP Professional SP1	Internet Explorer

		ver SP2; Advanced Server SP2	ver SP3; Advanced Server SP3			
V5.1	•	•	•	-	-	IE V5.5; IE V6.0
V6.0	-	•	•	•	•	IE V6.0; IE V6.0 SP1

Integration

Integration in corporation-wide solutions (IT and business integration)

WinCC builds consistently on Microsoft technologies which ensures the widest possible openness and integration capability. ActiveX controls permit technology-specific and sector-specific expansions. Cross-vendor communication is also easy. The reason is: WinCC is OPC-compliant, and can therefore be implemented as an OPC client and server and supports, in addition to access to current process values, standards like OPC HDA (Historical Data Access) and OPC Alarm & Events. Also important: Visual Basic for Applications (VBA) for customized expansions of the WinCC Graphics Designer and Visual Basic Scripting (VBS) in the form of an easy-to-learn, open runtime language. If preferred, professional application development engineers can also use ANSI-C. And access to the API programming interfaces is easy using the Open Development Kit ODK.

WinCC V6 has integrated, for the first time, a powerful, flexible Historian based on the Microsoft SQL Server 2000 into the basic system. The user therefore has all the options open: from high-performance archiving of current process data and long-term archiving with high-level data compression through to a central information hub in the shape of a corporation-wide Historian server. Flexibly implementable clients and tools for evaluation, open interfaces and special options (Connectivity Pack , Industrial DataBridge, Client Access Licences) form the basis of an effective IT and business integration.

Integration in automation solutions (valid from WinCC V6.0 upwards)

WinCC is an open process visualization system and offers the opportunity for connecting a wide range of different PLCs.

Approved communication software

Only the specified (or higher) versions of communications software may be used. The applicable SIMATIC NET updates are available to upgrade older versions and releases and are supplied with the WinCC base package or upgrade.

Number of PLCs that can be connected

The following numbers of PLCs can be connected through Industrial Ethernet CP 1613 with a maximum frame length of 512 bytes:

Type of interface	Number of stations
SIMATIC S5 Ethernet Layer 4 + TCP/IP	Up to 60
SIMATIC S5 Ethernet TF	Up to 60
SIMATIC S7 Protocol Suite	Up to 64
SIMATIC 505 Ethernet Layer 4 + TCP/IP	Up to 60

Via PROFIBUS, the CP 5611 can be used to connect up to 8 PLCs and the CP 5613 can be used to connect up to 44 PLCs. Industrial Ethernet is recommended with 10 PLCs or more.

Mixed operation with different PLCs

With their multiprotocol stack, the CP 1613® and CP 5613® communications processors support the simultaneous use of two protocols with a single bus cable, for example, where several different PLC types are used. Two interface boards of the same type can be used with WinCC only in conjunction with SIMATIC S5 Ethernet Layer 4 (2 x CP 1613), SIMATIC S7 Protocol Suite (2 x CP 1613, 2 x CP 5613) or PROFIBUS DP (4 x CP 5613; up to 12 slaves

per CP 5613). In addition to a CP 1613 for Industrial Ethernet® CP 1613 or PROFIBUS CP 5613, a CP 5511 or CP 5611 can each be used for communicating with SIMATIC S7 via MPI.

Client/server communication

The TCP/IP protocol is used to handle communications between clients and server. It is recommended that a separate PC LAN is constructed. For small projects with a relatively low message volume, a SIMATIC NET Industrial Ethernet can be implemented, for both the process communication (WinCC server ↔ PLC) and the PC–PC communication (WinCC client ↔ WinCC server).

Communication redundancy

WinCC does not itself support redundant bus interfaces. The S7-REDCONNECT software package is required for redundant connection of PCs to Industrial Ethernet with SIMATIC S7-400H. This connects the SIMATIC S7-400H with applications on the PC, e.g. SIMATIC WinCC. Communications redundancy can normally not be achieved by setting up optical rings (see Catalog IKPI).

Channel DLL PROFIBUS DP

According to the PROFIBUS standard, DP slaves are always permanently assigned to a DP master; i.e. a second WinCC station (DP master) cannot access the same PLCs (DP slave). This means that redundant operation of two WinCC stations is not possible when using the PROFIBUS DP interface.

Interfacing to non-Siemens PLCs:

OPC (OLE for Process Control) is recommended for interfacing to non-Siemens PLCs.

For the latest information about OPC servers from a wide range of different manufacturers, see:
www.opcfoundation.org/05_man.asp

WinCC supports the standards:

- Data Access 1.1
- Data Access 2.0

Additional information is available in the Internet under:

http://www.siemens.com/wincc-connectivity

Interface overview (from WinCC V6.0 upwards)

Protocol	Description
SIMATIC S7	
SIMATIC S7 Protocol Suite	Channel DLL for S7 functions via MPI, PROFIBUS or Ethernet Layer 4 + TCP/IP
SIMATIC S5	
SIMATIC S5 Ethernet Layer 4	Channel DLL for S5 Layer 4 communication + TCP/IP
SIMATIC S5 Ethernet TF	Channel DLL for S5 TF communication
SIMATIC S5 Programmer Port AS511	Channel DLL and driver for serial communication with S5 via AS511 protocol to programmer port
SIMATIC S5 Serial 3964R	Channel DLL and driver for serial communication with S5 via RK512 protocol
SIMATIC S5 PROFIBUS-FDL	Channel DLL for S5-FDL
SIMATIC 505	
SIMATIC 505 Serial	Channel DLL and driver for serial communication with 505 via NITP/TBP protocol to SIMATIC 535/545/555/565/575
SIMATIC 505 Ethernet Layer 4	Channel DLL for 505 Layer 4 communication
SIMATIC 505 TCP/IP	Channel DLL for 505 TCP/IP communication

Cross-vendor	
Windows DDE	Channel DLL for DDE communication, WinCC can acquire data from DDE server applications
OPC	Channel DLL for OPC communication, WinCC can acquire data from OPC server applications
OPC server	Server applications for OPC communication; WinCC provides process data for OPC clients
PROFIBUS FMS	Channel DLL for PROFIBUS FMS
PROFIBUS DP	Channel DLL for PROFIBUS DP

Communication components for PG/PC for SIMATIC (from WinCC V6.0 upwards)

Industrial Ethernet	SIMATIC S5 Ethernet (TF)	SIMATIC S5 Ethernet Layer 4	SIMATIC S5 TCP/IP	SIMATIC S7 Protocol Suite	SIMATIC 505 Ethernet Layer 4	SIMATIC 505 TCP/IP 1)	Order No.
WinCC – Channel DLL							
SIMATIC S5 Ethernet TF Channel DLL for S5 TF communication	•						Included in the basic package
SIMATIC S5 Ethernet Layer 4 Channel DLL for S5 Layer 4 communication + TCP/IP		•	•				Included in the basic package
SIMATIC S7 Protocol Suite Channel DLL for S7 functions				•			Included in the basic package
SIMATIC 505 Ethernet Layer 4 Channel DLL for 505 Layer 4 communication					•		Included in the basic package
SIMATIC 505 TCP/IP 1) Channel DLL for 505 TCP/IP communication						•	Included in the basic package
Communication components for expanding the OS/OP							
CP 1612 PCI card for connecting the PG/PC to Industrial Ethernet (SOFTNET-S7 must be ordered separately)				•		•	**6GK1 161-2AA00**
CP 1512 PCMCIA card (Cardbus 32-bit) for connecting the PG/PC to Industrial Ethernet (SOFTNET-S7 must be ordered separately)				•		•	**6GK1 151-2AA00**
SOFTNET-S7 Communication software for S7 functions				•			**6GK1 704-1CW61-3AA0**
• For Windows NT4.0/2000/XP							
CP 1613 PCI card for connecting the PG/PC to Industrial Ethernet (communications software must be ordered separately)	•	•	•	•	•	•	**6GK1 161-3AA00**
S7-1613 Communications software for S7 functions and S5/505 Layer 4 communication with TCP/IP		•	•	•	•		**6GK1 716-1CB61-3AA0**
• For Windows NT4.0/2000/XP							
TF-1613 Communications software for TF functions and S5/505 Layer 4 communication with TCP/IP	•	•	•		•		**6GK1 716-1TB60-3AA0**
• For Windows NT4.0/2000							

• System coupling is possible

1) Via any interface board with NDIS 3.0 interface; separate communications software is not necessary

Additional information is available in the Internet under:

http://www4.ad.siemens.de:8080/view/cs/de/14627901

Communication components for PG/PC for SIMATIC (from WinCC V6.0 upwards)

PROFIBUS	SIMATIC S5 PROFIBUS FDL	SIMATIC S7 Protocol Suite	PROFIBUS DP	PROFIBUS FMS	Order No.
WinCC – Channel DLL					
SIMATIC S5 PROFIBUS FDL Channel DLL for S5-FDL	•				Included in basic package
SIMATIC S7 Protocol Suite Channel DLL for S7 functions		•			Included in basic package
PROFIBUS DP Channel DLL for PROFIBUS DP			•		Included in basic package
PROFIBUS FMS Channel DLL for PROFIBUS FMS				•	Included in basic package
Communication components for expanding the OS/OP					
CP 5611 PC card for connecting a PG/PC to PROFIBUS or MPI (communications software included in the WinCC basic package)		•			**6GK1 561-1AA00**
CP 5511 PCMCIA card (16-bit) for connecting a PG/PC to PROFIBUS or MPI (communications software included in the WinCC basic package)		•			**6GK1 551-1AA00**
CP 5512 PCMCIA card (Cardbus 32-bit) for connecting a PG/PC to PROFIBUS or MPI (communications software included in the WinCC basic package)		•			**6GK1 551-2AA00**
PC/MPI adapter RS 232, 9-pin, male with RS 232/MPI converter up to 19.2 Kbit/s		•			**6ES7 972-0CA23-0XA0**
CP 5613 PCI card for connecting the PC to PROFIBUS (communications software must be ordered separately)	•	•	•	•	**6GK1 561-3AA00**
S7-5613 Communications software for S7 functions + FDL	•	•			**6GK1 713-5CB61-3AA0**
• For Windows NT4.0/2000/XP					
DP-5613 Communications software for DP master + FDL	•		•		**6GK1 713-5DB61-3AA0**
• For Windows NT4.0/2000/XP					

FMS-5613 Communications software for PROFIBUS-FMS + FDL	•			•	**6GK1 713-5FB61-3AA0**
• For Windows NT4.0/2000/XP					

• System coupling is possible

Additional information is available in the Internet under:

http://www4.ad.siemens.de:8080/view/cs/de/14628484

Technical Specifications

Type	SIMATIC WinCC V5.1	SIMATIC WinCC V6.0
Operating system	Windows NT4.0/ Windows 2000	Windows XP Professional/ Windows 2000
	WebClient, additionally: Windows 98, Windows ME, Windows 2000 terminal services	WebClient/Dat@Monitor Client, additionally: Windows NT4.0/ Windows XP Home, Windows 2000 terminal services
Hardware requirements for PC		
Processor type		
• Minimum	Pentium II, 400 MHz	Single-user system/server: Pentium III, 800 MHz
		Central archive server: Pentium IV, 2 GHz
		Client: Pentium III, 300 MHz
		WebClient/Dat@Monitor client: Pentium III, 300 MHz
• Recommended	Pentium III, 400 MHz	Single-user system/server: Pentium IV, 1400 MHz
		Central archive server: Pentium IV, 2,5 GHz
		Client: Pentium III, 800 MHz
		WebClient/Dat@Monitor client: Pentium III, 800 MHz
RAM (main memory)		
• Minimum	>= 128/256 MB (single-user station/server), >= 128 MB (client) 4)	Single-user system/server: 512 MB
		Central archive server: 1 GB
		Client: 256 MB
		WebClient/Dat@Monitor client: 128 MB
• Recommended	>= 256 MB (single-user station/server), >= 256 MB (client) 4)	Single-user system/server: 1 GB
		Central archive server: >= 1 GB
		Client: 512 MB

		WebClient/Dat@Monitor client: 256 MB
Graphics controller		
• Minimum	SVGA (4 MB), 800 x 600	SVGA (16 MB), 800 x 600
• Recommended	XGA (8 MB), 1024 x 768	SXGA (32 MB), 1280 x 1024
Hard disk		
• Minimum	> 3 GB	Single-user system/server: 20 GB
		Client: 5 GB
		WebClient/Dat@Monitor client: 5 GB
• Recommended	> 3 GB	Single-user system/server: 80 GB
		Client: 20 GB
		WebClient/Dat@Monitor client: 10 GB
• Hard disk (free disk space for installation)		
- Minimum	650 MB	Server: 1 GB
		Client: 700 MB
- Recommended	>= 650 MB	Server: > 10 GB
		Client: > 1.5 GB
CD-ROM/DVD-ROM	For software installation	For software installation
Functionality/quantity framework		
Messages (number)	50,000	50,000
• Message text (number of characters)	10 x 256	10 x 256
• Message archive	> 500,000 messages 2)	> 500,000 messages 2)
• Process values per message	10	10
• Continuous loading, max. messages	2/s	Central archive server 100/s
• Message surge, max.	2000 in 10 min.	Central archive server 15,000/10 sec. every 5 min.
Archive		
• Archive data points	Max. 30,000 per server	Max. 80,000 per server 5)
• Archive types	Polling and sequential archives	Short-term archive with and without long-term archiving
• Data storage format	Sybase SQL 7 or DBase III 3)	Microsoft SQL Server 2000
• Measured values per second, max.	Server/single-user station: 360/s (500/s dBase III)	Central archive server: 10,000/s
		Server/single-user station: 5,000/s
User archives		
• Archive (recipes)	500	Determined by system 2)
• Data records per user archive	65,536	65,536 6)
• No. of fields per user archive	500	500 6)
Graphics system		
• No. of diagrams	Determined by system 2)	Determined by system 2)
• No. of objects per picture	Determined by system 2)	Determined by system 2)
• No. of operator-controllable fields per picture	Determined by system 2)	Determined by system 2)
Process variables	64 K 1)	64 K 1)

Trend curves		
• Curve windows per display	8	25
• Curves per curve window	15	80
User administration		
• User groups	28	128
• No. of users	128	128
• Authorization groups	999	999
Runtime languages	> 9 per project	> 9 per project
Configuration languages	5 European (Ger., Eng., Fr., Ita., Sp.), 4 Asian (simpl.+trad. Chi. / Kor. / Jpn)	5 European (Ger., Eng., Fr., Ita., Sp.), 4 Asian (simpl.+trad. Chi. / Kor. / Jpn)
Protocols		
• Signal sequence protocols (simultaneous)	1 per server/single-user station	1 per server/single-user station
• Message archive reports (simultaneous)	1	3
• Application reports	Determined by system 2)	Determined by system 2)
• Report lines per body	66	66
• Variables per report	300 7)	300 7)
Multi-user system		
• Server	6	12
• Clients for server with operator terminal	3	4
• Clients for server without operator terminal	16	32 clients + 3 WebClients or 50 WebClients + 1 client

1) Depends on the number of licensed PowerTags.
2) Dependent on available memory
3) Dbase III only with TagLogging short-term archives
4) At least 32 MB more when using online configuration
5) Dependent on the number of licensed archive variables; 80,000 archive variables available with the first ServicePack
6) The product of number of fields and number of data records must not exceed 320,000
7) The number of variables per report depend on the performance of the process communication

Further Information

WinCC language versions

For the Asian market, SIMATIC WinCC V5 is also available in simplified Chinese, traditional Chinese, Korean and Japanese. These WinCC versions meet the needs of machine manufacturers, plant constructors and exporters who supply the regions of China, Taiwan, Korea and Japan.

WinCC ASIA contains all the familiar WinCC functions as well as a configuration interface in the relevant national language and in English. The online Help is available in simplified and traditional Chinese, in Korean, Japanese and in English. The Chinese, Korean, Japanese or multilingual version of Windows is required to run these versions.

WinCC ASIA is supplied on a stand-alone CD-ROM that contains all the above-mentioned language variants. The corresponding documentation can be obtained from the regional companies in China, Korea, Taiwan and Japan.

Runtime licenses are language-independent. The English data handling program (AuthorsW) can also run under the Chinese, Korean and Japanese versions of Windows.

Additional information is available in the Internet under:

http://www.siemens.com/wincc

Mounting	Standard DIN rail or threaded joint
Perm. ambient conditions	
• Operating temperature except OLM/G12-EEC	0 °C to +60 °C
• OLM/G12-EEC	–20 °C to +60 °C
• Transport/storage temperature	–40 °C to +70 °C
• Relative humidity	max. 95% at +25 °C
Design	
• Dimensions (W x H x D) in mm	39.5 x 110 x 73.2
• Weight	approx. 500 g
Degree of protection	IP 40

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Data sheet 6ES7321-7TH00-0AB0

SIMATIC S7/PCS7 Digital input SM 321, 16 DI; 24 V DC, 1 x 40-pole, diagnostics-capable, for contacts (wired/ not wired), NAMUR encoder, 3/4-wire Bero, with chatter monitoring; Pulse extension, open-circuit detection Interface module IM 153-2 HF or IM 153-4 HF possible

Figure similar

Supply voltage	
Load voltage L+	
• Rated value (DC)	24 V
• Reverse polarity protection	Yes
Input current	
from load voltage L+ (without load), max.	100 mA
from backplane bus 5 V DC, max.	100 mA
Encoder supply	
Number of outputs	4
Type of output voltage	1Vs1/2Vs1: 18 V, 1Vs2/2Vs2: 8.2 V
Short-circuit protection	Yes; Electronic
additional (redundant) feed	No
Output current	
• Rated value	190 mA; at 18V: 190mA, at 8.2V: 60mA
• permissible range, upper limit	Up to 60 degree: at 18V: 0 to 110mA, at 8.2V: 0 to 60mA; Up to 40 degree: at 18V: 0 to 190mA, at 8.2V: 0 to 60mA

Power loss	
Power loss, typ.	11 W
Digital inputs	
Number of digital inputs	16
Input characteristic curve in accordance with IEC 61131, type 1	No
Input characteristic curve in accordance with IEC 61131, type 2	Yes
Number of simultaneously controllable inputs	
horizontal installation	
— up to 60 °C, max.	16
vertical installation	
— up to 40 °C, max.	16
Input voltage	
• Type of input voltage	DC
• Rated value (DC)	8.2 V; 8.2V/18V
Input current	
• for signal "0", min.	0.35 mA
• for signal "0", max. (permissible quiescent current)	1.2 mA
• for signal "1", typ.	10 mA; for NAMUR: 2.1 to 7 mA, for 10k ohm/47k ohm contact: typical 10mA, for 4 wire BEROs: typical 10 mA
Input delay (for rated value of input voltage)	
for standard inputs	
— at "0" to "1", min.	2.5 ms
— at "0" to "1", max.	3.5 ms
— at "1" to "0", min.	2.5 ms
— at "1" to "0", max.	3.5 ms
Cable length	
• shielded, max.	400 m; max. 200m with 8.2 V sensor, max. 400m with 18 V sensor
• unshielded, max.	Not permitted
Interrupts/diagnostics/status information	
Alarms	Yes
Diagnostics function	Yes
Alarms	
• Diagnostic alarm	Yes
• Hardware interrupt	Yes
Diagnoses	
• Diagnostic information readable	Yes
• Wire-break	Yes
Diagnostics indication LED	

• Group error SF (red)	Yes
• Status indicator digital input (green)	Yes
• Encoder supply Vs (green)	Yes

Potential separation	
Potential separation digital inputs	
• between the channels	Yes
• between the channels, in groups of	8
• between the channels and backplane bus	Yes

Isolation	
Isolation tested with	600 V DC

Ambient conditions	
Ambient temperature during operation	
• min.	0 °C
• max.	60 °C

Connection method	
required front connector	1x 40-pin

Dimensions	
Width	40 mm
Height	125 mm
Depth	120 mm

last modified: 11/25/2020

SIEMENS

Data sheet 6ES7322-1BH01-0AA0

SIMATIC S7-300, Digital output SM 322, isolated, 16 DO, 24 V DC, 0.5A, 1x 20-pole, Total current 4 A/group (8 A/module)

Figure similar

Supply voltage	
Load voltage L+	
• Rated value (DC)	24 V
• permissible range, lower limit (DC)	20.4 V
• permissible range, upper limit (DC)	28.8 V
Input current	
from load voltage L+ (without load), max.	80 mA
from backplane bus 5 V DC, max.	80 mA
Power loss	
Power loss, typ.	4.9 W
Digital outputs	
Number of digital outputs	16
Short-circuit protection	Yes; Electronic
• Response threshold, typ.	1 A
Limitation of inductive shutdown voltage to	L+ (-53 V)
Controlling a digital input	Yes

Switching capacity of the outputs	
• on lamp load, max.	5 W
Load resistance range	
• lower limit	48 Ω
• upper limit	4 kΩ
Output voltage	
• for signal "1", min.	L+ (-0.8 V)
Output current	
• for signal "1" rated value	0.5 A
• for signal "1" permissible range for 0 to 40 °C, min.	5 mA
• for signal "1" permissible range for 0 to 40 °C, max.	0.6 A
• for signal "1" permissible range for 40 to 60 °C, min.	5 mA
• for signal "1" permissible range for 40 to 60 °C, max.	0.6 A
• for signal "1" minimum load current	5 mA
• for signal "0" residual current, max.	0.5 mA
Output delay with resistive load	
• "0" to "1", max.	100 µs
• "1" to "0", max.	500 µs
Parallel switching of two outputs	
• for uprating	No
• for redundant control of a load	Yes
Switching frequency	
• with resistive load, max.	100 Hz
• with inductive load, max.	0.5 Hz
• with inductive load (acc. to IEC 60947-5-1, DC13), max.	0.5 Hz
• on lamp load, max.	10 Hz
Total current of the outputs (per group)	
horizontal installation	
— up to 40 °C, max.	4 A
— up to 60 °C, max.	3 A
vertical installation	
— up to 40 °C, max.	2 A
Cable length	
• shielded, max.	1 000 m
• unshielded, max.	600 m

Interrupts/diagnostics/status information	
Alarms	No

Diagnostics function	No
Alarms	
• Diagnostic alarm	No
Diagnoses	
• Wire-break	No
• Short-circuit	No
• Fuse blown	No
• missing load voltage	No
Diagnostics indication LED	
• Rated load voltage PWR (green)	No
• Fuse OK FSG (green)	No
• Status indicator digital output (green)	Yes

Potential separation	
Potential separation digital outputs	
• between the channels	Yes
• between the channels, in groups of	8
• between the channels and backplane bus	Yes; Optocoupler

Isolation	
Isolation tested with	500 V DC

Connection method	
required front connector	20-pin

Dimensions	
Width	40 mm
Height	125 mm
Depth	120 mm

Weights	
Weight, approx.	190 g

last modified: 11/27/2020

SIEMENS

Data sheet 6ES7331-7TF01-0AB0

SIMATIC DP, HART analog input SM 331, 8 AI, 0/4 - 20 mA HART, for ET200M with IM153-2, 1 x 20-pole, Functions: FW update, HART auxiliary variables, redundancy, local diagnostic buffer with time stamping,

Figure similar

General information	
Product function	
• Isochronous mode	No

Supply voltage	
Load voltage L+	
• Rated value (DC)	24 V
• Reverse polarity protection	Yes

Input current	
from load voltage L+ (without load), max.	20 mA
from backplane bus 5 V DC, max.	120 mA

Output voltage	
Power supply to the transmitters	
• present	Yes
• Rated value (DC)	24 V
• short-circuit proof	Yes
• Supply current, max.	60 mA

Power loss	
Power loss, typ.	1.5 W
Analog inputs	
Number of analog inputs	8
permissible input current for current input (destruction limit), max.	40 mA
Input ranges (rated values), currents	
• 0 to 20 mA	Yes
— Input resistance (0 to 20 mA)	140 Ω
• -20 mA to +20 mA	
— Input resistance (-20 mA to +20 mA)	140 Ω
• 4 mA to 20 mA	
— Input resistance (4 mA to 20 mA)	140 Ω
Cable length	
• shielded, max.	800 m
Analog value generation for the inputs	
Measurement principle	Sigma Delta
Integration and conversion time/resolution per channel	
• Resolution with overrange (bit including sign), max.	16 bit
• Integration time, parameterizable	Yes
• Integration time (ms)	20 ms at 50 Hz; 16.6 ms at 60 Hz; 100 ms at 100 Hz
• Basic conversion time, including integration time (ms)	55 ms @ 60 Hz, 65 ms @ 50 Hz, 305 ms @ 100 Hz
• Interference voltage suppression for interference frequency f1 in Hz	10 / 50 / 60 Hz
Smoothing of measured values	
• parameterizable	Yes
• Step: None	Yes
• Step: low	Yes
• Step: Medium	Yes
• Step: High	Yes
Encoder	
Connection of signal encoders	
• for current measurement as 2-wire transducer	Yes
• for current measurement as 4-wire transducer	Yes
Errors/accuracies	
Operational error limit in overall temperature range	
• Current, relative to input range, (+/-)	0.15 %
Basic error limit (operational limit at 25 °C)	
• Current, relative to input range, (+/-)	0.1 %

Interrupts/diagnostics/status information	
Diagnostics function	Yes
Alarms	
• Diagnostic alarm	Yes
• Limit value alarm	Yes
Diagnostics indication LED	
• Group error SF (red)	Yes
• Channel fault indicator F (red)	Yes
Potential separation	
Potential separation analog inputs	
• between the channels	No
• between the channels and backplane bus	Yes
Isolation	
Isolation tested with	500 V DC
Degree and class of protection	
IP degree of protection	IP20
Connection method	
required front connector	20-pin
Dimensions	
Width	40 mm
Height	125 mm
Depth	117 mm
Weights	
Weight, approx.	205 g

last modified: 11/25/2020

SIEMENS

Data sheet 6ES7332-8TF01-0AB0

SIMATIC DP, HART analog output, SM 332, 8 AO, 0/4 - 20 mA HART, for ET200M with IM153-2, IM 153-2, 20-pole Functions: FW update, HART auxiliary variables, redundancy, local diagnostic buffer with time stamping,

Figure similar

General information	
Product function	
• Isochronous mode	No
Supply voltage	
Load voltage L+	
• Rated value (DC)	24 V
• Reverse polarity protection	Yes
Input current	
from load voltage L+ (without load), max.	350 mA
from backplane bus 5 V DC, max.	110 mA
Power loss	
Power loss, typ.	6 W
Analog outputs	
Number of analog outputs	8
Current output, no-load voltage, max.	24 V
Output ranges, current	

• 0 to 20 mA	Yes
• -20 mA to +20 mA	No
• 4 mA to 20 mA	Yes
Connection of actuators	
• for current output two-wire connection	Yes
Load impedance (in rated range of output)	
• with current outputs, max.	750 Ω
• with current outputs, inductive load, max.	10 mH
Destruction limits against externally applied voltages and currents	
• Voltages at the outputs towards MANA	+60/-0.5 V
Cable length	
• shielded, max.	800 m

Analog value generation for the outputs	
Integration and conversion time/resolution per channel	
• Resolution with overrange (bit including sign), max.	16 bit
• Basic execution time of the module (all channels released)	10 ms; 10 ms in AO mode 50 ms in HART-AO mode
Settling time	
• for resistive load	0.1 ms
• for inductive load	0.5 ms

Errors/accuracies	
Operational error limit in overall temperature range	
• Current, relative to output range, (+/-)	0.2 %
Basic error limit (operational limit at 25 °C)	
• Current, relative to output range, (+/-)	0.1 %

Interrupts/diagnostics/status information	
Diagnostics function	Yes
Substitute values connectable	Yes
Alarms	
• Diagnostic alarm	Yes
Diagnostics indication LED	
• Group error SF (red)	Yes

Potential separation	
Potential separation analog outputs	
• between the channels	No
• between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes

Isolation	
Isolation tested with	500 V DC

Degree and class of protection	
IP degree of protection	IP20

Connection method	
required front connector	20-pin

Dimensions	
Width	40 mm
Height	125 mm
Depth	117 mm

Weights	
Weight, approx.	220 g

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SIEMENS

Data sheet 6ES7414-5HM06-0AB0

SIMATIC S7-400H, CPU 414-5H, central processing unit for S7-400H and S7-400F/FH, 5 interfaces: 1x MPI/DP, 1x DP, 1x PN and 2 for sync modules, 4 MB memory (2 MB data/2 MB program),

General information	
Product type designation	CPU 414-5H PN/DP
HW functional status	1
Firmware version	V6.0
Product function	
• Isochronous mode	No
Engineering with	
• Programming package	As of STEP 7 V5.5 SP2 with HF1
CiR - Configuration in RUN	
CiR synchronization time, basic load	100 ms
CiR synchronization time, time per I/O byte	0 µs
Supply voltage	
Rated value (DC)	
• 24 V DC	No; Power supply via system power supply
Input current	
from backplane bus 5 V DC, typ.	1.6 A
from backplane bus 5 V DC, max.	1.9 A
from backplane bus 24 V DC, max.	150 mA; 150 mA per DP interface

from interface 5 V DC, max.	90 mA; At each DP interface
Power loss	
Power loss, typ.	7.5 W
Memory	
Type of memory	other
Work memory	
• integrated	4 Mbyte
• integrated (for program)	2 Mbyte
• integrated (for data)	2 Mbyte
• expandable	No
Load memory	
• expandable FEPROM	Yes; with Memory Card (FLASH)
• expandable FEPROM, max.	64 Mbyte
• integrated RAM, max.	512 kbyte
• expandable RAM	Yes
• expandable RAM, max.	64 Mbyte
Backup	
• present	Yes
• with battery	Yes; all data
• without battery	No
Battery	
Backup battery	
• Backup current, typ.	180 µA; Valid up to 40°C
• Backup current, max.	1 000 µA
• Backup time, max.	Dealt with in the module data manual with the secondary conditions and the factors of influence
• Feeding of external backup voltage to CPU	5 V DC to 15 V DC
CPU processing times	
for bit operations, typ.	18.75 ns
for word operations, typ.	18.75 ns
for fixed point arithmetic, typ.	18.75 ns
for floating point arithmetic, typ.	37.5 ns
CPU-blocks	
DB	
• Number, max.	6 000; Number range: 1 to 16000
• Size, max.	64 kbyte
FB	
• Number, max.	3 000; Number range: 0 to 7999
• Size, max.	64 kbyte
FC	

• Number, max.	3 000; Number range: 0 to 7999
• Size, max.	64 kbyte
OB	
• Number, max.	see instruction list
• Size, max.	64 kbyte
• Number of free cycle OBs	1; OB 1
• Number of time alarm OBs	4; OB 10-13
• Number of delay alarm OBs	4; OB 20-23
• Number of cyclic interrupt OBs	4; OB 32-35
• Number of process alarm OBs	4; OB 40-43
• Number of DPV1 alarm OBs	3; OB 55-57
• Number of startup OBs	2; OB 100, 102
• Number of asynchronous error OBs	9; OB 80-88
• Number of synchronous error OBs	2; OB 121, 122
Nesting depth	
• per priority class	24
• additional within an error OB	1

Counters, timers and their retentivity	
S7 counter	
• Number	2 048
Retentivity	
— adjustable	Yes
— lower limit	0
— upper limit	2 047
— preset	Z 0 to Z 7
Counting range	
— lower limit	0
— upper limit	999
IEC counter	
• present	Yes
• Type	SFB
• Number	Unlimited (limited only by RAM capacity)
S7 times	
• Number	2 048
Retentivity	
— adjustable	Yes
— lower limit	0
— upper limit	2 047
— preset	No times retentive
Time range	
— lower limit	10 ms

— upper limit	9 990 s
IEC timer	
• present	Yes
• Type	SFB
• Number	Unlimited (limited only by RAM capacity)
Data areas and their retentivity	
retentive data area in total	Total working and load memory (with backup battery)
Flag	
• Number, max.	8 192 byte
• Retentivity available	Yes
• Retentivity preset	MB 0 to MB 15
• Number of clock memories	8; in 1 memory byte
Local data	
• adjustable, max.	16 kbyte
• preset	8 kbyte
Address area	
I/O address area	
• Inputs	8 kbyte
• Outputs	8 kbyte
Process image	
• Inputs, adjustable	8 kbyte
• Outputs, adjustable	8 kbyte
• Inputs, default	256 byte
• Outputs, default	256 byte
• consistent data, max.	244 byte
• Access to consistent data in process image	Yes
Subprocess images	
• Number of subprocess images, max.	15
Digital channels	
• Inputs	65 536
— of which central	65 536
• Outputs	65 536
— of which central	65 536
Analog channels	
• Inputs	4 096
— of which central	4 096
• Outputs	4 096
— of which central	4 096
Hardware configuration	
Number of expansion units, max.	21
connectable OPs	63

Multicomputing	No
Interface modules	
• Number of connectable IMs (total), max.	6
• Number of connectable IM 460s, max.	6
• Number of connectable IM 463s, max.	4; Single mode only
Number of DP masters	
• integrated	2
• via CP	10; CP 443-5 Extended
• Mixed mode IM + CP permitted	No
• via interface module	0
Number of IO Controllers	
• integrated	1
• via CP	0
Number of operable FMs and CPs (recommended)	
• FM	See manual Automation System S7-400H fault-tolerant systems. Limited by number of slots and number of connections
• CP, PtP	See manual Automation System S7-400H fault-tolerant systems. Limited by number of slots and number of connections
• PROFIBUS and Ethernet CPs	14; Of which max. 10 CP as DP master
Slots	
• required slots	2

Time of day	
Clock	
• Hardware clock (real-time)	Yes
• retentive and synchronizable	Yes
• Resolution	1 ms
• Deviation per day (buffered), max.	1.7 s; Power off
• Deviation per day (unbuffered), max.	8.6 s; Power on
Operating hours counter	
• Number	16
• Number/Number range	0 to 15
• Range of values	SFCs 2, 3 and 4: 0 to 32767 hours SFC 101: 0 to 2^31 - 1 hours
• Granularity	1 h
• retentive	Yes
Clock synchronization	
• supported	Yes
• to MPI, master	Yes
• to MPI, slave	Yes
• to DP, master	Yes
• to DP, slave	Yes
• in AS, master	Yes
• in AS, slave	Yes

• on Ethernet via NTP	Yes; As client
Time difference in system when synchronizing via	
• Ethernet, max.	10 ms; Via NTP
• MPI, max.	200 ms

Interfaces	
Number of RS 485 interfaces	2
Number of other interfaces	2; Fiber-optic interface
Optical interface	No

1. Interface	
Interface type	Integrated
Physics	RS 485 / PROFIBUS + MPI
Isolated	Yes
Power supply to interface (15 to 30 V DC), max.	150 mA
Protocols	
• MPI	Yes
• PROFIBUS DP master	Yes
• PROFIBUS DP slave	No
MPI	
• Number of connections	32; If a diagnostics repeater is used on the line, the number of connection resources on the line is reduced by 1
• Transmission rate, max.	12 Mbit/s
Services	
— PG/OP communication	Yes
— Routing	Yes
— Global data communication	No
— S7 basic communication	No
— S7 communication	Yes
— S7 communication, as client	Yes
— S7 communication, as server	Yes
PROFIBUS DP master	
• Number of connections, max.	16; If a diagnostics repeater is used on the line, the number of connection resources on the line is reduced by 1
• Transmission rate, max.	12 Mbit/s
• Number of DP slaves, max.	32
Services	
— PG/OP communication	Yes
— Routing	Yes
— Global data communication	No
— S7 basic communication	No
— S7 communication	Yes
— S7 communication, as client	Yes

— S7 communication, as server	Yes
— Equidistance	No
— Isochronous mode	No
— SYNC/FREEZE	No
— Activation/deactivation of DP slaves	No
— Direct data exchange (slave-to-slave communication)	No
— DPV1	Yes
Address area	
— Inputs, max.	2 kbyte
— Outputs, max.	2 kbyte
User data per DP slave	
— User data per DP slave, max.	244 byte
— Inputs, max.	244 byte
— Outputs, max.	244 byte
— Slots, max.	244
— per slot, max.	128 byte
PROFIBUS DP slave	
• Number of connections	No configuration of CPU as DP slave

2. Interface	
Interface type	PROFINET
Physics	Ethernet RJ45
Isolated	Yes
automatic detection of transmission rate	Yes; Autosensing
Autonegotiation	Yes
Autocrossing	Yes
Change of IP address at runtime, supported	No
Number of connection resources	64
Interface types	
• Number of ports	2
• integrated switch	Yes
Protocols	
• PROFINET IO Controller	Yes
• PROFINET IO Device	No
• PROFINET CBA	No
• PROFIBUS DP master	No
• PROFIBUS DP slave	No
• Open IE communication	Yes
• Web server	No
• Point-to-point connection	No
• Media redundancy	Yes
PROFINET IO Controller	

• Transmission rate, max.	100 Mbit/s
Services	
— PG/OP communication	Yes
— S7 routing	Yes
— S7 communication	Yes
— Isochronous mode	No
— Shared device	Yes; Single mode only
— Prioritized startup	No
— Number of connectable IO Devices, max.	256; In redundant mode via both interfaces
— Number of connectable IO Devices for RT, max.	256
— of which in line, max.	256
— Activation/deactivation of IO Devices	No
— IO Devices changing during operation (partner ports), supported	No
— Device replacement without swap medium	Yes
— Send cycles	250 µs, 500 µs, 1 ms, 2 ms, 4 ms
— Updating time	250 µs to 512 ms, minimum value depends on the number of configured user data and the configured single or redundant mode
Address area	
— Inputs, max.	8 kbyte
— Outputs, max.	8 kbyte
— User data consistency, max.	1 024 byte
Open IE communication	
• Number of connections, max.	62
• Local port numbers used at the system end	0, 20, 21, 25, 102, 135, 161, 34962, 34963, 34964, 65532, 65533, 65534, 65535
• Keep-alive function, supported	Yes

3. Interface	
Interface type	Integrated
Physics	RS 485 / PROFIBUS
Power supply to interface (15 to 30 V DC), max.	150 mA
Number of connection resources	16
Protocols	
• PROFIBUS DP master	Yes
• PROFIBUS DP slave	No
PROFIBUS DP master	
• Number of connections, max.	16
• Transmission rate, max.	12 Mbit/s
• Number of DP slaves, max.	96
Services	
— PG/OP communication	Yes

— Routing	Yes
— Global data communication	No
— S7 basic communication	No
— S7 communication	Yes
— S7 communication, as client	Yes
— S7 communication, as server	Yes
— Equidistance	No
— Isochronous mode	No
— SYNC/FREEZE	No
— Activation/deactivation of DP slaves	No
— Direct data exchange (slave-to-slave communication)	No
— DPV0	Yes
— DPV1	Yes
Address area	
— Inputs, max.	6 kbyte
— Outputs, max.	6 kbyte
User data per DP slave	
— User data per DP slave, max.	244 byte
— Inputs, max.	244 byte
— Outputs, max.	244 byte
— Slots, max.	244
— per slot, max.	128 byte

4. Interface	
Interface type	Pluggable synchronization submodule (FO)
Plug-in interface modules	Synchronization modules 6ES7960-1AA06-0XA0 or 6ES7960-1AB06-0XA0

5. Interface	
Interface type	Pluggable synchronization submodule (FO)
Plug-in interface modules	Synchronization modules 6ES7960-1AA06-0XA0 or 6ES7960-1AB06-0XA0

Protocols	
Redundancy mode	
Media redundancy	
— Switchover time on line break, typ.	200 ms
— Number of stations in the ring, max.	50
SIMATIC communication	
• S7 routing	Yes
Open IE communication	
• TCP/IP	Yes; via integrated PROFINET interface and loadable FBs
— Number of connections, max.	62

— Data length, max.	32 kbyte
— several passive connections per port, supported	Yes
• ISO-on-TCP (RFC1006)	Yes; Via integrated PROFINET interface or CP 443-1 and loadable FBs
— Number of connections, max.	62
— Data length, max.	32 kbyte; 1 452 bytes via CP 443-1 Adv.
• UDP	Yes; via integrated PROFINET interface and loadable FBs
— Number of connections, max.	62
— Data length, max.	1 472 byte
Web server	
• supported	No

Isochronous mode	
Equidistance	No

Communication functions	
PG/OP communication	Yes
• Number of connectable OPs without message processing	63
• Number of connectable OPs with message processing	63; When using Alarm_S/SQ and Alarm_D/DQ
Data record routing	Yes
Global data communication	
• supported	No
S7 basic communication	
• supported	No
S7 communication	
• supported	Yes
• as server	Yes
• as client	Yes
• User data per job, max.	64 kbyte
• User data per job (of which consistent), max.	462 byte; 1 variable
S5 compatible communication	
• supported	Yes; (via CP max. 10 and FC AG_SEND and FC AG_RECV)
• User data per job, max.	8 kbyte
• User data per job (of which consistent), max.	240 byte
• Number of simultaneous AG-SEND/AG-RECV orders per CPU, max.	64/64
Standard communication (FMS)	
• supported	Yes; Via CP and loadable FB
Number of connections	
• overall	64
• usable for PG communication	

— reserved for PG communication	1
— adjustable for PG communication, max.	0
• usable for OP communication	
— reserved for OP communication	1
— adjustable for OP communication, max.	0
• usable for S7 basic communication	
— reserved for S7 basic communication	0
— adjustable for S7 basic communication, max.	0
• usable for S7 communication	
— reserved for S7 communication	0
— adjustable for S7 communication, max.	0
• usable for routing	
— reserved for routing	0
— adjustable for routing, max.	0

S7 message functions	
Number of login stations for message functions, max.	63; Max. 63 with Alarm_S/SQ and Alarm_D/DQ (OPs); max. 8 with Alarm, Alarm_8, Alarm_8P, Notify and Notify_8 (e.g. WinCC)
Symbol-related messages	No
SCAN procedure	No
Program alarms	Yes
Process diagnostic messages	Yes
simultaneously active Alarm-S blocks, max.	400; Simultaneously active alarm_S/SQ blocks or alarm_D/DQ blocks
Alarm 8-blocks	Yes
• Number of instances for alarm 8 and S7 communication blocks, max.	2 500
• preset, max.	900
Process control messages	Yes
Number of archives that can log on simultaneously (SFB 37 AR_SEND)	16

Test commissioning functions	
Status block	Yes
Single step	Yes
Number of breakpoints	16
Status/control	
• Status/control variable	Yes; Up to 16 variable tables
• Variables	Inputs/outputs, memory bits, DBs, distributed I/Os, timers, counters
• Number of variables, max.	70
Forcing	
• Forcing	Yes

• Forcing, variables	Inputs/outputs, bit memories, distributed I/Os
• Number of variables, max.	256
Diagnostic buffer	
• present	Yes
• Number of entries, max.	3 200
— adjustable	Yes
— preset	120
Service data	
• can be read out	Yes
EMC	
Emission of radio interference acc. to EN 55 011	
• Limit class A, for use in industrial areas	Yes
• Limit class B, for use in residential areas	No
Configuration	
Configuration software	
• STEP 7	Yes
Programming	
• Command set	see instruction list
• Nesting levels	7
• Access to consistent data in process image	Yes
• System functions (SFC)	see instruction list
• System function blocks (SFB)	see instruction list
Programming language	
— LAD	Yes
— FBD	Yes
— STL	Yes
— SCL	Yes
— CFC	Yes
— GRAPH	Yes
— HiGraph®	Yes
Number of simultaneously active SFCs	
— RD_REC	8
— WR_REC	8
— WR_PARM	8
— PARM_MOD	1
— WR_DPARM	2
— DPNRM_DG	8
— RDSYSST	8
— DP_TOPOL	1
Number of simultaneously active SFBs	
— RDREC	8

— WRREC	8
Know-how protection	
• User program protection/password protection	Yes
• Block encryption	Yes; With S7 block Privacy
Dimensions	
Width	50 mm
Height	290 mm
Depth	219 mm
Weights	
Weight, approx.	995 g

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