Introduction

SIMATIC is a family of programmable controllers (PLCs) consisting of many finely tuned components: Programmable controllers, programming devices, intelligent input/output modules, etc. And each product group encompasses in turn a whole range of individual components.

There are HMI systems and systems for open communications to match SIMATIC.

This graded performance capability is the strength of the SIMATIC family.

This catalog gives you information on our product ranges SIMATIC S5, SIMATIC 505, SIMATIC programming devices, SIMATIC PCs and SIMATIC S5 software.

Programmable controllers

From the compact mini controller to the high-performance PLC. There are SIMATIC controllers for every demand and every requirement, in all types and sizes.

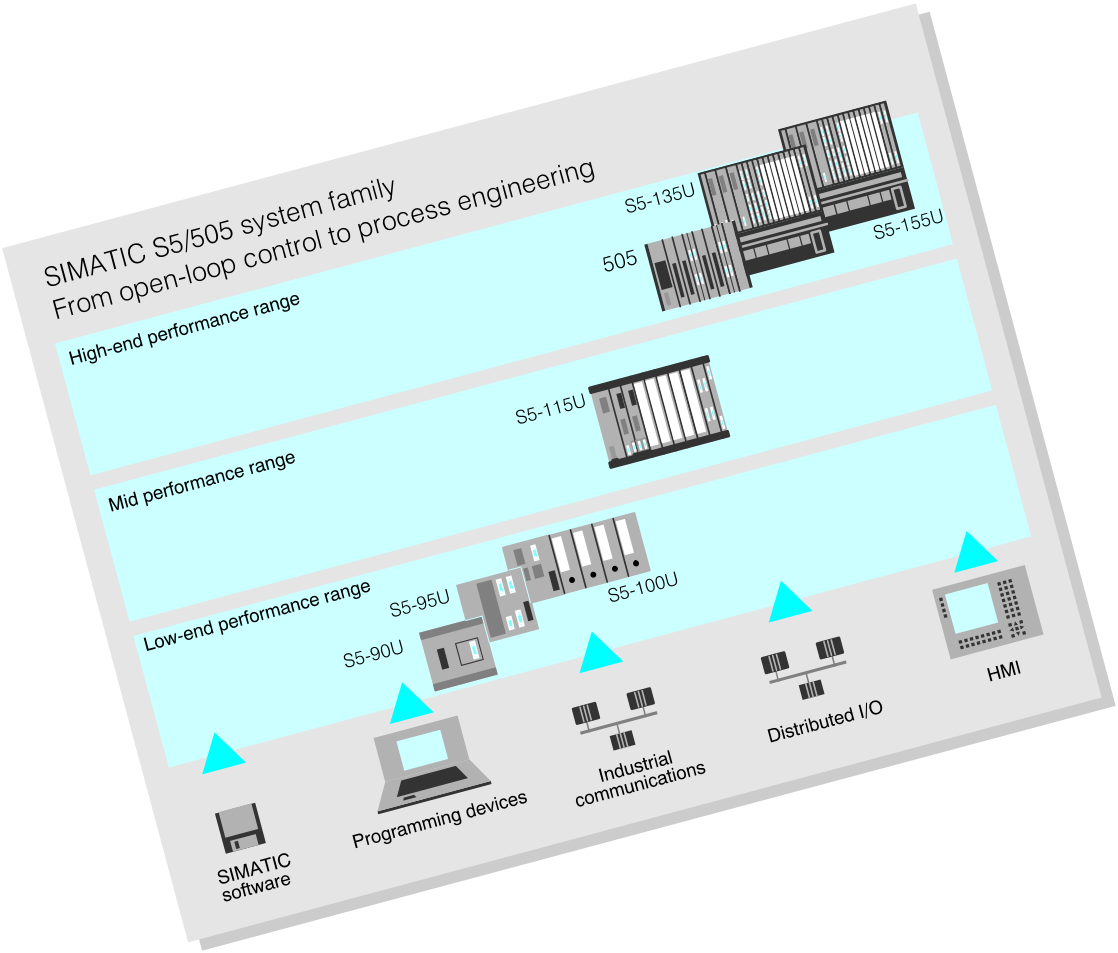
What they all have in common is high processing capability packed into the smallest possible space, ruggedness to cope with the harshest mechanical and climatic requirements, high speed and expandability.

Redundant systems

Failsafety? High availability? No problem for SIMATIC S5/505!

We offer the following PLCs based on our S5-95U, S5-115U, S5-155U and 505 standard systems

- The S5-95F and the S5-115F, two failsafe PLCs which can be used wherever there could be danger to personnel, material or the environment.
- The S5-115H, S5-155H and TI505 systems, three fault-tolerant systems which can be used wherever production downtimes must be avoided at all costs.



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Programmable controllers (continued)

Intelligent I/O modules

SIMATIC S5/TI505 PLCs don't just perform open-loop control these days, they also handle the following:

- Closed-loop control
- Positioning
- Counting, proportioning
- Valve control and much more.

For this purpose, there are intelligent I/O modules:
They are microprocessor controlled and execute time-critical special tasks completely autonomously, and they have a direct connection to the process via their own input/output channels. This avoids additional loads for the CPU.

Distributed I/Os

If it is necessary to bridge large distances between the process and the I/O modules, the wiring can become very complex and susceptible to faults. If a modular and flexible automation system is required, we recommend use of distributed I/O systems:

- Using the ET 100U electronic terminator, I/O modules can be located up to 3 km/1.8 miles from the process.
- With the ET 200 distributed I/O system, you can use distributed I/Os, mini-controllers and a large number of field devices at distances of up to 23 km/14.3 miles from the programmable controller. The connected devices are networked over the PROFIBUS-DP high-speed fieldbus, complying with EN 50 170.

Programming devices, software

The SIMATIC family offers you an attractive overall programming devices, concept – from the low-cost handheld programming devices to the especially powerful desktop programming devices.

And to match these – our software. Starting with the operating system:

- WINDOWS 95 — for the proven SIMATIC software and for all PC applications

And our STEP 5/TISOFT software allows you to program your controller simply and quickly. You generate, document and test with one and the same software.

Industrial PC

The rugged industrial PCs of the SIMATIC range are the ideal tools for acquiring, processing and archiving machine data and process data

for operator control and visualization of material flows and manufacturing sequences, as well as for process control tasks.

The PC-ÜSR software for monitoring, open-loop control and closed-loop control is available specially for high-speed configuring of low-end and mid range process control systems.

HMI

The more complex automated processes become, the more important it is to have "man-machine communications" suited to the process.

Our range of SIMATIC HMI devices provides the right solution for every task.

Open communications

The productivity of any manufacturing system depends to a great extent on the flexibility of the control systems used. Decentralization means increased flexibility but also an increased need for devices to exchange data with each other and with a host computer.

SIMATIC offers a choice of two solutions for this purpose:

- Point-to-point connection from CPU to CPU or over communications processors where only a few nodes are to be linked
- Communications over the Industrial Ethernet, PROFIBUS or SINEC L1 local area networks where larger numbers of programmable controllers are to be linked.

Services

Services such as qualified consultation, dependable maintenance or training all help you to realize the full potential of your SIMATIC.

Introduction

SIMATIC S5-115U

The mid performance range

The rugged programmable controller without fan for the entire mid-range. It can be adapted in stages exactly to your requirements.

	CPU 941	CPU 942	CPU 943	CPU 944	CPU 945
Main memory for program and data (1 statement = 2 bytes)	18 KB RAM/EPROM/ EEPROM	42 KB RAM/EPROM/ EEPROM	48 KB RAM/EPROM/ EEPROM	96 KB RAM/EPROM/ EEPROM	256/384 KB RAM/EPROM/ EEPROM
Execution time for 1 K binary statements	1.6 ms	1.6 ms	0.8 ms	0.8 ms	0.1 ms
Flags/S flags	2048/0[1)]	2048/0[1)]	2048/0[1)]	2048/0[1)]	2048/32768[1)]
Counters	128[1)]	128[1)]	128[1)]	128[1)]	256[1)]
Timers	128[1)]	128[1)]	128[1)]	128[1)]	256[1)]
Arithmetic functions	+, –, x, :[2)]	+, –, x, :[2)]	+, –, x, :[2)]	+, –, x, :[2)]	+, –, x, :[3)]
Digital inputs/outputs, max.	4096/4096 of which max. 512 with process I/O image	4096/4096 of which 1024/1024 with process I/O image	4096/4096 of which 1024/1024 with process I/O image	4096/4096 of which 1024/1024 with process I/O image	4096/4096 of which 1024/1024 with process I/O image
Analog inputs/outputs, max.	256/256	256/256	256/256	256/256	256/256
HMI devices	■	■	■	■	■
Communications: Point-to-point connection Bus-type LANs	— SINEC L1 PROFIBUS Ind. Ethernet AS-Interface	— SINEC L1 PROFIBUS Ind. Ethernet AS-Interface	■ SINEC L1 PROFIBUS Ind. Ethernet AS-Interface	■ SINEC L1 PROFIBUS Ind. Ethernet AS-Interface	SINEC L1 PROFIBUS Ind. Ethernet AS-Interface

■ = can be connected/available
— = cannot be connected/not available

1) Of which all, half or none can be retentive
2) Fixed point

SIMATIC S5-135U
SIMATIC S5-155U

The multiprocessor PLCs

S5-135U
The compact controller with multi-processor capacity for all tasks of the mid-range. It saves a lot of space in the control cabinet with its compact modules.

S5-155U
The high-performance PLC which combines the highest performance levels with extremely short execution times – the "memory giant with multiprocessor capability".

	CPU 922	CPU 928	CPU 928B	CPU 948[4]
	64 KB RAM/EPROM and 22 KB RAM for data blocks	64 KB RAM/EPROM and 46 KB RAM for data blocks	64 KB RAM/EPROM and 46 KB RAM for data blocks	640/1664 KB RAM/Flash-EPROM
	20 ms	1.1 ms	0.6 ms	0.2 ms
	2048/0	2048/0	2048/8192	2048/32768
	128	256	256	256
	128	256	256	256
	+, –, x, :[3]	+, –, x, :[3]	+, –, x, :[3]	+, –, x, :[3]
	max. 1024/1024 with process I/O image in addition 3072/3072 without process I/O image in addition 4096/4096 with direct memory access in addition 518152/518152 with page addressing			
	max. 192/192 in addition 256/256 with direct memory access in addition 32130/32130 with page addressing			
	■	■	■	■
	— SINEC L1 PROFIBUS Ind. Ethernet AS-Interface	— SINEC L1 PROFIBUS Ind. Ethernet AS-Interface	■ SINEC L1 (slave) PROFIBUS Ind. Ethernet AS-Interface	■ SINEC L1 (slave) PROFIBUS Ind. Ethernet AS-Interface

3) Fixed point/floating point
4) For S5-155U only

Introduction

SIMATIC 505

The controllers for process engineering

The powerful programmable controllers providing the ideal combination of open-loop control tasks, closed-loop control tasks and complex mathematical functions.

CPU	525-1102	535-1212	545-1102	545-1103	555-1101	555-1102	575	560T	565T
Main memory for program and data (1 statement = 2 bytes)	10 KB RAM/ EEPROM	40 KB RAM/ EEPROM	192 KB RAM/ EEPROM	96 KB RAM/ EEPROM	384 KB RAM/ EEPROM	1920 KB RAM/ EEPROM	832 KB RAM	1024 KB RAM	1024 KB RAM
Execution time per 1 K of binary statements	4 ms	0.8 ms	0.78 ms	0.78 ms	0.07 ms	0.07 ms	0.9 ms	1.3 ms	1.3 ms[1)]
Flags/of which retentive	511/256	1023/512	4096/ 1024	4096/ 1024	32768/ 4096	32768/ 4096	23552/ 4096	56320/ 4096	56320/ 4096[1)]
Counters	256	400	4096	1024	20480	20480	4096	20480	20480
Timers	256	400	4096	1024	20480	20480	4096	20480	20480
Arithmetic functions	+, –, x, :, √	+, –, x, :, √	+, –, x, :, √, trig. funct.	+, –, x, :, √, trig. funct.	+, –, x, :, √, trig. funct.	+, –, x, :, √, trig. funct.	+, –, x, :, √, trig. funct.	+, –, x, :, √	+, –, x, :, √, trig. funct.
Digital inputs/ outputs, max.	512	1023	2048	1024	8192	8192	8192	8192	8192
Analog inputs/ outputs, max.	128	1023	1024	1024	8192	8192	8192	8192	8192
Distance to distributed mounting racks	—	396 m	1000 m	—	1000 m	1000 m	1000 m	1000/ 4000 m	1000/ 4000 m
SIMATIC monitoring systems	—	—	■	■	■	■	■	—	—
Networking	TIWAY/ Industrial Ethernet	TIWAY/ Industrial Ethernet	TIWAY/ Industrial Ethernet	TIWAY/ Industrial Ethernet	TIWAY/ Industrial Ethernet	TIWAY/ Industrial Ethernet	TIWAY/ Industrial Ethernet	TIWAY/ Industrial Ethernet	TIWAY/ Industrial Ethernet
PID control	—	—	64	16	64	64	64	—	64
Analog interrupt blocks	—	—	128	16	128	128	■	—	128
Programs for special functions	—	—	1023	64	1023	1023	■	—	1023

■ = can be connected/available — = cannot be connected/not available 1) When used with CPU 560T

S5-115U

Application

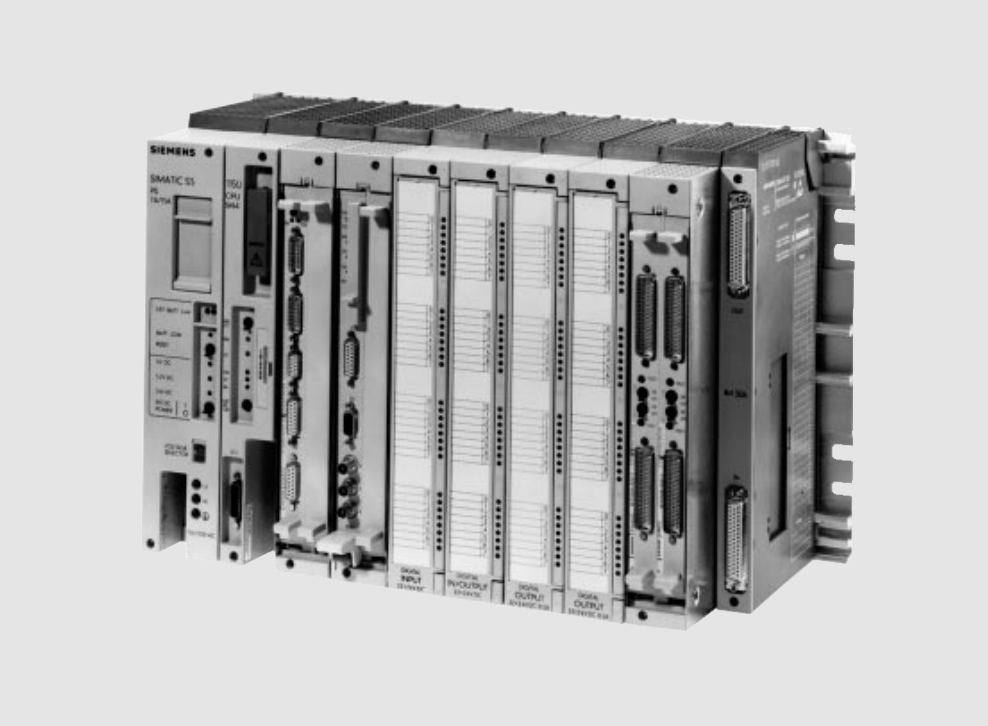


Fig. 3/1 S5-115U programmable controller (sample configuration)

The S5-115U programmable controller is suitable for automation tasks in the medium performance range.

Its highly modular design featuring five different powerful CPUs has set a new standard.

The S5-115U is suitable for such areas as:

- Machine control systems
- Process automation
- Process monitoring

The rugged construction of this PLC makes it suitable for use under harsh operating and environmental conditions, e.g. in the vicinity of power equipment, in cranes, on ocean-going ships, or in off-shore installations.

The standardized hardware technology, the highly modular design of the PLC and the high performance capabilities of the programming devices give the system the following features:

- Easy use due to simple assembly and connection
- Simple replaceability with snap-on block-type modules
- Adaptability through the use of different input and output voltages as well as the finely graduated modular expansion capability of the inputs, outputs and memory
- Operation without fans in all standard applications
- Simple and vibration-resistant mounting of modules, which are simply snapped onto the solid mounting rack and locked into position with screws
- Simple programming by means of structured programming and the use of standardized program sections (function blocks)
- Off-loading of the CPU and the program through the use of intelligent I/O modules (e.g. digital position decoder, valve control module)
- Simple communication with other programmable controllers and computers through the use of internal communications processors and LANs
- Easy system start-up by means of programming devices and service units with extensive programming and debugging aids

S5-115U (continued)

Design

An S5-115U programmable controller (PLC) consists of a central controller (with CR 700) and as many expansion units as required (with ER 701).

The central controller always contains a power supply module and a CPU module.

The expansion units can be configured with or without a power supply module, depending on the type. They are connected to the central controller using interface modules.

Depending on the automation task, different input/output modules can be plugged into the PLC:

- Digital and analog I/O modules
- Communications processors
- Intelligent I/O modules
- Modules for special functions

Adapter casings are available for modules which are not of block-type construction.

Possible configurations

Central configuration

In a central configuration the expansion units (EUs) are either in the same cabinet as the central controllers (CCs) or in a separate cabinet next to it. The maximum length for the cable connecting the CC to the furthest EU is 2.5 m (8.2 ft).

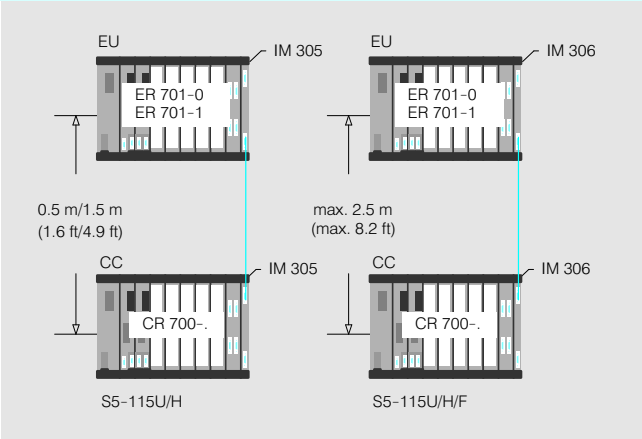


Fig. 3/2 Central connection of expansion units

Distributed configuration

In a distributed configuration the EUs are installed at a distance of up to 3000 m (9840 ft) from the CC. Three additional EUs can be connected in a central configuration to each distributed EU.

Note

The expansion units of other SIMATIC S5 programmable controllers, distributed peripherals and field devices can also be connected.

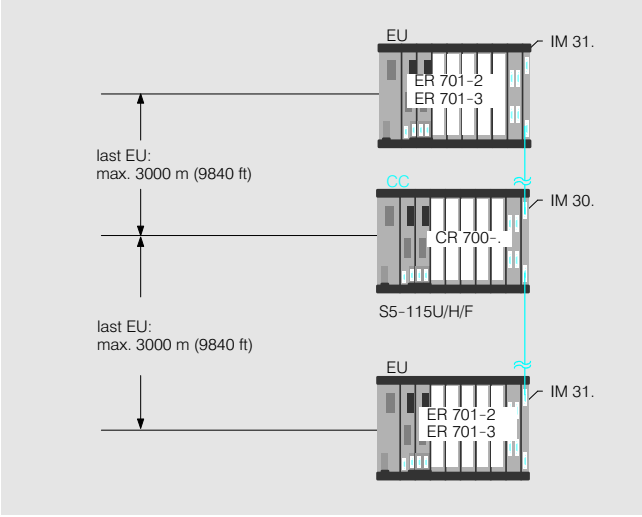


Fig. 3/3 Distributed connection of expansion units

General technical specifications

Insulation group	C in acc. wilth VDE 0110 (line-side), Para. 13 Group 2 (for 48 V, 24 V, 5 V input/output)	Humidity rating	F in acc. with DIN 40040 (15% to 95% non-condensing)
Degree of protection	IP 20 for power supply modules or modules with screw terminals, otherwise IP 00	Altitude rating	860...1060 hPa (660...1060 hPa during transport and storage)
Ambient temperature	0...55 °C (air inlet temperature below)	Mechanical loading	Mounting in fixed equipment which is free of vibrations; suitable precautions must be taken to prevent sustained vibration, shocks and bumping
Transport and storage temperature	- 40...+ 85 °C		

S5-115U (continued)

3

Principle of operation

The principle of operation of the S5-115U programmable controller is largely governed by the function components "program memory" and "processor".

In the versions of the S5-115H and S5-115F programmable controllers, the redundary functions are an additional factor.

Program memory

The program memory contains the user program.

Processor

The processor operates cyclically:

At the beginning of each cycle, the processor reads the signal states of all inputs and stores them in a process input image (PII).

The program is executed step by step.

The processor stores the calculated signal states in a process output image (POI). At the end of a cycle, the processor transfers the information from the process output image to the outputs.

The cycle can be stopped by interrupts (process and time interrupts).

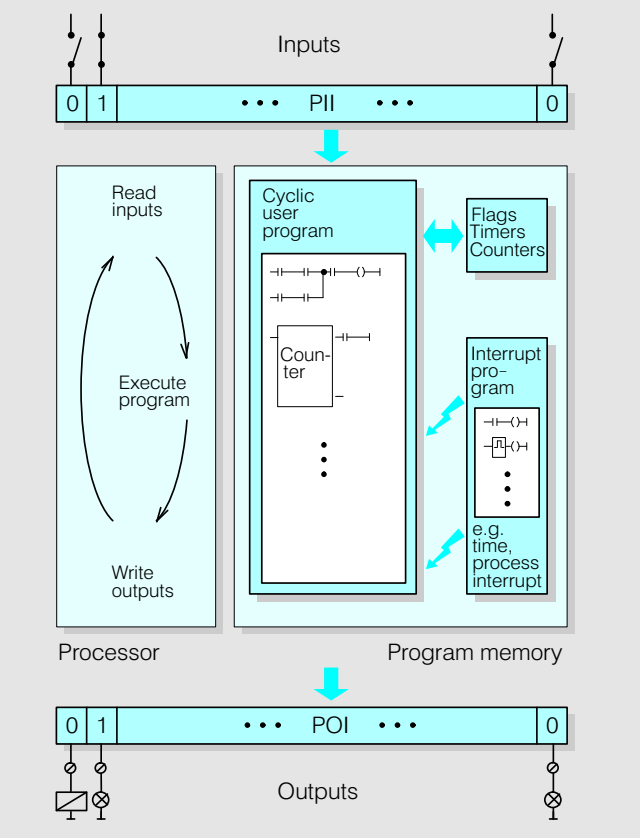


Fig. 3/4 Principle of operation of the S5-115U

Programming

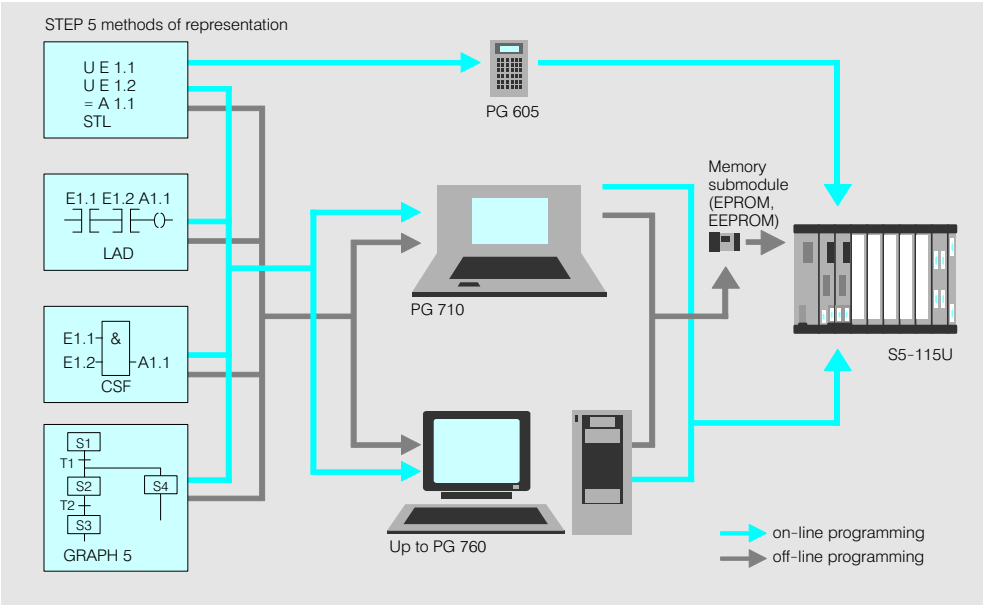


Fig. 3/5 Programming the S5-115U programmable controller

Programming language

The programming language for SIMATIC S5 programmable controllers is STEP 5 in one of the following representations:

- CSF - Control System Flowchart
- LAD - Ladder Diagram
- STL - Statement List

Programs for sequence control systems can be entered clearly in the form of a flow diagram using the GRAPH 5 software package.

Programmable controllers with CPU 945 can also be programmed in the SCL high-level language.

S5-115U (continued)

Programming devices

The following programming devices can be used for programming the S5-115U programmable controller:

- PG 605
- PG 720P
- PG 740
- PG 760

The programming devices have oper-ator prompting to facilitate programming and numerous aids for debugging and system start-up. A printer can be connected to the programmer for program documenting.

Program input

There are two ways of entering the user program:

- Direct program entry to the CPU in the central controller (on-line programming)
- Programming the memory cards or memory submodules (flash EPROM, EPROM and EEPROM) in the programming device without connecting it to the programmable controller. The memory card or memory submodule is then plugged into the CPU (off-line programming)

Program execution

Cyclic program execution

OB 1: The blocks of the user program are executed in the sequence specified in organization block OB 1.

Interrupt-driven program execution

OB 2 to OB 5: When certain input signal changes (process interrupts) occur, cyclic execution is interrupted at the next statement and an organization block assigned to this event is started. The user can formulate his response program to this interrupt in this organization block. Cyclic program execution is then resumed at the point at which it was inerrupted.

Time-controlled program execution

OB 10 to OB 13: The time when processing takes place depends on the call interval. This can be set between 1 ms and 1 min (CPU 945) or between 10 ms and 10 min (CPU 941 to CPU 944). It is therefore possible to process certain parts of the program independently of the scan time.

Time interrupt-controlled program execution

OB 6: After a specified period of time, a time interrupt is initiated and this organization block is called. Subsequent execution depends on the program contents of OB 6 defined by the user for this purpose.

The higher-priority execution levels (organization blocks) can interrupt the lower-priority execution levels after any STEP 5 operation. The order of priority is as follows (from the highest to the lowest priority): time interrupt-controlled, interrupt-controlled, time-controlled, cyclic.

S5-115U (continued)

3

Communication

Point-to-point connection

The communications processors enable the programmable controller to communicate with other programmable controllers, computers, operator control and process monitoring systems and peripherals via point-to-point connection.

They have their own memory for data, texts and displays. The communications processors handle data communications with the devices connected to them completely autonomously, thereby relieving the CPUs of time-consuming communications tasks.

For communication with computers, other programmable controllers and peripheral devices such as printers, either the CP 523, CP 524, CP 544 and CP 544B communications processors or the second interface of the CPU can be used (CPU 943, CPU 944, CPU 945).

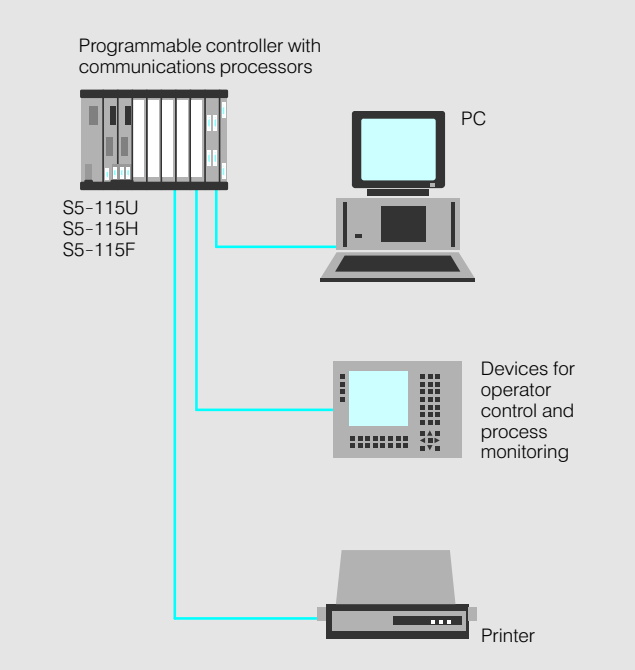


Fig. 3/6 Connections between programmable controller and PC, operator control and process monitoring equipment and printer

Communication with the equipment of the SIMATIC HMI operator control and process monitoring system is handled by the CP 526, CP 527 and CP 528 communications processors.

Local area networks

SINEC L1 local area network

SINEC L1 (Siemens Network Communication Low Range) makes it possible to configure a small, distributed automation system on the lower level of communications technology by simple means.

The S5-90U, S5-95U/F, S5-100U, S5-115U/H/F, S5-135U and S5-155U/H programmable controllers can be connected.

Features

- Up to 31 nodes
- Baud rate 9.6 kbit/s
- Max. coverage 50 km (31 miles)
- Transmission medium: twisted pair cable

PROFIBUS local area network

See Section 10.

Industrial Ethernet local area network

See Section 10.

S5-115U (continued)

Quality assurance procedures

To ensure correct operation of all SIMATIC S5 products and to prevent failures, extensive, cost-effective quality assurance procedures are carried out at every stage of the life of a product:

- During product planning
- During product development
- During production
- In product operation

Product planning

The product planning phase covers all the activities from market research to type specification. Quality assurance in the product planning phase ensures that the SIMATIC S5 product conforms to the right standards of quality required on the market.

Product development and production

The following are some examples of routing quality assurance precautions taken during development and production:

- Use of high-quality components
- Worst-case design of all circuits
- Systematic and computer-controlled testing of all components supplied by subcontractors
- Burn-in of all LSI circuits, e.g. processors and memories. Burning in is an aging process which helps to reduce the number of failures early in a product's life. The components are subjected to a high temperature for several hours in a burn-in cubicle
- Measures to prevent static charge from building up when handling MOS circuits
- Visual inspections at various stages of production
- In-circuit testing of all modules, i.e. computer-aided testing of all components and their interaction with other components in the complete circuit
- Continuous heat-run test at elevated ambient temperature over a period of several days
- Careful computer-controlled final testing
- Statistical evaluation of all failures to enable the immediate initiation of suitable corrective measures

Product operation

Even when the SIMATIC S5 products are in operation on the customer's premises, they are still under constant supervision. Extensive quality control precautions are taken in the following areas:

- Stockkeeping and despatch
- Service
- Field observation

Established methods are used in all these areas, which operate precisely, punctually and conscientiously, whilst also remaining flexible for special customer requirements.

Sometimes an even higher level of fault-tolerance or safety is required than that normally offered by the SIMATIC S5 U range. Fault-tolerant or failsafe programmable controllers, such as the S5-115H or S5-115F, are available for this purpose.

Availability

Availability is the probability of finding a system in a functional state at a specified point in time.

Safety

Safety is defined by DIN 31000 as "A state of lower risk than the permitted limit". The "permitted limit is the maximum acceptable degree of risk for a specific plant". The plant-specific degree of risk may be stipulated by law, by the plant operator or by an independent-body of experts, e.g. the German Technical Inspectorate (TÜV).

Installation guidelines

SIMATIC programmable controllers are designed for use in harsh industrial environments. To ensure correct operation of the equipment, it must be installed and connected in accordance with certain rules. Certain principles must also be observed as regards wiring, earthing and shielding.

Timely planning of the necessary measures for improving the electromagnetic compatibility (EMC) of the programmable controllers is advisable in order to avoid retrofitting. These rules are explained in the section entitled "Installation guidelines" in the relevant product manuals.

For the installation of failsafe controls, the relevant regulations must be observed.

S5-115H

3

Application

In many fields of automation, increasingly high demands are being placed on the availability and fault tolerance of programmable controllers (PLCs). Particularly in fields where a plant shutdown would be extremely expensive. In such cases, only redundant systems can offer the standard of availability required.

Fault-tolerant systems will normally continue to operate even if one or more faults cause parts or the control system to fail.

The S5-115H programmable controller consists of two inter-linked central controllers. It operates on the "master/slave" principle. One subunit, the master, controls the process. If a fault occurs, the other subunit, the slave, immediately takes over control.

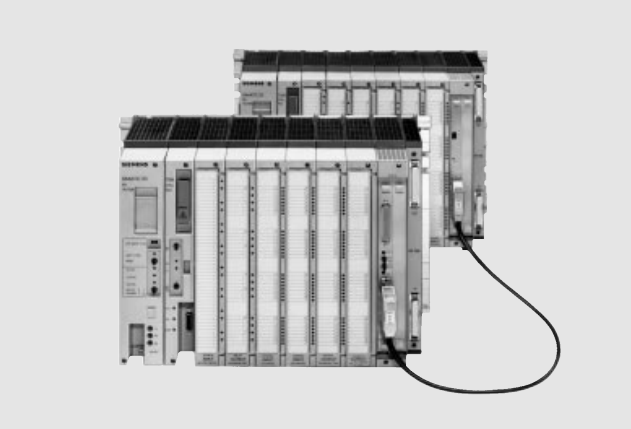


Fig. 3/7 S5-115H programmable controller

This ensures a high degree of fault tolerance, which makes the S5-115H especially suitable for applications in the following fields:

Fields with predominantly continuous processes, e.g.:

- Refineries
- Chemicals
- Power stations
- Steelworks
- Environmental protection (e.g. water treatment)
- Pipelines
- Off-shore installations

Areas of production employing batch processes, e.g.:

- The automotive industry
- The pharmaceutical industry
- The food industry
- In plants with flexible manufacturing systems
- In high-bay warehouses

The performance capability, user convenience and other technical features of the S5-115H fault-tolerant programmable controller correspond to a large extent to the features of the S5-115U.

Design

In the S5-115H programmable controller the central functions are always implemented in a redundant configuration. The I/Os can, however, also be configured with redundancy.

Three different levels of fault tolerance are possible, depending on the arrangement of the I/O modules:

- Normal fault tolerance (single-sided configuration)
- Enhanced fault tolerance (switched configuration)
- Maximum fault tolerance (fully redundant configuration)

Fig. 3/8 shows the configurations for the three levels of fault tolerance.

The different levels of fault tolerance can be combined as required.

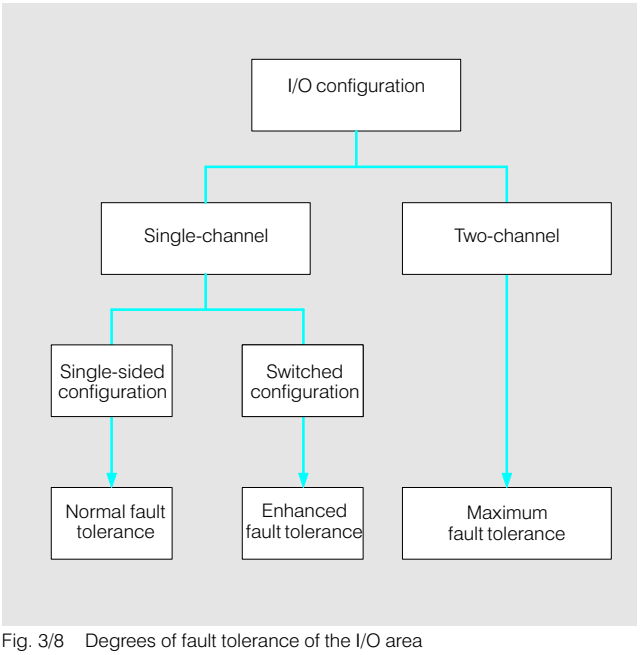


Fig. 3/8 Degrees of fault tolerance of the I/O area

S5-115H (continued)

Design (continued)

Normal fault tolerance
(single-sided configuration)

In the single-sided configuration (see Fig. 3/9) the I/Os are connected in single-channel mode and only addressed by one of the two subunits. The I/Os in this configuration can be plugged into either

- a central controller or,
- if the number of slots is not sufficient, expansion units.

Information read into the one subunit (e.g. from digital input modules) is automatically transmitted to the second subunit. It is immaterial whether one subunit is the master and the other the standby. What is important is whether or not the subunit which is connected to the I/Os is operational. In the event of a failure, the I/Os connected to the subunit concerned are also out of action.

This configuration is used for sections of a plant which do not require enhanced availability.

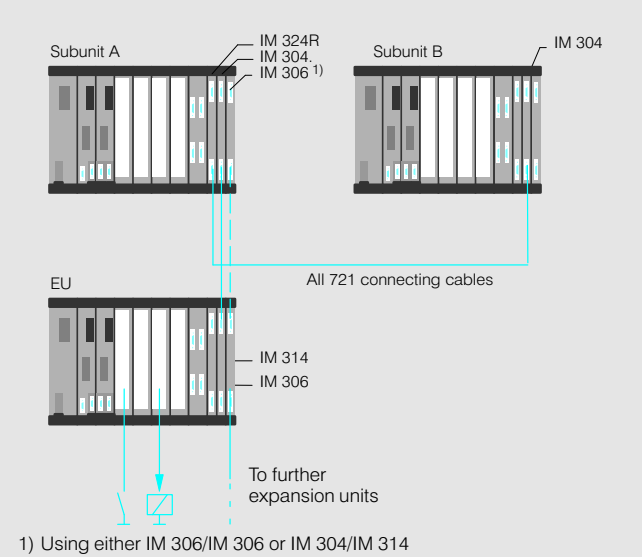


Fig. 3/9 Single-sided configuration (normal fault tolerance)

Enhanced fault tolerance
(switched configuration)

In the switched configuration (see Fig. 3/10) the I/Os are connected in single-channel mode, but they can be addressed by both subunits. The I/Os in this configuration must always be plugged into an expansion unit with an ER 701-3LH or EG 185U subrack.

Up to eight expansion units can be connected in switched configuration, distributed between up to two I/O bus lines.

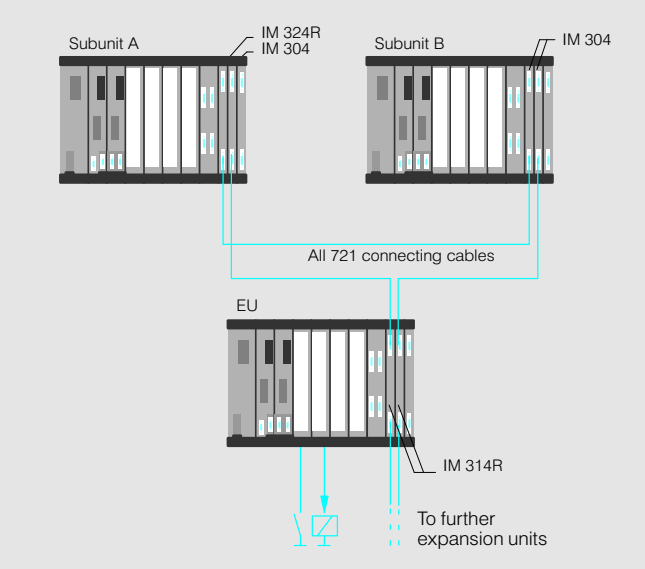


Fig. 3/10 Switched configuration (enhanced fault tolerance)

Expansion units in switched configuration are connected via the IM 304 interface module in the central controller and the IM 314R interface module in the expansion unit. The expansion units can also be expanded in a centralized configuration via the IM 306 interface module.

Expansion units in switched configuration are connected to both subunits and are addressed by the one currently acting as master.

This configuration is employed when failure of individual I/Os is not crucial.

S5-115H (continued)

3

Design (continued)

Maximum fault tolerance
(two-channel configuration)

In the two-channel configuration (see Fig. 3/11) identical I/Os are installed with the same addresses in both subunits. Inputs and outputs can be used in redundant configuration in both the central äcontroller and in additional expansion units. Both failure of central functions and failure of the I/Os on one channel can be tolerated. This configuration offers the maximum degree of availability.

The I/O modules in the redundant configuration must be made known to the operating system using the COM 115H parameterization software. The redundant I/O modules are addressed in the same way as single-channel I/O modules in the user program. The operating system does the rest.

The intelligent I/O modules and communications processors can also be used in two-channel, redundant configurations (see pages 3/53 and 3/56).

Expansion units can be connected to each central controller in the same way as for the S5-115U programmable controller, using the relevant interface modules (centralized and distributed configuration).

The ET 200 distributed I/O system can also be connected to the S5-115H programmable controller.

For further information on the configuration of the S5-115H fault-tolerant programmable controller, please see Section 11 (Configuring).

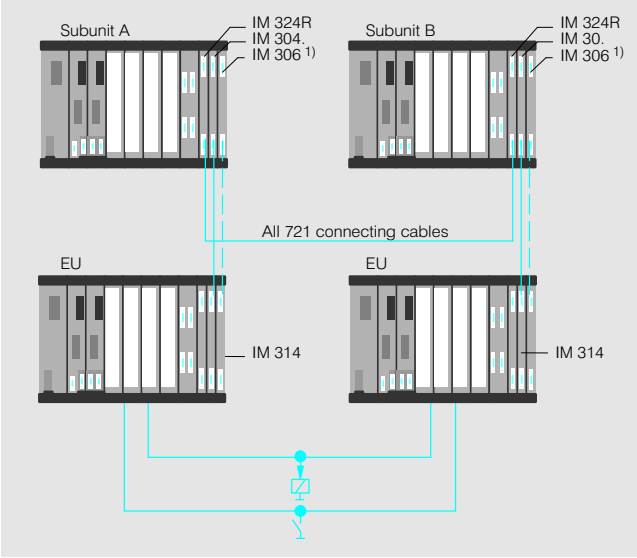


Fig. 3/11 Two-channel configuration (maximum fault tolerance)

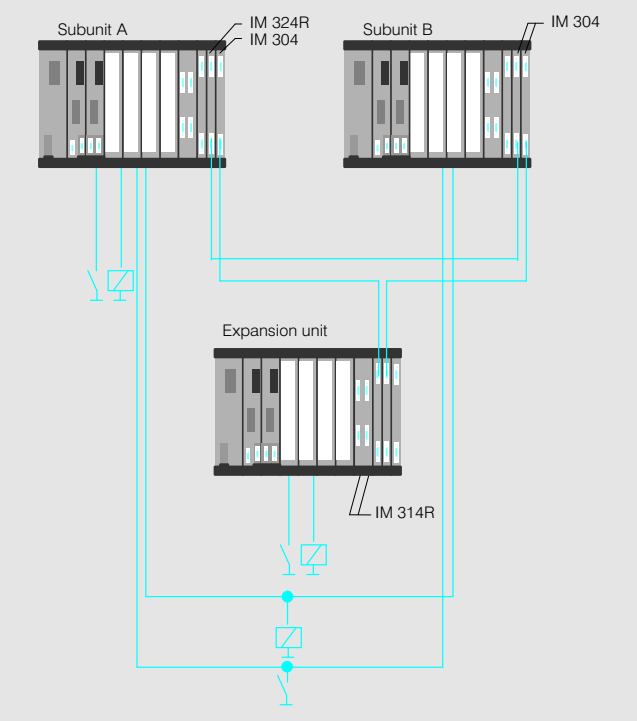


Fig. 3/12 Mixed configuration of an S5-115H

Mixed configuration

The different levels of fault tolerance can be combined as required. A mixed configuration (see Fig. 3/12), i.e. a combination of two-channel/redundant, switched and single-sided configuration is frequently the most economical solution.

S5-115H (continued)

Design (continued)

Redundancy of IPs and CPs

Intelligent I/O modules (IPs) and communications processors (CPs) can also be used redundantly. Both switched and two-channel redundant configurations are possible.

Criteria

Which configuration is the more suitable largely depends on the application.

Advantages of the switched redundant configuration:

- In the event of failure of one of the central controllers, the IPs/CPs retain their redundancy
- In the event of failure of one of the IPs/CPs, the central controllers retain their redundancy
- Shorter scan time

Disadvantages of the switched redundant configuration:

- At least two expansion units in switched configuration are required
- For repair of an IP/CP the expansion unit concerned needs be switched off. All the other I/O modules in the same expansion unit are therefore out of action.

Advantages of the two-channel redundant configuration:

- No expansion units in switched configuration are required
- For repair of IPs/CPs it is usually only necessary to disconnect redundant components from the power supply.

Disadvantages of the two-channel redundant configuration:

- Longer scan time

Switched redundant configuration

At least two units are required for the switched redundant configuration. An IP or CP of the same type must be installed in each expansion unit. When data is received by one IP or CP, it is automatically transmitted to the other subunit.

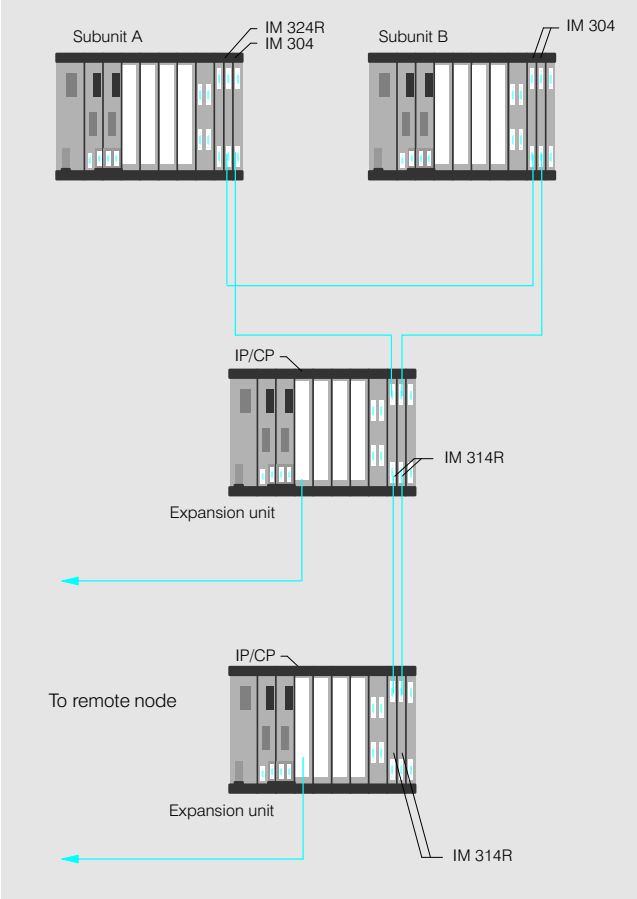


Fig. 3/13 IP/CP in switched redundant configuration

Two-channel redundant configuration

In the two-channel redundant configuration an IP or CP must be installed in each subunit. Unlike I/O modules in redundant configuration, the two IPs/CPs occupy different addresses or pages in the two subunits and operate independently of one another. When data is received by one IP or CP, it is automatically transmitted to the other subunit.

The redundancy function for the switched and two-channel redundant configurations must be programmed by the user. The user program defines which is the active IP or CP and must be able to detect a fault in one IP or CP in order to switch over to the other IP or CP if necessary. The operating system ensures that the data in the two subunits remains identical. The two IPs/CPs must be regarded as independent modules.

For further details, please see Configuring (Section 11).

S5-115H (continued)

3

Principle of operation

The principle of operation of the S5-115H fault-tolerant programmable controller can be compared with an "OR" operation. The programmable controller is in an operational state when at least one of the two subunits is functioning correctly (see Fig. 3/14).

Each of the central controllers contains a CPU 942H with a new firmware version compared with that of the CPU 942. This firmware performs all the additional functions of the S5-115H independently, e.g.:

- Data interchange
- Fault handling (switchover to standby)
- Synchronization of the two subunits
- Self-test
- Fault locating

The operating system of the S5-115H supports redundant operation of:

- Digital I/O modules
- Analog I/O modules

Data interchange and fault handling

Master-slave operation

The S5-115H basically operates on the master-slave principle in hot-standby mode (see right). One subunit, the master, controls the process. If a fault occurs, the other subunit, the standby or slave, takes over the control functions. The faulty subunit can then be repaired without interrupting the process.

The combined operation of the two subunits differs according to the I/O configuration:

- Switched configuration. The master controls the process whilst the slave merely runs on standby. If a fault occurs, the standby immediately takes over control

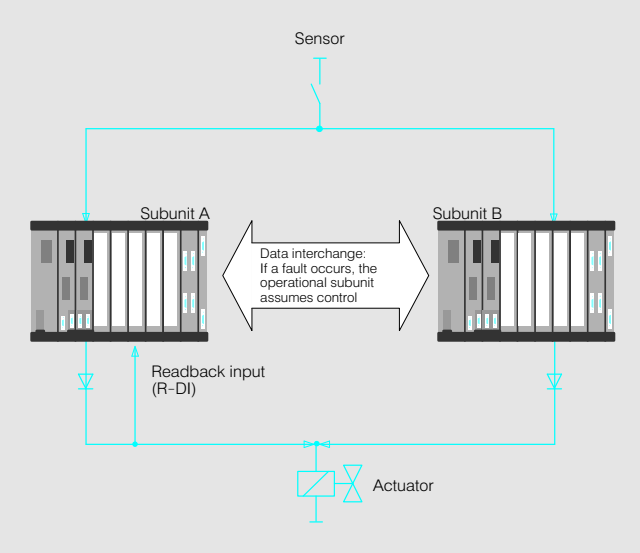


Fig. 3/14 Example of an S5-115H with redundant input and output

- Two-channel I/O configuration (fully redundant configuration). Both subunits control the process in parallel. The standby also issues output signals and reads in input signals. For further details please refer to Section 11

Hot-standby

Hot-standby is the ability to switch over to a standby device in the event of a fault automatically and without detremental effect. For operation in this mode it is absolutely essential that both subunits should be able to exchange data quickly and reliably. In the S5-115H the two subunits are normally linked by the central controller interface via which they are both supplied with:

- The same user program
- The same data blocks
- The same process I/O image contents
- The same receive buffer contents, e.g. when using communications processors

The standby unit is therefore always up to date and ready to take over control immediately if a fault occurs.

Synchronization

To avoid in switching over from master to standby, synchronization of the subunits is essential. This includes interchange and comparison of data to ensure that both units have the same information at their disposal. The synchronization procedure used for the S5-115H is "event-driven synchronization".

Event-driven synchronization is carried out every time an event occurs which could change the internal state of the subunits, e.g.

- Commands with direct access to the I/Os
- Block call commands
- Time function commands

When programming, the user does not need to think about synchronization because this is taken care of by the operating system.

S5-115H (continued)

Principle of operation (continued)

Self-test

Extensive self-test functions are implemented in the S5-115H programmable controller. The following components and functions are tested:

- Internal S5 bus
- Central controller link
- Fault location system
- CPUs
- Memories

Any faults detected during the self-test are reported.

Self-test on restart

Each subunit runs through all the self-test functions on restart.

Self-test in cyclic operation

For cyclic operation the operating system breaks down the self-test functions into short sections approximately 5 ms long. One or more of these are processed in a cycle. The number of sections per cycle is configured by the user.

Programming, parameter assignment

Programming

Programming of the S5-115H is the same as for the S5-115U. All STEP 5 operations allowed in the S5-115U can be used.

Both on-line and off-line programming are possible.

On-line programming

For on-line programming the programming device is connected to the CPU of one of the subunits. The program is auto-matically relayed to the other subunit.

Off-line programming

Off-line programming is possible using an EPROM submodule in the programming device without connecting it to the programmable controller. The submodule is then duplicated and plugged into the CPUs of both subunits.

Parameter assignment

The COM 115H parameterization software supports the user in parameter assignment and error diagnostics:

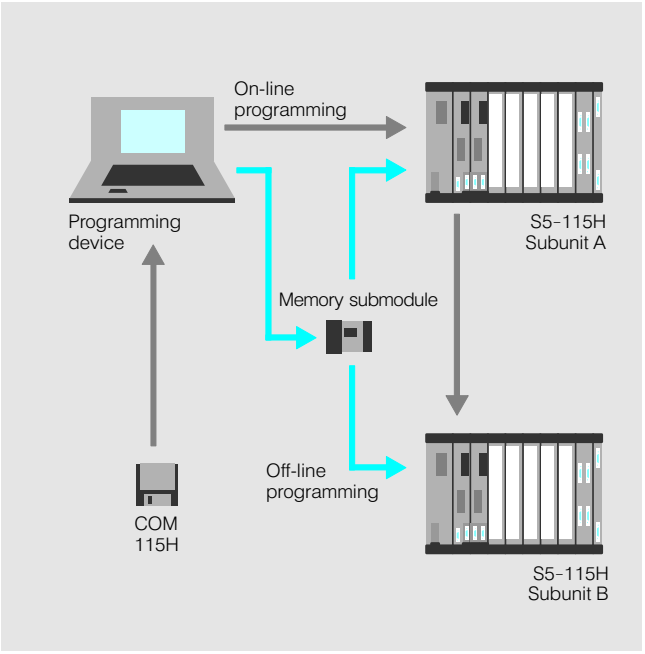


Fig. 3/15 On-line and off-line programming

- Interactive parameter assignment of data specific to the H version
- Generation of the parameter assignment data block from the parameter assignment data.
- System diagnostics using the error data blocks and the interrupt register
- Printout of data specific to the H version
- General system handling, e.g. loading blocks

S5-115H (continued)

3

Subracks for the S5-115H

Subracks for central controllers:

- CR 700-0LB
- CR 700-2
- CR 700-2F
- CR 700-3

Subracks for centralized expansion:

- ER 701-0
- ER 701-1

Subracks for distributed expansion:

- For single-sided or redundant configurations ER 701-2, ER 701-3 and ER 701-3LH
- For switched configurations ER 701-3LH and EG 185U

Interface modules for the S5-115H

In the S5-115H fault-tolerant programmable controller, interface modules are used for connecting expansion units in centralized and distributed configurations, for switched configurations and for linking the central controllers.

Configuration for	Interface module required in		
	Central controller	Expansion unit	
		Single-sided or redundant configuration	Switched configuration
Centralized expansion	IM 305 IM 306	IM 305, IM 306 in ER 701-0/1	—
Distributed expansion	IM 304	IM 314 in ER 701-2/3/3 LH	2 x IM 314R in ER 701-3LH or EG 185U

CPU for the S5-115H

A CPU 942H is required in both subunits of the S5-115H fault-tolerant programmable controller.

I/O modules for the S5-115H

The following I/O modules can be used for the S5-115H fault-tolerant programmable controller:

- I/O modules; all digital I/Os except for the 776 power output module; all analog I/Os
- Intelligent I/O modules; all intelligent I/Os except for the IP 241 digital position encoder
- Communications processors

For further information on the I/O modules which can be used, see Section 11.

S5-115F

Application

Safety is becoming more and more important in modern manufacturing processes. That is why systems which represent a danger to man, machine, production and the environment in the case of a fault must meet increasingly stringent safety requirements.

Redundant systems meet these safety requirements.

Failsafe systems deactivate the defective part immediately if a fault occurs. This does not, however, increase the availability.

Failsafe operation of the S5-115F programmable controller is achieved by comprehensive quality assurance measures and by:

- The two-channel, i.e. redundant structure with comparison of results via the central controller interface
- Self-tests performed by the operating system
- The failsafety-specific external interconnection of I/Os

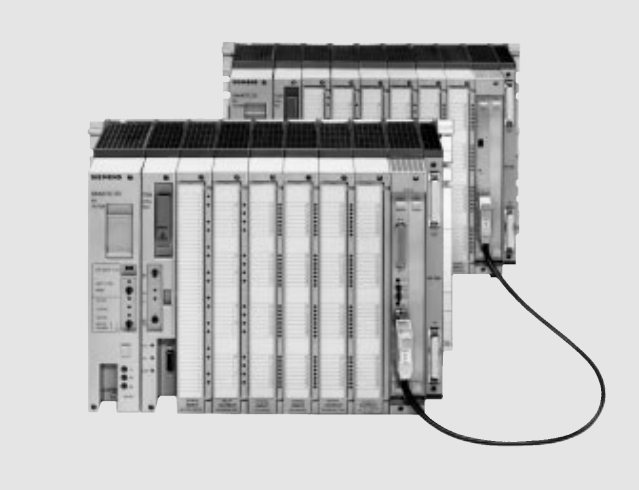


Fig. 3/16 S5-115F programmable controller

Requirement classes

The safety requirements which must be met by a control system are set down in DIN V 19250. This standard divides the control systems into eight safety requirement classes.

The requirement class for a certain application can be determined by means of the risk graph in accordance with DIN V 19250 shown in Fig. 3/17. Requirement class 1 represents the lowest safety requirements. Class 8 requires the highest safety standard.

The example illustrated in the risk graph shows how the requirement class fo a burner control is determined. From the four risk parameters (extent of damage, duration of stay in hazardous areas, danger prevention and probability of occurence) it is clear that the system must at least fulfill the conditions of requirement class 5.

In accordance with DIN V 19250, the failsafe S5-115F programmable controller corresponds to requirement class 6.

The S5-115F can therefore be used in the requirement classes 1 to 6.

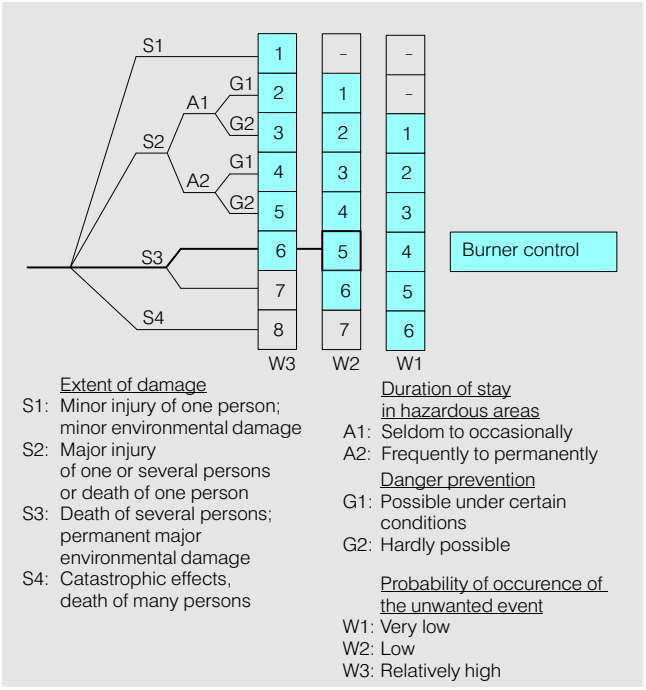


Fig. 3/17 Risk graph for the requirement classes in acc. with DIN V 19250 with examples of application

Applications for requirement class 6 include:

- Burner controls, e.g. in coal-fired power stations
- Passenger transport systems, such as cable railways, underground railways and fairground carousels
- Road traffic signal systems
- Telecontrol installations for gas and oil pipelines
- Environmental protection systems, e.g. pollutant filters
- Systems for the production of hazardous gases

S5-115F (continued)

3

Design

The S5-115F failsafe programmable controller consists of two interlinked central controllers. Only prototype-tested components may be used (see Section 11).

I/O configuration

The central functions of the S5-115F programmable controller are always redundant. For the I/O modules, a distinction is made between "safety-related" and "non-safety-related" areas.

Safety-related areas

In "safety-related" areas the I/O modules must always be in a two-channel, redundant configuration (see Fig. 3/18). This can be implemented in the central controllers or in expansion units. The operating system must be informed of which I/O modules are available in redundant configuration using the COM 115F parameter assignment software. The redundant I/O modules are addressed as single-channel I/O modules in the user program. The operating system does the rest.

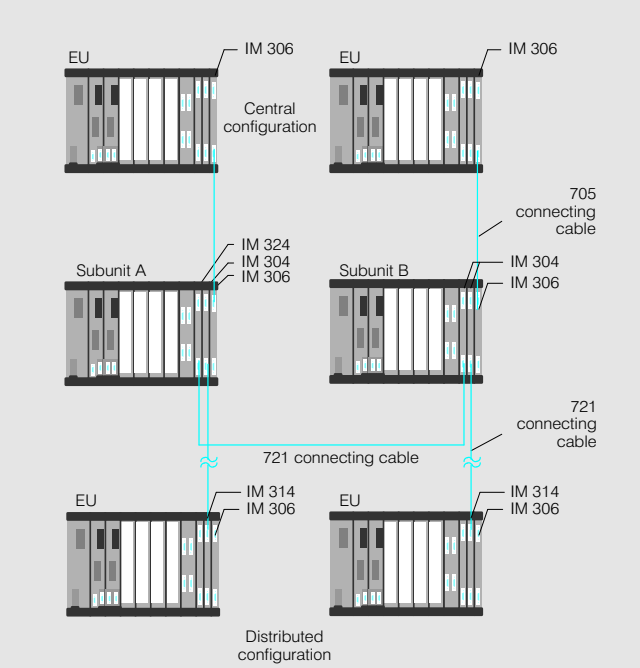


Fig. 3/18 Two-channel (redundant) I/O configuration (failsafe)

Non-safety-related areas

In "non-safety-related" areas single-channel configuration of the I/O modules is sufficient (see Fig. 3/19).

The two-channel/redundant and single-channel configurations can be combined with one another. The I/Os in single-channel configuration can be allocated to the two subunits as desired.

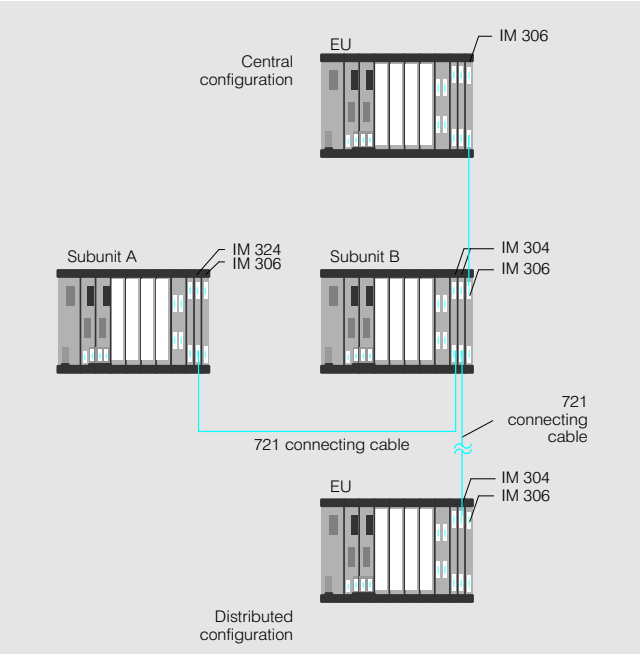


Fig. 3/19 Single-channel I/O configuration (failsafe in central controller, non-failsafe in expansion unit)

S5-115F (continued)

Principle of operation

The principle of operation of the failsafe S5-115F programmable controller can be compared with an "AND" logic operation. It is in the operating state only when both subunits operate properly.

The two central controllers each contain a CPU 942F with firmware that is different from that of the S5-115U. This firmware executes all additional functions of the S5-115F independently as, for example:

- Data exchange and response to errors
- Synchronization
- Self-test

The failsafety of the I/O is ensured by the external interconnection of sensors and actuators (see Fig. 3/20 and Configuring in Section 11).

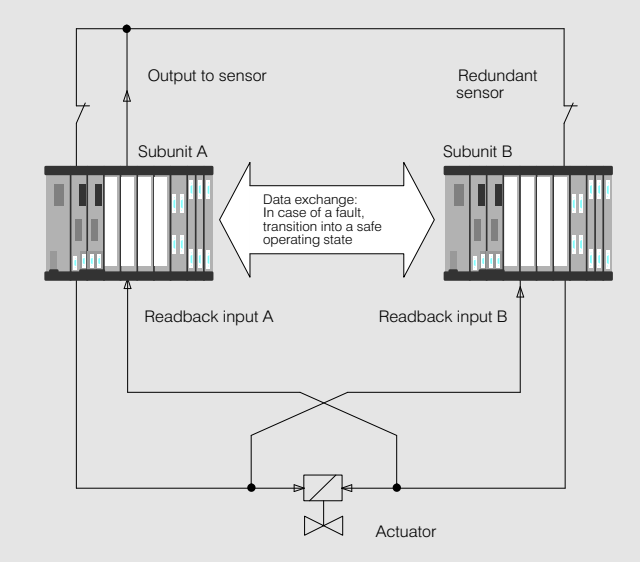


Fig. 3/20 Example of an S5-115F with safety-oriented input and output

Data exchange and response to errors

Both subunits can exchange data rapidly and reliably via the central controller interface, for the following purposes:

- Comparison
- Synchronization
- Passivation (switching off of functions)

Both subunits operate synchronously with the same user program. They carry out a cyclic comparison of:

- Their input signals
- Their output signals
- Other data, such as the timers and counters

Differences in the results of the two subunits indicate an error. A response to that error is then initiated. In the case of the failsafe S5-115F programmable controller this response and other protective functions have to be determined in the COM 115F parameter assignment software.

The following error response options are available:

- The entire unit is switched to STOP
- Only the defective components are deactivated
- User program response

Comparison of inputs

After reading the input signal states, the two subunits compare their process images. If they detect any differences between their process images, they read the input signals again – several times, if necessary – until the dis-crepancy time expires. If there are still any discrepancies between the two process images at that point, this indicates either an external or internal fault. The programmable controller immediately initiates the response to this error. The user can program the response and the discrepancy time himself as agreed with the acceptance authorities.

Comparison of outputs

At the end of one cycle, the two subunits compare their process images again. Different results indicate an internal fault. The selected error response is then initiated.

Comparison of further data

In addition, the two subunits compare

- The current state of timers and counters
- The current state of the logical program counter and, if necessary,
- The data from the SINEC L1 link

S5-115F (continued)

3

Principle of operation (continued)

Synchronization

Both subunits must be continuously synchronized. That is why synchronization points are provided at the beginning and end of each program cycle and at every 20 ms in the operating system. At these points, data are exchanged and compared with each other.

During user program execution, the S5-115F subunits are also synchronized with the following events:

- Direct I/O accesses and clock scans; After such commands, the operating system automatically synchronizes both subunits
- Process and time interrupts; Process and time interrupts are processed only after a synchronization. At the operating system level, the S5-115F responds to an interrupt after a maximum of 20 ms. During user program execution the user himself must ensure synchronization by means of a standard function block.

Self-test

Extensive self-test functions are implemented in the S5-115F failsafe programmable controller.

The following components are tested:

- Internal S5 bus
- Central controller interface
- Processors
- Memory
- All redundant I/Os

These self-tests can even detect errors which have occured in both subunits simultaneously.

Self-test during initialization

During initialization in failsafe operation, the whole range of selt-test functions is run through completely in each subunit.

Self-test in cyclic operation

For cyclic operation, the operating system splits up the self-test functions into small test segments. Depending on the number of I/Os these are between 5 and 140 ms long. The number of test segments per cycle is determined by the user through the setting of the test cycle time.

Programmming and parameter assignment

Programming

With the exception of certain restrictions, programming of the S5-115F is identical to that of the S5-115U. Program input can either be on-line or off-line (see S5-115H, page 3/14).

For on-line programming the CPUs of both subunits must be provided with the same memory submodule.

Frequently used functions, such as arithmetic and signalling functions, safety-oriented interfacing or burn control are available in the package of prototype-tested standard function blocks. These function blocks have already been tested by the German Technical Inspectorate (TÜV) and therefore facilitate the system acceptance procedure (see Section 7).

Note

In the failsafe mode, the control program must be stored on an EPROM or EEPROM submodule.

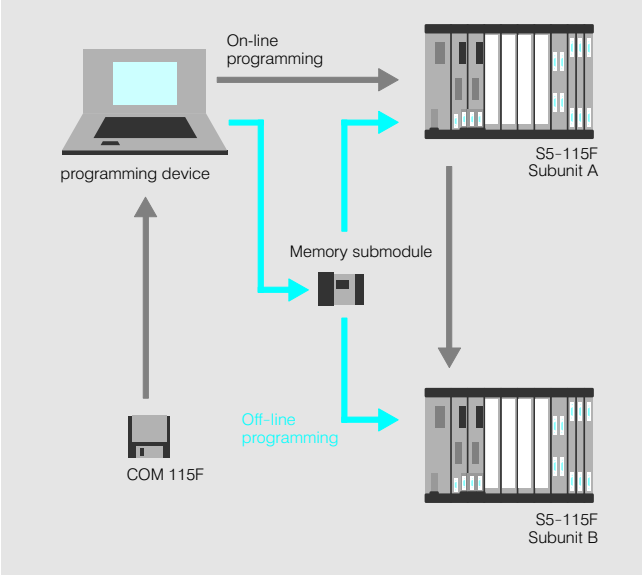


Fig. 3/21 On-line and off-line programming

Parameter assignment

The COM 115F parameterization software supports the user in parameter assignment and error diagnostics:

- Parameter assignment of safety-specific data in interactive mode
- Generation of the parameterization data block from the parameter assignment data
- System diagnostics via error data block and interrupt register
- Documentation of safety-specific data via printer
- General system handling, e.g. loading of block or reading of data
- Failsafe communication via SINEC L1 LAN

S5-115F (continued)

Communication

Point-to-point link

A point-to-point link with the S5-115F programmable controller is made possible using the CP 523 communications processor. It is primarily used for

- Connection of printers, VDUs, keyboards, etc.
- Data exchange with other SIMATIC-S5 units
- Failsafe data exchange with the S5-115F
- Data exchange with any unit with a 20 mA (TTY) interface

For further details of the CP 523 communications processor see Section 4.

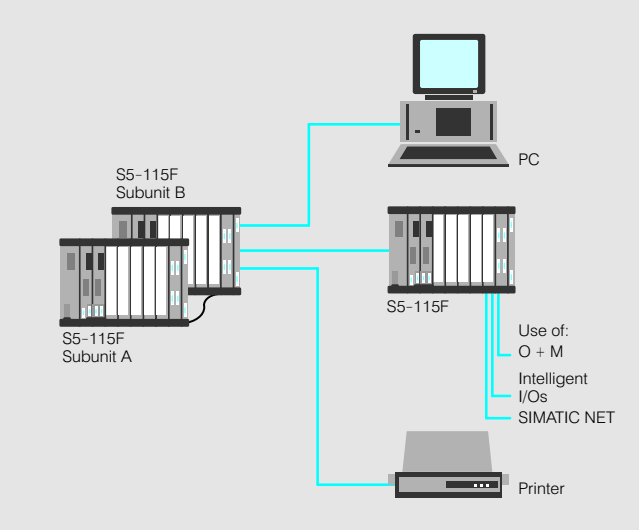


Fig. 3/22 Point-to-point link of the S5-115F with a CP 523 or via a programming device interface

SINEC L1 local area network

The moderately priced SINEC L1 local area notwork, which is designed for extensive communications networks, enables up to 30 S5-115F and S5-95F programmable controllers to communicate with each other. The PLCs are connected to the LAN via the CPU of one of the two subunits.

Features

- S5-115U, S5-135U or S5-155U programmable controllers with CP 530 communications processors or other devices with SINEC L1 master capability (e.g. PCs) can be used as active nodes (masters)
- The S5-115F and S5-95F programmable controllers can be operated and interrogated from the master
- SINEC L1 operation is reaction-free, i.e. faults of the individual nodes that might have occured are not transfered
- Intelligent I/O modules and communications processors can be used in the master units

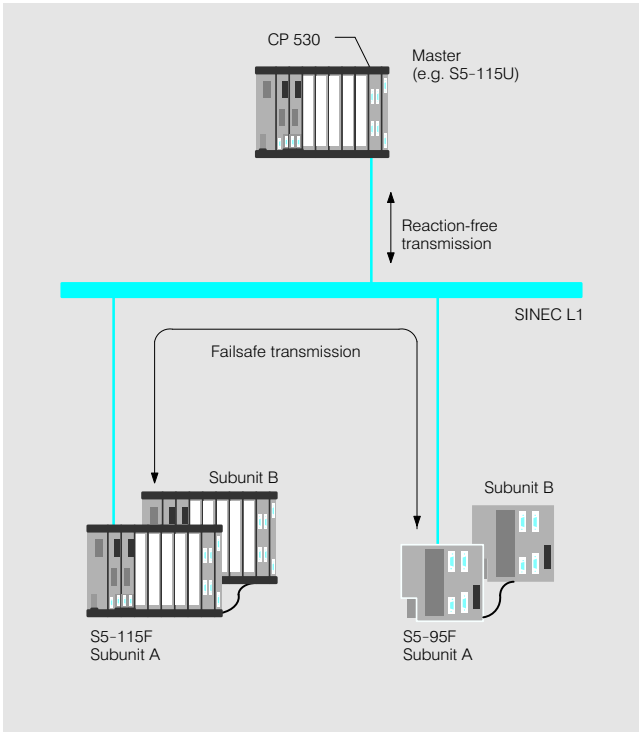


Fig. 3/23 Single-channel, safety-oriented link

The S5-115F failsafe programmable controllers can use these modules via the SINEC L1 LAN

- A failsafe link with the S5-95F programmable controller is also possible

S5-115F (continued)

3

Communication
(continued)
SINEC L1 local area network
(continued)

Possible configurations

Single-channel, non-safety-related link

The non-safety-related link is used for communication between programmable controllers of the U range (as master or slave) and failsafe S5-115F or S5-95F programmable controllers (as slaves).

Single-channel, safety-related link

The safety-related link can be established only with a programmable controller of the U range as master.
Safety-related links can only be established with S5-115F or S5-95F programmable controllers. The S5-115F failsafe programmable controllers are connected to the LAN via one of the two subunits. Data exchange is carried out by means of special protocols which are in accordance with the safety requirements. The connection to the master is not safety-related but only reaction-free.

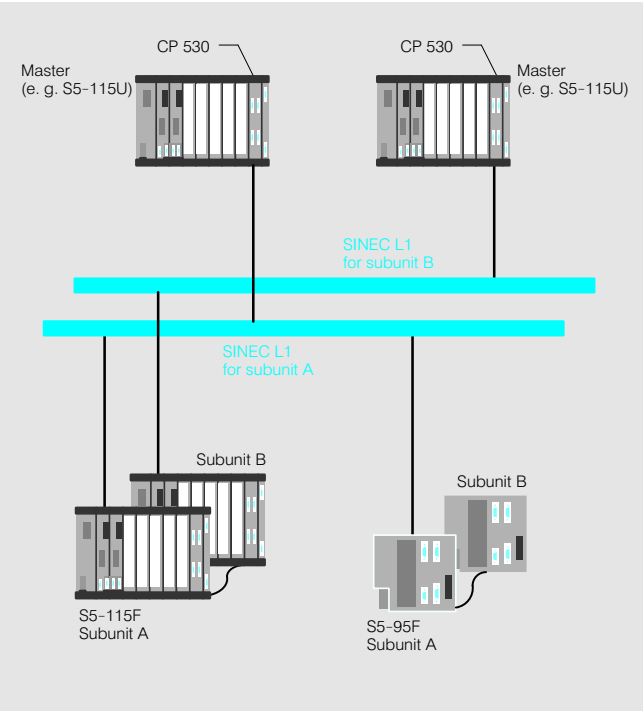


Fig. 3/24 Two-channel, safety-related link

Two-channel safety-related link

Data exchange is carried out in the same way as with the single-channel, safety-related link. The difference is that each subunit is connected to its own local area network. Both local area networks operate independently; merely the contents of the send and receive buffers of the two subunits are cyclically compared with each other. Failure of one LAN (e.g. through line interruption) does not interrupt data exchange, as there remains a single-channel, safety-related link via the other still functioning LAN.

PROFIBUS local area network

With the CP 541 communications processor (see Section 2) the S5-115F programmable controller can be connected to the PROFIBUS LAN. Thus, communication with the whole range of SIMATIC programmable controllers is possible.

Like in the case of the SINEC L1, data transmission takes place reaction-free and the same types of link

- Single-channel, non-safety-related link
- Single-channel, safety-related link and
- Two-channel, safety-related link

can be realized.

Operator-control and process monitoring

For the S5-115F programmable controller devices for operator control and process monitoring can be used, if they are connected via the CP 523 communications processor. It is also possible to connect the programming device terminal of the S5-115F in series with another SIMATIC S5 programmable controller of the U range, e.g. via the second programming-device terminal of a S5-115U.

The S5-115F programmable controller can be linked to devices for operator control and process monitoring via the SINEC L1 LAN.

A direct connection of TDs/OPs to the programming device interface of the S5-115F is not possible.

For further information on operator control and process monitoring systems, see Section 10 and Catalogs ST 80.

S5-115F (continued)

Subracks for the S5-115F

Subracks for central controllers:

- CR 700-0LB
- CR 700-2F

The components to be used with the S5-115F subracks partly differ from those of the S5-115U subracks (see Section 11). Only prototype-tested modules may be installed into the S5-115F failsafe programmable controller.

Subracks for centralized expansion:

- ER 701-1
- ER 701-2 and ER 701-3, each without power supply

Subracks for distributed expansion:

- ER 701-2
- ER 701-3

Interfaces modules for the S5-115F

In the S5-115F failsafe programmable controller, interface modules are used for connecting expansion units in centralized and distributed configurations, for switched configurations and for linking the central controllers.

Configuration for	Interface module required in	
	Central controller	Expansion unit
Centralized expansion	IM 306	IM 306 in ER 701-1/2/3
Distributed expansion	IM 304	IM 314 in ER 701-2/3

CPU for the S5-115F

A CPU 942F is required in both subunits of the S5-115F failsafe programmable controller.

I/O modules for the S5-115F

The operating system of the S5-115F supports the use of

- Digital input modules
  6ES5 430-7LA12
  6ES5 434-7LA12
  6ES5 435-7LC11
  6ES5 436-7LC11
- Digital output modules
  6ES5 451-7LA12
  6ES5 454-7LA12
  6ES5 454-7LB11
  6ES5 456-7LB11
  6ES5 458-7LA11[1)]
  6ES5 458-7LB11
  6ES5 453-4UA12
- Digital input/output modules
  6ES5 482-7LA11
  6ES5 482-7LF11
  6ES5 482-7LF21
  6ES5 482-7LF31
- Analog input modules
  6ES5 460-7LA13
  6ES5 463-4UA12
  6ES5 463-4UB12
- Analog output modules
  6ES5 470-7LA12
  6ES5 470-7LB12
  6ES5 470-7LC12

The CP 523 communications processor can also be used for the S5-115F. The CP 523 is used as:

- Fault indication module
- Safe communications module to further S5-115F programmable controllers
- Reaction-free communications module to other systems

Moreover, the communications processors and intelligent I/O modules in a programmable controller of the U range can exchange data with the S5-115F programmable controller via the SINEC L1 or PROFIBUS LAN. Nevertheless, they cannot be plugged directly into the S5-115F.

Note

When using other modules in the S5-115F, the operating permission expires.

1) For new systems the use of the 6ES5 453-4UA12 module is suggested.

3

CPU 941, CPU 942, CPU 943 and CPU 944 central processing units for the S5-115U

Application

The selection of the CPU to be used depends on the technical requirements of the automation task, especially with regard to processing times, memory capacities and functions. These criteria are the most important distinctive features of the CPUs.

The CPU 941, CPU 942, CPU 943 and CPU 944 can be programmed in the STEP 5 programming language. For programming under GRAPH 5 the standard function block of the same name is required.

Design

The CPU 941 to CPU 944 central processing units contain:

- STEP 5 processor for processing the user program
- Internal program memory (RAM)
- Integral hardware clock (in CPUs with 2 interfaces)
- Receptacle for 375 memory submodule (RAM/EPROM/EEPROM)
- RUN/STOP switch with corresponding LEDs
- Switch for setting retentiveness of bit memories, timers and counters
- Switch for overall reset (resetting the entire user RAM of the CPU)
- Built-in 20 mA (current loop) interface for connection of a programming device or operator panel or for connection to the SINEC L1 LAN
- CPU 943 and CPU 944 only: Optional 2nd interface for connection of a programming device or operator panel or for connection to the SINEC L1 LAN

Not all programming device functions can be used at the 2nd interface. Transmission without protocol is possible with the ASCII driver. On the CPU 944, the 2nd interface can also be used for links employing the 3964 or 3964R communications protocol (special operating system, to be ordered separately).

RAM submodules extend the internal RAM and are required for this purpose in the CPU 941 and CPU 942. When the RAM submodules are removed from their receptacles in the CPU, the data is erased. The CPU 943 and CPU 944 are already equipped with the necessary amount of RAM.

Programs and data can be stored on 375 memory submodules (EPROM or EEPROM) to protect them from power failures. The memory submodules are programmed on the programming device using the receptacle provided for this purpose and are then plugged into the CPU.

Functions

The functions of the CPU 941, CPU 942, CPU 943 and CPU 944 are as follows:

Program execution

- Cyclic (OB 1): Read-in of input statuses, execution of the control program and output of the output statuses
- Time-controlled (OB 10 to OB 13): Four independent levels for which the time of processing can be individually defined (times from 10 ms to 1 min).
- Interrupt-controlled (OB 2 to OB 5): Activation of four independent execution levels by process interrupts
- Time interrupt-controlled (OB 6): This level is activated after expiry of a programmed time (times from 3 ms to 1 min)

Execution levels of higher priority can interrupt those of lower priority after any STEP 5 operation (order of priority starting with the highest: time interrupt-controlled, interrupt-controlled, time-controlled, cyclic.

Monitoring

The CPUs monitor scan time, battery failure, or acknowledgement delay, for example.

Software protection for RAM operation

The software protection feature prevents inadvertent overwriting or read-out of programs by unauthorized persons.

Scan time measurement

The current, maximum and minimum scan times are measured.

CPU 941, CPU 942, CPU 943 and CPU 944 central processing units for the S5-115U (continued)

Functions
(continued)

Clock
The clock can be set and read. It can also be used for counting operating hours or for interrupt functions.

Integral function blocks
The operating system incorporates a number of function blocks programmed in machine language, which can execute at extremely high speed and do not occupy any space in the internal RAM. These integral function blocks are called in the same way as any other blocks in the user program and can only be interrupted by process interrupts.

- Conversion blocks (BCD code converters)
- Arithmetic blocks (multiplication, division)
- Analog value processing
- Data handling blocks (these enable communications processors and intelligent I/O modules to be used and control the exchange of data with the CPU)
- COMPR function block for compressing the contents of the internal RAM
- DELETE function block (for deleting blocks)

Integral organization blocks
- Scan time triggering
- Variable time loop (range 160 µs to 65 ms)
- PID control algorithm
- Scan cycle-independent read-in of digital inputs and ouput of the process I/O image

Restart modes
- Manual cold restart using mode selector or programming device
- Cold restart following power failure

COM DB1 parameterization software
The COM DB1 parameterization software enables the user to assign parameters to the CPU quickly and easily and without errors. The software correctly applies all the rules for creating DB1. Any errors in DB1 or input errors are pointed out to the user. Further data blocks rendered necessary by the parameters of DB1 can also be created with COM DB1.

COM DB1 cannot be used for assigning parameters to the second interface of CPU 943 and CPU 944.

For technical specifications, see page 3/25.

Ordering data	Order No.		Order No.
CPU 941	**6ES5 941-7UB11**	**3964, 3964R communications protocol** as an extension to the operating system for the CPU 944	**6ES5 816-1BB21**
CPU 942	**6ES5 942-7UB11**		
CPU 943			
With 1 serial interface	**6ES5 943-7UB11**		
With 2 serial interfaces	**6ES5 943-7UB21**		
CPU 944			
With 1 serial interface	**6ES5 944-7UB11**		
With 2 serial interfaces	**6ES5 944-7UB21**		
To be ordered as a separate item:		**375 memory submodules**	
S5-115U manual (CPU 941 to CPU 944) with operating instructions for power supply modules, CPUs, digital and analog input/output modules, EU interface modules and programming instructions		EPROM 8 Kbyte	**6ES5 375-1LA15**
		EPROM 16 Kbyte	**6ES5 375-1LA21**
		EPROM 32 Kbyte	**6ES5 375-1LA41**
		EPROM 64 Kbyte[1), 2), 5)]	**6ES5 375-1LA61**
		EPROM 128 Kbyte[1), 2), 3), 5)]	**6ES5 375-1LA71**
		EEPROM 8 Kbyte	**6ES5 375-0LC31**
		EEPROM 16 Kbyte	**6ES5 375-0LC41**
		RAM 8 Kbyte[3), 4)]	**6ES5 375-0LD11**
		RAM 16 Kbyte[3), 4)]	**6ES5 375-0LD21**
		RAM 32 Kbyte[1), 3), 4)]	**6ES5 375-0LD31**
German	**6ES5 998-0UF13**	**Standard function blocks** GRAPH 5/II, S5-115U closed-loop control	see Section 7
English	**6ES5 998-0UF23**		
French	**6ES5 998-0UF33**	**Programming software** GRAPH 5/II	see Section 7
Spanish	**6ES5 998-0UF43**		
Italian	**6ES5 998-0UF53**	**COM DB1 parameter assignment software**	see Section 7
S5-115U quick reference guide for CPU 941 to CPU 944		**COM REG S5-115U parameter assignment software**	see Section 7
German	**6ES5 997-7LA11**		
English	**6ES5 997-7LA21**		
French	**6ES5 997-7LA31**		
Spanish	**6ES5 997-7LA41**		
Italian	**6ES5 997-7LA51**		

1) Not suitable for CPU 941
2) Not suitable for CPU 942
3) Not suitable for CPU 943
4) Not suitable for CPU 944
5) Not suitable for CPU 942F

CPU 945 central processing unit for the S5-115U

Application

The CPU 945 is a new addition at the high end of the spectrum (CPU 941 to CPU 944). It is particularly suitable for fast, highly complex and calculation-intensive automation applications. Tasks are shared between several internal processors, enabling control tasks and communications tasks to be executed at the same time.

Interrupt response times are extremely short. In addition to STEP 5, the high-level language SCL can also be used for programming the CPU 945 (see Section 7). Even lengthy, complicated programs can therefore be written and edited clearly and easily.

Design

In addition to the points listed under CPU 941 to CPU 944, the module contains:

- STEP 5 processor with floating-point coprocessor
- Bus controller for autonomous handling of communications via the S5 internal backplane bus
- Microcontroller for interface communications
- Integral hardware clock
- Receptacle for memory card
- Slot for one of the following interface modules: programming device interface module, V.24 module, 20 mA (current loop) module, RS 422-A/RS 485 module, SINEC L1 module

Memory cards based on flash EPROMS (electrically erasable) are used in place of memory submodules.

Instead of a fixed second interface, a slot is provided for a replaceable interface module with a selection of different types.

Functions

The CPU 945 has the same basic function scope as the CPU 941 to CPU 944 with the following exceptions:

Program execution

The call interval for time-controlled program execution can be set between 1 ms and 1 min.

Monitoring

A monitoring facility for collision of two timed interrupts is also installed.

Process I/O image transfer

- DELTA transfer (parameter-selectable): When transferring the process output image, only the data which has changed since the last cycle is transferred
- Parallel process I/O image transfer (parameter-selectable): the process I/O image is updated parallel to cyclic program execution

Changing the operating system

The operating system of the CPU can be reloaded with the programming device, either via the PROFIBUS, the Industrial Ethernet or using Teleservice.

Integral function blocks

There is an PID control algorithm integrated in the operating system. Additional standard function blocks are available (see Section 7).

The CPU 945 can also process function and data extension blocks (FX and DX).

For technical specifications, see page 3/25.

Ordering data

	Order No.
CPU 945	
With 256 Kbyte RAM	**6ES5 945-7UA13**
With 384 Kbyte RAM	**6ES5 945-7UA23**
S5-115U quick reference guide for CPU 945	
German	**6ES5 997-7LB11**
English	**6ES5 997-7LB21**
French	**6ES5 997-7LB31**
Memory card for CPU 945	
128 Kbyte flash EPROM	**6ES5 374-1KG11**
256 Kbyte flash EPROM	**6ES5 374-1KH21**
512 Kbyte flash EPROM	**6ES5 374-1KJ11**

	Order No.
Interface modules	
20 mA module	**6ES5 752-0LA12**
V.24 module	**6ES5 752-0LA22**
RS 422-A/RS 485 module	**6ES5 752-0LA42**
programming device module	**6ES5 752-0LA52**
SINEC L1 module	**6ES5 752-0LA62**
Programming adapter for memory cards (for programmers without integral adapter only)	**6ES5 985-2MC11**
Parameter assignment software	see Section 7
To be ordered as a separate item: **Manual for the S5-115U with CPU 945**	
German	**6ES5 998-3UF11**
English	**6ES5 998-3UF21**
French	**6ES5 998-3UF31**
Italian	**6ES5 998-3UF51**

CPU 941, CPU 942, CPU 943, CPU 944 and CPU 945 central processing units for the S5-115U

Technical specifications

CPU		CPU 945	CPU 944	CPU 943	CPU 942	CPU 941
Memory capacity						
• Total	max.	256/384 Kbyte	96 Kbyte	48 Kbyte	42 Kbyte	18 Kbyte
• Internal RAM		256/384 Kbyte	96 Kbyte	48 Kbyte	10 Kbyte	2 Kbyte
• Submodule/memory card						
RAM/EPROM/EEPROM	max.	—	—/128[1]/16Kbyte	—/64[1]/16 Kbyte	32/32/16 Kbyte	16/16/16 Kbyte
Flash EPROM	max.	256/512[1] Kbyte	—	—	—	—
Memory extension with CP 516/CP 581		8/120 Mbyte	8/120 Mbyte	8/120 Mbyte	8/120 Mbyte	8/120 Mbyte
Programming language		STEP, SCL	STEP 5	STEP 5	STEP 5	STEP 5
Types of blocks		Organization blocks (OB), programming blocks (PB), function blocks (FB), sequence blocks (SB), data blocks (DB)				
		FX, DX	—	—	—	—
Number of blocks	max.	256 per block type				
Block nesting depth	max.	50	32	32	32	32
Program execution		Interruption possible after any STEP 5 operation				
• Cyclic		Yes				
• Time-controlled		4 execution levels OB 10 to OB 13				
Call interval		1 ms to 1 min	10 ms to 10 min			
• Interrupt-controlled		4 execution levels OB 2 to OB 5				
• Time interrupt-controlled		1 execution level OB 6				
Monitoring functions		Coll. 2 timed interr.	—	—	—	—
		Timeout, I/O error, acknowledgement delay, substitution error in FB/FX, transfer error in DB/DX, battery failure				
Execution time for						
• Bit operations		0.1 µs	0.8 µs	0.8 µs	1.6 µs	1.6 µs
• Load and transfer (data)		0.2 µs	1.5 µs	1.5 µs	3.0 µs	3.0 µs
• Timer/counter operations		0.1 µs	1.8 µs	1.8 µs	3.7 µs	3.7 µs
• Data word comparison		0.1 µs	0.8 µs	0.8 µs	1.6 µs	1.6 µs
• Substitution operations		0.5 µs	3.6 µs	160 µs	160 µs	160 µs
• Block call operations		0.1/1.0 µs	0.8/3.6 µs	0.8/3.6 µs	1.6/6.7 µs	1.6/6.7 µs
Fixed point arithmetic						
• Addition, subtraction		0.1 µs	0.8 µs	0.8 µs	1.6 µs	1.6 µs
• Multiplication		0.35 µs	[2]	[2]	[2]	[2]
• Division		0.4 µs	[2]	[2]	[2]	[2]
Floating-point arithmetic						
• Addition, subtraction, multiplication		0.75 µs	[2]	[2]	[2]	[2]
• Division		1.35 µs	[2]	[2]	[2]	[2]
Interrupt response time	typ.	50 µs	2 ms	2 ms	2 ms	2 ms
Principle supplementary functions						
• Software protection, scan time measurement		Yes				
• Scan time monitoring		Selectable as required				
• Real-time clock		Integral	Optional[3]	Optional[3]	—	—
• PID control algorithm		—	Integral	Integral	Integral	Integral
Flags/S flags		2048/32768	2048/-	2048/-	2048/-	2048/-
		All, half or none of which retentive, as required				
Nesting levels		6 (for binary logic operations)				
Timers						
• Number		256	128	128	128	128
• Range		0.01 to 9990 s, all, 64 or none of which retentive, as required				
Counters						
• Number		256	128	128	128	128
• Range		0 to 999 (up/down), all, 64 or none of which retentive, as required				
Digital inputs/outputs		4096/4096	4096/4096	4096/4096	4096/4096	4096/4096
• No. with process I/O image		1024 each	1024 each	1024 each	1024 each	512 each
Analog inputs/outputs		256/256	256/256	256/256	256/256	256/256

1) Physical capacity, not all available for use
2) With integral standard function blocks
3) Version with second interface

CPU 941, CPU 942, CPU 943, CPU 944 and CPU 945 central processing units for the S5-115U (continued)

Technical specifications (continued)

CPU		CPU 945	CPU 944	CPU 943	CPU 942	CPU 941
Interfaces						
1st interface (built-in)		PG/OP/SINEC L1	PG/OP/SINEC L1	PG/OP/SINEC L1	PG/OP/SINEC L1	PG/OP/SINEC L1
2nd interface, optional (CPU 945: replaceable interface module, CPU 943/CPU 944: with two interfaces)		PG/OP/3964/3964R, SINEC L1, ASCII driver	PG/OP/3964/3964R, SINEC L1, ASCII driver	PG/OP, SINEC L1 ASCII driver	—	—
Current consumption (5 V; with memory submodule)						
• With 1 interface (serial)	max.	0.55 A	—	—	0.16 A	0.16 A
• With 2 interfaces (serial)	max.	0.64 to 1.25 A[4)]	0.45 A	0.45 A	—	—
Weight						
• Module	approx.	0.8 kg (1.7 lb)	1.5 kg (3.3 lb)	1.5 kg (3.3 lb)	1.5 kg (3.3 lb)	1.5 kg (3.3 lb)
• Memory submodule	approx.	0.1 kg (0.2 lb)	0.1 kg (0.2 lb)	0.1 kg (0.2 lb)	0.1 kg (0.2 lb)	0.1 kg (0.2 lb)

4) Depending on the interface module

CPU 942H central processing unit for the S5-115H

Application

The CPU 942H is required for the setup of a S5-115H fault-tolerant programmable controller.

Principle of operation

The CPU 942H central processing unit contains a firmware which is able to carry out all additional functions of the S5-115H fault-tolerant programmable controller autonomously. Part of that are the following functions:

- Data interchange
- Synchronization of both subunits
- Self-test
- Fault handling (switchover to standby unit)
- Fault locating

Technical specifications

Memory capacity			
• Internal RAM			5 Kbyte
• Submodule	RAM	max.	32 Kbyte
	EPROM	max.	32 Kbyte
	EEPROM	max.	16 Kbyte
			(1 statement normally requires 2 byte in the program memory)
Execution time for 1000 binary statements		approx.	1.6 ms
Execution time for 1000 statements		approx.	15 ms (for 65 % binary and 35 % word operations)
Execution time for load and transfer operations to peripheral word			430 to 1700 µs
Execution time for block call			66 to 1100 µ
Basic cycle time (without user program)		typ.	50 ms
Interrupt detection time		approx.	2 ms
Interrupt response time		max.	30 ms
Scan time monitoring			Configurable
Bit memories			2032
Timers			
• Number			128
• Range			0.01 to 9990 s

Counters		
• Number		128
• Range		0 ... 999 (up, down)
Digital inputs	max.	1024
Digital outputs	max.	1024
Analog inputs	max.	64
Analog outputs	max.	64
Programming		Structured
Organization blocks	max.	256
Program blocks	max.	256
Function blocks	max.	256 (configurable)
Sequence blocks	max.	256
Data blocks	max.	254
Nesting depth	max.	32
Program execution		Cyclic, interrupt-driven, time-controlled
Nesting levels	max.	6 (for binary logic operations)
PID control algorithm		
• Processing time	approx.	1.7 ms
Closed-loop control		
• Scan time		0.1 to 12.8 s
• Individual controllers	max.	8 (for further details please see Section 7)
Current consumption (at 5 V) (with memory submodule)	max.	0.7 A
Power loss	max.	3.5 W
Weight		
• Module	approx.	1.5 kg (3.3 lb)
• Memory submodule	approx.	0.1 kg (0.2 lb)

Ordering data

	Order No.
CPU 942H for the S5-115H programmable controller, with receptacle for 375 memory submodule, connection for programmer or SINEC-L1 LAN and standard function blocks using communications processors	**6ES5 942-7UH11**
375 memory submodule (EPROM, max. 32 Kbyte)	see page 3/23
COM 115H parameterization software	see Section 7
Manual	
German	**6ES5 998-0UH11**
English	**6ES5 998-0UH21**
French	**6ES5 998-0UH31**
Spanish	**6ES5 998-0UH41**
Italian	**6ES5 998-0UH51**

CPU 942F central processing unit for the S5-115F

Application

The CPU 942F is designed for the setup of a S5-115F failsafe programmable controller.

Principle of operation

The CPU 942F contains a firmware which is able to carry out all additional functions of the S5-115F failsafe programmable controller autonomously.

Part of that are functions like:

- Data interchange
- Synchronization of both subunits
- Self-test
- Fault handling

Technical specifications

Memory capacity			
• Internal RAM			5 Kbyte
• Submodule	RAM	max.	32 Kbyte
	EPROM	max.	32 Kbyte
	EEPROM	max.	16 Kbyte
			(1 statement normally requires 2 byte in the program memory)
Execution time for 1000 binary statements		approx.	1.6 ms
Execution time for 1000 statements		approx.	15 ms (for 64 % binary and 35 % word operations)
Execution time for load and transfer operations to peripheral word			430 to 1700 µ
Execution time for block call			66 to 1100 µ
Basic cycle time (without user program)			60 to 140 ms (depending on the number of redundant I/O modules)
Interrupt detection time		approx.	2 ms
Interrupt response time		max.	30 ms
Scan time monitoring			Configurable
Bit memories			2032
Timers			
• Number			128
• Range			0.01 to 9990 s

Counters		
• Number		128
• Range		0 ... 999 (up, down)
Digital inputs	max.	1024
Digital outputs	max.	1008
Analog inputs	max.	64
Analog outpus	max.	64
Programming		Structured
Orangization blocks	max.	6
Program blocks	max.	256
Function blocks	max.	256 (configurable)
Sequence blocks	max.	256
Data blocks	max.	254
Nesting depth	max.	16
Program execution		Cyclic, interrupt-driven, time-controlled
Nesting levels	max.	6 (for binary logic operations)
PID control algorithm		
• Processing time	approx.	1.7 ms
S5-115U closed loop control		
• Scan time		0.1 to 12.8 s
• Individual controller	max.	8 (for further details please see Section 7)
Current consumption (at 5 V) (with memory submodule)	max.	0.7 A
Power loss	max.	3.5 W
Weight		
• Module	approx.	1.5 kg (3.3 lb)
• Memory submodule	approx.	0.1 kg (0.2 lb)

Ordering data

	Order No.
CPU 942F with receptacle for 375 memory submodule and connection for programming device or SINEC-L1 LAN	**6ES5 942-7UF15**
375 memory submodule (EPROM, max. 32 Kbyte)	see page 3/23

	Order No.
COM 115F parameterization software	see Section 7
S5-115F manual	
German	**6ES5 998-1UF15**
English	**6ES5 998-1UF25**
French	**6ES5 998-1UF35**
Italian	**6ES5 998-1UF55**

Overview

Digital input and output modules

Input modules

Voltage values	Module ID	Page
5... 15 V DC (NAMUR)	434-4	3/30
24 V DC	420-7 430-7 434-7	3/30
24/48 V UC	431-7	3/30
48/60 V UC	432-7	3/30
115 V UC	435-7LA 435-7LB 435-7LC	3/30
230 V UC	436-7LA 436-7LB 436-7LC	3/30

Output modules

Voltage values	Module ID	Page
Transistor outputs		
5/24 V DC; 0.1 A	457-7	3/35
24 V DC; 0.5 A	441-7 451-7LA1 451-7LA2	3/35
24 V DC; 2 A	453-4UA12 454-7LA 454-7LB	3/35
24/48/60 V DC; 0.5 A	453-7	3/35
48/115 V AC, 1 A	455-7	3/35
115/230 V AC; 1 A	456-7LA	3/35
115/230 V AC; 1.5 A	456-7LB	3/35
Relay outputs		
30 V UC; 0.5 A	458-7LA	3/35
250 V AC; 5 A	458-7LB	3/35
250 V AC; 5 A 24 V DC; 5 A	458-7LC	3/35

Input/output modules

Voltage values	Module ID	Page
24 V DC (inputs) 24 V DC; 0.5 A (outputs)	482-7LA/-7LF11 /-7LF21	3/41
24 V DC (inputs) 24 V DC; 2.5 A (outputs)	482-7LF31	3/41
24 V DC (inputs) 24 V DC; 1.5 A (outputs)	485-7	3/41

Digital input modules

Application

The digital input modules convert the external binary signals from the process to the internal signal level of the programmable controllers.

Design

Digital input modules are available with 8, 16 or 32 inputs and for a range of input voltages. The modules require 1/2 or 1 slot (depending on the subrack).

The modules comprise:
- Green LEDs for indicating signal status
- Enable input F (434-4 digital input module for NAMUR sensors only) for disabling input signals
- Relay contact (MELD) and 24 V input (RESET) for interrupt processing

The signal leads must be connected with front connectors. They can be labelled in the fields next to the LEDs.

Principle of operation

Enable input

Digital input 434-4 only:
The input signals can be dis-abled by means of enable input F. This enable input can be deactivated by removing a jumper on the module.

Interrupt processing

Digital input 434-7 only:
A group signal generates an interrupt in the CPU when a particular input signal changes. The group signal drives a latching relay on the module (the relay contact MELD is accessible from the front panel), which can be reset via a 24 V input (RESET).

In the user program the user can specify for each input whether the interrupt is to be set by the positive- or negative-going edge.

If interrupt processing is not essential, the 434-7 module can be used in any type of subrack. Interrupt evaluation by the 434-7 digital input module is only possible in a central controller. The module takes up two bytes for input addresses and two bytes for output addresses.

Interrupt evaluation is only possible in an expansion unit (ER 701-3 subrack) which is connected using the IM 307 and IM 317 interface modules and if the 432-4 digital input module (S5-135/-155U) is used in the expansion unit instead of the 434-7 digital input module generating the interrupt.

Note

All digital input modules of the S5-135U/-155U programmable controllers (see Section 4) can be used in the S5-115U with adapter casings.

The 434-4 digital input module requires an adapter casing (see page 3/98).

Technical specifications

Digital input module	6ES5 420-7LA11	6ES5 430-7LA12	6ES5 431-7LA11	6ES5 432-7LA11	6ES5 434-7LA12	6ES5 434-4UA12
Number of inputs	**32**	**32**	**16**	**16**	**8** (with group signal)	see page 4/36 (S5-135U, S5-155U/H)
Galvanic isolation	No	Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)	
• In groups of	—	8	4	4	1	
Input voltage						
• Rated value	**24 V DC**	**24 V DC**	**24/48 V UC**	**48/60 V UC**	**24 V DC**	
• Frequency with AC	—	—	47 ... 63 Hz	47 ... 63 Hz	—	
• For "0" signal	- 30 ... + 5 V	- 30 ... + 5 V	0 ... 5 V	0 ... 10 V	- 30 ... + 5 V	
• For "1" signal	+ 13 ...+ 30 V	+ 13 ...+ 30 V	13 ... 60 V	30 ...72 V	+ 13 ...+ 30 V	
Input current for "1" signal typ.	8.5 mA	8.5 mA	8.5/10.5 mA	9/10 mA	8.5 mA	
Delay						
• At "0" → "1"	1.4 ... 5 ms	2.2 ... 4.6 ms	2 ... 13 ms	2 ... 13 ms	0.5 ... 1.5 ms	
• At "1" → "0"	1.4 ... 5 ms	4.5 ... 12 ms	10 ... 25 ms	10 ... 25 ms	0.5 ... 1.5 ms	
Load factor[1] at 55 °C	100 %	100 %	100 %	100 %	100 %	

1) With respect to number of inputs in a group

Digital input modules (continued)

Technical specifications (continued)

Digital input module (cont.)	6ES5 420-7LA11	6ES5 430-7LA12	6ES5 431-7LA11	6ES5 432-7LA11	6ES5 432-7LA12	6ES5 434-4UA12
Cable length						see page 4/36
• Unshielded max.	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)	(S5-135U,
• Shielded max.	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	S5-155U/H)
Interrupt output	—	—	—	—	Latching relay contact	
• Permissible load max.	—	—	—	—	100 V DC; 0.2 A	
• Switching capacity max.	—	—	—	—	20 W; 35 VA	
Reset input	—	—	—	—	24 V DC	
Insulation voltage rating (external connections to housing, internal connections, other groups)						
• In acc. with VDE 0160	—	30 V DC	60 V AC	60 V AC	30 V DC	
• Tested with	—	500 V AC	500 V AC	500 V AC	500 V AC	
Current consumption						
• Internal (from power supply module; 5 V) max.	5 mA	5 mA	5 mA	5 mA	70 mA	
Power loss (rated operation) typ.	6.5 W	6.5 W	9.0 W	10.0 W	2 W	
Front connector	46-pin	46-pin	24-pin	24-pin	46-pin	
Weight approx.	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	

Digital input module	6ES5 435-7LA11	6ES5 435-7LB11	6ES5 435-7LC11	6ES5 436-7LA11	6ES5 436-7LB11	6ES5 436-7LC11
Number of inputs	**16**	**16**	**8**	**16**	**16**	**8**
Galvanic isolation	Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)
• in groups of	4	2	1	4	2	1
Input voltage						
• Rated value	**115 V UC**	**115 V UC**	**115 V UC**	**230 V UC**	**230 V UC**	**230 V UC**
• Frequency with AC	47 ... 63 Hz	47 ... 63 Hz	47 ... 63 Hz	47 ... 63 Hz	47 ... 63 Hz	47 ... 63 Hz
• For "0" signal	0 ... 40 V	0 ... 40 V	0 ... 40 V	0 ... 70 V	0 ... 70 V	0 ... 100 V
• For "1" signal	85 ... 135 V	85 ... 135 V	85 ... 135 V	170 ... 264 V	170 ... 264 V	170 ... 264 V
Input current	6 mA DC	6 mA DC	6 mA DC	2.2 mA DC	2.2 mA DC	2.2 mA DC
at "1" signal typ.	15 mA AC	10 mA AC	10 mA AC	15 mA AC	15 mA AC	16 mA AC
Delay						
• At "0" → "1"	2 ... 13 ms	2 ... 13 ms	2 ... 13 ms	2 ... 13 ms	2 ... 13 ms	2 ... 13 ms
• At "1" → "0"	10 ... 25 ms	10 ... 25 ms	10 ... 25 ms	10 ... 35 ms	10 ... 35 ms	10 ... 25 ms
Load factor [1]						
• At 55 °C	75 %	75 %	75 %	75 %	75 %	100 %
• At 20 °C	100 %	100 %	100 %	100 %	100 %	100 %
Cable length						
• Unshielded max.	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)
• Shielded max.	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)
Insulation voltage rating (external connections to housing, internal connections, other groups)						
• In acc. with VDE 0160	250 V AC	250 V AC	250 V AC	250 V AC	250 V AC	250 V AC
• Tested with	1500 V AC	1500 V AC	2700 V AC	1500 V AC	1500 V AC	2700 V AC
Current consumption						
• Internal (from power supply module; 5 V) max.	5 mA	5 mA	5 mA	5 mA	5 mA	5 mA
Power loss (rated operation) typ.	11.0 W	11.0 W	5.5 W	11.0 W	11.0 W	5.5 W
Front connector	24-pin	24-pin	24-pin	24-pin	24-pin	24-pin
Weight approx.	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)

1) With respect to number of inputs in a group

Digital input modules (continued)

Ordering data	Order No.		Order No.
Non-floating:		**436-7 digital input module**	
420-7 digital input module	**6ES5 420-7LA11**	for S5-115U/H	
for S5-115U/H		16 inputs, 230 V UC,	
32 inputs, 24 V DC		in groups of 4	**6ES5 436-7LA11**
Floating:		in groups of 2	**6ES5 436-7LB11**
430-7 digital input module	**6ES5 430-7LA12**	for S5-115U/H/F	
for S5-115U/H/F		8 inputs, 230 V UC,	**6ES5 436-7LC11**
32 inputs, 24 V DC,		in groups of 1	
in groups of 8		The operating instructions are	
431-7 digital input module	**6ES5 431-7LA11**	included in the S5-115U manual	
for S5-115U/H		(see page 3/23).	
16 inputs, 24/48 V UC,		**490 front connector**	
in groups of 4		For screw terminals	
432-7 digital input module	**6ES5 432-7LA11**	• 24-pin	**6ES5 490-7LB11**
for S5-115U/H		• 46-pin	**6ES5 490-7LB21**
16 inputs, 48/60 V UC,		For crimp terminals, 46-pin	
in groups of 4		• With 59 crimp contacts	**6ES5 490-7LA11**
434-4 digital input module for NAMUR[1] **sensor** for S5-115U/H	**6ES5 434-4UA12**	• Without crimp contacts	**6ES5 490-7LA21**
32 inputs, 5/15 V DC		For snap-on clip terminals, 46-pin	**6ES5 490-7LC11**
(TTL, CMOS, NAMUR)		**497 front connector**	
434-7 digital input module	**6ES5 434-7LA12**	for 434-4 digital input module	
for S5-115U/H/F		• Crimp terminals, single-width, 42-pin	**6ES5 497-4UA12**
with interrupt group signal		• Screw terminals, single-width, 42-pin	**6ES5 497-4UB31**
8 inputs, 24 V DC,			
in groups of 1		**Adapter casing**	see page 3/98
435-7 digital input module			
for S5-115U/H			
16 inputs, 115 V UC,			
in groups of 4	**6ES5 435-7LA11**		
in groups of 2	**6ES5 435-7LB11**		
for S5-115 U/H/F			
8 inputs, 115 V UC,			
in groups of 1	**6ES5 435-7LC11**		

1) NAMUR = Working group on standards in the measurement technique and control engineering

Digital input modules (continued)

Connection diagrams

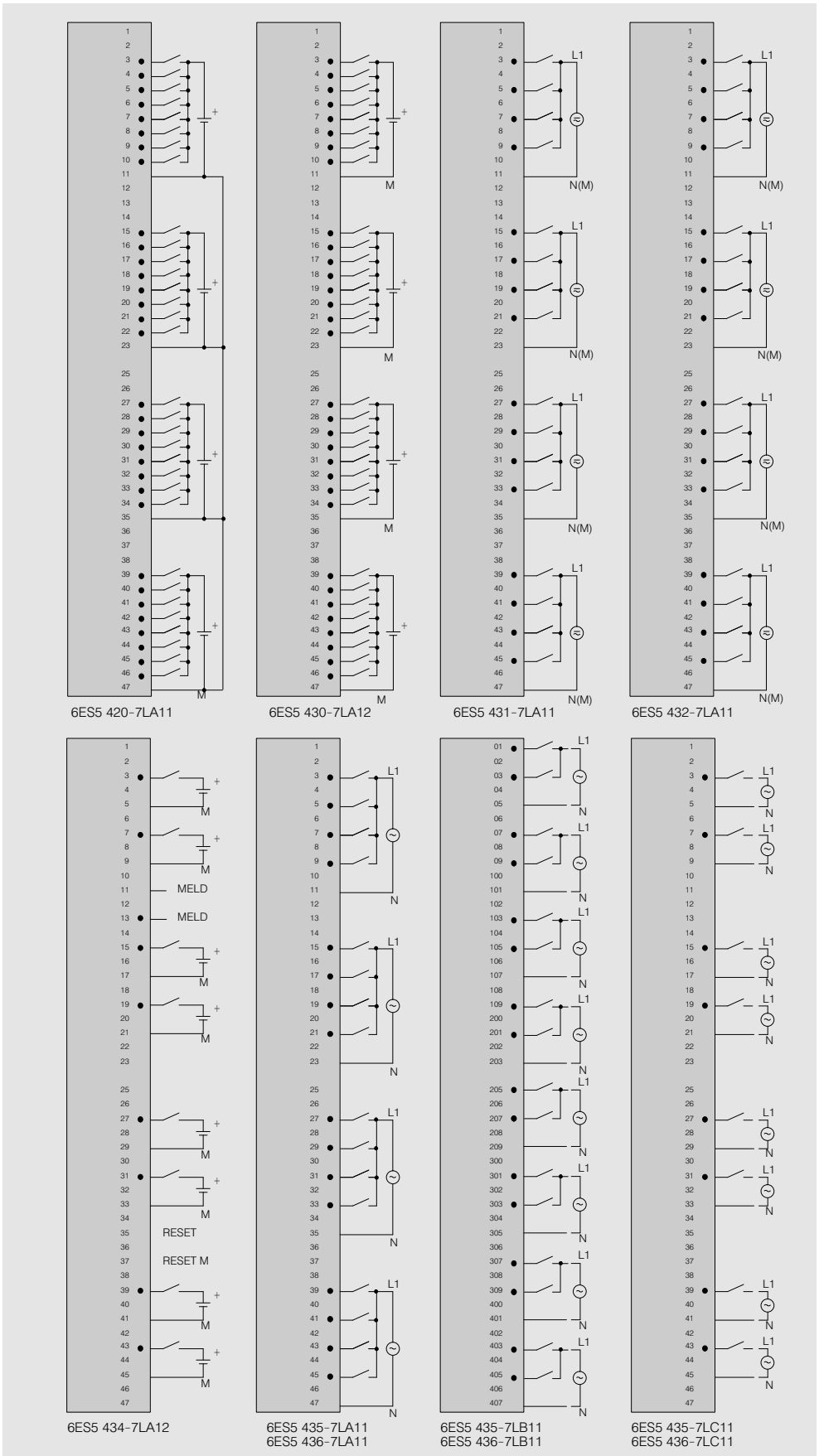
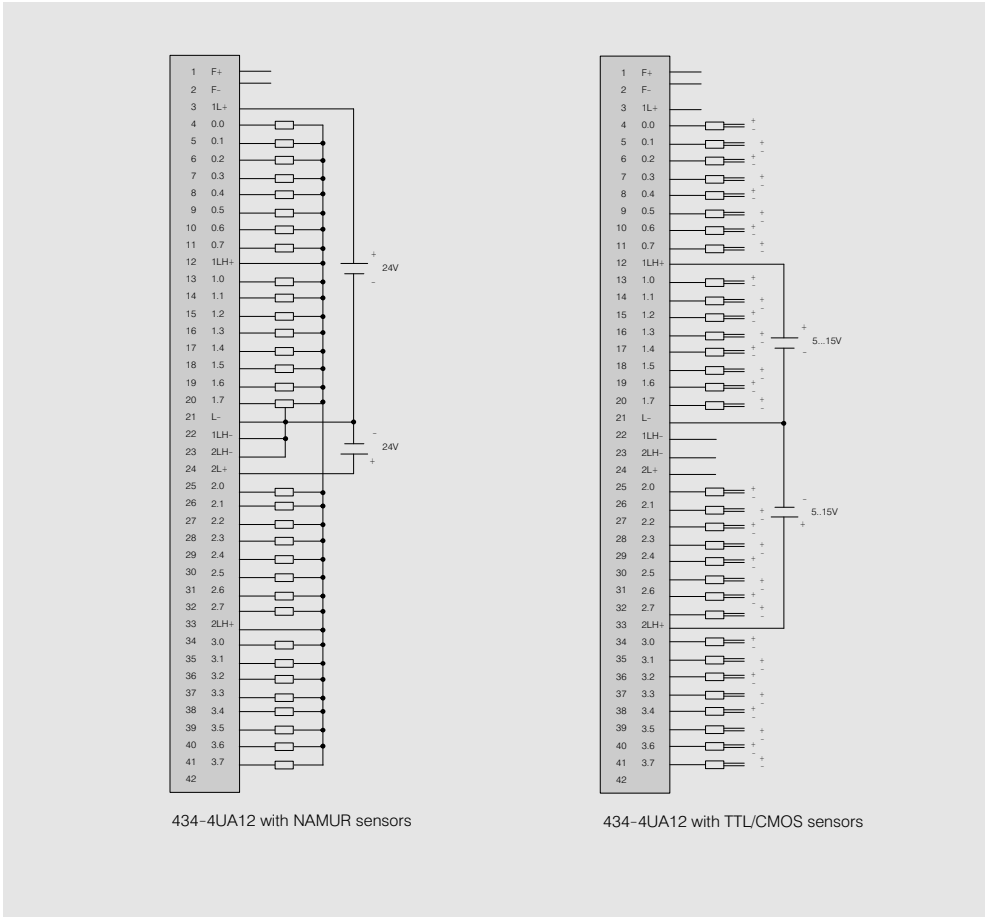


Fig. 3/25 Connection diagrams for digital input modules

Digital input modules (continued)

Connection diagrams
(continued)



434-4UA12 with NAMUR sensors

434-4UA12 with TTL/CMOS sensors

Fig. 3/26 Connection diagrams for digital input modules

Digital output modules

Application

The digital output modules convert the internal signal levels of the programmable controllers into the binary signal levels required externally by the process.

Design

Digital output modules are available with 8, 16 or 32 outputs and for a range of supply voltages (load) and rated load currents. The modules require one slot.

Depending on the version, the modules comprise:

- Green LEDs for indicating signal status
- Short-circuit detection
- Group signalling output for short-circuits (latching relay) with reset input
- Red LEDs for indicating a short-circuit

The signal leads must be connected with front connectors. They can be labelled in the field next to the LEDs.

The module address (byte parameter when programming) is slot-dependent and need therefore not be set on the module.

Principle of operation

The module converts the internal output signals of the programmable controller to the load voltage levels (DC or AC) used to control the process. The output voltage ranges are fixed. A selection of 2 or 3 ranges is available on some modules.

Short-circuit protection

The digital output modules are short-circuit-protected (except for the relay outputs and the DA 457-7 digital output module).

Protection is provided either electronically or by means of fuses. In the DA 451-7 and 453-7 modules, the short-circuit signal is stored via a latching relay contact and indicated by a red LED for each group. In both modules a signal can be reset with a separate 24 V input (RES) or internally by a BASP signal. On the modules protected with fuses, red LEDs also indicate when a fuse has blown.

Parallel connection of outputs

Parallel connection of the outputs is only possible with the relay output modules.

Note

All the digital output modules of the S5-135U/-155U programmable controllers (see Section 4) can be used in the S5-115U with adapter casings.

Digital output modules (continued)

Technical specifications

Digital output module	6ES5 441-7LA12	6ES5 451-7LA11	6ES5 451-7LA21	6ES5 453-7LA11	6ES5 453-4UA12
Number of outputs	**32**	**32**	**32**	**16**	see page 4/40 (S5-135U, S5-155U/H)
Galvanic isolation	No	Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)	
• In groups of	—	8	8	8	
Supply voltage V_{pos} (for load)					
• Rated value	**24 V DC**	**24 V DC**	**24 V DC**	**24/48/60 V DC**	
• Ripple V_{pp} max.	3.6 V	3.6 V	3.6 V	3.6 V	
• Permissible range (with ripple)	20 ... 30 V	20 ... 30 V	20 ... 30 V	20 ... 75 V	
Value at t < 0.5 s max.	35 V	35 V	35 V	87 V	
Output current at "1" signal					
• Rated value	**0.5 A**	**0.5 A**	**0.5 A**	**0.5 A**	
• Permissible range	5 mA ... 0.5 A	5 mA ... 0.5 A	5 mA ... 0.5 A	5 mA ... 0.5 A	
Lamp load max.	5 W	5 W	5 W	5 W	
Short-circuit protection	Electronic	Electronic	Electronic	Electronic	
Short-circuit display	—	—	1 LED/group with one common group signal	1 LED/group with one common group signal	
Short-circuit group signal output	—	—	Latching relay cont.	Latching relay cont.	
• Permissible load	—	—	100 V DC ; 0.2 mA	100 V DC ; 0.2 mA	
• Switching capacity	—	—	20 W; 35 VA	20 W; 35 VA	
Reset input	—	—	24 V DC	24 V DC	
Inductive surge voltage on circuit interruption (internal) limited to	- 15 V	- 15 V	- 15 V	- 30 V	
Switching frequency					
• Resistive loads max.	100 Hz	100 Hz	100 Hz	100 Hz	
• Lamp loads max.	8 Hz	8 Hz	8 Hz	8 Hz	
• Inductive loads max.	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	
Load factor [1]					
• At 25 °C	100 %	100 %	100 %	100 %	
• At 55 °C	50 %	50 %	50 %	100 %	
Residual current at "0" signal max.	1 mA	1 mA	1 mA	1 mA	
Signal level of the outputs					
• At "0" signal max.	+ 3 V	+ 3 V	+ 3 V	+ 3 V	
• At "1" signal min.	V_{pos} - 2 5 V	V_{pos} - 2.5 V	V_{pos} - 2.5 V	V_{pos} - 2.5 V	
Cable length					
• Unshielded max.	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)	
• Shielded max.	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	
Insulation voltage rating (external connections to housing, internal connections, other groups)					
• In acc. with VDE 0160	—	30 V DC	30 V DC	75 V DC	
• Tested with	—	500 V AC	500 V AC	500 V AC	
Current consumption					
• Internal (at 5 V) typ.	10 mA	100 mA	100 mA	50 mA	
• External (at 24 V, no load) typ.	17 mA/group	17 mA/group	17 mA/group	50 mA/group	
Power loss (rated operation) typ.	20 W	20 W	20 W	16 W	
Front connector	46-pin	46-pin	46-pin	24-pin	
Weight approx.	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	

1) Referred to the sum of the rated currents via an L + supply

Digital output modules (continued)

Technical specifications

Digital output module	6ES5 454-7LA12	6ES5 454-7LB11	6ES5 455-7LA11	6ES5 456-7LA11	6ES5 456-7LB11	6ES5 457-7LA11
Number of outputs	**16**	**8**	**16**	**16**	**8**	**32** (m switch)
Galvanic isolation	Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)		Yes (optocoupler)
• In groups of	4	1	2	4	1	8
Supply voltage V_p, V_{pos} (for load)						
• Rated value	**24 V DC**	**24 V DC**	**48/115 V AC**	**115/230 V AC**	**115/230 V AC**	**5/12/24 V DC**
• Frequency	—	—	47 ... 63 Hz	47 ... 63 Hz	47 ... 63 Hz	—
• Ripple V_{pp} max.	3.6 V	3.6 V	—	—	—	2.4 V at 24 V
• Permissible range (with ripple)	20 ... 30 V	20 ... 30 V	40 ... 140V	89 ... 264V	89 ... 264V	4.75 ... 30V
Value at t < 0.5 s max.	35 V	35 V	—	—	—	35 V
Output current at "1" signal						
• Rated value	**2 A**	**2 A**	**2 A/group**	**1 A**	**2 A**	**100 mA**
• Permissible range	10 mA[1] ... 2 A	10 mA[1] ... 2 A	40 mA ... 2 A	40 mA ... 1 A	40 mA ... 2 A	—
Lamp load max.	10 W	10 W	50/100 W/group	25/50 W	25/50 W	—
Short-circuit protection	Electronic	Fuse (8 · 2.55 A FF)	Fuse (8 · 2.55 A FF)	Fuse (4 · 10 A FF)	Fuse (8 · 6.3 A FF)	None
Short-circuit display	—	8 LEDs	1 LED/group	1 LED/group	8 LEDs	—
Inductive surge voltage on circuit interruption (internal) limited to	- 15 V	- 23 V	—	—	—	- 10 V
Switching frequency						
• Resistive loads max.	100 Hz	100 Hz	10 Hz	10 Hz	10 Hz	10 Hz
• Lamp loads max.	8 Hz	8 Hz	10 Hz	10 Hz	10 Hz	8 Hz
• Inductive loads max.	0.27 Hz	0.27 Hz	10 Hz	10 Hz	10 Hz	2 Hz
Load factor [1]						
• At 25 °C	50 %	100 %	100 %	100 %	100 %	100 %
• At 55 °C	50 %	50 %	100 %	100 %	100 %	100 %
Residual current at "0" signal max.	1 mA	1 mA	1/3 mA	3/5 mA	3/5 mA	100 µA
Signal level of the outputs						
• At "0" signal max.	+ 3 V	+ 3 V	+ 3 V	+ 3 V	+ 3 V	Open collector output
• At "1" signal min.	V_{pos} - 3 V	V_{pos} - 3 V	V_{pos} - 7 V	V_{pos} - 7 V	V_{pos} - 7 V	
Cable length						
• Unshielded max.	600 m (1968 ft)	600 m (1968 ft)	300 m (984 ft)	300 m (984 ft)	300 m (984 ft)	300 m (984 ft)
• Shielded max.	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)
Insulation voltage rating (external connections to the housing, internal connections, other groups)						
• In acc. with VDE 0160	30 V DC	30 V DC	250 V AC	250 V AC	250 V AC	30 V DC
• Tested with	500 V AC	500 V AC	1500 V AC	1500 V AC	2700 V AC	500 V AC
Current consumption						
• Internal (at 5 V) typ.	50 mA	50 mA	175 mA	70 mA	35 mA	100 mA
• External (at 24 V, no load) typ.	8.5 mA/group	—	—	—	—	4 mA
Power loss (rated operation) typ.	20 W	20 W	16 W	16 W	16 W	6 W
Front connector	24-pin	24-pin	24-pin	24-pin	24-pin	46-pin
Weight approx.	1.1 kg (2.4 lb)	0.8 kg (1.8 lb)	1.1 kg (2.4 lb)	1.1 kg (2.4 lb)	1.1 kg (2.4 lb)	0.7 kg (1.5 lb)

1) Referred to the sum of the rated currents via an L + or L1 supply

Digital output modules (continued)

Technical specifications

Digital output module	6ES5 458-7LA11[1]	6ES5 458-7LB11	6ES5 458-7LC11
Number of outputs	**16**	**8**	**16**
Galvanic isolation	Yes (relay contacts)[4]	Yes (relay contacts)[3]	Yes (relay outputs)
• In groups of	1	1	4
Continuous current I_{th}	**0.5 A**	**5 A**	**5 A**
Switching capacity of the contacts			
• Resistive loads max.	10 W/0.5 A/30 V UC	5 A at 250 V AC 2.5 A at 30 V DC	5 A at 250 V AC 5 A at 30 V DC 0.4 A at 110 V DC
• Inductive loads max.	Not permitted	1.5 A at 250 V AC 0.5 A at 30 V DC	1.5 A at 250 V AC 1 A at 30 V DC 0.08 A at 110 V DC
Service life: Switching cycles (VDE 0660, Part 200)	$1 \cdot 10^9$ (to DC-11)	$1.5 \cdot 10^6$ (to AC-11) $0.5 \cdot 10^6$ (to DC-11)	$1.5 \cdot 10^6$ (to AC-11) $0.5 \cdot 10^6$ (to DC-11)
Short-circuit protection	None	None	None
Switching frequency			
• Resistive loads max.	60 Hz	10 Hz	10 Hz
• Inductive loads max.	Not permitted	10 Hz	2 Hz
Insulation voltage rating (external connections to housing, internal connections, other groups)			
• In acc. with VDE 0160	30 V DC	250 V AC	250 V AC
• Tested with	500 V AC	1500 V AC	1500 V AC
Supply voltage V_{pos}			
• Rated value	24 V DC	24 V DC	24 V DC
• Ripple V_{pp} max.	3.6 V	3.6 V	3.6 V
• Permissible range (with ripple)	20 ... 30 V	20 ... 30 V	20 ... 30 V
Value at t < 0.5 s	35 V	35 V	35 V
Current consumption			
• Internal (at 5 V) typ.	50 mA	50 mA	50 mA
• External (at 24 V) typ.	240 mA	200 mA	256 mA
Power loss (rated operation) typ.	5 W	4 W	6.5 W
Front connector	46-pin	24-pin	46-pin
Weight approx.	0.8 kg (1.8 lb)	0.8 kg (1.8 lb)	0.8 kg (1.8 lb)

Ordering data

	Order No.
Non-floating:	
441-7 digital output module for S5-115U/H; 32 outputs, 24V DC; 0.5 A	**6ES5 441-7LA12**
Floating:	
451-7 digital output module for S5-115U/H/F; 32 outputs, 24V DC; 0.5 A	**6ES5 451-7LA12**
451-7 digital output module for S5-115U/H; 32 outputs, 24V DC; 0.5 A with short-circuit indication	**6ES5 451-7LA21**
453-7 digital output module for S5-115U/H; 16 outp., 24/60 V DC; 0.5 A	**6ES5 453-7LA11**
453-4 digital output module for S5-115U/H/F[2];16 outputs, 24V DC; 2 A	**6ES5 453-4UA12**
454-7 digital output module for S5-115U/H/F	
16 outputs, 24 V DC; 2 A	**6ES5 454-7LA12**
8 outputs, 24 V DC; 2 A	**6ES5 454-7LB11**
455-7 digital output module for S5-115U/H; 16 outp., 48/115 V DC; 1 A	**6ES5 455-7LA11**
456-7 digital output module for S5-115U/H	
16 outputs, 115/230 V AC; 1 A	**6ES5 456-7LA11**
for S5-115U/H/F	
8 outputs, 115/230 V AC; 1.5 A	**6ES5 456-7LB11**
457-7 digital output module for S5-115U/H; 32 outputs, 5/24 V DC; 100 mA	**6ES5 457-7LA11**
458-7 digital output module for S5-115U/H/F	
16 relay contact outputs [1] 30 V UC; 0.5 A	**6ES5 458-7LA11**
8 relay contact outputs, 250 V AC; 5A	**6ES5 458-7LB11**
for S5-115U/H	
16 relay contact outputs 250 V AC; 5 A, 30 V DC; 5 A	**6ES5 458-7LC11**
The operating instructions are included in the S5-115U manual (see page 3/23)	
490 front connector For screw terminals	
• 24-pin	**6ES5 490-7LB11**
• 46-pin	**6ES5 490-7LB21**
For crimp terminals, 46-pin	
• With 50 crimp contacts	**6ES5 490-7LA11**
• Without crimp contacts	**6ES5 490-7LA21**
For snap-on clip terminals, 46-pin	**6ES5 490-7LC11**

1) For new systems the use of the 6ES5 453-4UA12 module is suggested
2) Adapter casing required
3) Each contact is jumpered with a varistor (residual current max. 1 mA at 250 V AC)
4) Reed relay for measuring circuits

Digital output modules (continued)

Connection diagrams

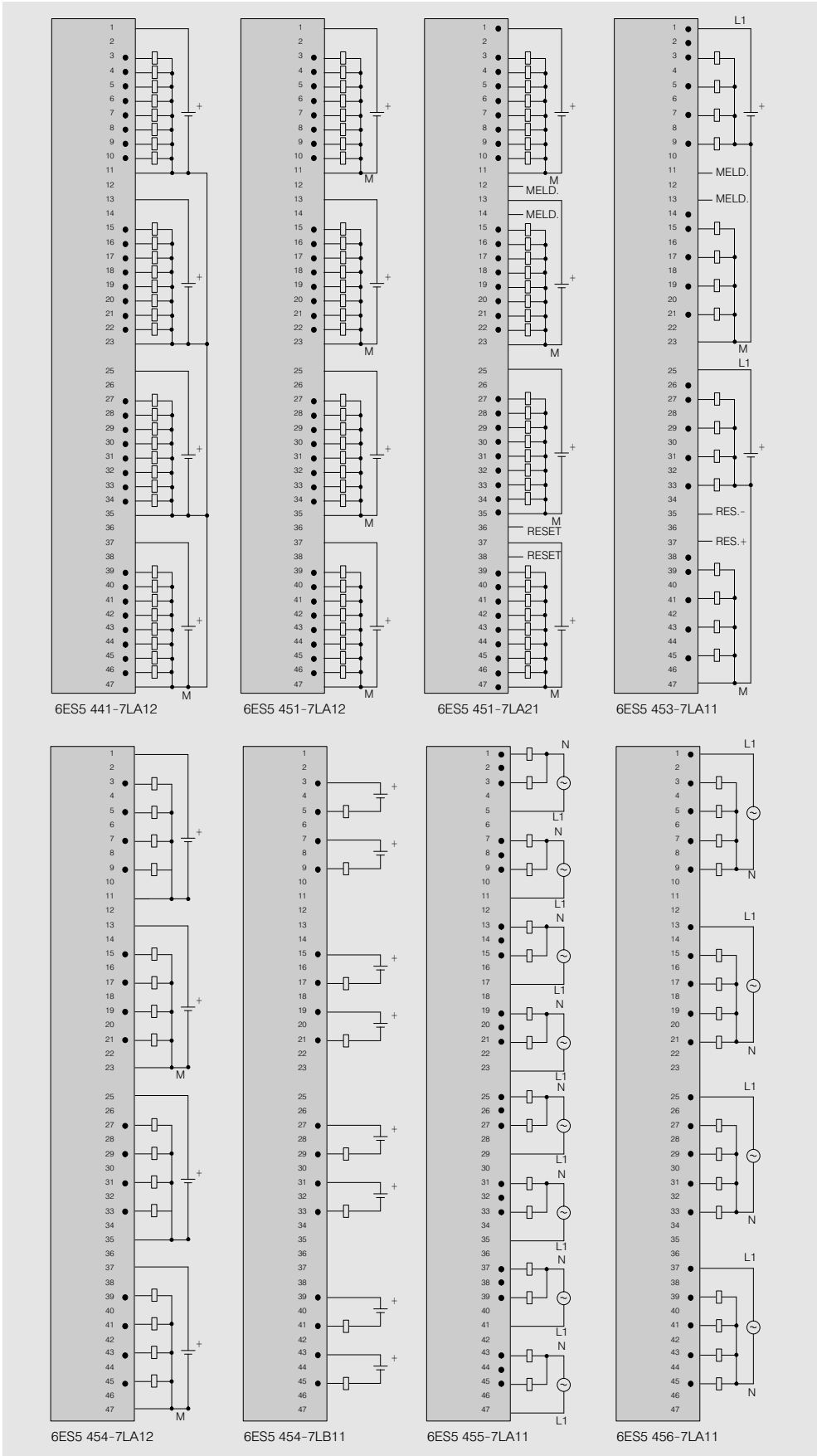


Fig. 3/27 Connection diagrams for digital output modules

Digital output modules (continued)

Connection diagrams
(continued)

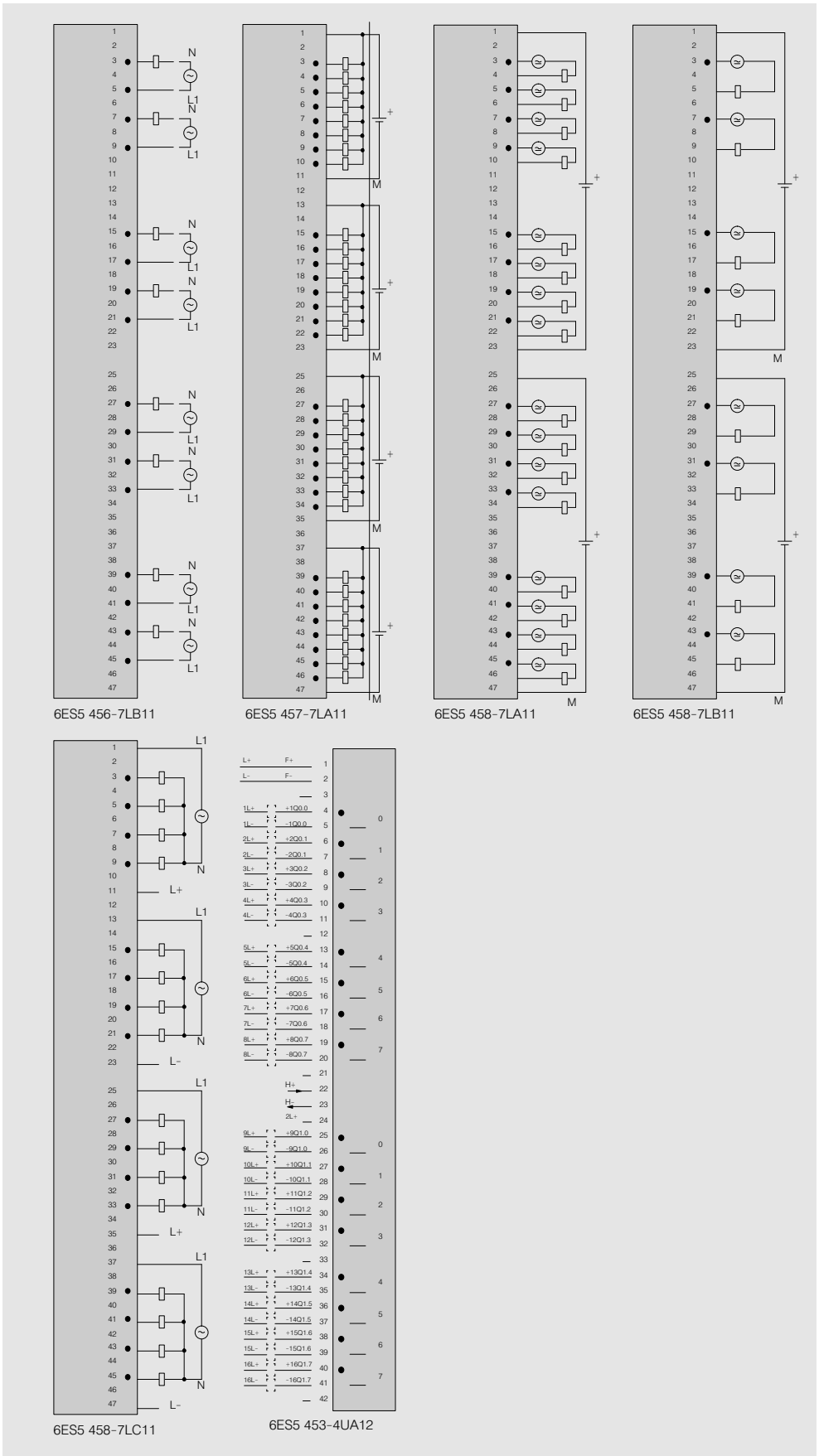


Fig. 3/28 Connection diagrams for digital output modules

Digital input/output modules

Application

The digital input/output modules combine the functions of the digital input and output modules on one module. In the digital input section external binary signals from the process are converted to the internal signal levels of the programmable controller.

In the digital output section the internal signal levels of the programmable controller are converted to the binary signal levels required externally by the process.

Design

Digital input/output modules are available with 8 inputs and 8 outputs, 16 inputs and 16 outputs or 24 inputs and 16 outputs. The modules require 1/2 or 1 slot (depending on the subrack).

The signal leads must be connected with front connectors. They can be labelled in the field next to the LEDs.

The inputs and outputs can be addressed with the same addresses (e.g. E 4.0 to E 5.7 and A 4.0 to A 5.7). The input/output connection (sink input/source input or sink output/source output) is fixed for the 482-7 and 485-7 modules, but parameter-selectable for the 482-7LF31 module.

Principle of operation

Interrupt processing

485-7 digital input/output module only:
The 485-7 digital input/output module can be operated with or without interrupt processing. Four of the total of 24 inputs can be used to generate a group signal which triggers an interrupt when one of the input signals changes on the positive-going edge. Interrupt evaluation is only possible in the central controller.

Note

All the digital input/output modules of the S5-135U/-155U programmable controllers (see Section 4) can be used in the S5-115U with adapter casings.

Technical specifications

Digital input/output module		6ES5 482-7LA11	6ES5 482-7LF11	6ES5 482-7LF21	6ES5 482-7LF31	6ES5 485-7LA11
Number of inputs		**16,** sink input	**16,** source readback	**16,** sink readback	**8,** source/sink readb.	**24**
Galvanic isolation		Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)	No
• In groups of		8	8		8	—
Interrupt inputs		—	—	—	—	4
Suitable for safety signals		No	Yes	Yes	Yes	No
Input voltage						
• Rated value		**24 V DC**	**24 V DC**	**24 V DC**	**24 V DC**	**24 V DC**
• For "0" signal		- 30 ... + 5 V	- 10 ... + 30 V[1]	- 30 ... + 5 V	- 30 ... + 15 V (10 ... + 30 V)[1]	- 30 ... + 5 V
• For "1" signal		+ 13 ... + 30 V	- 30 ... + 5 V[1]	+ 13 ... + 30 V	+ 20 ... + 30 V (- 30... + 5 V)[1]	+ 13 ... + 30 V
Input current at "1" signal	typ.	8.5 mA	0.8 mA	0.8 mA	0.8 mA	7.2 mA
Delay						
• At "0" → "1"		2.2 ... 4.6 ms	1.4 ... 5 ms	1.4 ... 5 ms	1.4 ... 5 ms	3 ms
• At "1" → "0"		4.5 ... 12 ms	1.4 ... 5 ms	1.4 ... 5 ms	1.4 ... 5 ms	3 ms
• For interrupt inputs		—	—	—	—	1.5 ms
Cable length						
• Unshielded	max.	600 m (1968 ft)	60 m (196.8 ft)	60 m (196.8 ft)	60 m (196.8 ft)	60 m (196.8 ft)
• Shielded	max.	1000 m (3280 ft)	100 m (328 ft)	100 m (328 ft)	100 m (328 ft)	100 m (328 ft)

1) Values for source input

Digital input/output modules (continued)

Technical specifications (continued)

Digital input/output module		6ES5 482-7LA11	6ES5 482-7LF11	6ES5 482-7LF21	6ES5 482-7LF31	6ES5 485-7LA11
Number of outputs		**16,** source output	**16,** source output	**16,** sink output	**8,** source/sink output	**16**
Galvanic isolation		Yes (optocoupler)	Yes (optocoupler)	Yes (optocoupler)	Yes (transformer)	No
• In groups of		8	8			—
Supply voltage						
V_{pos} (for load)						
• Rated value		**24 V DC**	**24 V DC**	**24 V DC**	**24 V DC**	**24 V DC**
• Ripple V_{pp}	max.	3.6 V	3.6 V	3.6 V	3.6 V	—
• Permissible range (with ripple)		20 ...30 V	20 ...30 V	20 ...30 V	20 ...30 V	20 ...30 V
Value at t < 0.5 s	max.	35 V	35 V	35 V	35 V	35 V
Output current at "1" signal						
• Rated value		**0.5 A**	**0.5 A**	**0.5 A**	**2.5 A**	**1.5 A**
• Permissible range		5 mA ... 0.5 A	5 mA ... 0.5 A	5 mA ... 0.5 A	5 mA ... 2.5 A	5 mA ... 1.5 A
Lamp load	max.	5 W	5 W	5 W	40 W	5 W
Inductive load	max.	8.5 W	8.5 W	8.5 W	60 W	
Short-circuit protection		Electronic	Electronic	Electronic	Electronic	Electronic (from 3.6 A)
Voltage induced on circuit interruption (internal) limited	to	V_{pos} - 47 V	V_{pos} - 47 V	V_{pos} - 47 V	V_{pos} - 47 V	- 15 V
Switching frequency						
• Resistive loads	max.	100 Hz	100 Hz	100 Hz	100 Hz	100 Hz
• Lamp loads	max.	8 Hz	8 Hz	8 Hz	8 Hz	8 Hz
• Inductive loads	max.	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz
Load factor[1]						
• At 25 °C		100 %	100 %	100 %	100 %	50 %
• At 55 °C		50 %	50 %	50 %	100 %	50 %
Residual current at "0" signal	max.	1 mA	1 mA	1 mA	0.5 mA	1 mA
Signal level of the outputs						
• At "0" signal	max.	+ 3 V	+ 3 V	V_{pos}	+ 3 V; V_{pos}[2]	
• At "1" signal	min.	V_{pos} - 2.5 V	V_{pos} - 2.5 V	+ 2.5 V	V_{pos} - 1 V; (+ 1 V) [2]	V_{pos} - 2.5 V
Cable length						
• Unshielded	max.	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)	600 m (1968 ft)
• Shielded	max.	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)
Insulation voltage rating (external connections to housing, internal connections, other groups)						
• In acc. with VDE 0160		30 V DC	30 V DC	30 V DC	30 V DC	30 V DC
• Tested with		500 V AC	500 V AC	500 V AC	500 V AC	500 V AC
Current consumption						
• Internal (at 5 V)		50 mA	50 mA	50 mA	150 mA	100 mA
• External (at 24 V, no load)		10 mA	10 mA	10 mA	95 mA	80 mA per output module
Power loss (rated operation)	typ.	20 W	18 W	18 W	23 W	15 W
Front connector		46-pin	46-pin	46-pin	46-pin	46-pin
Weight	approx.	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	0.7 kg (1.5 lb)	0.9 kg (2 lb)	0.7 kg (1.5 lb)

1) Referred to the sum of rated currents of a group.

2) Values for sink output

Ordering data

	Order No.
482-7 digital input/output module[3] for S5-115U/H/F	
16 inputs, 24 V DC and 16 outputs, 24 V DC; 0.5 A, source input, source output	**6ES5 482-7LA11**
sink input, source output	**6ES5 482-7LF11**
source input, sink output	**6ES5 482-7LF21**
8 inputs, 24 V DC and 8 outputs, 24 V DC; 2.5 A either source input/ sink input or source output/ sink output	**6ES5 482-7LF31**
485-7 digital input/output module for S5-115U 24 inputs, 24 V DC and 16 outputs, 24 V DC	**6ES5 485-7LA11**
490 front connector	
For screw terminals, 46-pin	**6ES5 490-7LB21**
For crimp terminals, 46-pin	
• With 50 crimp contacts	**6ES5 490-7LA11**
• Without crimp contacts	**6ES5 490-7LA21**
For snap-on clip terminals, 46-pin	**6ES5 490-7LC11**

3) Operating instructions are included in the S5-115U manual (see page 3/23).

Digital input/output modules (continued)

Connection diagrams

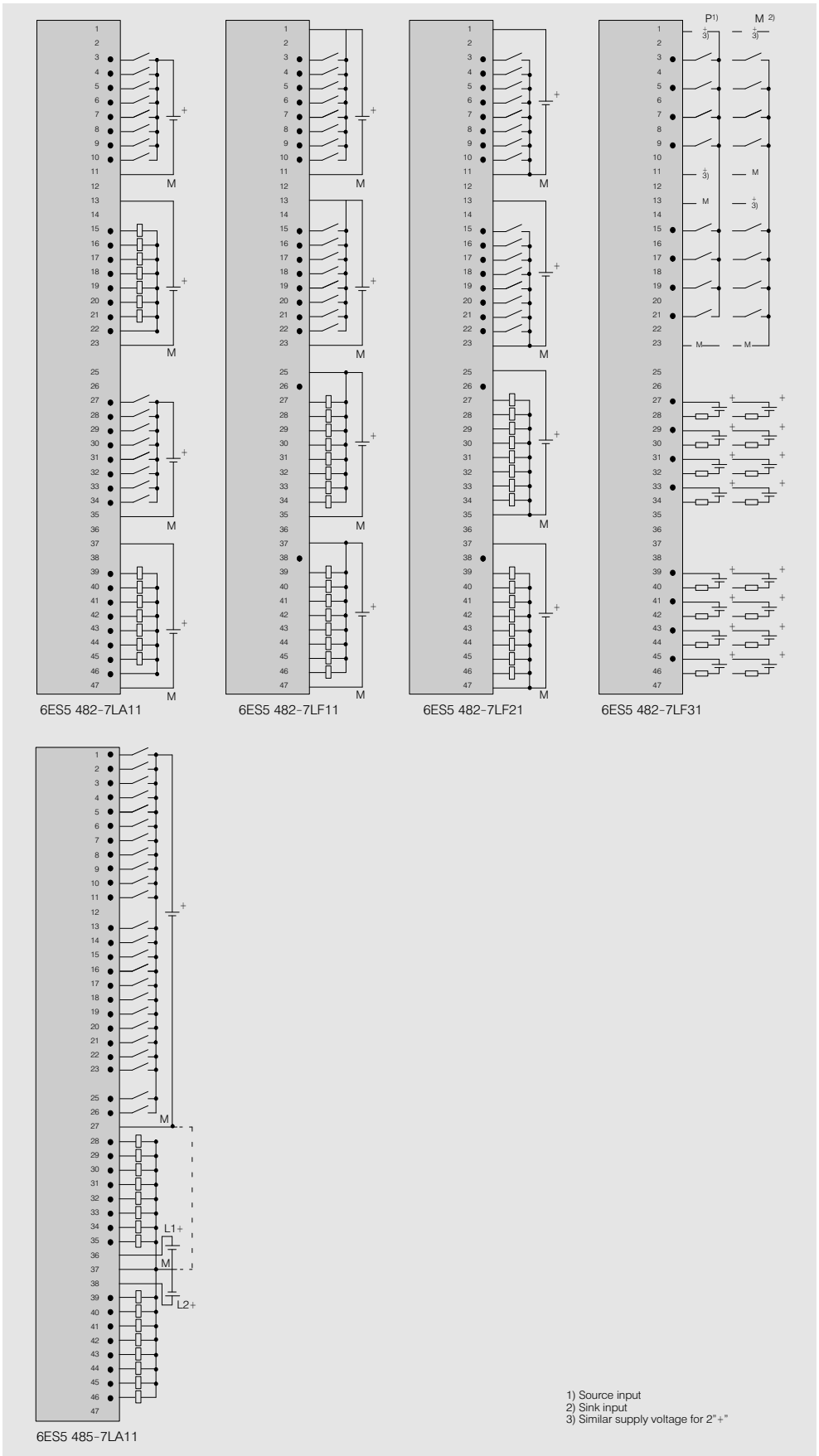
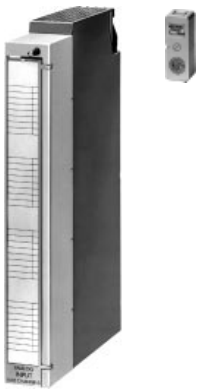


Fig. 3/29 Connection diagrams for digital input/output modules

Analog input/output modules

Analog input modules

Application



The analog input modules convert the analog signals from the process into digital values which can be processed by the programmable controller.

Design

Modules with 4, 8 or 16 inputs are available. The modules each require one slot.

The signal leads must be connected with front connectors. They can be labelled in the field on the front panel.

Measuring range modules required for signal conditioning are plugged into the module. Each module sets the measuring range for a group of 4 channels (inputs).

The 460-7 and 463-4 modules are reaction-free, the 463-4 module is also suitable for failsafe operation.

Functions such as wire break signalling, line frequency or measuring range are set using switches at the rear of the module.

Principle of operation

The analog input modules have different methods of operation. The 460-7, 465-7 and 463-4 modules work on an integrating measuring principle, whereas the 466-3 analog input module uses instantaneous value encoding. Analog-digital conversion is performed in the 460-7 and 465-7 modules by voltage-time conversion and in the 463-4 by voltage-frequency conversion. The 466-3 module employs successive approximation and has the shortest encoding time.

All modules indicate overrange errors. The 460-7 and 465-7 can also detect wire breakage in the sensor line for the Pt 100 (user-configurable).

All modules have a high degree of noise suppression.

Note

All the analog input modules of the S5-135U/-155U programmable controllers (see Section 4) can be used in the S5-115U with adapter casings.

An adapter casing is required for the 463-4 and 466-3 analog input modules (page 3/98).

The 463-4 module must not be operated in the third centrally connected ER 701-3 subrack for S5-115F.

Technical specifications

Analog input module	6ES5 460-7LA13	6ES5 465-7LA13	6ES5 463-4U.12
Number of inputs	**8** voltage/current inputs or **8** inputs for Pt 100 resistance thermometer	**16** voltage/current inputs or **8** inputs for Pt 100 resistance thermometer	**4** voltage/current inputs
Galvanic isolation	Yes	No	Yes
Input ranges (rated values)	**± 50 mV; ± 500 mV; Pt 100; ± 1 V; ± 5 V; ± 10 V; ± 20 mA; + 4 ... 20 mA** Input ranges can be selected for 4 channels at a time using measuring range modules		**0 ... 1 V, 0 ... 10 V, 0 ... 20 mA + 4 ... 20 mA** for two-wire and four-wire measuring transducers
Input resistance in the individual ranges	50 mV: ≧ 10 MΩ 500 mV: ≧ 10 MΩ Pt 100 : ≧ 10 MΩ	1 V: 90 kΩ; 2 ‰ 5 V: 50 kΩ; 2 ‰ 10 V: 50 kΩ; 2 ‰	20 mA: 25 Ω; 1 ‰ 4 ... 20 mA: 31.2 Ω; 1 ‰	1 V: ≧ 10 MΩ; 10 V: 90 kΩ; 20 mA: 50 Ω 4 ... 20 mA: 62.5Ω
Types of connection of sensors	Two-wire connection; four-wire connection for Pt 100		Two-wire connection
Digital representation of the input signal	12 bit + sign or 13 bit two's complement (2048 units = rated value)		11 bit two's complement (1024 units = rated value)

Analog input modules (continued)

Technical specifications

Analog input module	6ES5 460-7LA13	6ES5 465-7LA13	6ES5 463-4U.12
Measuring principle	Integrating	Integrating	Integrating
Conversion principle	Voltage-time conversion	Voltage-time conversion	Voltage-time conversion
Integration time (adjustable for optimum noise suppression)	20 ms at 50 Hz $16^2/_3$ ms at 60 Hz	20 ms at 50 Hz $16^2/_3$ ms at 60 Hz	20 ms at 50 Hz $16^2/_3$ ms at 60 Hz
Encoding time max. (single value encoding possible)	60 ms at 50 Hz 50 ms at 60 Hz (referred to nominal value)	60 ms at 50 Hz 50 ms at 60 Hz (referred to nominal value)	60 ms at 50 Hz $16^2/_3$ ms at 60 Hz
Cycle time for 4 inputs	—	—	20 ms at 50 Hz $16^2/_3$ ms at 60 Hz
8 inputs	0.48 s at 50 Hz	0.48 s at 50 Hz	—
16 inputs	—	0.96 s at 50 Hz	—
Permissible voltage between inputs or between inputs and the central earthing point (destruction limit) max.	± 18 V or max. ± 75 V for 1 ms with a pulse repeat rate of 50 pulses/second		± 30 V or max. ± 75 V for 1 ms with a pulse repeat rate of 100 pulses/second
Permissible voltage between the reference potential of a non-floating sensor and the central earthing point max.	75 V DC/60 V AC	± 1 V	75 V DC/60 V AC
Error indication for			
• Overranging	At 200 % of the nominal value (4095 units)		At 150 % of the nominal value
• Wire breakage of the sensor line	It can be designed for the ranges 50 mV, 500 mV and Pt 100		No
Noise suppression for f = n • (50/60 Hz ± 1%); n = 1,2 ...			
• Common mode noise (V_p < 1 V) min.	120 dB	86 dB	80 dB
• Series mode noise (peak noise value < rated value of the range) min.	40 dB	40 dB	40 dB
Basic error limits[1]	50 mV: ± 2 ‰ 1 V: ± 3.5 ‰ 500 mV: ± 1.5 ‰ 5 V: ± 3.5 ‰ Pt 100: ± 2 ‰ 10 V: ± 3.5 ‰	20 mA: ± 2.5 ‰ 4 ... 20 mA: ± 2.5 ‰	1.1 ‰
Operational error limits[1] (0 °C to 60 °C)	50 mV: ± 5 ‰ 1 V: ± 7.7 ‰ 500 mV: ± 4.5 ‰ 5 V: ± 7.7 ‰ Pt 100: ± 5 ‰ 10 V: ± 7.7 ‰	20 mA: ± 6.7 ‰ 4 ... 20 mA: ± 6.7 ‰	3.7 ‰
Cable length (shielded) max.	200 m (650 ft); max. 50 m (164 ft) at 50 mV	200 m (650 ft); max. 50 m (164 ft) at 50 mV	200 m (650 ft)
Supply voltage			
• Rated value	+ 24 V	+ 24 V	+ 24 V
• Ripple V_{pp}	3.6 V	3.6 V	3.6 V
• Permissible range (including ripple)	20 ... 30 V	20 ... 30 V	20 ... 30 V
• Value at t < 0.1 s	36 V	36 V	36 V
Current consumption			
• Internal (at 5 V) typ.	0.15 A	0.15 A	0.2 A
• External (at 24 V) typ.	0.1 A	—	0.15 A
Front connector	46-pin	46-pin	42-pin
Weight approx.	0.4 kg (0.9 lb)	0.4 kg (0.9 lb)	0.4 kg (0.9 lb)

1) In accordance with DIN 43 745; referred to nominal measuring range (5 V supply from power supply module).

Analog input modules (continued)

Technical specifications

Analog input module		**6ES5 466-3LA11**
Number of inputs		**8** differential inputs or **16** individual inputs (referred to ground) in 4 or 2 groups (selectable)
Galvanic isolation		Yes
Input ranges (rated values)		**0 ... 20 mA; 4 ... 20 mA; ± 20 mA** **0 ... 1.25 V; 0 ... 2.5 V; 0 ... 5 V; 1 ... 5 V; 0 ... 10 V** **± 1.25 V; ± 2.5 V; ± 5 V; ± 10 V** } selector switch lets you select these values for 4 channels separately
Input resistance in the individual ranges		Voltage measuring range: ≥ 10 MΩ Current measuring range: 125 MΩ
Types of connection of signal sensors		Two-wire connection
Digital representation of the input signal		13 bit two's complement or 12 bit abs. value + sign or 12 bit binary
Measuring principle		Instantaneous value encoding
Conversion principle		Successive approximation
Encoding time per channel	max.	250 µs
Cycle time for 8 inputs 16 inputs	 max. max.	 2 ms 4 ms
Permissible voltage between inputs or between inputs and the central earthing point (destruction limit)	max.	± 30 V (static) or ± 75 V for 1 ms with a pulse repeat rate of 50 pulses/second
Permissible voltage between the reference potential of a non-floating sensor and the central earthing point	max.	75 V DC/60 V AC
Error indication for • Overranging • Wire breakage of the sensor line		 Yes (overflow bit) No
Noise suppression for f = n · (50/60 Hz ± 1%); n = 1,2 ... • Common mode noise (V_p < 1 V) • Series mode noise (peak noise value < rated value of the range)	 min. min.	 70 dB 40 dB
Basic error limits[1] (at 20 °C)		Voltage ranges (except 0... 1.25 V; ± 1.25 V): 0.1 % Current ranges and 0... 1.25 V; ± 1.25 V: 0.12%
Operational error limits[1] (0 °C to 60 °C; for one year)		Voltage ranges (except 0... 1.5 V; ± 1.25 V): 0.2 % Current ranges and 0... 1.25 V; ± 1.25 V: 0.24%
Cable length (shielded)	max.	200 m (650 ft)
Current consumption • Internal (at 5 V) • External (at 24 V)	 typ. typ.	 0.7 A —
Front connector		43-pin
Weight	approx.	0.4 kg (0.9 lb)

1) In accordance with DIN 43 745; referred to nominal measuring range (5 V supply from power supply module).

Analog input modules (continued)

Ordering data	Order No.		Order No.
460-7 analog input module for S5-115U/H/F 8 inputs (current/voltage or Pt 100), input range set by measuring range module, floating	**6ES5 460-7LA13**	**466-3 analog input module** for S5-115U/H 16 individual inputs/ 8 differential inputs floating, with short encoding time	**6ES5 466-3LA11**
465-7 analog input module for S5-115U/H 16 inputs (current/voltage) or 8 inputs (Pt 100), input range set by measuring range module, non-floating	**6ES5 465-7LA13**	Operating instructions are included in the S5-115U manual (see page 3/23).	
To be ordered as a separate item:		**490 front connector** for AE 463-4, 466-3	
498 measuring range module for 4 channels		For screw terminals, 46-pin	**6ES5 490-7LB21**
± 50 mV; ± 500 mV; Pt 100	**6ES5 498-1AA11**	For crimp terminals, 46-pin	
± 1 V	**6ES5 498-1AA21**	• With 50 crimp contacts	**6ES5 490-7LA11**
± 5 V	**6ES5 498-1AA61**	• Without crimp contacts	**6ES5 490-7LA21**
± 10 V	**6ES5 498-1AA31**	For snap-on clip terminals, 46-pin	**6ES5 490-7LC11**
± 20 mA	**6ES5 498-1AA41**	**497 front connector** for AE 463-4	
+ 4 ... 20 mA; for 2-wire transducer	**6ES5 498-1AA51**	Crimp terminals, 42-pin	**6ES5 497-4UA12**
+ 4 ... 20 mA; for 4-wire transducer	**6ES5 498-1AA71**	Screw terminals, 42-pin	**6ES5 497-4UB31**
463-4 analog input module for S5-115U/H/F 4 inputs, floating		**K front connector** for AE 466-3 Crimp terminals, single-width, 43-pin	**6XX3 068**
For 50 Hz systems	**6ES5 463-4UA12**	Screw terminals, single-width, 42-pin	**6XX3 081**
For 60 Hz systems	**6ES5 463-4UB12**	**Adapter casing** for 463-4, 466-3 analog input modules	see page 3/98

Connection diagrams

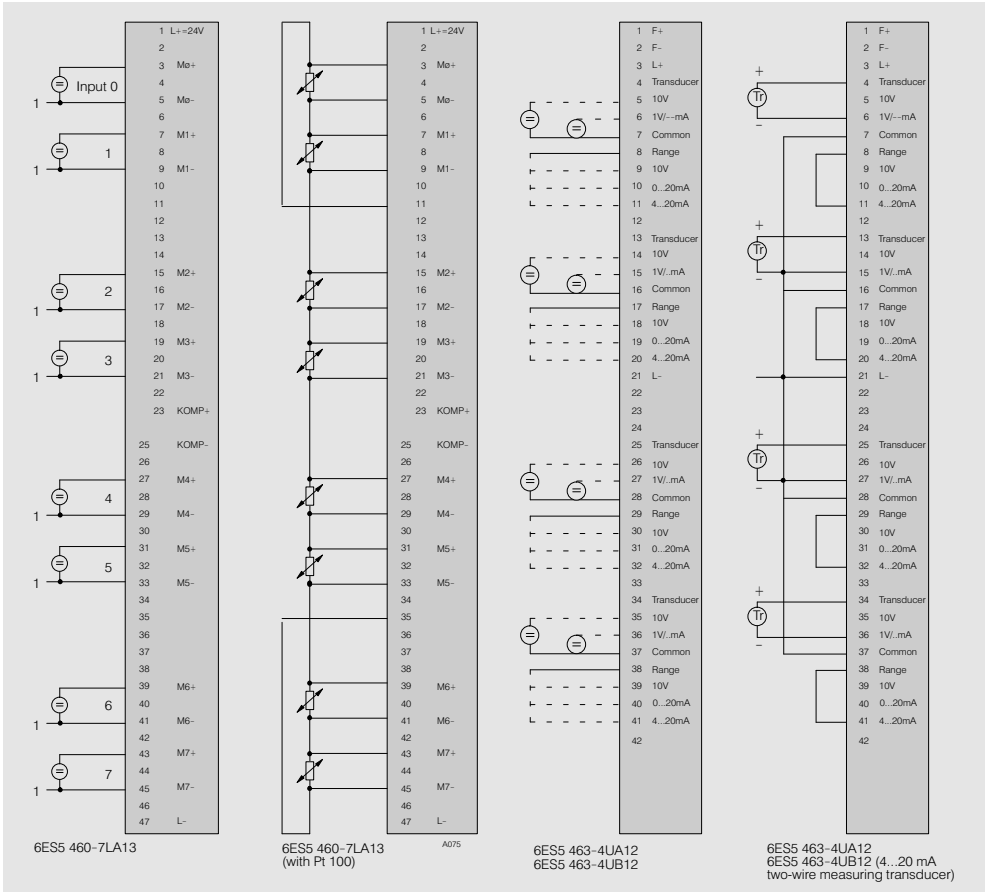


Fig. 3/30 Connection diagram for analog input modules

Analog input modules (continued)

3

Connection diagrams

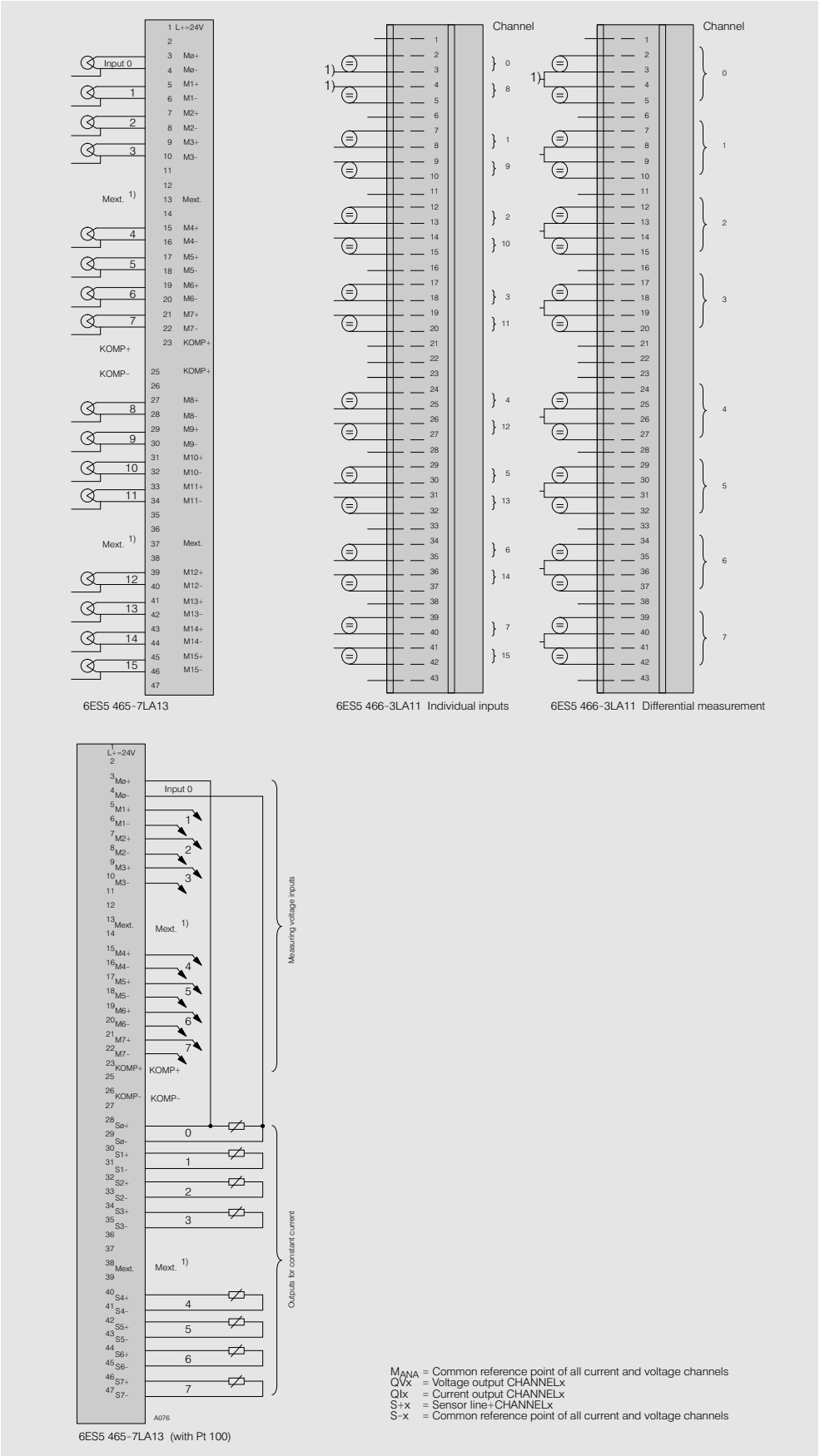


Fig. 3/31 Connection diagrams for analog input modules

Analog output modules

Application

The analog output modules convert digital values from the programmable controller into the analog signals required by the process.

Design

Three analog output modules are available with 8 outputs each and a range of output voltages. The modules each require one slot.

The signal leads must be connected with front connectors. They can be labelled in the fields on the front panel. The modules and front connectors can be inserted and removed under power. The module address (byte parameter when programming) is slot-dependent and need therefore not be set on the module.

Principle of operation

The CPU of the central controller transmits output values in digital form to the processor of the analog output module. These are converted to analog voltages by a digital-analog converter and a sample-and-hold procedure.

A voltage-current converter is also used to generate the corresponding output currents.The voltage and current output ranges for each module are fixed.

Note

All the analog output modules of the S5-135U/155U programmable controllers (see Section 4) can be used in the S5115U with adapter casings.

Technical specifications

Analog output module	6ES5 470-7L.13	Analog output module	6ES5 470-7L.13
Number of outputs (voltage and current outputs)	**8**	Open-circuit voltage (current output) approx.	18 V
Galvanic isolation	Yes (not between the outputs)	Voltage between the reference potential of the load (0 V connection) and the housing max.	60 V AC/75 V DC
Output ranges (rated values)		Linearity in the rated range	± 2.5 ‰; ± 3 units
• 6ES5 470-7LA12	**±10 V; 0...20 mA**	Operational limits (0 to + 55 °C)	± 6 ‰
• 6ES5 470-7LB12	**±10 V**	Cable length (shielded) max.	200 m (650 ft)
• 6ES5 470-7LC12	**+1...5 V; +4...20 mA**	Supply voltage	
Load resistance	Only ohmic resistance	• Rated value	+ 24 V
• For voltage outputs min.	3.3 kΩ	• Ripple V_{pp}	3.6 V
• For current outputs max.	300 Ω	• Permissible range (including ripple)	20...30 V
Load connection	Load to the 0 V terminal	• Value at t < 0.1 s	36 V
Digital representation of the output signal	12 bit two's complement (1024 units = rated value)	Power consumption	
Conversion time	1 ms	• Internal (at 5 V) typ.	0.25 A
Permiss. overload capability approx.	25 % (up to 1280 units)	• External (at 24 V) typ.	0.3 A
Short-circuit protection	Yes	Front connector	46-pin
Short-circuit current (voltage output) approx.	25 mA	Weight approx.	0.4 kg (0.9 lb)

Analog output modules (continued)

Ordering data	Order No.		Order No.
470-7LA analog output module for S5-115U/H/F 8 outputs; ± 10 V/0 ... 20 mA	**6ES5 470-7LA13**	Operating instructions are included in the S5-115U manual (see page 3/23).	
470-7LB analog output module for S5-115U/H/F 8 outputs; ± 10 V	**6ES5 470-7LB13**	**490 front connector** For screw terminals, 46-pin	**6ES5 490-7LB21**
470-LC analog output module for S5-115U/H/F 8 outputs; + 1 ... 5 V; + 4 ... 20 mA	**6ES5 470-7LC13**	For crimp terminals, 46-pin • With 50 crimp contacts • Without crimp contacts	**6ES5 490-7LA11** **6ES5 490-7LA21**
		For snap-on clip terminals, 46-pin	**6ES5 490-7LC11**

Connection diagrams

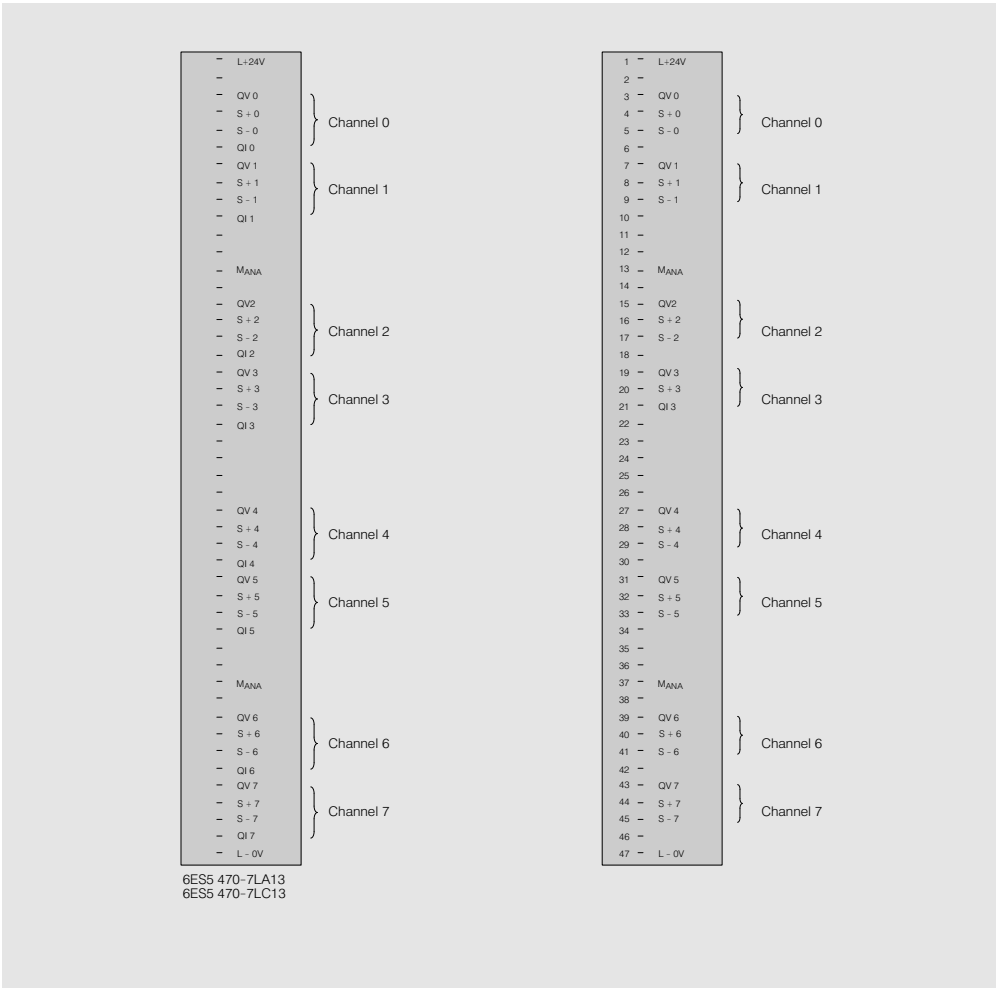


Fig. 3/32 Connection diagrams for analog output modules

Intelligent I/O modules

Overview

Intelligent I/O modules are used for high-speed, high accuracy

- Closed-loop control
- Positioning
- Counting and proportioning
- Processing

of analog signals.

The advantage of the intelligent I/O modules lies in the fact that they execute these time-critical tasks completely autonomously (in most cases with their own processor). The CPU can then concentrate on its own control tasks more closely.

These intelligent I/O modules are linked directly with the process via input and output channels. There is an entire range of intelligent I/O modules for the S5-115U programmable controller, which can be used for the S5-135U and S5-155U/H.

For further information, see Section 4.

Overview

Overview

Special tasks

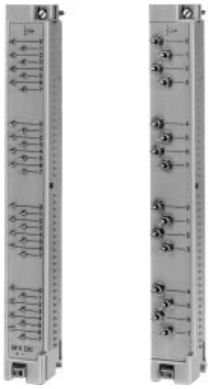
Memory	Page	PC functions	Page
CP 516 memory submodule	4/96	CP 581, the integral PC in the SIMATIC	4/97
		CP 581 with COROS LS-B	4/101

Supplementary equipment

Communication	Page	Simulation	Page
TK 858 telecommunications unit	8/16	Simulation connectors	3/54
		Simulation panel	3/55
		Simulation modules	4/108
		313 monitoring module	4/109

Simulation connectors

Application



For simulating binary input signals on the S5-115U programmable controller.

Design

The simulation connectors must be plugged into digital input modules in the same way as front connectors and must be supplied with the signal voltage. They have switches which can be used as maintained-contact switches (up position) or as momentary-contact switches (down position).

2 versions are available:

- With 32 switches for 420-7LA and 430-7LA digital input modules
- With 16 switches for 431-7LA, 432-7LA, 435-7LA and 436-7LA digital input modules

Ordering data	Order No.
Simulation connectors	
With 32 switches	**6ES5 490-7SA11**
With 16 switches	**6ES5 490-7SA21**

Communications modules and bus systems

Overview

Communications processors are used for data interchange between the S5-115U/H/F programmable controllers and the I/Os or other programmable controllers connected to them.

Programmable controllers can be linked in two ways:

Point-to-point connection

Point-to-point connection is used for connecting one or more I/Os or programmable controllers to a single S5115U/H/F programmable controller. The link can, for example, be made via the second interface of the CPU 943, CPU 944 and CPU 945. The CP 523, CP 524, CP 544 and CP 544B communications processors can also be used. These primarily relieve the CPU of the responsibility for communications, thus enabling a large number of I/Os to be connected.

Bus systems

LANs are used for interlinking a number of nodes. Possible nodes include:

- S5-115U/H/F programmable controllers
- Third-party programmable controllers
- Personal computers
- Minicomputers or workstations
- Field equipment

There are three different LANs to choose from, depending on the area to be covered, the number and type of nodes and the transmission speed:

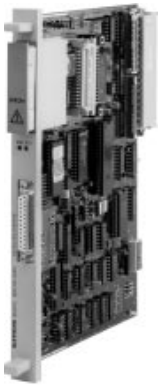
- SINEC L1
- PROFIBUS
- Industrial Ethernet

A communications processor is available for each of these three bus systems.

For further information, selection and ordering data, see Section 4.

CP 523 communications processor for the S5-115F

Application



The CP 523 communications processor makes linking to any desired devices with serial interfaces possible. The module is especially suitable for:

- Direct safety-related link between two programmable controllers
- Direct reaction-free link between a S5-115F programmable controller and another SIMATIC programmable controller
- Link with a personal computer as well as operator control and process monitoring equipment

Devices with serial interfaces like, for example, printers, terminals, keyboards, barcode readers, CP 523, etc. can be connected.

Design

In the S5-115F programmable controller it must be observed that the V.24 interface must only be used if the partner device ensures an electrical separation in accordance with VDE 0160.

For further information, see Section 4.

Principle of operation

Interfacing

The FB 252 integral function block in the S5-115F programmable controller delivers block-wise data transfer to the CP 523.

A safety-related link of further S5-115F programmable controllers is possible with standard function blocks (see Section 7).

Message printout

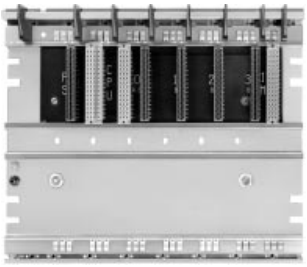
In the S5-115F programmable controller the CP 523 can be used for the output of system fault signals. For that, it assigns the top 256 signals and in the event of system faults gives out one of these signals automatically. The signal texts for the system fault signals are contained in the diskette with the COM 115F parameterization software as an example.

For further information, see Section 4.

3

CR 700-0LA subrack for S5-115U central controllers

Application



A small central controller with up to four I/O modules can be configured with the CR 700-0LA subrack. A power supply and CPU module are always required. Hardware interrupt evaluation is possible on all admissible slots for the corresponding modules.

Design

Up to three expansion units can be connected in series in centralized configuration (via IM 305 and IM 306 interface modules).

- Type:
  Aluminium baseplate of extruded section with bus board for connecting the modules
- Dimensions (W x H x D) in mm: 353 x 303 x 47
- Weight: approx. 4 kg

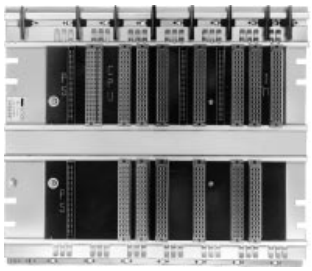
Module locations

Slot No.	PS	CPU	0	1	2	3	IM
PS 951 power supply module	■						
CPU 941 to CPU 945		■					
Digital input and output, digital input/output, analog input and output modules (block type: 6ES5 4..-7....)			■	■	■	■	
Digital input and output, analog input and output modules (compact modules: 6ES5 4..-4...., 6ES5 466-3LA11)			■				
Communications processors	For slot assignment, see Section 11						
Intelligent I/O modules	For slot assignment, see Section 11						
IM 305, IM 306							■

Ordering data	Order No.
CR 700-0LA subrack	**6ES5 700-0LA12**

CR 700-0LB subrack for S5-115U central controllers

Application



A small central controller with up to six I/O modules can be configured with the CR 700-0LB subrack. A power supply and CPU module are always required.

Design

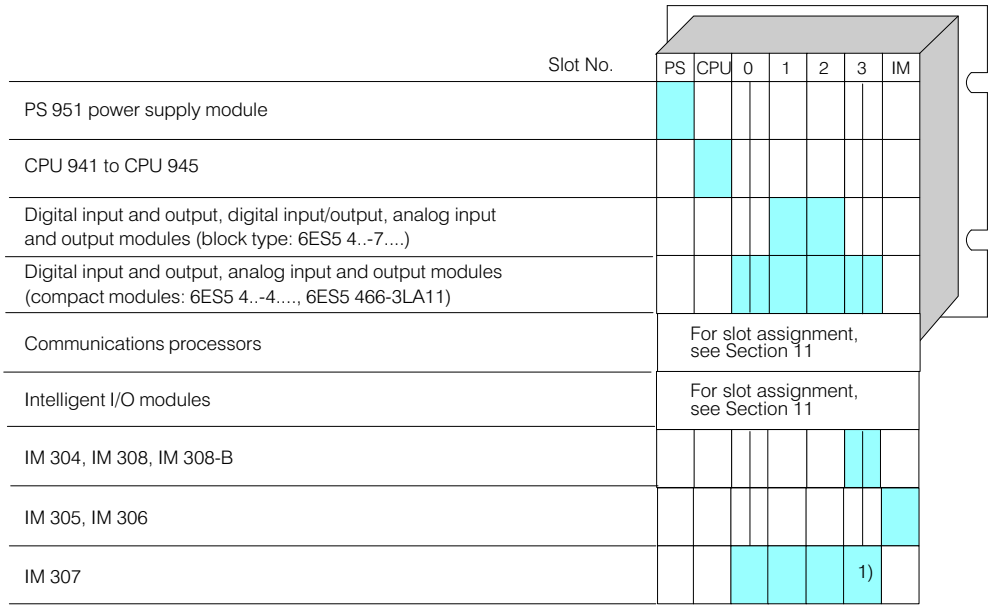
Two single-width modules in one adapter casing can be plugged into slots 0 and 3. Where two or more modules are installed in one casing, a fan subassembly is always required.

Hardware interrupt evaluation is possible on the admissible slots for the corresponding modules.

Connection of expansion units the same as for the CR 700-2 subrack, but 2 interface modules can be used for distributed configuration in 1 adapter casing in slot 3.

Type, dimensions and weight: see CR 700-0LA subrack.

Module locations



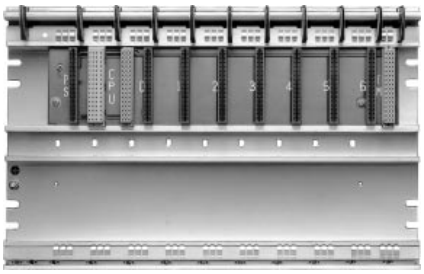
1) No interrupt processing possible in slot 3.

Ordering data	Order No.
CR 700-0LB subrack	**6ES5 700-0LB11**

3

CR 700-1 subrack for S5-115U central controllers

Application



A central controller with up to seven I/O modules can be configured with the CR 700-1 subrack. A power supply and CPU module are always required. Hardware interrupt evaluation is possible on the admissible slots for the corresponding modules.

Design

Up to 3 expansion units can be connected in series in centralized configuration.

- Type:
  Aluminium baseplate of extruded section with bus board for connecting the modules
- Dimensions (W x H x D) in mm: 483 x 303 x 47
- Weight: approx. 5 kg

Module locations

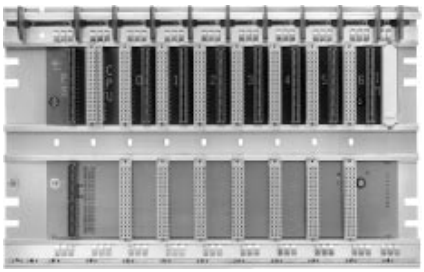
Slot No.	PS	CPU	0	1	2	3	4	5	6	IM
PS 951 power supply module	■									
CPU 941 to CPU 945		■								
Digital input and output, digital input/output, analog input and output modules (block type: 6ES5 4..-7....), 776 power output			■	■	■	■	■	■	■	
Digital input and output, analog input and output modules (compact modules: 6ES5 4..-4...., 6ES5 466-3LA11)			■							
Communications processors	For slot assignment, see Section 11									
Intelligent I/O modules	For slot assignment, see Section 11									
IM 305, IM 306										■

1) Analog modules in slots 4, 5 and 6 only possible when using the IM 306 interface module.

Ordering data	Order No.
CR 700-1 subrack	**6ES5 700-1LA12**

CR 700-2 subrack for S5-115U central controllers

Application



A central controller with up to seven I/O modules can be configured with the CR 700-2 subrack. A power supply and CPU module are always required.

Hardware interrupt evaluation is possible on the admissible slots for the corresponding modules.

Design

In centralized configuration up to 3 expansion units can be connected in series.

In distributed configuration the following can be connected:

- Up to 600 m, up to 2 times 4 expansion units (via IM 304)
- Up to 3000 m, up to 63 expansion units (via IM 308)
- For a distance of 50 to 500 m between 2 interface modules, max. 3 expansion units (via IM 307)
- Up to 23 km, max. 122 ET 200 distributed I/O modules (in two phases, via IM 308-B)

In addition to that, up to 3 expansion units can be connected in centralized configuration to distributed expansion units.

Type, dimensions and weight: see CR 700-1 subrack.

Module locations

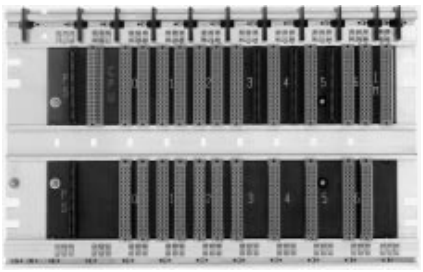
Slot No.	PS	CPU	0	1	2	3	4	5	6	IM
PS 951 power supply module	■									
CPU 941 to CPU 945		■								
Digital input and output, digital input/output, analog input and output modules[1] (block type: 6ES5 4..-7....)			■	■	■	■	■	■	■	
Digital input and output[2], analog input and output modules (compact modules: 6ES5 4..-4...., 6ES5 466-3LA11)			■	■	■	■	■	■	■	
Communications processors	For slot assignment, see Section 11									
Intelligent I/O modules	For slot assignment, see Section 11									
IM 304, IM 308, IM 308-B									■	
IM 305, IM 306										■
IM 307			■	■	■	■	■	■	3)	

1) Analog modules in slots 4, 5 and 6 only possible when using the IM 306 interface module.
2) 434-4 digital input module not in slot 6.
3) No interrupt processing possible in slot 6.

Ordering data	Order No.
CR 700-2 subrack	**6ES5 700-2LA12**

CR 700-3 subrack for S5-115U central controllers

Application



A central controller with up to eleven I/O modules can be configured with the CR 700-3 subrack. A power supply and CPU module are always required.

Design

Two single-width modules in one adapter casing can be plugged into slots 0, 1, 2 and 6. Where two or more modules are installed in one casing, a fan subassembly is always required.

Hardware interrupt evaluation is possible in the admissible slots for the corresponding modules.

Connection of expansion units the same as for the CR 700-2 subrack, but 2 interface modules can be used for distributed configuration in one adapter casing in slot 6.

Type, dimensions and weight: see CR 700-1 subrack.

Module locations

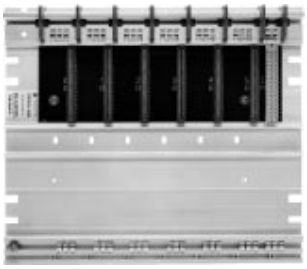
Slot No.	PS	CPU	0	1	2	3	4	5	6	IM
PS 951 power supply module	■									
CPU 941 to CPU 945		■								
Digital input and output, digital input/output, analog input and output modules[1] (block type: 6ES5 4..-7....)						■	■	■		
Digital input and output[2], analog input and output modules (compact modules: 6ES5 4..-4...., 6ES5 466-3LA11)			■	■	■	■	■	■	■	
Communications processors	For slot assignment, see Section 11									
Intelligent I/O modules	For slot assignment, see Section 11									
IM 304, IM 308, IM 308-B									■	
IM 305, IM 306										■
IM 307			■	■	■	■	■	■	2)	

1) Analog modules in slots 4, 5 and 6 only possible when using the IM 306 interface module.
2) No interrupt processing possible in slot 6.

Ordering data	Order No.
CR 700-3 subrack	**6ES5 700-3LA12**

ER 701-0 subrack for S5-115U expansion units

Application



An expansion unit containing up to six I/O modules can be configured with the ER 701-0 subrack. Power supply by the central controller or an expansion unit with the ER 701-2 or ER 701-3 subrack.

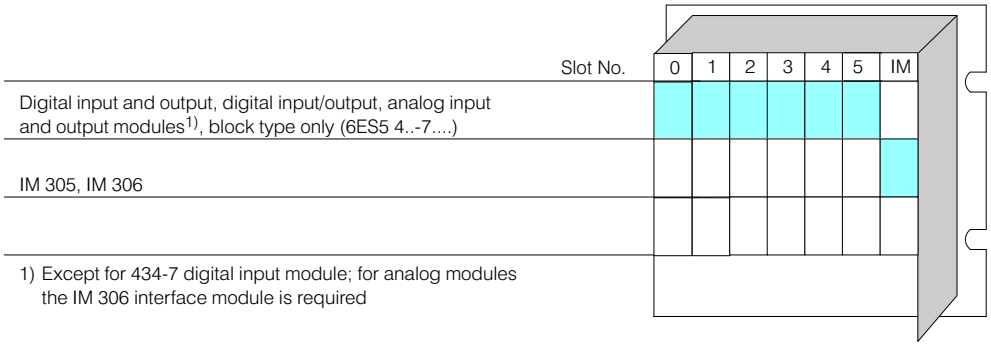
Design

An expansion unit with the ER 701-0 subrack must always be connected in centralized configuration (IM 305 or IM 306 interface module).

Interrupt evaluation is not possible in this expansion unit.

Type, dimensions and weight: see CR 700-0 subrack.

Module locations



1) Except for 434-7 digital input module; for analog modules the IM 306 interface module is required

Ordering data	Order No.
ER 701-0 subrack	**6ES5 701-0LA11**

ER 701-1 subrack for S5-115U expansion units

Application

An expansion unit containing up to nine I/O modules can be configured with the ER 701-1 subrack. Power supply by the central controller or an expansion unit with the ER 701-2 or ER 701-3 subrack.

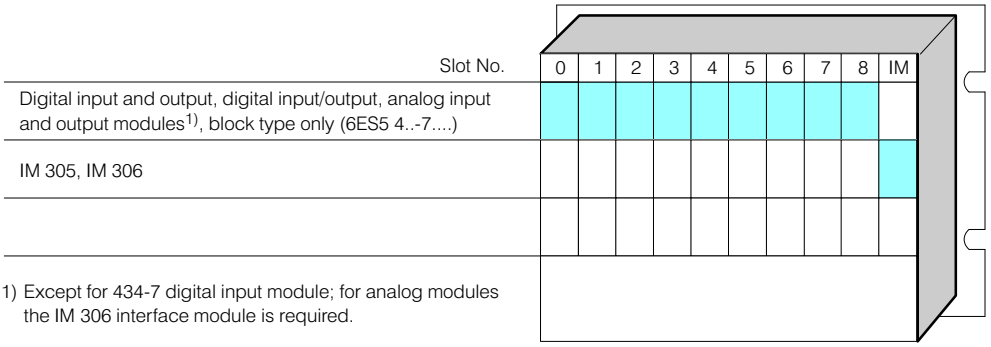
Design

An expansion unit with the ER 701-1 subrack must always be connected in centralized configuration (IM 305 or IM 306 interface module).

Interrupt evaluation is not possible in this expansion unit.

Type, dimensions and weight: see CR 700-1 subrack.

Module locations

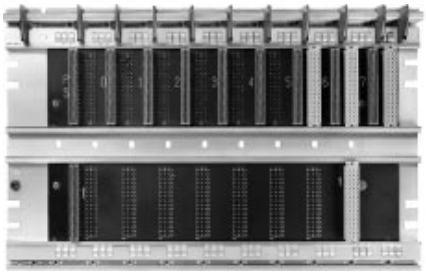


1) Except for 434-7 digital input module; for analog modules the IM 306 interface module is required.

Ordering data	Order No.
ER 701-1 subrack	**6ES5 701-1LA12**

ER 701-2 subrack for S5-115U expansion units

Application



An expansion unit containing up to seven I/O modules can be configured with the ER 701-2 subrack. A power supply module and the IM 306 interface module (for modules in block design) are always required.

Design

An expansion unit with the ER 701-2 subrack must always be connected in distributed configuration (IM 314, IM 317 or IM 318 interface modules).

Interrupt evaluation is not possible in this expansion unit.

Type, dimensions and weight: see CR 700-1 subrack.

Module locations

Slot No.	PS	0	1	2	3	4	5	6	7	IM
PS 951 power supply module	■									
Digital input and output, digital input/output, analog input and output modules[1] (block type: 6ES5 4..-7....),		■	■	■	■	■	■	■		
Digital input and output, analog input and output modules[1] (compact modules: 6ES5..-4.-...., 6ES5 466-3LA11)								■		
Communications processors	For slot assignment, see Section 11									
IM 306										■
IM 314, IM 317, IM 318									■	
313 monitoring module								■		

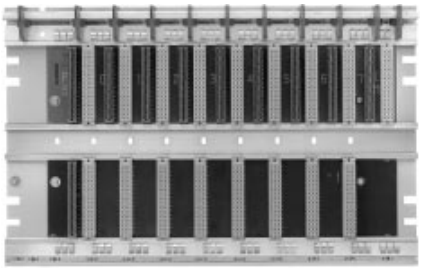
1) The IM 306 interface module is necessary for modules in block design (for address setting).

Ordering data	Order No.
ER 701-2 subrack	**6ES5 701-2LA12**

3

ER 701-3 subrack for S5-115U expansion units

Application



An expansion unit containing up to seven I/O modules can be configured with the ER 701-3 subrack. A power supply module and the IM 306 interface module (for modules in block design) are always required.

Design

An expansion unit with the ER 701-3 subrack must always be connected in distributed configuration (IM 314, IM 317 or IM 318 interface modules). When using IM 314 or IM 317 interface modules, also communications processors and intelligent I/O modules with page frame address can be plugged in.

In the ER 701-3 expansion unit interrupt processing is only possible when using the IM 307/IM 317 fiber optic interface modules.

Type, dimensions and weight: see CR 700-1 subrack.

Module locations

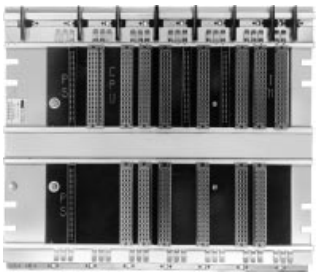
Slot No.	PS	0	1	2	3	4	5	6	7	IM
PS 951 power supply module	■									
Digital input and output, analog input and output modules[1] (block type: 6ES5 4..-7....),		■	■	■	■	■	■	■		
Digital input and output, digital input/output, analog input and output modules (compact mod.: 6ES5..-4.-...., 6ES5 466-3LA11)		■	■	■	■	■	■	■		
Communications processors	For slot assignment, see Section 11									
Intelligent I/O modules	For slot assignment, see Section 11									
IM 306 (always required)										■
IM 314 (also IM 310) or IM 318									■	
IM 307, IM 317		■	■	■	■	■	■	■	2)	
313 monitoring module		■								

1) Except for 434-7 digital input module.
2) No interrupt processing possible in slot 7.
3) The IM 306 interface module is necessary for modules in block design (for address setting).

Ordering data	Order No.
ER 701-3 subrack	**6ES5 701-3LA13**

CR 700-0LB subrack for S5-115H central controllers

Application



A small central controller with up to four I/O modules can be configured with the CR 700-0LB subrack. A power supply and CPU module are always required, as well as an IM 304 or IM 324R interface module for linking the two central controllers.

Design

Up to three expansion units can be connected in centralized configuration (for redundant or single-sided configurations).

Up to two times four expansion units (each with three additional EUs in centralized configuration) can be connected in distributed configuration up to 600 m (1968 ft).

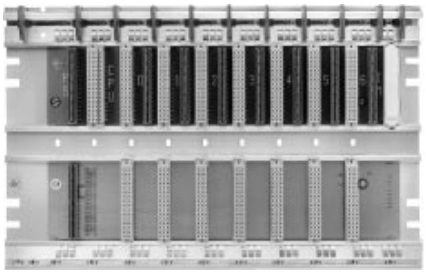
Module locations

Slot No.	PS	CPU	0	1	2	3	IM
PS 951 power supply module	■						
CPU 942H		■					
Digital input and output, digital input/output, analog input and output modules (block type: 6ES5 4..-7....)				■	■		
Digital input and output, analog input and output modules (compact modules: 6ES5 4..-4...., 6ES5 466-3LA11)			■	■	■		
Communications processors	For slot assignment, see Sec. 11						
Intelligent I/O modules	For slot assignment, see Sec. 11						
IM 304 for linking central controllers or for distributed expansion						■	
IM 304, IM 306							■
IM 307			■	■	■	■	
IM 324R for linking central controllers						■	

Ordering data	Order No.
CR 700-0LB subrack	**6ES5 700-0LB11**

CR 700-2 subrack for S5-115H central controllers

Application



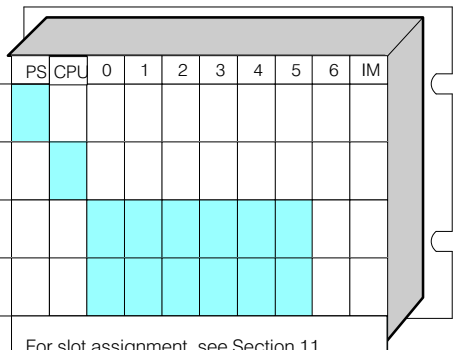
A central controller with up to six I/O modules can be configured with the CR 700-2 subrack. A power supply and CPU module are always required, as well as an IM 304 or IM 324R interface module for linking the two central controllers.

Design

Up to three expansion units can be connected in centralized configuration (for redundant or single-sided configurations).

Expansion units in switched or distributed configurations cannot be used with this subrack.

Module locations



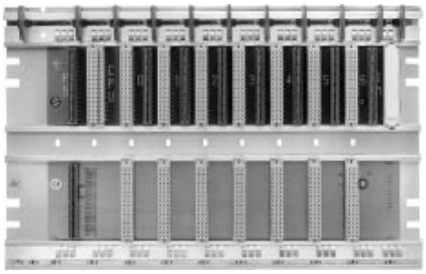
Slot No.	PS	CPU	0	1	2	3	4	5	6	IM
PS 951 power supply module	■									
CPU 942H		■								
Digital input and output, digital input/output, analog input and output modules (block type: 6ES5 4..-7....)			■	■	■	■	■	■		
Digital input and output, analog input and output modules[1] (compact modules: 6ES5 4..-4...., 6ES5 466-3LA11)			■	■	■	■	■	■		
Communications processors[2]	For slot assignment, see Section 11									
Intelligent I/O modules	For slot assignment, see Section 11									
IM 304 for linking central controllers									■	
IM 305, IM 306										■
IM 324R for linking central controllers									■	

1) 434-4 digital input module not in slot 6
2) CP 526 and CP 527 basic boards only

Ordering data	Order No.
CR 700-2 subrack	**6ES5 700-2LA12**

CR 700-2F subrack for S5-115H central controllers

Application



A central controller with up to six I/O modules can be configured with the CR 700-2F subrack. A power supply and CPU module are always required, as well as an IM 304 or IM 324R interface module for linking the two central controllers.

Design

Up to three expansion units can be connected in centralized configuration (for redundant or single-channel I/O configurations).

Up to two times four expansion units can be connected in distributed configuration up to 600 m (1968 ft).

Module locations

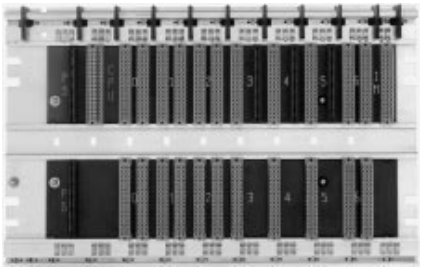
Slot No.	PS	CPU	0	1	2	3	4	5	6	IM
PS 951 power supply module	■									
CPU 942H		■								
Digital input and output, digital input/output, analog input and output modules (block type: 6ES5 4..-7....)			■	■	■	■	■	■		
Digital input and output, analog input and output modules (compact modules: 6ES5 4..-4...., 6ES5 466-3LA11)			■	■	■	■	■	■		
Communications processors[1]	For slot assignment, see Section 11									
Intelligent I/O modules	For slot assignment, see Section 11									
IM 304 for linking central controllers or for distributed expansion								■	■	
IM 305, IM 306										■
IM 307									■	
IM 324R for linking central controllers								■	■	

1) CP 526 and CP 527 as basic board only

Ordering data	Order No.
CR 700-2F subrack	**6ES5 700-2LA22**

CR 700-3 subrack for S5-115H central controllers

Application



A central controller with up to nine I/O modules can be configured with the CR 700-3 subrack. A power supply and CPU module are always required, as well as an IM 304 or IM 324R interface module for linking the two controllers.

Design

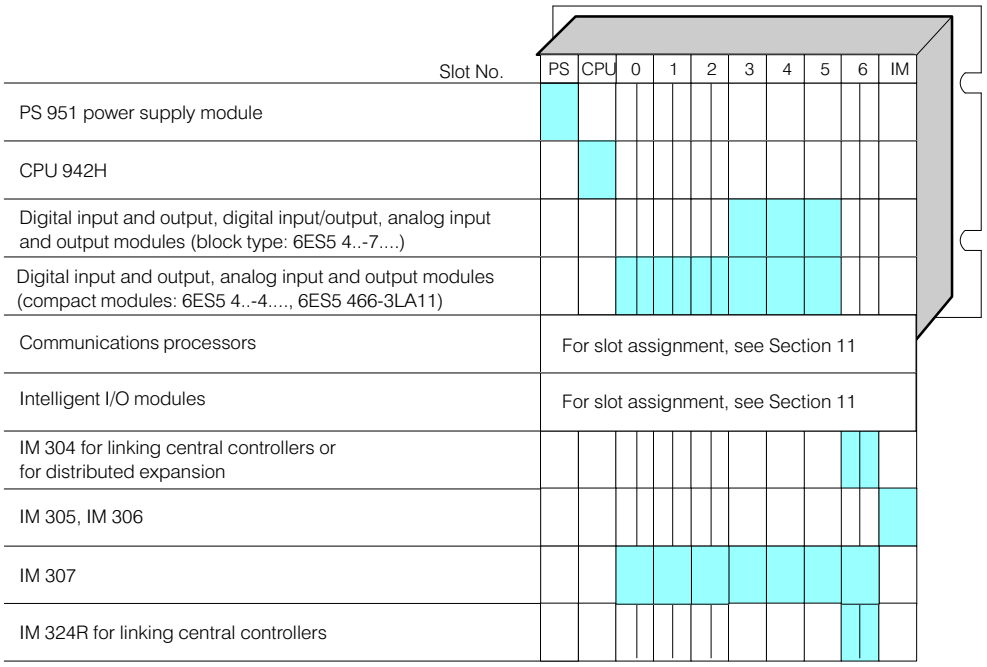
Two single-width modules in one adapter casing can be plugged into slots 0, 1, 2 and 6. Where two modules are installed in one casing, a fan subassembly is always required (see page 3/77).

Up to three expansion units can be connected in centralized configuration (for redundant or single-channel I/O configurations).

Up to two times four expansion units can be connected in distributed configuration up to 600 m (1968 ft).

Two interface modules in one adapter casing can be plugged into slot 6.

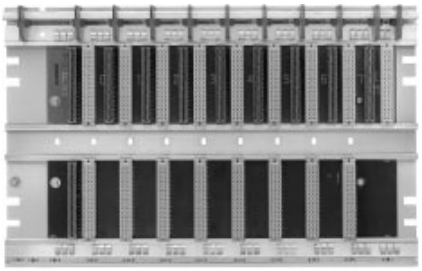
Module locations



Ordering data	Order No.
CR 700-3 subrack	**6ES5 700-3LA12**

ER 701-3LH subrack for I/O modules in switched configuration with S5-115H

Application



An expansion unit in switched configuration containing up to six I/O modules can be configured with the ER 701-3LH subrack. A power supply module and an IM 306 interface module for address setting are always required.

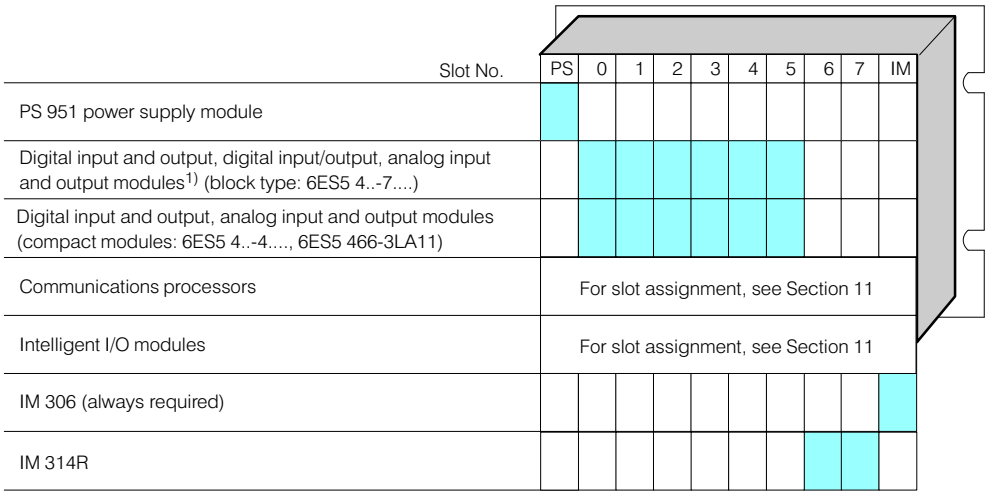
Design

A switched expansion unit with the ER 701-3LH subrack is connected to the central controllers in distributed configuration via two IM 314R interface modules.

Note on single-sided and two-channel configuration:
The ER 701-2 and ER 701-3 subracks can also be used for single-sided and two-channel configuration for the S5-115H programmable controller.

The possible configurations are the same as those for the S5-115U. For further details of these subracks please see pages 3/65 and 3/66.

Module locations



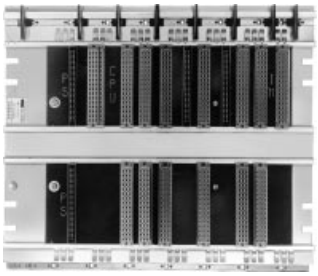
1) except 434-7 digital input module

Ordering data	Order No.
ER 701-3LH subrack	**6ES5 701-3LH11**

3

CR 700-0LB subrack for S5-115F central controllers

Application



A central controller with up to four I/O modules can be configured with the CR 700-OLB subrack. A power supply and CPU module are always required, as well as an IM 304 or IM 324R interface module for linking the two central controllers.

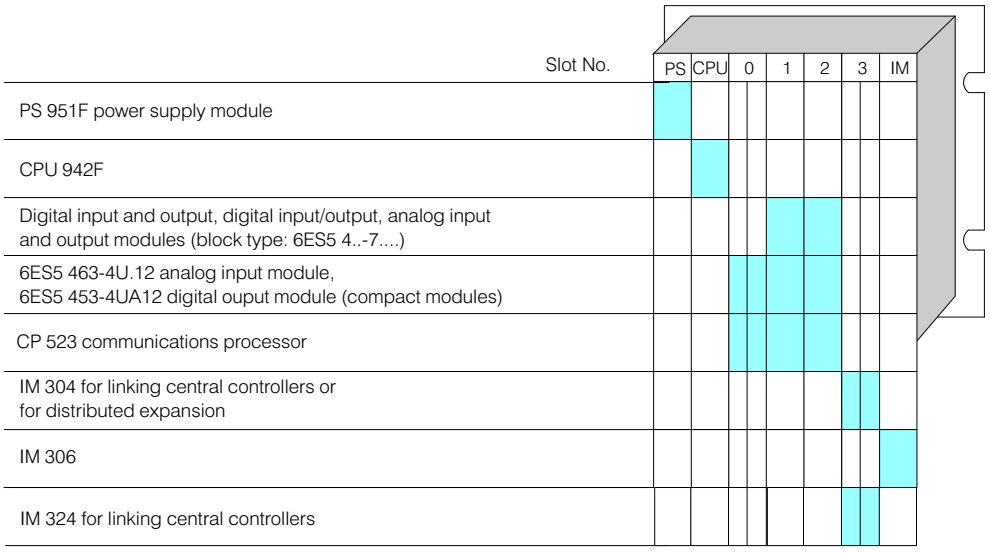
Design

Two communications processors in one adapter casing can be plugged into slot 0, two interface modules in one adapter casing can be plugged into slot 3.

Up to three expansion units can be connected in centralized configuration (for redundant or single-sided configurations).

Up to two times four expansion units (each with three additional EUs in centralized configuration) can be connected in distributed configuration up to 600 m (1968 ft) (for redundant or single-channel I/O configurations).

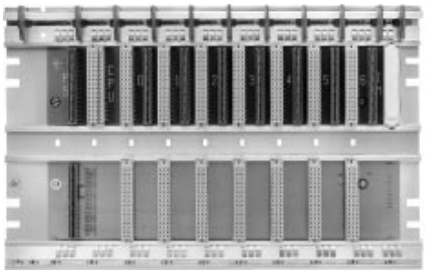
Module locations



Ordering data	Order No.	
CR 700-0LB subrack	**6ES5 700-0LB11**	

CR 700-2F subrack for S5-115F central controllers

Application



A central controller with up to six I/O modules can be configured with the CR 700-2F subrack. A power supply and CPU module are always required, as well as an IM 304 or IM 324R interface module for linking the two central controllers.

Design

Up to three expansion units can be connected in centralized configuration (for redundant or single-channel I/O configurations).

Up to two times four expansion units (each with three additional EUs in centralized configuration) can be connected in distributed configuration up to 600 m (1968 ft) (for redundant or single-channel I/O configurations).

Module locations

Slot No.	PS	CPU	0	1	2	3	4	5	6	IM
PS 951F power supply module	■									
CPU 942F		■								
Digital input and output, digital input/output, analog input and output modules (block type: 6ES5 4 ..-7 ....)			■	■	■	■	■	■		
6ES5 463-4U.12 analog input module, 6ES5 453-4UA12 digital output module (compact modules)			■	■	■	■	■	■		
CP 523 communications processor			■	■	■	■	■			
IM 304 for linking central controllers or for distributed expansion								■	■	
IM 306										■
IM 324 for linking central controllers								■	■	

Ordering data	Order No.
CR 700-2F subrack	**6ES5 700-2LA22**

3

ER 701-1 subracks for S5-115F expansion units

Application

A central controller with up to nine I/O modules can be configured with the ER 701-1 subrack. Power supply by the central controller or an expansion unit with the ER 701-2 or ER 701-3 subrack.

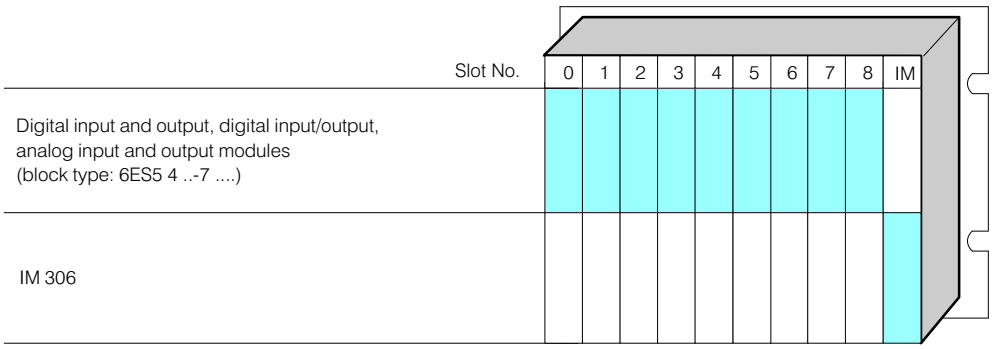
Design

An expansion unit with the ER 701-1 subrack must always be connected in centralized configuration.

The IM 306 interface module is required for the expansion unit.

Interrupt processing is not possible in this expansion unit.

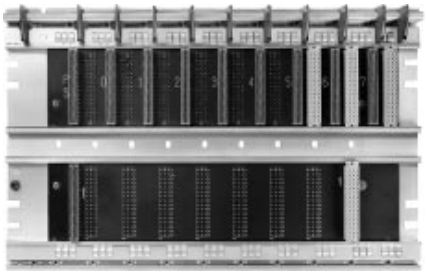
Module locations



Ordering data	Order No.	
ER 701-1 subrack	**6ES5 701-1LA12**	

ER 701-2 subrack for S5-115F expansion units

Application



A central controller with up to seven I/O modules can be configured with the ER 701-2 subrack. The IM 306 interface module is always required for address setting.

Design

Expansion units with ER 701-2 subracks can be connected to a central controller or an expansion unit with power supply with the IM 306 interface module in centralized configuration or in distributed configuration with the IM 314 interface module to a central controller.

In centralized configuration, no power supply module must be plugged into the ER 701-2 subrack. In distributed configuration, a power supply module is absolutely necessary.

This subrack makes two-channel, redundant configuration of I/O modules possible (see page 3/16).

Interrupt evaluation is not possible in expansion units.

Module locations

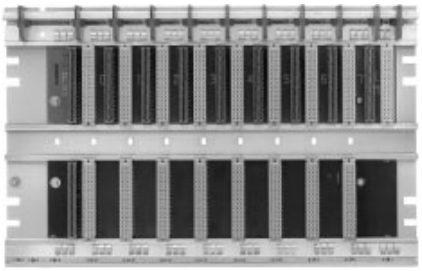
Slot No.	PS	0	1	2	3	4	5	6	7	IM
Power supply module	■									
Digital input and output, digital input/output, analog input and output modules (block type 6ES5 4 .. -7 ....)		■	■	■	■	■	■	■	1)	
IM 306										■
IM 314									■	

1) Only possible in this slot for centralized links (without power supply in the ER 701-2 subrack).

Ordering data	Order No.
ER 701-2 subrack	**6ES5 701-2LA12**

ER 701-3 subrack for S5-115F expansion units

Application



A central controller with up to eight I/O modules can be configured with the ER 701-3 subrack. The IM 306 interface module is always required for address setting.

Design

Expansion units with ER 701-3 subracks can be connected to a central controller or an expansion unit with power supply with the IM 306 interface module in centralized configuration or in distributed configuration with the IM 314 interface module to a central controller.

In centralized configuration, no power supply module must be plugged into the ER 701-3 subrack. In distributed configuration, a power supply module is absolutely necessary.

In an expansion unit with this subrack also the 463 analog input module can be plugged in.

This subrack makes two-channel, redundant configuration of I/O modules possible (see page 3/16).

Interrupt evaluation is not possible in expansion units.

Module locations

Slot No.	PS	0	1	2	3	4	5	6	7	IM
Power supply module	■									
Digital input and output, digital input/output, analog input and output modules[1] (block type: 6ES5 4 ..-7 ....)		■	■	■	■	■	■	■	2)	
6ES5 463-4U.12 analog input module[3], 6ES5 453-4UA12 digital output module (compact modules)		■	■	■	■	■	■	■	2)	
CP 523 communications processor		■	■	■	■	■	■	■		
IM 306										■
IM 314									■	

1) Except for 434-7LA12 digital input module
2) Only possible in this slot for centralized configuration (without power supply in the ER 701-3 subrack).
3) In centralized link with ER 701-3 subracks the 463 analog input module must only be used in the central controller and in the first and second expansion unit. Only the 6ES5 705-0AF00 cable (length 0.5 m) may be used for that.

Ordering data	Order No.
ER 701-3 subrack	**6ES5 701-3LA13**

Fan subassembly

Application

A fan subassembly is required:

- If the power supply module has an output load of more than 7 A
- If several modules are installed in one adapter casing (except for IM 304/ IM 308 in one casing)
- If certain modules are used (see Section 11 for further details)

Design

The fan subassembly contains two fans, a dust filter and fan monitors with floating contacts.

The fan subassembly and mounting accessories are available in two versions:

- For long subracks (483 mm/19")
- For short subracks (353 mm/14")

The fan subassembly should be installed under the PLC, using the relevant mounting accessories. A wiring duct is supplied along the mounting accessories. The field cables can be run off neatly to the sides in this duct.

Technical specifications

	For long subracks	For short subracks
Supply voltage	115/230 V AC or 24 V DC	115/230 V AC or 24 V DC
Current consumption	0.6/0.3 A or 0.8 A	0.6/0.3 A or 0.8 A
Dimensions (W x H x D) in mm (in)	480 x 172 x 264 (19 x 6.77 x 10.4)	359 x 172 x 264 (14 x 6.77 x 10.4)
Weight		
• Cable duct with mounting brackets approx.	0.5 kg (1.1 lb)	0.5 kg (1.1 lb)
• Fan subassembly approx.	1.5 kg (3.3 lb)	1.4 kg (3.3 lb)

Ordering data

	Order No.
Fan subassembly	
• 115/230 V AC	**6ES5 981-0H ■11**
• 24 V DC	**6ES5 981-0H ■21**
Mounting accessories	**6ES5 981-0G ■11**
Dust filter (filter mat)	**6ES5 981-0J ■11**
For long subracks	**A**
For short subracks	**B**

	Order No.
Replacement fan for above fan subassembly, comprising: 1 fan, plug-in connector, replacement instructions	**6ES5 988-7NA11**

Power supply modules

PS 951 power supply modules for the S5-115U/H

Application

Power supply modules generate the voltages required by the programmable controller from the external power supply:

+ 5 V
as supply voltage for all modules;

+ 5,2 V
as supply voltage for the PG 605 programmer, the OP 393 and OP 396 operator panels and the BT 777 (observe max. current);

+ 24 V
for the 20 mA current loop interfaces.

Design

Power supply modules are available with one or two backup batteries, depending on the model. These can be replaced even when the power supply is switched off. In the case of the power supply modules with only one backup battery, the backup voltage is supplied via sockets during replacement. In those with two backup batteries, the second battery begins to supply the backup voltage as soon as the first one fails. This also applies when it is removed for replacement.
Five power supply modules are available for the S5-115U/H programmable controller.

Technical specifications

Power supply module		6ES5 951-7LB21	6ES5 951-7LD21	6ES5 951-7NB21	6ES5 951-7ND51	6ES5 951-7ND41
Supply voltage						
• Rated value		**230/120 V AC**	**230/120 V AC**	**24 V DC**	**24 V DC**	**24 V DC**
• Ripple V_{pp}	max.	—	—	3.6 V	3.6 V	3.6 V
• Permissible range (including ripple)		187 ... 264 V 94 ... 132 V	187 ... 264 V 94 ... 132 V	19.2 ... 30 V	9.2 ... 30 V	9.2 ... 30 V
• Frequency range		47 ... 63 Hz	47 ... 63 Hz	—	—	—
Current consumption						
• Rated value I_N		0.4/0.6 A	0.4/0.6 A	1.5 A	5 A	5.6 A
• Inrush current	max.	0.8/1.4 A	0.8/1.4 A	15 x I_N	15 x I_N	15 x I_N
• I^2t		15 x I_N 15 x I_N 0.2 A^2s 1.8 A^2s	15 x I_N 15 x I_N 0.2 A^2s 1.8 A^2s	0.4 A^2s	16 A^2s	4.5 A^2s
Mains buffering		20 ms	20 ms	20 ms	20 ms	20 ms
Output voltage V_1		+ 5 V ± 1.5 %	+ 5 V ± 1.5 %	+ 5 V ± 1.5 %	+ 5 V ± 1.5 %	+ 5 V ± 1.5 %
Auxiliary voltages						
• V_2 (e.g. for programmers)		+ 5.2 V (1 A)	+ 5.2 V (2.5 A)	+ 5.2 V (1 A)	+ 5.2 V (2.5 A)	+ 5.2 V (2.5 A)
• V_3 (e.g. for CP 525)		+ 24 V (0.2 A)	+ 24 V (0.35 A)	+ 24 V (0.2 A)	+ 24 V (0.35 A)	+ 24 V (0.35 A)
Output current[1]						
• Rated value for operation						
Without fan		**3 A**	**7 A**	**3 A**	**7 A**	**7 A**
With fan		**3 A**	**15 A**	**3 A**	**15 A**	**15 A**
• Permissible range		0.3 ... 3 A	0.3 ... 15 A	0.3 ... 15 A	0.3 ... 15 A	0.3 ... 15 A
Backup battery		1 x lithium battery Size C, (3.6 V/5 Ah)	2 x lithium battery Size AA, (3.6 V/2 x 1.75 Ah)	1 x lithium battery Size C, (3.6 V/5 Ah)	2 x lithium battery Size AA, (3.6 V/2 x 1.75 Ah)	2 x lithium battery Size AA, (3.6 V/2 x 1.75 Ah)
• Backup time	min.	1 year (at 0.3 mA, 25 °C and uninterrupted buffering)				
• External backup voltage		+ 3.4 ... + 9 V				
Short-circuit protection		Electronic				
Open-circuit protection		Yes				
Fuse (primary circuit)		Integral				
Class of protection		Class 1				
Galvanic isolation		Yes	Yes	No	No	Yes
Test voltage		2.5 kV AC	2.5 kV AC	—	—	500 V AC
RI specification		A in acc. with VDE 0871	A in acc. with VDE 0871	A in acc. with VDE 0871	A in acc. with VDE 0871	A in acc. with VDE 0871
Weight	approx.	1.6 kg (3.5 lb)	1.9 kg (4.1 lb)	1.6 kg (3.5 lb)	1.6 kg (3.5 lb)	1.6 kg (3.5 lb)

1) Fan subassembly required for output currents from 7 to 15 A (page 3/77)

PS 951 power supply modules for the S5-115U/H (continued)

Ordering data	Order No.		Order No.
PS 951 power supply module for internal power supply of the S5-115U/H (without backup battery)		**Backup battery,** lithium battery	
230/120 V AC; 5 V, 3 A	**6ES5 951-7LB21**	Size C, 3.6 V/5 Ah	**6EW1 000-7AA**
230/120 V AC; 5 V, 7/15 A[1]	**6ES5 951-7LD21**	Size AA, 3.6 V/1.75 Ah	**6ES5 980-0AE11**
24 V DC; 5 V, 3 A; non-floating	**6ES5 951-7NB21**		
24 V DC; 5 V, 7/15 A[1]; non-floating	**6ES5 951-7ND51**		
DC 24 V; 5 V, 7/15 A[1]; floating	**6ES5 951-7ND41**		
Operating instructions included in the S5-115U manual (see page 3/23).			

1) Fan subassembly required in the subrack (see page 3/77)

3

PS 951 power supply module for the S5-115F

Application

The PS 951 power supply module generates the internal operating voltage of 5 V DC required by the programmable controller from the external power supply 24 V DC. Only the PS 951-7ND41 is approved for the S5-115F failsafe programmable controller.

Moreover, the module makes backup supply of the RAM modules of the CPU possible. Two backup batteries are installed for that in the PS 951-7ND41. These can be replaced even when the power supply is switched off. The second battery begins to supply the backup voltage as soon as the first one fails or is removed for replacement.

Design

The PS 951 power supply module is potential-isolated and is suitable for applications where the input circuit of the I/O modules is operated without ground connection.

The lines with the supply voltage are connected to the bottom of the power supply module with the help of screw terminals.

Technical specifications

Supply voltage		
• Rated value		**24 V DC**
• Ripple V_{pp}	max.	3.6 V
• Permissible range (including ripple)		19.2 ... 30 V
Current consumption		
• Rated value IN		5.6 A
• Inrush current	max.	15 x I_N
• I^2t		4.5 A^2s
Mains buffering		20 ms
Output voltage V_1		+ 5 V ± 1.5 %
Auxiliary voltage		
• V_2 (e.g. for programming devices)		+ 5.2 V (2.5 A)
• V_3 (e.g. for CP 525)		+ 24 V (0.35 A)

Output current		
• Rated value for operation		
Without fan		7 A
With fan		15 A
• Permissible range		0.3 ... 15 A
Backup battery		2 x lithium battery Size AA, (3.6 V/2 x 1.75 Ah)
• Backup time	min.	1 year (at 0.3 mA, 25 °C and uninterrupted buffering)
• External backup voltage		+ 3.4 ... + 9 V
Short-circuit protection		Electronic
Open-circuit protection		Yes
Fuse (primary circuit)		Integral
Class of protection		Class 1
Galvanic isolation		Yes
Test voltage		500 V AC
RI specification		A in acc. with VDE 0871
Weight	approx.	1.9 kg (4.1 lb)

Ordering data

	Order No.
PS 951 power supply module for S5-115F for internal power supply (without backup battery) 24 V DC; 5 V, 7 A; non-floating	**6ES5 951-7ND41**

	Order No.
Backup battery (lithium battery) Size AA, 3.6 V/1.75 Ah	**6ES5 980-0AE11**

Interface modules

Overview

The following table shows the interface modules and connecting cables required to link the various expansion units to the central controllers.

Configuration/ Transmission mode	Central controller		Expansion unit			Connecting cable
	PLC type	Type of interface	EU type for S5-115U/H/F	EU type for S5-135U, S5-155U/H	Type of interface	Type Length
Centralized up to 2 m, asymmetric	S5-115U S5-115H[1]	**IM 305**	ER 701-0 ER 701-1		**IM 305**	Permanently connected 0.5 m (1.6 ft) or 1.5 m (5 ft)
	S5-115U S5-115H[1] S5-115F[4]	**IM 306**	ER 701-0 ER 701-1		**IM 306**	705-0 0.5 m (1.6 ft) ... 2.5 m (8.2 ft)
Distributed up to 200 m, symmetric	S5-115U S5-115H[1]	**IM 301** (see Section 4)	ER 701-2[2] ER 701-3[2]	EG 183U	**IM 310** (see Section 4)	721-0 0.5 m (1.6 ft) ... 200 m (656 ft)
Distributed up to 600 m symmetric	S5-115U S5-115H[1] S5-115F	**IM 304**	ER 701-2[2] ER 701-3[2]	EG 183U EG 185U	**IM 314**	721-0 1 m (3.28 ft) ... 600 m (1968 ft)
	S5-115H[3]	**IM 304**	ER 701-3LH[2]	EG 185U	**IM 314R**	721-0 1 m (3.28 ft) ... 600 m (1968 ft)
Distributed 50 ... 1500 m (between every 2 modules), serial optical	S5-115U	**IM 307**	ER 701-2[2] ER 701-3[2] ER 701-3[2]	EG 183U EG 185U	**IM 317** **IM 307**	722-2 (fiber optic cable)
Distributed up to 3000 m, serial electrical	S5-115U	**IM 308**	ER 701-2[2] ER 701-3[2] ET 100U	EG 183U EG 185 U	**IM 318-3** **IM 318-8**	Shielded twisted two-wire cable (on request)
Distributed up to 23 km, serial electrical or optical	S5-115U S5-115H[1]	**IM 308-B**	ET 200U		**IM 318-B/C**	Shielded twisted two-wire cable (on request) or fiber optic cable

1) S5-115H with two-channel I/O modules (fully redundant configuration) or single-channel/single-sided I/O configuration
2) An IM 306 interface module is required for setting the addresses of modules of block design
3) S5-115H with single-sided I/O (switched)
4) The 463 analog input module can only be used in the 1st and 2nd EU and only with a 0.5 m (1.6 ft) cable.

IM 305 and IM 306 interface modules; centralized configuration with S5-115U

3

Application

The IM 305 and IM 306 interface modules enable expansion units (EUs) to be connected in centralized configuration. The IM 305 interface module is used for connecting one expansion unit to the central controller.

The IM 306 interface module can be used for connecting up to three expansion units to the central controller (CC) or to an expansion unit with a power supply module.

Design

IM 305 interface module

The IM 305 interface module consists of two modules which are permanently connected by a cable (0.5 or 1.5 m (1.5 ft or 4.7 ft) long). It provides the expansion unit (in an ER 701-0 or ER 701-1 subrack) with the supply voltage and the signals from the internal bus. The expansion unit must be positioned either above the central controller or (with a 1.5 m (4.7 ft) cable) adjacent to it.

In this configuration, the addresses for the input and output modules are permanently assigned to the slots. For example, slot 0 in the central controller is reserved for byte addresses 0 to 3 (binary signals 0.0 to 3.7, inputs or outputs) and slot 3 for byte addresses 12 to 15.

IM 306 interface module

One IM 306 interface module must be plugged into the central controller and one into an expansion unit connected in centralized configuration (in an ER 701-0 or ER 701-1 subrack). It is also used in expansion units connected in a distributed configuration (in an ER 701-2 or ER 701-3 subrack) for setting the addresses of the I/O modules of block design. The IM 306 provides the expansion units with the supply voltage and the signals from the internal bus. The cable length from the central controller to the last expansion unit can be up to 2.5 m (8 ft). The minimum vertical clearance between two units is 100 mm (4").

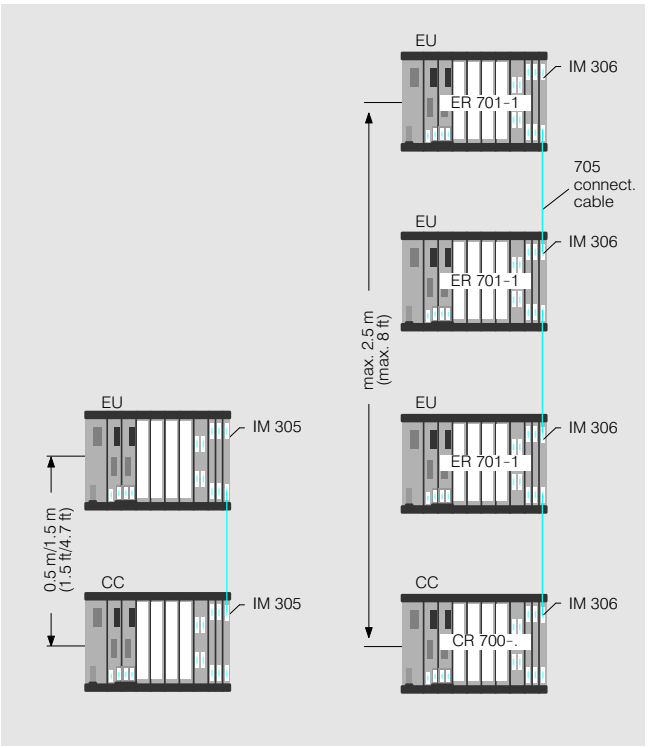


Fig. 3/33 Connection of expansion units to the central controller in centralized configuration using IM 305 (left) and IM 306 (right) interface modules

In this configuration, the addresses for the input and output modules must be assigned to the slots using DIL switches on the IM 306 interface module. The fixed address assignments do not apply. Inputs and outputs can have the same address.

The IM 306 interface module is also required for the ER 701-2 and ER 701-3 subracks if they contain I/O modules of block design (6ES5 4..-7.).

Expansion units in the ER 701-0 and ER 701-1 subracks can also be connected in a centralized configuration to the S5135U and S5-155U programmable controllers (see Section 4) using the IM 306 interface module. An IM 300-5LB interface module must be plugged into the central controller for this purpose.

IM 305 and IM 306 interface modules; centralized configuration with S5-115U (continued)

Technical specifications

IM 305 interface module			**IM 306 interface module**		
Current supplied to EU	max.	1 A	Current supplied to EU	max.	2 A
Current consumption (at 5V)		10 mA	Current consumption (at 5V)		50 mA
Power loss	max.	0.05 W	Power loss	max.	0.25 W
Weight (total)	approx.	0.6 kg (1.3 lb)	Weight	approx.	0.3 kg (0.6 lb)

Ordering data

	Order No.		Order No.
IM 305 interface module for S5-115 U/H With 0.5 m (1.5 ft) cable With 1.5 m (4.7 ft) cable	 **6ES5 305-7LA11** **6ES5 305-7LB11**	**705 connecting cable** for connecting IM 306 to IM 306 or IM 300-5LB interface modules to IM 306 Length 0.5 m (1.6 ft) 1.25 m (4.1 ft) 1.5 m (4.9 ft) 2.5 m (8.2 ft)	 **6ES5 705-0AF00** **6ES5 705-0BB20** **6ES5 705-0BB50** **6ES5 705-0BC50**
IM 306 interface module for S5-115U/H/F Operating instructions included in the S5-115U manual (see page 3/23).	**6ES5 306-7LA11**		

IM 304 and IM 314 interface modules; distributed configuration up to 600 m with S5-115U

3

Application

The IM 304 and IM 314 interface modules are used for distributed configuration of expansion units (EUs) with a central controller (CC). The expansion units can be up to 600 m (1969 ft) away from the central controller.

Design

The IM 304 interface module is plugged into the central controller (CR 700-0LB, CR 700-2 and CR 700-3 subracks) and the IM 314 interface module into the expansion unit (ER 701-2 and ER 701-3 subracks).

Up to two times four expansion units (with power supply module) can be connected in distributed configuration to one IM 304 interface module.

The central controller and the distributed expansion units can be expanded with up to three additional expansion units (ER 701-0 and ER 701-1 subracks) connected in a centralized configuration.

An IM 306 interface module must be plugged into each expansion unit to enable the addresses for the input and output modules to be assigned to the slots. This interface module is required even if no additional expansion unit is connected.

Up to four areas of 256 bytes each in the S5-115U programmable controller can be addressed with an IM 304 interface module. The areas can be set with a switch on the IM 314 interface module.

A terminator must always be inserted in the last IM 314 interface module.

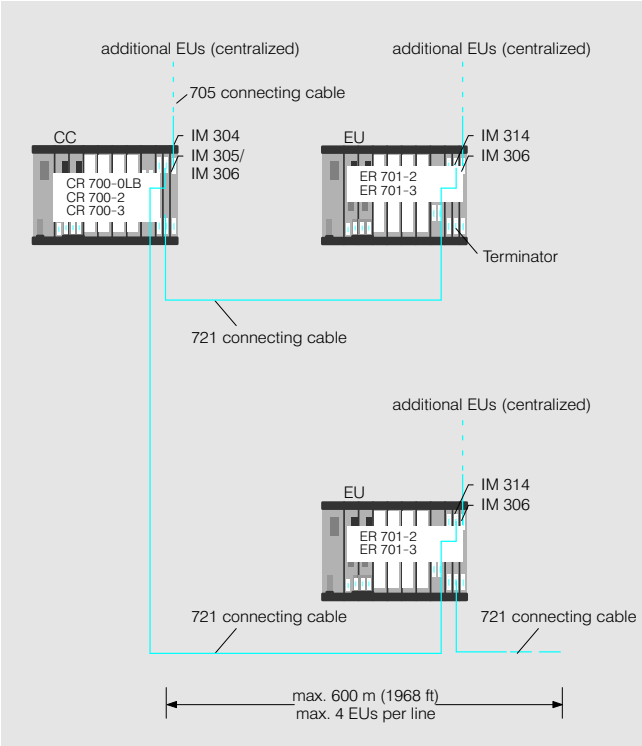


Fig. 3/34 Connection of expansion units to the central controller in distributed configuration using IM 304 and IM 314 interface modules

Connection of other programmable controllers

Expansion units in ER 701-2 and ER 701-3 subracks can also be connected to the S5-135U and S5-155U programmable controllers using the IM 304 and IM 314 interface modules (see Section 4).

These two interface modules can also be used for connecting the EU 183U and EU 185U expansion units to the S5-115U programmable controller.

Adapter casing required (page 3/98)

IM 304 and IM 314 interface modules; distributed configuration up to 600 m (1968 ft) with S5-115U (continued)

Technical specifications

Current consumption (at 5 V)		
• IM 304	max.	1.5 A
• IM 314	max.	1.0 A
Power loss		
• IM 304	max.	7.5 W
• IM 314	max.	5 W
Space requirements		1/2 slot or 1 slot (see subracks, page 3/58f.)
Weight	approx.	0.3 kg (0.6 lb)

Ordering data

	Order No.
IM 304 interface module for the central controller of an S5-115U/H/F	**6ES5 304-3UB11**
IM 314 interface module for the expansion unit of an S5-115U/H/F	**6ES5 314-3UA11**
Operating instructions included in the S5-115U manual (see page 3/23).	
Terminator for IM 314 interface module	**6ES5 760-1AA11**
Adapter casing	see page 3/98
721 connecting cable	
Standard lengths 1 m (3.2 ft)	**6ES5 721-0BB00**
1.6 m (5.2 ft)	**6ES5 721-0BB60**
2 m (6.5 ft)	**6ES5 721-0BC00**
5 m (16.4 ft)	**6ES5 721-0BF00**
10 m (32.8 ft)	**6ES5 721-0CB00**
50 m (164.0 ft)	**6ES5 721-0CF00**
Special lengths 2.5 m (8.2 ft)	**6ES5 721-0BC50**
3.2 m (10.5 ft)	**6ES5 721-0BD20**
8 m (26.2 ft)	**6ES5 721-0BJ00**
12 m (39.3 ft)	**6ES5 721-0CB20**
16 m (52.5 ft)	**6ES5 721-0CB60**
20 m (65.6 ft)	**6ES5 721-0CC00**
25 m (82.0 ft)	**6ES5 721-0CC50**
32 m (105.0 ft)	**6ES5 721-0CD20**
40 m (131.2 ft)	**6ES5 721-0CE00**
63 m (206.6 ft)	**6ES5 721-0CG30**
80 m (262.4 ft)	**6ES5 721-0CJ00**
100 m (328.0 ft)	**6ES5 721-0DB00**
500 m (1640.4 ft)	**6ES5 721-0DF00**

IM 308 and IM 318 interface modules; distributed configuration up to 3000 m with S5-115U

Application

The IM 308 and IM 318 interface modules are used for connecting I/O modules in the following expansion units (EUs) to a central controller (CC) in distributed configuration:

- ER 701-2
- ER 701-3
- EG 183U
- EG 185U

The ET 100U electronic terminator (see Section 6) can also be connected.

The expansion units and the ET 100U electronic terminator can be up to 3000 m (9900 ft) away from the central controller.

Design

The IM 308 interface module is plugged into the central controller and the IM 318-3 interface module into the expansion unit or the IM 318-8 interface module into the ET 100U electronic terminator.

Two lines, each containing up to 32 expansion units (with IM 318-3) or electronic terminators (with IM 318-8) in any order can be connected to one IM 308 interface module. A total of 63 expansion units and ET 100U electronic terminators can operate via one IM 308 interface module. Digital and analog I/Os, intelligent I/O modules and communications processors with linear addressing can be used in the expansion units.

The central controller and distributed expansion units (ER 701-2 and ER 701-3 subracks) can be expanded with up to three additional expansion units in centralized configuration.

A memory submodule with the address list for the IM 308 interface module is only required for connecting ET 100U electronic terminators.

In the S5-115U programmable controller up to four areas of 256 bytes each can be addressed with an IM 308 interface module. These areas can be set with a switch on the IM 318 interface module.

The central controller and the expansion units or electronic terminators are isolated from one another.

Cables

The interface modules must be connected via two-core cables. They are supplied together with connectors for connecting the cables using screw terminals. The connectors are provided with screw terminals for the incoming and the outgoing line.

A terminating resistor (120 Ω; supplied with the IM 308 interface module) must be fitted to the connector of the last IM 318 in place of the outgoing line. An expansion unit can be switched off without affecting the operation of the other units.

Selecting the cables:

Shielded, twisted two-core cables are to be used. The resistance of a core must not exceed 50 Ω , irrespective of the cable length. The surge impedance should be around 120 Ω . The capacity per unit length must be as low as possible (<60 pF/m). The bottom table shows two types of cables that can be used.

Adapter casing required (page 3/98)

Type of cable	Transmission speed Distance 500 m/1640	1000 m/3280 ft	3000 m/9840 ft
Siemens control cable type A[1)] 6XV1 830-0AH10	375 kbit/s	187 kbit/s	—
Siemens control cable type B V45551-F21-B5 (1.5 mm^2, paired)	187 kbit/s	62 kbit/s	31 kbit/s

1) Available by the meter

IM 308 and IM 318 interface modules; distributed configuration up to 3000 m with S5-115U (continued)

Design (continued)

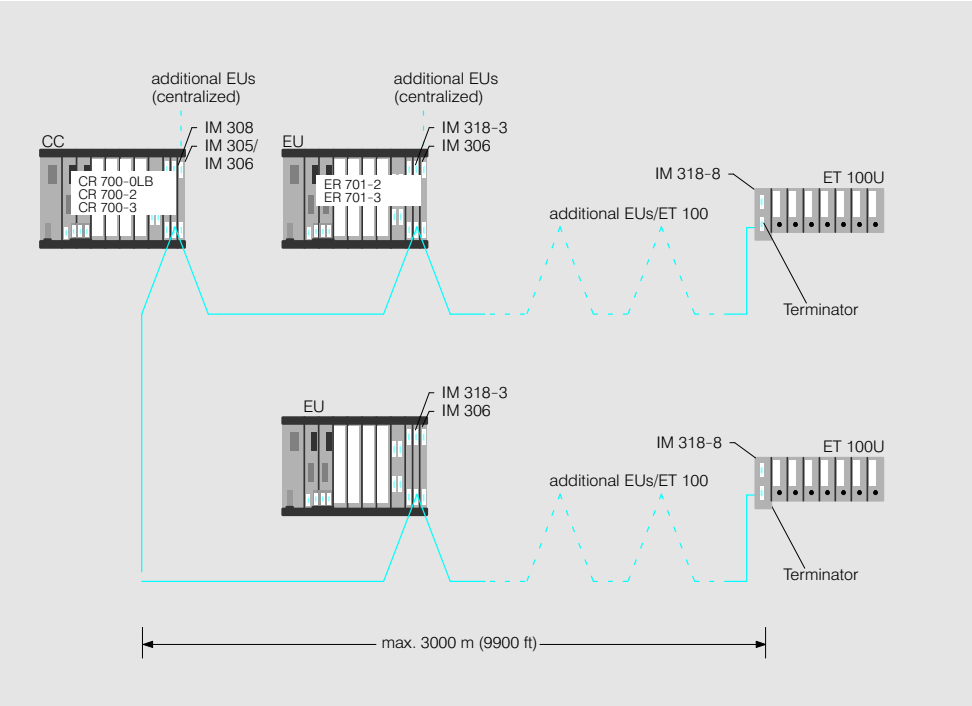


Fig. 3/37 Connection of expansion units and ET 100U electronic terminators to the central controller in distributed configuration using IM 308 and IM 318 interface modules

Technical specifications

Transmission speed (selectable)		31, 62, 187 or 375 kbit/s
Number of units that can be connected		
• Per connection	max.	32
• Total	max.	63
Addressing range for I/O modules	max.	1 Kbyte
Current consumption (at 5 V)		
• IM 308	max.	0.5 A
• IM 318-3	max.	0.3 A
Power loss		
• IM 308	max.	2.5 W
• IM 318-3	max.	1.5 W
Space requirements		1 slot or $^1/_2$ slot (see subracks, starting page 3/58)
Weight	approx.	0.4 kg (0.9 lb)

Ordering data

	Order No.
IM 308 interface module for the S5-115U central controller	**6ES5 308-3UA12**
376 memory submodule (EPROM) for storing the address list for the ET 100U (not required for other expansion units); to be plugged into the IM 308	**6ES5 376-1AA11**
IM 318-3 interface module for the EG 183U, EG 185U, ER 701-2 and ER 701-3 expansion units	**6ES5 318-3UA11**
IM 318-8 interface module for the ET 100U electronic terminator	**6ES5 318-8MA12**
Adapter casing	see page 3/98
To be ordered as a separate item:	
IM 308/IM 318 manual	
German	**6ES5 998-2DP11**
English	**6ES5 998-2DP21**
French	**6ES5 998-2DP31**

IM 308-C interface module; PROFIBUS-DP interface for the S5-115U/H (up to S5-155U/H)

Application

The IM 308-C is a PROFIBUS-DP master and/or slave module for SIMATIC S5-115U/H up to S5-155U/H.

Up to 122 passive users like, for example, ET 200 distributed I/O devices, the S5-95U/DP programmable controller or field devices with PROFIBUS-DP interface can be connected to an IM 308-C interface module.

Design

The IM 308-C interface module must be plugged into the slot designed for it in the S5-115U/H up to S5-155U/H programmable controller.

The module needs a single-width slot.

The connection to the PROFIBUS LAN is made via

- a RS 485 bus interface plug or
- a RS 485 bus terminal

Adapter casing required (page 3/98)

Principle of operation

As master module, the IM 308-C interface module coordinates the bus access and the data transfer to the PROFIBUS-DP.

It can also operated as PROFIBUS-DP slave and thus makes data exchange with other PROFIBUS-DP masters possible.

The master and slave function can be used in combination, i.e. as a slave, an IM 308-C interface module receives data from another programmable controller and simultaneously works as master of e.g. ET 200 I/O components.

- Global control:
  Sync, Freeze of I/O devices
- Address volume:
  13 Kbyte data from the CPU can be addressed per IM 308-C
- Shared inputs:
  the inputs of a slave can be read by several IM 308-C interface modules

Configuring

Configuring takes place with the COM ET 200 Windows configuring package (see Section 9).

Technical specifications

Transfer rate	9.6 kbit/s up to 12 Mbit/s
Interfaces	
• Connection to PROFIBUS	9-pin Sub D socket
Supply voltage	+5 V DC via backplane bus
Current consumption	max. 0.6 A at +5 V DC
Address volume	13 Kbyte for inputs, outputs and diagnostics
Number of I/O devices which can be connected	max. 122 ET 200 U/B/C, S5-95U/DP and/or other field devices
Data volume	244 byte inputs and outputs per slave

Permissible environmental conditions	
• Operating temperature	0 °C to +60 °C
• Transport/storage temperature	-40 °C to +70 °C
• Relative humidity	5 to 95 %
Mechanical design	
• Module format	Double eurocard
• Dimensions (W × H) in mm	160 × 233.4
• Weight approx.	0.5 kg
• Space requirements	1 slot

Ordering data

	Order No.
IM 308-C interface module for connecting the SIMATIC S5-115U/H, S5-135U, S5-155U/H to PROFIBUS-DP, with memory card (256 Kbyte)	**6ES5 308-3UC11**

	Order No.
Memory card 256 Kbyte EPROM	**6ES5 374-1FH21**
1 Mbyte EPROM	**6ES5 374-1KK21**

3

IM 304 and IM 324R interface modules, for interfacing the S5-115H central controllers

Application

The IM 324R and IM 304 interface modules are used for linking the two central controllers of an S5-115H failsafe programmable controller.

Design

The IM 324R interface module is plugged into the first central controller (subunit A) and the IM 304 interface module into the second central controller (subunit B). The two interface modules are connected via a 721 connecting cable (up to 100 m (328 ft)). The IM 324R interface module has two memory areas where the necessary process data for data communications between the two central controllers is stored.

Adapter casing required (page 3/98)

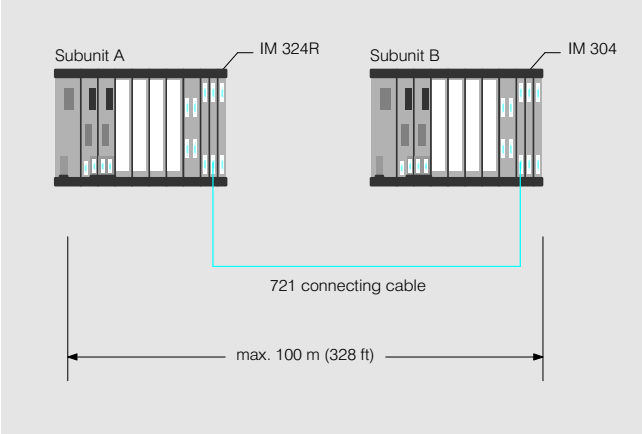


Fig. 3/38 Interfacing of central controllers

Principle of operation

The IM 324R and IM 304 interface modules handle all data communications between the two central controllers of the failsafe programmable controller.

Technical specifications

Current consumption (at 5 V)		
• IM 304	max.	1.5 A
• IM 324R	max.	1.0 A
Power loss		
• IM 304	max.	7.5 W
• IM 324R	max.	5 W
Space requirements		1 slot or $^1/_2$ slot
Weight	approx.	0.3 kg (0.66 lb)

Ordering data

	Order No.
IM 304 interface module for linking the central controllers of the S5-115H programmable controller	**6ES5 304-3UB11**
IM 324R interface module for linking the central controllers of the S5-115H programmable controller	**6ES5 324-3UR11**
Adapter casing	see page 3/98
721 connecting cable	see page 3/83

IM 304 and IM 314R interface modules, for distributed configuration of I/O modules at S5-115H

Application

The IM 314R and IM 304 interface modules are used for connection of I/O modules to the S5-115H failsafe programmable controller in a single-channel switched configuration.

Design

An IM 304 interface module is plugged into each of the two central controllers. Two IM 314R interface modules are plugged into each expansion unit. The interface modules must be interconnected via 721 connecting cables (up to 600 m (1968 ft)). A terminator must be plugged into the last interface module in each chain.

A maximum of two chains, each with up to four expansion units, can be connected to the central controllers, i.e. a total of eight expansion units.

The IM 306 interface module can also be used for connecting additional expansion units to each of the expansion units connected in switched configuration. Moreover, all other interface modules of the S5-115U programmable controller can be used in the S5-115H failsafe programmable controller.

Adapter casing required (page 3/98)

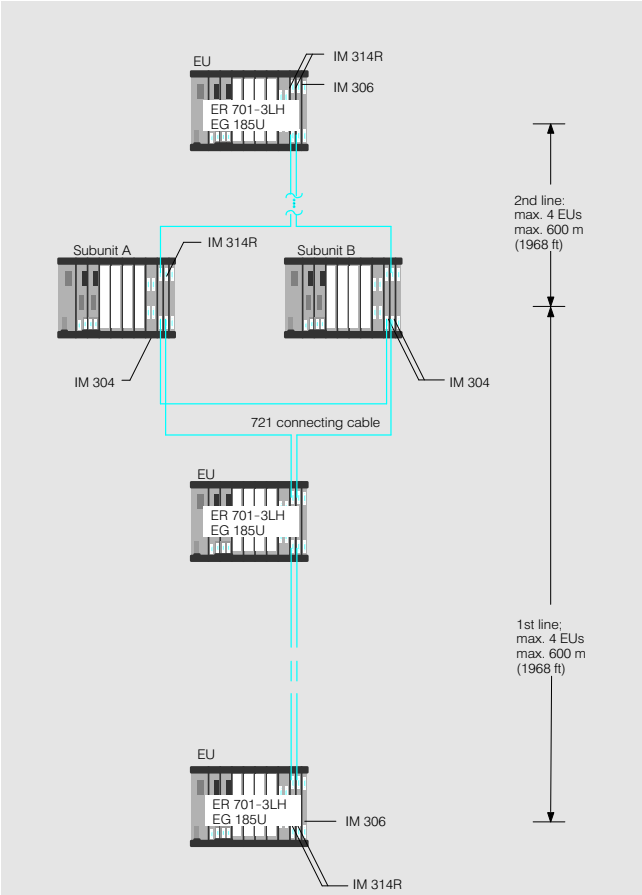


Fig. 3/39 Distributed switched configuration of I/O modules

Technical specifications

		IM 304	IM 314R
Current consumption (at 5 V)	max.	1.5 A	1.0 A
Power loss	max.	7.5 W	5 W

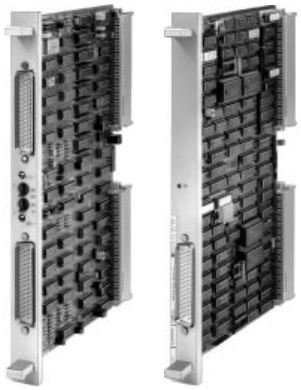
Space requirements		1 slot or $^1/_2$ slot
Weight	approx.	0.3 kg (0.66 lb)

Ordering data

	Order No.
IM 304 interface module for the S5-115H programmable controller	**6ES5 304-3UB11**
IM 314R interface module for the expansion unit	**6ES5 314-3UR11**
Terminator for the IM 314R	**6ES5 760-0HA11**
Adapter casing	see page 3/98
721 connecting cable (up to 600 m (1968 ft))	see page 3/85

IM 304 and IM 324 interface modules; for interfacing the S5-115F central controllers

Application



The IM 324 and IM 304 interface modules are used for linking the two central controllers of an S51-115F failsafe programmable controller.

Design

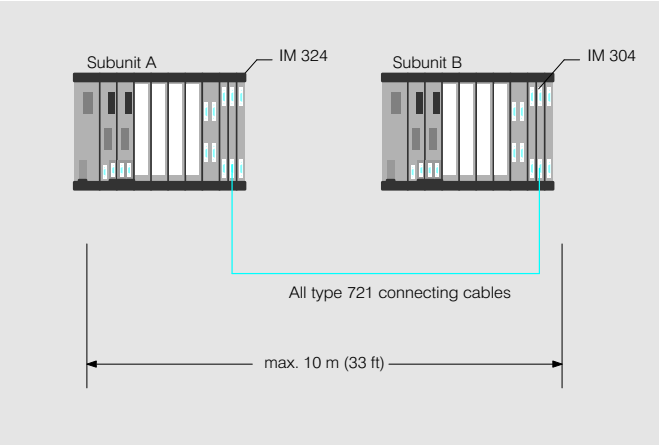


Fig. 3/40 Interfacing of central controllers

The IM 324 interface module is plugged into the first central controller (subunit A) and the IM 304 interface module into the second central controller (subunit B). The two interface modules are connected via a 721 connecting cable (up to 10 m (33 ft)).
The IM 324 interface module has two memory areas with a capacity of 2 K words each where the necessary process data for data communications between the two central controllers is stored.

Technical specifications

Current consumption (at 5 V)			Power loss		
• IM 304	max.	1.5 A	• IM 304	max.	7.5 W
• IM 324	max.	1.0 A	• IM 324	max.	5 W
			Weight	approx.	0.3 kg (0.66 lb)

Ordering data

	Order No.		Order No.
IM 304 interface module for linking the central controllers of the S5-115F programmable controller	**6ES5 304-3UB11**	**Adapter casing**	**6ES5 491-0LB11**
IM 324 interface module for linking the central controllers of the S5-115F programmable controller	**6ES5 324-3UA12**	**721 connecting cable**	see page 3/85
Operating instructions included in the S5-115F manual (see page 3/29)			

IM 306 interface module; for centralized configuration of I/O modules at S5-115F

Application

The IM 306 interface module is used for connecting up to three expansion units in a centralized configuration to a central controller or distrib-uted expansion unit.

Design

The ER 701-1, ER 701-2 and ER 701-3 subracks, without power supply modules, can be used for the expansion units. The IM 306 interface module must be plugged into the central expansion units and into the central controller or distributed expanison unit. The interface modules are connected via a 705 connecting cable..

Note

When the 6ES5 463-4U.12 analog input module is used, only cable 6ES5 705-0AF00 (length 0.5 m (1.5 ft)) may be used for connecting the expansion units.

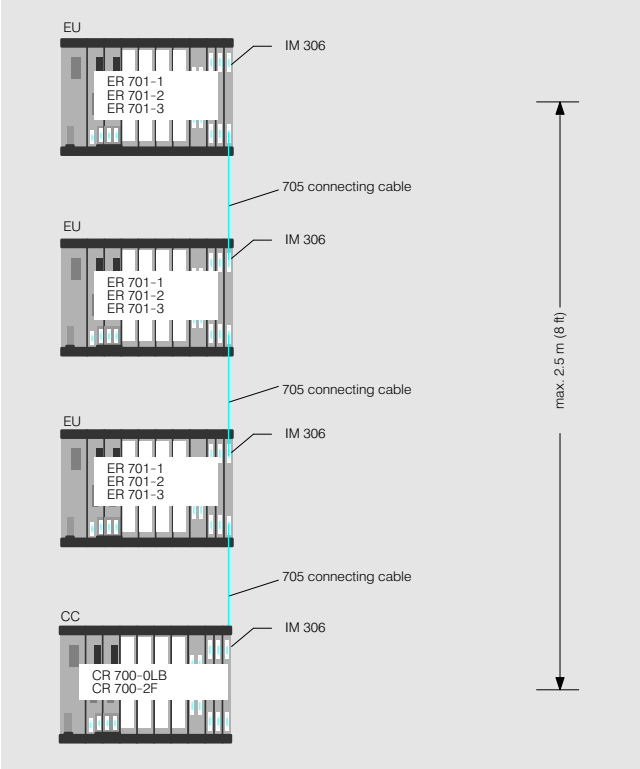


Fig. 3/41 Central configuration of expansion units with IM 306 (1 subunit)

Principle of operation

The IM 306 interface modules handle all data communica-tions between the connected central controller and expan-sion units. The addresses to the input and output modules must be allocated to the slots of the subrack using the DIP switches on the IM 306 inter-face module. It is possible for inputs and outputs to have the same addresses.

For technical data, see page 3/83.

Ordering data	Order No.		Order No.
IM 306 interface module Operating instructions included in the S5-115F manual (see page 3/29).	**6ES5 306-7LA11**	**705 connecting cable** between IM 306 and IM 306 Length 0.50 m (1.5 ft) 1.25 m (3.9 ft) 1.50 m (4.7 ft) 2.50 m (8.2 ft)	 **6ES5 705-0AF00** **6ES5 705-0BB20** **6ES5 705-0BB50** **6ES5 705-0BC50**

3

IM 304 and IM 314 interface modules for distributed configuration of I/O modules at S5-115F

Application

The IM 314 and IM 304 interface modules are used for connection of expansion units to the S5-115F failsafe programmable controller in a distributed configuration.

Design

The ER 701-1 and ER 701-3 subracks, without power supply modules, can be used for the expansion units. The IM 304 interface module is plugged into the central controller and the IM 314 interface module into the expansion unit. The interface modules must in interconnected via type 721 connecting cables (max. 600 m (1968 ft)). A terminator must be plugged into the last interface module in each chain.

Up to two chains with an expansion unit in direct configuration each or 3 expansion units in centralized configuration via an IM 306 3 interface module each can be connec ted. A total of 8 expansion units can be connected.

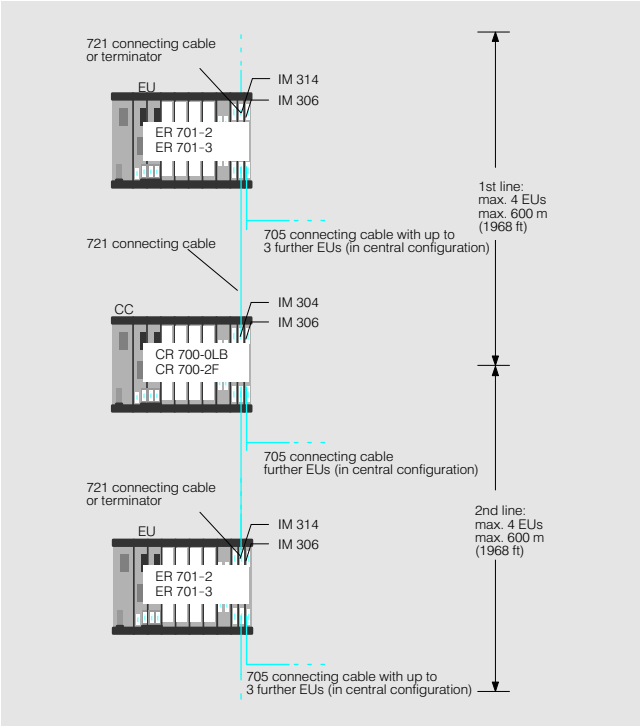


Fig. 3/42 Distributed configuration of expansion units

Principle of operation

The IM 314 and IM 304 interface modules handle all data communications between the central controller and the expansion unit and between the expansion units.

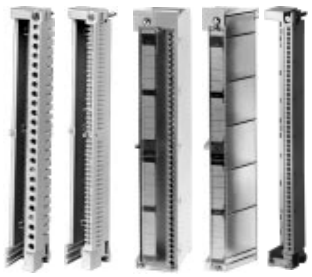
An IM 306 interface module must be plugged into each central controller and expansion unit to enable addresses for the input and output modules to be allocated to the slots of the subracks.

This interface module is still required if no additional expansion units are to be connected.
For technical data, see page 3/85.

Ordering data	Order No.		Order No.
IM 304 interface module for the central controller	**6ES5 304-3UB11**	**Terminator for IM 314 interface module**	**6ES5 760-1AA11**
IM 314 interface module for the expansion unit	**6ES5 314-3UA11**	**Adapter casing**	see page 3/98
Operating instructions included in the S5-115F manual (see page 3/28)		**721 connecting cable**	see page 3/85

Front connector

Application



Front connectors are required for connecting signal leads to input and output modules. They simplify the installation and, if necessary, replacement of modules.

490 front connectors are suitable for all modules of block design and 497 front connectors for compact modules used in the S5-115U in adapter casings.

Design

Modules can be connected by the following methods:

- Screw terminals (end sleeves not required)
- Crimp terminals
- Snap-on clip terminals (490 front connector only)

The front connectors are hooked onto the module at the bottom and screwed down at the top. Each front connector has a duct for the signal leads, thus enabling the 490 front connector to be comletely covered by the module frontplate.

Individual leads can be removed with the front connector in place. For the duplication of connections (e.g. incoming feeders) in 490 front connectors with screw terminals, the 763 bridge jumper is available.

Technical specifications

Front connector		6ES5 490-7LB11	6ES5 490-7LB21	6ES5 490-7LA..	6ES5 490-7LC11	6ES5 497- ...
Connectors		Screw terminals 24-pin	Screw terminals 46-pin	Crimp terminals 46-pin	Snap-on clip terminals 46-pin	see Section 4
Wire cross-section for stranded conductors		1 x (1.0 ... 2.5) mm^2 or 2 x (0.5 ... 2.5) mm^2	1 x (0.5 ... 2.5) mm^2 or 2 x (0.5 ... 1) mm^2 or max. 1.5 mm^2 with bridge jumper	1 x (1.0 ... 2.5) mm^2 or 2 x (0.5 ... 0.75) mm^2	1 x (0.25 ... 1.5) mm^2 or max. 1.5 mm^2 with conductors combined in an end sleeve	
Duct:						
• Cross-section	approx.	470 mm^2 (729 in^2)				
• Number of leads						
2.5 mm^2 cross-section	max.	24				
1.5 mm^2 cross-section	max.	36				
1.0 mm^2 cross-section	max.	48				
Weight	approx.	0.18 kg (0.3 lb)	0.22 kg (0.4 lb)	0.11 kg (0.2 lb)	0.15 kg (0.3 lb)	

Ordering data

	Order No.
490 front connector For screw terminals	
• 24-pin	**6ES5 490-7LB11**
• 46-pin	**6ES5 490-7LB21**
For crimp terminals, 24/46-pin	
• With 50 crimp contacts	**6ES5 490-7LA11**
• Without crimp contacts	**6ES5 490-7LA21**
For snap-on clip terminals, 46-pin	**6ES5 490-7LC11**
763 bridge jumper for use with screw terminal 490 front connector; 1 package contains 10 jumpers	**6ES5 763-7LA 11**
497 front connector for 463-4 analog input module	see Section 4

	Order No.
K front connector for 466-3LA11 analog input module For screw terminals single-width, 43-pin	**6XX3 081**
For crimp terminals single-width, 43-pin	**6XX3 068**
Crimp contacts 1 package contains 250 contacts	**6XX3 070**
Crimping tool for crimping the crimp contacts	**6XX3 071**
Extraction tool for crimp contacts (for S5-115U modules)	**6ES5 497-8MA11**
Labelling strips for the front cover; 1 sheet contains 6 strips	**6ES5 497-7LA11**

Adapter casings

Application

Compact modules (ES 902 design) can also be used in the S5-115U/H/F programmable controller with adapter casings.

The casings protect the modules against environmental effects. They are mounted on the rack in block design as the other modules.

Technical specifications

Adapter casing	6ES5 491-0LB11	6ES5 491-0LD11	6ES5 491-0LC11
Width	Single-width	Double-width	Triple-width
Number of accomodated compact modules max.	2	4	6
Dimensions (W x H x D) in mm	43 x 303 x 187	86 x 303 x 187	129 x 303 x 187
Weight approx.	0.45 kg	0.8 kg	1.8 kg
For use in subracks	CR 700-0 CR 700-1 CR 700-2 CR 700-3 ER 701-2 ER 701-3	CR 700-0LB CR 700 700-2 CR 700-3 ER 701-3	CR 700-0LB CR 700 700-2 CR 700-3 ER 701-3

Ordering data

	Order No.
Adapter casing with 1 protective cover	
• Single-width, for up to 2 compact modules	**6ES5 491-0LB11**
• Double-width, for up to 4 compact modules	**6ES5 491-0LD11**
• Triple-width, for up to 6 compact modules	**6ES5 491-0LC11**

Text Display TD 390

Application

The TD 390 text display is a compact text display unit for SIMATIC S5 systems. Its small dimensions enable it to be installed where space is limited.
The TD 390 can be used with the

- S5-90U, S5-95U/F, S5-100U
- S5-115U and
- S5-135U, S5-155U/H

programmable controllers.

Text can be displayed in standard mode (one line, 20 characters) or extended mode (two lines, 40 characters).

The TD 390 provides the following functions:

- Display of up to 120 texts with or without variables
- Display and setting of time-of-day and prompter interval
- Operating hours counter (display and reset)
- Display and modification of 24 timer or counter values and 24 other process values as required.

Design

The TD 390 text display is connected to the programmable controller direct via the programmer interface of the CPU. It can be installed directly in a cabinet door or control panel without a special mounting frame.

The TD 390 comprises:

- Two-line display panel (LCD)
- Three membrane keys.

A cable for connection to the CPU of the programmable controller (5 m/16 ft.) and a cable for the 24 V power supply (5 m/16 ft.) are also supplied with the unit.

Application

For the time-of-day, prompter interval and operating hours counting the TD 390 accesses the relevant function in the CPU of the programmable controller direct.

Text, timers, counters and other process values are displayed and modified using data blocks in the CPU previously defined in the user program. Information is written to and read out from values (data) stored in the data blocks is possible during operation. A display can be requested in the user program by setting flags or on the TD 390 by calling and scrolling with the membrane keys.

The system texts are stored in the TD 390 in German, English, French, Spanish and Italian.

Technical specifications

Display		Backlit LCD 2 lines 20 characters/line	Transport and storage temperature		-40 to 70 °C
			Degree of protection		IP 65 at the front
Character size		5 mm	Dimensions (W x H x D) in mm		
Power supply		24 V external	• Unit		144 x 72 x 27
	average	60 mA	• Panel cutout Standard size (W x H)		138 x 68
	max.	120 mA	• Thickness of cabinet/ control panel	max.	4
Ambient temperature		0 to 60 °C	Weight		0.25 kg

Ordering data

	Order No.
TD 390 text display incl. product manual (German, English, French, Spanish, Italian)	**6ES5 390-0UA11**

S5-135U, S5-155U

Application
General

Fig. 4/1 S5-155U programmable controller

The SIMATIC S5-135U and S5-155U programmable controllers are multiprocessor controllers intended for automation tasks in the medium and upper performance levels. They provide a simple and economical solution for all automation tasks such as

- Open-loop control
- Closed-loop control and computation
- Communication
- Operator control and process monitoring
- Signalling and logging
- Data processing

The controllers are therefore suitable for:

- Machine control systems
- Process automation
- Process monitoring
- Coordinating functions

The standardized hardware technology, modular design of the PLCs and high performance capabilities of the programming device result in the following features:

- Easy use thanks to simple assembly of the modules and connection to I/O modules
- Simple adaptability of the various process signals because of different input/output voltages of the I/O modules
- Analog process signals can also be adapted via I/O modules
- Extra-discrete modular assembly using different I/O modules
- Simple programming by structuring the program and using standardized program sections (function blocks)
- Off-loading of the central processors and user program through the use of intelligent I/O modules (e.g. digital position decoder, valve control module)
- Simple communication with other programmable controllers and computers by means of internal communications processors and bus systems
- Easy system start-up by means of programming devices and service units with extensive programming and debugging aids

The programming language used is STEP 5 with the following methods of representation:

- Control system flowchart - CSF
- Ladder diagram - LAD
- Statement list - STL

and at a higher level

- GRAPH 5/II for sequential control.

S5-135U programmable controller

The S5-135U is a multi-processor programmable controller with special-purpose central processors (CPUs) which are available in various combinations, each with its own program memory:

- CPU 928B,
  optimized for fast bit and word processing as well as serial point-to-point communication
- CPU 928,
  optimized for open- and closed-loop control tasks
- CPU 922,
  optimized for arithmetic operations, closed-loop control, monitoring and reporting

Each CPU uses the same operations set and is optimized for its particular tasks.

By using a number of CPUs, the automation task can be broken down into manageable parts. Each processor executes its program independently of the others. This increases the overall processing speed. Each processor can be started independently of the others.

S5-135U, S5-155U (continued)

Application (continued)
S5-155U programmable controller

Apart from the CPUs men-tio-ned, the following CPU can be used in the S5-155U program-mable controller:

- CPU 948, optimized for high-speed execution of bit and word operations, with large ca-pacity program memory

The S5-155U programmable controller is therefore the most powerful PLC in the SIMATIC S5 system.

The S5-155U programmable controller
- has a high processing speed and
- offers the largest memory expansion.

S5-155H fault-tolerant programmable controller

The fault-tolerant variant SIMATIC S5-155H is for au-tomation tasks that must not be interrupted under any cir-cumstances.

In order to ensure that the fault-tolerant S5-155H pro-grammable controller is avail-able in every case it is de-signed redundantly.

The S5-155H consists of 2 ZG 135U/155U central con-trollers (same hardware and software).

Both central controllers work together in dynamic 1 out of 2 structure (hot-standby).

This enables high demands to be placed on failsafety and availability.

Design

It is essential to have a CPU in the central controller. The CPU handles central control of the entire programmable controller.

Depending on requirements, a central controller can be equipped with the following modules:

- CPU 948 (in the S5-155U only) for high-speed bit and word processing with large memory
- CPU 928B, optimized for fast bit and word processing and serial point-to-point connection
- CPU 928, optimized for open-loop and closed-loop control tasks
- CPU 922, primarily for cal-culation, closed-loop con-trol, monitoring and report-ing
- Coordinator, required where more than one CPU is in use
- External memory: CP 516 memory submodule
- Communications processors for connecting human–ma-chine interfaces and periph-eral devices as well as for connection to local area net-works
- Modules for the input and output of binary and analog signals
- CP 581 integrated PC
- Intelligent I/O modules
- Interface modules for con-necting expansion units and distributed I/Os and field devices

Expansion units

If there are not enough slots available in the central con-troller, or if certain modules are to be deliberately located elsewhere, expansion units can be connected to the cen-tral controller. Centralized ex-pansion units are located di-rect at the central controller or in a cabinet next to it. Distributed expansion units can be located up to 3000 m (9840 ft) from the central con-troller. Additional centralized expansion units can be con-nected to the distributed ex-pansion units.

An expansion unit can be equipped with the following modules depending on de-sign and requirements:

- Communications processors for connecting human-ma-chine-interfaces, personal computers (PCs) and pe-ripheral devices as well as for connection to local area networks
- Modules for the input and output of binary and analog signals
- CP 581 integrated PC
- Intelligent I/O modules
- Interface modules for con-nection to the central con-troller or additional expan-sion units

4

S5-135U, S5-155U (continued)

Design (continued)

Multiprocessing

The performance capability of a programmable controller can be considerably enhanced by using several CPUs. Each CPU executes its program independently of the others.

A coordinator assigns access to the internal S5 bus to the CPUs. The necessary information exchange between the CPUs is also handled by the coordinator.

Each CPU can be started up independently of the others.

Internal S5 bus

The internal S5 bus connects the modules of the programmable controller with each other. All internal data traffic between the CPUs, memory submodules, communications processors, interfaces and input/output modules is conducted over this bus.

If several CPUs are in use, a coordinator controls access to the internal S5 bus.

Interface modules

In centralized and distributed configurations, interface modules handle data traffic between the central controller and the expansion units as well as distributed I/Os completely autonomously. This means that modules in the expansion units behave in exactly the same way for the user as modules in the central controller.

The PROFIBUS-DP field bus can be designed with a special interface module.

A feature of this LAN is fast cyclical communication and enables simple connection of distributed I/O stations and field devices to the automation system.

Communications processors

Communications processors handle data traffic with the following completely autonomously:

- Standard peripheral devices such as printers, keyboards, CRT units
- Computers
- Other programmable controllers

This offloads the CPU of time-intensive communications tasks.

The necessary data for texts and images can be stored in each communications processor's own RAM or EPROM submodule.

In addition, communications processors can be used to configure the SINEC L1, PROFIBUS and Industrial Ethernet LANs and to connect programmable controllers to the LAN.

Input/output modules and intelligent I/O modules

The input/output modules and the intelligent I/O modules constitute the link between the programmable controller and the process. They can be plugged into the central controller and the expansion units.

S5-135U, S5-155U (continued)

Design (continued)
Possible configurations

Central configuration

In a central configuration, the expansion units are either in the same cabinets as the central controllers or in a separate cabinet next to it. The maximum length for the cable connecting the central controller to the furthest expansion unit is 2 m (6.5 ft).

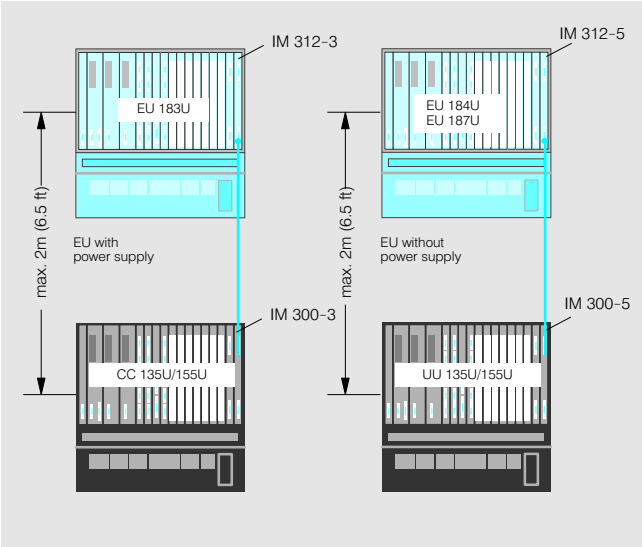


Fig. 4/2 Central configuration of expansion units

Distributed configuration

In a distributed configuration, the expansion units are installed at a distance of up to 3000 m (9840 ft) from the central controller. Four additional expansion units can be connected in a distributed configuration to each distributed expansion unit.

Expansion units of the S5-115U and the distributed I/O and field devices can also be connected.

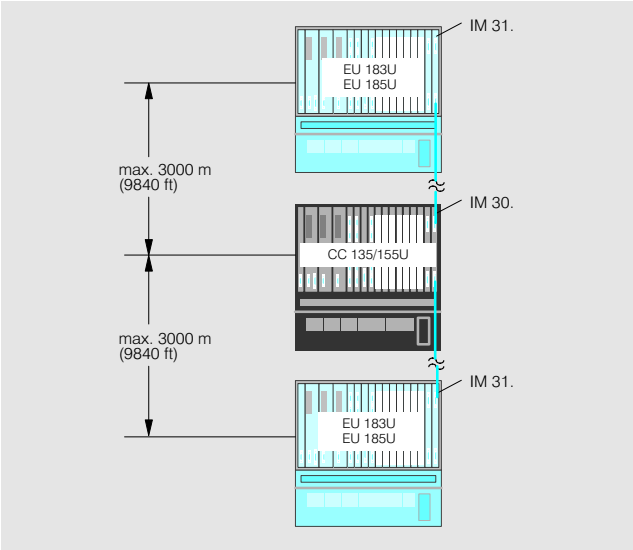


Fig. 4/3 Distributed configuration of expansion units

4

S5-135U, S5-155U (continued)

Design (continued)
Mechanical features

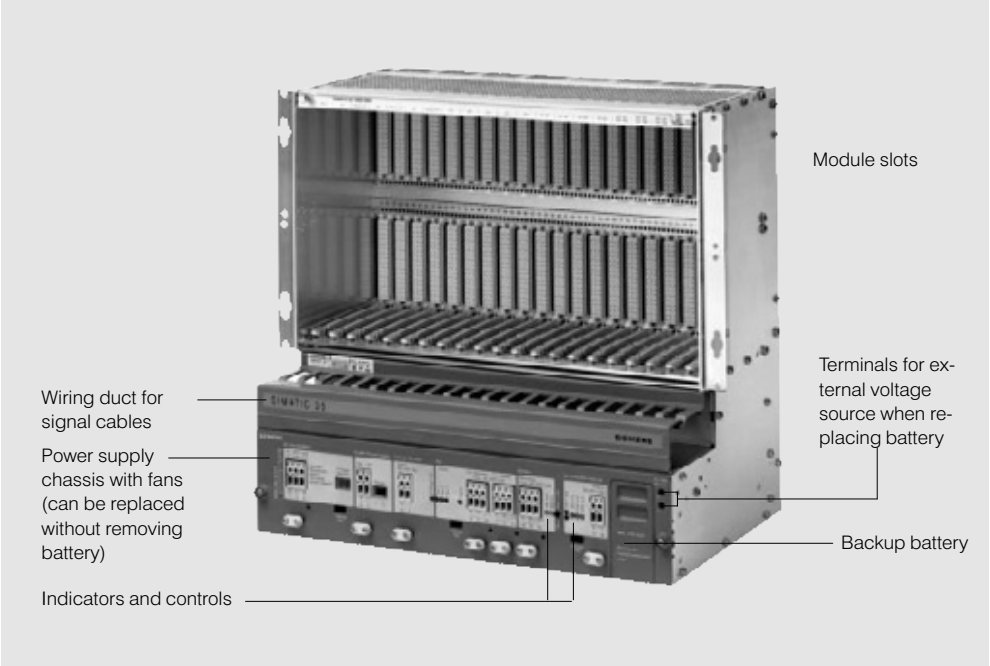


Fig. 4/4 Mechanical features of the ZG 135U/155U central controller for the S5-135U and S5-155U programmable controllers

The central controllers and expansion units consist of a compact housing with

- Power supply chassis with 3 fans and a lithium backup battery as well as a storage battery (for the RAM)
- 21 (or 20 or 11) module slots

The backup battery is not required in expansion units. Expansion units are also available without the power supply chassis or fans.

Housing

The housing consists of bolted sheet-steel sections with ventilation openings at the top and bottom. The slots have socket connectors and guides to accommodate the modules.

A wiring duct for signal cables runs along the front, beneath the modules and above the power supply chassis.

Power supply chassis

The power supply chassis with 3 fans is located in a tier in the bottom part of the housing.

The input voltage is either 24 V DC or 230/120 V AC. An internal switch is provided for selecting either 230 V or 120 V AC.

Output voltages for the internal power supply to the modules:

5 V DC (10 A, 18 A, 40 A; short-circuit protected), with jacks for measuring current,
24 V DC (0.4 A, 0.5 A, 1 A, 2 A; fused), with jacks
for measuring voltage
15 V DC

Monitoring facilities (with LED indicators) are provided for:

- Input voltage (no indication)
- 5 V output voltage
- 15 V, 24 V output voltage
- 3.4 V backup battery voltage
- Airflow for the fans
- 24 V load voltage (external)

All screw terminals on the power supply chassis are intended for conductors of up to 4 mm^2 cross-section.

Backup battery

A lithium backup battery with storage battery as reserve is provided to supply power to all RAMs in the event of a power failure.

Two jacks are provided for external input of the backup voltage. This allows the backup battery to be replaced without interrupting the backup voltage, even when the input voltage is switched off. The power supply chassis can be replaced without interrupting the backup supply.

S5-135U, S5-155U (continued)

Design (continued)
Mechanical features (continued)

Design and connection of the I/O modules

The input and output modules have a plastic cover to protect the components and printed circuits from accidental contact. The module widths correspond to either 1 or 2 slots.

LEDs to the left of the terminal pins - corresponding to the labelling area of the front connectors - indicate the statuses of inputs and outputs.

A DIL coding switch is used to set the parameter range (address range) for addressing a module.

A swivelling handle facilitates module extraction.

Front connectors (of single and double width) are available for connecting signal leads to the module. The front connectors latch onto the module at the bottom and are screwed to the module at the top.

Attaching front connectors for AC to DC modules is prevented by mechanical keying as a safeguard against dangerous operating conditions.
The front connectors can be labelled on their sides.

Special self-adhesive labelling strips are provided with each module. These should be affixed to the front connector. This clearly identifies the individual inputs and outputs.

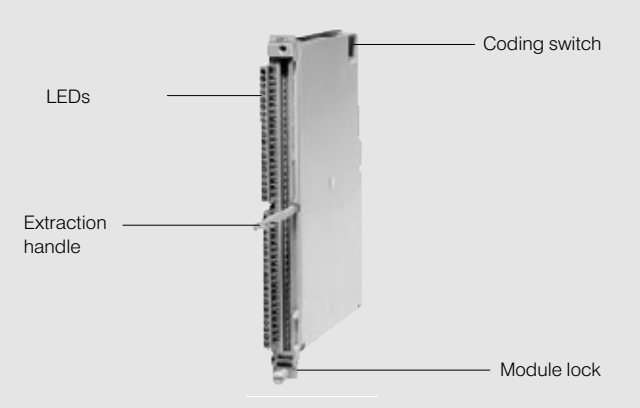


Fig. 4/5 Design of the I/O modules

Fig. 4/6 Connection via front connectors

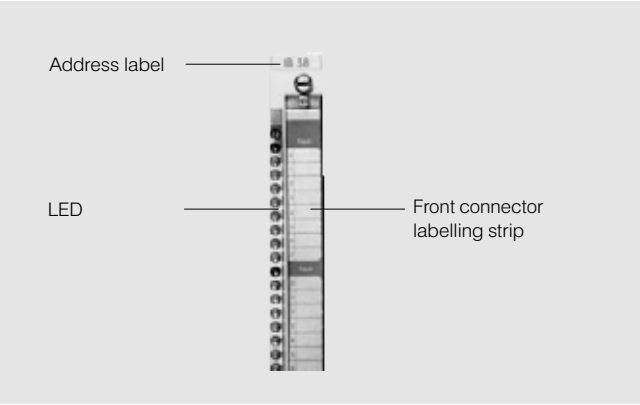


Fig. 4/7 I/O modules with labelling strips

S5-135U, S5-155U (continued)

Design (continued)
Mechanical features (continued)

Desing and connection of the I/O modules
(continued)

Signal leads are connected to the modules using the front connectors.

There are two ways of connecting signal leads to the front connectors:

- Crimp snap-in terminals for single and double-width front connectors
- Screw terminals for single and double-width front connectors; end sleeves for the conductors are not required.

Fig. 4/8 Connection of the signal cable

Principle of operation

The principle of operation of the S5-135U and S5-155U programmable controllers is largely governed by the components "program memory" and "processor".

In the S5-155H fault-tolerant programmable controller, the redundancy functions are an additional factor (see page 4/18).

Program memory

The program contains the user program.

Processor

The processor operates cyclically:

At the beginning of the cycle, the processor reads the signal states of all inputs and stores them in a process input image (PII).

The program is then executed step by step.

The processor stores the calculated signal states in a process output image (POI).
At the end of the cycle, the processor writes the signal states into the outputs.

The cycle can be stopped by interrupts (process and time interrupts).

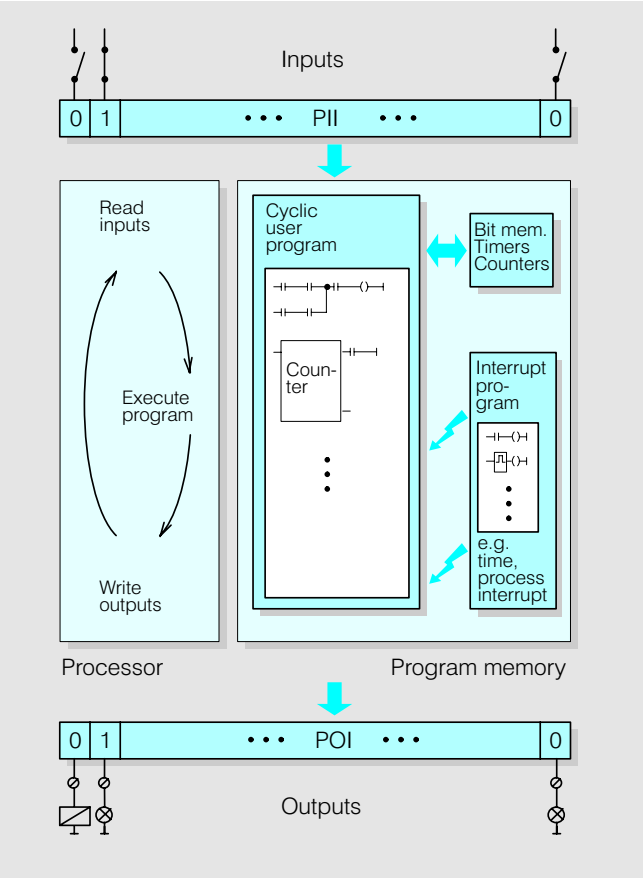


Fig. 4/9 Functional design of the S5-135U, S5-155U

S5-135U, S5-155U (continued)

Programming

Programming language

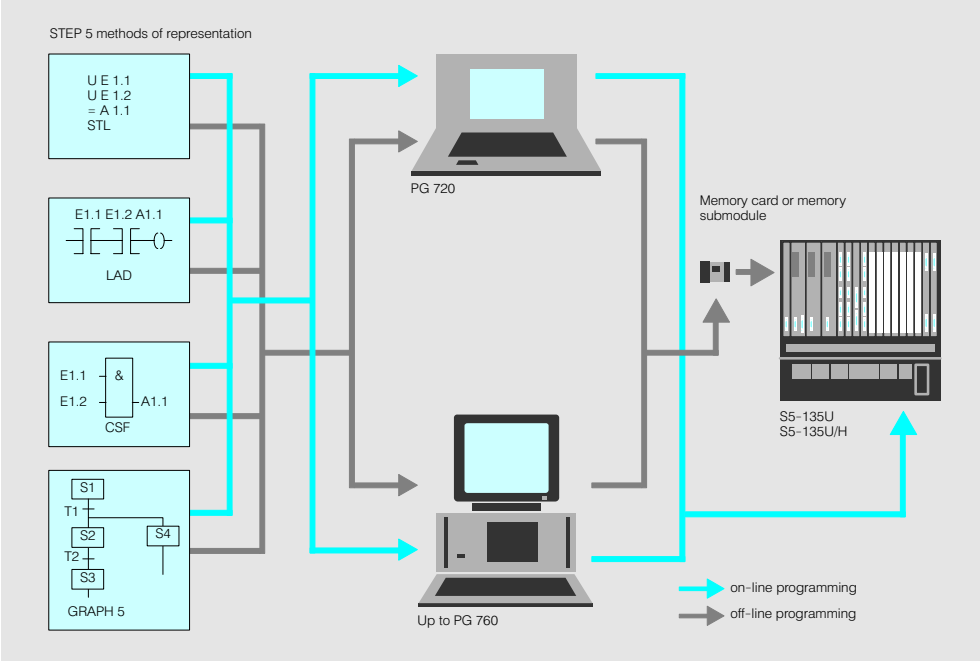


Fig. 4/10 Programming the S5-135U and S5-155U/H programmable controllers

The programming language for SIMATIC S5 programmable controllers is STEP 5 (see Section 7) in one of the following representations:

- CSF - Control System Flowchart
- LAD - Ladder Diagram
- STL - Statement List

Programs for sequence control systems can be entered clearly in the form of a flow diagram using GRAPH 5 (see Section 7).

Programming devices

The following programming devices can be used for programming the S5-135U and the S5-155U/H programmable controllers:

- PG 720, PG 720P
- PG 740
- PG 760
- PG 710 Plus, PG 730, PG 750, PG 770

The programming devices have operator prompting to facilitate programming and aids for debugging and system start-up.

A printer can be connected to the programming device for program documenting.

Program input

There are two ways of entering the program:

- Direct program entry to the CPU in the central controller (on-line programming)
- Programming the memory cards or memory submodules (EPROM or EEPROM) in the programming device without connecting it to the PLC.

The memory card or memory submodule is then plugged into the central controller (off-line programming).

Program execution

Cyclic program execution

The blocks of the user program are executed in the sequence specified in the organization block.

Interrupt-driven program execution

When certain input signal changes occur, cyclic execution is interrupted at the next statement and an organization block assigned to this event is started. The user can formulate his response program to this interrupt in this organization block. Cyclic program execution is then resumed at the point at which it was interrupted.

Time-controlled program execution

An organization block is called after a preset time (time interrupt). Organization blocks are available. Times between 10 ms and 20 min can be set for each organization block. This makes it possible for certain parts of the program to be processed independently of the scan time.

S5-135U, S5-155U (continued)

Communication

Point-to-point connection

Communications processors enable the programmable controller to communicate with other programmable controllers, computers, human-machine-interfaces, and peripheral devices through point-to-point connections.

They have their own memory for data, texts and graphics. Data communication with the devices connected is handled by the communications processors absolutely independently, which relieves the central processing units from time-consuming communications tasks.

Communication with computers, other programmable controllers and peripheral devices, such as printers, is carried out by the CP 523, CP 524 and CP 544 communications processors.

The CP 526, CP 527 and CP 528 communications processors are responsible for communications with the units of the SIMATIC HMI human-machine-interface.

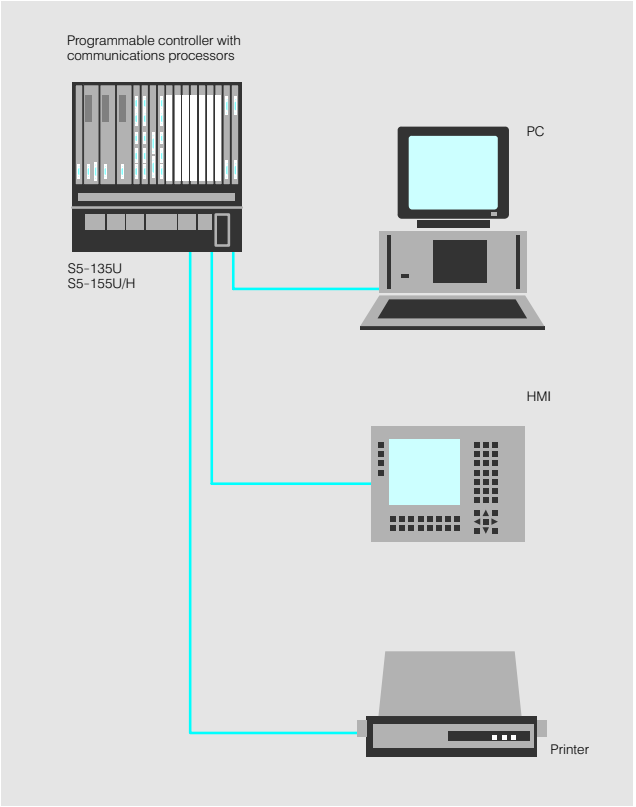


Fig. 4/11 Interfacing the programmable controller with PC, HMI devices and printer

Local area networks

SINEC L1 bus system

The SINEC L1 bus system (Siemens Network Communication Low Range) provides a simple solution to the configuring of small, distributed automation systems on the lower level of communications technology.

The following PLCs can be connected to this bus system: S5-90U, S5-95U/F, S5-100U, S5-115U/H/F, S5-135U and S5-155U/H.

Features

- Up to 31 nodes
- Baud rate 9.6 kbit/s
- Max. coverage 50 km (31 miles)
- Transmission medium: twisted pair cable

PROFIBUS bus system

See Section 10.

Industrial Ethernet bus system

See Section 10.

S5-135U, S5-155U (continued)

Quality assurance procedures

To ensure correct operation of all SIMATIC S5 products and to prevent failures, extensive, cost-effective quality assurance procedures are carried out at every stage of the life of a product:

- During product planning
- During product development
- During production
- In product operation

Product planning

The product planning phase covers all the activities from market research to type specification. Quality assurance in the product planning phase ensures that the SIMATIC S5 product conforms to the high standards of quality required on the market.

Product development and production

The following are some examples of routine quality assurance precautions taken during development and production:

- Use of high-quality components
- Worst-case design of all circuits
- Systematic and computer-controlled testing of all components supplied by subcontractors
- Burn-in of all LSI circuits, e.g. processors and memories. Burning in is an aging process which helps to reduce the number of failures early in a product's life. The components are subjected to a high temperature for several hours in a burn-in cubicle
- Measures to prevent static charge building up when handling MOS circuits
- Visual inspections at various stages of production
- In-circuit testing of all modules, i.e. computer-aided testing of all components and their interaction with other components in the complete circuit
- Continuous heat-run test at elevated ambient temperature over a period of several days
- Careful computer-controlled final testing
- Statistical evaluation of all failures to enable the immediate initiation of suitable corrective measures

Product operation

Even when the SIMATIC S5 products are in operation on the customer's premises, they are still under constant supervision. Extensive quality control precautions are taken in the following areas:

- Stockkeeping and dispatch
- Service
- Field observation

Established methods are used in all these areas, which operate precisely, punctually and conscientiously, whilst also remaining flexible for special customer requirements.

Sometimes an even higher level of fault-tolerance or safety is required than that normally offered by the SIMATIC S5 U range. Fault-tolerant or failsafe programmable controllers, such as the S5-115H or the S5-115F are available for this purpose.

Availability

Availability is the probability of finding a system in a functional state at a specified point in time.

Safety

Safety is defined by DIN 31000 as "A state of lower risk than the permitted limit". The "permitted limit is the maximum acceptable degree of risk for a specific plant". The plant-specific degree of risk may be stipulated by law, by the plant operator or by an independent body of experts, e.g. the German Technical Inspectorate (TÜV).

Installation guidelines

SIMATIC programmable controllers are designed for use in harsh industrial environments. To ensure correct operation of the equipment, it must be installed and connected in accordance with certain rules. Certain principles must also be observed as regards wiring, earthing and shielding.

Timely planning of the necessary measures for improving the electromagnetic compatibility (EMC) of the programmable controllers is advisable in order to avoid retrofitting. These rules are explained in the section entitled "Installation guidelines" in the relevant product manuals.

For the installation of failsafe controls, the relevant regulations must be observed.

S5-155H, S5-155H Lite

Application

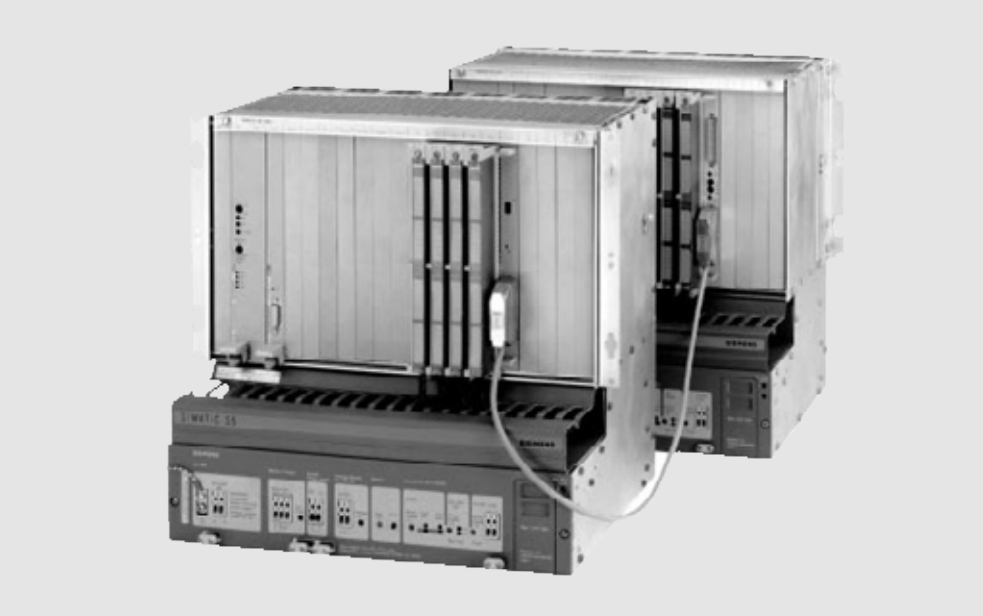


Fig. 4/12 S5-155H programmable controller

In many fields of automation, increasingly high demands are being placed on the availability and fault-tolerance of programmable controllers (PLCs). Particularly in fields where a plant shutdown would be extremely expensive. In such cases, only redundant systems can offer the standard of availability required.

Fault-tolerant systems continue to work in all likelihood when one or more parts of the control fail.

The S5-155H/S5-155H Lite programmable controller consists of two interlinked central controllers. It operates on the "master/slave" principle. One subunit, the master, controls the process. If a fault occurs, the other subunit, the slave, takes over control.

This ensures a high degree of fault-tolerance, which makes the S5-155H/S5-155H Lite programmable controller especially suitable for applications in the following fields:

Fields with predominantly continuous processes, e.g.:

- Refineries
- Chemicals
- Power stations
- Steelworks
- Environmental protection (e.g. water treatment)
- Pipelines
- Off-shore installations

Areas of production employing batch processes, e.g.:

- The automotive industry
- The pharmaceutical industry
- The food industry
- In plants with flexible manufacturing systems
- In high-bay warehouses

S5-155H, S5-155H Lite (continued)

Design

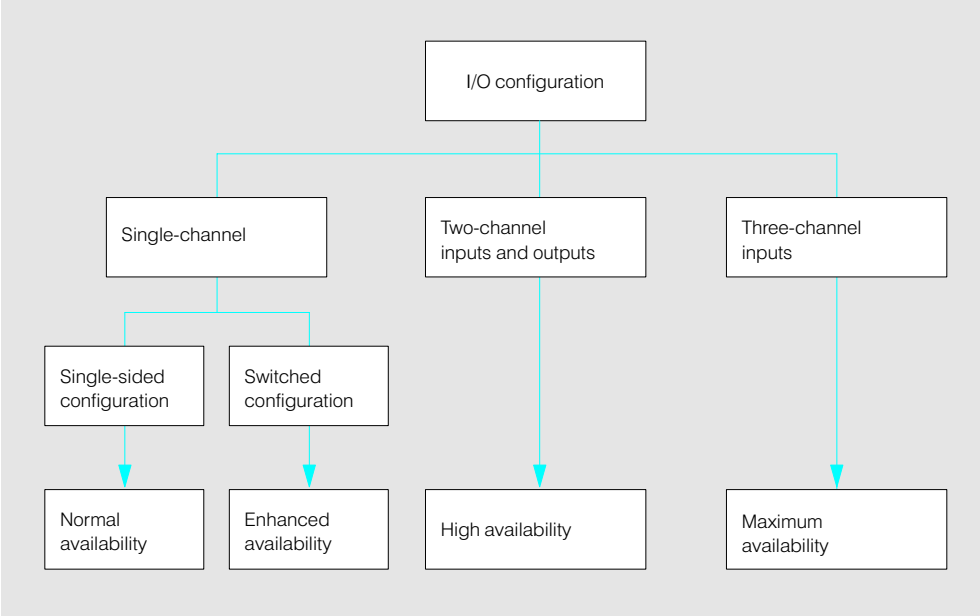


Fig. 4/13 Degrees of availability of the I/O area

In the S5-155H/S5-155H Lite programmable controller the central functions are always implemented in a redundant configuration.

S5-155H

Configured with CPU 948R

S5-155H Lite

Configured with CPU 948RL

The I/Os can, however, also be configured with redundancy.

The two subunits of the S5-155H/S5-155H Lite programmable controller are both equipped with the same hardware and software and interlinked via the IM 304 and IM 324R interface modules (for linking central controllers) and the 721 connecting cable.

Three different levels of availability are possible, depending on the arrangement of the I/O modules:

- Normal availability (single-sided configuration)
- Enhanced availability (switched configuration)
- Maximum availability (fully redundant configuration)

Full redundancy of the S5-155H/S5-155H Lite is implemented with

- Two-channel configuration of inputs and outputs
- Three-channel input configuration

Fig. 4/13 shows the configurations for the three levels of availability.

The different levels of availability can be combined as required.

The performance capability, user convenience and other technical features of the S5-115H/S5-155H Lite fault-tolerant programmable controller correspond to a large extent to the features of the S5-155U.

S5-155H, S5-155H Lite (continued)

4

Design

Normal availability (single-sided configuration)

In the single-sided configuration (see Fig. 4/14) the I/Os are connected in single-channel mode and only addressed by one of the two subunits. The I/Os in this configuration can be plugged into either

- a central controller or, if the number of slots is not sufficient,
- expansion units.

Information read into the one subunit (e.g. from digital input modules) is automatically transmitted to the second subunit.

It is immaterial whether one subunit is the master and the other the standby. What is important is whether or not the subunit which is connected to the I/Os is operational.

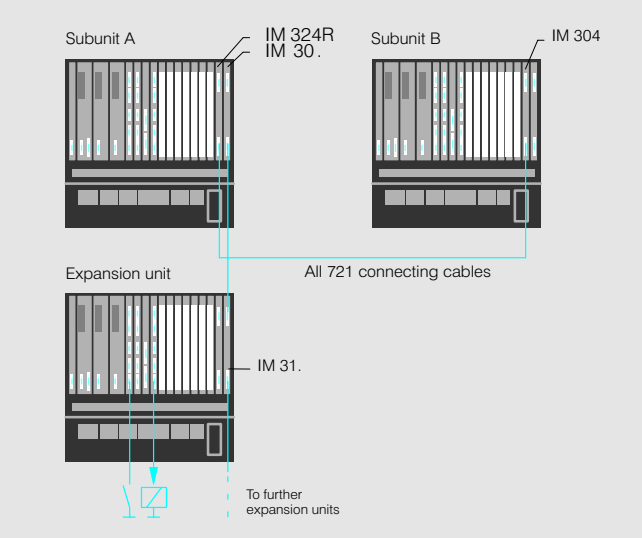


Fig. 4/14 Single-sided configuration (normal availability)

In the event of a failure, the I/Os connected to the subunit concerned are also out of action.

This configuration is used for sections of a plant which do not require enhanced availability.

Enhanced availability (switched configuration)

In the switched configuration (see Fig. 4/15) the I/Os are connected in single-channel mode, but they can be addressed by both subunits. The I/Os in this configuration must always be plugged into an EG 185U expansion unit.

Up to 16 expansion units can be connected in switched configuration, distributed between up to 8 I/O bus lines.

Expansion units in switched configuration are connected via the IM 304 interface module in the central controller and the IM 314R interface module in the expansion unit. The expansion units can also be expanded in a centralized configuration via the IM 300 interface module.

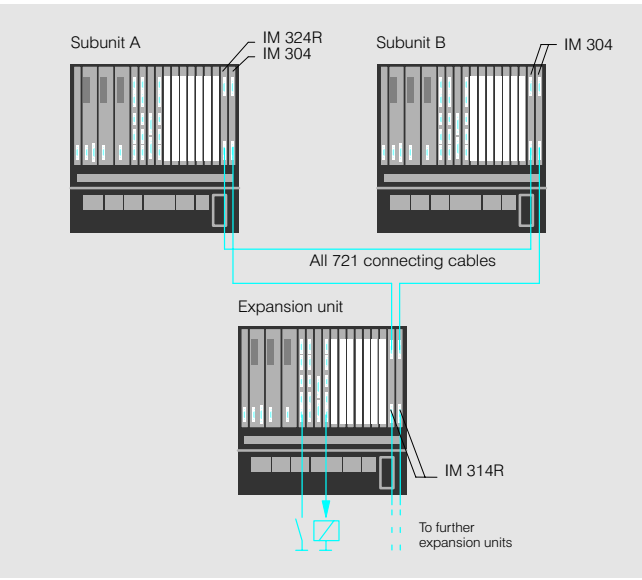


Fig. 4/15 Switched configuration (enhanced availability)

Expansion units in switched configuration are connected to both subunits and are addressed by the one currently acting as master.

This configuration is employed when failure of individual I/Os is not crucial.

S5-155H, S5-155H Lite (continued)

Design (continued)
High availability
(fully redundant configuraion)

Two-channel configuration

In the two-channel I/O configuration, identical I/Os are installed with the same addresses in both subunits. Both failure of one of the central controllers and failure of one of the two redundant I/Os can be tolerated. The I/O modules can be installed either in the central controllers themselves or in expansion units.

Three-channel configuration

The maximum degree of availability is obtained with a three-channel input configuration. Two of the three input channels are assigned to the CPUs directly, whereas the third channel is connected to both CPUs via an expansion unit in switched configuration. If one of the CPUs fails, the intact CPU continues to operate with two input channels.

The three-channel input configuration has the following advantages:

- A high degree of availability with a choice of two out of three
- Numerous faults can be recognized and located without additional wiring such as:
  Module fault,
  Load voltage failure,
  Wirebreak,
  Short-circuit to frame and
  Sensor fault
- Low wiring overhead
- Both redundant and diverse sensor configurations possible

The redundant I/O modules to be used in the two- and three-channel configurations must be made known to the operating system using the COM 155H parameter assignment software.

They can be addressed in the same way as single-channel I/Os in the user program. The operating system does the rest.

The communications processors can also be used with two-channel mode in a redundant configuration (see page 4/16). The user must program the redundancy function.

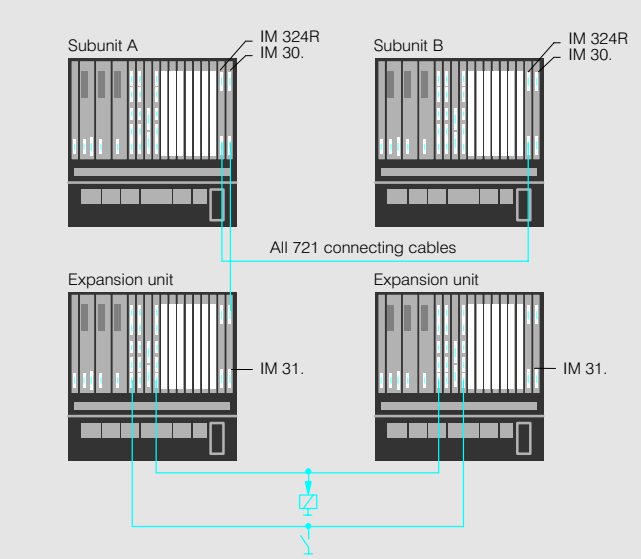


Fig. 4/16 Two-channel configuration (high availability)

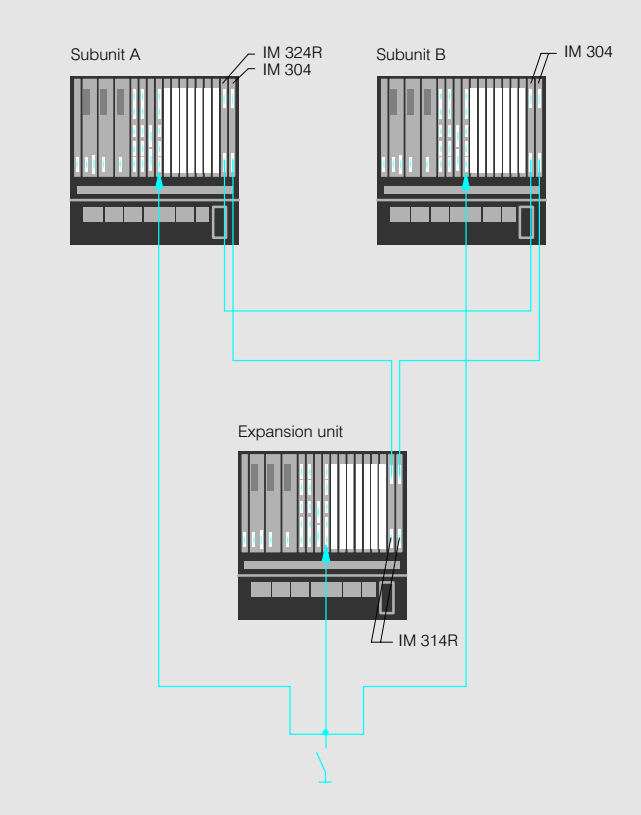


Fig. 4/17 Three-channel configuration (maximum availability)

The following can be connected to the central controller:

- EG 184U
- EG 185U
- EG 187U
- ET 100U
  electronic terminator
- ET 200 distributed
  I/O system

S5-155H, S5-155H Lite (continued)

Design (continued)
Mixed configuration

The different levels of availability can be combined as required. A mixed configuration, i.e. a combination of redundant, switched and single-sided configuration, is frequently the most economical solution.

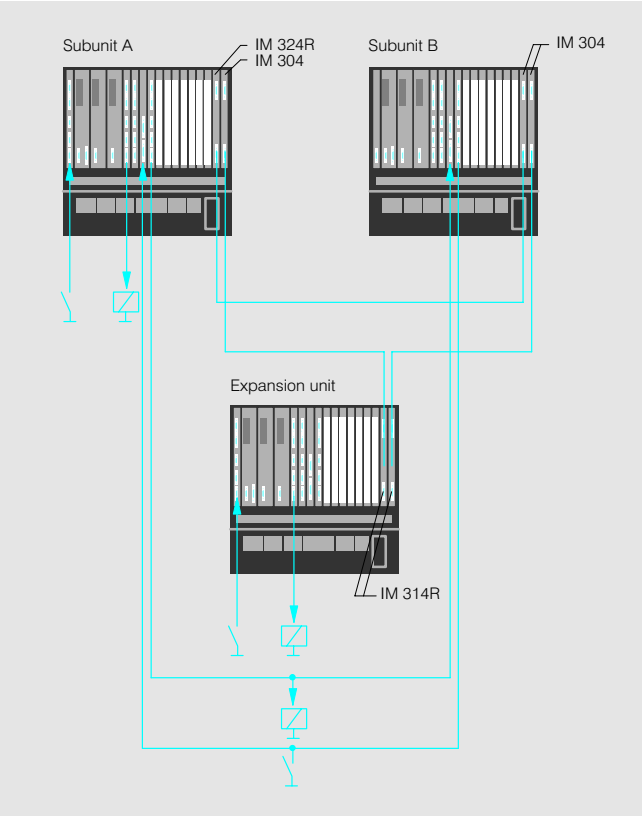


Fig. 4/18 Mixed configuration

Redundancy of the IPs and CPs

Intelligent I/O modules (IPs) and communications processors (CPs) can also have redundant configuration.

Switched redundant configuration

The IPs and CPs can be plugged into expansion units of switched configuration.

Two-channel redundant configuration

The CPs can additionally be plugged into the two subunits.

Selection criteria

The type of configuration which is most favorable depends on the type of application.

Advantages of the switched redundant configuration:

- In the case of a central controller failure, the IPs/CPs remain redundant
- In the case of an IP/CP failure, the central controllers remain highly fault tolerant
- Shorter scan time

Disadvantages of the switched redundant configuration:

- At least two switched expansion units required
- If the IPs/CPs are to be repaired, the corresponding expansion unit must be switched off. This means that all other I/O modules in this expansion unit are out of operation

Advantages of the two-channel redundant configuration:

- No switched expansion units required
- If the CPs are to be repaired, only redundant components have to be disconnected from the power supply

Disadvantages of the two-channel redundant configuration:

- Longer scan time

S5-155H, S5-155H Lite (continued)

Design (continued)
Redundancy of the IPs and CPs

IPs and CPs in switched redundant configuration

If an intelligent I/O module (IP) or a communications processor (CP) is to be used in switched expansion units, a minimum of two expansion units is required. One CP/IP each must be plugged into the two expansion units. If data is received in an intelligent I/O module or a communications processor, it is automatically transmitted to the second subunit, regardless of which is the master and which is the reserve unit.

CPs and IPs in two-channel redundant configuration

If a communications processor (CP) or an intelligent I/O module (IP) is to be of two-channel redundant configuration, one CP/IP must be plugged into each of the two subunits. Both CPs/IPs are assigned different page frames and operate independent of each other. If a CP/IP receives data, it is automatically transmitted to the second subunit, regardless of which is the master and which is the reserve unit.

The redundancy function both in the case of the switched and the two-channel redundant configuration must be programmed by the user. The user program defines which CPs/IPs are active and it must detect whether one of the CPs/IPs is faulty, in order to be able to switch over to the other CP/IP if necessary.

The operating system ensures that the data in both subunits remains equal. Both CPs/IPs are regarded as independent modules.

In contrast to the I/O modules in redundant configuration, redundant CPs and IPs are assigned different addresses and page frames in the two subunits.

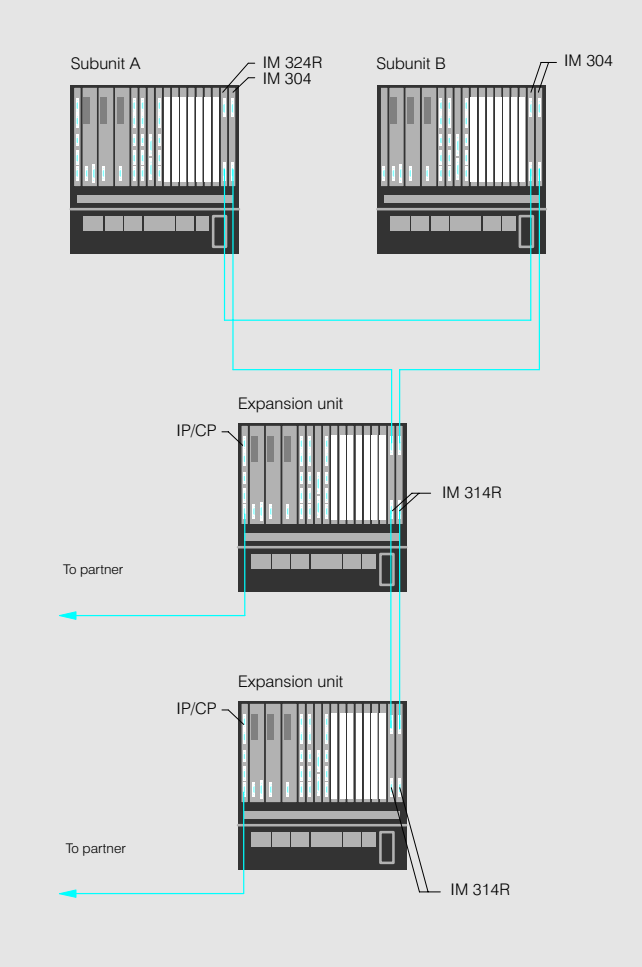


Fig. 4/19 CP/IP in switched redundant configuration

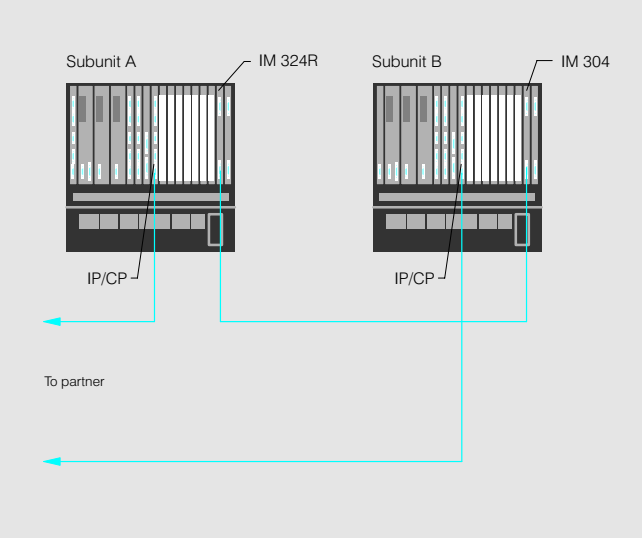


Fig. 4/20 CP/IP in two-channel redundant configuration

S5-155H, S5-155H Lite (continued)

4

Principle of operation

The principle of operation of the S5-155H/S5-155H Lite fault-tolerant programmable controller can be compared with an "OR" operation. The programmable controller is in an operational state when at least one of the two subunits is functioning correctly (see Fig. 4/21).

Both central controllers contain the CPU 948R/RL. The oper-ating system of the CPU 948R/RL performs all the additional functions of the S5-155H/S5-155H Lite independently e.g.:

- Data exchange
- Fault handling (switchover to standby unit)
- Synchronization of the two subunits
- Self-test
- Fault locating

The operating system of the S5-155H/S5-155H Lite supports redundant operation of:

- Digital I/O modules
- Analog I/O modules

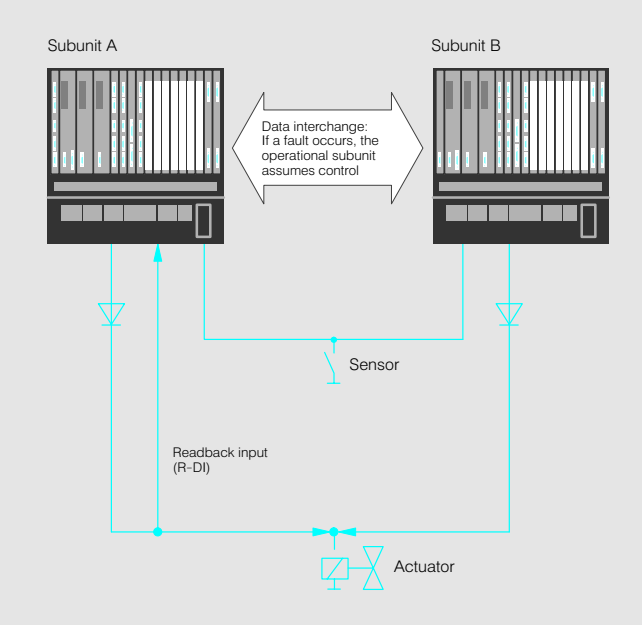


Fig. 4/21 Example of an S5-155H with redundant input and output

Data interchange and fault handling

Master-slave operation

The S5-155H/S5-155H Lite basically oper-ates on the master-slave principle in hot-standby mode (see right). One subunit, the master, controls the process. If a fault occurs, the other subunit, the standby or slave, takes over the control functions. The faulty subunit can then be repaired without interrupting the process.

The combined operation of the two subunits differs according to the I/O configuration:

- Switched configuration
  The master controls the process whilst the slave merely runs on standby. If a fault occurs, the standby immediately takes over control
- Two-chanel I/O configuration (fully redundant configuration)
  Both subunits control the process in parallel. The standby also issues output signals and reads in input signals. For further details, please refer to Section 11 (Configuring)
- Three-channel I/O configuration (fully redundant configuration).
  The combined operation of both subunits corresponds to the two-channel I/O configuration

Hot-standby

Hot-standby is the ability to switch over to a standby device in the event of a fault automatically and without detrimental effect.

For operation in this mode it is absolutely essential that both subunits should be able to exchange data quickly and reliably. In the S5-155H/S5-155H Lite the two subunits are normally linked by the central controller interface via which they are both supplied with:

- The same user program
- The same data blocks
- The same process I/O image contents
- The same receive buffer contents, e.g. when using communications processors

The standby unit is therefore always up to date and ready to take over control immediately if a fault occurs.

S5-155H, S5-155H Lite (continued)

Principle of operation (continued)

Synchronization

To avoid delay in switching over from master to standby, synchronization of the subunits is essential. This includes interchange and comparison of data to ensure that both subunits have the same information at their disposal. The synchronization procedure used for the S5-155H/ S5-155H Lite is "event-driven synchronization".

Event-driven synchronization is carried out every time an event occurs which could change the internal state of the subunits, e.g.:

- Commands with direct access to the I/Os
- Block call commands
- Time function commands

The user need not think about the synchronization when programming. The synchronization is completely taken over by the operating system.

Self-test

Extensive self-test functions are implemented in the S5-155H/S5-155H Lite. The following components and functions are tested:

- Internal S5 bus
- Central controller link
- Fault locating device
- CPUs
- Processing unit/ASIC
- Memories

Every fault recognized by self-test is reported.

Self-test on restart

Each subunit runs through all the self-test functions on restart.

Self-test in cyclic operation

For cyclic operation the operating system breaks down the self-test functions into short sections approxi-mately 5 ms long. One or more of these is processed in a cycle. The number of sections per cycle is configured by the user.

Operating modes

Fault detection

In the two-channel redundant I/O configuration faults are detected by:

- Comparison, in the case of digital inputs
- A readback input, in the case of digital outputs
- Comparison, in the case of analog inputs
- Comparison and readback, in the case of analog outputs

In the three-channel redundant input configuration fault detection takes place with a choice of two out of three.

Fault detection with fault locating

For uninterrupted operation, the operating system must be able not only to detect faults but also to locate them, in order to deactivate the faulty module (by switching off the load voltage, in the case of outputs).

This operating mode can be used for both digital input and output modules. Advantages of this operating mode:

- In the event of a fault, the programmable controller S5-155H/S5-155H Lite continues to operate with the module which is functioning correctly
- Faults can be corrected more quickly and easily

In the two-channel redundant I/O configuration, the operating system is responsible for the software side of fault locating. On the hardware side, locating inputs and outputs (L-DIs and L-DOs) are required.

In the three-channel redundant input configuration, fault detection takes place by fault locating with a choice of two out of three.

For further information regarding the principle of operation of the fault-tolerant S5-155H/ S5-155H Lite programmable controller, see Section 11 (Configuring).

S5-155H, S5-155H Lite (continued)

Programming, parameter assignment
Programming

Programming of the S5-155H/ S5-155H Lite programmable controller is the same as for the S5-155U. All STEP 5 operations allowed in the S5-155U, apart from the multiprocessing operations, can be used.

Both on-line and off-line programming are possible.

On-line programming

For on-line programming the programming device is connected to the CPU of one of the subunits. The program is auto-matically relayed to the other subunit.

Off-line programming

Off-line programming is possible using an EPROM submodule in the programming device without connecting it to the programmable controller. The submodule is then duplicated and plugged into the CPUs of both subunits.

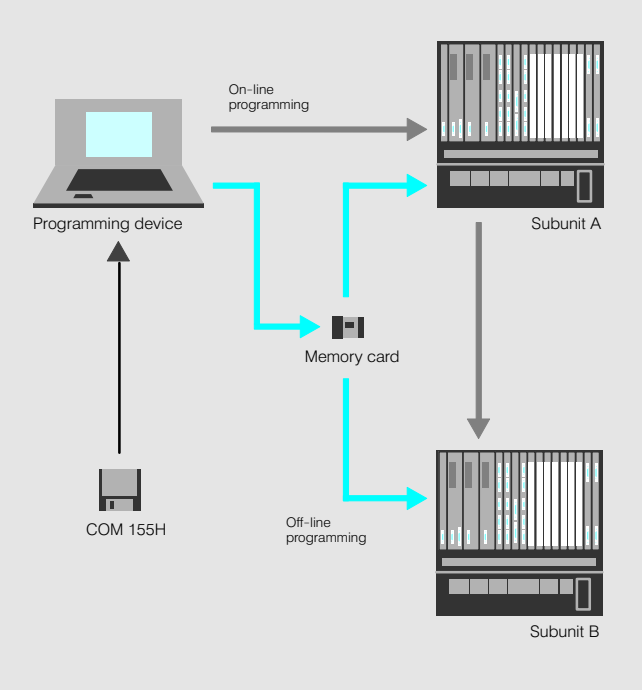


Fig. 4/22 On-line and off-line programming

parameter assignment

COM 155H parameter assignment software

The COM 155H parameterization software supports the user in parameter assignment and error diagnostics:

- Interactive parameter assignment of data specific to the H version
- Generation of the parameter assignment data block from the parameter assignment data
- System diagnostics using the error data blocks and the interrupt register
- Printout of data specific to the H version
- General system handling, e.g. starting the system

CPU 928A

Application

The CPU 928A is designed for mid-range applications. It is particularly suitable for high-speed word processing (arithmetic operations, closed-loop control) and for high-speed binary signal processing (logic control).
It can be used in S5-135U and S5-155U.

Design

The module contains the following:

- Microprocessor (ASIC) for processing binary statements and for high-speed processing of a number of selected word statements
- Microprocessor (16 bit) for processing word statements and the operating program of the module
- Microprocessor (8 bit) for processing the programming device port
- Memory (RAM) for bit memories, timers, counters, process image, etc.
- Internal memory:
  64 Kbyte for the user program and 46 Kbyte (RAM) for data of the user program (data blocks)
- Receptacle for SIMATIC memory card (FLASH EPROM) for max. 64 Kbyte user program.
  STEP 5 V6.6 and higher is required for programming and erasing the memory card.
- Programming device port (15-way Cannon socket)
- Shift register (246 x 8 bit) with high processing speed
- Operating program for cyclic, time- and process-controlled processing and error handling
- Software for multiprocessor communication
- Closed-loop controller algorithm (e.g. for pressure, temperature or flow control) with the following features: Output signal as manipulated variable or change in manipulated variable, parameterization via data block (fixed or variable values), limiting the output signal (high and low limits)

Depending on the job to be done, one to four CPUs 928 can be used in a central controller of the S5-135U or S5-155U programmable controllers, which are also suitable for multiprocessor operation with the following CPUs:

- CPU 948, CPU 928B, CPU 928 in the central controller of the S5-135U/155U.

Both time-controlled (clock: 10, 20, 100, 200, 500, 1000, 2000 and 5000 ms) and interrupt-driven program execution are possible.

CPU 928A (continued)

Restart modes	
Cold restart with reset, manual	All bit memories, timers and counters are reset and the process image erased. Scanning of the user program starts at the beginning.
Warm restart, manual	The bit memories, timers, counters and the process image are retained during the down-time. Scanning of the user program continues at the point of interuption.
Warm restart, automatic	Following power recovery, the PLC automatically enters the RUN mode. The other data is as listed under warm restart, manual.
Overall reset	All memory areas are erased. The programmable controller enters the basic state. If a RAM is used, the user program must be loaded. If an EPROM ist used, a cold restart with reset is possible. The overall reset function can be triggered by a switch on the processor or from the programming device.
The following start-up is possible if block DX 0 is programmed accordingly:	
Automatic restart	After voltage recovery the CPU returns automatically to the operating state. The other data is as listed under cold restart with reset, manual.

Technical specifications

Microprocessors			8031 (8 bit) 80186 (16 bit), ASIC
Memory space			
• RAM internal (for data blocks only)			46 Kbyte
• RAM internal or Memory card (flash EPROM); for program		max.	64 Kbyte
Execution time for			
• 1 K binary statements (AND, OR)			1.1 ms
• 1 K digital statements (load, transfer)			15 ms
• 8 control loops			20 ms
Number of control loops		max.	64 with standard function block "R64 controller structure" (see Section 7)
Bit memories			2048
Timers			
• Number			256
• Range			0.01 ... 9990 s
Counters			
• Number			256
• Range			0 ... 999
Inputs	digital	max.	1024 with process image
	additional	max.	3072 without process image
	additional	max.	4096 for direct memory access [1]
	additional	max.	518,152 for page addressing [2]
	analog	max.	192
	additional	max.	256 for direct memory access [1]
	additional	max.	32,130 for page addressing [2]
Outputs	digital	max.	1024 with process image
	additional	max.	3072 without process image
	additional	max.	4096 for direct memory access [1]
	additional	max.	518,152 for page addressing [2]
	analog	max.	192
	additional	max.	256 for direct memory access [1]
	additional	max.	32,130 for page addressing [2]
Program execution			• Cycle (OB1) • Interrupt-driven • Time-controlled in 9 clock pulses
Current consumption (at 5 V)			
• CPU 928A		max.	0.6 A
• Memory card		max.	0.2 A
Power loss		max.	3 W
Space requirement			1 slot
Weight			
• CPU 928		approx.	0.5 kg (1.1 lb)
• Memory submodule		approx.	0.04 kg (0.088 lb)

1) Only with IM 304, IM307, IM 308 interface modules.
2) Only with IM 308 interface module (theoretical end value).

Ordering data

	Order No.		Order No.
CPU 928 with receptacle for 1 memory submodule	**6ES5 928-3UA21**	**Memory card with flash** EPROMs 128 Kbyte (only 64 Kbyte usable)	**6ES5 374-2KG21**
System manual, programming guide, manual	see page 4/155		

CPU 928B

Application

The CPU 928B is designed for mid-range applications. It is particularly suitable for high-speed word processing (arithmetic operations and closed-loop control) and high-speed binary signal processing (logic control).

In addition the module also has a second interface and is thus suitable for high-speed serial point-to-point connections or for connecting to the SINEC L1 LAN (slave or master with point-to-point connections).
It can be used in S5-135U and S5-155U.

Design

The module contains the following:

- Arithmetic unit, microprogrammed, with bit and word processor (16 bit), for high-speed processing of binary and word statements
- Microprocessor (16 bit) for processing the operating program of the module
- Microprocessor (16 bit) for processing the built-in interface and the second optional serial interface
- Memory (RAM) for bit memories, S bit memories, timers, counters, process image, etc.
- Internal memory:
  64 Kbyte for the user program and 46 Kbyte (RAM) for data of the user program (data blocks)
- Receptacle for SIMATIC memory card (FLASH EPROM) for max. 64 Kbyte user program.
  STEP 5 V6.6 and higher is required for programming and erasing the memory card.
- Programming device port (15-way Cannon socket)
- Receptacle for interface module; the following can be installed:
  Second interface for programming device and operator panel;
  V.24 interface;
  TTY interface;
  RS 422 A interface for point-to-point connections;
  SINEC L1 interface
- Shift register (246 x 8 bit) with high processing speed
- Hardware clock
- Operating program for cyclic, time- and process-controlled processing and error handling
- Software for multiprocessor communication
- Closed-loop controller algorithm (e.g. for pressure, temperature or flow control) with the following features: Output signal as manipulated variable or change in manipulated variable, parameterization via data block (fixed or variable values), limiting the output signal (high and low limits)
- Driver for 3964, 3964R, RK512, "open driver"
- Special functions for cycle statistics

Depending on the job to be done, one to four CPUs 928B can be used in a S5-135U/155U central controller, which are also suitable for multiprocessor operation with the following CPUs:

- CPU 922, CPU 928, CPU 948 in the central controller of the S5-135U/155U

The CPU 928B functions on the same basis as, and is upwards-compatible with, the CPU 928. All STEP 5 commands for the CPU 928 can execute without modification on the CPU 928B.

Restart modes	
Cold restart with reset, manual	All bit memories, timers and counters are reset and the process image erased. Scanning of the user program starts at the beginning.
Warm restart, manual	The bit memories, timers, counters and the process image are retained during the down-time. Scanning of the user program continues at the point of interruption.
Warm restart, automatic	Following power recovery, the CPU automatically enters the RUN mode. The other data is as listed under warm restart, manual.
Overall reset	All memory areas are erased. The programmable controller enters the basic state. If a RAM is used, the user program must be loaded. If an EPROM is used, a cold restart with reset is possible. The overall reset function can be triggered by a switch on the processor or from the programming device.

CPU 928B (continued)

Design (continued)

Restart modes (continued)	
By parameterizing the DX 0 the following start-up is possible:	
Cold restart, automatic (without memory)	Following power recovery, the CPU goes to RUN mode automatically. Otherwise the same as cold restart with reset, manual.
Cold restart, automatic (with memory)	Following power recovery, scanning of the user program starts at the beginning. All bit memories, timers and counters are retained.

4

Technical specifications

Microprocessors			80186 (16 bit) 80188 (16 bit)
Memory space			
• RAM internal (for data blocks only)			46 Kbyte
• RAM internal or Memory card (flash EPROM); for program		max.	64 Kbyte
Execution time for			
• 1 K binary statements			0.6 ms
• 1 K word statements			1.5 ms
• 8 control loops			20 ms
Scan time monitoring			Programmable, default: 200 ms
Number of control loops		max.	64 with standard function block "R 64 controller structure" (see Section 7)
Bit memories			2048
S bit memories			8192
Timers			
• Number			256
• Range			0.01 ... 9990 s
Counters			
• Number			256
• Range			0 ... 999
Inputs	digital	max.	1024 with process image
	additional	max.	3072 without process image
	additional	max.	4096 for direct memory access[1])
	additional	max.	518,152 for page addressing[2])
	analog	max.	192
	additional	max.	256 for direct memory access [1])
	additional	max.	32,130 for page addressing[2])
Outputs	digital	max.	1024 with process image
	additional	max.	3072 without process image
	additional	max.	4096 for direct memory access[1])
	additional	max.	518,152 for page addressing[2])
	analog	max.	192
	additional	max.	256 for direct memory access[1])
	additional	max.	32,130 for page addressing [2])
Program execution			• Cycle (OB1) • Interrupt-driven • Time-controlled in 9 clock pulses • Clock-controlled
Current consumption (at 5 V)			
• CPU 928B		typ.	0.6 A
• Memory card		max.	0.2 A
• 377 memory submodule (RAM)		max.	0.1 A
• Interface modules			0.1 ... 0.2 A
• Power loss		max.	3 W
Space requirements			1 slot
Weight			
• CPU 928B		approx.	0.5 kg (1.1 lb)
• Memory submodule		approx.	0.04 kg (0.088 lb)

1) Only with IM 304, IM 307, IM 308 interface modules.
2) Only with IM 308 interface module (theoretical end value).

Ordering data

	Order No.
CPU 928 B with receptacle for 1 memory submodule and receptacle for 1 interface module	**6ES5 928-3UB21**
System manual, programming guide, communications manual, instruction manual	see page 4/155
Memory card with flash EPROMs 128 Kbyte (only 64 Kbyte usable)	**6ES5 374-2KG21**
Interface module	
for 20 mA current loop (TTY)	**6ES5 752-0AA12**
for V.24 (RS 232C)	**6ES5 752-0AA23**
for RS 422-A/RS 485	**6ES5 752-0AA43**
for SINEC L1	**6ES5 752-0AA53**
COM PP parameter assignment software	**6ES5 752-0AA62** see Section 7

CPU 948

Application

The CPU 948 is the high-speed memory giant for the S5-155U. It is the most powerful CPU and is designed for applications in the upper performance range. It has a large user memory and is suitable for both very high-speed word processing (arithmetic operations and closed-loop control) and very high-speed binary signal processing (logic control). The CPU 948 is fully compatible with its predecessors, the CPU 946/947.

Design

The module contains the following:

- STEP 5 processing unit (with 2 ASICs) for processing the user program
- Microprocessor (16 bit) for processing the operating system of the module
- Microprocessor (16 bit) for processing the built-in interface and the second optional serial interface
- Memory (RAM) for bit memories, S bit memories, timers, counters, process image, etc.
- Internal memory (RAM) with 640 or 1664 Kbyte for the user program
- Receptacle for SIMATIC memory card (flash EPROMs)
- Hardware clock
- Interfaces
  1. Built-in serial interface (TTY) for programming device
     or operator panel
  2. Slot for interface module for programming device;
     V.24 interface;
     TTY interface;
     RS 422 A interface for point-to-point connections;
     SINEC L1 interface

Depending on the job to be done, up to 4 CPUs 948 can be used in a central controller of the S5-155U programmable controller; they are also suitable for multi-processor operation with CPU 948B, CPU 928 and CPU 922.

The user programs can be stored in the integral RAM (640 or 1664 Kbyte). If necessary, the programming device can be used to store the user program on a flash EPROM to protect it from power failures.

The CPU 948 is fully compatible with the CPUs 946/947. It is not necessary to modify existing programs.

Functions

Program execution

- Cyclic program execution;
  Read-in of input statuses, execution of the control program and output of the output statuses
- Time-controlled program execution; 9 independent time-controlled program execution levels. The time of processing can be defined separately for each level. Times between 10 ms and 20 min can be set. A time-controlled timed interrupt is also available
- Interrupt-controlled program execution;
  via interrupts or process alarms;
  4 interrupts via signal lines of the internal S5 backplane bus;
  8 process alarms via input byte IB 0
- Time interrupt-controlled program processing;
  This execution level is activated after expiry of a programmed time (time resolution: 1 ms)

Execution levels of higher priority can interrupt execution levels of lower priority after each STEP 5 operation.

Monitoring

- Scan time
- Collision of two timed interrupts
- Addressing error
- Acknowledgement delay

Time

- Set, read, interrupt
- Operating hours counter

Integral function blocks

Including, for example

- Disable or delay interrupts
- Delete or generate blocks
- Transfer process images
- Copy data blocks

Hardware self-test functions

- Including, for example, RAM test, BASP (output disable) test and clock test

Further functions

- Easy access to the extended I/O area via function block FB 196 (contained in the "Basic functions" program package, (see Section 7)
- Programming device functions via the internal S5 backplane bus, thus providing fast program loading via the Industrial Ethernet bus system
- Password protection of the user program

CPU 948 (continued)

Design (continued)

Restart modes	
Cold restart with reset, manual	All bit memories, timers and counters are reset and the process image erased. Scanning of the user program starts at the beginning.
Warm restart, manual	The bit memories, timers, counters and the process image are retained during the down-time. Scanning of the user program continues at the piont of interruption.
Warm restart, automatic	Following power recovery, the PLC automatically enters the Run mode. The other data is as listed under warm restart, manual.
The following start-up is possible if block DX 0 is programmed accordingly:	
Cold restart, automatic	Following power recovery, the programmable controller automatically enters the RUN mode. The other data is as listed under cold restart with reset, manual.
Cold restart with memory, manual	The bit memories, timers, counters and the process image are retained during the down-time. Scanning of the user program continues at the point of interruption.
Cold restart with memory, automatic	Following power recovery, the programmable controller automatically enters the RUN mode. The other data is as listed under cold restart with memory, manual.

Technical specifications

Microprocessors			80186 (16 bit) 80188 (16 bit), 2 ASICs
Total memory space • Internal memory • Memory submodule (flash EPROM)			 640 Kbyte or 1664 Kbyte 640 Kbyte or 1164 Kbyte
Programming language			STEP 5, SCL
Block types			Organization blocks (OB), Programming blocks (PB), Function blocks (FB, FX), Data blocks (DB, DX)
Number of blocks		max.	256 per block type
Nesting depth of the blocks			60
Program execution			• Cyclic (OB1) • Interrupt-driven • Time-controlled • Operator-controlled stop
Execution times for • Bit operations • Word operations • Time/counter operations • Fixed-point addition • Floating-point addition			 0.18 µs 0.5 µs 0.18 µs 0.55 µs 3.3 µs
Scan time monitoring			Programmable, default: 200 ms
Inputs	digital	max.	1024 with process image
	additional	max.	3072 without process image
	additional	max.	4096 for direct memory access [1]
	additional	max.	518,152 for page addressing [2]
	analog	max.	192
	additional	max.	256 for direct memory access [1]
	additional	max.	32,130 for page addressing [2]
Outputs	digital	max.	1024 with process image
	additional	max.	3072 without process image
	additional	max.	4096 for direct memory access[1]
	additional	max.	518152 for page addressing [2]
	analog	max.	192
	additional	max.	256 for direct memory access [1]
	additional	max.	32,130 for page addressing [2]
Bit memories			2048
S bit memories			32768
Nesting levels			8
Timers • Number • Range			 256 0.01 ... 9990 s
Counters • Number • Range			 256 0 ... 999
Interfaces 1st interface (integral) 2nd interface (optional)			 programming device/operator panel depending on interface module used
Current consumption (at 5 V) • CPU 948 • Memory card • Interface module		 max. max. max.	 3.6 A 0.2 A 0.1 ... 0.2 A
Power loss		max.	20 W
Space requirements			2 slots
Weight • CPU 928 • Memory submodule		 approx. approx.	 1 kg (2.2 lb) 0.06 kg (0.13 lb)

1) Only with IM 304, IM 307, IM 308 interface modules.
2) Only with IM 308 interface module (theoretical end value).

CPU 948 (continued)

Ordering data	Order No.		Order No.
CPU 948		**Interface module**	
• With 640 Kbyte user memory	**6ES5 948-3UA11**	for 20 mA current loop (TTY)	**6ES5 752-0AA12**
• With 1664 Kbyte user memory	**6ES5 948-3UA21**	for V.24/V.28 (RS 232C)	**6ES5 752-0AA22**
System manual, programming instructions, manual	see page 4/155	for RS 422-A/RS 485	**6ES5 752-0AA43**
Memory card		for programming device for SINEC L1	**6ES5 752-0AA53**
with flash EPROMs			**6ES5 752-0AA62**
Memory capacity:		**COM PP parameter assignment software**	see Section 7
256 Kbyte	**6ES5 374-2KH21**		
1 Mbyte	**6ES5 374-2KK21**		
2 Mbyte	**6ES5 374-2KL21**		
Programming adapter (for memory cards)	**6ES5 985-2MC11**		

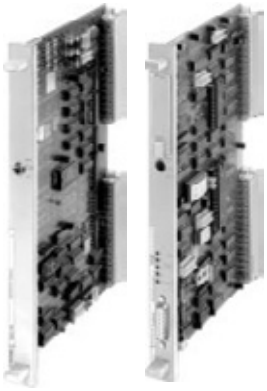
On account of the higher CPU speed, it is necessary to make adjustments to the standard function blocks in the case of the intelligent I/O modules.

Please check that the version numbers of your standard function block comply with the required minimum version, by referring to the following table.

Module	FB numbers concerned	Standard FB can be used from
IP 240	167 to 173	V 2.2
IP 241	156 to 158	A 04
IP 242 A (...-1AA3.)	178 to 182	A 02
IP 242 B (...-1AA41)	183, 184	A 03
IP 243	160, 161	A 02
IP 244	162	A 03, B 03, C 04
IP 246	164, 165	A 02
IP 247	164, 165	A 02
IP 252	100, 101	V 3.0
IP 260	170	A 02
IP 261	171	Not implementable
IP 281	(no FB)	Implementable due to direct access

923A and 923C coordinators

Application



Several CPUs can be used in one central controller, depending on the task to be performed. The 923A/C coordinators allocate access rights to the internal S5 bus to the individual CPUs.

923A coordinator

The 923A coordinator is used for coordinating access of from two to four CPUs in the S5-135U and S5-155U programmable controllers.

923C coordinator

The 923C coordinator is used for coordinating access of from two to four CPUs in the S5-135U and S5-155U programmable controllers and for programming and start-up of up to eight CPUs and communications processors. The coordinator also enables the programmable controller to be programmed via the Industrial Ethernet, PROFIBUS and SINEC L1 LANs.

Design

923A coordinator

The module contains the following:

- Memory (RAM) for 2048 interprocessor communication bit memories
- Clock generator and scaler for producing the time base on which access to the S5 bus is allocated among the CPUs

923C coordinator

The module contains the following:

- RAM for 2048 interprocessor communication bit memories and for data blocks
- Clock generator and scaler for producing the time base on which the internal S5 backplane bus is allocated to the CPUs
- Central programming device port with multiplexer:
  With the programming device connected to a 923C coordinator, the user can program up to eight processors without changing the front connectors

For programming a programmable controller via the Industrial Ethernet, PROFIBUS and SINEC L1 local area network, the programming device ports of the 923C coordinator and the CP 143, CP 5430 or CP 530 communications processors need to be linked by means of the 725 connecting cable.

The central programming device interface can only be operated if the S5-DOS operating system is loaded in the programming device.

Principle of operation

Each CPU communicates with the input and output modules via the internal S5 backplane bus. The coordinator allocates access rights to the S5 backplane bus to each CPU in cycles (time-sharing). The allocation sequence is fixed (CPU 1 - CPU 2 - CPU 3 - CPU 4).

The CPUs can exchange information via interprocessor communication bit memories in the coordinator.

Technical specifications

Current consumption (at 5 V)		
• 923A coordinator	max.	0.5 A
• 923C coordinator	max.	1.1 A
Power loss		
• 923A coordinator	max.	2.5 W
• 923C coordinator	max.	6 W

Space requirements	approx.	1 slot
Weight		0.3 kg (0.7 lb)

Ordering data

	Order No.
923A coordinator The operating instructions are included in the S5-135U/155U system manual (see page 4/155).	**6ES5 923-3UA11**
923C coordinator The operating instructions are included in the S5-135U/155U system manual (see page 4/155).	**6ES5 923-3UC11**

	Order No.
725 connecting cable for connecting 923C coordinator to the CP 143 or CP 530 communications processor	
0.9 m (3 ft)	**6ES5 725-0AK00**
2.5 m (8 ft)	**6ES5 725-0BC50**

CPU 948R/RL for S5-155H/S5-155H Lite

Application

The CPU 948R is designed for the S5-155H fault-tolerant programmable controller, the CPU 948RL for the S5-155H Lite.

They have a large user memory and are suitable for both high-speed word processing (arithmetic operations and closed-loop control) and high-speed binary signal processing (logic control).

Design

The CPU 948R/RL differs only in its firmware from the CPU 948 for the S5-155U programmable controller. You must plug in a CPU 948R/RL into both subunits of the S5-155H/-155H Lite fault-tolerant programmable controller.

The module contains the following:

- STEP 5 processing unit (with 2 ASICs) for processing the user program
- Microprocessor (16 bit) for processing the operating system of the module
- Microprocessor (16 bit) for processing the built-in serial interface
- Internal memory (RAM) with 128, 640 or 1664 Kbyte for the user program (355 memory submodule and RAM memory submodules are no longer required)
- Memory (high-speed RAM) for bit memories, S bit memories, timers, counters, process image, etc.
- Receptacle for memory card (flash EPROMs, non-volatile and electrically erasable)
- Hardware clock
- Built-in serial interface (TTY) for programming device or operator panel

The CPU 948R requires 2 slots. It can be plugged into the ZG 135U/155U central controller.

Principle of operation

Depending on the application, the central processing unit executes the user program either cyclically, time-controlled, interrupt-controlled or time interrupt-controlled. The firmware executes all additional functions of the fault tolerant programmable controller S5-155H/-155H Lite automatically.

These functions include the following:

- Data exchange
- Synchronization of the two subunits
- Self-test
- Fault handling (switchover to standby unit)
- Fault locating

Multi-processor operation as with the CPU 948 is not possible with the CPU 948RL. The additional functions (self-test, synchronization, fault locating) increase the execution time by 5 to 15 %.

Functions

- Event-driven synchronization
- Transparent programming
- Any combination of 1-, 2- and 3-channel I/O configuration (3-channel configuration only for inputs)
- Support of redundant analog inputs and outputs with fault detection and fault locating
- Comprehensive self-test functions
- Comprehensive system diagnostics functions
- Single-channel and redundant connection to the SINEC L1, PROFIBUS and Industrial Ethernet LANs
- Single-channel and redundant connection to the PROFIBUS-DP field bus
- Programming device functions via the Industrial Ethernet LAN

For further information on functions, program execution and restart modes, refer to the description of the CPU 948 on page 4/27.

Programming

In addition to programming in STEP 5, the CPU 948R/RL can also be programmed with the SCL compiler in the SCL programming language. The SCL high-level language is a programming language similar to PASCAL which has been optimized for PLC applications.

SCL can be used for programming complex tasks simply and easily in the SIMATIC S5. The SCL compiler is integrated in the STEP 5 basic package S5-DOS/MT, Version 6.

The user programs can be stored in the integral RAM (128, 640 or 1664 Kbyte). If necessary, the programming device can be used to store the user program on a flash EPROM to protect it from power failures. For this purpose, a programming adapter is required.

CPU 948R/RL for S5-155H/S5-155H Lite (continued)

Technical specifications

Microprocessors			80186 (16 bit) 80188 (8 bit), 2 ASICs
Total memory space			
• Internal memory (RAM)			128 Kbyte (CPU 948RL) 640 or 1664 Kbyte (CPU 948R)
• Memory submodule (flash EPROM)			128 Kbyte (CPU 948RL) 640 or 1664 Kbyte (CPU 948R)
Programming language			STEP 5, SCL
Program execution			• Cycle (OB1), • Interrupt-driven • Time-controlled • Operator-controlled stop
Execution times for			
• Bit operations			0.18 µs
• Word operations			0.5 µs
• Timer/counter operations			14/0.18 µs
• Fixed-point addition			0.55 µs
• Floating-point addition			3.3 µs
Basic cycle time		typ.	10 ms (CPU 948R) 20 ms (CPU 948RL)
Scan time monitoring			Programmable, default: 200 ms
Inputs	digital	max.	1024 with process image (1-, 2- or 3-channel)[2]
	additional	max.	3072 without process image (1-channel)
	additional	max.	6144 for direct memory access (1-channel)
	additional	max.	518,152 for page addressing[1]
Inputs	analog	max.	CPU 948RL: 192 (1-, 2- or 3-channel) CPU 948RL: 64 (1- or 2-channel))
	additional	max.	384 for direct memory access (1-channel)
	additional	max.	32,130 for page addressing[1]
Outputs	digital	max.	1024 with process image (1- or 2-channel)
	additional	max.	3072 without process image (1-channel)
	additional	max.	6144 for direct memory access
	additional	max.	518,152 for page addressing[1]
	analog	max.	CPÜ 948R: 192 (1- or 2-channel)
	CPU 948RL	max.	CPÜ 948RL: 64 (1- or 2-channel)
	additional	max.	384 for direct memory access
	additional	max.	32,130 for page addressing[1]
Bit memories/S bit memories			2048/32768
Timers			
• Number/Range			256/0.01 to 9990 s
Counters			
• Number/Range			256/0 to 999
Current consumption (at 5 V DC)			
• CPU 948R		max.	3.6 A
• Memory card			0.2 A
Power loss		max.	20 W
Space requirements			2 slots
Weight		approx.	1 kg (2.2 lb)

1) Only with IM 308 interface module (theoretical end value).
2) 3-channel no possible with CPU 948RL.

Ordering data

	Order No.
CPU 948R	
For S5-155H	
With 640 Kbyte user memory	**6ES5 948-3UR12**
With 1664 Kbyte user memory	**6ES5 948-3UR22**
CPU 948RL	
For S5-155H Lite	
With 128 Kbyte user memory	**6ES5 948-3UR51**
Memory card (flash EPROM)	
256 Kbyte	**6ES5 374-2KH21**
1 Mbyte	**6ES5 374-2KK21**
2 Mbyte	**6ES5 374-2KL21**
ZG 135U/155U subrack	
230 V/115 V AC; 5 V, 18 A	**6ES5 188-3UA12**
230 V/115 V AC; 5 V, 40 A	**6ES5 188-3UA22**
24 V DC; 5 V, 18 A	**6ES5 188-3UA32**
24 V DC; 5 V, 40 A	**6ES5 188-3UA52**
ZG 155H subrack	
24 V DC; 5 V, 14 A	**6ES5 188-3UH31**
COM 155H parameterization software	
for configuration and diagnostics of the S5-155H fault-tolerant PLC on 3 1/2" diskettes,	
Single license	**6ES5 895-3SR 3**
Copy license	**6ES5 895-3SR 3-0KL1**
German	**1**
English	**2**
French	**3**

	Order No.
To be ordered as a separate item:	
S5-155H manual	
consisting of the S5-155H operating instructions, the programming instructions and the CPU 948R/RL quick reference	
German	**6ES5 998-4SR11**
English	**6ES5 998-4SR21**
French	**6ES5 998-4SR31**
S5-135U/155U system manual	
consisting of the descriptions of the central controllers (CC) and expansion units (EU), the interface modules (IM), the power supply and the I/Os	
German	**6ES5 998-0SH11**
English	**6ES5 998-0SH21**
French	**6ES5 998-0SH31**

Overview

Digital input/output modules

Input modules

Voltage values	Module ID	Page
5... 15 V DC	434-4	4/33
24 V DC	420-4	4/33
	430-4	4/33
	432-4	4/33
24/48/60 V DC	431-4	4/33
24/48/60 V AC	435-4	4/33
115 V AC	436-4UA	4/33
	436-4UB	4/33
230 V AC	436-4UA	4/33
	436-4UB	4/33
230 V AC	436-4UA	4/33
	436-4UB	4/33
230 V AC	436-4UA	4/33
	436-4UB	4/33
230 V AC	436-4UA	4/33
	436-4UB	4/33

Output modules

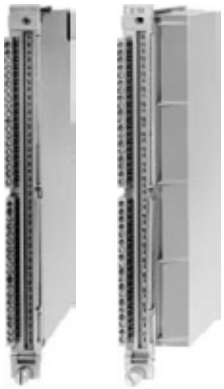
Voltage values/ current values	Module ID	Page
Transistor outputs		
24 V DC; 0.5 A	441-4	4/38
	451-4	4/38
24 V DC; 2 A	453-4	4/38
	454-4	4/38
24/48/60 V DC; 0.5 A	457-4	4/38
24/48/60 V AC, 2 A	455-4	4/38
115/230 V AC; 2 A	456-4UA	4/38
	456-4UB	4/38
Relay outputs		
60 V DC; 0.5 A	458-4UA	4/38
250 V AC; 5A	458-4UB	4/38

Input/output modules

Voltage values/ current values	Module ID	Page
24 V DC (inputs), 24 V DC; 0.5 A (outputs)	482-4	4/43

Digital input modules

Application



The digital input modules convert the external binary signals from the process to the internal signal level of the programmable controllers.

Design

Digital input modules with 32, 16 and 8 inputs for a range of input voltages are available. The modules require either one or two slots.

Front connectors are used for terminating the signal cables. Both modules and front connectors may be inserted and removed under power.

Green LEDs indicate the signal status of the inputs.

Adhesive labels are supplied to identify the modules and front connectors.

Principle of operation

Enable input

The input signals can be disabled by means of the enable input F. This enable input can be deactivated by removing a jumper on the module.

Interrupt processing

The 432-4 digital input module generates an interrupt when an input signal changes:

- In the central controller, an interrupt line is provided for each CPU. Modules must be plugged into the central controller
- The CPU 948 has a mode of operation available which recognizes an interrupt by scanning the input byte 0. All modules (max. 8) used for interrupt generation must be accommodated in the same unit.

Digital input modules (continued)

Technical specifications

Digital input module		6ES5 420-4UA14	6ES5 430-4UA14	6ES5 431-4UA12	6ES5 432-4UA12[1]
Number of inputs		**32**	**32**	**16**	**32** (with a group signal)
Galvanic isolation		No	Yes	Yes	Yes
• In groups of		—	32	1	8
Input voltage (rated value)		**24 V DC**	**24 V DC**	**24/48/60 V DC**	**24 V DC**
Input voltage					
• For "0" signal		– 33 ... + 5 V	– 3 ... + 7 V	– 33 ... + 8 V	– 33 .. +5 V
• For "1" signal		+ 13 ... + 33 V	+ 13 ... + 33 V	+ 13 ... + 72 V	+ 13 ... + 33 V
Input current					
• For "1" signal	typ.	8.5 mA	7 mA	4.5 mA (at 24 V) 6.5 mA (at 48 V) 7.5 mA (at 60 V)	8.5 mA
Delay		1.4 ... 5 ms	2.5 ... 6.5 ms	1.4 ... 5 ms	3 ms/1 ms/0.3 ms
Cable length					
• Unshielded (at delay)	max.	600 m (1968 ft)	600 m (1968 ft)	400 m (1312 ft)	600 m (1968 ft) (3 ms) 200 m (656 ft) (1 ms) 50 m (164 ft) (0.3 ms)
• Shielded	max.	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)	1000 m (3280 ft)
Enable input F					
Input voltage					
• Rated value		24 V DC	24 V DC	24/48/60 V DC	24 V DC
• Enable		+ 13 ... + 33 V	+ 13 ... + 33 V	+ 13 ... + 72 V	+ 13 ... + 33 V
• Disable		– 33 ... + 5 V	– 33 ... + 5 V	– 33 ... + 8 V	– 33 ... + 5 V
Input current of enable input	typ.	5 mA	5 mA	5 mA (at 48 V)	5 mA
Cable length (unshielded)	max.	200 m (656 ft)	200 m (656 ft)	200 m (656 ft)	200 m (656 ft)
Insulation voltage (external connections to housing)					
• In acc. with VDE 0160		—	75 V DC	75 V DC	75 V DC
• Tested with		—	1250 V AC	1250 V AC	1250 V AC
Supply voltage V_{pos}					
• Rated value		—	24 V DC	—	—
• Ripple V_{pp} (referred to rated voltage)	max.	—	+ 15 %	—	—
• Permissible range (including ripple)		—	20 ... 30 V	—	—
• Value at <0.1 s	max.	—	36 V	—	—
Current consumption					
• Internal (at 5 V)	typ.	80 mA	100 mA	90 mA	200 mA
• External (at 24 V)	typ.	—	100 mA	—	—
Power loss	max.	7.0 W	8.3 W	2.2 ... 7.7 W (at 24 ... 60 V)	7.5 W
Space requirements		1 slot	1 slot	1 slot	1 slot
Front connector		42-pin	42-pin	42-pin	42-pin
Weight	approx.	0.4 kg (0.88 lb)	0.4 kg (0.88 lb)	0.4 kg (0.88 lb)	0.4 kg (0.88 lb)

1) A shielded signal lead is required for use of the module.
A filter (SIFI C, B84113-C-B30 or equivalent) is required in the 24 V DC load power supply for the module.

Digital input modules (continued)

Technical specifications (continued)

Digital input module		6ES5 434-4UA12	6ES5 435-4UA12	6ES5 436-4UA12[1)]	6ES5 436-4UB12[1)]
Number of inputs		**32**	**16**	**16**	**8**
Galvanic isolation		Yes	Yes	Yes	Yes
• In groups of		32	8	8	1
Input voltage (rated value)		**TTL signals** (+ 5 V) **CMOS signals** (+ 15 V) **signals from NAMUR sensors** (with current output in acc. with DIN 19234)	**24/48/60 V AC** (47 ... 63 Hz)	**115/230 V AC** (47 ... 63 Hz)	**115/230 V AC** (47 ... 63 Hz)
Input voltage					
• For "0" signal		0 ... + 0.8 V (TTL) 0 ... + 4.5 V (CMOS)	0 ... 15 V	0 ... 60 V	0 ... 60 V
• For "1" signal		+ 2.4 ... + 5 V (TTL) or open input + 10.5 ... + 15 V (CMOS) or open input	20 ... 72 V	90 ... 264 V	90 ... 264 V
Input current					
• For "0" signal	typ.	- 1 mA (TTL) - 3 mA (CMOS)) ≤1.2 mA (NAMUR)	—	—	—
• For "1" signal	typ.	0.1 mA (TTL) 0.3 mA (CMOS) ≥2.1 mA (NAMUR)	15 mA (at 48 V) 20 mA (at 60 V)	15 mA (at 115 V) 25 mA (at 230 V)	15 mA (at 115 V) 25 mA (at 230 V)
Delay					
• Positive edge		1.4 ... 5 ms	2 ... 15 ms	2 ... 15 ms	2 ... 15 ms
• Negative edge		1.4 ... 5 ms	10 ... 25 ms	10 ... 25 ms	10 ... 25 ms
Cable length					
• Unshielded	max.	200 m (656 ft) (TTL/CMOS) 600 m (1968 ft)/ (NAMUR)	600 m (1968 ft) 1000 m (3280 ft)	600 m (1968 ft) 1000 m (3280 ft)	600 m (1968 ft) 1000 m (3280 ft)
• Shielded	max.	1000 m (3280 ft)			
Enable input F			Jumper F+/F- in the front connector	Jumper F+/F- in the front connector	Jumper F+/F- in the front connector
Input voltage					
• Rated value		5/15/24 V DC			
• Enable		+ 4 ... + 33 V			
• Disable		- 15 ... + 2 V			
Input current of enable input	typ.	5 mA			
Cable length (unshielded)	max.	100 m (328 ft)			
Insulation voltage (External connections to housing)		75 V DC 1250 V AC	250 V AC 1500 V AC	250 V AC 1500 V AC	250 V AC 1500 V AC
• In acc. with VDE 0160					
• Tested with					
Supply voltage V_{pos}		24 V DC (L+); 15 V DC (LH+)	—	—	—
• Rated value					
• Ripple V_{pp} (referred to rated voltage)	max.	15 %	—	—	—
• Permissible range (including ripple)		20 ... 30 V; 5....15 V	—	—	—
• Value at t < 0.1 s	max.	36 V	—	—	—
Current consumption					
• Internal (at 5 V)	typ.	80 mA	100 mA	100 mA	80 mA
• External (at 24 V)	typ.	200 mA			
• External (at 15 V)	typ.	300 mA			
Power loss	max.	5.5 W	3.5 W (at 24 V) 18.0 W (at 60 V)	3.5 W (at 115 V) 17.0 W (at 230 V)	2.0 W (at 115 V) 8.5 W (at 230 V)
Space requirements		1 slot	2 slots	2 slots	2 slots
Front connector		42-pin	20-pin	20-pin	20-pin
Weight	approx.	0.4 kg (0.88 lb)	0.4 kg (0.88 lb)	0.4 kg (0.88 lb)	0.4 kg (0.88 lb)

1) A filter (SIFI C, B84113-C-B30 or equivalent) is required in the 230 V AC load power supply for the module.

Digital input modules (continued)

Ordering data	Order No.		Order No.
Non-floating			
420-4 digital input module 32 inputs, 24 V DC	**6ES5 420-4UA14**	**436-4UB digital input module** 8 inputs, 115/230 V AC The operating instructions are included in the S5-135U/155U system manual (see page 4/155).	**6ES5 436-4UB12**
Floating			
430-4 digital input module 32 inputs, 24 V DC	**6ES5 430-4UA14**		
431-4 digital input module 16 inputs, 24/48/60 V DC	**6ES5 431-4UA12**	**497 front connector**	
432-4 digital input module for interrupt processing, 32 inputs, 24 V DC	**6ES5 432-4UA12**	Crimp terminals, single-width, 42-pin	**6ES5 497-4UA12**
		Crimp terminals, double-width, 42-pin	**6ES5 497-4UA22**
434-4 digital input module 32 inputs, 5/15 V DC (TTL, CMOS, NAMUR)	**6ES5 434-4UA12**	Crimp terminals, double-width, 20-pin	**6ES5 497-4UA42**
		Screw terminals, single-width, 42-pin	**6ES5 497-4UB31**
435-4 digital input module 16 inputs, 24/48/60 V AC	**6ES5 435-4UA12**	Screw terminals, double-width, 42-pin	**6ES5 497-4UB12**
436-4UA digital input module 16 inputs, 115/230 V AC	**6ES5 436-4UA12**	Screw terminals, double-width, 20-pin	**6ES5 497-4UB42**

Digital input modules (continued)

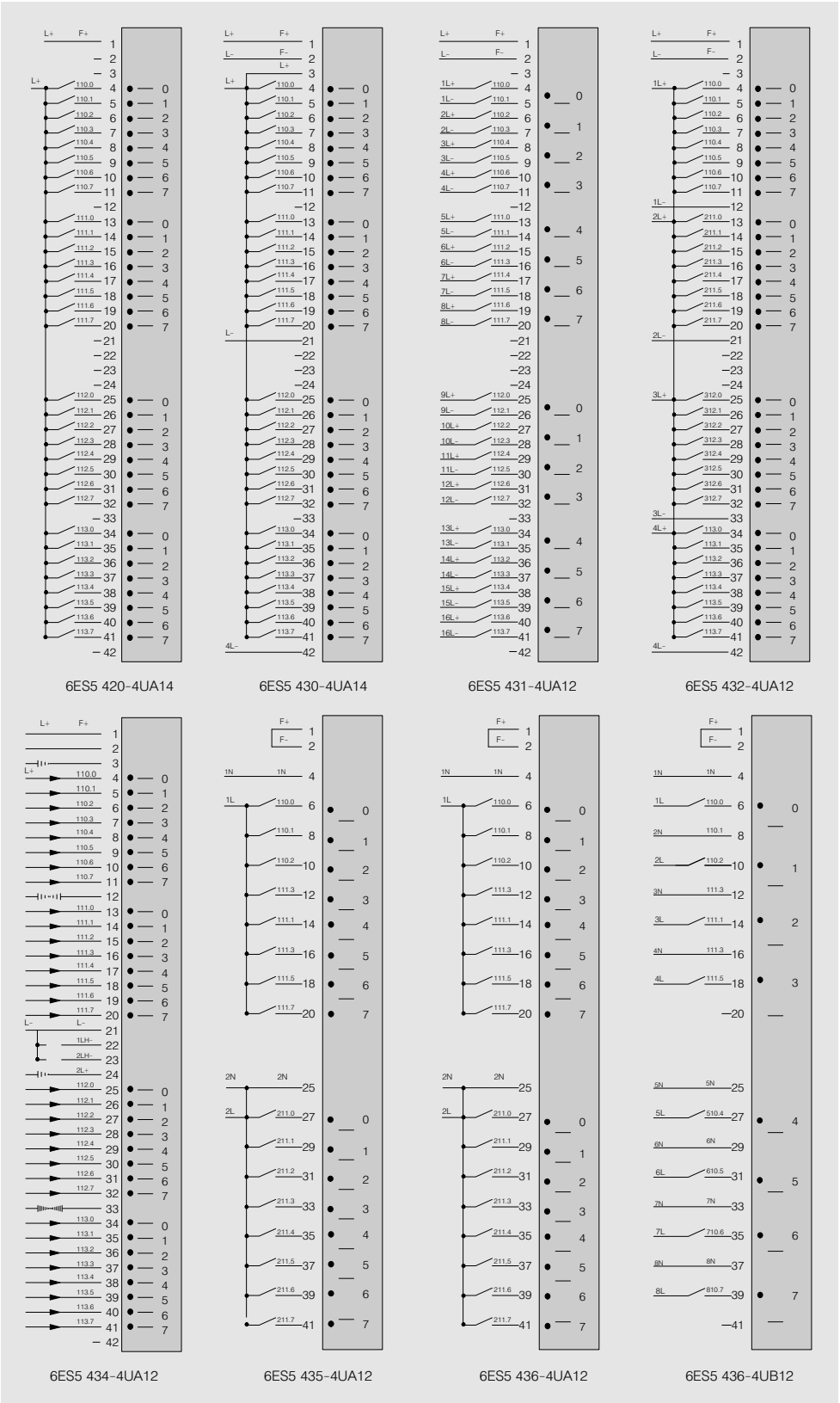
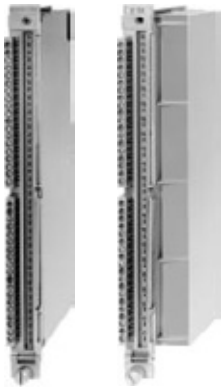


Fig. 4/23 Connection diagrams of the digital input modules

Digital output modules

Application



The digital output modules convert the internal signal levels of the programmable controllers into the binary signal levels required externally by the process.

Design

Digital output modules with 32, 16 and 8 outputs are available with a range of output voltages and also with relay contact outputs. The modules require either one or two slots.

Front connectors are used for terminating the signal cables. Modules and front connectors may be inserted and removed under power.

Green LEDs indicate the signal status of the outputs. In DC output modules, red LEDs indicate short-circuits in the signal leads. The signal output H is set to "1" if an overcurrent or short-circuit is detected in an output. Up to 16 signal outputs can be connected in parallel. In AC output modules, red LEDs indicate when a fuse has blown.

Adhesive labels are supplied to identify modules and front connectors.

Principle of operation

Enable input

The output of signals can be suppressed by an enable input F. This function can be deactivated by removing a jumper on the module.

Digital output modules (continued)

Technical specifications

Digital output module	6ES5 441-4UA14	6ES5 451-4UA14	6ES5 453-4UA12[4]	6ES5 454-4UA14[5]	6ES5 455-4UA12
Number of outputs	**32**	**32**	**16**	**16**	**16**
Galvanic isolation	No	Yes	Yes	Yes	Yes
• In groups of	—	32	1	16	8
Supply voltage V_p, V_{pos}					
• Rated value	**24 V DC**	**24 V DC**	**24 V DC[1]**	**24 V DC**	**24/48/60 V AC**
• Frequency					47 to 63 Hz
• Ripple V_{pp} (referred to rated voltage) max.	15 %	15 %	15 %	15 %	—
• Permissible range (including ripple)	20 ... 30 V	20 ... 30 V	20 ... 30 V	20 ... 30 V	20 ... 72 V
• Value at <0.1 s max.	36 V	36 V	36 V	36 V	—
Output current at "1" signal					
• Rated value	**0.5 A**	**0.5 A**	**2 A**	**2 A**	**2 A**
• Permissible range	5 mA ... 0.5 A	5 mA ... 0.5 A	10 mA[2] ... 2 A	10 mA[2] ... 2 A	0.4 ... 2 A
• Making current per group for t <3/<20/<50 ms max.					25/15/13 A
Lamp load max.	5 W	5 W	10 W	10 W	25 W
Short-circuit protection	Electronic	Electronic	Electronic	Electronic	Fuse (4x6.3 A)
Limitation of the voltage inducedon circuit interr. (int.) to	V_{pos} - 47 V	V_{pos} - 47 V	V_{pos} - 47 V	V_{pos} - 47 V	
Switching frequency for					
• Resistive loads max.	100 Hz	100 Hz	100 Hz	100 Hz	20 Hz
• Lamps max.	11 Hz	11 Hz	11 Hz	11 Hz	11 Hz
• Inductive loads max.	2 Hz (at 0.3 A) 0.5 Hz (at 0.5 A)	2 Hz (at 0.3 A) 0.5 Hz (at 0.5 A)	0.2 Hz (at 1 A) 0.5 Hz (at 2 A)	0.2 Hz (at 1 A) 0.5 Hz (at 2 A)	2 Hz
Total load rating [3]					
• With fan	100 %	100 %	100 %	50 %	75 %
• Without fan	50 %	50 %	25 %	50 %	50 %
Leakage current at "0" sign. max.	0.5 mA	0.5 mA	1 mA	1 mA	5 mA
Signal level of the outputs					
• At "0" signal max.	+ 3 V	+ 3 V	+ 3 V	+ 3 V	0.1 V_p
• At "1" signal min.	V_{pos} -1.5 V	V_{pos} -1.5 V	V_{pos} -2.5 V	V_{pos} - 2 V	
max.					V_{pos} - 1.5 V
Cable length (unshielded) max.	400 m (1312 ft)	400 m (1312 ft)	400 m (1312 ft)	400 m (1312 ft)	300 m (984 ft)
Enable input F					Junper F+/F- in the front connector
Input voltage					
• Rated value	24 V DC	24 V DC	24 V DC	24 V DC	
• Enable	+ 13 ... + 33 V	+ 13 ... + 33 V	+ 13 ... + 33 V	+ 13 ... + 33 V	
• Disable	- 33 ... + 5 V	- 33 ... + 5 V	- 33 ... + 5 V	- 33 ... + 5 V	
Input current of enable input typ.	5 mA	5 mA	5 mA	5 mA	
Cable length (unshielded) max.	200 m (656 ft)	200 m (656 ft)	200 m (656 ft)	200 m (656 ft)	
Signalling output H					
Voltage if fault min.	V_{pos} - 5 V	V_{pos} -5 V	V_{pos} -5 V	V_{pos} - 5 V	
Current if fault (limited) max.	10 mA	10 mA	10 mA	10 mA	
Voltage if no fault max.	3 V	3 V	3 V	3 V	
Insulation voltage (external connections to housing)					
• In acc. with VDE 0160	—	75 V DC	75 V DC	75 V DC	250 V AC
• Tested with	—	1250 V AC	1250 V AC	1250 V AC	1500 V AC
Current consumption					
• Internal (at 5 V) typ.	80 mA	120 mA	120 mA	100 mA	100 mA
• External (at 24 V, no load) typ.	150 mA	150 mA	—	100 mA	—
Power loss max.	17.0 W	17.0 W	49.0 W	17.5 W	39.0 W
Space requirements	1 slot	1 slot	2 slots	1 slot [5]	2 slots
Front connector	42-pin	42-pin	42-pin	25-pin/42-pin	20-pin
Weight approx.	0.45 kg (1 lb)	0.45 kg (1 lb)	0.6 kg (1.3 lb)	0.55 kg (1.2 lb)	0.7 kg (1.5 lb)

1) Can also be used as L- switch.
2) 1 input of a digital input module is permissible as the minimum load.
3) Referred to the sum of the rated currents through an L+ input.
4) A shielded signal lead is required for use of the module.
A filter (SIFI C, B84113-C-B-30 or equivalent) is required in the 24 V DC load power supply for the module.
5) Due to current load a double wide front connector is required.

Digital output modules (continued)

Technical data (continued)

Digital output module		6ES5 456-4UA12 [5]	6ES5 456-4UB12[5]	6ES5 457-4UA12[6]	6ES5 458-4UA12	6ES5 458-4UA12
Number of outputs		**16**	**8**	**16**	**16** (relay contacts)	**16** (relay contacts)
Galvanic isolation		yes	yes	yes	yes	yes
• In groups of		8	1	1	1	8
Supply voltage V_p, V_{pos}						
• Rated voltage		**115/230 V AC**	**115/230 V AC**	**24/48/60 V DC**[1]	**24 V DC**	**24 V DC**
• Frequency		47 to 63 Hz	47 to 63 Hz	—	—	—
• Ripple V_{pp} (referred to rated voltage)	max.	—	—	15 %	15 %	15 %
• Permissible range (including ripple)		88 ... 264 V	88 ... 264 V	20 ... 72 V	20 ... 30 V	20 ... 30 V
• Value at t < 0.1 s	max.	—	—	90 V[2]	35 V	35 V
Output current at "1" signal						
• Rated value		**2 A**	**2 A**	**0.5 A**	—	—
• Permissible range		0.04 ... 2 A	0.04 ... 2 A	5 mA ... 0.5 A	—	—
• Making current per group for t <3/<20/<50 ms	max.	25/15/13 A	16/8/6,5 A	—	—	—
Lamp load	max.	100 W	100 W	5 W	—	—
Short-circuit protection		Fuse (4x6.3 A)	Fuse (4x6.3 A)	Electronic	None	None
Switch. cap. of the contacts	max.				60V DC/48 V AC	110V DC/250 V AC
• Resistive load						
With arc suppr. module	max.	—	—	—	500 mA	5 A at 30 V DC , 5 A at 250 V DC
Without arc suppr. module	max.	—	—	—	70 mA[4]	0.3 A at 115 V DC A
• Inductive load						
With arc suppr. module	max.	—	—	—	50 mA[4]	1.0 A at 30 V DC 1.5 A at 250 V AC
Without arc suppr. module	max.	—	—	—	—	0.08 A at 115 V DC
Switch. cycl. (VDE 0660, Part 200)		—	—	—	$1 \cdot 10^8$	$3 \cdot 10^7$
Limitation of the voltage induced on circuit interruption (internal)	to			V_{pos} -75 V		
Switching frequency for						
• Resistive loads	max.	20 Hz	20 Hz	100 Hz	100 Hz	10 Hz
• Lamps	max.	11 Hz	11 Hz	11 Hz	11 Hz	5 Hz
• Inductive loads	max.	2 Hz	2 Hz	2 Hz (at 0.5 A)	2 Hz	2 Hz
Total load rating [3]						
• With fan		75 %	100 %	100 %	100 %	100 %
• Without fan		70 %	50 %	50 % (100 % at 35 °C)	100 %	100 %
Leakage current at "0" sign.	max.	5 mA	5 mA	1 mA	—	—
Signal level of the outputs						
• At "0" signal	max.	0.1 V_p	0.1 V_p	+ 3 V	—	—
• At "1" signal	min.	—	—	V_p -2.5 V		
	max.	V_p - 1.5 V	V_p - 1.5 V	—	—	—
Cable length (unshielded)	max.	300 m (984 ft)	300 m (984 ft)	400 m (1312 ft)	400 m (1312 ft)	400 m (1312 ft)
Enable input F		Jumper F+/F- in the front connector	Jumper F+/F- in the front connector			
Input voltage						
• Rated value				24/48/60 V DC	24/48/60 V DC	24 V DC
• Enable				+ 13 ... + 72 V	- 13 ... + 33 V	+ 13 ... + 33 V
• Disable				- 72 ... + 8 V	- 33 ... + 5 V	- 33 ... + 5 V
Input current of enable input	typ.			2.5 ... 6.5 mA	5 mA	5 mA
Cable length (unshielded)	max.			200 m (656 ft)	200 m (656 ft)	200 m (656 ft)

1) Can also be used as L-switch.
2) For supply voltages higher than 72 V, the output voltage may exceed 13 V ("1" signal) in the non-drive state.
3) Referred to the sum of the rated currents through an L+ input.
4) Up to 500 mA possible with protective circuitry for the load (see operating instructions).
5) A filter (SIFI C, B84113-C-B-30 or equivalent) is required in the 230 V AC load power supply for the module.
6) A shielded signal lead is required for use of the module.
A filter (SIFI C, B84113-C-B-30 or equivalent) is required in the 24 V DC load power supply for the module.

Digital output modules (continued)

Technical specifications (continued)

Digital output module		6ES5 456-4UA12 [1]	6ES5 456-4UB12[1]	6ES5 457-4UA12[2]	6ES5 458-4UA12	6ES5 458-4UA12
Signal output H						
Voltage if fault	min.			V_{pos} - 5 V		
Current if fault (limited)	max.			10 mA		
Voltage if no fault	max.			3 V		
Insulation voltage (external connections to housing)						
• In acc. with VDE 0160		250 V AC	250 V AC	75 V DC	75 V DC	250 V AC
• Tested with		1500 V AC	1500 V AC	1250 V AC	500 V AC	1500 V AC
Current consumption						
• Internal (at 5 V)	typ.	100 mA	100 mA	120 mA	80 mA	120 mA
• External (at 24 V, no load)	typ.	—	—	—	200 mA	250 mA
Power loss	max.	39.0 W	18.0 W	13.0 W	5.2 W	6.6 W
Space requirements		2 slots	2 slots	2 slots	1 slot	1 slot
Front connector		20-pin	20-pin	42-pin	42-pin	42-pin
Weight	approx.	0.7 kg (1.5 lb)	0.6 kg (1.3 lb)	0.6 kg (1.3 lb)	0.45 kg (1 lb)	0.7 kg (1.5 lb)

1) A filter (SIFI C, B84113-C-B30 or equivalent) is required in the 230 V AC load power supply for the module.
2) A shielded signal lead is required for use of the module.
A filter (SIFI C, B84113-C-B30 or equivalent) is required in the 24 V DC load power supply for the module.

Ordering data

	Order No.
Non-floating	
441-4 digital output module 32 outputs, 24 V DC; 0.5 A	**6ES5 441-4UA14**
Floating	
451-4 digital output module 32 outputs, 24 V DC; 0.5 A	**6ES5 451-4UA14**
453-4 digital output module 16 outputs, 24 V DC; 2 A (can also be used as L-switch)	**6ES5 453-4UA12**
454-4 digital output module 16 outputs, 24 V DC; 2 A	**6ES5 454-4UA14**
455-4 digital output module 16 outputs, 24/48/60 V AC; 2 A	**6ES5 455-4UA12**
456-4UA digital output module 16 outputs, 115/230 V AC; 2 A	**6ES5 456-4UA12**
456-4UB digital output module 8 outputs, 115/230 V AC; 2 A	**6ES5 456-4UB12**
457-4 digital output module 16 outputs, 24/48/60 V DC; 0,5 A (can also be used as L- switch)	**6ES5 457-4UA12**
458-4UA digital output module 16 relay-contact outputs, 60 V; 0.5 V	**6ES5 458-4UA12**
458-4UC digital output module 16 relay-contact outputs, 110 V DC; 250 V AC; 5 A	**6ES5 458-4UC11**
498 arc-suppression module for the 458-4UA.. digital output module (RC elements for 4 outputs)	**6ES5 498-1AB11**
The operating instructions are included in the S5-135U/155U system manual (see page 4/155).	
497 front connector	
Crimp terminals, single-width, 42-pin	**6ES5 497-4UA12**
Crimp terminals, double-width, 42-pin	**6ES5 497-4UA22**
Crimp terminals, double-width, 20-pin	**6ES5 497-4UA42**
Screw terminals, single width, 42-pin	**6ES5 497-4UB31**
Screw terminals, double width, 42-pin	**6ES5 497-4UB12**
Screw terminals, double width, 25-pin (454-4 only)	**6ES5 497-4UB22**
Screw terminals, double width, 20-pin	**6ES5 497-4UB42**

Digital output modules (continued)

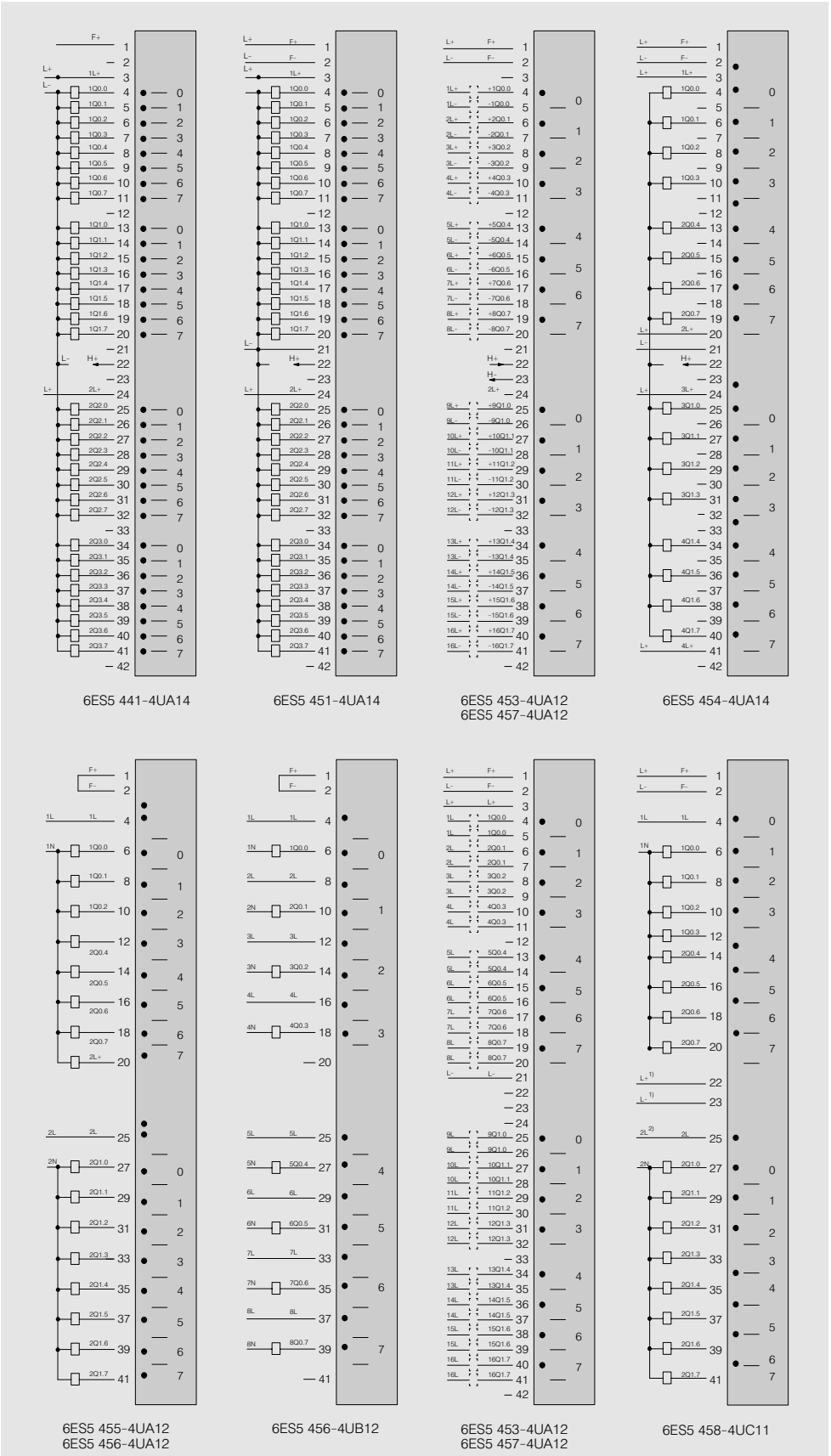


Fig. 4/24 Connection diagrams of digital output modules

1) 24 V DC supply voltage for the relays
2) Voltage for the relay contacts

Digital input/output module

Application

The digital input/output module converts the external signals from the process to the internal signal levels of the programmable controllers and converts the internal signal levels of the programmable controllers to the levels required externally by the process.

Design

The digital input/output module provides 16 binary inputs and eight binary outputs. Another eight terminals can be used either as inputs or outputs.

A shielded signal lead is required for use of the module.

Technical specifications

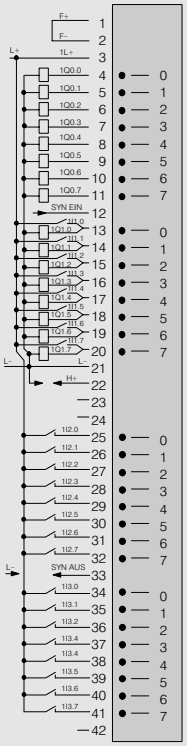
Number of inputs		**16** or **24**
Galvanic isolation		Yes
• In groups of		16/24
Input voltage		
• Rated value		**24 V DC**
• For "0" signal		– 33 ... + 5 V
• For "1" signal		+ 13 ... + 33 V
Input current		
• At "1" signal	typ.	8.5 mA
Delay		
• At "0"→"1"	typ.	0.3 ms
• At "1"→"0"	typ.	0.3 ms
Cable length		
• Unshielded	max.	50 m (164 ft)
Number of outputs		**8** or **16**
Galvanic isolation		Yes
• In groups of		8/16
Output current at "1" signal		
• Rated value		**0.5 A**
• Permissible range		5 mA ... 0.5 A
Lamp load	max.	5 W
Inductive load	max.	12 W
Short-circuit protection		Electronic
Limitation of the voltage induced on circuit interruption (internal)	to	– 27 V
Switching frequency for		
• Resistive loads	max.	100 Hz
• Lamps	max.	11 Hz
• Inductive loads	max.	2 Hz at 0.3 A, 0.5 Hz at 0.5 A
Total load rating		
• With fan		100 %
• Without fan		50 % (100 % at 35 °C)
Leakage current at "0" signal	max.	0.5 mA
Signal level of the outputs		
• At "0" signal	max.	+ 3 V
• At "1" signal	min.	V_{pos} – 1.5 V
Cable length		
• Unshielded	max.	400 m (1312 ft)

Enable input		Jumper F+/F– in the front connector
Synchronization input		As for other binary inputs
Synchronization output and short-circuit signalling output		
• At "0" signal	max.	+3 V
• At "1" signal (short-circuit)	min.	V_{pos} – 5 V
• Output current	max.	10 mA (current-limited)
Supply voltage V_{pos} (for load)		
• Rated value		**24 V DC**
• Ripple V_{pp} (referred to rated voltage)	max.	15 %
• Permissible range (including ripple)		20 ... 30 V
• Value at t < 0.1 s	max.	36 V
Insulation voltage (external connections to housing, internal connections, other groups)		
• In acc. with VDE 0160		75 V DC
• Tested at		1250 V AC
Current consumption		
• Internal (at 5 V)	typ.	90 mA
• External (at 24 V, without load)	typ.	30 mA
Power loss	max.	13 W
Space requirements		1 slot
Front connector		42-pin
Weight	approx.	0.4 kg (0.88 lb)

Digital input/output module (continued)

Ordering data	Order No.		Order No.
482-4 digital input/output module 16 or 24 inputs, 24 V DC and 8 or 16 outputs, 24 V DC; 0.5 A The operating instructions are included in the S5-135U/155U system manual (see page 4/155).	**6ES5 482-4UA11**	**497 front connector** Crimp terminals, single-width, 42-pin Crimp terminals, double-width, 42-pin Screw terminals, single-width, 42-pin Screw terminals, double-width, 42-pin	 **6ES5 497-4UA12** **6ES5 497-4UA22** **6ES5 497-4UB31** **6ES5 497-4UB12**

4



6ES5 482-4UA11

Fig. 4/25 Connection diagrams for the 482 digital input/output module

Overview

Analog input/output modules

Input modules

Voltage values/ current values	Module ID	Page
±12.5 mV... 10 V ±20 mA or +4.... 20 mA	460-4 465-4	4/45 4/45
0... 1 V 0... 10 V 0... 20 mA or +4...20 mA	463-4	4/45
±1.25 V to ±10 V 0... 1.25 V to 0... 10 V +1... 5 V 0... 20 mA or 4... 20 mA ±20 mA	466-3	4/45

Output modules

Voltage values/ current values	Module ID	Page
±10 V... or 0... 20 mA ±10 V	470-UA 470-4UB	4/50 4/50
±1... 5 V ±4... 20 mA	470-4UC	4/50

4

Analog input modules

Application

The analog input modules convert the analog signals from the process into digital values, which can be processed by the programmable controller.

Application of analog input modules:

- Process monitoring
- Measuring physical quantities, e.g. in mechanical engineering, process engineering, building services automation
- Control engineering

Design

Analog input modules with 16, 8 and 4 inputs are available. The modules require one slot.

Front connectors are used for terminating the signal cables. Modules and front connectors may be inserted and removed under power (except for the 466 input module).

Adhesive labels are supplied to identify modules and front connectors.

460 input module:

- Eight floating channels
- Sequential measured value acquisition by means of optovoltaic multiplexer
- Measuring range selection by means of measuring range modules
- Direct acquisition of thermocouple voltages
- Direct four-wire connection of resistance-type sensors, e.g. Pt 100
- Power supply from L+, L-
- Use in large plants/machines with high common-mode voltages
- For closed-loop control applications with time constant ranging from seconds to infinity

463 input module:

- Four individually isolated channels
- Simultaneous scanning of all channels within $16^2/_3$ or 20 ms (50 or 60 Hz)
- Measuring range selection via jumpers in the front connector
- Acquisition of transducer signals
- For fast, noise-immune measured value acquisition even under unfavourable potential conditions
- For closed-loop control applications where speed is a critical factor (time constants >20 ms)

Analog input modules (continued)

Design (continued)

465 input module:
- 16 non-floating channels
- Sequential measured value acquisition with semiconductor multiplexers
- Measuring range selection by means of measuring range modules
- Direct acquisition of thermocouple voltages
- Direct four-wire connection of resistance-type sensors, e.g. Pt 100
- Use in small-scale plants/machines where potential conditions are not a critical factor

Common features of the 460, 463 and 465 input modules:
- Integrating analog-digital conversion with a high degree of noise suppression at 50 (60) Hz and suppression of harmonics
- Enable input and input signals can be disabled
- The 460-4 input modules require two 498 measuring range modules
- The 465-4 input modules require two or four 498 measuring range modules, depending on whether up to 8 inputs or more than 8 inputs are used

466 input module:
- Eight differential or 16 individual channels (floating)
- Instantaneous value coding
- Measuring range selection through fixed wiring at the front connector
- For closed-loop control applications where speed is a critical factor (time constant >4 ms)

4

Technical specifications

Analog input module	6ES5 460-4UA13	6ES5 465-4UA13[2)]	6ES5 463-4U.12
Number of inputs	**8** voltage/current inputs or **8** inputs for Pt 100 resistance thermometers	**16** voltage/current inputs or **8** inputs for Pt 100 resistance thermometers	**4** voltage/current inputs
Galvanic isolation	Yes	No	Yes
Input ranges (rated value)	± **12.5 mV** (for 460-4 only); ± **50 mV;** ± **500 mV; Pt 100;** ± **1 V;** ± **5 V;** ± **10 V;** ± **20 mA; + 4 ... 20 mA** Input range can be selected for 4 channels at a time, using measuring range modules		**0 ... 1 V, 0 ... 10 V, 0 ... 20 mA + 4 ... 20 mA** for two-wire transducers and four-wire transducers
Input resistance in the individual ranges	12.5 mV: ≧ 10 MΩ 50 mV: ≧ 10 MΩ 500 mV: ≧ 10 MΩ	Pt 100: ≧ 10 MΩ 1 V: 90 kΩ; 2 ‰ 5 V: 50 kΩ 2 ‰	10 V: 50 kΩ; 2 ‰ 20 mA: 25 kΩ; 1 ‰ 4 ... 20 mA: 31.25 Ω; 1 ‰	1V: ≧ ± 10 MΩ; 10 V: 90 kΩ; 20 mA: 50 Ω 4 ... 20 ,A: 62.5 Ω;
Types of connection for signal sensors	Two-wire connection; four-wire connections for Pt 100			Two-wire connection
Digital representation of the input signal	12 bit plus sign or 13 bit two's complement (2048 units = rated value)			12 bit two's complement (1024 units = rated value)
Measuring principle	Integrating			Integrating
Conversion principle	Voltage-time conversion			Voltage-frequency conversion
Integration time (selectable for optimum noise suppression)	20 ms at 50 Hz 16 $^2/_3$ ms at 60 Hz			20 ms at 50 Hz 16 $^2/_3$ ms at 60 Hz
Encoding time per channel max.	60 ms at 50 Hz based on rated value 50 ms at 60 Hz based on rated value			20 ms at 50 Hz 16 $^2/_3$ ms at 60 Hz
Cycle time for 4 inputs	—	—		20 ms at 50 Hz 16 $^2/_3$ ms at 60 Hz
8 inputs	0.48 s at 50 Hz	0.48 s at 50 Hz		—
16 inputs	—	0.96 s at 50 Hz		—
Permissible voltage between inputs or between inputs and the central grounding point (destruction limit) max.	± 18 V or max. ± 75 V for 1 ms with a pulse repeat rate of 50 pulses/second			± 30 V or ± 75 V for 1 ms with a pulse repeat rate of 100 pulses/second
Permissible voltage between the reference potential of a non-floating sensor and the central grounding point max.	75 V DC/60 V AC	± 1 V		75 V DC/60 V AC

Analog input modules (continued)

Technical specifications (continued)

Analog input module	6ES5 460-4UA13	6ES5 465-4UA13[2]	6ES5 463-4U.12
Fault indication for			
• Overranging	At 200 % of rated value (4095 units)		At 150 % of rated value
• Wire breakage of sensor line	Can be designed for the range 50 mV, 500 mV and Pt 100		No
Noise suppression for f = n · (50/60 Hz ± 1 %) n = 1,2 ...			
• Common mode noise (V_p < 1 V) min.	100 dB	86 dB	80 dB
• Series mode noise max. (peak noise value < rated value of the range)	40 dB	40 dB	40 dB
Basic error limits[1] (at 20 °C)	12.5 mV: ± 2 ‰ Pt 100: ± 2 ‰ 10 V: ± 3.5 ‰ 50 mV: ± 2 ‰ 1 V: ± 3,5 ‰ 20 mA: ± 2.5 ‰ 500 mV: ± 1.5 ‰ 5 V: ± 3.5 ‰ 4 ... 20 mA: ± 2.5 ‰		1.1 ‰
Operational error limits[1] (at 0 °C to 60 °C; for one year)	12.5 mV: ± 6 ‰ Pt 100: ± 5 ‰ 10 V: ± 7.7 ‰ 50 mV: ± 5 ‰ 1 V: ± 7.7 ‰ 20 mA: ± 6.7 ‰ 500 mV: ± 4.5 ‰ 5 V: ± 7.7 ‰ 4 ... 20 mA: ± 6.7 ‰		3.7 ‰
Cable length (shielded) max.	200 m (656 ft); 50 m (164 ft) up to 50 mV	200 m (656 ft); 50 m (164 ft) up to 50 mV	200 m (656 ft)
Enable inputs (as with analog outputs)	+ 24 V	+ 24 V	+ 24 V
Supply voltage (as with analog outputs)	+ 24 V	+ 24 V	+ 24 V
Constant current source for Pt 100	2.5 mA	2.5 mA	—
Current consumption			
• Internal (at 5 V) typ.	0.13 A	0.15 A	0.2 A
• External (at 24 V) typ.	0.15 A	0.15 A	0.15 A
Power loss max.	3.5 W	1.5 W	5.0 W
Space requirements	1 slot		1 slot
Front connector	42-pin		42-pin
Weight approx.	0.4 kg (0.88 lb)		0.4 kg (0.88 lb)

Analog input module	6ES5 466-3LA11
Number of inputs	**8** differential inputs or **16** individual inputs (referred to ground) in 4 or 2 groups (selectable)
Galvanic isolation	Yes
Input ranges (rated values)	**0 ... 20 mA; 4 ... 20mA; ± 20 mA** **0 ... 1.25 V; 0 ... 2.5 V; 0 ... 5 V; 1 ... 5 V; 0 ... 10V** **± 1.25 V; ± 2.5 V; ± 5 V; ± 10 V;** } Selector switch lets you select these values for 4 channels separately
Input resistance in the individual ranges	Voltage measuring range: ≥ 10 MΩ Current measuring range: 125 Ω
Types of conn. for signal sensors	Two-wire connection
Digital repres. of the input signal	13 bit two's complement or 12 bit abs. value + sign or 12 bit binary
Measuring principle	Instantaneous value encoding
Conversion principle	Successive approximation
Encoding time per channel max.	250 µs
Cycle time for	
• 8 inputs max.	2 ms
• 16 inputs max.	4 ms
Permissible voltage between inputs or between inputs and central grounding point max.	± 30 V (static) or ± 75 V for 1 ms with a pulse repeat rate of 50 pulses/second
Permissible voltage between the reference potential of a non-floating sensor and the central grounding point max.	75 V DC/60 V AC

1) In accordance with DIN 43 745; referred to nominal measuring range (5 V supply from power supply chassis).
2) A filter (SIFI C, B84113-C-B30 or equivalent) is required in the 24 V DC load power supply for the module.

Analog input modules (continued)

Technical specifications (continued)

Analog input module	6ES5 466-3LA11 (continued)	
Fault indication for		
• Overranging	Yes (overflow bit)	
• Wire breakage of sensor line	No	
Noise suppression for f = n · (50/60 Hz ± 1 %); n = 1,2 ...		
• Common mode noise (V_p < 1 V) min	70 dB	
• Series mode noise (peak noise value < value of the range) min.	40 dB	
Basic error limits[1] (at 20 °C)	Voltage ranges (except 0 ... 1.25 V; ± 1.25 V): Current ranges and 0 ... 1.25 V; ± 1.25 V:	0.1 % 0.2 %
Operational error limits[1] (at 0 to 60 °C; for one year)	Voltage ranges (except 0 ... 1.25 V; ± 1.25 V): Current ranges and 0 ... 1.25 V; ± 1.25 V:	0.2 % 0.4 %
Cable length (shielded) max.	200 m (656 ft)	
Enable inputs (as with analog outputs)	—	
Supply voltage (as with analog outputs)	—	
Constant current source for Pt 100	—	
Current consumption		
• Internal (at 5 V) typ.	0.7 A	
• External (at 24 V) typ.	—	
Power loss max.	3.5 W	
Space requirements	1 slot	
Front connector	43-pin	
Weight approx.	0.4 kg (0.88 lb)	

1) In accordance with DIN 43 745; referred to nominal measuring range (5 V supply from power supply chassis).

Ordering data

	Order No.
460-4 analog input module 8 inputs, signal range set via measuring range module (two 498 measuring range modules are required); floating	**6ES5 460-4UA13**
465-4 analog input module 16 inputs (8 with Pt 100), signal range set via measuring range module (two or four 498 measuring range modules are required); non-floating	**6ES5 465-4UA13**
498 measuring range module for 460-4 and 465-4 analog input modules; four channels each	
±12.5 mV, ± 50 mV, ± 500 mV, Pt100	**6ES5 498-1AA11**
± 1 V	**6ES5 498-1AA21**
± 5 V	**6ES5 498-1AA61**
± 10 V	**6ES5 498-1AA31**
± 20 V	**6ES5 498-1AA41**
+ 4 ... 20 mA; for two-wire transducer	**6ES5 498-1AA51**
+ 4 ... 20 mA; for four-wire transducer	**6ES5 498-1AA71**

	Order No.
463-4 analog input module 4 inputs, floating	
For 50 Hz power systems	**6ES5 463-4UA12**
For 60 Hz power systems	**6ES5 463-4UB12**
466-3 analog input module 16 inputs, floating The operating instructions are included in the S5-135U/155U system manual (see page 4/155).	**6ES5 466-3LA11**
497 front connector for 460, 463, 465 analog input modules	
Crimp terminals, single-width, 42-pin	**6ES5 497-4UA12**
Crimp terminals, double-width, 42-pin	**6ES5 497-4UA22**
Screw terminals, single-width, 42-pin	**6ES5 497-4UB31**
Screw terminals, double-width, 42-pin	**6ES5 497-4UB12**
Front connector for 466 analog input module	
Crimp terminals, single-width, 43-pin	**6XX3 068**
Screw terminals, single-width, 43-pin	**6XX3 081**

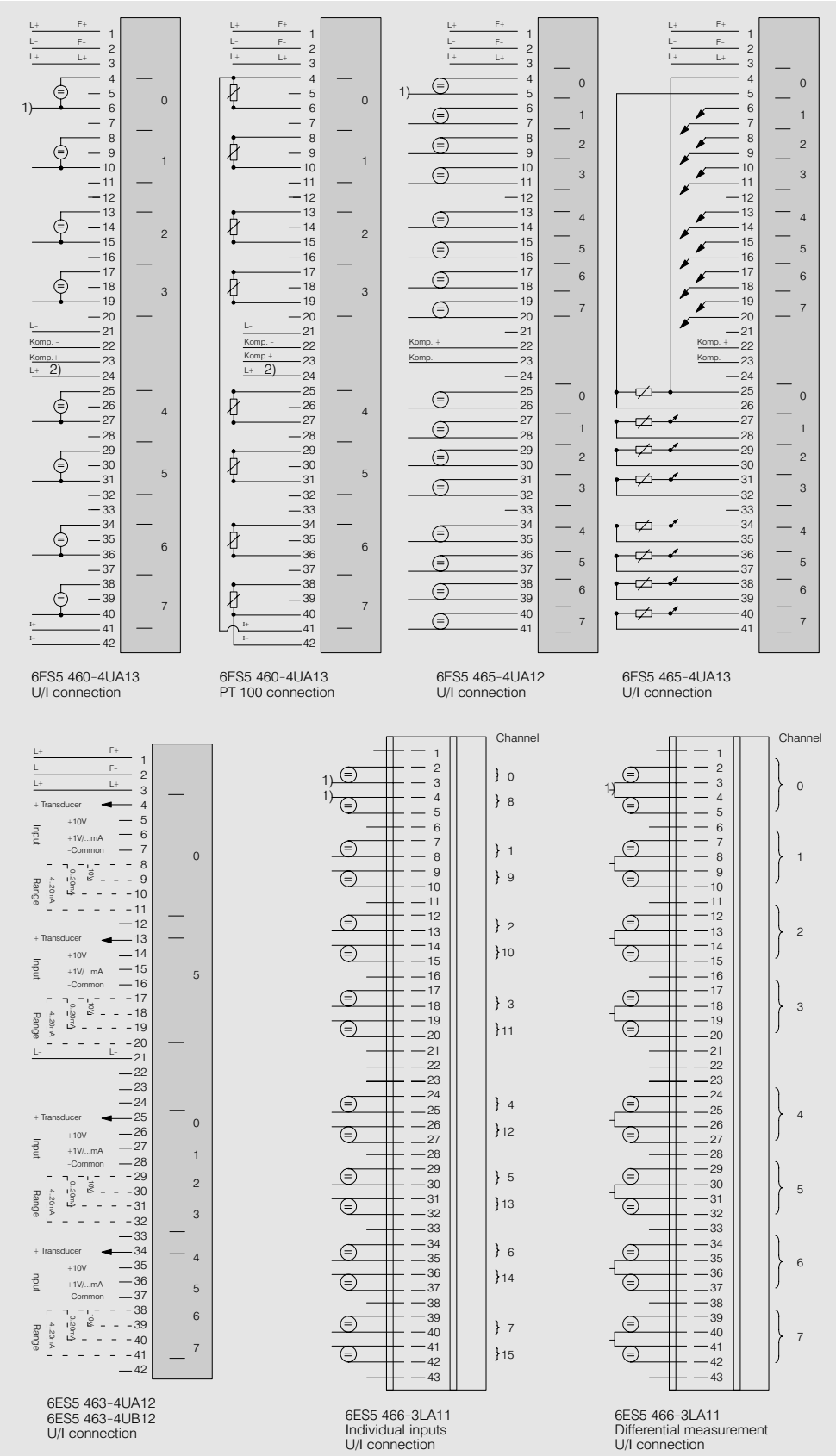


Fig. 4/26 Connection diagrams for analog input modules

1) Connection to the central grounding point of the system (see under technical specifications)
2) Only for disconnecting the test current if wire breakage monitoring is not activated

Analog output modules

Application

The analog output modules convert the digital values from the programmable controller into analog signals required by the process.

Design

Three analog output modules are available with eight outputs each and a range of output voltages. The modules require one slot.

Front connectors are used for terminating the signal cables. Modules and front connectors may be inserted and removed under power.

Adhesive labels are supplied for identifying modules and front connectors.

Principle of operation

Enaple input

The enable input can be used to disable the output of new values. The last output value is retained. The enable input can be deactivated by removing the respective jumper on the module.

Technical specifications

Number of outputs		**8** voltage and current outputs
Galvanic isolation		Yes (not between the outputs)
Output ranges		
(rated values)		
• 6ES5 470-4UA12		**± 10 V; 0 ... 20 mA**
• 6ES5 470-4UB12		**± 10 V**
• 6ES5 470-4UC12		**+ 1 ... 5 V; + 4 ... 20mA**
Load resistance		Purely ohmic
• For voltage outputs	min.	3.3 kΩ
• For current outputs	max.	300 Ω
Load connection		To the M_{analog} terminal
Digital representation of the output signal		12 bit two's complement (1024 units = rated value)
Permissible overload capability	approx.	25 % (up to 1280 units)
Conversion time		1 ms
Short-circuit protection		Yes
Short-circuit current	approx.	25 mA (for a voltage output)
Open-circuit voltage	max.	18 V (for a current output)
Voltage between the reference potential of the load (M_{analog} connection) and the casing	max.	60 V AC/75 V DC
Basic error limits[1] (at 20 °C)		± 2 ‰ ± 2 units
Operational error limits (0 to 60 °C; for one year)		± 6 ‰
Cable length (shielded)	max.	200 m (656 ft)

Enable input F		
Input voltage		
• Rated value		24 V DC
• Enable		+ 13 ... 33 V
• Disable		- 33 ... + 5 V
Input current (for enable)	typ.	5 mA
Cable length (unshielded)	max.	200 m (656 ft)
Supply voltage V_{pos}		
• Rated value		24 V DC
• Ripple V_{pp} (referred to rated voltage)		15 %
• Permissible range (including ripple)		20 ... 30 V
• Value at t < 0.1 s	max.	36 V
Current consumption		
• Internal (at 5 V)	typ.	0.25 A
• External (at 24 V)	typ.	0.3 A
Space requirements		1 slot
Power loss	max.	9.0 W
Front connector		42-pin
Weight	approx.	0.4 kg (0.88 lb)

1) In accordance with DIN 43 745; referred to nominal measuring range (5 V supply from power supply chassis)
2) A filter (SIFI C, B84113-C-B30 or equivalent) is required in the 24 V DC load power supply for the module.

Analog output modules (continued)

Ordering data	Order No.		Order No.
470-4UA analog output module 8 outputs, ± 10 V, 0 ... 20 mA; floating	**6ES5 470-4UA13**	**497 front connector** Crimp terminals, single-width, 42-pin	**6ES5 497-4UA12**
470-4UB analog output module[2] 8 outputs, ± 10 V, floating	**6ES5 470-4UB13**	Crimp terminals, double-width, 42-pin	**6ES5 497-4UA22**
470-4UC analog output module 8 outputs, + 1 ... 5 V, + 4 ... 20 mA; floating	**6ES5 470-4UC13**	Screw terminals, single-width, 42-pin	**6ES5 497-4UB31**
The operating instructions are included in the S5-135U/155U system manual (see page 4/155).		Screw terminals, double-width, 42-pin	**6ES5 497-4UB12**

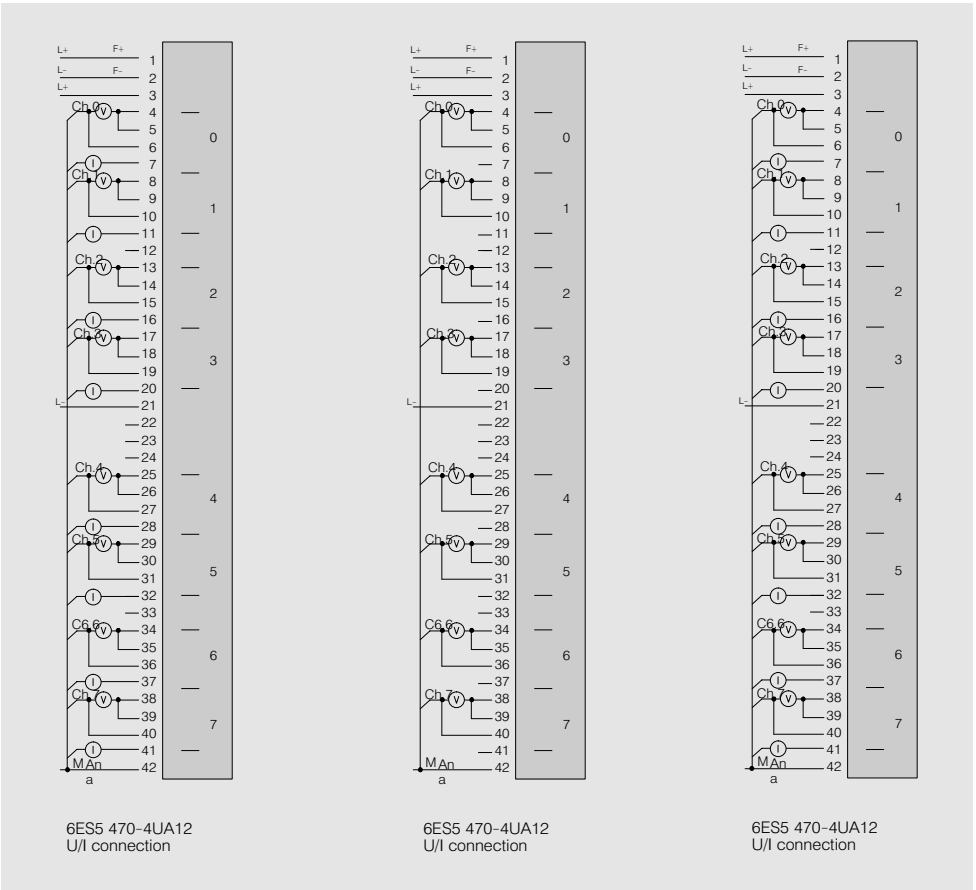


Fig. 4/27 Connection diagrams for analog output modules

Overview

Application

Intelligent I/O modules are used for high-speed, high accuracy

- Closed-loop control
- Positioning
- Counting and proportioning

The advantage of the intelligent I/O modules lies in the fact that they execute these time-critical tasks completely autonomously. The CPU can then concentrate on its own control tasks more closely.

There is an entire range of intelligent I/O modules for the S5-135U and S5-155U/H programmable controllers, which can be used for various applications.

The following overview shows which modules can be used for which applications.

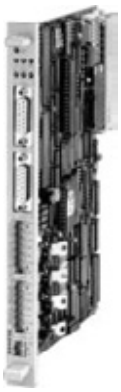
Signal preprocessing

Closed-loop control	Page	Positioning Open-loop control	Page	Positioning Closed-loop control	Page	Counting/ proportioning	Page	Signal processing	Page
• IP 244 temperature	4/61	• IP 240 counter/position decoder/positioning module	4/53	• IP 246I and IP 246A positioning module for servo drives	4/65	• IP 240 counter/position decoder/positioning module	4/53	• IP 243 analog module	4/53
• IP 252 closed-loop control module for drives	4/71	• IP 241 digital position decoder	4/55	• WF 721, WF 723A, WF 723B and WF 723C positioning modules	4/89	• IP 242A, IP 242B counter modules	4/57		
• IP 260 closed-loop control module for high-speed individual controllers	4/74	• IP 247 positioning module for stepper motors	4/69			• IP 261 proportioning module	4/77		
		• WF 705 position encoder module	4/81			• IP 281 counter module	4/79		
		• WF 706C positioning module	4/83						
		• WF 707 cam controller	4/86						

- Page 4/84: Comparison of IP 240 and IP 288 with WF 706
- Page 4/87: Comparison of IP 241 and IP 288 with WF 707
- Page 4/90: Comparison of IP 246 with WF 721 and WF 723A

IP 240 counter, position decoder and positioning module

Application



The IP 240 counter, position decoder and positioning module is used for acquiring and preprocessing pulse trains for counting, position decoding, positioning and speed measurement with the IP 252 closed-loop control module (with incremental pulse generator).

The combination with IP 252 is only possible in the S5-115U.

Design

The module contains two channels that can be used independently of each other in four modes:

- Counting (signals from pulse encoders at frequencies of up to 70 kHz)
- Position decoding (in conjunction with incremental position encoders)
- Positioning via cut-off points
- Speed measurement for the IP 252 closed-loop control-module (in conjunction with incremental speed encoders)

Besides the inputs for pulse sensing (inputs for 5 V and 24 V available), each channel of the module is provided with:

- 1 enable input (5 V/24 V) for "counting" mode
- 1 reference input (preliminary contact, 5 V/24 V) for position decoding and positioning
- 2 outputs (5 V/24 V; 0.5 A) for control of actuators

The cables to the sensors can be connected

- either with 15-pin sub D connectors (upper sockets, shielded cables) or with
- screw-type connectors (lower sockets, cables up to 1.5 mm^2, up to approx. 10 kHz)

The module requires one slot.

Principle of operation

Counting

The positive-going edge of the enable input sets the counter to the initial value set in the user program (max. 9999). The counter counts the input pulses down to zero. When 0 is reached, the counter generates a process interrupt or sets its output (program-selectable). The pulses continue to be counted (down to max. -9999) if the enable input remains "1".

Position decoding

The counter counts up and down to ± 99,999. The counting pulse frequency can be doubled or quadrupled via user program. The channel is synchronized via the reference input.

Eight tracks (cams; travel sections or counting ranges; with allowance for a zero offset) can be specified via software.

Positioning via cut-off points

In this mode, defined points within the traverse range (± 9,999,999) of the axis can be approached.

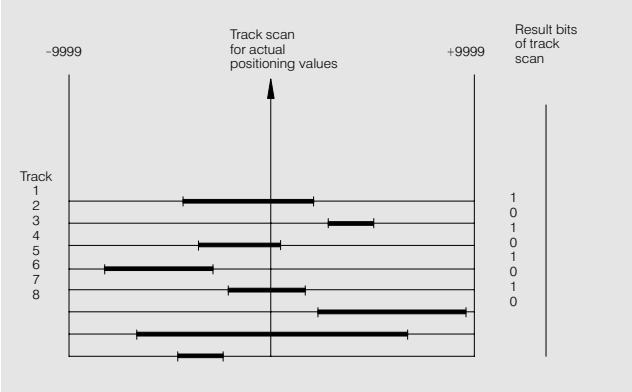


Fig. 4/29 Timing diagram for a positioning decoder

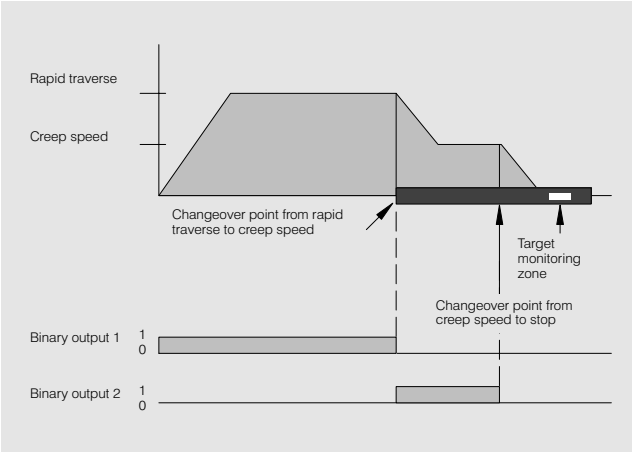


Fig. 4/30 Positioning of a pole-changing motor

IP 240 counter, position decoder and positioning module (continued)

Principle of operation (continued)

The drives used are driven direct. Up to 254 positions per channel can be stored in the module. The poisitons lie within three zones, which represent the cut-off points and the target range.

Synchronization is implemented via:

- Reference point approach
- Software synchronization
- Cyclic synchronization at the positive-going edge of the signal

A rotary or linear axis function can be programmed.

The actual value can be offset through relative and additive zero offset.

The positioning tolerance varies between

± 0.002 mm at 0.06 m/min

and ± 2 mm at 60 m/min.

The following errors are detected:

- Wire breakage with 5V symmetrical position encoders
- Short-circuit in signal cables
- Zero mark errors

The necessary program for the CPU is available in the form of standard function blocks (see Section 7).

4

Technical specifications

Pulse inputs			
Galvanic isolation		No	
Position decoding, positioning			
• Differential inputs (5 V, symmetr.) for sensor interfaces to RS 422A or similar		2 pulses displaced by 90° and zero mark and inverse signals (e.g. Siemens 6FX2 001-2... positioning encoder)	
Input frequency	max.	500 kHz	
Cable length (shielded)	max.	30 m (98.4 ft) (w/ 5 V sensor sply)	
• 5V/24V inputs (asymmetrical)		2 pulses displaced by 90° and zero mark (e.g. Siemens 6FX2 001-4... posn. encoder)	
Input frequency	max.	50 kHz	25 kHz
Cable length (shielded)	max.	25 m (82 ft)	100 m (328 ft)
Counting			
5V/24V inputs		Pulses	
Input frequency	max.	70 kHz	25 kHz
Cable length (shielded)	max.	25 m (82 ft)	100 m (328 ft)
Input voltage			
• Rated value		5 V DC	24 V DC
• For "0" signal		0 ... 0.8 V	- 30 ... + 5 V
• For "1" signal		+ 2.4 ... 5 V	+ 13 ... 30 V
Input current at "1" signal	typ.	0.14 mA	6.5 mA
Binary inputs			
Galvanic isolation		No	No
Input voltage			
• Rated value		5 V DC	24 V DC
• For "0" signal		0 ... 0.8 V	- 30 ... + 5 V
• For "1" signal		+ 2.4 ... 5 V	+ 13 ... 30 V
Input current at "1" signal	max.	0.14 mA	6.5 mA
Cable length (shielded)	max.	100 m (328 ft)	100 m (328 ft)

Binary outputs		
Number per channel		2 with position decoding and positioning, 1 with counting
Galvanic isolation		Yes
Supply voltage V_{pos} (for load)		
• Rated value		24 V DC
• Ripple V_{pp}	max.	3 V
• Permissible range (including ripple)		20 ... 30 V
Output current at "1" signal		
• Rated value		500 mA
Switching frequency with		
• Resistive load (24 V, 50 mA)	max.	200 Hz
• Inductive load (8.5 W)	max.	2 Hz
• Lamp load (5 W)	max.	8 Hz
Residual load at "0" signal	max.	1 mA
Output voltage		
• At "1" signal	min.	V_{pos} - 3 V
Cable length		
• Shielded	max.	1000 m (3280 ft)
Current consumption		
• Internal (at 5 V)	typ.	0.8 A (excluding sensor supply)
Supply current for sensors		
• At 5 V	max.	0.8 A total
• At 24 V (external supply)	max.	0.6 A total
Addresses used		16 byte
Space requirements		1 slot
Weight	approx.	0.45 kg (0.99 lb)

Ordering data

	Order No.
IP 240 counter, position decoder and positioning module	**6ES5 240-1AA21**
To be ordered as a separate item:	
Configuring package for IP 240 comprising manual and standard FB[1] for counting, position acquisition and positioning	
German	**6ES5 240-5AA11**
English	**6ES5 240-5AA21**
French	**6ES5 240-5AA31**
Italian	**6ES5 240-5AA51**

	Order No.
705-3 connecting cables for Siemens positioning encoder 6FX 2001-2 with V_{pos} = 5 V	
5 m (16.4 ft)	**6ES5 705-3BF01**
10 m (32.8 ft)	**6ES5 705-3CB01**
20 m (65.6 ft)	**6ES5 705-3CC01**
32 m (104.9 ft)	**6ES5 705-3CD21**
Sub D connector 15-pin	**6ES5 750-2AA21**

1) For description see Page 7/109

IP 242A and IP 242B counter modules

Application

The IP 242A and IP 242B counter modules are used for acquiring and processing counting pulses up to a frequency of 500 kHz. They are suitable for pulse counting, frequency generation and division, and for measuring frequency, time and speed.

The IP 242B counter module is designed for applications where the result needs to be processed extremely quickly. It has a large number of arithmetic functions and an integral measured value memory, which reduces the dependency on the access time of the CPU and it can therefore pass on the count values to the CPU ready processed.

Design

The IP 242A and IP 242B counter modules contain a total of seven independent 16-bit or 32-bit counter channels. Five of these channels can be used for counting up and down. The inputs and outputs are galvanically isolated. The IP 242A can be upgraded to an IP 242B with an EPROM and operated when the standard function blocks have been replaced.

The modules each require one slot.

Features

Counting frequency up to 500 kHz;

- Scaler chain (programmable and assigned randomly to counters 1 to 5), 4 x part factor 10 or 16 (BCD) and 1 x 4 bit
- Counters 1 to 5 cascadable
- Group interrupt output for user program
- 19 modes of operation for counters 1 to 5
- 1/3 modes of operation for counters 6 and 7
- Input signal level 5 V or 24 V, with 16-bit counters, adaption for each individual input by jumpers or resistors
- Output signal (24 V level) with up to 40 kHz pulse or varied pulse and pulse pause

Principle of operation

The counting and gate pulses of the individual counter channels can be derived from an external pulse encoder or from an internal quartz crystal. The counter outputs can be configured as either pulse outputs or level switch outputs.

An interrupt can be issued when a predefined interrupt value or the synchronization point is reached. The response times can be reduced considerably by instruction lists (short user programs) on the counter modules.

If the counting range of one counter is not sufficient, several counters can be cascaded together.

The necessary software for the CPU is available in the form of standard function blocks (see Section 7).

Technical specifications

Counter module	IP 242A	IP 242B
Number of counters		
• With 16 bit (cascadable) (counters 1 to 5)	5 (up/down programmable)	—
• With 24 bit (counters 6 and 7)	2 up and down for direct connection of incremental encoders with two pulse trains displaced by 90° (5 V, RS 422)	—
• With 32 bit (counters 6 and 7)	—	2 up and down for direct connection of incremental encoders with two pulse trains displaced by 90° (5 V, RS 422)
Number of modes (software-selectable)	19 (counters 1 to 5) 1 (counters 6 and 7)	19 (counters 1 to 5) 3 (counters 6 and 7)
Number of counters with comparison facility for random counts	7 (one interrupt value can be specified for each counter)	7 (one interrupt value can be specified for each counter)
Clock frequency (internal)		
• Counters 1 to 5	1 MHz with 16-bit scaler as well as programmable scaler chain	1 MHz with 16-bit scaler as well as programmable scaler chain
• Counters 6 and 7	—	10 MHz (direct, without scaler)
Counter frequency conditioning	Yes, for counters 1 to 5	Yes, for counters 1 to 5
Counting frequency		
• 24 V signals/ 5 V signals max.	480 kHz (counters 1 to 5)	480 kHz (counters 1 to 5)
• 5 V (RS 422) max.	500 kHz (counters 6 and 7)	500 kHz (counters 6 and 7)
Measured value preprocessing	No	Yes, by means of arithmetic functions
Measured value memory	No	Yes, freely assignable up to 100 measured values (100 x 2 data words)

IP 242A and IP 242B counter modules (continued)

Technical specifications (continued)

Counter module		IP 242A	IP 242B
Galvanic isolation (for inputs and outputs)		Yes, but not for incremental encoder inputs 6 and 7	
Power supply voltage V_{pos}			
• Rated value		24 V DC	
• Ripple V_{pp}	max.	3.6 V	
• Permissible range (including ripple)		20 ... 30 V	
• Value at t < 0.5 s	max.	35 V	
Input voltage (counters 1 to 5)		The counters can also be set to 24 V or 5 V signal levels by jumpers (one per input)	
• Rated value		24 V DC	
• For "0" signal		- 35 ... + 4.5 V	
• For "1" signal		+ 13 ... + 33 V	
• Rated value		5 V DC	
• For "0" signal		- 3 ... + 1.5 V	
• For "1" signal		+ 4 ... + 6.5 V	
Input voltage (counters 6 and 7)		5 V (RS 422)	
Input voltage at "1" signal	typ.	13 mA (at 24 V), 12 mA (at 5 V)	
Output voltage			
• Rated value		24 V DC	
• At "0" signal	max.	+ 3 V	
• At "1" signal	min.	V_{pos} - 2.5 V	
Output current at "1" signal			
• Rated value		200 mA	
• Permissible range		0.2 ... 100 mA	
Output frequency	max.	40 kHz	
Residual current at "0" signal	max.	100 µA	
Short-circuit protection		Electronic	
Insulation voltage rating			
External connections to housing			
• In acc. with VDE 0160		75 V DC	
• Tested with		500 V AC	
Current consumption			
• Internal (at 5 V)		1.1 A	
• External (at 24 V, no load)		50 mA	
Assigned binary addresses		1 Kbyte with S5-155U, page addressing optional, 1 page frame	Page addressing, 1 page frame
Space requirements		1 slot	
Weight	approx.	0.4 kg (0.9 lb)	

Ordering data

	Order No.		Order No.
IP 242A counter module[2]	**6ES5 242-1AA32**	**Connector** (4 pcs.)	**6ES5 983-2AB11**
Upgrade kit from IP 242A and IP 242B	on request	**Converter** for 24 V asymmetrical incremental encoder up to 5 V (RS 422) - symmetrical incremental encoder	**6ES5 242-1AU11**
IP 242B counter module	**6ES5 242-1AA41**		
To be ordered as a separate item: **Configuring package for IP 242A/B** comprising manual and standard FB[1]		**705 connecting cable** for connection of Siemens position encoder 6FX2 001-2...	
German	**6ES5 242-5AB11**	Length 5 m (16.4 ft)	**6ES5 705-2BF00**
English	**6ES5 242-5AB21**	10 m (32.8 ft)	**6ES5 705-2CB00**
French	**6ES5 242-5AB31**	20 m (65.6 ft)	**6ES5 705-2CC00**
Italian	**6ES5 242-5AB51**		

1) For description see Page 7/121
2) Cannot be used with CPU 945

IP 243-3 analog module

Application

The analog module IP 243-3 allows the input, output, preprocessing and routing of analog signals with a short processing time.

Design

The module contains the following components:

- 1 analog/digital converter (-10 to + 10V, 12 bits, 35 s) with 8 inputs
- 2 digital/analog converters (-10 to +10V, 12 bit, 5 s)
- 1 digital/analog converter (0 to + 10V, 8 bit, 10 s)
- 4 analog value matching functions (zero offsets and amplifier settings)
- 2 difference amplifiers (P controllers) with settable gain
- 2 analog value comparators, the results are read in via a following logical circuit and then further processed as alarms (depending on the type of programmable controller used via alarm cables or via a digital input module with alarm generation)
- 1 digital output (8 outputs, 24 V; 0.4 A)
- 1 digital input (8 inputs, 24 V)

The gains and zero points can be set on the front panel via trimpots. 6 measuring sockets are available for checking the settings.

The module requires 1 slot.

Principle of operation

Depending on the given task, the components can be connected to each other or to the inputs and outputs (routing).

The analog values of an input selected via the multiplexer are converted to digital values via the A/D converter so that they can then be processed directly in the central controller.

At the same time they can be compared with other values in the IP 243-3. Individual analog values can be adapted for this. Set values for direct comparison can be sent from the central controller to the IP 243-3 through the D/A converter.

The program required for the central controller is available as standard function modules (see Catalog Section 7).

Technical specifications

A/D converter, 12 bit	**1**
Number of inputs	8
Input voltage range (set with jumpers)	-5 to +5 V, -10 to +10 V, 0 to 10 V
Input resistance approx.	1 MΩ
Digital representation of signal	11 bit + sign; input voltage range = 2047 units
Conversion method	successive approximation
Conversion time max. (without command processing times)	35 µs
Basic error limits	± 0.6 ‰
Operational error limits	± 1.2 ‰ (0 to 55 °C)

D/A converter, 12 bit	**2**
Output voltage	-10 to +10 V
Load impedance min.	2 kΩ
Digital representation of signal	11 bit + sign; output voltage range = 2047 units
Short-circuit protection	yes
Short-circuit current approx.	25 mA
Settling time to 99% of final value for 20 m line length	5 µs
Basic error limits	± 0.6 ‰
Operational error limits	± 0.9 ‰ (0 to 55 °C)

IP 243-3 analog module (continued)

Technical specifications (continued)

D/A converter, 8 bit (with amplifier)	**1**
Output voltage range	0 to 10 V
Load impedance min.	2 kΩ
Digital representation of signal	8 bit; output voltage range = 255 units
Short-circuit protection	yes
Short-circuit current approx.	50 mA
Settling time to 99% of final value for 20 m line length	10 µs
Basic error limits	± 2 ‰
Operational error limits	± 4 ‰ (0 to 55 °C)
Analog value matching	**4**
Input voltage range	-4 to +10 V
Input resistance approx.	200 kΩ
Input filter time constant approx.	0.1 ms
Gain range	0.5 to 5
Setting range for zero offset	-2 to +2 V
Difference amplifier	**2**
Input voltage range	-10 to +10 V
Input resistance approx.	1 MΩ
Input filter time constant approx.	0.5 ms
Gain range	1.1 to 20
Output voltage range	-10 to 10 V
Load impedance min.	2 kΩ
Short-circuit protection	yes
Short-circuit current approx.	50 mA
Comparator	**2**
Number of inputs	2
Input voltage range	0 to +10 V
Input resistance approx.	44 kΩ
Input filter time constant approx.	0.25 ms
Binary inputs	**8**
Input voltage range	
• nominal value	24 V DC
• for signal "0"	-5 to +5 V (or input open)
• for signal "1"	+13 to +30 V
Input current for signal "1" typ.	2.5 mA
Delay time typ.	3 ms

Binary outputs	**8**
Output voltage range	
• nominal value	24 V DC
• for signal „0" max.	3 V
• for signal „1" min.	U_p - 1.9 V
Output current for signal "1"	
• nominal value	200 mA
• permissible range	2 to 200 mA
Short-circuit protection	Fuse
Limitation of inductive switch-off voltage to auf	-2 V
Operating frequency with ohmic load max.	1 kHz
Total load capability at 55 °C (with ref. to the sum of the nominal currents of all outputs)	37 %
Residual current at signal "0"	250 µA
General data	
Supply voltage *Vp*	
• nominal value	24 V DC
• ripple *Vpp*	3.6 V
• permissible range (incl. ripple)	20 to 30 V
• value at t < 0.5 s	35 V
Current consumption	
• internal (at 5 V)	600 mA
• external (at 24 V, no load)	270 mA
Galvanic isolation	No
Cable length	
• for analog signals, shielded	20 m
• for binary signals unshielded	400 m
shielded	1000 m
Reference potential for analog signals	0-V-connection (low resistance connected to housing)
Permissible voltage between analog input and 0 V connection max.	35 V (destruction limit)
Assigned binary addresses	8 bytes
Space requirement	1 slot
Weight approx.	0.36 kg

Ordering data

	Order No.
IP 243-3 analog module	**6ES5 243-1AA13**
To be ordered as a separate item:	
IP 243-3 manual	
German	**6ES5 998-0KF11**
English	**6ES5 998-0KF21**
French	**6ES5 998-0KF31**

	Order No.
Front connector K	
• 43-pin, for crimp connection	**6XX3 068**
• 43-pin, for screw connection	**6XX3 081**
Standard-function blocks for IP 243[1)]	**6ES5 848-7MA01**

1) For description see Page 7/119

IP 244 temperature control module

Application

The IP 244 temperature control module is used for controlling and monitoring temperatures and for measuring and monitoring analog values. This module processes temperature control loops, thus offloading the CPU.
The IP 244 can replace up to 13 individual controllers.

Design

The IP 244 contains a microprocessor which implements the control functions in multiplex mode. User setting is also possible.
The module requires one slot.

Inputs

- 1 binary input for switching the controller on and off (heating switch); operates only on controllers for which it was configured
- 13 analog inputs for connecting floating (grounding required) or non-floating thermocouples, two-wire connection, linearization by firmware, 0 ... 50 mV: Fe-CuNi, NiCr-Ni, Pt 10%-RhPt, Pt 13%-RhPt in accordance with DIN 43710 for temperatures up to 1600 °C
- 1 compensation input for connecting a Pt 100 resistance thermometer for reference junction temperature compensation (three-wire connection)
- 2 monitoring inputs (0 ... 20 V) for connecting transmitters. These signals are not processed by the controller but only monitored for limits

or

- 8 analog inputs for connecting Pt 100 resistance thermometers (0 ... 500 mV, four-wire connection)

or

- 16 analog inputs for connecting voltage sensors, such as pyrosensors (0 ... 500 mV; two-wire connection).

The analog inputs are designed, with respect to earthing and shielding, with enhanced resistance to interference which allows operation of the module in the proximity of electrical drives.

Outputs

- 17 outputs for two-position controller (HEAT-OFF) or three-position controller (HEAT-OFF-COOL); can be selected from 13 two-position to 8 three-position and 1 two-position controllers.
  The "on" duration of an output (manipulated variable for cooling or heating) during one sampling interval corresponds to the value of the manipulated variable calculated by the controller. Manual operation is possible.

Principle of operation

Controller characteristics

- 13 controllers can be programmed with P, I and D components
- The treshold value can be selected to avoid pumping of an output
- The sampling time can be selected between 800 ms and 32 s
- Cascade controllers with one master controller and up to twelve secondary follow-up controllers optional
- Separate parameter sets for heating and cooling

Continued on the next page.

IP 244 temperature control module (continued)

4

Principle of operation (continued)

Controller self-optimization

The module has a self-optimizing facility (see Fig. 4/33) suitable for gradual processes (e.g. in the plastics industry). The module determines the optimum parameters in a heating-up phase.

Preconditions:

- The controlled process must have low-pass characteristics
- Two-position controlled systems must permit a temperature rise of 37 K; three-position controlled systems: 110 K
- The actual value may rise at a rate of 60 K/min, in max. at full heating capacity
- The heat-up phase must not exceed 12 hours

The self-optimization can be activated for each channel by means of a start/stop bit.

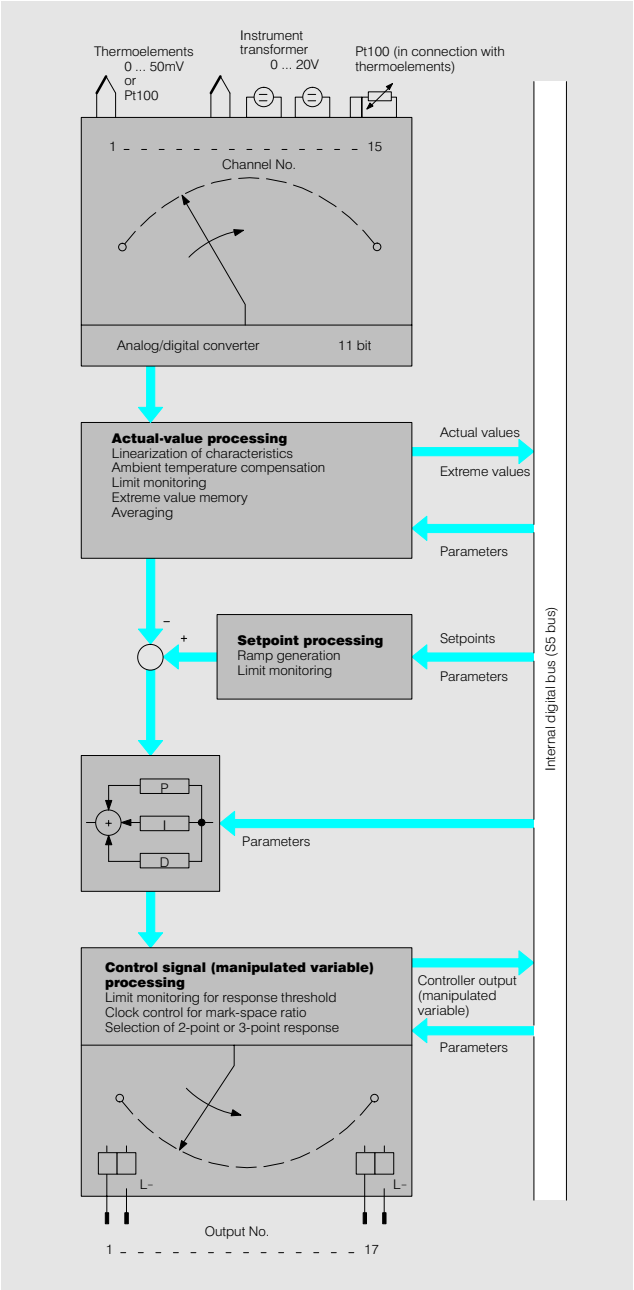


Fig. 4/33 Function diagram of temperature control module

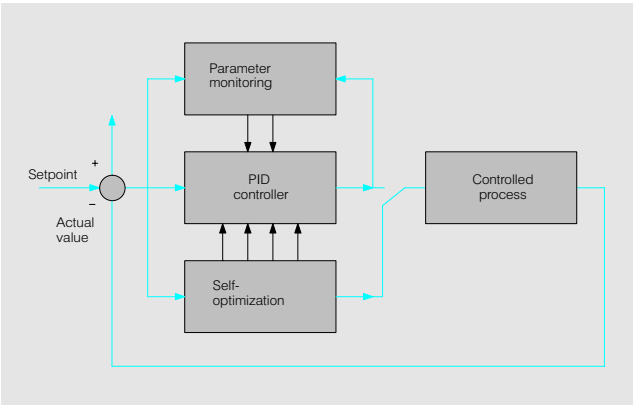


Fig. 4/34 Function diagram of controller self-optimization

IP 244 temperature control module (continued)

Principle of operation (continued)

Actual-value processing

- Conversion of analog input values to 11-bit digital values
- Monitoring of actual values for two high and two low limits. A signal is given if a first limit is exceeded and the maximum or minimum value reached is stored (can be scanned at any time); if a second limit is exceeded, the controller in question is switched off
- Actual-value averaging is carried out if large deviations or disturbances are to be compensated
- Monitoring of the thermoelement cable for a break in the wire with the following reactions:
  Output of the value of the manipulated variable determined in the past or manual operation or changeover to another thermoelement

Setpoint processing

- Step changes in the setpoints can be converted into ramp functions with variable slope coefficients
- A second setpoint can be entered (e.g. for reduced temperature at night); either the first or the second setpoint can be selected with a control bit (set by the user program)
- Limit monitoring of the setpoints entered

Analog output

The CPU can read the manipulated variables of all controllers of the IP 244 in one scanning cycle and therefore transfer the manipulated variables to analog output modules.

Heating current monitoring

The module can also be programmed for the "closed-loop control with heating current monitoring" mode (thermoelements only).

Failure of the individual heating elements can be detected by monitoring the heating currents. The program evaluates any drop below the permissible heating current range.

Note

The IP 244 temperature control module must be inserted in the central controller when using the IM 307/IM 317 interface modules.

Operation of the IP 244 temperature control module is permissible only in slots with battery backup.

The necessary software for the CPU is available in the form of standard function blocks (including an example for easy start-up) (see Section 7).

4

Technical specifications

Analog inputs		
either		
Inputs for thermoelements		13 (two-wire connection)
Input voltage range		0 ... 50 mV
Input resistance		10 MΩ
Permissible thermoelements (for max. temperature)		Fe-CuNi (700 °C), type L, type J NiCr-Ni (1200 °C); type K Pt10%-RhPt (1600 °C); type S Pt13%-RhPt (1600 °C); type R
Inputs for instrument transformers		2
Input ranges (rated values)		0 ... 20 V; can be changed to 0 ... 50 V
Input resistance	min.	50 kΩ (20 V); 10 kΩ (50 mV)
Themperature compensation inputs		1 for Pt 100 (three-wire connection)
or		
Inputs for Pt 100 (resistance thermometers, max. temperature 830 °C)		8 (four-wire connection)
Input voltage range		0 ... 500 mV
or		
Inputs for voltage sensors		16 (two-wire connection)
Input voltage range		0 ... 500 mV
Digital representation of input signals (internal)		11 bit + sign (2048 units = nominal value)
Galvanic isolation		Yes
Measuring principle		Integrating
Integrating time (adjustable for optimum noise suppression)		
• At 50 Hz		20 ms
• At 60 Hz		16 2/3 ms
Conversion time (1 measured value)	max.	
• At 50 Hz		60 ms
• At 60 Hz		50 ms
Permissible voltage between		
• Inputs or between inputs and central grounding point	max.	18 V (V_-, V_p; destruction limit)
• Reference potential of a sensor and the central grounding point	max.	25 V AC/60 V DC
Test voltage		
• Analog input to analog input		120 V AC
• Analog input to S5 bus		500 V AC
Fault message for		
• Range exceeded		Yes
• Wire-breakage		Yes
• Limit exceeded (programmable limit)		Yes
• Short-circuit		Yes
Noise suppression for f = n · (50/60 Hz ± 1 %); n = 1, 2, 3 ...		
• Common mode noise	min.	100 dB
• Series mode noise (peak value of the noise voltage < rated value of the range)	min.	40 dB

IP 244 temperature control module (continued)

Technical specifications (continued)

Analog inputs (continued)

Basic error limits (for actual value acquisition)		50 mV: ± 1.0 ‰ ± 1 unit 20 V: ± 2.5 ‰ ± 1 unit
Operational error limits (0 ... 55 °C)		50 mV: ± 3.0 ‰ ± 1 unit 20 V: ± 3.5 ‰ ± 1 unit
Cable length	max.	50 m (164 ft) shielded

Binary input

Input voltage		
• Rated value		24 V DC
• For "0" signal		– 2 ... + 4.5 V
• For "1" signal		+ 13 ... + 35 V
Input current at "1" signal	typ.	5 mA
Delay	max.	5 ms
Cable length	max.	600 m (1969 ft) unshielded

Controller

Sampling time T_A (cycle time of module)		0.8 ... 32 s
Function		$y = K \cdot (k \cdot x + \frac{1}{T_N}\int xdt + T_D \cdot \frac{dx}{dt})$
Parameters		
• k		0 or 1
• K		0.01 ... 256
• T_N		(1 ... 512) · T_A or $T_N = \infty$
• T_D		(0.5 ... 512) · T_A or $T_D = 0$
Setpoint		0 ... 1600 °C (11 bit)
Setpoint ramp		0 ... 65 536 K/h
Limit values		Setpoint ± 255 K
Threshold value		0 ... 50 % (of setpoint)
Hysteresis		0 ... 50 % (of setpoint)

Outputs

Outputs 1 ... 17		Controller outputs
Response		Depends on the programmed controller types: 13 x two-point to 8 x three-point and 1 x two-point
Galvanic isolation		No
Power supply voltage V_{pos}		
• Rated value		24 V DC
• Ripple V_{pp}	max.	3.6 V
• Permissible range (including ripple)		20 ... 30 V
Output current at "1" signal		
• Rated value		120 mA
• Permissible range		0.2 ... 120 mA
Short-circuit protection		Yes
Limiting of the voltage induced on circuit interruption	to	– 1 V
Lamp load	max.	2.4 W
Load factor at 55 °C		100 %
Residual current at "0" signal	max.	2 µA
Signal level of the outputs		
• At "0" signal	max.	+ 3 V
• At "1" signal	min.	V_{pos} – 2.5 V
Cable length		
• Unshielded	max.	400 m (1312 ft)
• Shielded	max.	1000 m (3300 ft)

General specifications

Current consumption		
• Internal (at 5 V)	typ.	0.4 A
• External (at 24 V, without load)	typ.	0.05 A
Assigned binary addresses		32 byte
Space requirements		1 slot
Weight	approx.	0.3 kg (0.66 lb)

Ordering data

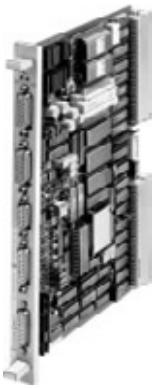
	Order No.
IP 244 temperature control module	**6ES5 244-3AB31**
To be ordered as a separate item:	
Configuring package for IP 244 comprising manual and standard FB[1)]	
German	**6ES5 244-5AA11**
English	**6ES5 244-5AA21**
French	**6ES5 244-5AA31**
Italian	**6ES5 244-5AA51**

	Order No.
721 connecting cables	
shielded;	
For binary signals (max. 500 m (1640 ft))	
2.5 m (8.2 ft)	**6ES5 721-4 BC50**
3.2 m (10.5 ft)	**6ES5 721-4 BD20**
5 m (16.4 ft)	**6ES5 721-4 BF00**
10 m (32.8 ft)	**6ES5 721-4 CB00**
32 m (104.9 ft)	**6ES5 721-4 CD20**
For analog signals (max. 50 m (164 ft))	
2.5 m (8.2 ft)	**6ES5 721-5 BC50**
5 m (16.4 ft)	**6ES5 721-5 BF00**
10 m (32.8 ft)	**6ES5 721-5 CB00**
32 m (104.9 ft)	**6ES5 721-5 CD20**
50 m (164 ft)	**6ES5 721-5 CF00**

1) For description see Page 7/121

IP 246I and IP 246A positioning modules

Application



The IP 246 positioning module is used for positioning and position control of two independent axes with variable speed drives.

Design

Two versions of the IP 246 positioning module are available:

- IP 246I for incremental position encoders
- IP 246A for absolute (digital) position encoders

Principle of operation

Machine data and programs required for positioning are stored in the RAM of the IP 246 positioning module. For this, the COM 246 parameterization software (see Section 7) must be loaded into the programming device used.

The user can program target positions and traversing speeds:

- In the program memory of the CPU
- In the program memory of the IP 246 positioning module (with the COM 246 parameterization software)

The current position of the two axes is determined from the signals of the position encoder. From the difference to the current set position, a position controller (P-controller) calculates the current speed set-point, which is output as an analog signal (± 10 V) and is available to the speed controller of the current converter of the appropriate axis.

The module can be serviced via two interfaces, either from the programmable controller or from a programming device.

Both axes can be used independent of each other either as a rotary or linear axis.

Operation with a programming device

In the diagnostics mode, both axes can be controlled from a programming device. Set-points, actual values, following error and a number of other values are displayed on the screen. Error messages are displayed in detailed plain text.

For operation with a programmer (and for programming), the COM 246 parameterization software is required (see Section 7).

Operation with a programmable controller

For communication between the positioning module and the CPU, the appropriate standard function block (FB 164 and FB 165; see Section 7) must be loaded into the CPU. The possible calls are put together in a list (see page 4/66).

The PLC and programming device interfaces can be operated simultaneously. Using the PLC, simple point-to-point linkage of the two axes is possible.

Machine data

The machine record includes axis-specific parameters such as

- Various speeds
- Accelerations and decelerations in both directions
- Coordinates for reference point, software position switch
- Offsets, tool compensations
- Resolution
- Type of axis: Rotary or linear axis

IP 246I and IP 246A positioning modules (continued)

Principle of operation (continued)

Traversing programs

The notation of the traversing programs conforms to a subset of DIN 66025. They are edited on the programming device using either this notation or in plain text.

Up to 255 programs can be stored on the positioning module. A program can be up to 1023 characters long, and the program memory can take a total of 10,000 characters.

Programs can be linked using subroutine calls. Other programmable functions are e.g.:

- Loops, including infinite loops
- On-the-fly changeovers
- Dwell times
- Offsets, tool compensations
- Metric and imperial measures

Each traversing program can be carried out by both axes (even simultaneously).

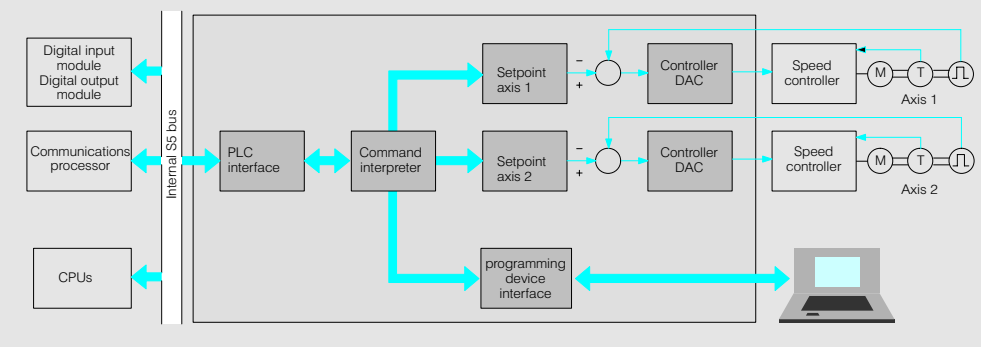


Fig. 4/35 Function diagram of the IP 246 positioning module

Functions

Module	IP 246I	IP 246A
Application	Positioning and position control of two independent axes with variable-speed drives	
Encoders used	Incremental • 5 V differential signal • 24 V signal	Absolute (digital) • 24 V signal • Switching to P potential • Switching to M potential
Type of axis	Linear axis Rotary axis	
Modes for • Operator communication	Jogging mode Follow-up mode Reference point approach and/or set reference point Incremental travel Automatic mode Teach-in mode Zero shift Tool offset Entry of machine data and traversing program Module identifier Drift compensation	
• Monitoring	Read machine data Read traversing program Read current actual values Read module identifier Path actual value Following error Distance to go	
Binary outputs signal the following: Selectable via binary inputs	"Axis ready for operation"; "Position reached" External start/stop	
User program referencing the IP 246 Can be stored in	RAM/EPROM CPU	
Machine data and traversing programs can be modified via CPU	Yes	
Module replacement possible without reloading program	Yes	

IP 246I and IP 246A positioning modules

Technical specifications

Position detection, incremental		
5 V inputs (to RS 422)		Two 90° displaced pulses, zero mark, and the inverse signals
24 V inputs		Two 90° displaced pulses and zero mark
Input voltage		
• Rated value		24 V DC 5 V DC (RS 422)
• For "0" signal		– 33 ... + 3 V
• For "1" signal		+ 10.5 ... 33 V
Input current (at "1" signal)	max.	7 mA
Galvanic isolation		No
Counting frequency		
• For 5 V inputs	max.	500 kHz
• For 24 V inputs	max.	50 kHz
Cable length (shielded)	max.	32 m (105 ft)
Position detection, absolute		
	max.	20 bit (parallel, Gray code)
Input voltage		
• Rated value		24 V DC
• For "0" signal		– 33 ... + 3 V
• For "1" signal		+ 10.5 ... 33 V
Input current (at "1" signal)	max.	7 mA
Galvanic isolation		No
Cable length (shielded)	max.	32 m (105 ft)
Binary inputs/outputs		4/2 per axis
Galvanic isolation		No
Input voltage		
• Rated value		24 V DC
• For "0" signal		- 33 ... + 3.6 V
• For "1" signal		+ 13 ... 33 V
Input current	typ.	9.5 mA (at 24 V)
Output voltage		
• Rated value		24 V DC
• For "0" signal	max.	+ 3 V
• For "1" signal	min.	V_{pos24} – 1.5 V
Output current		
• Output current at "1" Permissible range	max.	120 mA (short-circuit proof) 5 ... 120 mA
• Residual current at "0"	max.	0.5 mA

Controller output		Analog rotational speed setpoint
Voltage range		-10 ... + 10 V
Load resistance	min.	5 kΩ
Short-circuit protection		Yes
Cable length (shielded)	max.	32 m (105 ft)
Machine data (general)		
Resolution		0.1 ... 99.9 µm
Traversing range	max.	± 40,000 mm or infinitely for rotary axis
Traversing speed		1 ... 65,000 mm/min.
Acceleration		10 ... 9999 mm/s^2
Following error	max.	99.999 mm
Speed gain K_V		0.1 ... 99.9/s $\frac{\text{Programmed speed V}}{\text{Following error } \Delta S}$
Backlash compensation	max.	64.999 mm
Tool length compensation	max.	± 40,000 mm
Supply voltages		
V_{pos24}		
• Rated value		24 V DC
• Ripple V_{pp}		3.6 V
• Permissible range (including ripple)		20 ... 30 V
Current consumption (at 5 V)	typ.	1.3 A (without position encoder)
Supply current for position encoder at 5 V and 24 V	max.	0.3 A per encoder
Supply voltage for 2-wire BERO		22 ... 33 V
Backup		From battery in PLC
Space requirements		
Weight	approx.	0.4 kg (0.9 lb)

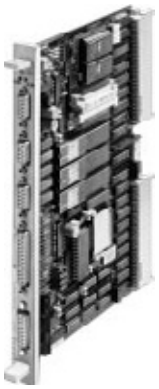
IP 246I and IP 246A positioning modules

Ordering data	Order No.
IP 246I positioning module	
Incremental	**6ES5 246-4UA31**
IP 246A positioning module	
Absolute (digital)	**6ES5 246-4UB11**
To be ordered as a separate item:	
Configuring package for IP 246I/A	
comprising manual, standard FB[1] and parameter assignment software COM 246[2]	
German	**6ES5 246-5AA11**
English	**6ES5 246-5AA21**
French	**6ES5 246-5AA31**
Sub D connector	
15-pin (socket)	**6ES5 750-2AB21**
15-pin (plug)	**6ES5 750-2AA21**
9-pin (plug)	**6ES5 750-2AA11**
706 connecting cable	
• For Heidenhain ROD 320 (installed in 1HU and 1FT motors)	
5 m (16.4 ft)	**6ES5 706-1BF00**
10 m (32.8 ft)	**6ES5 706-1CB00**
20 m (65.6 ft)	**6ES5 706-1CC00**
32 m (104.9 ft)	**6ES5 706-1CD20**
• For 5 V sensor (open cable end)	
5 m (16.4 ft)	**6ES5 706-2BF00**
10 m (32.8 ft)	**6ES5 706-2CB00**
20 m (65.6 ft)	**6ES5 706-2CC00**
32 m (104.9 ft)	**6ES5 706-2CD20**
706 connecting cable (cont.)	
• For 24 V sensor (open cable end)	
5 m (16.4 ft)	**6ES5 706-3BF00**
10 m (32.8 ft)	**6ES5 706-3CB00**
20 m (65.6 ft)	**6ES5 706-3CC00**
32 m (104.9 ft)	**6ES5 706-3CD20**
• For absolute encoders	
5 m (16.4 ft)	**6ES5 706-6BF00**
10 m (32.8 ft)	**6ES5 706-6CB00**
20 m (65.6 ft)	**6ES5 706-6CC00**
32 m (104.9 ft)	**6ES5 706-6CD20**
• For motor power section	
5 m (16.4 ft)	**6ES5 706-4BF00**
10 m (32.8 ft)	**6ES5 706-4CB00**
20 m (65.6 ft)	**6ES5 706-4CC00**
• For binary inputs/outputs	
1 m (3.28 ft)	**6ES5 706-5BB00**
5 m (16.4 ft)	**6ES5 706-5BF00**
10 m (32.8 ft)	**6ES5 706-5CB00**
20 m (65.5 ft)	**6ES5 706-5CC00**
705-5 connecting cable	
• For Siemens position encoder 6FX2 001-2... with V_{pos} = 5 V/24 V	
standard lengths 5 m (16.4 ft)	**6ES5 705-5B F01**
standard lengths 10 m (32.8 ft)	**6ES5 705-5CB01**
standard lengths 20 m (65.6 ft)	**6ES5 705-5CC01**
standard lengths 32 m (104.9 ft)	**6ES5 705-5CD21**

1) For description see Page 7/123
2) For description see Page 7/21

IP 247 positioning module

Application



The IP 247 positioning module is used for positioning three independent axes with stepper motors.

Principle of operation

Machine data and traversing programs required for positioning are stored in the RAM of the IP 247 positioning module. For this, the COM 247 parameter assignment software (see Section 7) must be loaded into the programming device used.

The user can program target positions and traversing speeds

- In the program memory of the CPU or
- In the program memory of the IP 247 (with the COM 247 parameter assignment software).

The module calculates the angular increment to be carried out by the motor from the actual and target positions. The actual position of an axis is not fed back from outside but determined by the module itself.

From the mechanical characteristics of the drive unit (transmission ratio) and the machine data stored on the module (e.g. max. acceleration) the module determines the required pulse sequence (and direction) and transfers this to the power section of the stepper motor. Acceleration and deceleration are calculated using an exponential function: With exponential acceleration a greater path is covered over a given length of time than with linear acceleration.

Stepper motors with two, four or five phases can be controlled with step frequencies of 0.5 Hz to 100 kHz.

Operation with a programming device

All three axes can be controlled from a programming device. Actual values, residual path and a number of other values are displayed on the screen. Error messages are displayed in detailed plain text.

For operation with a programming device (and for programming) the COM 247 parameter assignment software is required.

Operation with a programmable controller

For communication between the positioning module and the CPU, the appropriate standard function blocks (FB 164 and FB 165; see Section 7) must be loaded into the CPU.

Machine data

The machine record includes axis-specific parameters such as:

- Various speeds
- Accelerations (frequency changes)
- Coordinates for reference point, software position switch
- Offsets, tool compensations
- The number of angular increments of the motor per revolution
- Transmission gear ratio of the drive
- Type of axis: rotary or linear axis

Traversing programs

The program memory takes 7000 characters. The rest same as for IP 246.

Operating modes

The following groups of modes are possible:

- Set reference point procedure and reference point by software
- Modes for manual traversing
- Automatic modes
- Input and deletion of compensations and shifts
- Teach-in mode

IP 247 positioning module (continued)

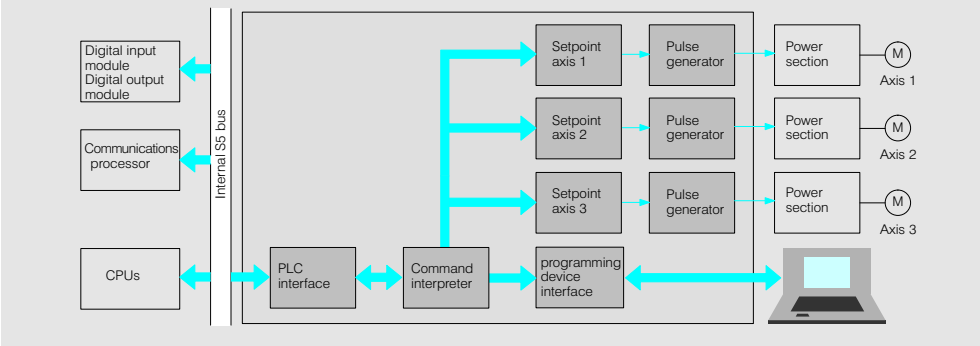


Fig. 4/36 Function diagram of the IP 247 positioning module

Technical specifications

Signal to the power section		
Positioning outputs		Pulse, $\overline{\text{Pulse}}$ Direction, $\overline{\text{Direction}}$ Reset, $\overline{\text{Reset}}$
Signal level for power section with		
• Optocouplers		5 V/20 mA, 24 V/20 mA jumper-selectable; 5 V to 24 V/20 mA with additional voltage
• Differential inputs		5 V
Ready signal input		
• Rated value		24 V DC
• For "0" signal		– 33 ... + 3 V
• For "1" signal		+ 10.5 ... 33 V
• Input current (at 24 V)	typ.	7 mA
Binary inputs/outputs		
Signal output "Position reached"		
• Rated value		24 V DC
• For "0" signal	max.	3 V
• For "1" signal	min.	V_{pos24} – 1.5 V
• Output current at "1" Permissible range	max.	120 mA 5 ... 120 mA
• Residual current at "0"	max.	0.5 mA
Inputs for position switch (2), reference point switch, external Start/Stop		
• Rated value		24 V DC
• For "0" signal		– 33 ... + 3.6 V
• For "1" signal		+ 13 ... V
• Input current (at 24 V)	typ.	9.5 mA

Machine data		To be preselected with COM 247
Traversing range		± 100.000 mm
Number of angular increments per revolution		12 ... 1000 $\frac{\text{pulses}}{\text{rev.}}$
Transmission ratio of the drive		0,012 ... 64. 999 $\frac{\text{mm}}{\text{rev.}}$
Pulse frequency		12 Hz ... 100 kHz
Frequency gain		5 ... 2599.99 $\frac{\text{Hz}}{\text{ms}}$
Backlash compensation	max.	64.999 mm
Tool length compensation	max.	± 100,000 mm
Supply voltages		20 bit (parallel, Gray code)
V_{pos24}		
• Rated value		24 V DC
• Ripple	max.	3.6 V
• Permissible range (including ripple)		20 ... 30 V
Current consumption		
• Internal (at 5 V)	typ.	0.8 A
• External (at 24 V, without load)	typ.	0.05 A
Supply voltage for 2-wire BERO		22 ... 33 V
Battery backup		PLC battery
Cable length	max.	100 m (328 ft)
Space requirements		1 slot
Weight	approx.	0.4 kg (0.9 lb)

Ordering data

	Order No.
IP 247 positioning module without manual	**6ES5 247-4UA31**
To be ordered as a separate item:	
Configuring package for IP 247 comprising manual, standard FB[1] and parameter assignment software COM 247[2]	
German	**6ES5 247-5AA11**
English	**6ES5 247-5AA21**
French	**6ES5 247-5AA31**
Sub D connector	
9-pin (plug)	**6ES5 750-2AA11**
25-pin (plug)	**6ES5 750-2AA31**

	Order No.
704 connecting cable (open cable end)	
• For power section	
1.6 m (5.2 ft)	**6ES5 704-4BB60**
5 m (16.4 ft)	**6ES5 704-4B F00**
10 m (32.8 ft)	**6ES5 704-4CB00**
20 m (65.6 ft)	**6ES5 704-4CC00**
50 m (164 ft)	**6ES5 704-4CF00**
• For binary inputs and outputs	
2 m (6.56 ft)	**6ES5 704-5BC00**
5 m (16.4 ft)	**6ES5 704-5BF00**
10 m (32.8 ft)	**6ES5 704-5CB00**
20 m (65.6 ft)	**6ES5 704-5CC00**
50 m (164 ft)	**6ES5 704-5CF00**

1) For description see Page 7/123
2) For description see Page 7/21

IP 281 counter module

Application

The IP 281 counter module is used for acquiring and processing counting pulses up to a frequency of 250 kHz. This module is an economical alternative to the IP 242A and IP 242B counter modules. It is designed for applications where only one or two counter channels are required.

Design

The IP 281 basic board has one counter channel for direct connection of incremental encoders or pulse encoders. A second channel can be connected using an optional plug-in submodule. The two 16- or 32-bit counters can operate either independently or in conjunction with one another. The channel(s) can be used for counting both up and down.

The counter function and the bus interface of the IP 281 counter module are implemented in an ASIC. This ensures very fast data interchange with the CPU of the programmable controller. It is therefore particularly suitable for measured value acquisition, interrupt processing and high-speed closed-loop control.

The incremental encoders are connected via Sub D connectors; the digital inputs and outputs are connected via screw terminals (included in the scope of delivery).

The module requires one slot.

Features

- One channel for counting up and down (16 or 32 bit), upgradable to two channels (16 or 32 bit) with a plug-in submodule, for connection of incremental encoders
- Five operating modes for independent operation of the two counters
- Four operating modes for operation of the two counters in conjunction with one another
- Individual setting of counting width, counting range and counting mode for each counter
- Counting pulses are acquired from three different evaluations of the signal levels at the encoder inputs (single, double and quadruple evaluation)
- Transfer of values from counter 1 to counter 2 in the form of interrupt or load values
- Direct start of counter 2, when counter 1 has reached an interrupt value
- Enabling/disabling in the form of levels, pulses (at the digital input of the counter) or by software control
- Gate start, gate stop and setting via digital inputs
- Counters loaded with defined initial values
- Cormparison with one interrupt value for each counter
- Synchronous setting of start, stop and readout

Principle of operation

The IP 281 counter module captures the pulses from incremental encoders depending on direct connectable gate signals. The module evaluates the direction and compares the actual value per counter with a definable interrupt value. For fast response, the counter outputs can be used and/or an interrupt can be sent to the CPU. The counter outputs can be configured with a selectable minimum pulse or with level switching.

The user program does not require standard function blocks for data exchange with the CPU. High-speed access is achieved via load and transfer operations.

IP 281 counter module (continued)

Technical specifications

Number of counters with 16 or 32 bit alternatively		1 upgradable to 2 both up and down with 2 pulse trains displaced by 90° (5 V level, RS 422), also 24 V incremental encoders
Number of modes (software-selectable)		5
Number of counters with comparison facility for random counts		1 or 2
Counting frequency when driven with		
• 24 V signals	max.	250 KHz
• 5 V RS 422 signals	max.	250 KHz
Galvanic isolation		
• For inputs and outputs		Yes
• Between two inputs		Yes (between encoder and digital inputs)
• Between input and S5 bus		Yes
Power supply voltage V_{pos}		
• Rated value		24 V DC
• Ripple V_{pp}	max.	3.6 V
• Permissible range (including ripple)		20 ... 30 V
• Value at t > 5 s	max.	35 V
Signal input voltage		
• Rated value		24 V DC
• For "0" signal		-3 V ... + 4,5 V
• For "1" signal		+13 V ... + 30 V
• Rated value		5 V DC (to RS 422)
Input current at "1" signal	typ.	13 mA (at 24 V)
	typ.	12 mA (at 5 V)
Output voltage		
• At "0" signal	max.	+3 V
• At "1" signal	min.	V_{pos} - 2.5 V
Output current at "1" signal		
• Rated value		500 mA
Short-circuit protection		Electronic
Insulation voltage		
External connections to housing		
• In acc. with VDE 0160		75 V DC
• Tested with		500 V AC
Current consumption		
• Internal (at 5 V)	max.	0.6 A
• External (at 24 V, without load)	max.	2.5 A
Assigned binary addresses		8 byte with linear addressing
Space requirements		1 slot
Weight	approx.	0.4 kg (0.88 lb)

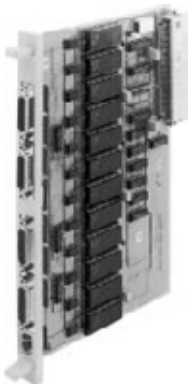
Ordering data

	Order No.
IP 281 counter module with 24 V encoder power supply 24 V and 5.2 V encoder power supply	**6ES5 281-4UA12** **6ES5 281-4UP12**
Plug-in submodule for upgrading with 2nd channel	**6ES5 281-4UB12**
To be ordered as a separate item: **IP 281 manual**	
German	**6ES5 998-0KP11**
English	**6ES5 998-0KP21**
French	**6ES5 998-0KP31**
Italian	**6ES5 998-0KP51**
703 connecting cable Between IP 281 and	
• Siemens incremental position encoder 6FX2 001-2 ...	
5 m (16.4 ft)	**6ES5 703-1BF0**
10 m (32.8 ft)	**6ES5 703-1CB0**
20 m (65.6 ft)	**6ES5 703-1CC0**
25 m (82.0 ft)	**6ES5 703-1CC5**
32 m (104.9 ft)	**6ES5 703-1CD2**
• Incremental position encoder for 5 V signals, to RS 422, power supply voltage 5 V, with one end open	
5 m (16.4 ft)	**6ES5 703-2BF0**
10 m (32.8 ft)	**6ES5 703-2CB0**
20 m (65.6 ft)	**6ES5 703-2CC0**
25 m (82.0 ft)	**6ES5 703-2CC5**
32 m (104.9 ft)	**6ES5 703-2CD2**
Cable opening bottom	**0**
top	**1**

	Order No.
703 connecting cable Between IP 281 and	
• Incremental position encoder for 5 V signals, to RS 422, power supply voltage 24 V, with one end open	
10 m (32.8 ft)	**6ES5 703-3CB0**
20 m (65.6 ft)	**6ES5 703-3CC0**
32 m (104.9 ft)	**6ES5 703-3CD2**
50 m (164.0 ft)	**6ES5 703-3CF0**
100 m (328.0 ft)	**6ES5 703-3DB0**
• Incremental position encoder for 24 V signals, power supply voltage 24 V, with one end open	
10 m (32.8 ft)	**6ES5 703-4CB0**
20 m (65.6 ft)	**6ES5 703-4CC0**
32 m (104.9 ft)	**6ES5 703-4CD2**
50 m (164.0 ft)	**6ES5 703-4CF0**
100 m (328.0 ft)	**6ES5 703-4DB0**
Cable opening bottom	**0**
top	**1**
Sub D connector 15-pin (plug)	**6ES5 750-2AA21**

Wegerfassungsbaugruppe WF 705

Anwendungsbereich



Die Wegerfassungsbaugruppe WF 705 dient dem Erfassen und Verarbeiten der Signale von bis zu 12 synchron-seriellen Absolutwertgebern (SSI).

Aufbau

An die Wegerfassungsbaugruppe WF 705 lassen sich anschließen:

- 4 Absolutwertgeber, direkt anschließbar

Erweiterung über Istwertverteiler, der die Werte von je 3 Achsen erfaßt;
bis zu 4 Istwertverteiler sind an eine Wegerfassungsbaugruppe anschließbar. Der Mischbetrieb (Direktanschluß und Istwertverteiler) ist möglich

Die Baugruppe benötigt 1 Einbauplatz.

Arbeitsweise

Bild 4/41 zeigt den prinzipiellen Ablauf des Datenverkehrs zwischen den Wegmeßgebern und der Zentralbaugruppe des Automatisierungsgerätes.

Für den Datenaustausch mit der Zentralbaugruppe sind Standard-Funktionsbausteine für das Anwenderprogramm lieferbar (siehe Katalogteil 7).

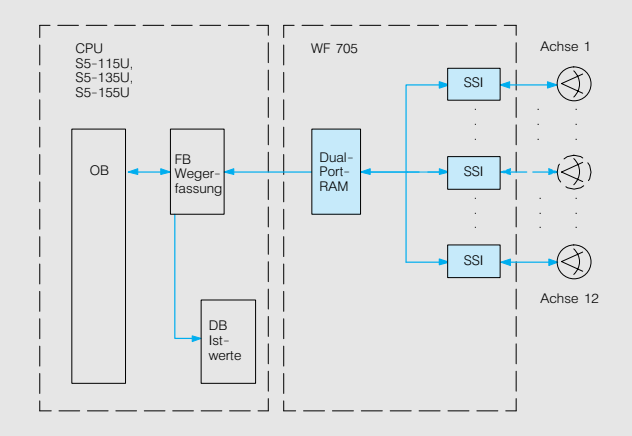


Bild 4/41 Funktionsbild des Datenverkehrs zwischen CPU und WF 705

Technische Daten

Anschließbare Geber		synchron-serielle Absolutwertgeber (SSI)	Versorgungsstrom für Wegmeßgeber bei 24 V	max.	0,3 A je Geber
Wegerfassung absolut		25 Bit Datenlänge (SSI, Gray- oder Binär-Code)	Leitungslänge (geschirmt) zum Geber		
Verfahrbereich	max.	8192 Winkelschritte je Umdrehung, 4096 Umdrehungen	• bei 125 kbit/s	max.	120 m
			• bei 1 Mbit/s	max.	25 m
Übertragungsgeschwindigkeit	max.	1 Mbit/s	zum Istwertverteiler	max.	10 m
Stromaufnahme (bei 5 V)		0,5 A (ohne Geberversorgung)	Überwachungen		auf Kabelbruch und Kurzschluß
Versorgungsspannung für Wegmeßgeber		DC 24 V (extern)	Belegte Adressen		4 Byte
			Platzbedarf		1 Einbauplatz
			Gewicht	etwa	0,4 kg

Weitere Angaben zu den Wegerfassungsbaugruppen finden Sie im Katalog AR 10.

Wegerfassungsbaugruppe WF 705 (Fortsetzung)

Bestelldaten	Bestell-Nr.	Preis
Wegerfassungsbaugruppe WF 705	**6FM1 705-3AA00**	
Istwertverteiler	**6FM1 590-5AA00**	
Standard-Software WF 705 zur Istwerterfassung auf Disketten $3^1/_2$“		
• MS-DOS Einfachlizenz	**6FM1 705-7UA30-1AA0**	
• 50er-Kopierlizenz	**6FM1 705-7UA30-1AA5**	
• weitere Kopierlizenzen	siehe Katalog AR 10	
zusätzlich zu bestellen ist die **Beschreibung WF 705**		
deutsch	**6ZB5 440-0AA01-0BA5**	
englisch	**6ZB5 440-0AA02-0BA5**	

		Bestell-Nr.	Preis
Steckleitung 790/590 mit offenem Leitungsende, zwischen WF 705 und			
• SSI-Wegmeßgeber			
Standardlängen	2 m	**6FM1 790-1GA00**	
	5 m	**6FM1-790-1GB00**	
	10 m	**6FM1 790-1GC00**	
	18 m	**6FM1 790-1GD00**	
Sonderlängen[1], max. 25 m bei 1 Mbit/s, max. 120 m bei 125 Kbit/s		**6FM1 790-1GZ00**	
• Istwertverteiler			
Standardlängen	2 m	**6FM1 790-1HA00**	
	5 m	**6FM1 790-1HB00**	
Sonderlängen[1], max. 10 m		**6FM1 790-1HZ00**	
• zwischen Istwertverteiler und SSI-Wegmeßgeber			
Standardlängen	2 m	**6FM1 590-2EA00**	
	5 m	**6FM1 590-2EB00**	
	10 m	**6FM1 590-2EC00**	
	18 m	**6FM1 590-2ED00**	
	25 m	**6FM1 590-2EE00**	
	35 m	**6FM1 590-2E F00**	
	50 m	**6FM1 590-2EG00**	
	60 m	**6FM1 590-2EH00**	
Sonderlängen[1], max. 25 m bei 1 Mbit/s, max. 120 m bei 125 Kbit/s		**6FM1 590-2EZ00**	

1) Länge im Klartext angeben

Wegerfassungsbaugruppe WF 706 C

Anwendungsbereich

Die Positionierungsbaugruppe WF 706 C dient dem Positionieren von Achsen über Abschaltpunkte mit polumschaltbaren Motoren oder (in Verbindung mit einem optionellen Analogmodul) zur Positionierung von Achsen mit Frequenzumrichtern, Servoantrieben oder Proportionalventil-Steuerungen. Außerdem eignet sich die WF 706 C ausgezeichnet zur Wegerfassung und zum Zählen.

Aufbau

Die WF 706 C ist in zwei Ausführungen lieferbar:

- Mit 3 Kanälen
- Mit 6 Kanälen

Zur Positionierung mit Frequenzumrichtern ist die WF 706 C modular mit 1 oder 2 Analogmodulen erweiterbar (3- bzw. 6-Kanal-version).

An die Baugruppe lassen sich folgende Geber anschließen:

- Inkrementalgeber
- Absolutwertgeber mit serieller Datenübertragung (SSI-Geber)
- Einfache 24-V-Signalgeber (BERO)

Durch die geringe Schnittstellenbreite von 8 Byte im Peripheriebereich können bis zu 16 Baugruppen in einem Automatisierungsgerät betrieben werden.

Die Baugruppe benötigt 1 Einbauplatz bei 3 Kanälen und 2 Einbauplätze bei 6 Kanälen.

Arbeitsweise

Je nach Variante können mit der WF 706 C drei oder sechs Achsen betrieben werden. Durch die einfache und offene Struktur stehen viele Funktionen zur Verfügung, z. B.

- Positionieren über Abschaltpunkte
- Wegerfassung mit schneller Schaltpunktausgabe
- Zähler mit schneller Vergleichswertausgabe
- Dosierzähler

In Verbindung mit Analogmodulen zusätzlich:

- Positionieren von Achsen mit Frequenzumrichtern oder Servoantrieben
- Positionieren von 3 Achsen mit Proportional-Ventilsteuerungen

Mit Hilfe der 4 Digitalausgänge mit einer Schaltleistung von 0,5 A bei 24 V lassen sich alle notwendigen Schütze direkt ansteuern.

Durch die ausschließliche Verwendung von Hardware-Logik und den Einsatz eines speziell für diese Aufgabe entwickelten integrierten Bausteins schalten die Ausgänge in weniger als 50 ms.

Dadurch ist die WF 706 auch als Universalzähler mit maximal 6 Kanälen einsetzbar.

Spezielle Funktionen unterstützen den Zählvorgang. So kann z. B. mit der Tor-Funktion ein Zählvorgang durch ein externes Signal auf einen schnellen Digitaleingang oder alternativ durch einen internen Zeittakt gesteuert werden.

Ein Analogmodul enthält 4 Analogausgänge, von denen drei direkt Kanälen zugeordnet sind. Sie können zur Positionierung von Antrieben (wahlweise ±10 V-Schnittstelle oder 0 ... 10 V-Schnittstelle mit Richtungsbit) werden.

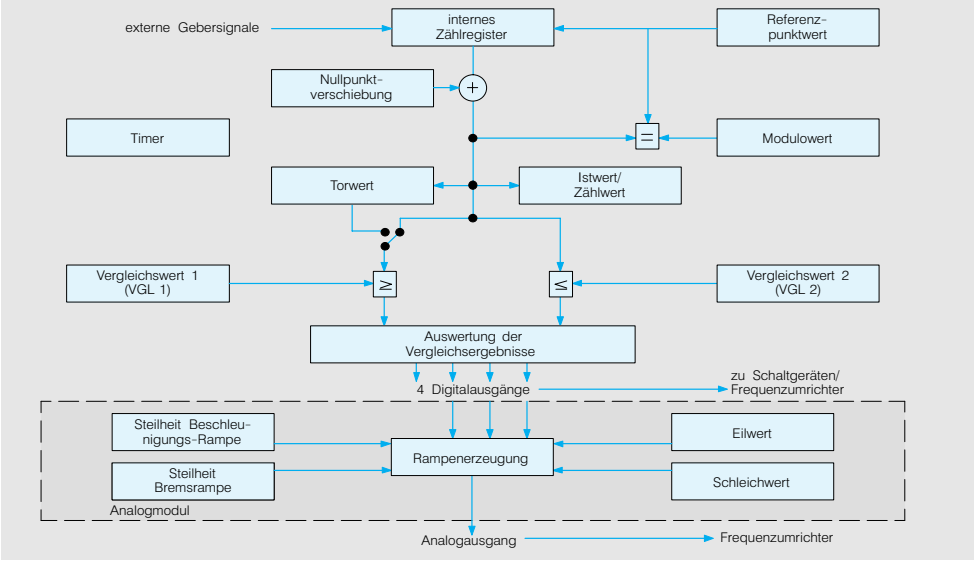


Bild 4/42 Struktur eines Kanals mit Analogmodul

Wegerfassungsbaugruppe WF 706 C (Fortsetzung)

Gesteuerte Positionierung mit IP 240 oder WF 706 C

	IP 240	WF 706
Anzahl der Achsen max.	2	3/6
Anschließbare Wegmeßger	• inkremental 5 V • inkremental 24 V	• inkremental 5 V • SSI-Absolut-Wertgeber
Geberfrequenz bei 5 V inkremental max. bei 24 V inkremental max. Übertragungsrate (SSI) max.	 500 kHz 70 kHz —	 500 kHz — 1 Mbit/s
Verfahrbereich	±9 999 999 Inkremente	16 777 215 Inkremente
Binäreingänge je Achse	Referenznocken (Vorkontakt)	Referenznocken (Vorkontakt)
Binärausgänge je Achse,	2 für • Eilgang • Schleichgang- oder • rechts • links	4 für • Eilgang • Schleichgang- oder • rechts • links
Speicherbare Positionen	254 je Achse	2 je Achse
Reaktionszeit	typ. 2 ms	< 50 µs
Belegte Adressen	16 Byte	8 Byte
Sonderfunktionen	• Längenmessung • externe Synchronisation • Zählfunktionen • Rundachse	• Längenmessung • externe Synchronisation • Zählfunktionen
Besondere Merkmale	• selbständige Berechnung der Schaltpunkte	• schneller Datenaus-tausch mit der CPU • kurze Reaktions-zeiten • Analogmodul für Frequenzumrichter (optional)

Technische Daten

Anschließbare Geber		inkrementale Geber synchr.-serielle Absolutwert-geber (SSI) 24-V-Signalgeber (BERO)
Wegerfassung inkremental 5-V-Eingänge (nach RS 422)		symmetrische Signale A, $\overline{A}$; B, $\overline{B}$; Z, $\overline{Z}$. Vierfachauswertung erfolgt immer
Verfahrbereich	max.	16 777 215 Inkremente
Potentialtrennung		nein
Zählfrequenz	max.	500 kHz
Leitungslänge(geschirmt)	max.	35 m
Wegerfassung absolut		13 Bit, 21 Bit und 25 Bit Daten-länge (SSI, Gray- oder Binär-Code) 24 Bit werden ausgewertet
Verfahrbereich	max.	8192 Winkelschritte je Umdrehung 2048 Umdrehungen
Potentialtrennung		nein
Übertragungsrate		62,5 kbit/s bis 1 Mbit/s
Leitungslänge (geschirmt) bei 125 kbit/s bei 1 Mbit/s	 max. max.	 120 m 25 m
Zählen 24-V-Eingänge Zählfrequenz Zählbereich	 max. max.	 siehe Binäreingänge 200 kHz 16 777 215
Binäreingänge Eingangsspannung Eingangsstrom		2 je Kanal 24 V 5 mA (bei 24 V)
Binärausgänge Ausgangsspannung Ausgangsstrom	 max.	4 je Kanal 24 V 0,5 A (kurzschlußfest)

Wegerfassungsbaugruppe WF 706 C (Fortsetzung)

Technische Daten (Fortsetzung)

Analogausgänge (optional)			Stromaufnahme (bei 5 V)		
• pro Modul		4	• 3-Kanal-Ausführung		0,75 A (ohne Geberversorgung)
angesteuert durch			• 6-Kanal-Ausführung		1,5 A (ohne Geberversorgung)
– WF 706 C		3	Versorgungsstrom für Wegmeßgeber bei		
– SIMATIC S5		1	5 V und bei 24 V	max.	0,3 A je Geber
• Ausgangsspannung		DC – 10 V ... +10 V	Belegte Adressen		8 Byte
Ausgangsstrom		– 5 mA ... + 5 mV	Platzbedarf		1 Einbauplatz
Reaktionszeit		< 50 µs bei ohmscher Last	• 3-Kanal-Ausführung		1 x $1^1/_3$ SEP
Überwachungen		auf Kabelbruch und Kurzschluß	• 6-Kanal-Ausführung		2 x $1^1/_3$ SEP
Versorgungsspannungen			Gewicht		
• Nennwert		DC 24 V	• 3-Kanal-Ausführung	etwa	0,4 kg
• Welligkeit U_{ss}		3 V	• 6-Kanal-Ausführung	etwa	0,45 kg
• zulässiger Bereich (Welligkeit eingeschlossen)		20 ... 30 V			

Bestelldaten

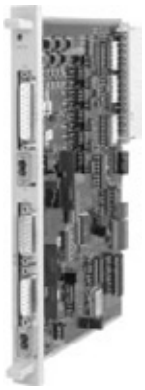
	Bestell-Nr.	Preis
Positionierbaugruppe WF 706 C		
mit 3 Kanälen	**6FM1 706-3AA20**	
mit 6 Kanälen	**6FM1 706-3AB20**	
Analogmodul	**6FM1 706-4AA00**	
zusätzlich zu bestellen ist **Beschreibung WF 706** mit Beispielprogramm-Diskette	**6ZB5 440-0KR01-0BA7**	

		Bestell-Nr.	Preis
Steckleitung 790			
zwischen WF 706 und			
• Heidenhain-Wegmeßgeber ROD 320			
Standardlängen	5 m	**6FM1 790-1BB00**	
	10 m	**6FM1 790-1BC00**	
	18 m	**6FM1 790-1BD00**	
Sonderlängen[1]: max. 35 m		**6FM1 790-1BZ00**	
• Siemens-Wegmeßgeber 6FC9 320 oder 6FX2 001-2			
Standardlängen	2 m	**6FM1 790-1CA00**	
	5 m	**6FM1 790-1CB00**	
	10 m	**6FM1 790-1CC00**	
	18 m	**6FM1 790-1CD00**	
Sonderlängen[1]: max. 35 m		**6FM1 790-1 CZ00**	
• SSI-Wegmeßgeber mit offenem Leitungsende			
Standardlängen	2 m	**6FM1 790-1FA00**	
	5 m	**6FM1 790-1FB00**	
	10 m	**6FM1 790-1FC00**	
	18 m	**6FM1 790-1FD00**	
Sonderlängen[1]: max. 25 m bei 1 Mbit/s max. 120 m bei 125 Kbit/s		**6FM1 790-1 FZ00**	

1) Länge im Klartext angeben.

Nockensteuerwerk WF 707

Anwendungsbereich



Das Nockensteuerwerk WF 707 dient der Ausgabe von wegabhängigen Schaltfunktionen bei Antrieben mit Linear- und Rundachsen. Das Einsatzgebiet liegt hauptsächlich bei kleinen und schnellaufenden Maschinen.

Aufbau

Die Baugruppe verfügt über 16 Nockenbahnen, auf denen insgesamt 32 Nocken verteilt werden können.

An die Baugruppe lassen sich folgende Geber anschließen:

- Inkrementalgeber
- Absolutwertgeber mit serieller Datenübertragung (SSI-Geber)
- Einfache 24-V-Signalgeber (BERO)

Durch die geringe Schnittstellenbreite von 8 Byte im Peripheriebereich können bis zu 16 Baugruppen in einem Automatisierungsgerät betrieben werden.

Die Baugruppe benötigt 1 Einbauplatz.

Arbeitsweise

32 Nocken, die beliebig auf 16 Nockenbahnen verteilt werden können, schalten genauer als 1 Grad bei 2400 Takten pro Minute. Das entspricht einer Reaktionszeit kleiner als 60 ms. Bei Verlängerung der Reaktionszeit auf ca. 120 ms stehen sogar 64 Nocken zur Verfügung.

Soll mit linearen Bewegungen gearbeitet werden, können jeweils 32 Nocken beliebig aufgeteilt werden für ein Nockenprogramm „Vorwärts“ und ein Nockenprogramm „Rückwärts“. Die Umschaltung zwischen den beiden Programmen erfolgt entweder mit Hilfe der automatischen Richtungserkennung oder gesteuert durch das Automatisierungsgerät.

Alle Nocken können wahlweise definiert werden als

- Weg-Weg-Nocken oder
- Weg-Zeit-Nocken.

Zusätzlich stehen zur Verfügung:

- Ein Zählnocken
- Ein Bremsnocken.

Durch die geschwindigkeitsabhängige, dynamische Verschiebung gleicht jeder Nokken automatisch die Totzeit des angeschlossenen Stellgliedes aus.

Jeder Nockendatensatz ist während des Betriebes über das Automatisierungsgerät veränderbar, so daß auch an der laufenden Maschine optimiert werden kann. Ein Rücklesen der Istwerte bzw. der aktuellen Nockendaten ist möglich.

Für jede Nockenbahn steht ein Digitalausgang 24 V/0,5 A auf der Baugruppe direkt zur Verfügung. Damit lassen sich die zu steuernden Aggregate direkt oder über Hilfsschütze ansteuern. Nicht benötigte Digitalausgänge können vom Automatisierungsgerät angesteuert werden.

Die Überwachung der

- Gebersignale,
- Synchronisation,
- Digitalausgänge

erhöht die Betriebssicherheit bzw. führt im Fehlerfall zu definierten Betriebszuständen und Meldungen.

Der Digitalausgang „OK-Meldung“ signalisiert den fehlerfreien Betrieb.

Die Synchronisation des Istwertzählers mit dem inkrementalen Geber ist möglich durch

- Geber-Nullmarke,
- externes Synchronisationssignal,
- externes Synchronisationssignal und Geber-Nullmarke (UND-Verknüpfung) und
- Synchronisationsbit vom Automatisierungsgerät.

Nockensteuerwerk WF 707 (Fortsetzung)

Gesteuerte Positionierung mit IP 241 und WF 707

	IP 241	WF 707
Anzahl der Kanäle	2	1
Weggebereingänge	mit Geberan-paßmodul: Geber mit 3-Excess-Gray-Code, BCD-Code, Dual-Code; Analogwertgeber	5-V-Inkremental-geber (RS 422) 24-V-Inkremental-geber SSI-Absolutwertgeber
maximale Zählfrequenz	50 kHz für digitale Werte; 200 kHz für absolute, serielle Meß-werteingabe	200 kHz bei 5 V, 100 kHz bei 24 V, 1 Mbit/s bei SSI-Geber
Nockensteuerwerk	pro Kanal 16 Spuren mit je 1 Nocke	16 Spuren mit 32/64 Nocken
Digitalausgänge pro Kanal		16, DC 24 V
Geberversorgung von der Baugruppe	ja	ja

Technische Daten

Für rotatorische Achse		
Nocken pro Nockenprogramm		32
Nocken wirksam		vorwärts/rückwärts
Zykluszeit pro Nockenprogramm		57,6 µs
Nocken pro Nockenprogramm		64
Nocken wirksam		vorwärts/rückwärts
Zykluszeit pro Nockenprogramm		115,2 ms
Für lineare Achse		
Nocken pro		
• Vorwärtsprogramm		32
• Rückwärtsprogramm		32
Zykluszeit pro Nockenprogramm		57,6 µs
Nocken		
Nockenarten		• Weg-Weg-Nocken • Weg-Zeit-Nocken • Zähl-Nocken • Brems-Nocken
Nockenbahnen	max.	16
Taktzahl/min	max.	2400

Programmierung		
Weg-Weg-Nocken		Start-/Endposition in Inkrementen
Weg-Zeit-Nocken		Startposition in Inkrementen, Zeit als Faktor zur Zykluszeit
anschließbare Geber		Inkrementalgeber Synchr.-serieller Absolutwert-geber (SSI-Absolutwertgeber) 24-V-Signalgeber (BERO)
erforderlicher Eingangsstrom der Gebersignale		10 mA
Nutzung des Gebersignals für weitere Baugruppen	max.	5
Wegerfassung, inkrementell		
5 V-Eingänge (nach RS 422)		symmetrische Signale A, $\overline{A}$; B, $\overline{B}$; z, $\overline{Zt}$. immer Vierfachauswertung
Verfahrbereich	max.	65 536 Inkremente
Potentialtrennung		nein
Zählfrequenz	max.	500 kHz

NockensteuerwerkWF 707 (Fortsetzung)

Technische Daten (Fortsetzung)

Wegerfassung, absolut		SSI mit 13 oder 25 Bit Datenlänge (Gray- oder Dual-Code) 16 Bit werden ausgewertet
Verfahrbereich	max.	65 536 Schritte
Potentialtrennung		nein
Übertragungsrate	max.	125 Kbit/s bis 1 Mbit/s
Digitaleingänge		3
Eingangsspannung		DC 24 V
Eingangsstrom		5 mA (bei 24 V)
Potentialtrennung		nein
Eingangsfrequenz	max.	100 kHz
Digitalausgänge		16
Ausgangsspannung		DC 24 V
Ausgangsstrom	max.	0,5 A kurzschlußfest
Potentialtrennung		nein

Überwachungen und Statusmeldungen	• Geber-Leitungsbruch • Geberfehler • Kurzschluß/Überlastung der Digitalausgänge • Synchronisation • Istwert • Nockenbahnstatus • Bewegungsrichtung
Versorgungsspannungen U_p	
• Nennwert	DC 24 V
• Welligkeit U_{ss}	3 V
• zulässiger Bereich (Welligkeit eingeschlossen)	20 bis 30 V
Versorgungsspannung	DC 5 V
Stromaufnahme bei DC 5 V ohne Geber	0,25 A
Versorgungsstrom für Weggeber bei DC 5 V und DC 24 V max.	0,3 A
Platzbedarf	1 Einbauplatz
Gewicht etwa	0,4 kg

Bestelldaten

	Bestell-Nr.	Preis
Nockensteuerwerk WF 707	**6FM1 707-3AA10**	
Steckleitung 790 zwischen WF 707 und		
• WF 707 zum Durchschleifen der Wegistwerte Längen 0,5 m	**6FM1 790-1JS00**	
2,0 m	**6FM1 790-1JA00**	
• Heidenhain-Wegmeßgeber ROD 320	siehe WF 706C (siehe Seite 4/85)	
• Siemens-Wegmeßgeber 6FC9 320 oder 6FX2 001-2	siehe WF 706C (siehe Seite 4/85)	
• SSI-Wegmeßgeber mit offenem Leitungsende	siehe WF 706C (siehe Seite 4/85)	

	Bestell-Nr.	Preis
Wegmeßgeber		
• für Anbau 1000 Pulse/Umdrehung	**6FX2 001-2CB00**	
2000 Pulse/Umdrehung	**6FX2 001-2CC00**	
2500 Pulse/Umdrehung	**6FX2 001-2CC50**	
• für Einbau in Motoren der Baureihe 1 FT	siehe Katalog SD 12	
• weitere Wegmeßgeber	siehe Katalog ST 71	
zusätzlich zu bestellen ist die **Beschreibung WF 707** mit Beispielprogramm-Diskette und EMV-Richtlinien	**6ZB5 440-0ST01-0BA3**	

Weitere Angaben zum Nockensteuerwerk finden Sie im Katalog AR 10.

Positionierbaugruppen WF 721/WF 723 A/WF 723 B/WF 723 C

Anwendungsbereich

Die Baugruppen WF 721, WF 723 A, WF 723 B und WF 723 C bilden die Positionierfamilie WF 721/WF 723. Diese Baugruppen decken das Positionierspektrum ab bezüglich geregeltem Positionieren von drehzahlgeregelten Antrieben für sowohl Einachs- als auch Mehrachsanwendungen.

Durch sie lassen sich die elektrischen und hydraulischen Achsen von Maschinen und Anlagen einfach und wirtschaftlich automatisieren, z. B.:

- Transferstraßen
- Fördereinrichtungen
- Montagelinien
- Beschickungseinrichtungen
- Pressen
- Holzbearbeitungsmaschinen
- Verpackungsmaschinen
- Handhabungsgeräte, Portale
- Sondermaschinen
- Rundtaktmaschinen

WF 721/WF 723 A

Die Positionierbaugruppe WF 721 ist für typische Einachs-Anwendungen geeignet, während die WF 723 A auch für die Anwendung von mehreren unabhängigen Achsen ausgelegt ist. Die Positionierbaugruppen WF 721/WF 723 A sind bezüglich der Funktionalität und der Datenformate der WF-Parameter identisch. Das heißt, ein Maschinendatensatz einer WF 723 A-Achse kann auch von einer WF 721-Achse interpretiert werden und umgekehrt. Die WF 721 besitzt darüber hinaus im Vergleich zu einer WF 723 A einen doppelt so schnellen Meßkreistakt. Sie ist deshalb besonders für dynamische Einachs-Positionieraufgaben geeignet.

WF 723 B

Die Positionierbaugruppe WF 723 B setzt auf der Funktionalität der WF 721/ WF 723 A auf und ergänzt das Positionierspektrum in der SIMATIC S5 hinsichtlich NC-Funktionalität. Die Positionierbaugruppe WF 723 B beinhaltet Bearbeitungsfunktionen wie Linear- und Zirkularinterpolation, Spindelfunktionen, Parameterrechnung und Standard-Bohrzyklen. Die Baugruppe WF 723 B läßt sich für drei Vorschubachsen, zwei Vorschubachsen und eine Spindel oder für drei Vorschubachsen und eine externe Spindel verwenden.

WF 723 C

Neben Einachs- und NC-Anwendungen gibt es weitere Positionieraufgaben, wobei mehrere Achsen in einem Verfahrprogramm koordiniert und damit verkettet zu verfahren sind. Die Positionierbaugruppe WF 723 C vervollständigt mit dieser Funktionalität die Positionierfamilie WF 721/ WF 723. Weitere wichtige Anforderungen können mit der WF 723 C erfüllt werden, z. B. schnelles und exaktes Positionieren von Walzenvorschüben und Gleichlauf von maximal 3 Achsen.

Aufbau

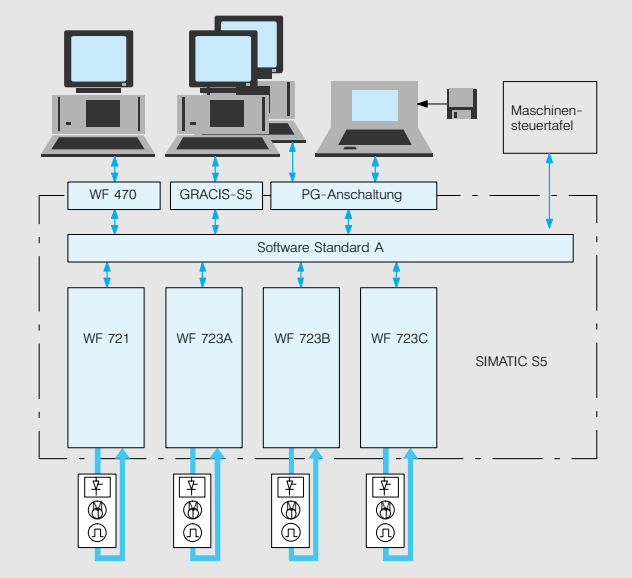


Bild 4/43 Struktur des Aufbaus zur Positionierung und Lageregelung

Durch die Standardisierung der Nahtstellen lassen sich Peripherie, Hardware- und Software-Module baugruppenübergreifend einsetzen. Dies spart Kosten bei der Projektierung, der Inbetriebnahme und dem Service.

An die Baugruppen lassen sich folgende Geber anschließen:

- Inkrementalgeber
- Absolutwertgeber mit serieller Datenübertragung (SSI)

Durch die geringe Schnittstellenbreite von 32 Byte im Peripheriebereich lassen sich bis zu 28 Baugruppen, d. h. 84 Achsen in einem Automatisierungsgerät betreiben.

Die Baugruppen benötigen jeweils 1 Einbauplatz. Ein Betrieb ohne Lüfter ist möglich.

Positionierbaugruppen WF 721/WF 723 A/WF 723 B/WF 723 C (Fortsetzung)

Arbeitsweise

Die Baugruppen ermöglichen schnelles und genaues Positionieren beim Einrichten, Zustellen, Handhaben und Transportieren sowie eine hohe Oberflächengüte bei einfachen Bearbeitungsaufgaben. Folgende Betriebsarten sind möglich:

Betriebsarten	WF 721	WF 723 A	WF 723 B	WF 723 C
Einrichten	x	x	x	x
Referenzpunktfahren	x	x	x	x
Handbetrieb (MDI)	x	x	x	x
Steuern	x	x	x	x
Automatik	x	x	x	x
Automatik-Einzelschritt	x	x	x	x
Automatik-Einzelsatz	—	—	x	x
Nachführbetrieb	x	x	x	x
Slave	—	—	—	x

Weitere Merkmale
- Vorschubkorrektur (Override)
- Rundachse
- Beschleunigungsorverride
- Werkzeugkorrektur
- Schnelle Ein-/Ausgänge

Mit Maschinendaten wird die Positionierbaugruppe an die spezielle Bearbeitungstechnologie angepaßt.

Geregelte Positionierung mit IP 246, WF 721 oder WF 723 A

	IP 246	WF 721	WF 723 A
Anzahl der Achsen max.	2	1	3
Anschließbare Wegmeßgeber	• inkremental 5 V • inkremental 24 V • Absolutwertgeber parallel	• inkremental 5 V • SSI-Absolutwertgeber	• inkremental 5 V • SSI-Absolutwertgeber
Grundauflösung	0,1 ... 99,9 µm	1, 10, 100 µm	1, 10, 100 µm
Geberfrequenz • absolut • bei 5 V inkremental max. • bei 24 V inkremental max.	 — 500 kHz 50 kHz	 — 200 kHz —	 1 Mbit/s 200 kHz —
Verfahrbereich Verfahrgeschw. max. Beschleunigung	± 40 m 65 000 mm/min 9999 mm/s²	± 1000 m 500 000 mm/min 99999 mm/s²	± 1000 m 500 000 mm/min 99999 mm/s²
Programmspeicher	10000 Zeichen (etwa 500 Sätze) in bis zu 255 Programmen	bis zu 250 Sätze in bis zu 200 Programmen	bis zu 750 Sätze in bis zu 200 Programmen
Ausgabe M-Funktionen	während des gesamten Verfahrsatzes	zeit- oder quittungsgesteuert vor, während oder nach Verfahrsatz, istwertbezogen	
Verweilzeiten	100-ms-Schritte	4-ms-Zeit-raster	4-ms-Zeit-raster
Sonderfunktionen • Ruckbegrenzung • schnelle Eingänge für Prozeßsignal	 — 4 Binäreingänge • Start/Stopp von extern	 ja 6/6 Binäreingänge für • externen Satzwechsel • Start von extern • externen Satzwechsel mit fliegendem Istwert-Setzen • fliegendes Messen	
• Simulation • Satz-Vorlauf/-Rücklauf • Satz Ausblenden	— — —	ja ja ja	
PG-Anschluß	ja	für COM 723, PC-Steuern zentral über SIMATIC S5-PG-Schnittstelle	
Software für • Erstellen von Maschinendaten und Verfahrprogramm • Unterstützung bei Test und Inbetriebnahme	 COM 246 COM 246 und Standard-Funktionsbausteine	 COM 723 und Standard B-470, Standard-B-OP25 Standard B-GRACIS Standard A und Standard B-470, Standard-B-OP25 Standard B-GRACIS PC-Steuern	

Positionierbaugruppen WF 721/WF 723 A/WF 723 B/WF 723 C (Fortsetzung)

Programmierung

Der modulare Aufbau der Standard-Software erleichtert das Erstellen maschinenspezifischer STEP 5-Programme. Der Speicher der SIMATIC S5 wird dabei nicht belastet. Die Programme lassen sich auch im Simulationsbetrieb testen, ohne die Maschine in Betrieb zu nehmen.

Die Kommunikation zwischen der SIMATIC S5 und den Positionierbaugruppen übernimmt die Software Standard A.

Speicherkapazität	WF 721	WF 723 A	WF 723 B	WF 723 C
Anzahl Programme	200	200/Achse	200	200/Achse
Anzahl/ Sätze/Programme	100	100	200	200
max. Gesamtanzahl Sätze	250	750	1000	1000

Bedienung über	WF 721	WF 723 A	WF 723 B	WF 723 C
COM 723	x	x	x	x
PC-Steuern	x	x	x	x
Standard B-470	x	x	—	—
Standard B-GRACIS	x	x	x	—
Standard B-OP25	x	x	in Vorbereitung	in Vorbereitung

COM 723

Komfortabel bei Programmierung und Projektierung und unterstützend bei Inbetriebnahme und Service. Das Software-Paket COM 723 in Verbindung mit SYSDOK 723 hilft. Einfach und schnell lassen sich mit COM 723 Datensätze erstellen und archivieren, die damit im Inbetriebnahme- und Servicefall schnell und unabhängig verfügbar sind.

COM 723 bietet:

- Einfache Handhabung durch bedienergeführte Window-Technik auf Basis Windows 3.1
- Einfache, kurze und flexible Projektierung und Inbetriebnahme durch Plausibilitätskontrollen und Offline-Projektierung im Büro
- Kurze Projektierungszeiten durch das Duplizieren von Anlagendateien und das gemeinsame Datenformat mit Standard B-GRACIS
- Einfacher und schneller Baugruppentausch durch Einstellung und Parametrierung der Baugruppe mittels Job-listen
- Servicefreundlichkeit durch das schnelle Vergleichen von Dateninhalten
- Gut lesbare Datensätze durch mögliche anwenderspezifische Erläuterungen
- Schneller Zugriff auf unterstützende Informationen durch die systemintegrierte, papierlose Dokumentation SYSDOK 723

SYSDOK 723

Die Systemintegrierte Dokumentation SYSDOK 723 beinhaltet die papierlose Form der jeweiligen Funktionsbeschreibung bzw. Programmieranleitung.

SYSDOK 723 basiert auf dem Standard-Hilfesystem von MS-Windows und läuft in einem eigenen Fenster neben COM 723. Es bietet neben der kontextbezogenen Hilfe folgende Funktionen:

- Einblendung und Sprünge zu verwandten Themen
- Blättern
- schrittweises Zurückverfolgen des Informationspfades
- elektronische Lesezeichen
- elektronische Notizzettel
- Suchen mit zweistufigem Index

PC-Steuern

Mit PC-Steuern steht zu Inbetriebnahme- und Testzwecken ein hilfreiches Werkzeug zur Verfügung. Erste Verfahrergebnisse der Achsen sind ohne die später hinzukommende Maschinensteuertafel möglich.

Im Servicefall kann der Anwender zum Lokalisieren eines Fehlers die Achsen direkt verfahren oder mit Statusanzeige einen Achsfehler im Klartext auslesen.

Vor unbefugten Eingriffen läßt sich das Software-Paket PC-Steuern durch die Funktion Schlüsselschalter schützen.

Die Bedienung von PC-Steuern erfolgt unter Windows ab Version 3.1.

Positionierbaugruppen WF 721/WF 723 A/WF 723 B/WF 723 C (Fortsetzung)

Programmierung (Forsetzung)

Standard Bedienoberfläache

Zur Bedienung und Diagnose der Positionierbaugruppe WF 721/723A stehen Standard-Masken für das Bildschirmsystem WF 470 und das Operator Panel OP 25 zur Verfügung.

Die Kopplung zwischen SIMATIC S5 und dem Visualisierungsgerät erfolgt mit den Software-Paketen Standard B-470 bzw. Standard B-OP 25. Diese bieten standardisierte Masken und ermöglichen zusammen mit der Menütechnik eine komfortable Bedienung. Von der Eingabe der Maschinendaten bei der Inbetriebnahme über die Programmierung der Verfahrbewegung bis zur Fehlerdiagnose wird der Anwender mit Masken geführt.

Außerdem besteht die Möglichkeit, die Maschine an den jeweiligen Prozeß durch frei projektierbare Masken anzupassen.

Standard B-GRACIS

Mit der Bedienoberfläche Standard B-GRACIS können die Bedienung und Diagnose sowie die Datenverwaltung und Datenversorgung der Positionierbaugruppen WF 721/723A und WF 723 B realisiert werden. Standard B-GRACIS ist sowohl unter GRACIS ULB (unterer Leistungsbereich) als auch unter GRACIS OLB (oberer Leistungsbereich) ablauffähig.

Neben Standard-Masken bietet das Visualisierungssystem GRACIS die Möglichkeit, die Maschine an den jeweiligen Prozeß durch frei projektierbare Masken anzupassen. Die einfache Bedienerführung erfolgt über Menütechnik und Softkey-Leiste.

Standard B-GRACIS bietet:

- Einfache Handhabung durch bedienergeführte Menütechnik und Hinweise in der Statuszeile
- Zeit- und Kostenersparnis in Verbindung mit der SIMATIC S5-CPU durch Standard B-GRACIS-Lösung auf Basis GRAPI (Gracis Applikations Interface)
- Schnelle, kurze Fehlerlokalisierung und Inbetriebnahme durch eindeutige Schnittstellen und Meldungen im Klartext
- Bedienerfreundliche Bedienung durch einmalige Zuordnung der Einheit in der Projektierungsphase
- Einfaches Ändern/Editieren von Datensätzen durch Plausibilitätskontrollen
- Standardbilder, die sich um spezielle Anlagenbilder erweitern lassen

Bei Standard B-GRACIS OLB stehen für die Verwaltung, Versorgung und Projektierung eigene Menüzweige zur Verfügung. Dadurch kann man komfortabel Datensätze kopieren und verliert bei komplexen Anlagen nie den Überblick.

Standard B-GRACIS OLB bietet zusätzlich:

- Hohe Verfügbarkeit im Falle eines Baugruppendefekts durch zentrale Datenarchivierung
- Kurze Projektierungszeiten durch das Duplizieren der Anlagendateien und das gemeinsame Datenformat mit COM 723
- Sowohl lokalen als auch vernetzten Einsatz (PROFIBUS oder Industrial Ethernet)
- Effektive Projektierung durch offene Struktur mit Import-Export-Funktionen
- Gut lesbare Datensätze durch mögliche anwenderspezifische Erläuterungen

Technische Daten

	WF 721	WF 723 A	WF 723 B	WF 723 C
Meßsysteme	inkrementelle Geber SSI-Absolutwertgeber	inkrementelle Geber SSI-Absolutwertgeber	inkrementelle Geber SSI-Absolutwertgeber	inkrementelle Geber SSI-Absolutwertgeber
Anzahl Kanäle	1	3 unabhängige Achsen	3 Vorschubachsen oder 2 Vorschubachsen/ 1 Spindel oder 3 Vorschubachsen/ 1 externe Spindel	bis zu 3 unabhängig kombinierbare Achsen 2 Walzenvorschub/ 1 Achse 1 Walzenvorschub 2 Achsen
Verfahrgeschwindigkeit				
• von mm/min	0,01	0,01	0,05	0,01
• bis mm/min	500 000	500 000	500 000	500 000
Beschleunigung				
• von mm/s^2			1	1
• bis mm/s^2	99 999	99 999	99 999	99 999
Ruckbegrenzung				
• von mm/s^2	1	1	—	1 (in Vorbereitung)
• bis mm/s^2	999 999	999 999	—	999 999 (in Vorbereitung)
Verfahrbereich in m	± 999.999 999	± 999.999 999	± 999.999 999	± 999.999 999
max. Spindeldrehzahl (1/min)	—	—	12 000	—

Positionierbaugruppen WF 721/WF 723 A/WF 723 B/WF 723 C (Fortsetzung)

Technische Daten (Fortsetzung)

	WF 721	WF 723 A	WF 723 B	WF 723 C
Kenngrößen				
• 1 Referenzpunkt je Achse	x	x	x	x
• 2 Software-Endschalter	x	x	x	x
• Rundachse rangierbar	x	x	x	x
• Umkehrlose-Kompensation	x	x	x	x
• TEACH IN	x	x	x	x
• Istwertbewertungsfaktor zur Anpassung von Getriebeübersetzungen	x	x	x	x
• 6 Nullpunktverschiebungen	—	—	x	x
• Linear-/Zirkularinterpolation	—/—	—/—	3D/2D	2D/—
• Schraubenlinien-/F-Wort-Interpolation	—/—	—/—	x/x	—/—
• Standard-Bohrzyklen/Parameter	—/—	—/—	x/x	—/—
• orientierter Spindelhalt	—	—	x	—
• Gleichlauf von 3 Achsen	—	—	—	x
• Verfahrprogramme DIN 66025	x	x	x	x
Walzenvorschub	—	—	—	x[1)]
Technologische Korrekturen				
• Vorschub/Beschleunigung (Override)	x/x	x/x	x/—	x/x
• Driftkompensation	x	x	x	x
• Werkzeugkorrektur	Länge, Verschleiß	Länge, Verschleiß	Länge, Radius, Verschleiß	Länge, Verschleiß
Eingänge für Prozeßsignale				
• fliegendes Messen/Istwertsetzen	x/x	x/x	x/—	x/x
• Start UND/ODER verknüpft	x	x	x	x
• externer Satzwechsel	x	x	—	x
• Referenzpunktverfahren ohne BERO/-setzen	x/x	x/x	x/—	x/x
• Istwert sperren/Einlesefreigabe extern	—/—	—/—	—/—	x/x
Ausgänge für Prozeßsignale				
• Änderung von M-Funktionen	x	x	x	x
• Position erreicht und Halt	x	x	x	x
• Achse fährt vorwärts/rückwärts	x	x	x	x
• Startfreigabe	x	x	x	x
• Konstantfahrt/Beschleunigen, Verzögern	—/—	—/—	—/—	x/x
Schaltfunktionen (M-Funktionen, BCD-Ausgabe + 2 Dekaden)				
• quittungs-/zeitgesteuert	x/x	x/x	x/x	x/x
• wegabhängig	x	x	—	—
Überwachungen				
• Systemprogrammspeicher	x	x	x	x
• Busnahtstelle	x	x	x	x
• Ein-/Ausgabe der Daten	x	x	x	x
• Schleppabstand	x	x	x	x
• Spannungswerte 5 V, 15 V, 24 V	x	x	x	x
• Meßkreis	x	x	x	x
• Gleichlauftoleranz	—	—	—	—
Versorgungsspannungen				
• Baugruppe (von SIMATIC S5-Bus) Spannung/Stromaufnahme	DC 5 V/ 1,0 A	DC 5 V/ 1,3 A	DC 5 V/ 1,4 A	DC 5 V/ 1,4 A
• Geber Spannung intern/extern	DC 5 V/DC 24 V	DC 5 V/DC 24 V	DC 5 V/DC 24 V	DC 5 V/DC 24 V
Stromaufnahme bei DC 5 V/ DC 24 V je Geber	0,3 A	0,3 A	0,3 A	0,3 A
• Eingänge (pro Kanal) Spannung/Stromaufnahme	DC 24 V/5 mA	DC 24 V/5 mA	DC 24 V/5 mA	DC 24 V/5 mA
• Ausgänge (pro Kanal) Spannung/Strom max.	DC 24 V/500 mA	DC 24 V/500 mA	DC 24 V/500 mA	DC 24 V/500 mA
Signalspannungs-Sollwert				
• Spannung/Strom bei ± 10 V	± 10 V/2 mA	± 10 V/2 mA	± 10 V/2 mA	± 10 V/2 mA

Positionierbaugruppen WF 721/WF 723 A/WF 723 B/WF 723 C (Fortsetzung)

Technische Daten (Fortsetzung)

	WF 721	WF 723 A	WF 723 B	WF 723 C
Ein- und Ausgänge				
• parametrierbare Aus-/Eingänge	6/6	6/6	6/6	6/6
• Reglerfreigabe/Reglerrückmeldung	1/1	3/3	3/3	3/3
SIMATIC S5-115U, -135U, -155U				
• Platzbedarf	1 x $1^1/_3$ SEP	1 x $1^1/_3$ SEP	1 x $1^1/_3$ SEP	1 x $1^1/_3$ SEP
• belegter Adreßraum	32 Byte	32 Byte	32 Byte	32 Byte
• Anzahl Baugruppen, max.	28	28	28	28
• Betrieb ohne Lüfter	möglich	möglich	möglich	möglich
Gewicht etwa	0,6 kg	0,7 kg	0,7 kg	0,7 kg

1) Funktionen Walzenvorschub: Konstantfahrt, Ruck am Beschleunigungsanfang, Beschleunigungsknickpunkte, Istwertnullen bei Start oder externer Einlesefreigabe, Überspeichern des Geschwindigkeitswertes, Druckmarkensteuerung

Bestelldaten

	Bestell-Nr.	Preis
Positionierbaugruppe WF 721	**6FM1 721-3AA20**	
Positionierbaugruppe WF 723 A	**6FM1 723-3AA10**	
Firmware-Hochrüstsatz WF 721	**6FM1 721-4AA00**	
Firmware-Hochrüstsatz WF 723 A	**6FM1 723-4AA00**	
Positionierbaugruppe WF 723 B	**6FM1 723-3BA00**	
Firmware-Hochrüstsatz WF 723 B	**6FM1 723-4BA00**	
Positionierbaugruppe WF 723 C	**6FM1 723-3CA00**	
Wegmeßgeber, inkrementell		
• für Anbau		
1000 Pulse/Umdrehung	**6FX2 001-2CB00**	
2000 Pulse/Umdrehung	**6FX2 001-2CC00**	
2500 Pulse/Umdrehung	**6FX2 001-2CC50**	
weitere	siehe Katalog ST 71	
• für Einbau in Motoren der Baureihe 1FT	siehe Katalog SD 114	
Standard A Kopplung SIMATIC S5 mit WF-Technologiebaugruppen	**6FM1 700-7UA31-1AA0**	
Standard B-470 STEP 5-Bausteine für SIMATIC S5 und Bildmasken für WF 470 Kopplung Standard A mit WF 470 Software für Datenverkehr	**6FM1 723-8AA31-1AA0**	
Standard-B-GRACIS ULB Bildmasken und Textlisten für GRACIS ULB Kopplung Standard A mit GRACIS Grund-Software	**6FM1 723-8UD31-1MA0**	
Standard B-GRACIS OLB Applikationen und Bildmasken für GRACIS OLB Kopplung Standard A mit GRACIS Grund-Software	**6FM1 723-8UC31-1AA0**	
Standard-B-OP 25 STEP 5-Bausteine für SIMATIC S5 und Bildmasken für OP 25 Kopplung Standard A	**6FM1 025-8AA30-1MA0**	
Software-Pakete für Programmiergeräte PG 710+/720/730/740/750/760/770 oder IBM-kompatiblen Standard-PC (Diskette 3,5" MS-DOS)		
Software COM 723 einschließlich SYSDOK 723 und Beschreibung COM 723	**6FM1 723-6UA31-1AA0**	
PC-Steuern	**6FM1 723-6UB30-1MA0**	

	Bestell-Nr.	Preis
Dokumentation		
Kurzbeschreibung WF 721/ WF 723A deutsch	**6ZB5 440-0PW01-0BA5**	
Handbuch WF 721/ 723A komplett		
• deutsch	**6ZB5 440-0VK01-0BA2**	
• englisch	**6ZB5 440-0VK02-0BA2**	
SYSDOK 723A		
• deutsch	**6ZB5 440-0RS01-2AA6**	
• englisch	**6ZB5 440-0RS02-2AA5**	
Kurzbeschreibung WF 723B deutsch	**6ZB5 440-0SB01-0BA1**	
Beschreibung WF 723B deutsch	**6ZB5 440-0SC01-0BA1**	
Handbuch WF 723B komplett		
• deutsch	**6ZB5 440-0VM01-0BA1**	
• englisch	**6ZB5 440-0VM02-0BA1**	
SYSDOK 723B		
• deutsch	**6ZB5 440-0SJ01-2AA2**	
• englisch	**6ZB5 440-0SJ02-2AA2**	
Kurzbeschreibung WF 723C		
• deutsch	**6ZB5 440-0VS01-0BA0**	
• englisch	**6ZB5 440-0VS02-0BA0**	
Beschreibung WF 721/WF 723		
• deutsch	**6ZB5 440-0VP01-0BA2**	
• englisch	**6ZB5 440-0VP02-0BA2**	
Handbuch WF 723C komplett		
• deutsch	**6ZB5 440-0VY01-0BA1**	
• englisch	**6ZB5 440-0VY02-0BA1**	
SYSDOK 723C deutsch	**6ZB5 440-0WA01-2AA2**	
Steckleitung 790		
zwischen		
• WF 721 und Stromrichter		
Standardlängen 2 m	**6FM1 790-2BA00**	
5 m	**6FM1 790-2BB01**	
10 m	**6FM1 790-2BC00**	
Sonderlängen, max. 30 m[1]	**6FM1 790-2BZ00**	
• WF 723 und Stromrichter		
Standardlängen 2 m	**6FM1 790-2CA00**	
5 m	**6FM1 790-2CB00**	
10 m	**6FM1 790-2CC00**	
Sonderlängen, max. 30 m[1]	**6FM1 790-2CD00**	
zwischen WF-Baugruppe und		
• Heidenhain ROD 320	siehe WF 706C	
• Siemens-Wegmeßgeber 6FC9 320	siehe WF 706C	
• SSI-Wegmeßgeber, 1 Leitungsende offen	siehe WF 706C	

[1] Länge in Klartext angeben.

Overview

Overview

Special functions

Memory	Page	PC functions	Page
CP 516 memory submodule	4/95	CP 581, the integral PC in the SIMATIC	4/96
		CP 581 with COROS LS-B	4/100
		Videomat IV	4/107

Supplementary devices

Simulation	Page
Simulation modules	4/104
313 monitoring module	4/105

CP 516 memory submodule

Application

The CP 516 memory submodule is used for storing large amounts of data which are not constantly required in the user memory of the CPU, e.g. recipes and message texts. The module can also be used as a backup medium for production data acquisition.

Design

Two memory cards can be inserted in the CP 516 memory submodule. Memory cards with flash EPROM are useful for storing data for reading only. For greater data protection when using RAM memory cards, a lithium battery can be fitted in the CP 516 memory submodule, to ensure that the data is retained when the CP 516 is not plugged in.

The module has a special connection for data interchange with a programming device.

Principle of operation

Data storage is controlled by the CPU using a standard function block. The data handling blocks for communications are already inserted in the operating system of the central controller (CPU).

Technical specifications

Number of memory locations		2	Power loss	max.	5 W
Memory capacity	max.	8 Mbyte	Space requirements		1 slot
Current consumption (at 5 V)	max.	0.8 A	Weight		0.6 kg (1.32 lb)

Ordering data

	Order No.		Order No.
CP 516 memory submodule	**6ES5 516-3UA11**	**Memory card**	
Standard function blocks including CP 516 manual	see Section 7	RAM, 256 Kbytes	**6ES5 374-2AH21**
		RAM, 512 Kbytes	**6ES5 374-2AJ21**
To be ordered as a separate item:		RAM, 1 Mbytes	**6ES5 374-2AK21**
CP 516 manual		Flash EPROM, 256 Kbytes	**6ES5 374-2FH21**
German	**6ES5 998-1EB11**	Flash EPROM, 1 Mbytes	**6ES5 374-2FK21**
English	**6ES5 998-1EB21**	Flash EPROM, 2 Mbytes	**6ES5 374-2FL21**
French	**6ES5 998-1EB31**	Flash EPROM, 4 Mbytes	**6ES5 374-2FM21**
		Lithium backup battery for CP 516	**6ES5 980-0AE11**

CP 581; the integral PC in the SIMATIC

Application

The CP 581 is an AT-compatible PC for use in the S5-115U, S5-135U and S5-155U/H programmable controllers. When linked to the CPU of the programmable controller it offers additional computing power for solving complex automation tasks.

The CP 581 is used for acquisition, processing and storage of large quantities of data. The CP 581 also allows you to incorporate especially simple PC applications under MS-DOS into automation applications.

Since there is no rotating memory on the basic board, the CP 581 can also be used reliably in applications where the shock level is high.

Design

The CP 581 has a modular design. It consists of a basic board and optionally a mass storage module and up to 2 slot modules.

CP 581 basis board

The basic board contains the following:

- 80486 DX4 microprocessor (100 MHz)
- VGA graphics interface (can be disabled)
- User memory, modular with 4 to 32 Mbyte
- Receptacle for a memory card with 1 Mbyte, 2 Mbyte, 4 Mbyte, 8 Mbyte or 16 Mbyte capacity
- Optional 4 Mbyte onboard silicon disk can be accessed as drive and implemented with flash EPROMS
- 1 V.24/TTY interface (COM 1) for printer
- 1 V.24/RS 485 interface (COM 2) for mouse
- 1 free V.24/RS 485 interface (COM 3)
- 1 VIDEO interface for multifrequency monitor (3 Coax midi sockets) for distances up to 250 m (820 ft)
- 1 interface for standard keyboard, for distances up to 250 m (820 ft) with remote terminal interface (RTI)

Operator controls and indicators on the front panel:

- "RUN"-"STOP" switch: The tasks executed for the different switch settings can be specified in the user program (e.g. application start in the case of "RUN").
- "RESET" pushbutton
- LEDs: "RUN" (green) for operation "STOP" (red) for interrupts
- LEDs: "Fault" (red) for module faults, "SD" (green) for indicating memory card access

Mass storage module

Every basic board can be expanded by a mass storage-module.

A mass storage module consists of the following:

- Hard disk drive with at least 800 Mbyte capacity
- $3^1/_2$" diskette drive
- 1 Centronics interface for e.g. dongle, printer
- 1 free V.24/TTY interface (COM 4)

Operator controls and indicators on the front panel:

- "HD" LED (green) indicates access to the hard disk

Slot module

A basic board can be expanded by up to 2 slot modules.
A short AT module can be plugged into a slot module.

The short AT module for the CP 581 can be up to 10 mm wide, 120 mm high and 165 mm deep.

The CP 581 receives its power supply and battery backup from the programmable controller.

The CP 581 integral personal computer requires 1 to 4 slots depending on configuration.

CP 581 system software

The CP 581 system software contains communications software for data exchange with the CPU of the programmable controller (see Fig. 4/44) and the CP_Link software.

CP_Link enables start-up of the basic board without mass memory module using a programming device or PC via the interface (COM 1) of the CP 581. Using CP_Link, the operating system and the user program can be loaded into the basic board without mass storage module.

CP 581, the integral PC in the SIMATIC (continued)

Design (continued)

Operating system

Communication with the CPU of the programmable controller is supported by the sys-tem software of the CP 581 under the MS-DOS operating system.

The German version of the MS-DOS V 6.22 operating system is included in the scope of delivery of the basic board.

Language upgrades for English and French are to be ordered separately.

Principle of operation

While the CPU of the programmable controller concentrates on the pure control tasks, the CP 581 integral personal computer handles acquisition, processing and storage of large data quantities. MS-DOS standard user programs can be used for these tasks.

The CPU of the programmable controller communicates with the CP 581 via the S5 backplane bus. This ensures effective data exchange. Standard data handling blocks must be loaded into the program memory of the programmable controller's CPU for data exchange purposes. Addressing of the CP 581 is either linear or via pages (8 Kbyte dual-port RAM).

The CP 581 can also be used as a standard PC.

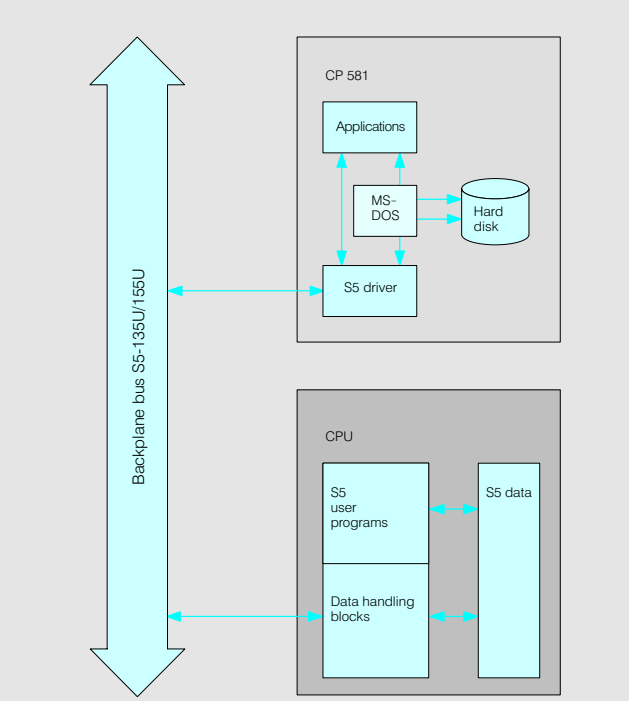


Fig. 4/44 Data exchange between CP 581 and CPU

Functions

Process data acquisition

This function can be used to capture data from different S5 data areas, such as data blocks and bit memories, in the CP 581. This data can be read globally or selectively from the data area within a defined timebase and collected in one or more files in the CP 581. The CP 581 can record the collected and converted process data and then manage and process this data with a suitable MS-DOS user program (e.g. dBASE), and all independently of the programmable controller.

S5 drive emulation

Thanks to the S5 drive emulation, S5 data can easily be incorporated into CP 581 programs.

- S5 data blocks can be converted automatically in order to incorporate them e.g. into standard programs such as Excel or Lotus 1-2-3 without any intermediate steps.
- S5 data blocks can be accessed via almost all MS-DOS commands.

After starting the drive emulation (S5 Remote), the CP 581 provides a new (virtual) drive. This is a logical and not a physical drive. There are 4 catalogs on this drive, one each for the CPUs 1 to 4. The CP 581 stores the data blocks of the CPUs in the catalogs in the form of MS-DOS files. It is operated on-line with data of the S5-CPU.

CP 581, the integral PC in the SIMATIC (continued)

Functions (continued)

Mass storage functions

If there is insufficient memory space available on the CPU of the programmable controller, it is possible to use these functions to store data in the CP 581 and to fetch it back to the CPU as required - selectively, if desired.

The mass storage functions also offer the facility of deleting an entire CP 581 catalog (without subcatalog) from the CPU.

Command interpreter

This function is used to execute any MS-DOS commands on the CP 581 from the CPU. If the CP 581 is operated without keyboard and-monitor (e.g. mass memory functions), the command interpreter can be used, if necessary, to copy data on the CP 581 or to execute other necessary MS-DOS functions.

Programming

Programming is used to solve all those tasks resulting from communication between the CPU and the CP 581 which cannot be handled by the system programs supplied. These include, e.g., data exchange with higher-level computers or operator inputs for a CPU.

Additional functions

Interrupts are possible from the CP 581 integral PC to the CPU of the programmable controller and vice versa.

Direct network connection is possible via a slot module.

The booting sequence can be selected freely by the user.

Technical specifications

Basic board		
Microprocessor		80486DX4
Clock frequency		100 MHz
Coprocessor		Integrated
Onboard silicon disk (optional)		4 Mbyte
User memory		Without; can be equipped modularly up to 32 Mbyte
Ambient temperature		
• Operating		+ 5 °C to + 55 °C
• Transport/storage		- 20 °C to + 60 °C
• Relative humidity		8 to 80 % at 25 °C, no condensation
Supply voltage		5 V DC, ± 5 % 24 V DC, + 25 %/- 15 %
Current consumption		
• At + 5 V	typ.	1.8 A
• At + 24 V	typ.	0.1 A
Power loss	approx.	12 W
Dual-port RAM		8 Kbyte
Space requirements		1 slot
Weight		0.5 kg (1.1 lb)
Mass storage module		
Diskette drive		$3\,^1/_2$"
Hard disk drive (memory capacity)	min.	800 Mbyte
Shock (measured on hard disk drive)		
• Form	max.	$^1/_2$ sine
• Duration	max.	11 ms
• Operating	max.	50 m/s²
• Transport	max.	500 m/s²
Vibration (measured on hard disk drive)		
• Operating	max.	5 m/s²
• Transport	max.	20 m/s²
Ambient temperature		
• Operating		+ 5 °C to + 55 °C
• Transport/storage		- 20 °C to + 60 °C
Relative humidity		8 to 80 % at 25 °C, no condensation
Supply voltage		5 V DC, ± 5 % 24 V DC, + 25 %/- 15 %
Current consumption		
• At + 5 V	typ.	0.5 A
• At + 24 V	typ.	0.1 A
Space requirements		1 slot, beside the basic board
Weight		0.9 kg (2 lb)
Slot module		
Ambient temperature		
• Operating		+ 5 °C to + 55 °C
• Transport/storage		- 20 °C to + 60 °C
Relative humidity		8 to 80 % at 25 °C, no condensation
Supply voltage		5 V DC, ± 5 4 V DC, + 25 %/-15 %
Current consumption		
• At + 5 V	typ.	0.8 A (without AT module)
• At + 24 V	typ.	—
Space requirements		1 slot beside the basic board, mass storage module or slot module
Weight		0.3 kg (0.66 lb)

CP 581, the integral PC in the SIMATIC (continued)

Ordering data	Order No.
CP 581 basic board for S5-115U/H, S5-135U and S5-155U/H 80 486 DX4 microprocessor 100 MHz, without user memory, incl. MS-DOS V 6.22 German	**6ES5 581-0ED13**
Memory expansion	
• For internal RAM	
4 Mbyte	**6ES7 478-1AM00-0AA0**
8 Mbyte	**6ES7 478-1AN00-0AA0**
16 Mbyte	**6ES7 478-1AP00-0AA0**
32 Mbyte	**6ES7 478-1AQ00-0AA0**
• For Silicon disc (OSD) Flash EPROM 4 Mbyte	**6ES7 478-1BM10-0AA0**
Y adapter	
• For converting COM 1/COM 3 to standard connectors	**6ES5 714-2AS01**
• For keyboard/COM 2	**6ES5 714-2AT01**
Extension for keyboard/mouse RTI (remote terminal interface)	**6ES5 751-3AA12**
RTI connecting cable	
10 m (32.8 ft)	**6ES5 714-3CB00**
20 m (65.6 ft)	**6ES5 714-3CC00**
25 m (82 ft)	**6ES5 714-3CC50**
32 m (104 ft)	**6ES5 714-3CD20**
40 m (131.2 ft)	**6ES5 714-3CE00**
50 m (164 ft)	**6ES5 714-3CF00**
63 m (206.6 ft)	**6ES5 714-3CG30**
80 m (262.4 ft)	**6ES5 714-3C J00**
100 m (328 ft)	**6ES5 714-3DB00**
200 m (656 ft)	**6ES5 714-3DC00**
PG keyboard	**6ES9 501-3CA00–0AX0**

	Order No.
RGB/VGA adapter for connecting multi-frequency monitors with standard VGA connector (monitor must be able to filter the sync signals from the green channel)	**6ES5 714-2AV01**
Connecting cables for monitors (3 cables are required per monitor)	
3.2 m (10.4 ft)	**6ES5 736-2BD20**
5 m (16.4 ft)	**6ES5 736-2BF00**
10 m (32.8 ft)	**6ES5 736-2CB00**
Mass storage module	**6ES5 581-3LA11**
Slot module	**6ES5 581-0RA12**
CP 581 system software ($3^1/_2$" diskette) German, English, French	
Single license	**6ES5 835-8MD01**
Copy license	**6ES5 835-8MD01-0KL1**
Operating system MS-DOS V 6.22 - Upgrade	
English	**6ES5 895-0BS22**
French	**6ES5 895-0BS32**
To be ordered as a separate item:	
CP 581 manual	
German	**6ES5 998-2AT11**
English	**6ES5 998-2AT21**
French	**6ES5 998-2AT31**
CP 581 DDE server	
German	
Single license	**6ES5 835-6DD11**
Copy license	**6ES5 835-6DD11-0KL1**
English	
Single license	**6ES5 835-6DD21**
Copy license	**6ES5 835-6DD21-0KL1**

4

Simulation modules

Application

The simulation modules simulate input and output signals and thereby enable control of input and output modules.

Design

788-7LA simulation module

For 16 binary input signals and 16 binary output signals. The module is for use with the 482 digital input/output module.

The module contains the following:

- 16 switches for the input of binary signals; can be used as latching pushbutton (to the left) or as momentary-contact pushbutton (to the right)
- 16 LEDs for indicating binary output signals
- 2 sockets for feeding in the signal voltages
- 1 connection for the 768-7LA cable (0.3 m (1 ft); to be ordered separately) to the 482 digital input/output module

788-7LB simulation module

For 1 analog input signal and 1 analog output signal. The module is for use with the 460 analog input module and the 470-7LB analog output module. The module contains the following:

- 1 rotary switch for selecting the input range
- 1 ten-turn potentiometer for setting the input value (scale 0 to 100 %)
- 1 measuring instrument for indicating the input value (scale 0 to 100 %)
- 1 rotary switch for selecting the output range
- 1 measuring instrument for indicating the output value (scale 0 to 100 %)
- 1 connection for the 768-7LB cable (0.3 m (1 ft); to be ordered separately) to the 460 analog input module and to the 470-7LB analog output module

788-7LC simulation module

For input and indication of digital values (e.g. timer or counter values). The module is for use with the 482 digital input/output module. It contains the following:

- 1 4-digit key code switch for specifying digital values
- 1 4-digit numerical display for indicating digital values
- 1 connection for the 768-7LA cable (0.3 m (1 ft); to be ordered separately) to the 482 digital input/output module

The simulation modules can be used in the central controller ZG 135U/155U, ZG 135U and in the expansion unit EG 185U.

The modules each require 2 slots.

Ordering data

	Order No.
788-7LA simulation module for binary signals	**6ES5 788-7LA11**
788-7LB simulation module for analog signals	**6ES5 788-7LB11**
788-7LC simulation module for digital values	**6ES5 788-7LC11**

	Order No.
To be ordered as a separate item:	
Manual	
German	**6ES5 998-0EA11**
English	**6ES5 998-0EA21**
Connecting cables for simulation modules in S5-135U/155U	on request

Picture evaluation systems

Introduction

The optical inspection and recognition of products in manufacturing is becoming an important topic as quality demands and production rates increase. The arguments in its favor are obvious:

- reduction of waste
- supply of tested products

These demands can be derived from the rules of DIN ISO 9000 or from the product liability laws.

Monotonous human visual inspection or identification is too expensive and inhumane. Moreover continuously increasing production rates are increasingly making use of personnel for inspection impossible.

Use of a picture evaluation system is an obvious choice:

- Automatic visual inspection in quality assurance; the machine tests objectively, fast and reliably dimensions, contours, forms and presence, correct assembly, positioning and completeness of parts, which can be microscopic (e.g. chip structures)
- Automatic part identification; parts can be assigned to predefined categories by shape, dimension, pattern, color, codes and symbols.

Picture evaluation systems can be used especially economically if certain conditions are fulfilled:

- Features of the product can be described uniquely by shape, dimension and pattern
- Delimitable number of these features
- Delimitable inspection location
- Sufficiently large image of the product to be tested
- High contrast between product and background

SIMATIC VIDEOMAT picture evaluation system

Application

SIMATIC VIDEOMAT is a complete picture evaluation system for implementation in the S5-115U, S5-135U/155U or S5-155H programmable controllers. With SIMATIC VIDEOMAT, pictures from both monochrome and color cameras can be evaluated. The automation of visual inspection using picture evaluation systems results in uniform product quality and is therefore both reliable and economical.

The main application for SIMATIC VIDEOMAT is in

- assembly technology in the automotive industry and automotive suppliers, the electrical industry, the plastics industry

and in

- packaging technology in the pharmaceutical, cosmetic, foodstuffs and beverage industries.

The module allows:

- Contactless visual inspection for quality assurance (dimensions, contours, shape, existence, assembly, location, quantity)
- Monitoring of high-speed processes
- Inspection of products with high throughput
- Identification of components on the basis of shape, dimensions, pattern, color, codes or characters
- Assignment of components to classes and categories

Features

SIMATIC VIDEOMAT has the following special features:

- Up to six cameras can be connected
- Fast moving objects can be captured from different viewpoints
- Picture preprocessing in real-time
- Recorded picture data is accessed while the picture is still being acquired
- Processing rates of up to 30 items per second
- Remote diagnostics and service is possible via modem and telephone lines
- Perfect optimization of the production process due to knowledge from online logging
- Wide range of applications by configuration of the most varied inspection tasks
- Low configuration effort due to easy operation and tried and tested function blocks
- Space saving integration into SIMATIC automation systems

SIMATIC VIDEOMAT picture evaluation system (continued)

Design

The module contains:

- 4 Mbyte picture memory, resolution 1024 x 1024 x 8 bit, freely configurable format
- 1024 x 1024 bit overlay and marking or mass storage
- 4 Mbyte program and data memory
- 360 Mbyte hard disk for archiving programs, data and pictures
- SVGA graphical resolution 1024 x 768, display of graphics and video is possible using windowing techniques

Interfaces:

- SVGA video output with simultaneous display of picture and graphic
- PCMCIA interface for connecting a modem for digital picture and data transmission via the telephone lines
- 1 serial (RS232 or TTY) interface and 1 centronics interface
- Keyboard interface, mouse interface
- 8 x 24 V digital inputs
- 8 x 24 V digital outputs

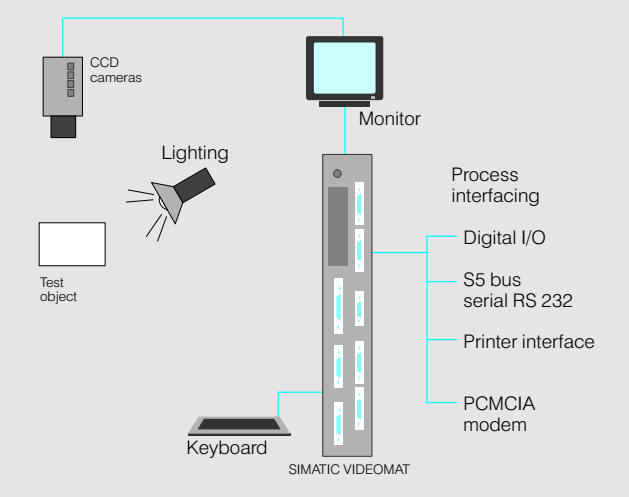


Fig. 4/45 Videomat IV picture evaluation system

Software:

- MS-DOS 6.2 operating system
- System software for interactive generation of applications from monochrome pictures including parameterizable sequencing control and an interface to the process
- Driver for communication via standard data handling blocks

The module requires two slots.

Principle of operation

SIMATIC VIDEOMAT is a target system and programming system in one. The request for evaluation and output of the results takes place automatically via communication with the SIMATIC CPU.

Test programs, data and also camera pictures can be archived on-board.
In order to program the system, simply connect a monitor and keyboard. On the monitor, up to three pictures, data and graphics can be displayed in windows.

Due to user-friendly operator prompting, the picture evaluation system SIMATIC VIDEOMAT is easily adapted to the specific task, and no programming knowledge is necessary.

Technical specifications

Picture processor	80486 DX4, 133 MHz	Monitor connection	1 SVGA
Picture memory	8 Mbyte	Keyboard connection	1
Format	From 256 x 256 x 8 bit to 1024 x 1024 x 8 bit, freely configurable	Mouse connection	1
		24 V digital inputs	8
Operating system	MS-DOS 6.2	24 V digital outputs	8
Interfaces	RGB video output PCMCIA interface for connecting a modem 1 serial (RS232 or TTY) 1 centronics interface	Current consumption	4 A at 5 V
		Space requirements	2 slots

SIMATIC VIDEOMAT picture evaluation system (continued)

Ordering data	Order No.		Order No.
SIMATIC VIDEOMAT for monochrome picture evaluation for monochrome cameras, 50 Hz or 60 Hz picture frequency, simultaneous storage of up to 3 camera pictures, system software, runtime license, several languages		**CCD camera with C mount** 756 x 581 square pixels, 625 lines, 50 half-pictures / s, exposure time adjustable from 1/10,000 to 1/50 s, with restart and reset, voltage rating 12 V DC, 210 mA	**6GF9 002-1AA**
• 6 camera ports	**6GF2 005-0BC01**	**Single-chip-RGB color camera** 756 x 581 square pixels, 625 lines, 50 half-pictures / s, exposure time adjustable from 1/10,000 to 1/50 s, voltage rating 12 V DC, 500 mA	**6GF9 002-1BA**
• 6 camera ports, with hardware real-time picture processing	**6GF2 005-0BE01**	**Lenses for above cameras** depending on the application	on request
SIMATIC VIDEOMAT for color picture evaluation for RGB, FBAS, SVHS, Y-C color cameras, 50 Hz or 60 Hz picture frequency, HSI hardware or YUV color coding, system software, run-time license		**Lighting equipment** depending on the application	on request
• 2 camera ports	**6GF2 005-0CC01**	**14" color monitor** max. resolution 1024 x 768 pixels	**6GF6 130-1MA**
SIMATIC VIDEOMAT manual		**Keyboard**	**C7951-Z727-K3**
German	**6GF7 002-1CA01**	**Mouse**	**6ES7 790-0AA00-0XA0**
English	**6GF7 002-1CA02**	**Connecting cables for VIDEOMAT**	**6GF9 002-1AG**
		• Adapter cable for connecting monochrome cameras	
		• Connecting cable for one RGB color camera, Length 10 m (32.8 ft) Length 20 m (approx. 66 ft)	**6GF9 002-1BD** **6GF9 002-1BE**

Communications processors and bus systems

Overview

Communications processors are used for data interchange between the S5-135U and S5-155U/H programmable controllers and the I/O stations or other programmable controllers connected to them.

Programmable controllers can be linked in two ways:

Point-to-point connection

Point-to-point connection is used for connecting one I/O station or programmable controller to a single S5-135U or S5-155U/H programmable controller. The link can, for example, be made through the second interface of the CPU. The CP 523, CP 524, CP 544 and CP 544B communications processors can also be used. These primarily relieve the CPU of the responsibility for communications thus enabling a large number of I/Os to be connected.

Bus interfacing

Bus interfacing is used for interlinking a number of nodes. Possible nodes include:

- S5-135U and S5-155U/H programmable controllers
- Third-party programmable controllers
- Personal computers
- Minicomputers or workstations
- Field equipment
- Printers

There are four different busses to choose from, depending on the area to be covered, the number of nodes and the transmission rate:

- SINEC L1
- AS interface
- PROFIBUS
- Industrial Ethernet

A communications processor is available for each of these four bus systems.

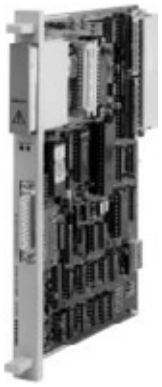
4

Communication

Point-to-point connection via V.24, 20 mA, RS 422/485	Page	Bus interfacing		Page
• CP 523 communications processor Point-to-point connection with fixed protocols; One interface: V.24, 20 mA	4/110	• CP 530 communications processor	**SINEC L1** for small and medium-sized communications applications Transmission rate 9.6 kbit/s	4/118
• CP 524 communications processor Point-to-point connection with protocols loaded from diskette; Selection of protocols available for connection of third-party systems; One interface: V.24, 20 mA, RS 422/485	4/112	• CP 2430 FMS/DP communications processor	**AS interface** for digital sensors and actuators for the lowest field level	4/122
• CP 544 communications processor Point-to-point connection; Selection of protocols available for connecting third-party systems; two interfaces (interchangeable interface modules): V.24, 20 mA, RS 422/485	4/114	• CP 5431 FMS/DP communications processor	**PROFIBUS** to PROFIBUS standard DIN 19245, Part 1 Transmission rate 9.6 to 1500 kbit/s selectable	4/118
• CP 544B communications processor as CP 544, but with protocols loaded from diskette (special driver)	4/114	• CP 1430 TF/CP 1430 TCP/ CP 1473 MAP communications processors	**Industrial Ethernet** CSMA/CD (IEEE 802.3) Transmission rate 10 Mbit/s	4/124

CP 523 communications processor

Application



The CP 523 communications processor is used for point-to-point connection to other programmable controllers and third-party equipment using standard protocols.

Design

The module contains the following:

- Microprocessor (8 bit) and interface chips (USART)
- RAM as user memory for temporary storage of messages
- Receptacle for 375 memory submodule (EPROM, EEPROM with max. 32 Kbyte) for a maximum of 4095 messages
- Hardware clock
- Interface for connection of devices with V.24 or 20 mA current-loop signals (sub D connector, 25-pin)

Operator controls and indicators on the front panel:

- 2 LEDs (green) for indicating the interface status

Devices with serial interfaces can be connected, e.g.:

- Printers
- Terminals
- Keyboards
- Barcode readers
- Programming devices and AT compatible PCs (e.g. in connection with the PRODAVE DOS 64R driver software)
- Programmable controllers via CPU 943, CPU 944, CPU 928B or the CP 521, CP 523, CP 544 communications processors (CP 524 and CP 525-2 only in conjunction with special drivers)

Interface

The interface is suitable for the transmission of

- 20 mA current-loop signals (TTY) and
- V.24 signals.

The transmission rate of the interface is 200 bit/s up to 9600 bit/s and is selectable in fixed steps.

The module requires one slot.

Principle of operation

The CP 523 communications processor can be used for the following functions:

- Interfacing programmable controllers and third-party devices and
- Message printout

The CP 523 handles data communication with the device connected to it completely autonomously, as well as preprocessing and temporary storage of data. The CP 523 occupies 8 byte in the analog I/O area.

All information between the communications processor and the CPU is exchanged via this area.

Interfacing

With the CP 523, interfacing to any desired unit with serial interface, e.g. interfacing with a personal computer for operator control and process monitoring, is possible.

Data transfer is possible either with a 10-bit or 11-bit character frame:
10-bit character frame either:

- 1 start bit, 7 data bit, 2 stop bit
- 1 start bit, 7 data bit, 1 parity bit, 1 stop bit
- 1 start bit, 8 data bit, 1 stop bit

CP 523 communications processor (continued)

Principle of operation (continued)

11-bit character frame either:

- 1 start bit, 7 data bit, 1 parity bit, 2 stop bit
- 1 start bit, 8 data bit, 1 parity bit, 1 stop bit
- 1 start bit, 8 data bit, 2 stop bit

In the communications mode, two open listings and one standardized listing are available on the module:

- In the transparent communications mode, data transmission is without receive-side end identifier sequence (message frames with fixed lengths or evaluation of the character delay time determine the end of the message)
- In the interpretive mode, data transmission commences with receive-side end identifier sequence and-control character. The characters RUB OUT = 7Fh, Backspace = 08h, XON/XOFF (assign nothing or 01 h to 7Eh), 1 or 2 end characters (selectable from 01 h to FFh) are evaluated
- In the 3964(R)-K communications mode, data transmission is via the 3964 or 3964R protocol

Message printout

With the CP 523 communications processor it is possible to output up to 4095 messages on a peripheral device with serial interface (printer, visual display unit, etc.). The message texts are stored on the module's memory submodule. Each message can have a maximum of three variables.

Permissible variables include the following: Date, time of day, token characters for further message texts, printer control parameters.

Programming

Programming of the module is not necessary. Only the type of interface (V.24, TTY), the additional interface parameters (transmission rate, handshake, ...) and the operating mode (event recorder, interfacing) can be parameterized with the user submodule or via an initialization message from the programmable controller.

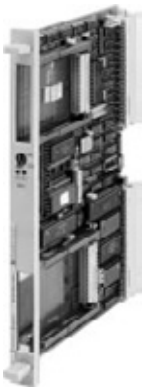
See page 4/115 for technical specifications.

Ordering data

	Order No.		Order No.
CP 523 communications processor	**6ES5 523-3UA11**	**Manual**	
		German	**6ES5 998-0DD11**
		English	**6ES5 998-0DD21**
		French	**6ES5 998-0DD31**
		Spanish	**6ES5 998-0DD41**
		Italian	**6ES5 998-0DD51**
375 memory submodule			
EPROM 8 Kbyte	**6ES5 375-1LA15**	**Connecting cables**	see Page 4/116
EPROM 16 Kbyte	**6ES5 375-1LA21**		
EPROM 32 Kbyte	**6ES5 375-1LA41**		
EEPROM 8 Kbyt e	**6ES5 375-0LC31**		
EEPROM16Kbyte	**6ES5 375-0LC41**		
Program examples for data link	**6ES5 897-2UE11**		

CP 524 communications processor

Application



The CP 524 communications processor is used for point-to-point connection to other programmable controllers and third-party equipment using standard protocols. The CP 524 has one interface.

Design

The module contains the following:

- Microprocessor (8 bit) and interface chips
- RAM for variable data
- 2 dual-port RAM
- Receptacle for 373 memory submodule (EPROM) for up to 128 Kbyte of user program (interprocessor communication functions or message texts)
- Receptacle for interface module for connecting devices with V.24/V.28, 20 mA (TTY) or RS 422-A/RS 485 signals; software clock

Operator controls and indicators on the front panel:

- "RUN"-"STOP" switch "RUN" for normal operation, "STOP" for interrupting normal operation
- 2 LEDs (red) for indicating the interface status

Devices with a serial interface can be connected, e.g.:

- Printers, e.g. DR 210, DR 211, DR 230, DR 231, PT 88 and PT 89 (with ECMA character set)
- Programmable controllers, through CPU 928B or communications processors CP 524, CP 525-2, CP 544, CP 544B
- Programmable controllers via CPU 944 or communications processors CP 523, CP 521SI in conjunction with special drivers
- SICOMP M minicomputers
- AS 215, AS 235K, AS 235 and AS 235H automation systems of the TELEPERM M process control system (see Catalogs PLT 110 and PLT 111)
- Programming devices and AT compatible PCs (e.g. in connection with the PRODAVE DOS 64R driver software, see Section 7)
- Other automation systems
- Third-party computers

Each module requires one slot.

Interfaces

Three different interface modules are available for the interface of the CP 524 for transmitting:

- 20 mA current-loop signals (TTY)
- V24/V.28 signals
- RS 422-A/RS 485 signals

The transmission rate of the interface is

- 110 bit/s to 19,200 bit/s (9600 bit/s with TTY) and is
- selectable in fixed steps using the programming device.

The V.24/V.28 module provides a number of auxiliary-signals conforming to the RS 232C or CCITT V.24 standard when using the relevant special driver software (see Section 7).

RS 422-A or RS 485 signals (voltage difference) ensure a higher degree of immunity to noise from external sources than V.24 or TTY signals. The following links can be established in accordance with the EIA standard:

- Point-to-point connections with RS 422-A in full-duplex mode
- Multipoint connections with RS 485 in half-duplex mode (with special driver software)

See page 4/115 for technical specifications.

CP 524 communications processor (continued)

Principle of operation

The CP 524 communications processor is used for the following functions:

- Linking programmable controllers and third-party devices
- Message printout

The CP 524 handles data communication with the devices connected to it completely autonomously, as well as editing and buffering the data.

Interfacing

Communications are handled by the RK 512 standard driver program, which is supplied with the COM 525 parameter assignment software (S5-DOS version). For interfacing to third-party computers etc., special driver software may be re-quired (see Section 7).

The computer link permits the sending and fetching of all SIMATIC S5 data types, such as data words, peripheral byte, bit memories, input images, etc.

Linking orders for the connected programmable controller or the computer are stored in the memory submodule (EPROM) of the module. Thus, the data do not occupy any memory space in the central controllers (or memory submodules).

Data transmission between CP 524 and connected devices is initiated via standard function blocks (handling blocks) in the memory of the central controller.

Listing

Process status reports

Production and shopfloor data can be printed out for documentation purposes. Printout is initiated by the user program. Process status reports may be

- up to 99 lines long and
- include up to 40 variables per line.

The variables are transferred to the CP 524 in one single data block.

Message printouts

Up to 1000 different messages (e.g. fault messages, signals from limit monitors, changes in switch positions) can be printed out. Each message may have one variable.

Programming

The CP 524 can be programmed off-line using the 373 memory submodule. For this purpose, the COM 525 parameter assignment software

(S5-DOS version, see Section 7) must be loaded into the relevant programming device. The parameter assignment software

also supports start-up of the communications processors.

Ordering data

	Order No.
CP 524 communications processor	**6ES5 524-3UA15**
752 interface submodule for CP 524 only	
for 20 mA current loop (TTY)	**6ES5 752-0AA12**
for V.24/V.28 (RS 232C)	**6ES5 752-0AA22**
for RS 422-A/RS 485	**6ES5 752-0AA43**
373 memory submodule	
EPROM 32 Kbyte	**6ES5 373-1AA41**
EPROM 64 Kbyte	**6ES5 373-1AA61**
EPROM 128 Kbyte	**6ES5 373-1AA81**
COM 525 parameter assignment software	see Section 7
Special drivers (customized transmission protocols)	see Section 7
To be ordered as a separate item:	
Manual for CP 524 (S5-DOS version)	
German	**6ES5 998-1DB11**
English	**6ES5 998-1DB21**
French	**6ES5 998-1DB31**
Connecting cables	see page 4/116

CP 544, CP 544B communications processors

Application

The CP 544 and CP 544B communications processors are used for fast point-to-point connection to other programmable controllers and equipment of other manufacture with standard protocols. In the case of the CP 544B, customer-specific communications protocols can also be used. The CP 544 and the CP 544B have two replaceable interfaces.

Design

The modules contain the following:

- 80186 microprocessor (16 MHz)
- RAM for variable data
- Two dual-port RAM
- Receptacle for memory card (flash EEPROM) for up to 256 Kbyte (optional)
- 2 receptacles for interface submodules for the connection of devices with V.24/V.28, 20 mA TTY or RS 422-A/RS 485 signals
- Hardware clock

Operator controls and indicators on the front panel:

- "RUN"-"STOP" switch, RUN for normal operation, STOP for interrupting normal operation
- Four LEDs (red/green) for indicating the interface status
- Two LEDs for indicating the status of the module (RUN, STOP)

The following can be connected to the module:

- DR 210, DR 211, DR 230, DR 231, PT 88, PT 89 printers
- SIMATIC S5 programmable controllers via CP 524, CP 544, CPU 928B, CPU 944 and CPU 945; connection is also possible via CP 521 SI and CP 523 (see pages 2/67 and 4/110)
- SICOMP M minicomputers
- Automation systems AS 215, AS 235K, AS 235 and AS 235H from the TELEPERM M process control system (see Catalogs PLT 110 and PLT 111)
- Programming devices and AT compatible PCs (e.g. in connection with the PRODAVE DOS 64R driver software)
- Other automation systems
- Third-party computers

Interfaces

Three different interface submodules are available for the interfaces of the CP 544 and CP 544B for transmitting:

- 20 mA current-loop signals (TTY),
- V.24/V.28 signals (RS 232C)
- RS 422-A/RS 485 signals

The transmission rate of the interfaces is 300 bit/s to 76800 bit/s (9600 bit/s for TTY, 19200 bit/s V.24 and is selectable in fixed steps using the programming device.

The sum of the two transmission rates must not exceed 76800 bit/s when both interfaces are assigned.

RS 422-A or RS 485 signals (voltage difference) ensure a higher degree of immunity to noise from external sources than V.24 or TTY signals. Moreover, higher transmission rates can be reached. Point-to-point connection with RS 422-A in full-duplex mode can be established in accordance with the EIA standard.

CP 544, CP 544B communications processors (continued)

Principle of operation

The CP 544 and CP 544B communications processors enable point-to-point connection to other programmable controllers and computers.

- Third-party devices can be connected via open drivers
- Safe data transport over the transmission line is possible with the help of the 3964 (R) procedure
- A safe end-to-end link between the CPUs of both communications partners can be achieved with the RK 512 standard computer link

The CP 544 and CP 544B communications processors handle data communications with the devices connected to it completely autonomously.

Communications jobs for the programmable controller or the computer can be stored in a data block in the CPU, the internal RAM of the CP 544 and CP 544B or on the additional memory card (flash EEPROM).

Programming

The CP 544 is programmed using the COM PP parameterization software. It can be programmed either on-line or off-line via the active TTY interface with the PG 720, PG 740, PG 760, PG 710 Plus, PG 730, PG 750 and PG 770 programming device. For parameter assignment, the COM PP parameterization software must be loaded into the programming device.

COM PP permits simple, operator-prompted programming and supports both start-up and debugging.

4

Technical specifications for CP 523, CP 524, CP 544 and CP 544B

Communications processors		CP 523	CP 524	CP 544 and CP 544B
Interfaces		1, asynchronous, serial selectable: 20 mA (current loop) V.24 (RS 232 C)	1, asynchronous, serial plug-in submodule: 20 mA (current loop) V.24 (RS 232 C) RS 422-A/RS 485	2, asynchronous, serial plug-in submodule: 20 mA (current loop) V.24 (RS 232 C) RS 422-A/RS 485
Transmission rate				
• 20 mA (TTY; current loop)	max.	9600 bit/s	9600 bit/s	9600 bit/s
• V.24/V.28 (RS 232 C)	max.	9600 bit/s	19200 bit/s	19200 bit/s
• RS 422-A/RS 485	max.	—	19200 bit/s	76800 bit/s
• Sum of both interfaces	max.	—	—	76800 bit/s
Transmission protocols		3964 (R) ASCII, interpretive ASCII, transparent	RK 512, with special driver, e. g.: • 3964 (R) • ASCII, interpretive • ASCII, transparent • Customer-specific protocols, for other protocols see Section 7	RK 512, 3964 (R) ASCII, interpretive ASCII, transparent Additional functions for CP 544B: Use of customer-specific communications protocols (special drivers) is possible
Parity		Even, odd, mark, space, none	Even, odd, none	
Data format		7 or 8 bit	5-8 bit	6-8 bit
Character frame		10 or 11 bit	7-12 bit	8-12 bit
Listing				
• Message printouts	max.	4065 messages 3 variables per message Message text stored on memory submodule of CP	1000 messages 1 variable per message Message text stored on memory submodule of CP	
• Process status report	max.	—	Production and shopfloor data 99 lines long, 40 variables per line	
Parameterization		Off-line on EPROM/ EEPROM or in user program	with COM 525 off-line in EPROM	with COM PP on-line or off-line
Connector • 20 mA and V. 24 • RS 422-A/RS 485		Screw connection Sub D socket, 25-pin	Sliding locking devices Sub D socket, 25-pin Sub D socket, 15-pin	Sliding locking device Sub D socket, 25-pin Sub D socket, 15-pin

CP 523, CP 524, CP 544 and CP 544B communications processors (continued)

Technical specifications for CP 523, CP 524, CP 544 and CP 544B (continued)

Communications processors		CP 523	CP 524	CP 544 und CP 544B
Cable length				
• 20 mA current loop (TTY)	max.	Active: 10 m (32.8 ft) Passive	1000 m (3280 ft)	1000 m (3280 ft)
• V.24	max.	16 m (52.4 ft)	16 m (52.4 ft)	16 m (52.4 ft)
• RS 422-A/RS 485	max.	—	1200 m (3936 ft)	1200 m (3936 ft)
Current consumption				
• Module		(5 V) typ. 130 mA	(5 V) max. 1.5 A	(5 V/24 V) max. 0.9 A/0.12 A
• 373 memory submodule (5 V)	max.	—	0.3 A	
• 375 memory submodule(5 V)	max.	—	—	
• 377 memory submodule (5 V)	max.	—	—	
• Interface submodule for				
20 mA current loop (5 V/24 V)	max.	—	0.1 A/60 mA	0.1 A/60 mA
V.24/V.28 (5 V)	max.	—	0.2 A	0.2 A
RS 422-A/RS 485 (5 V)	max.	—	0.5 A	0.5 A
Power loss		1.2 W	7.5 W	4.5 W
Fan required		No	Yes	No
Space requirements		1 slot		
Weight				
• Module	approx.	0.3 kg (0.66 lb)	0.4 kg (0.88 lb)	0.5 kg (1.1 lb)
• Memory submodule	approx.	0.1 kg (0.22 lb)	0.1 kg (0.22 lb)	0.1 kg (0.22 lb)
• Interface submodule	approx.	—	0.1 kg (0.22 lb)	0.1 kg (0.22 lb)

Ordering data

	Order No.
CP 544 communications processor	**6ES5 544-3UA11**
CP 544B communications processor	**6ES5 544-3UB11**
752 interface submodule	
for 20 mA current loop (TTY)	**6ES5 752-0AA12**
for V.24/V.28 (RS 232C)	**6ES5 752-0AA22**
for RS 422-A/RS 485	**6ES5 752-0AA43**
Memory card	
with flash EPROM, 256 Kbyte	**6ES5 374-2KH21**
with RAM, 256 Kbyte	**6ES5 374-2AH21**
COM PP parameterization software The instruction manual for COM PP is contained in the CP 544 manual.	see Section 7
CP 544 adapter cable to programming device connecting cable	**6ES5 734-4AG00**
Special driver for CP 544B (customer-specific protocols)	see Section 7
To be ordered as a separate item:	
CP 544/CP 544B manual	
German	**6ES5 998-2DB11**
English	**6ES5 998-2DB21**
French	**6ES5 998-2DB31**

	Order No.
725, 726, 734 connecting cables	
to other SIMATIC S5 devices via CP 524, CP 525-2, CP 544, CP 544B	
• 20 mA current loop (TTY)	
3.2 m (10.4 ft)	**6ES5 726-1BD20**
5 m (16.4 ft)	**6ES5 726-1B F00**
10 m (32.8 ft)	**6ES5 726-1CB00**
50 m (164 ft)	**6ES5 726-1CF00**
200 m (656 ft)	**6ES5 726-1DC00**
• V.24 (max. 16 m (52 ft))	
2 m (6.56 ft)	**6ES5 726-8BC00**
3.2 m (10.4 ft)	**6ES5 726-8BD20**
5 m (16.4 ft)	**6ES5 726-8BF00**
10 m (32.8 ft)	**6ES5 726-8CB00**
16 m (52.4 ft)	**6ES5 726-8CB60**
• RS 422-A/RS 485 (for CP 524 and CP 544)	
5 m (16.4 ft)	**6ES5 725-7B F00**
10 m (32.8 ft)	**6ES5 725-7CB00**
50 m (164 ft)	**6ES5 725-7CF00**
200 m (656 ft)	**6ES5 725-7DC00**
to SICOMP R minicomputers via PROMEA EA 01-G with DUST 3964R	
• 20 mA current loop	
3.2 m (10.4 ft)	**6ES5 726-3BD20**
5 m (16.4 ft)	**6ES5 726-3B F00**
10 m (32.8 ft)	**6ES5 726-3CB00**
50 m (164 ft)	**6ES5 726-3CF00**
200 m (656 ft)	**6ES5 726-3DC00**
• V.24 (max. 16 m (52 ft))	
2 m (6.56 ft)	**6ES5 726-4BC00**
3.2 m (10.4 ft)	**6ES5 726-4BD20**
5 m (16.4 ft)	**6ES5 726-4BF00**
10 m (32.8 ft)	**6ES5 726-4CB00**
20 m (65.6 ft)	**6ES5 726-4CC00**

CP 523, CP 524, CP 544 and CP 544B communications processors (continued)

Ordering data	Order No.
725, 726 and 734 connecting cables	
to SICOMP minicomputers via PROMEA EA 01-E with DU 04	
• 20 mA current loop (max. 200 m (656 ft))	
3.2 m (10.4 ft)	**6ES5 725-8BD20**
5 m (16.4 ft)	**6ES5 725-8B F00**
10 m (32.8 ft)	**6ES5 725-8CB00**
50 m (164 ft)	**6ES5 725-8C F00**
200 m (656 ft)	**6ES5 725-8DC00**
to N10 modem (max. 16 m (52 ft))	
2 m (6.56 ft)	**6ES5 726-7BC00**
3.2 m (10.4 ft)	**6ES5 726-7BD20**
5 m (16.4 ft)	**6ES5 726-7B F00**
10 m (32.8 ft)	**6ES5 726-7CB00**
16 m (52.4 ft)	**6ES5 726-7CB60**
assigns parameters to the CP 544 with PG 7. and CP 544 adapter cable	
5 m (16.4 ft)	**6ES5 734-2BF00**
10 m (32.8 ft)	**6ES5 734-2CB00**
25 m (82 ft)	**6ES5 734-2CC50**
for printing with DR 210, DR 211, DR 230, DR 231 printer (with CP 524 and CP 525 only in connection with ECMA character set in the printer) (20 mA current loop up to 1000 m (3280 ft), V.24 up to 16 m (52.5 ft))	
3.2 m (10.4 ft)	**6ES5 726-5BD20**
5 m (16.4 ft)	**6ES5 726-5B F00**
10 m (32.8 ft)	**6ES5 726-5CB00**
50 m (164 ft)	**6ES5 726-5C F00**
200 m (656 ft)	**6ES5 726-5DC00**

CP 2430 communications processor; AS-Interface

Application

The CP 2430 is an interface master module for connecting the

- SIMATIC S5-115U:
  The CP can be used in CP slots in the central controller and expansion unit via adapters
- SIMATIC S5-135/-155U:
  If used for I/O mode only, can be used in the I/O slots in the central unit and expansion unit; in paging mode the CP can be used in CP slots in the central controller and expansion unit

Depending on the configuration of the PLC up to four CP 2430 can be used in the PLC.

Configuration of the CP is not necessary.

Control of up to 2 x 31 AS-Interface slaves in accordance with the ASi specification is implemented.

Up to 496 binary elements can be controlled if bi-directional slaves are used.

The supply voltage is monitored on the AS-Interface profile line.

Design

- Two AS-Interface masters on one module
- Occupies one slot in the SIMATIC S5
- In I/O mode, 32 bytes are used in the I/O address space
- Display of the connected and activated slaves and their ready-for-operation signals
- Connection of both AS-Interface lines via connectors with terminal blocks (solderless connection with screw locking)
- A pushbutton for each master part for switching the operating state and accepting the existing configuration
- Coding plug for setting addresses and variants

Principle of operation

Both AS-Interface masters control a separate AS-Interface segment with up to 31 AS-Interface slaves completely independently of one another

- Two operating variants:
  Standard mode:
  Data bits of the slaves can be addressed in the I/O address space of the PLC. Master calls are not possible.

Expanded mode:
Access to master calls in accordance with the ASI specification (e.g. writing parameters) is possible

User interface

Three variants are available:

- I/O mode:
  Only accesses to slave data in the I/O address space, no master calls
- I/O and paging operation:
  Accesses to slave data in the I/O address space and master calls via paging access
- Paging mode:
  Access to slave data and master calls via paging access

CP 2430 communications processor; AS-Interface (continued)

Technical specifications

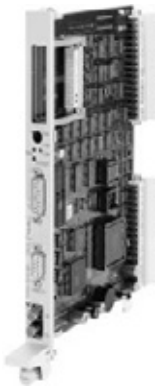
Access method	Cyclical polling-master-slave-method, cyclical data transfer from host (PLC, PC)	CP 2430	
Cycle time max.	5 ms with complete configuration	Supply voltage	+5 V DC via backplane bus
Transmission medium	unshielded two-wire cable (2x1.5 mm^2) for data and auxiliary power	Current consumption • via backplane bus typ. • from the AS-Interface shaped cable max.	700 mA with 5 V DC 100 mA per AS-Interface segment
Connection method	Contact with the AS-Interface cables using the penetration method	Interfaces • Assignment of I/O address area in PLC • AS-Interface connection	32 bytes with I/O operation 2 x 4-pin socket for connectors with terminal connections
Number of nodes max.	31		
Number of binary sensors/actuators	max. 124 (4 x 31) when using 4I, 4O, 2I/O- and 2 x 2I modules max. 248 when using 4I/4O modules	Permissible ambient conditions • Operating temperature • Transport/storage temperature	 0 to 60 °C -40 to +70 °C
Error detection	Identification and repetition of faulty message frames	Space required	1 slot
		Weight	400 g

Ordering data

	Order No.		Order No.
CP 2430 Communications processor for connection of SIMATIC S5-115U, S5-135U, S5-155U to AS-Interface, including connector	**6GK1 243-0SA10**	**Manual for AS-Interface** contains CP 2413/CP 2430/ CP 2433 description, introduction and basics incl. software (FB60 + examples) • German • English • French • Italian	 **6GK1 971-2SA01-0AA0** **6GK1 971-2SA01-0AA1** **6GK1 971-2SA01-0AA2** **6GK1 971-2SA01-0AA4**

CP 5431 FMS/DP communications processor; PROFIBUS

Application



The CP 5431 FMS/DP communications processor is used for connecting the
- S5-115U/H,
- S5-135U and
- S5-155U/H

programmable controllers to the PROFIBUS network.

The programmable controller with the CP 5431 FMS/DP acts as a master on the PROFIBUS network.

Design

The module contains the following:
- One microprocessor with memory
- One receptacle for 376, 377 memory submodule
- One programming device interface
- One interface for PROFIBUS two-wire line
- One interface for plastic fiber optic cable (PROFIBUS)

Operator controls and indicators on the front panel:
- "RUN" - "STOP" switch
- LEDs for Stop, Run and CP fault

The module requires one slot.

Principle of operation

The CP 5431 FMS/DP communications processor handles data communications via the PROFIBUS network or via the PROFIBUS protocol (PROFIBUS FMS). The functions of a DP master (class 1) in accordance with EN 50 170 can also be used (combi-master functions).

The communications processor relieves the programmable controller of a considerable proportion of communications tasks.
It is programmed using the COM 5431 FMS/DP parameterization software with operator prompting (see Section 7).

The transmission rate can be set via the software (9.6, 19.2, 93.75, 187.5, 500 kbit/s or 1.5 Mbit/s). The preferred transmission rate of 187.5 kbit/s is preset.

Standard function blocks for the user program are available for data communications with the CPU (see Section 7).

Functions of the CP 5431 FMS/DP in accordance with EN 50 170:
- FDL interface: Direct access to layer 2 services (PROFIBUS layer 2); PLC-PLC connections
- Global I/O interface: Automatic transmission of I/O areas with global I/O
- Distributed I/O interface: Automatic transmission of I/O areas to PROFIBUS DP slaves
- Programming device interface for local and remote programming via the network
- Clock functions: Network-wide clock synchronization
- FMS user interface (PROFIBUS FMS)
- Cyclic I/O interface: Automatic transmission of I/O areas with cyclic interface

CP 5431 FMS/DP communications processor; PROFIBUS (continued)

Technical specifications

PROFIBUS overview	
Access method	• Token passing between the active nodes • Master-slave between active and passive nodes in acc. with EN 50170
Transmission rate	9.6 to 1500 kbit/s, selectable
Transmission mode	Bit-serial
Number of nodes max.	127 (32 per segment)
Protocols	PROFIBUS-FMS PROFIBUS-DP
PROFIBUS electrical	
Connection of nodes via	RS 485 bus terminal
Topology	Row/tree structure
Transmission medium	Twisted pair cable
Max. distance between 2 nodes	9.6 km at 9.6 kbit/s
PROFIBUS optical	
Connection of nodes	Optical Link Modules
Topology	Line, ring or star structure
Transmission medium	Glass fiber optic 62.5/125 µm; Plastic fiber optic 980/1000 µm
Max. distance between 2 OLMs	Glass fiber optic 2850 m (9348 ft); Plastic fiber optic 53 m (173.8 ft)
Possible connections	
• No. of optical channels	
OLM P3/S3	1
OLM P4/S4	2
OLM P4/S4 electrical channels	3
5431 FMS/DP comm. processor	
Supply voltage	+ 5 V + 5 %; + 24 V + 25/–15 %
Current consumption	
• At 5 V	450 mA
• At 24 V	70 mA with RS 485, Average 100 mA, using both current sources of the programming device interface (terminating resistance irrelevant)
Connection to	
• PROFIBUS (RS 485)	9-pin sub D socket
• PROFIBUS (plastic)	Plastic fiber optic cable, HP-duplex
• Programming device/diagnostics interface	15-pin sub D socket
Permissible ambient conditions	
• Operating temperature	0 °C to + 55 °C
• Transport/storage temperature	– 40 °C to + 70 °C
Space requirements	1 slot
Weight	
• Module	0.4 kg (0.88 lb)
• Memory submodule	0.1 kg (0.22 lb)

Ordering data

	Order No.
CP 5431 FMS/DP communications processor SINEC L2 interface module for S5-115U/H, S5-35U, S5-155U/H	**6GK1 543-1AA01**
COM 5431 FMS/DP parameter asgmt software	see Section 7
CP 5431 FMS/DP manual	
German	**6GK1 970-5AB01-0AA0**
English	**6GK1 970-5AB01-0AA1**
French	**6GK1 970-5AB01-0AA2**
376 memory submodule (EPROM)	
16 Kbyte	**6ES5 376-1AA11**
32 Kbyte	**6ES5 376-1AA21**
64 Kbyte	**6ES5 376-1AA31**
377 memory submodule (RAM)	
16 Kbyte	**6ES5 377-1AA11**
32 Kbyte	**6ES5 377-1AA21**
64 Kbyte	**6ES5 377-1AA32**
RS 485 bus terminal for PROFIBUS with connecting cable	
1.5 m (4.92 ft)	**6GK1 500-0AA00**
3.0 m (9.84 ft)	**6GK1 500-0AB00**
Bus cables for PROFIBUS	
Bus cable[2)3)] **2-wire, shielded**	**6XV1 830-0AH10**
Bus cable, halogen–free 2-wire, shielded	**6XV1 830-0CH10**

	Order No.
Bus cable for PROFIBUS (ctd.)	
Bus cable with PE coating[2)3)] 2-wire, shielded	**6XV1 830-0BH10**
Bus cable (buried) [2)3)] 2-wire, shielded	**6XV1 830-3AH10**
Trailing cable [2)3)] 2-wire, shielded	**6XV1 830-3BH10**
Bus cable for festoon mounting [2)3)] 2-wire, shielded	**6XV1 830-0AH10**
Bus cable for PROFIBUS-PA	
• blue, for applications in hazardous areas	**6XV1 830-5AH10**
• black, for applications in non-harzardous areas	**6XV1 830-5BH10**
FIBER OPTIC CABLE [2)] **standard cable, splittable** without connector, sold by the meter, max. 400 m (1312 ft)	see Section 10
FLEXIBLE FIBER [2)] **OPTIC CABLE** **trailing cable, splittable** without connector, sold by the meter, max. 200 m (656 ft)	see Section 10
BFOC connector; single for FIBER OPTIC CABLE, standard cable and trailing cable	**6GK1 901-0DA00-0AA0**
Additional fiber optic cables, PROFIBUS fiber optic network components and PC modules	see Catalog IK 10

1) Up to 187.5 kbit/s

2) Sold by the meter, max. 1000 m (3280 ft), minimum order 20 m (65.6 ft)

CP 1430 TF/CP 1430 TCP/CP 1473 MAP communications processors; Industrial Ethernet

Application

CP 1430 TF/1430 TCP communications processor

The CP 1430 TF/1430 TCP communications processor is used for connecting the

- S5-115U/H,
- S5-135U and
- S5-155U/H

programmable controllers to the Industrial Ethernet cell network in accordance with IEEE 802.3.

Mit dem CP 1430 TF können Kommunikationen in Local Area Networks (LAN) aufgebaut werden.

Mit dem CP 1430 TCP können Kommunikationen über Wide Area Networks (WAN) realisiert werden.

CP 1473 MAP communications processor

The CP 1473 MAP communications processor is used for connecting the

- S5-115U/H,
- S5-135U and
- S5-155U/H

programmable controllers to the international standard MAP 3.0 Ethernet network.

Design

CP 1430 TF/1430 TCP communications processor

Two versions of the CP 1430 TF communications processor are available:

- CP 1430 TF Basic
  for using the SEND/RECEIVE interface or few TF connections; up to 64 ISO transport connections (for SEND/RECEIVE) or up to 16 TF connections.
- CP 1430 TF Extended
  for high-end applications, many TF connections and high real-time accuracy (1 ms), up to 100 TF connections or up to 100 ISO transport connections (for SEND/RECEIVE).

The CP 1430 TF and CP 1430 TCP communications processor have the following interfaces:

- 15-pin sub D socket (push-locking) for connection to Industrial Ethernet; switchable to AUI or Industrial Twisted Pair
- 15-pin sub D socket (screw-locking) for connection to programming devices.

Operator controls and indicators on the front panel:

- "RUN" – "STOP" switch
- LEDs for indicating the "STOP", "RUN", "FAULT" and "15 V" states

The module requires one slot.

CP 1473 MAP communications processor

The communications processor has two interfaces:

- 25-pin sub D socket for connection of the PG 720, PG 720 C, PG 740 and PG 760 programming devices
- 15-pin sub D socket for connection to Industrial Ethernet

Operator controls and indicators on the front panel:

- "RUN" – "STOP" switch
- "RESET" pushbutton
- LEDs for indicating the "STOP" and "RUN" states

The module requires two slots.

Principle of operation

The CP 1430 TF, the CP 1430 TCP and CP 1473 MAP handle data communications with the entire network completely autonomously. All layers of the ISO 7-layer reference model are implemented. The communications processors therefore relieve the programmable controller of a large proportion of communications tasks.

The CP 1473 MAP is programmed using the COM 1473 parameterization software with operator prompting. The CP 1430 TF and the CP 1430 TCP is programmed using the COM 1430 TF or COM 1430 TCP parameterization software. Standard function blocks for the user program are avail-able for data interchange with the CPU (see Section 7).

Programming

The PG 720, PG 720 C, PG 740 and PG 760 programming devices can be connected directly to the Industrial Ethernet. In this way, all programmable controllers can be programmed remotely. Using the programming device multiplexer (see Section 8), several modules can be programmed via one interface.

See Section 10 as well as Catalog IK 10 for further details of the Industrial Ethernet LAN as well as of PC modules.

CP 1430 TF/CP 1430 TCP/CP 1473 MAP communications processors; Industrial Ethernet (continued)

Technical specifications

Industrial Ethernet electrical		
Topology		Bus structure
Transmission medium		Triaxial cable 50 ohms
Transmission rate		10 Mbit/s
Transmission mode		Bit-serial
Max. distance between 2 random terminals		0.5 km (0.3 miles) without repeater 1.8 km (1.1 miles) with 2 repeaters 3 km (1.8 miles) with 4 repeaters and 2 x 500 m (1640 ft) fiber opitc cable
Max. number of nodes		100 nodes per segment 1024 nodes for the whole network
Allocation method		CSMA/CD in acc. with IEEE 802.3 (Ethernet)
Industrial Ethernet fiber optic		
Topology		Star structure
Transmission medium		Fiber optic cable, fiber 62.5/125 µm
Transmission rate		10 Mbit/s
Transmission mode		Bit-serial
Max. distance between 2 random terminals		Max. 4.6 km (2.7 miles) with 1 active star coupler
Max. number of nodes		1024 nodes for the whole network
Allocation method		CSMA/CD in acc. with IEEE 802.3 (Ethernet)
CP 1430 TF/CP 1430 TCP/ CP 1473 MAP communications processors		
Current consumption		
• CP 1430 TF/CP 1430 TCP without transceiver at 5 V	max.	1.7 A
• CP 1430 TF/CP 1430 TCP with transceiver at 5 V	max.	3.2 A
at 24 V	max.	100 mA
• CP 1473 with 15 V module at 5 V	max.	4.2 A (2.6 A without transceiver load)
Space requirements		
• CP 1430 TF with transceiver		1 slot
• CP 1473 MAP		2 slots
Weight		
• CP 1430 TF/ CP 1430 TCP	approx.	0.7 kg (1.54 lb)
• CP 1473 MAP	approx.	0.85 kg (1.87 lb)

Transceiver		
Supply voltage		9 to 15 V DC
Current consumption		250 mA (with 1 interface) 490 mA (with 2 interfaces)
Connectors		
• For connection to Industrial Ethernet		SINEC bus connector with coaxial socket
• For connection to terminal		15-pin sub D plug
Dimensions (W x H x D) in mm (in)		180 x 85 x 45 (6.92 x 3.26 x 1.73)
Weight	approx.	0.64 kg (1.4 lb)
Repeater		
Supply voltage		120/220 V AC
Current consumption max.		on request
Dimensions (W x H x D) in mm		on request
Weight	approx.	on request
SSV 104 fan-out unit		
Supply voltage		100 to 240 V AC
Power input		40 W
Dimensions (W x H x D) in mm		432 x 46 x 252
Weight (of desktop unit)	approx.	2.1 kg (4.62 lb)

4

CP 1430 TF/CP 1473 MAP communications processors; Industrial Ethernet (continued)

Ordering data	Order No.
Communications processor	
• **CP 1430 TF Basic**	**6GK1 143-0TA02**
• **CP 1430 TF Extended**	**6GK1 143-0TB01**
COM 1430 TF parameter assignment software	see Section 7
CP 1430 TF/COM 1430 TF manual	
German	**6GK1 970-1TA43-0AA0**
English	**6GK1 970-1TA43-0AA1**
French	**6GK1 970-1TA43-0AA2**
Italian	**6GK1 970-1TA43-0AA4**
CP 1430 TCP communications processor	**2XV9 450-1AU00**
COM 1430 TCP parameter assignment software	see Section 7
CP 1430 TCP/COM 1430 TCP manual	
German	**2XV9 450-1AU03**
English	**2XV9 450-1AU02**
CP 1473 MAP communications processor	**6GK1 147-3MA00**
COM 1473 TCP parameter assignment software with CP 1473 MAP manual	see Section 7
CP 1473 MAP manual	
German	**6GK1 970-1MA73-0AA0**
English	**6GK1 970-1MA73-0AA1**
Connecting cable PG 7xx/CP 1473 2.5 m (8.2 ft)	**6XV1 800-6CH25**
CP-PLC cable for S5-115U/135U/155U 0.6 m (1.97 ft)	**6XV1 800-6FE60**
376 memory submodule (EPROM) for CP 1473 MAP	
16 Kbyte	**6ES5 376-1AA11**
32 Kbyte	**6ES5 376-1AA21**
64 Kbyte	**6ES5 376-1AA31**
Memory card for CP 1430 TF, long format,	
flash EPROM, 256 Kbyte (16 bit)	**6ES5 374-2KH21**
RAM, 256 Kbyte (16 bit)	**6ES5 374-2AH21**
Bus transceiver for Industrial Ethernet lets you connect a terminal to Industrial Ethernet, incl. assembly instructions in German, English, French	**6GK1 901-0AA00-0AA0**
Bus transceiver w/ 2 interfaces for Industrial Ethernet lets you connect two terminals to Industrial Ethernet, incl. assembly instructions in German, English, French	**6GK1 901-0AA00-0AC0**
SIBUKO transceiver package 2 for Industrial Ethernet consisting of: 1 tapping mechanism, 1 transceiver, 2 dust protectors for transceiver, 1 mounting plate for transceiver, 1 permanent mounting set for transceiver cable, 1 instruction (German, English, French)	**6GK1 100-0AB00**
Terminating resistors (2) for Industrial Ethernet	**6ES5 755-3AA11**
Coaxial connector (N connector; 2) for 727-0 bus cable	**6ES5 755-4AA11**
Repeater	**6ES5 755-1AA12**
SSV 104 fan-out unit for connecting a maximum of 8 nodes to Industrial Ethernet	**6GK1 104-0AA00**
727-1 connecting cable for connecting transceiver to node	
Length 3.2 m (11 ft)	**6ES5 727-1BD20**
10 m (32 ft)	**6ES5 727-1CB00**
15 m (49 ft)	**6ES5 727-1CB50**
20 m (65 ft)	**6ES5 727-1CC00**
32 m (105 ft)	**6ES5 727-1CD20**
50 m (164 ft)	**6ES5 727-1CF00**
727-0 bus cable sold by the meter, without connector; length to be specified in m	**6ES5 727-0AA11**
725-0 connecting cable for connecting the CP 1430 TF to the module to be programmed (for remote programming)	
Length 0.9 m (2.9 ft)	**6ES5 725-0AK00**
2.5 m (8.2 ft)	**6ES5 725-0BC50**

135U/155U central controller

Application

The 135U/155U central controller can be used optionally for the construction of a S5-135U, S5-155U or S5-155H programmable controller.

Two 135/155U central controllers are required for a S5-155H programmable controller.

Design

The 135U/155U central controller comprises:

- 21 free slots
- 1 power supply chassis with built-in fan

S5-135U, S5-155U

Depending on the extent of the automation task, the central controller can be equipped with the following CPUs:

- CPU 948 (max. 4)
- CPU 928B (max. 4)
- CPU 928 (max. 4)
- CPU 922 (max. 4)

All CPUs can also operate jointly in multiprocessor mode. When more than one of these central modules is used a 923A/923C coordinator is required (see page 4/30).

S5-155H

One CPU 948R can be used per central controller.

Power supply chassis

- Redundant two-out-of-three fan concept;
  Should one fan cease operating the speed of the other fans is increased thus enabling the programmable controller to continue operation. The defective fan can be replaced while the controller is in operation
- Redundant one-out-of-two battery concept;
  In the case of a failure of the main battery (Li battery) the accu battery switches on automatically for a period of three weeks
- Mains buffering to NAMUR: 20 ms
- Enhanced electromagnetic compatibility (EMC)

135U/155U central controller (continued)

Design

Possible configurations S5-135U/155U

Note the respective slot requirements of the modules!

Slot No.	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
923 A/C coordinator	■																				
CPU 922, CPU 928A, CPU 928B		■		■		■		■													
CPU 948		■	■	■	■	■	■	■	■												
IM 300-5, IM 301-5 interface modules[2]																				■	■
IM 300-3, IM 301-3, IM 304, IM 308, IM 308-B interface modules																		■	■	■	■
IM 308-C, IM 307[1] interface modules														■	■	■	■	■	■	■	■
Digital input modules, digital output modules	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Analog input modules, analog output modules	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Intelligent I/O modules	For slot assignment, see Section 11																				
Communications processors[3]	For slot assignment, see Section 11																				
Hardware interrupt processing			■		■		■		■	■	■	■	■	■	■	■	■				
PG MUX function via 923C coordinator		■		■		■		■		■	■	■	■								
Floating operation	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				

1) Jumper selection on the IM 307 must be observed.
Interrupt transfer is only possible on slots 107 to 131.
2) In the case of 135U with Order No. 6ES5 135-3UA42 only slot 163.
3) Note the functions given in the lower half of the table.

Possible configurations of the S5-155H

Note the respective slot requirements of the modules!

Slot No.	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
CPU 946R[4]		■	■																		
Communications processor[6]	For slot assignment, see Section 11																				
Intelligent I/O modules	For slot assignment, see Section 11																				
IM 301-3, IM 304-3, IM 308-3, IM 308-B interface modules																		■	■	■	■
IM 300-5, IM 301-5 interface modules	■																			■	■
IM 304 or IM 342R interface module for linking the central controllers[7]																■	■				
Digital input modules[5], digital output modules	■			■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■
Analog input modules, analog output modules	■			■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■
IM 308-C, IM 307														■	■	■		■	■	■	■

4) Occupied slots.
5) Redundant operation of digital input modules is not possible with an input voltage of 115/230 V AC.
6) The space requirements for the separate modules must be taken into account.
7) Subunit A with IM 324R, subunit B with IM 304.

135U/155U central controller (continued)

Principle of operation

Multiprocessor operation

When using several CPUs, every single one processes the tasks assigned to it indepedently from the others. Every CPU features its own user program memory, own time and count cells and own bit memories.

In a time sharing process the coordinator assigns the access to the internal S5 bus cyclically to the individual CPUs. Thus, data collision on the bus is prevented.

Additionally, the coordinator is the intermediate memory for the communication of the CPUs with each other. Two alternatives are available for that:

- The coupling bit memory exchange for small amounts of data suppored by the system program of the CPUs
- The multiprocessor communication for large amounts of data

Ordering data

	Order No.
135U/155U central controller without CPU, without backup battery, with power supply	
• 230/120 V AC, 5 V/18 A, 15V/0.5 A, 24 V/1 A[1]	**6ES5 188-3UA12**
• 230/120 V AC; 5 V/40 A, 15 V/2 A, 24 V/2.8 A	**6ES5 188-3UA22**
• 24 V DC; 5 V/18 A, 15 V/0.5 A, 24 V/1 A	**6ES5 188-3UA32**
• 24 V DC; 5 V/40 A, 15 V/2 A, 24 V/2.8 A[1]	**6ES5 188-3UA52**
135U central controller without CPU, without backup battery	
• 24 V DC; 5 V/10 A	**6ES5 135-3UA42**
Backup battery (lithium battery)	**6EW1 000-7AA**
To be ordered as a separate item:	
S5-135U/155U system manual	see page 4/155
Additional manuals	see page 4/155
Replaceable fan	**6ES5 988-3NB41**
Accessories, spare parts	see page 4/155

1) Also for S5-155H

155H central controller

Application

The ZG155H central controller is suitable for building a complete S5-155H programmable controller in a module subrack.

Design

The central controller 155H is a module subrack divided into two halves. It has

- 10 slots (left half)
- 11 slots (right half)

Of these slots two each are used for the power supply, two for the CPU and one for the IM 324R/IM 304.

Five (left half) or six (right half) free slots are therefore available.

The 155H is supplied with two 24V DC; 5V,14A power supplies and a fan subassembly.

One or two backup batteries per power supply can also be ordered to back up the CPU (redundant backup).

Possible configurations of S5-155H (redundant configuration)

Pay attention to the number of slots required!

Slot	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
Power supplies	■	■									■	■									
CPU 948R/RL			■	■									■	■							
Communications processor						■	■	■	■	■						■	■	■	■	■	■
Signal preprocessing modules						■	■	■	■	■						■	■	■	■	■	■
Interface modules IM 304, IM 324 R					■	■									■	■					
Interface module IM 304								■	■	■									■	■	■
Interface module IM 308						■	■	■	■	■						■	■	■	■	■	■
Digital inputs/outputs						■	■	■	■	■						■	■	■	■	■	■
Analog inputs/outputs						■	■	■	■	■						■	■	■	■	■	■

Ordering data	Order No.		Order No.
155H central controller without CPU; without backup battery, with two power supplies 24 V DC; 5 V/14 A	**6ES5 188-3UH31**	To be ordered as a separate item: **S5-155H manual** (with description of the 155H)	see Page 4/155
Backup battery	**6ES7 971-0BA00**	**Other manuals**	see Page 4/155
		Accessories, parts	see Page 4/155

183U expansion unit

Application

The 183U expansion unit is designed for centralized and distributed connection to central controllers. It is also suitable for the centralized connection to distributed expansion units for S5-135U and S5-155U.

Design

The 183U expansion unit comprises:

- 21 free slots
- 1 built-in power supply chassis with fans

The 183U can be centrally connected to the central controller or to other expansion units with the IM 312 interface module. In addition the 183U can be connected distributed to central controllers with the IM 310, IM 314, IM 317 and IM 318 interface modules.

A hardware interrupt is not possible in the 183U expansion unit. No battery backup is provided for the RAM.

Possible configurations

Note the respective slot requirements of the modules!

Slot No.	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
IM 300 interface module																					■
IM 310, IM 314, IM 317 or IM 318 interface modules	■																				
IM 312-3 interface module																					■
Digital input modules, digital output modules	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Analog input modules, analog output modules	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Intelligent I/O modules	For slot assignment, see Section 11																				
313 monitoring module	■																				■

Ordering data

	Order No.		Order No.
183U expansion unit with power supply • 230/120 V AC; 5 V/18 A, 15 V/0.5 A, 24 V/1 A	**6ES5 183-3UA13**	To be ordered as a separate item: **S5-135U/155U system manual**	see page 4/155
• 24 V DC; 5 V/18 A, 15 V/0.5 A, 24 V/1 A	**6ES5 183-3UA22**	**Additional manuals**	see page 4/155
		Accessories, spare parts	see page 4/155

184U expansion unit

Application

The 184U expansion unit is designed for the centralized connection to central controllers and expansion units with power supply chassis for S5-135U and S5-155U.

Design

The 184U expansion unit comprises:

- 21 free slots
- 1 fan subassembly

The 184U can be centrally connected to the central controller or to other expansion units by using the IM 312 interface module.

A power supply chassis is not required because the expansion unit is supplied via the connecting cable for the IM 312-5 interface module.

A hardware interrupt is not possible in the expansion unit. Modules with RAM backup cannot be implemented because there is no battery backup for the supply voltage.

Possible configurations

Note the respective slot requirements of the modules!

Slot No.	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
IM 312-5 interface module																					■
Digital input modules, digital output modules	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Analog input modules, analog output modules	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Intelligent I/O modules	For slot assignment, see Section 11																				
313 monitoring module	■																				

Ordering data	Order No.		Order No.
184U expansion unit without power supply • With 230/120 V AC fan • With 24 V DC fan	**6ES5 184-3UA11** **6ES5 184-3UA21**	To be ordered as a separate item: **S5-135U/155U system manual** **Additional manuals** **Accessories, spare parts**	 see page 4/155 see page 4/155 see page 4/155

EG 185U expansion unit

Application

The EG 185U expansion unit is suitable for the distributed connection to central controllers and other expansion units S5-135U/155U. In addition, the EG 185U makes switched I/O design possible in the case of the fault-tolerant S5-155H programmable controller.

Design

The EG 185U expansion unit comprises:

- 21 free slots
- 1 built-in power supply chassis with fans

The EG 185U can be connected distributed to central controllers or other expansion units with the IM 314, IM 317 and IM 318 interface modules.

All intelligent I/O modules (IP) and communications processors (CP) can be connected in the EG 185U.

Up to 8 communications processors can be programmed via an interface if a 923C coordinator is used.

A hardware interrupt is not possible in the EG 185U expansion unit. A backup battery is provided for the RAM.

,

Possible configurations when connected to S5-135U, S5-155U

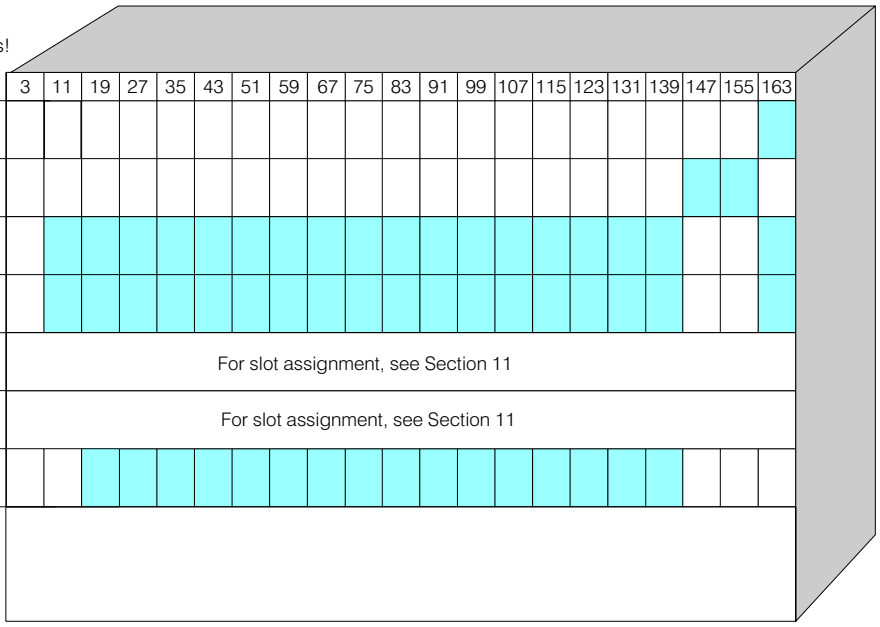
Note the respective slot requirements of the modules!

Slot No.	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
923 C coordinator		■																			
IM 300-5 interface module																					■
IM 314, IM 317 or IM 318 interface modules	■																				
IM 308-A interface module																			■	■	■
Digital input modules, digital output modules		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Analog input modules, analog output modules		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Intelligent I/O modules	For slot assignment, see Section 11																				
Communications processors	For slot assignment, see Section 11																				
IM 314R interface module (for the S5-155H)																			■	■	
313 monitoring module	■																				■

185U expansion unit (continued)

Design (continued)
Possible configurations when connected to S5-155H

Note the respective slot requirements of the modules!



1) Operation in EU only in combination with S5-155H

Ordering data	Order No.		Order No.
185U expansion unit with power supply, without backup battery		To be ordered as a separate item:	
• 230/120V AC; 5V/18A, 15V/0.5A, 24V/1A	**6ES5 185-3UA13**	**S5-135U/155U system manual**	see page 4/155
• 230/120V AC; 5V/40A, 15V/2A, 24V/2.8A	**6ES5 185-3UA33**	**Additional manuals**	see page 4/155
• 24V DC; 5V/18A, 15V/0.5A, 24V/1A	**6ES5 185-3UA23**	**Accessories, spare parts**	see page 4/155
• 24V DC; 5V/40A, 15V/2A, 24V/2.8A	**6ES5 185-3UA43**		
Backup battery (lithium battery)	**6EW1 000-7AA**		

187U expansion unit

Application

The 187U expansion unit is designed for the centra-lized connection to central control-lers and expansion units with power supply chassis for S5-135U and S5-155U.

Design

The 187U expansion unit comprises:

- 11 free slots

A power supply chassis, fan and wiring duct are not avail-able.

The 187U expansion unit can be centrally connected to central controllers or other ex-pansion units with the IM 312 interface module.

The power supply is delivered by the connecting cable of the IM 312-5 interface module.

A hardware alarm is not pos-sible in the 187U expansion unit. No battery backup is provided for the RAM.

Possible configurations

Note the respective slot requirements of the modules!

Slot No.	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
IM 312-5 interface module																					■
Digital input modules, digital output modules	■		■		■		■		■		■		■		■		■		■		
Analog input modules, analog output modules	■		■		■		■		■		■		■		■		■		■		
313 monitoring module	■																				

Ordering data	Order No.		Order No.
187U expansion unit	**6ES5 187-5UA11**	**Additional manuals**	see page 4/155
To be ordered as a separate item: **S5-135U/155U system manual**	see page 4/155	**Accessories, spare parts**	see page 4/155

Power supply chassis

Technical specifications

Power supply chassis	6ES5 955	-3LC41	-3LF41	-3LNC41	-3NF41	-3NA12	-7NC11
Installed in		ZG 135U/155U EG 183U EG185U	ZG 135U/155U EG 185U	ZG 135U/155U EG 183U EG 185U	ZG 135U/155U EG 185U	ZG 135U	ZG 155H
Input voltage							
• Rated value		**230 V/120 V AC**		**24 V DC**	**24 V DC**	**24 V DC**	**DC 24 V**
• Permissible range (including ripple)		187 to 264 V/93 to 132 V		18 to 33 V	18 to 33 V	20 to 30 V	18 to 33 V
Line frequency							
• Rated value		50 Hz					
• Permissible range		47 to 63 Hz					
Input current							
• Rated value		1.5 A (230 V)/ 2.5 A (120 V)	2.6 A (230 V)/ 4.5 A (120 V)	9.5 A	20 A	4.8 A	14 A
• Inrush current	max.	26 A for 100 µs	25 A for 2 ms	100 A for 100 µs	200 A for 1 ms	100 A	100 A
$I^2 \cdot t$ value of inrush current		4 A^2s	5.2 A^2s	2,7 A^2s	18 A^2s	20 A^2s	2.7 A^2s
Stored energy time in the event of power failure		20 ms	20 ms	20 ms	20 ms	5 ms	5/20 ms (settable)
Message via separate floating contacts		Fan failure (1 fan), Fan failure (2 or 3 fans), Battery failure				Fan failure, Battery failure	Fan failure, Battery failure
Number of outputs		3 (outputs A1/A2/A3)				2	2
Output voltage (A1/A2/A3)							
• Rated value		5.1 V DC/24V DC/15 V DC				5.1 V DC/24 V DC	5.1V DC/24V DC
• Tolerance		± 0.5 %/(+ 25 %, −12.5 %)/ ± 5 %				± 0.5 % (+ 25 %, − 24 %)	− 0.5 %, + 2% (+ 25%, −12.5%)
Output current (A1/A2/A3)							
• Rated value		18 A/1 A/0,5 A	40 A/2.8 A/2 A	18 A/1 A/0.5 A	40 A/2.8 A/2 A	10 A/0.4 A	14 A/0,1 A
• Permissible range		0.5 to 18 A	1.6 to 40 A	0.5 to 18 A	1.6 to 40 A	0 to 10 A	0.2 to 14 A
Galvanic isolation		Yes				No	Yes
Main buffering		Li battery (3.6 V; 5 Ah)				Li battery (3.6 V; 5 Ah)	Li battery (3.6 V; 1.9 Ah)
Reserve buffering		Accumulator (3.6 V; 1.2 Ah)				-	Li battery (3.6 V; 1.9 Ah)
Input for monitoring the load voltage 24 V		Yes				No	No
Auxiliary voltage							
• 15 V ± 0.5 %		0.5 A	2 A	0.5 A	2 A	—	—
• 24 V + 25 %/- 12.5 %		1 A	2.8 A	1 A	2.8 A	0.4 A	1 A
Power loss	max.	80 W	147 W	90 W	153 W	50 W	50 W
Number of integrated fans		3 (2-out-of-3 fan concept; fans can be exchanged during operation)				2	—
Weight	approx.	5.8 kg (12.7 lb)				3.8 kg (8.4 lb)	1.3 kg (2.9 lb)

15 V submodule		**6ES5 956-0AA12 (for power supply only 6ES5 955-3NA12)**
Can be installed in		Power supply chassis
Input voltage		24 V auxiliary voltage of the power supply chassis
Input current	approx.	Equal to output current
Output voltage		
• Rated value		+ 15 V
• Tolerance		± 0.5 %
Output current	max.	0.5 A
Weight	approx.	0.2 kg (0.4 lb)

Note:
The power supply units can be switched from 230 V to 120 V supply voltage. 5 V and 15 V ouput voltages are stabilized, the 24 V output voltage is roughly stabilized.

SITOP load power supplies

Application

The SITOP power family of power supplies is designed for supplying electrical consumers such as actuators or transmitters. The SITOP power family offers a uniform range of regulated power supplies, from 2 A to 40 A, for every application.

The 24 V power supplies of the SITOP family have the following characteristics:

- High efficiency, up to 90%
- Easy mounting on standard rails or on a mounting plate
- Low space requirements
- Accurate output voltage
- Minimal residual ripple
- Integrated short-circuit protection
- Safe electrical isolation
- Compliance with national and international standards

SITOP power basic line

The SITOP power basic line (24 V/2 A to 40 A) has been specially developed and optimized for industrial use. The units are used as load power supplies and for supplying electronic modules with a narrow input voltage range. It has excellent control characteristics, without the need for optional extras at additional cost. With no more than the essential functions, these units represent the optimum solution for industrial customers in terms of price and technology.

SITOP power special line

The SITOP power special line (24 V/5 A to 10 A) is, like the basic line, specially designed for industrial use. The units are particularly suitable for use with distributed I/O (5A, 10 A) and for supplying the ASI bus (2.4 A). The special feature of these units is the extremely narrow and rigid metal case. It allows installation in applications requiring a low mounting depth, i.e. in machines, tight spaces, U-profiles and switch-boxes at the machine.

SITOP power universal line

The units of the SITOP power universal line (24 V / 2.5 A to 4 A) have been developed for applications with demanding technical requirements. Interference suppression to class B guarantees minimal emitted interference. This means that in addition to industrial operation, the units are also suitable for domestic use, i.e. in building services automation.

For the basic technical specifications, see the following page.

SITOP load power supplies (continued)

Technical specifications

Equipment series	basic line	special line	universal line
	SITOP power 24 V/2 to 40 A	SITOP power 24 V/5 to 10 A	SITOP power 24 V/2.5 to 4 A
Rated supply voltage	120/230 V AC to 3 400 V AC	120/230 V AC	120/230 V AC
Stored energy time in the event of power failure	> 20 ms; > 3 ms	> 20 ms	> 20 /30 ms (at 120/187 V)
Line frequency			
• Rated value	50/60 Hz	50/60 Hz	50/60 Hz
• Permissible range	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz
Output voltage			
• Rated value	24 V DC	24 V DC	24 V DC
• Tolerance	± 3%; ±1%	± 3%	± 1%
• Residual ripple	< 150 mV	< 150 mV	< 50 mV
Efficiency, approx.	83 % to 89 %	87 % to 89 %	> 85 %
Line frequency			
• Rated value	50 Hz		
• Permissible range	47 to 63 Hz		
Output current			
• Rated value	2 to 40 A	5 to 10 A	2.5 to 4 A
• Range	0 to 40 A	0 to 10 A	0 to 4 A (up to 50 °C)
Short-circuit protection	Electronic	Electronic	Electronic
Degree of protection (IEC 536)	Class I	Class I	Class I
Galvanic isolation (SELV in acc. with EN 60950)	Yes	Yes	Yes
Radio interference suppression	Class A	Class A (EN 55011)	Class B (VDE 0871)
Degree of protection (IEC 529)	IP 20 and IP 00	IP 20	IP 20
Ambient temperature	0 to + 60 °C	0 to + 60 °C	0 to + 60 °C
Weight	0.5 to 7 kg	0.7 to 1.2 kg	0.5 kg

Ordering data

	Order No.		Order No.
Power supply		**Power supply**	
SITOP power basic line		**SITOP power universal line**	
Single-phase, 24 V/2 A	**6EP1 331-1SL11**	Single-phase, 24 V/2.5 A	**6EP1 332-1SH11**
Single-phase, 24 V/5 A	**6EP1 333-1SL11**	Single-phase, 24 V/4 A	**6EP1 332-1SH21**
Single-phase, 24 V/10 A	**6EP1 334-1SL11**	Single-phase, 24 V/20 A	**6EP1 336-1SH01**
3-phase, 24 V/20 A	**6EP1 436-1SL11**	3-phase (500 V), 24 V/20 A	**6EP1 436-1SH01**
3-phase, 24 V/40 A	**6EP1 437-1SL11**		
Power supply			
SITOP power special line			
Single-phase, 24 V/5 A	**6EP1 333-1AL11**		
Single-phase, 24 V/10 A	**6EP1 334-1AL11**		
DC/DC, 30 V/2.4 A	**6EP1 632-1AL01**		

Further information can be found in the catalog for systems engineering KT 10.

Overview

Overview

The following overview shows the interface modules and connecting cables used to connect the various expansion units to the central controllers.

Configuration/ transmission mode	Central controller		Expansion unit			Connecting cable
	Programmable controller type	Interface module type	EU type for S5-135U, S5-155U/H	ER type for S5-115U/H/F	Interface module type	Type Length
Centralized up to 2 m (6.5 ft), asymmetrical	S5-135U S5-155U S5-155H[1],	**IM 300-3**	EU 183U	—	**IM 312-3**	0.5 m[2] 0.95 m[2]
		IM 300-5 (-5CA11[1])	EU 184U EU 187U	—	**IM 312-5**	0.5 m[2] 1.5 m[2]
		IM 300-5 (-5LB1[1])	—	ER 701-1	**IM 306**	705-0/ 0.5 ... 2.5 m
		IM 301-3	EU 183U	—	**IM 312-3**	0.5 m[2] 0.95 m[2]
		IM 301-5	EU 184U EU 187U	—	**IM 312-5**	0.5 m[2] 1.5 m[2]
Centralized and distributed up to 100 m (328 ft), symmetrical	S5-135U S5-155U S5-155H[1],	**IM 301-3**	EU 183U		**IM 312-3**	0.5 m[2] 0.5 m[2]
		IM 301-3	EU 183U	ER 701-2 ER 701-3	**IM 310**	705-0/ 1 ... 100 m
		IM 301-5	EU 184U EU 187U		**IM 312-5**	0.5 m[2] 1.5 m[2]
Distributed up to 500 m (1640 ft), symmetrical	S5-135U S5-155U S5-155H[1],	**IM 304**	EU 183U EU 185U	ER 701-2 ER 701-3	**IM 314**	721-0/ 1 ... 500 m
	S5-155H[3]		EU 185U	ER 701-3H	**IM 314R**	721-0/ 1 ... 500 m
Distributed up to 3000 m (9840 ft), serial electrical	S5-135U S5-155U S5-155H[1],	**IM 308**	EU 183U EU 185U	ER 701-2 ER 701-3	**IM 318-3**	Shielded, twisted 2-wire cable
			ET 100U		**IM 318-8**	
Distributed 50 ... 1500 m (164 ... 4920 ft) (each between 2 interface modules), serial optical	S5-135U S5-155U S5-155H[1],	**IM 307**	EU 183U EU 185U	ER 701-2 ER 701-3	**IM 317** **IM 307** (IM 307 not in ER 701-2)	722-2 (fiber optic cable)

1) S5-155H with two-channel I/O modules (fully redundant configuration) or single-channel/single-sided I/O configuration.
2) At its one end, the cable is permanently connected to IM 312, at the other end it is provided with a plug connector for connection to IM 300-, or IM 301-.
3) S5-155H with single-channel I/Os (switched).

IM 300 and IM 312 interface modules; centralized configuration

Application

The IM 300/IM 312 interface modules are used for centralized configuration of I/O modules and intelligent I/O modules (without page addressing) with a central controller via the following expansion units:

- EG 183U
- EG 184U
- EG 187U

These expansion units can also be connected in centralized configuration with the EG 183U and EG 185U expansion units.

Design

The IM 300 interface module must be plugged into the slot provided in the central controller. The IM 312 interface module is plugged into the expansion unit. Up to four IM 300 interface modules can be used in the central controller, however, not more than two IM 300-5 in the ZG 135U/155U.

One IM 300 interface module can be plugged into each EG 183U or EG 185U expansion unit.

The IM 300 interface module allows two areas of 256 byte to be configured (P and Q areas).

Connecting the EG 184U and EG 187U expansion units

(Expansion units without power supply chassis)
The IM 300-5C interface module is to be used in the central controller and the IM 312-5 interface module in the expansion unit (see Fig. 4/49). Power (5 V, internal) is supplied to the EG 184U and EG 187U expansion units by way of the interface modules.

Connection of the EG 183U expansion unit

(Expansion unit with power supply chassis) The IM 300-3 interfacemodule is to be used in the central controller and the IM 312-3 interface module in the expansion unit (see Fig. 4/47). The IM 312-3 and IM 312-5 interface modules cannot be used simultaneously in one chain.

Connecting additional expansion units

In addition to the aforementioned expansion units, an expansion unit in the ER 701-1 expansion rack of the S5-115U programmable controller can also be connected (see Fig. 4/48). The expansion unit is supplied with power (5 V) by way of the interface module.

Technical specifications

Current consumption (at 5 V)		
• IM 300	max.	0.6 A
• IM 312	max.	0.2 A
Power loss		
• IM 300	max.	3 W
• IM 312	max.	1 W
Space requirements		1 slot
Weight	approx.	0.35 kg (0.77 lb)

Ordering data

	Order No.
IM 300 interface module for the central controller	
• For connecting the EG 184U or EG 187U	**6ES5 300-5CA11**
• For connecting the EG 183U	**6ES5 300-3AB11**
• For connecting the ER 701-0 or ER 701-1	**6ES5 300-5LB11**
IM 306 interface module for the expansion units ER 701-0, ER 701-1	**6ES5 306-7LA11**
705 connecting cable for connecting the IM 300-5LB interface module to the IM 306	
Length 0.5 m (1.64 ft)	**6ES5 705-0AF00**
1.2 m (3.93 ft)	**6ES5 705-0BB20**
1.5 m (4.92 ft)	**6ES5 705-0BB50**
2.5 m (8.2 ft)	**6ES5 705-0BC50**

	Order No.
IM 312 interface module for the expansion units	
EG 184U or EG 187U;	
• Expansion unit arranged above the central controller, 0.5 m (1.6 ft) cable	**6ES5 312-5CA12**
• Location of expansion unit arbitrary, 1.5 m (4.9 ft) cable	**6ES5 312-5CA22**
EG 183U;	
• Expansion unit arranged above the central controller, 0.5 m (1.6 ft) cable	**6ES5 312-3AB12**
• Expansion unit arranged below the central controller, 0.95 m (3.1 ft) cable	**6ES5 312-3AB32**
Terminator for the IM 312-3 interface module	**6ES5 760-0AB11**

The operating instructions are included in the S5-135U/155U system manual (see page 4/155).

IM 300 and IM 312 interface modules; centralized configuration (continued)

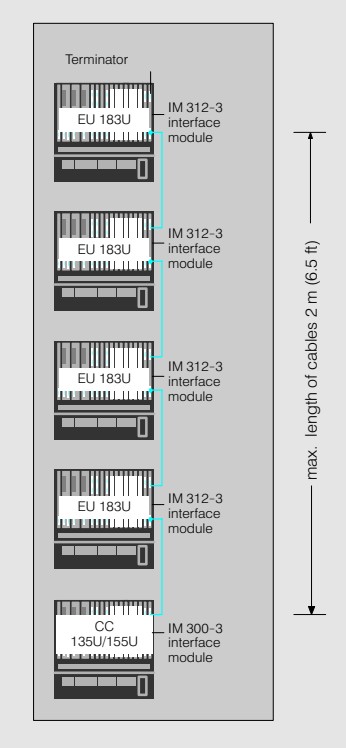


Fig. 4/47 Connection of expansion units with power supply chassis to the central controller in centralized configuration using the IM 312-3 and IM 300-3 interface modules

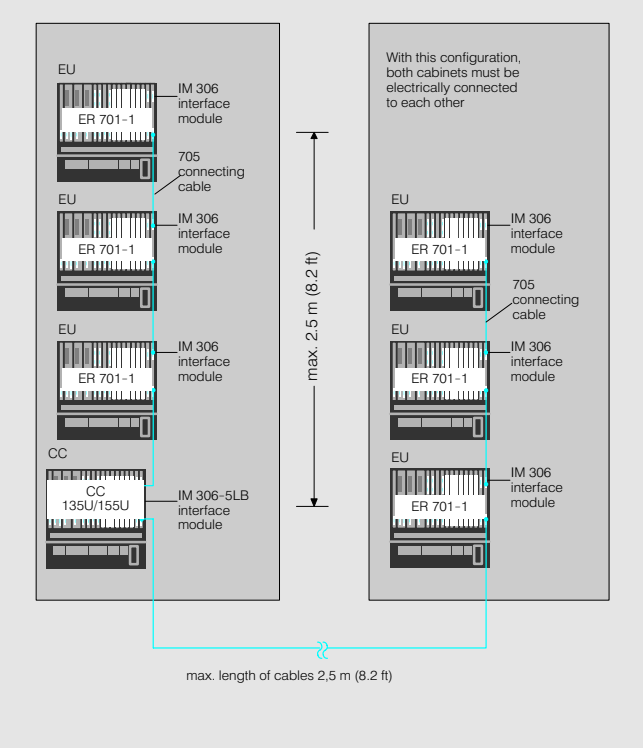


Fig. 4/48 Connection of expansion units without power supply chassis to the central controller in centralized configuration using the IM 306 and IM 300-5LB interface modules.

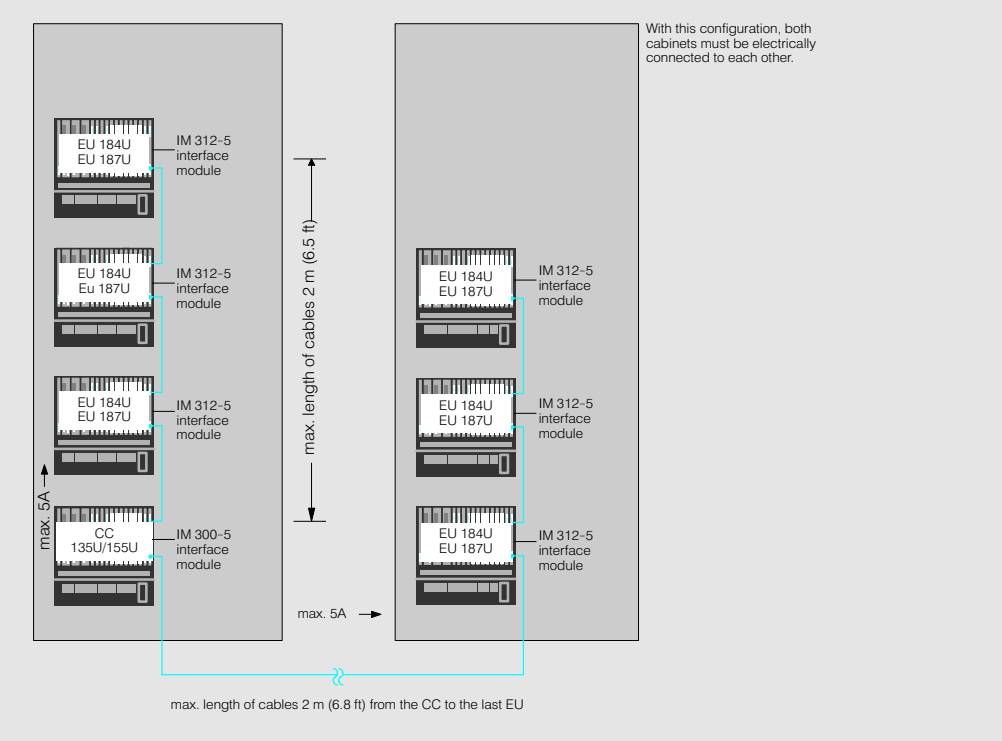
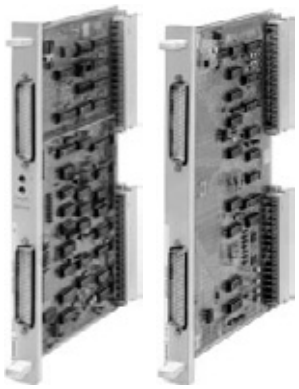


Fig. 4/49 Connection of expansion units without power supply chassis to the central controller in centralized configuration using the IM 312-5 and IM 300-5 interface modules.

IM 301 and IM 310 interface modules; distributed configuration up to 200 m (656 ft)

Application



The IM 301/IM 310 interface modules are used for distributed configuration of I/O modules and intelligent I/O modules (without page addressing) with a central controller via the EG 183U expansion unit. The expansion unit can be up to 200 m (656 ft) away from the central controller.

Design

The IM 301 interface module is plugged into the central controller and the IM 310 interface module into the expansion unit. Additional expansion units can be connected in centralized configuration to the distributed EG 183U expansion units. Up to four IM 301 interface modules can be plugged into the central controller.

The IM 301-5 interface module is used if additional EG 184U or EG 187U expansion units are to be connected in a centralized configuration to the central controller.

The IM 301-3 interface module is used if additional EG 183U expansion units are to be connected in a centralized configuration to the central controller.

Terminators must always be inserted into the last IM 310 and into the unused central connectors of the IM 301-3 and the unused distributed connectors of the IM 301-3 and IM 301-5.

The IM 301 interface module allows two areas of 256 byte to be configured (CP and Q areas).

Technical specifications

Current consumption (at 5 V)		
• IM 301	max.	0.8 A
• IM 310	max.	0.7 A
Power loss		
• IM 301	max.	4 W
• IM 310	max.	3.5 W

Space requirements		1 slot
Weight	approx.	0.3 kg (0.66 lb)

Ordering data

	Order No.
IM 301 interface module for the central controller	
• For the connection of the EG 184U or EG 187U	**6ES5 301-5CA12**
• For the connection of the EG 183U	**6ES5 301-3AB13**
Terminator for the IM 301	
• For free distributed connection of IM 301-3 and IM 301-5 (bottom)	**6ES5 760-0AA11**
• For free centralized connection of IM 301-3 (top)	**6ES5 760-0AB11**
IM 310 interface module for the expansion unit	**6ES5 310-3AB11**
Terminator for the IM 310	**6ES5 760-0AA11**

The operating instructions are included in the S5-135U/155U system manual (see page 4/155).

721 connecting cable	Order No.
1.00 m (3.28 ft)	**6ES5 721-0 BB00**
1.60 m (5.20 ft)	**6ES5 721-0 BB60**
2.00 m (6.56 ft)	**6ES5 721-0 BC00**
2.50 m (8.20 ft)	**6ES5 721-0 BC50**
3.20 m (10.4 ft)	**6ES5 721-0 BD20**
5.00 m (16.4 ft)	**6ES5 721-0 BF00**
8.00 m (26.2 ft)	**6ES5 721-0 BJ00**
10.00 m (32.8 ft)	**6ES5 721-0 CB00**
12.00 m (39.3 ft)	**6ES5 721-0 CB20**
16.00 m (52.4 ft)	**6ES5 721-0 CB60**
20.00 m (65.6 ft)	**6ES5 721-0 CC00**
25.00 m (82.0 ft)	**6ES5 721-0 CC50**
32.00 m (104.9 ft)	**6ES5 721-0 CD20**
40.00 m (131.2 ft)	**6ES5 721-0 CE00**
50.00 m (164.0 ft)	**6ES5 721-0 CF00**
63.00 m (206.6 ft)	**6ES5 721-0CG30**
80.00 m (262.4 ft)	**6ES5 721-0 CJ00**
100.00 m (328.0 ft)	**6ES5 721-0 DB00**
500.00 m (1640 ft)	**6ES5 721-0 DF00**

IM 301 and IM 310 interface modules; distributed configuration up to 200 m (656 ft) (continued)

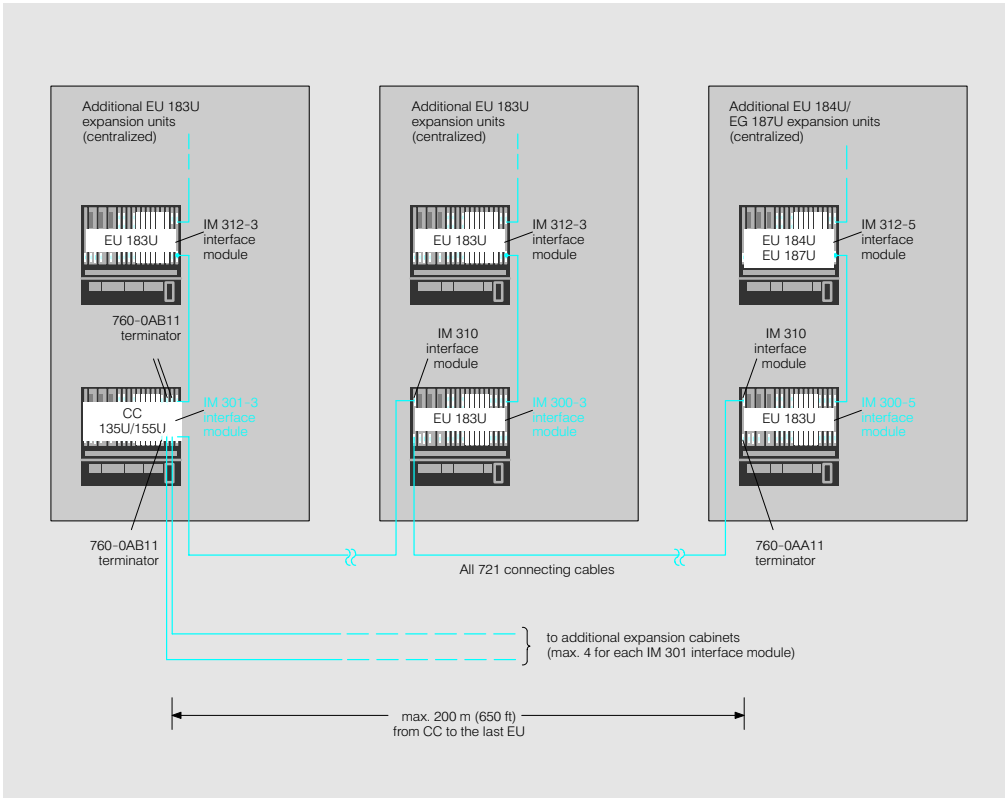


Fig. 4/50 Distributed connection of EG 183U expansion units to the central controller via the IM 310 and IM 301-3 interface modules

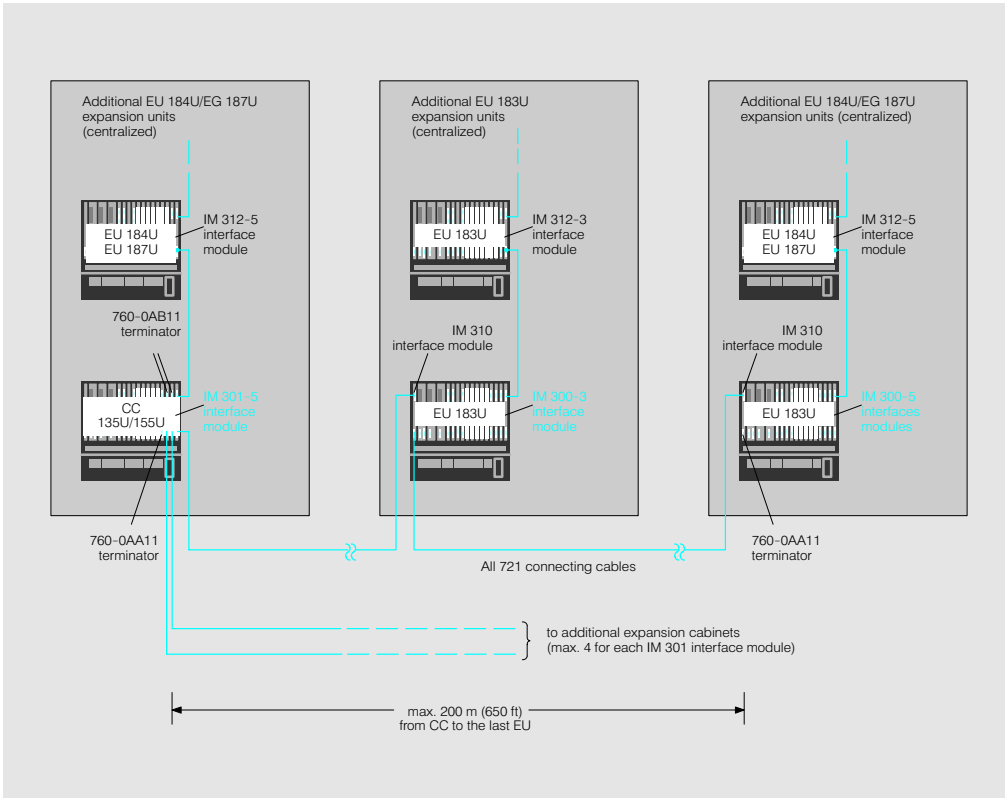


Fig. 4/51 Distributed connection of EG 184U/187U expansion units to the central controller via the IM 310 and IM 301-5 interface modules

IM 304 and IM 314 interface modules; distributed configuration up to 600 m (1969 ft)

Application

The IM 304/IM 314 interface modules are used for distributed configuration of I/O modules, intelligent I/O modules and communications processors with a central controller via the following expansion units:

- EG 183U
- EG 185U

The expansion unit can be up to 600 m (1969 ft) away from the central controller.

Design

The IM 304 interface module is plugged into the central controller and the IM 314 interface module into the expansion unit. Additional expansion units can be connected in a centralized configuration to the distributed expansion units. Up to four IM 304 interface modules can be plugged into the central controller.

Terminators must always be inserted into the last IM 314 interface module.

The IM 314 interface module allows four areas of 256 byte to be configured (P, Q, IM 3 and IM 4 areas). The IM 3 and IM 4 areas can only be accessed via absolute addresses.

Technical specifications

Current consumption (at 5 V)		
• IM 304	max.	1.2 A
• IM 314	max.	1.0 A
Power loss		
• IM 304	max.	6 W
• IM 314	max.	5 W

Number of units connectable to one IM 304		4
Space requirements		1 slot
Weight	approx.	0.3 kg (0.66 lb)

Ordering data

	Order No.
IM 304 interface module for the central controller	**6ES5 304-3UB11**
IM 314 interface module for the expansion unit	**6ES5 314-3UA11**
Terminator for the IM 314	**6ES5 760-1AA11**
The operating instructions are included in the S5-135U/155U system manual (see page 4/155).	

	Order No.
721 connecting cable	see page 4/142

IM 304 and IM 314 interface modules; distributed configuration up to 600 m (1969 ft) (continued)

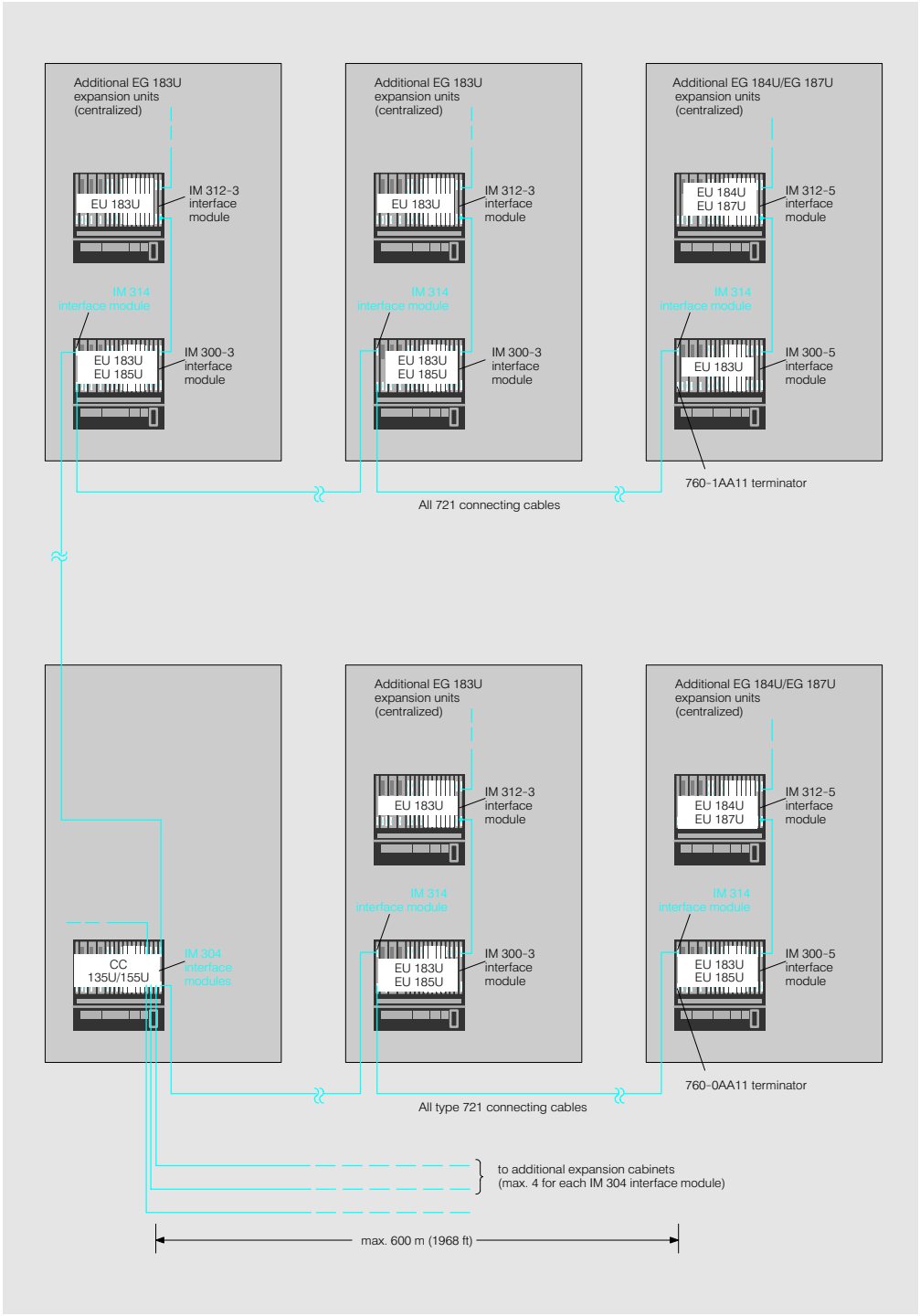


Fig. 4/52 Connection of expansion units to the central controller in a distributed configuration using the IM 314 and IM 304 interface modules

IM 308 and IM 318 interface modules; distributed configuration up to 3000 m (9900 ft) and ET 100U connection

Application

The IM 308/IM 318 interface modules are used for distributed configuration of I/O modules with a central controller via the following expansion units:

- EG 183U
- EG 185U

The ET 100U intelligent electronic terminator can also be connected (see Section 6).

The expansion unit and the electronic terminator may be up to 3000 m (9900 ft) away from the central controller.

Design

The IM 308 interface module is plugged into the central controller and the IM 318-3 interface module into the expansion unit, or the IM 318-8 interface module into the ET 100U electronic terminator. Up to four IM 308 interface modules can be plugged into the central controller.

Two lines, each containing up to 32 expansion units or ET 100U electronic terminators in any order can be connected to an IM 308 interface module. A total of 63 expansion units and ET 100U electronic terminators can operate via one IM 308 interface module. Digital and analog I/Os can be used in the expansion units and electronic terminators, but not intelligent I/Os or communications processors.

A memory submodule containing the address list is only required for the IM 308 if ET 100U electronic terminators are connected to it.

The central controller and the expansion units or electronic terminators are floating with respect to each other.

The IM 308 interface module allows four areas of 256 byte to be configured (P, Q, IM 3 and IM 4 areas). The IM 3 and IM 4 areas can only be accessed via absolute addresses.

Cables

The interface modules are to be connected via two-core cables. The modules are supplied together with connectors for connecting the cables using screw terminals. The connectors are provided with screw terminals for the incoming and the outgoing line. A terminating resistor (120 Ω; supplied with the IM 308) is to be mounted to the connector of the last IM 318. An expansion unit or an ET 100U electronic terminator can be switched off without affecting operation of the other units.

Selecting the cables:
Shielded, twisted two-core cables are to be used. The resistance of a core must not exceed 50 Ω, irrespective of the cable length. The surge impedance should be around 120 Ω. The capacitance per unit length must be as low as possible (< 60 pF/m). The bottom table shows two types of cable that can be used.

Maximum transmission rates, depending on type of cable and distance to the last unit of a line:

Type of cable	Transmission rate		
Distance	500 m (1640 ft)	1000 m (3280 ft)	3000 m (9840 ft)
Siemens control cable type A[1)] 6ES5 707-5AA00	375 kbit/s	187 kbit/s	—
Siemens control cable type B V45551-F21-B5 (1.5 mm^2, paired)	187 kbit/s	62 kbit/s	31 kbit/s

1) Supplied by the meter

Technical specifications

Transmission rate (selectable)		31, 62, 187 or 375 kbit/s
Number of units that can be connected		
• Per connection	max.	32
• Total	max.	63
Current consumption (at 5 V)		
• IM 308	max.	0.5 A
• IM 318	max.	0.3 A
Power loss		
• IM 308	max.	2.5 W
• IM 318	max.	1.5 W
Space requirements		1 slot
Weight	approx.	0.4 kg (0.88 lb)

IM 308 and IM 318 interface modules; distributed configuration up to 3000 m (9900 ft) and connection of the ET 100U (cont.)

Ordering data	Order No.		Order No.
IM 308 interface module Master interface module for central controller and EG 185U or for connecting up to 63 ET 100Us with S5-115U/H, S5-135U or S5-155U/H programmable controllers via plug-in connection and three terminating resistors	**6ES5 308-3UA12**	**IM 318-3 interface module** Slave interface module for EG 183U and EG 185U expansion units	**6ES5 318-3UA11**
IM 318-8 interface module Slave interface module for ET 100U electronic terminator	**6ES5 318-8MA12**	To be ordered as a separate item: **Manual** **Distributed I/Os,** **IM 308-3U/318-3U** German English French	**6ES5 998-2DP11** **6ES5 998-2DP21** **6ES5 998-2DP31**

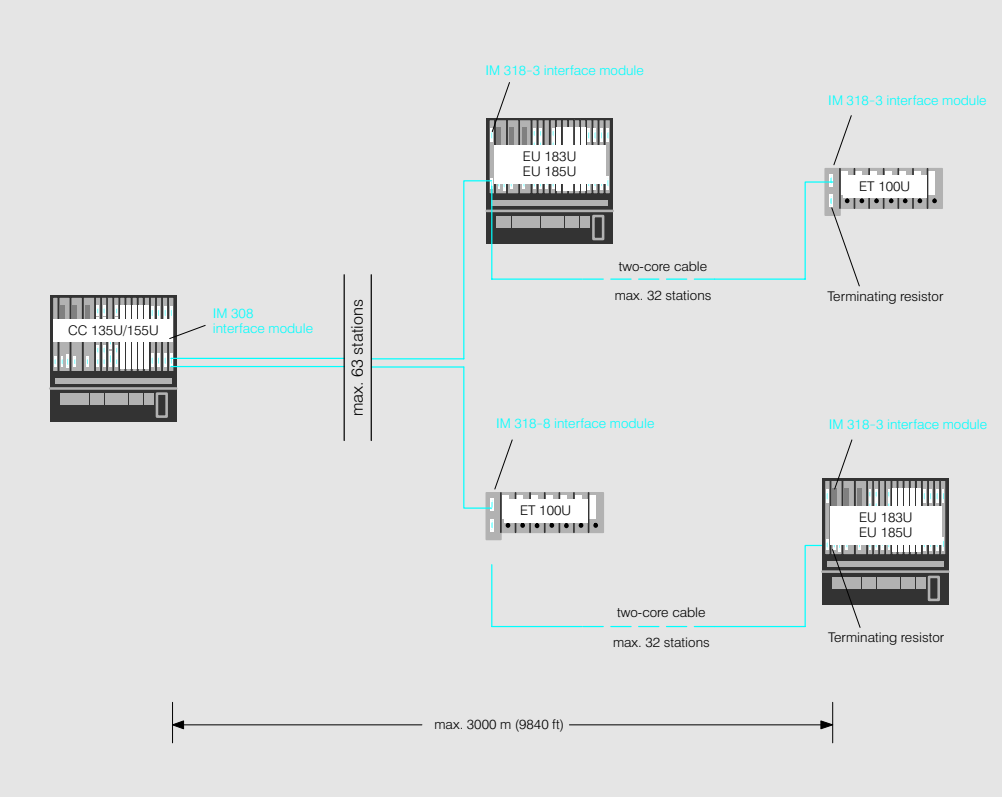


Fig. 4/55 Connection of expansion units and ET 100U to the central controller in a distributed configuration using the IM 318 and IM 308 interface modules

IM 308-C interface module; PROFIBUS-DP interface for S5-115U/H up to S5-155U/H

Application

The IM 308-C is a PROFIBUS-DP master and/or slave module for SIMATIC S5-115U/H up to S5-155U/H.

Up to 122 passive users like, for example, ET200 distributed I/O devices, the S5-95U/DP or field devices with PROFIBUS-DP interface can be connected to an IM 308-C interface module.

Design

The IM 308-C interface module must be plugged into the slot designed for it in the S5-115U/H up to S5-155U/H programmable controller.

The module requires a single-width slot.

The connection to the PROFIBUS LAN is made via

- a RS 485 bus interface plug or
- a RS 485 bus terminal.

Principle of operation

As master module, the IM 308-C interface module coordinates the bus access and the data transfer to the PROFIBUS-DP.

It can also operate as PROFIBUS-DP slave and thus makes data exchange with other PROFIBUS-DP masters possible.

The master and slave function can be used in combination, i.e. as a slave, an IM 308-C interface module receives data from another programmable controller and simultaneously works as master of e.g. ET 200 I/O components.

- Global Control:
  Sync, Freeze of I/O devices
- Address volume:
  13 Kbyte data from the CPU can be addressed per IM 308-C
- Shared Inputs:
  the inputs of a slave can be read by several IM 308-C interface modules

Configuration

Configure this module with the configuration package COM PROFIBUS (see Section 7).

Technical specifications

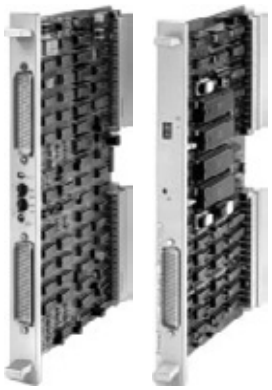
Transfer rate	9.6 kbit/s up to 12 Mbit/s	Data volume	244 byte inputs and outputs per slave
Interfaces at PROFIBUS	9-pin sub D socket	Permissible environmental conditions	
Supply voltage (via backplane bus)	+5 V DC	• Operating temperature	0 °C to +60 °C
		• Transport/storage temperature	-40 °C to +70 °C
Current consumption at 5 V DC max.	0.6 A	• Relative humidity	5 to 95 %
Address volume for inputs, outputs and diagnostics	13 Kbyte	Mechanical design	
		• Module format	Double eurocard
Number of I/O devices which can be connected	max. 122 ET 200 U/B/C, S5-95U/DP and/or other field devices	• Dimensions (W × H) in mm	160 × 233.4
		• Weight approx.	0.5 kg
		• Space requirements	1 slot

Ordering data

	Order No.		Order No.
IM 308-C interface module for connecting the SIMATIC S5-115U/H, S5-135U, S5-155U/H to PROFIBUS-DP, with memory card (256 kByte)	**6ES5 308-3UC11**	**Memory card** 256 Kbyte EPROM 1 Mbyte EPROM	**6ES5 374-1KH21** **6ES5 374-1KK21**

IM 304 and IM 324R interface modules for interfacing the S5-155H central controllers

Application



The IM 324R and IM 304 interface modules are used for linking the two ZG 135U/155U central controllers with a S5-155H failsafe programmable controller.

Design

The IM 324R interface module is plugged into the first central controller (subunit A) and the IM 304 interface module into the second central controller (subunit B). The two interface modules are connected via a 721 connecting cable (max. 100 m (328 ft)).

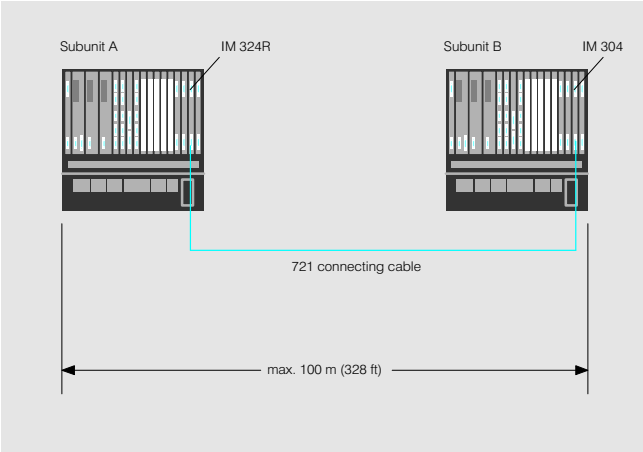


Fig. 4/56 Interfacing of the two central controllers

Principle of operation

The two IM 324R and IM 304 interface modules handle all data communications between the two central controllers of the failsafe programmable controller.

Technical specifications

Current consumption (at 5 V)		
• IM 304	max.	1.5 A
• IM 324R	max.	1.0 A
Power loss		
• IM 304	max.	7.5 W
• IM 324R	max.	5 W

Space requirements	1 slot
Weight	0.3 kg (0.66 lb)

Ordering data

	Order No.
IM 304 interface module for linking the central controllers of the S5-155H	**6ES5 304-3UB11**
IM 324R interface module for linking the central controllers of the S5-155H	**6ES5 324-3UR11**
721 connecting cable	see page 4/142

IM 304 and IM 314R interface modules for switched configuration at S5-155H

Application

The IM 304 and IM 314R interface modules are used for the single-channel configuration of the I/O modules of a S5-155H redundant programmable controller.

In addition, the interface modules are recommended for the three-channel input configuration when connecting the EG 185U expansion unit.

Design

An IM 304 interface module is plugged into each of the two central controllers. Two IM 314R interface modules are plugged into each expansion unit. The interface modules must be interconnected via 721 connecting cables (max. 600 m (1968 ft)). A terminating resistor must be plugged into the last interface module in each chain.

The expansion units (EG 185U) can be situated up to 600 m (1968 ft) away from the central controllers. A maximum of eight lines, each with up to four expansion units, can be connected to the central controllers. The maximum number of expansion units which can be connected is 16.

The following can also be connected to each EG 185U expansion unit:

- Expansion units EG 183U, EG 184U and EG 187U in a centralized configuration using IM 300 interface modules
- Expansion unit EG 183U and the ET 100U electronic terminator in distributed configuration using IM 308 interface modules
- The ET 200 distributed I/O system using the IM 308-C interface module (see Section 6)

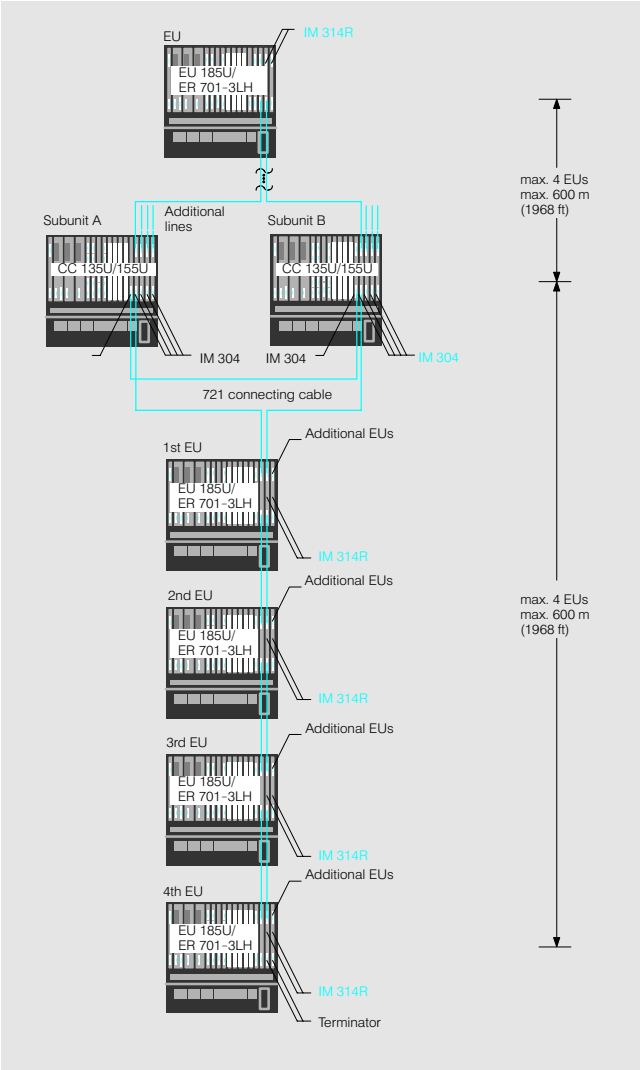


Fig. 4/57 Distributed switched I/O configuration

IM 304 and IM 314R interface modules for switched configuration at S5-155H (continued)

Principle of operation

The IM 304 and IM 314R interface modules handle all data communications between the respective central controller and the expansion unit.

Technical specifications

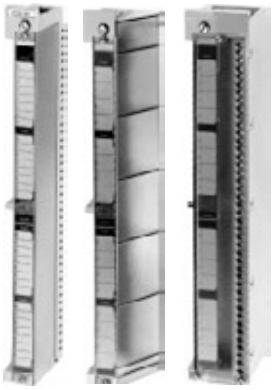
Current consumption (at 5 V)		
• IM 304	max.	1.5 A
• IM 314R	max.	1.0 A
Power loss		
• IM 304	max.	7.5 W
• IM 314R	max.	5 W
Space requirements		1 slot
Weight	approx.	0.3 kg

Ordering data

	Order No.
IM 304 interface module for the central controller	**6ES5 304-3UB11**
IM 314R interface module for the EG 185U expansion unit	**6ES5 314-3UR11**
Terminator for IM 314R	**6ES5 760-0HA11**
721 connecting cable	see page 4/142

Front connectors

Application



Front connectors must be used to terminate the signal cables for input and output modules. Either crimp terminals or screw terminals can be selected for all modules. Connector sleeves are not required.

Design

The front connectors are hooked into the module at the bottom, swung towards the module and bolted at the top.

The width of the front connectors corresponds to one of the following:

- 1 slot (single-width) or
- 2 slots (double-width).

Double-width front connectors should always be used for double-width modules or if the slot adjacent to the module at the right is unused (always in the EG 187U expansion unit; without fan).

Stranded conductors should be used for easy movement of the front connectors.

Further types of connection with modified front connectors, prepared cables and terminals for sensors and actuators can be found in the Catalog KT 10 (SITOP power).

Technical specifications

Front connector	**6ES5 497-...**
Connection	Crimp terminals or screw terminals
Conductor cross-section	
• Crimp terminals	0.5 ... 1.5 mm^2
• Screw terminals	0.5 ... 2.5 mm^2

Space in the front connector		
• Cross-section	approx.	470 mm^2
• Number of cables		
with 2.5 mm^2	max.	24
with 1.5 mm^2	max.	36
with 0.5 mm^2	max.	48
Weight	approx.	0.2 kg (0.44 lb)

Ordering data

	Order No.
497-4UA front connector for crimp terminals (without crimp contacts)	
• Width = 1 slot, 42-pin for the following modules (with fan) 6ES5-420.., -430.., -431.., -432.., -434.., -441.., -451.., -458.., -460.., -463.., -465.., -470.., -482..	**6ES5 497-4UA12**
• Width = 2 slots, 42-pin for the modules 6ES5-453.., -454.., -457.., -482..; for the following modules (without fan) 6ES5-420.., -430.., -431.., -432.., -434.., -441.., -451, -458.., -460.., -463.., -465.., -470..	**6ES5 497-4UA22**
• Width = 2 slots, 20-pin for the following modules 6ES5-435.., -436.., -455.., -456.., -951..	**6ES5 497-4UA42**

	Order No.
497-4UB front connector for screw terminals	
• Width = 1 slot, 42-pin for the following modules (with fan) 6ES5-420.., -430.., -431.., -432.., -434.., -441.., -451.., -458.., -460.., -463.., -465.., -470.., -482..	**6ES5 497-4UB31**
• Width = 2 slots, 42-pin for the modules 6ES5-453.., -454.., -457.., -482..; for the following modules (without fan) 6ES5-420.., -430.., -431.., -432.., -434.., -441.., -451.., -458.., -460.., -463.., -465.., -470..	**6ES5 497-4UB12**
• Width = 2 slots, 25-pin for the module 6ES5-454..	**6ES5 497-4UB22**
• Width = 2 slots, 20-pin for the following modules 6ES5-435.., -436.., -455.., -456.., -951..	**6ES5 497-4UB42**

Front connectors (continued)

Ordering data (continued)	Order No.
Front connector K for 6ES5-466..	
• For screw terminals Width = 1 slot, 43-pin;	**6XX3 081**
• For crimp terminals Width = 1 slot, 43-pin;	**6XX3 068**
LED extension for front connector with	
• screw terminals	**6ES5 497-4UL21**
• crimp terminals	**6ES5 497-4UL11**
Crimp contacts pack of 250	**6XX3 070**
Crimping tool for crimping crimp contacts	**6XX3 071**
Extraction tool for crimp contacts	**6ES5 497-4UC11**

Manuals, further accessories

Ordering data	Order No.
S5-135U/155U system manual with operating instructions for CC, EU, CPU, IM 300 to IM 314 interface modules, digital input and output modules and analog input and output modules	
German	**6ES5 998-0SH11**
English	**6ES5 998-0SH21**
French	**6ES5 998-0SH31**
Spanish	**6ES5 998-0SH41**
Italian	**6ES5 998-0SH51**
Programming instructions	
• for CPU 922 G, GB, F, E	**6ES5 998-0PR□1**
• for CPU 928 G, GB, F, E	**6ES5 998-1PR□1**
• for CPU 928B G, GB, F, E, I	**6ES5 998-2PR□1**
• for CPU 948 G, GB, F, E, I	**6ES5 998-3PR□1**
Communications manual for CPU 928B G, GB, F, E, I	**6ES5 998-0CN□2**
S5-135U/155U manual for	
• **CPU 922** with S5-135U/155U system manual and programming instructions CPU 922; G, GB, F, E	**6ES5 998-0UL□3**
• **CPU 928** with S5-135U/155U system manual and programming instructions CPU 928; G, GB, F, E	**6ES5 998-1UL□4**
• **CPU 928B** with S5-135U/155U system manual, communications manual for CPU 928B/ CPU 948 and CPU 928B programming instructions; G, GB, F, E, I	**6ES5 998-2UL□4**
• **CPU 948** with S5-135U/155U system manual, communications manual for CPU 928B/ CPU 948 and CPU 922 programming instructions; G, GB, F, E, I	**6ES5 998-1UM□2**
German	**1**
English	**2**
French	**3**
Spanish	**4**
Italian	**5**

Manuals (continued)	Order No.
S5-135U/155U pocket guide for CPU 922, CPU 928, CPU 928B and CPU 948; G, GB, F, E, I	**6ES5 997-3UA□3**
German	**1**
English	**2**
French	**3**
Spanish	**4**
Italian	**5**
S5-155H manual with operating instructions for S5-155H, programming guide and CPU 948R/RL quick reference	
German	**6ES5 998-4SR11**
English	**6ES5 998-4SR21**
French	**6ES5 998-4SR31**
Power supply chassis	
• 230V/120V AC; 5V, 18A; 24V, 1A; 15V, 0.5A for ZG 135U/155U, EG 183U and EG 185U	**6ES5 955-3LC41**
• 230V/120V AC; 5V, 40A; 24V, 2.8A; 15V, 2A for ZG 135U/155U and EG 185U	**6ES5 955-3LF41**
• 24V DC; 5V, 18A; 24V, 1A; 15V, 0.5A for ZG 135U/155U, EG 183U and EG 185U	**6ES5 955-3NC41**
• 24V DC;5V, 40A; 24V, 2.8A; 15V,2A for ZG 135U/155U and EG 185U	**6ES5 955-3NF41**
• 24V DC; 5V, 10A; 24V, 0.8A for ZG 135U	**6ES5 955-3NA12**
Fan chassis for EG 184U	
• 230/120V AC	**6ES5 988-3LA11**
• 24V DC	**6ES5 988-3NA11**
Spare fan for CC and EUs with power supply chassis 6ES5 955-3. .41	**6ES5 988-3NB41**

Manuals, further accessories (continued)

Ordering data (continued)	Order No.
Accessories for ZG 135U/155U, EG 183U to EG 187U (cont.)	
Spare fan (set of 2)	
• 230V AC for 6ES5 955-3LC14/-3LF12 and 6ES5 988-3LA11	**6ES5 988-3LB21**
• 24V DC for 6ES5 955-3NA12/ -3NC13/-3NF11 and 6ES5 988-3NA11	**6ES5 988-3NB11**
Backup battery	
• For power supply chassis (3.4V, 5Ah)	**6EW1 000-7AA**
• For memory submodules with RAM (3V, 0.2Ah)	**6ES5 980-0DA11**
Rechargeable battery for power supply chassis 6ES5 955-3xx41	**6ES5 980-0NC11**
Baffle plate for improving the cooling of devices with fan; air entry from lower front side, air exit upper back side	**6ES5 981-0DA11**
Dust filter holder for CC and EUs with power supply chassis 6ES5 955-0FA41	**6ES5 981-0FA41**
Dust filter (set of 10) for dust filter holder 6ES5 981-0FA41	**6ES5 981-0EA41**
Dust filter holder for CC and EUs with power supply chassis 6ES5 955-3LC14/ -3LF12/-3NA12/-3NC13/-3NF11, 6ES5 988-3xA11	**6ES5 981-0FA11**

	Order No.
Accessories for ZG 135U/155U, EG 183U to EG 187U (cont.)	
Dust filter (set of 10) for dust filter holder 6ES5 981-0FA11	**6ES5 981-0EA11**
Dummy front plates for covering free slots	
• Width 1 slot	**6XF2 008-6KB00**
• Width 2 slots	**6XF2 016-6KB00**
15 V module for building into power supply chassis 6ES5 955-3NA12/ -3NF11/-3LF12 for supplying the bus connector for Industrial Ethernet. All other power supply chassis do not require a 15 V module.	**6ES5 956-0AA12**
Accessories for ZG 155H	
Power supply 24 V DC; 5 V, 14 A	**6ES5 955-7NC11**
Fan subassembly 24 V DC	**6ES7 408-1TA01-0XA0**
Replacement fan	**6ES7 408-1TA00-6AA0**
Dust filter (10 items)	**6ES7 408-1TA00-7AA0**
Backup battery Lithium, type AA 3.6 V; 1.9 Ah	**6ES7 971-0BA00**

Application

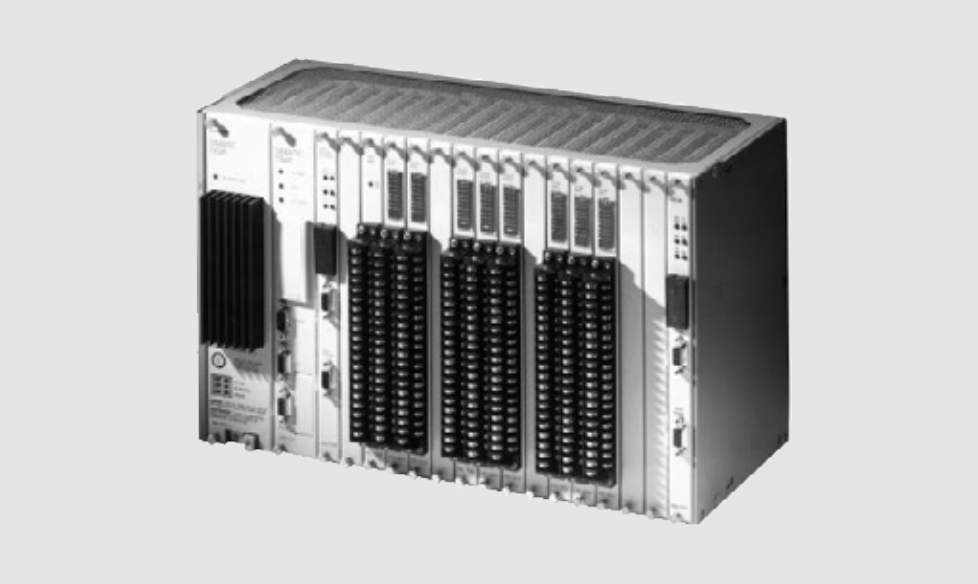


Fig. 5/1 SIMATIC 505 programmable controllers

The SIMATIC 505 programmable controllers provide a special combination of open-loop control tasks, closed-loop control tasks and complex mathematical functions for a large variety of applications in process engineering.

Design

Compactness

The SIMATIC 505 programmable controllers have an extremely compact design corresponding to the state-of-the-art of integrated circuits (ASICs). The latest design technology ensures low space requirements with high performance. System costs and space requirements decrease at the same time as system reliability increases.

Intelligent I/O modules

The SIMATIC 505 programmable controllers have different digital, analog and intelligent I/O modules as well as communications processors available. There are digital module versions with 8, 16, 32 inputs/outputs, and relay module versions with 8, 16, 32 outputs. Analog input/output modules acquire signals from thermocouples and RTD inputs. In addition, there are AT-compatible PC modules and different communications processors (for example, with RS 232 interfaces) available.

Distributed control

The SIMATIC 505 programmable controllers let you take a truly distribued approach to your plant control. First of all they are designed to meet the latest IEC safety and reliability standards to withstand the toughest industrial environments so that they can be placed wherever they are needed. Secondly, a powerful, remote I/O capability enables I/O modules and subracks to be placed as far as 1000 m/3280 ft from the controller itself, thus eliminating the need for long, multiple cable runs to remote sensors and actuators.

Design (continued)

Redundant systems

For critical process applications, the SIMATIC 560T/TI565T systems can be combined with the TI505 I/O modules to form a redundant system. The redundant design reduces any possible down time to a minimum.

Hot backup with single-channel I/O design

The hot backup system consists of a redundant configuration of the CPUs.

The active PLC and the standby PLC are each equipped with a hot backup card.

A fiber-optic connection between the active and the standby PLC executes self monitoring and synchronization of the programs up to four times per cycle.

The active PLC updates the standby PLC automatically and hands over control as soon as a serious fault occurs.

The hot backup system requires no additional programming by the user.

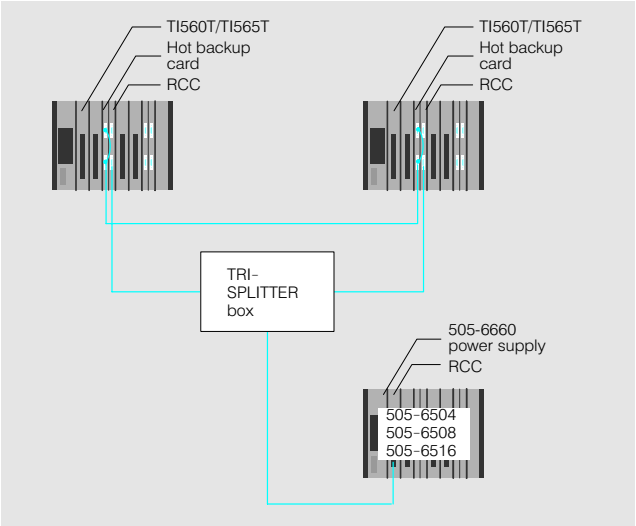


Fig. 5/2 Hot backup with single-channel I/O

It guarantees the integrity of both PLCs even during on-line program edits.

Hot backup with two-channel I/O design

The TI505 I/O system can also operate redundantly.

For this purpose, a special power supply module and the RBC (remote base controller) are installed redundantly (double) in a special redundantly designed mounting rack. The RF-RBC is an intelligent interface between the RCC (remote channel controller) and the redundant mounting rack.

The redundant mounting rack, equipped with 11 slots, contains two power supply modules (110/220 V AC or 24 V DC) and two RBCs. In addition, each redundant mounting rack has two cables so that if one line fails an automatic switch can be made to the other.

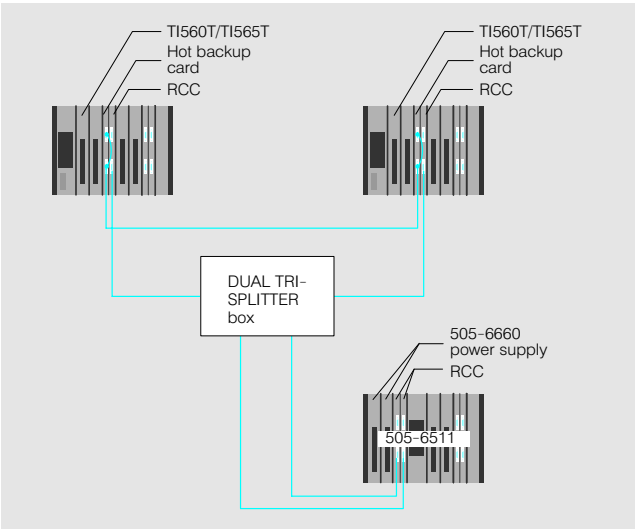


Fig. 5/3 Hot backup with two-channel I/O

In normal mode, one of the redundant RCBs is active and the other is in standby. If an fatal fault occurs in the active RCB, communications are automatically switched to the redundant standby RCB. This takes place within one PLC cycle.

Programming

Ease of use means different things to different people. That's why a choice of different development tools is offered.

The SIMATIC TISOFT package is available for programming the PLC. For those with previous knowledge of process automation, there is SIMATIC APT.

SIMATIC APT uses CASE (computer-aided software engineering) technology which provides for a structured approach to programming while simultaneously enabling mastery of sequential control processes and continuous closed-loop control functions.

APT ensures that the programs are well structured and documented. The data coherence check reduces programming errors to a minimum.

General technical specifications

Safety and reliability	SIMATIC 505 corresponds to the IEC 65A and DIN 41 494 standards for industrial and process control systems.
Insulation group	In accordance with IEC 801, Part 2, Paragraph 4. Protection against static electrical discharge to 15 kV.
Temperature range	In accordance with IEC 68-2-14 NB. Fault-free operation at temperatures fluctuating between 0 to 60 °C.
Humidity	In accordance with IEC 68-2-3 Ca. Fault-free operation under environmental conditions up to 95% humidity at 60 °C.
Mechanical shock test	In accordance with IEC 68-2-21 EA test. No detrimental effect in the case of non-repetitive shocks.

See Section 1 for further technical specifications

Ordering data TI525 to TI565

	Order No.
Mounting racks	
for TI505	
4 slots	**PPX:505-6504**
8 slots	**PPX:505-6508**
11 slots, redundant	**PPX:505-6511**
16 slots	**PPX:505-6516**
Power supply units	
1 required per mounting rack	
2 per redundant mounting rack	
110/220 V AC, single	**PPX:505-6660**
110/220 V AC, single or redundant	**PPX:505-6660-A**
24 V DC, single or redundant	**PPX:505-6663**
CPUs	
TI525 Memory 10 KB, 512 digital/128 analog inputs/outputs	**PPX:525-1102**
TI535 Memory 40 KB, 1024 digital/1024 analog inputs/outputs	**PPX:535-1212**
TI545 Memory 192 KB, 2048 digital/1024 analog inputs/outputs, 64 controllers	**PPX:545-1102**
TI545 Memory 96 KB, 1024 digital/1024 analog inputs/outputs, 16 controllers	**PPX:545-1103**

	Order No.
CPUs (continued)	
Firmware upgrade kit	
for TI545-1101 Version 2.1.1	**PPX:2601099-8005**
for TI545-1102 Version 3.1	**PPX:2601099-8006**
TI555 8192 digital/8192 analog inputs/outputs,	
memory 384 KB,	**PPX:555-1101**
memory 1920 KB	**PPX:555-1102**
TI560T (with power supply)	
for twisted-pair cable	
• 110 V AC, RS 485, RCC	**PPX:560T1KM-1101**
• 24 V DC, RS 485, RCC	**PPX:560T1KM-1102**
for coaxial cable connection	
• 110 V AC, RCC	**PPX:560T4KM-1101**
• 24 V DC, RCC	**PPX:560T4KM-1102**
TI565T (with power supply)	
for twisted-pair cable	
• 110 V AC, RS 485, RCC	**PPX:565T1KM-1101**
• 24 V DC, RS 485, RCC	**PPX:565T1KM-1102**
for coaxial cable connection	
• 110 V AC, RCC	**PPX:565T4KM-1101**
• 24 V DC, RCC	**PPX:565T4KM-1102**

Ordering data TI525 to TI565	Order No.
CPUs (continued)	
Programming manual for TI505	
German	**PPX:505-8104D**
English	**PPX:505-8104-5**
Italian	**PPX:505-8104I**
Technical product description for TI525/TI535	
English	**PPX:505-8103**
System manual for TI525, TI535	
English	**PPX:505-8106**
German[1]	**PPX:505-8106D**
French[1]	**PPX:505-8106F**
Technical product description for TI545/TI555	
CPU 1101	
English	**PPX:545-8101-4**
German	**PPX:545-8101D**
French	**PPX:545-8101F**
Italian	**PPX:545-8101I**
System manuals for TI545/TI555	
CPU 1102, English	**PPX:545-555-8101-2**
Documentation set TI545 (hardware, design, I/O programming), English	**PPX:545-8102**
Technical product description for TI545	
English	**PPX:545-8103-3**
German	**PPX:545-8103-3D**
French	**PPX:545-8103-3F**
Italian	**PPX:545-8103-3I**
System manual for TI555, CPU	
English	**PPX:555-8101-2**
German	**PPX:555-8101-1D**
französich	**PPX:555-8101-1F**
Italian	**PPX:555-8101-1I**
System manual for TI560T/TI565T, English	**PPX:560-65-8109**
Programming manual for TI560T/TI565T	
English	**PPX:560-65-8102**
German[1]	**PPX:560-65-8102D**
French[1]	**PPX:560-65-8102F**
Italian[1]	**PPX:560-65-8102I**
Product description for TI560T/TI565T	
English	**PPX:560-65-8107**
French	**PPX:560-65-8107F**
Italian	**PPX:560-65-8107I**
User manual for redundant I/O, English	**PPX:560-65-8108**

	Order No.
Controllers	
Controllers for expansion units	
• I/O channel controller (IOCC) for TI535[2]	**PPX:505-6830**
• Distributed base controller (DBC) for TI535[3]	**PPX:505-6840**
• Remote channel controller (RCC), coaxial	**PPX:560-2126-B**
• Remote channel controller (RCC), RS 485 interface	**PPX:560-2127-B**
• Remote base controller (RBC), coaxial FM mode[4]	**PPX:505-6850-A**
• Remote base controller (RBC), RS 485 interface[4]	**PPX:505-6851-A**
• Remote base controller (RBC) for TI560T/565T, max. 4 km, coaxial	**PPX:500-2114-A**
• Remote base controller (RBC), for TI560T/565T, max. 1 km, RS 485	**PPX:500-5114-A**
• 505/6MT controller	**PPX:505-5190**
• 505/7MT controller	**PPX:505-7190**
Manuals	
• 7 MT interface adapter	**PPX:505-8115-2**
• 6 MT interface adapter	on request
Communications modules	
Peerlink module, Point-to-point link between 2 to 16 modules, mixed link between TI500 and TI505, with manual	
• for TI505, 2 redundant channels	**PPX:505-7354**
• for TI500, 1 channel	**PPX:500-5053**
• for TI500, 2 redundant channels	**PPX:500-5054**
TIWAY communications processor NIM with manual	
• 2 redundant interfaces (local line) for TI505	**PPX:505-7339**
• 2 redundant interfaces (RS232) for TI505	**PPX:505-7340**
• 2 redundant interfaces (local line) for TI500	**PPX:500-5039**
• 2 redundant interfaces (RS232) for TI500	**PPX:500-5040**
UNLINK host adapter with manual and PIM	
• 115 V AC, local line/local line TI-WAY interfaces, computer interfaces RS232C/423	**PPX:505-7111**
• 115 V AC, RS232C/RS232C TI-WAY interfaces, computer interfaces RS232C/423	**PPX:505-7112**
• 220 V AC, local line/local line TI-WAY interfaces, computer interfaces RS232C/423	**PPX:505-7113**
• 220 V AC, RS232C/RS232C TI-WAY interfaces, computer interfaces RS232C/423	**PPX:505-7114**

1) Available in Europe only.
2) TI535: additional IOCC in basic mounting rack.
3) TI535: DBC as interface in each expansion rack.
4) RBC as interface between CPU and RCC in expansion racks for 560T/565T.

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Ordering data 525 to 565	Order No.
Communications modules (continued)	
FIM fieldbus interface module, (with manual) Connection with USS protocol (for SIMOVERT/SIMOREG drives), Profibus link (e.g. ET 200, S5-95U, drives), connection as for expansion rack (remote base)	**PPX:505-7202**
Industrial Ethernet module (NIM/Ethernet) Point-to-point link via Layer 4, connection via TF functionality Layer 7, with manual	**PPX:505-CP1434TF**
MODBUS NIM 2 redundant interfaces, slave stations, with manual (English) and software	**PPX:505-5184**
RS485 coaxial converter for connecting coaxial I/O to TI545/555/575	**PPX:505-6860**
TIWAY TAP Distributor terminal for bus cable	**PPX:2703770-8001**
500 and 505 manual	**PPX:500-8115**
Manuals for TIWAY modules	
• TI505 user description, English	**PPX:TIWAY-8124**
• TI500 user description, English	**PPX:TIWAY-8110**
• TI500 technical description, English	**PPX:TIWAY-8119**
Manuals for UNILINK host adapter	
• Installation manual, English	**PPX:TIWAY-8106**
• User manual, English	**PPX:TIWAY-8121**
• TIWAY system, English	**PPX:TIWAY-8101**
User for FIM,	
German	**PPX:505-8124-2D**
English	**PPX:505-8124-3**
French	**PPX:505-8124-2F**
Italian	**PPX:505-8124-2I**
User for Industrial Ethernet,	
German	**PPX:505-8126-1D**
English	**PPX:505-8126-2**
French	**PPX:505-8126-1F**
Italian	**PPX:505-8126-1I**
MODBUS NIM, English	**PPX:505-8122-1**
I/O modules	
Digital input modules	
• 4 to 15 V DC, 8-point source/sink inputs	**PPX:505-4108**
• 4 to 15 V DC, 16-point source/sink inputs	**PPX:505-4116**
• 4 to 15 V DC, 32-point source/sink inputs	**PPX:505-4132**
• 24 V DC, 8-point source/sink inputs	**PPX:505-4308**
• 24 V DC, 32-point source/sink inputs	**PPX:505-4332**

I/O modules (continued)	Order No.
Digital input modules (cont.)	
• 48/24 V DC, 16 inputs	**PPX:505-4316-A**
• 24 V AC, 8 inputs	**PPX:505-4008-A**
• 24 V AC, 16 inputs	**PPX:505-4016-A**
• 24 V AC, 32 inputs	**PPX:505-4032-A**
• 110 V AC, 8 inputs	**PPX:505-4208-A**
• 110 V AC, 16 inputs	**PPX:505-4216-A**
• 110 V AC, 32 inputs	**PPX:505-4232-A**
• 220 V AC, 8 inputs	**PPX:505-4408-A**
• 220 V AC, 16 inputs	**PPX:505-4416-A**
• 220 V AC, 32 inputs	**PPX:505-4432-A**
• 24 V DC isolated, 16/8 interrupt inputs	**PPX:505-4317**
• 48 V DC, isolated interrupts, 16 inputs/outputs	**PPX:505-4318**
• 125 V DC, isolated interrupts, 16 inputs/outputs	**PPX:505-4319**
• Simulation modules, 32 inputs	**PPX:505-6010**
Digital output modules	
• 24 V DC, 0.5 A, 8 source-only outputs	**PPX:505-4508**
• 24 V DC, 0.5 A, 8 sink-only outputs	**PPX:505-3508**
• 24 V DC, 0.5 A, 16 source-only outputs	**PPX:505-4516**
• 24 V DC, 0.5 A, 16 sink-only outputs	**PPX:505-3516**
• 24 V DC, 0.5 A, 32 source-only outputs	**PPX:505-4532**
• 24 V DC, 0.5 A, 32 sink-only outputs	**PPX:505-3532**
• 24 V DC, 2 A, 8 source-only outputs	**PPX:505-4708**
• 24 V DC, 2 A, 8 sink-only outputs	**PPX:505-3708**
• 24 V DC, 2 A, 16 source-only outputs	**PPX:505-4716**
• 24 V DC, 2 A, 16 sink-only outputs	**PPX:505-3716**
• 24 V DC, 2 A, 32 source-only outputs	**PPX:505-4732**
• 24 V DC, 2 A, 32 sink-only outputs	**PPX:505-3732**
• 115 V AC/DC, 4 A, 16 relay outputs	**PPX:505-5417**
• 24/110 V AC, 0.5 A, 8 outputs	**PPX:505-4608**
• 24/110 V AC, 0.5 A, 16 outputs	**PPX:505-4616**
• 24/110 V AC, 0.5 A, 32 outputs	**PPX:505-4632**
• 110/220 V AC, 1 A, 8 outputs	**PPX:505-4808**
• 110/220 V AC, 1 A, 16 outputs	**PPX:505-4816**
• 110/220 V AC, 1 A, 32 outputs	**PPX:505-4832**
• 220 V AC, 24 V DC, 2 A, 8 relay outputs	**PPX:505-4908**
• 220 V AC, 24 V DC, 2 A, 16 relay outputs	**PPX:505-4916-A**
• 220 V AC, 24 V DC, 2 A, 32 relay outputs	**PPX:505-4932**
• 220 V AC, 24 V DC, 5 A/3 A, 16 relay outputs	**PPX:505-5518**
• Simulation modules, 32 outputs	**PPX:505-6011**

Ordering data 525 to 565	Order No.
I/O modules (continued)	
Analog input module 8-channel, 12 bits (0-5 V DC/ ± 5V)	**PPX:505-6108-A**
Analog output module 8-channel, 12 bits (0-10 V DC/0-20 mA)	**PPX:505-6208-A**
Analog input/output modules • 8x15 bit input/4x12 bit output (mixed ranges)	**PPX:505-7012**
• 8x13 bit input/4x12 bit high-speed output (mixed ranges)	**PPX:505-7016**
Parallel input/output modules • 8-channel, multiplex TTL, 16-bit word inputs	**PPX:505-6308**
• 8-channel, multiplex TTL, 16-bit word inputs	**PPX:505-6408**
User manual for digital I/O modules	**PPX:505-8105-2**
Manual for 505-4317 interrupt module	**PPX:505-8123-1**
Manual for analog I/O English German French Italian	**PPX:505-8110-2** **PPX:505-8110-2D** **PPX:505-8110-2F** **PPX:505-8110-2I**
Special modules	
Thermocouple/RTD modules (with manual)	
• 8 inputs, -50 to +50 mV, thermocouples	**PPX:505-7028**
• 8 inputs, -50 to +50 mV, RTD	**PPX:505-7038**
• Calibration connector for RTD module	**PPX:2587705-8009**
User manual for thermocouple module English German French Italian	**PPX:505-8111-3** **PPX:505-8111-2D** **PPX:505-8111-2F** **PPX:505-8111-2I**
User manual for RTD module English German French Italian	**PPX:505-8114** **PPX:505-8114-2D** **PPX:505-8114-2F** **PPX:505-8114-2I**
High-speed counter and encoding module 2 counters, 4 inputs, 4 outputs, counter speed 50 kHz, 5 to 24 V DC, with manual	**PPX:505-7002**
High-speed counter and encoding module 6 counters, 8 inputs, 8 outputs, counter speed 100 kHz, 5 to 24 V DC, with manual	**PPX:505-7003**

	Order No.
Special modules (continued)	
Manual for counter module with 2 counters, English	**PPX:505-8113-2**
with 6 counters, English	**PPX:505-8127-1**
Basic module 2 (RS232C/423) interfaces, memory 28 KB, transmission rate 110-19200 bps	**PPX:505-7101**
Backup battery for basic module	**PPX:2587678-8010**
EEPROM for basic program	**PPX:2587681-8028**
Manual (supplied with module)	**PPX:505-8101-2**
386/ATM module with CPU 30C286SX, RAM 4 MB, hard disk 120 MB, clock frequency 8 or 16 MHz, MS-DOS manual (English) and software	**PPX:505-ATM-4120**
Manual (supplied with module)	**PPX:505-ATM-MANL-3**
Turbo plastic module 5 analog inputs 0 to +5/0 to +10V DC 4 analog outputs, -10 to +10 V DC 4 digital outputs, 15 to 24 V DC	**PPX:505-5100**
Turbo parison module 4 digital inputs/5 analog inputs 4 digital inputs/4 analog inputs	**PPX:505-5103**
Hot backup system	
560T hot backup system with 560/565T hot backup card, upgrade kit (PPX:560-2129-A) and:	
• 2 560T CPU (PPX:560T1KM-1101)	**PPX:560H1KM-1101**
• 2 560T CPU (PPX:560T1KM-1102)	**PPX:560H1KM-1102**
• 2 560T CPU (PPX:560T4KM-1101)	**PPX:560H4KM-1101**
• 2 560T CPU (PPX:560T4KM-1102)	**PPX:560H4KM-1102**
• 2 565T CPU (PPX:565T1KM-1101)	**PPX:565H1KM-1101**
• 2 565T CPU (PPX:565T1KM-1102)	**PPX:565H1KM-1102**
• 2 565T CPU (PPX:565T4KM-1101)	**PPX:565H4KM-1101**
• 2 565T CPU (PPX:565T4KM-1102)	**PPX:565H4KM-1102**
Manuals	
• Hot backup installation instructions, English	**PPX:560-65-8103-2**
• TI505 redundant I/O, English	**PPX:505-8125-2**

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Ordering data

Ordering data 525 to 565

	Order No.
Spares for TI525 to TI555	
• Connector: Side access (qty 1)	**PPX:2587705-8010**
• Connector: Front access (qty 1)	**PPX:2587705-8011**
• dummy plate (pack of 5)	**PPX:2587705-8003**
• Fuse holder for power supply (pack of 4)	**PPX:2587704-8001**
• Screws for dummy plate (pack of 10)	**PPX:2587705-8001**
• 505 RTD calibration connector	**PPX:2587705-8009**
• EEPROM for 525/535 for 545/555, 128 KB for 555, 256 KB	 **PPX:2587681-8020** **PPX:2587681-8022** **PPX:2587681-8031**
• EPROM for 525/535 for CPU 545/555, 128 KB for 555, 256 KB	 **PPX:2587681-8012** on request **PPX:2587681-8030**
• Backup battery for 525/535/545/650T/656T	**PPX:2587678-8005**
• Programming cable for 545	**PPX:2601094-8001**
• Memory expansion for 545-1101, 256 KB	**PPX:545-1111**
• Relay, 5 A, pack of 5	**PPX:2587704-8002**

	Order No.
Spares for 525 to 555 (continued)	
Fuses	
• Set, 3 A/125 V, pack of 5, for 505-45xx	**PPX:2587679-8012**
• Set, 3 A/250 V, pack of 5, for 505-48xx	**PPX:2587679-8013**
• Set, 3 A/250 V, pack of 5, for 505-46xx	**PPX:2587679-8014**
• Set, 3 A/250 V, pack of 5, for 505-6660	**PPX:2587679-8015**
Spares for TI560/565	
• 560T digital CPU	**PPX:560-2820**
• 565T special function CPU	**PPX:565-2820**
• 560T/565T power supply module, 110/220 V AC	**PPX:560-2122**
• 560T/565T power supply module, 24 V DC	**PPX:560-2123**
• Remote channel controller (RCC) (FM)	**PPX:560-2126-B**
• Remote channel controller (RCC) (RS 485)	**PPX:560-2127-B**
• Hot backup card	**PPX:560-2128-A**
• Hot backup upgrade kit (2 modules + cable)	**PPX:560-2129-A**
• Memory expansion module 64 K words	**PPX:560-2130**
• Memory expansion module 256 K words	**PPX:560-2136**
• Distributor box for 565T hot backup, tri splitter	**PPX:2587755-8001**
• Fiber- optic cable for 565 HBU	**PPX:2587693-8010**

Ordering data 575

	Order No.
575 CPU 832 KB	**PPX:575-2103**
System manual for 575	**PPX:575-8101-4**
575 user manual	**PPX:575-8104-1**
Power supply modules (VME)	
• 115 V AC, 185 watts	**PPX:575-6660**
• 115/230 V AC, 300 watts	**PPX:575-6663**
Interface for expansion unit (RCC) Plug-in card in CPU 575	**PPX:575-2126**
Digital input module (VME) with 32 inputs, 110 V AC	**PPX:575-4232**
Digital output module (VME) with 16 outputs, 110 V AC	**PPX:575-4616**
Digital input/output module (VME) with 16 I/O, 24 V DC	**PPX:575-4366**
Mounting rack (VME) 1.0”	
• with 9 slots	**PPX:575-2124**
• with 14 slots	**PPX:575-2128**
• with 16 slots	**PPX:575-2130**
Coprocessor (optional, Motorola 68882)	**PPX:2589739-8010**

	Order No.
Accessories	
• Connecting cable with RS232 interface (for connecting programming devices)	**PPX:VPU200-3605**
• dummy plate 1” for 575-2124 (9 slots)	**PPX:2589739-8003**
• dummy plate 0.2” for 575-2124 (9 slots) or for 575-2128 (14 slots)	**PPX:2589739-8004**
• dummy plate 0.4” for 575-2124 (9 slots) or for 575-2128 (14 slots)	**PPX:2589739-8005**
• dummy plate 0.6” for 575-2130 (16 slots)	**PPX:2589739-8014**
• dummy plate 0.8” for 575-2130 (16 slots)	**PPX:2589739-8015**
• Mounting rail for 575-2124 (9 slots)	**PPX:2589739-8001**
• Mounting rail for 575-2128 (14 slots)	**PPX:2589739-8002**
• Mounting rail for 575-2130 (16 slots)	**PPX:2589739-8016**
• Ventilator set for 575-2130, 115/230 V AC	**PPX:575-2131**
• J2 backplane bus connector for power supply, 1 slot for all devices (optional)	**PPX:2589739-8012**
• Daisy chain bridging connector for 575-2124 or for 575-2128	**PPX:2589739-8011**
• Spare I/O connector	**PPX:2589739-8007**
• Spare battery, 4 V, 5 Ah	**PPX:2589739-8006**
• Spare fuse for 575-6660, 8 A	**PPX:2589739-8008**

STEP 5 programming software

Application

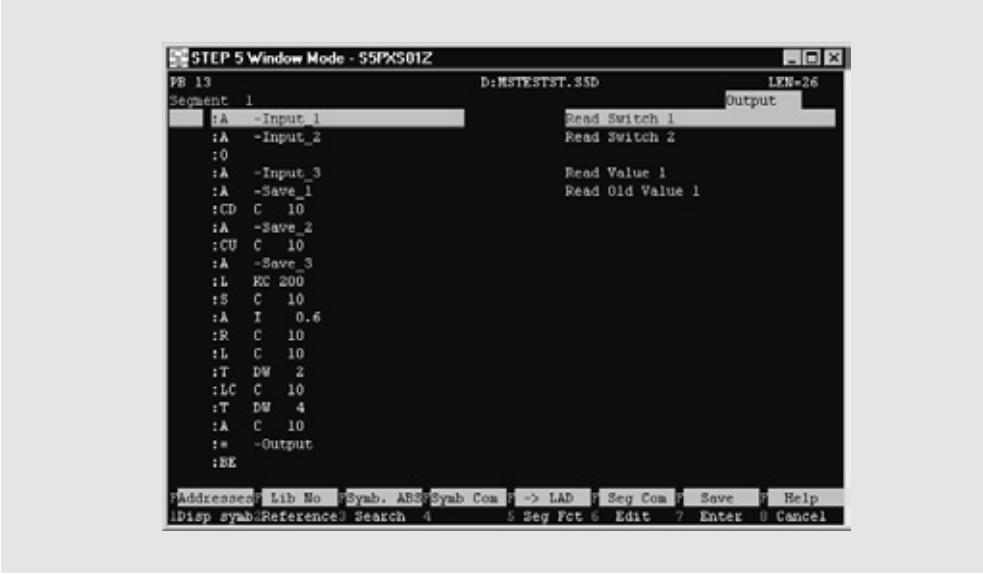

Fig. 7/2 STEP 5, STL representation

STEP 5 is the time-tested programming software for SIMATIC S5 programmable controllers. With STEP 5 it is possible to create, test and document user programs for all SIMATIC S5 programmable controllers.

STEP 5 is an attractive solution for all S5 users:

- Ergonomic user interface according to the SAA standard;
  makes STEP 5 user friendly and easy to operate
- Novell-based network capability; facilitates data maintenance and archiving considerably
- Large range of functions; manages even complex tasks without great effort

STEP 5 is available in two variants:

- STEP 5/ST basic package for programming devices and PCs;
  for programming, testing, documenting, installing and automatic documentation of S5 programs for the programmable controllers S5-90U, S5-95U/F, S5-100U, S5101-U, S5-115U/H/F,S5-135U, S5-150U and S5-155U/H.
- STEP 5/ST for mini PLCs for PC;
  STEP 5/ST for mini PLCs is specially for programming the mini controllers S5-90U, S5-95-U/F and S5-100U. Only the following software packages are executable: GRAPH Mini, COM IP 266, COM GRAPH, COM Text, COM 95F, COM DB1, COM 521 BASIC.
  All other COM packages and optional packages cannot be used.

STEP 5 runs under the operating systems

- MS-DOS 5.0 or higher
- Windows 3.x and
- Windows 95

on

- PG 730, PG 750, PG 770
- PG 720, PG 740, PG 760
  or
- AT-compatible PC.

At least 4 megabytes of RAM are required.

Design

STEP 5/ST basic package for programming devices and PCs

The scope of supply includes:

- STEP 5 programming software (including KOMDOK)
- STL editor/batch compiler
- COM DB 1 parameterization software

The basic package is installed on the programming devices PG 720, PG 740 and PG 760 as standard software. If it is required for a PC it is supplied on CD and diskettes.

STEP 5/ST for mini controllers

The scope of supply includes:

- STEP 5 programming software for mini controllers; based on the STEP 5 programming language.

STEP 5 for mini controllers is only supplied for PC on CD and diskettes.

STEP 5 programming software (continued)

Function
Structured programming

With STEP 5 it is possible to program clearly from simple AND/OR operations to complex functions, e.g. switch off delays or arithmetic calculations. A STEP 5 program can be several thousand statements long. To keep programs as clear as possible, STEP 5 features several control structures:

- Blocks
  A linear sequence of commands is subdivided into sections and each section packed into a block. There are different types of blocks for different technological subtasks of a program.
  The executable program consists of calls of blocks in other blocks. Nesting is possible to a depth of 32 levels.
- Segments
  For fine structuring inside blocks subtasks can be programmed in individual segments. Segments can be copied from one block to another.
- Comments
  A complete program, blocks, segments and individual statements can be commented directly. This ensures that the program remains understandable on every level of abstraction.

Methods of representation

STEP 5 can be programmed in three methods of representation:

- Statement list (STL):
  The program consists of a sequence of mnemonic abbreviations of the commands to be executed by the programmable controller.
- Ladder diagram (LAD):
  Graphic representation of the automation task with circuit diagram symbols (American representation)
- Control system flowchart (CSF):
  Graphical method of representing the automation task with symbols according to DIN 40700/DIN 40719

With all three methods of representation, absolute or symbolic designations for operands can be used.

In LAD and CSF, complex functions and function block calls can be entered using the function keys. They are displayed as graphic symbols on the screen.

Programs that were created in STL cannot necessarily be displayed in LAD or CSF because STL has several features of its own. However, programs in LAD or CSF can be translated to STL. LAD and SCF are largely mutually compatible.

Fig. 7/3 Compatibility of the STEP 5 methods of representation

STEP 5 programming software (continued)

Function (continued)
Blocks

There are 5 types of block:
- Organization blocks (OB); for organizing the control program
- Program blocks (PB); contain the control program, subdivided according to functional or technological criteria
- Sequence blocks (SB); for programming sequential control systems
- Function blocks (FB); contain frequently recurring or especially complex parts of the program (e.g. signaling and calculation functions). Function blocks can be parameterized and have an extended operation set
- Data blocks(DB) for storing data that is required to process the control program, e.g. actual values, limit values, texts

Types of operation

STEP 5 makes a distinction between three types of operation:
- Basic operations; e.g. logic operations, storage operations, loading and transferring, timer operations, counter operations, comparison operations, arithmetic operations, block operations. They can be executed in organization, program, sequence and function blocks.

Except for addition (+F), subtraction (-F) and organizational operations they can be executed in all three methods of representation
- Supplementary operations; complex functions, e.g. substitution statements, test functions, word logic, decrementing/incrementing and branching functions. This can only be executed in STL.
- System operations; These access the operating system directly and must therefore only be used by experienced programmers. They can only be executed in STL.

Additional functions

A whole range of easy-to-use additional functions make program handling easy:
- Storage of user-specific project settings
- Symbol editor; for creating and automatically updating assignment lists for the symbolic programming of blocks
- Automatic generation and updating of cross-reference lists
- Comparison of user programs between diskette, hard disk, PLC or EPROM
- Transfer of blocks to EPROM or EEPROM submodules for the programmable controllers
- Rewiring of inputs, outputs, flags, timers and counters (i.e. renaming operands in the entire user program or individual blocks)

Test- and service fuctions

For commissioning and maintenance, STEP 5 provides a number of test and service functions;
- Direct and program-dependent signal state display, i.e. status of variables or blocks (program status)
- Control of outputs, flags etc.
- Detection of double assignment of bit, byte and word addresses for I/Q/F/S

Program documentation

With the menu "documentation" it is possible to output the following documentation on a printer:
- Complete programs or program sections, if necessary with comments
- Cross-reference lists for operand symbols(I/Q/F/T/C/S) and/or individual operands (e.g. I 1.7)
- Program overview display, if necessary with call structure of all blocks of a complete program
- Assignment plan for inputs, outputs, flags, timers and counters
- Assignment lists with comments (up to 40 characters per assignment)

In addition to standard output, user-friendly output of documentation functions (previously called KOMDOK) can be used. It permits, for example, automation of printout using control statements or graphic preparation, sorting and evaluation of program data.

7

STEP 5 programming software (continued)

Function (continued)
STEP 5 Version 7.0

STEP 5 Version 7.0 includes a whole range of improvements and innovations over the previous version.

Real DOS application

Version 7.0 is the first "real" DOS variant of STEP 5 and makes consistent use of the functions of this operating system:

- Consistent implementation of the SAA standard
- Use of DOS directory paths; the previous restriction to one directory per drive has been abolished
- Use of all drive letters from A to Z

Improved performance

Version 7.0 includes further increases in performance:

- Use of the entire RAM including extended memory (XMS)
- Reduction of the memory requirements in the conventional memory area
- Lower package reloading times for improved strategy
- Integration of the EPROM driver into the STEP 5/ST basic package; it no longer needs to be resident in the RAM

Ergonomic user interface

Operator ergonomics has been improved once again:

- Shallower menu structures; by and large there are now only two menu levels
- Standardization of the dialog field structure
- New acceleration keys and hotkeys
- Project settings in "index cards"
- Access to interfaces from project settings
- Direct fast callup of editors from the project settings, the block directory and ISTACK
- Test functions quickly accessible through new menu items "test" and "PLC"
- Online/offline switchover now in dialog boxes

Fig. 7/4 Dialog field-structure

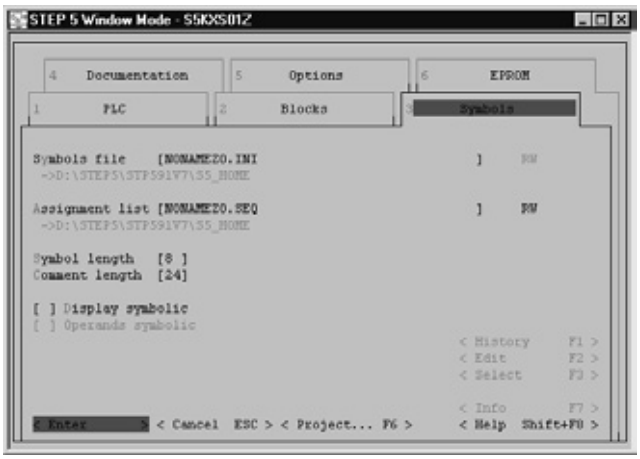

Fig. 7/5 Project settings (index cards)

- Extended and standardized syntax for the block list, valid for all functions (editor, printer etc.)

New functions

Numerous new functions have been integrated into the program:

- Switchover between various languages within STEP 5
- Call of a DOS shell from STEP 5
- Automatic loading of the last active optional package on restarting STEP 5 (if parameterized)
- Retention of the project files last used in the "file" menu
- History (repetition function) for input fields in dialog boxes or in program handling
- Extension of help and info functions in the menu and in the dialog boxes, fast access by menu keys
- Integration of COM packages into the "change" menu
- New options for general project settings, e.g. compatibility monitoring between older and new STEP 5 versions

Extensive downward compatibility

In the development of STEP 5/ST V7.0, the greatest possible compatibility with versions 3.x and 6.x has been retained.

If new options are used, e.g. DOS paths, incompatibility with older STEP 5 versions can arise because they do not know these functions. In this case a message appears indicating abandonment of compatibility.

7

STEP 5 basis packages (continued)

Technical specifications

	STEP 5/ST basic package for programmers and PCs	STEP 5/ST for mini-controllers
Current version	V 7.0	V 7.0
Operating system	MS-DOS V5.0 and higher Windows 3.x Windows 95	MS-DOS V5.0 and higher Windows 3.x Windows 95
RAM capacity min. in the programmer/PC	4 Mbytes	4 Mbytes
Disk requirements in the programmer/PC	13 Mbytes	13 Mbytes
Platform	PG, PC	PC
Target system	S5-90U S5-95U/F S5-100U S5-101U S5-115U/H/F S5-135U S5-150U S5-155U/H	S5-90U S5-95U S5-100U

Ordering data

	Order No.
STEP 5/ST-basic pacakge for PG and PC (V7.0) on the basis of MS-DOS with authorization diskette, for programming all PLCs with PCs, on $3^1/_2$" diskettes in German, English, French, Spanish, Italian. Single license Copy license	 **6ES5 894-0MA04** **6ES5 894-0MA04-0KL1**
STEP 5/ST for mini-controllers (V7.0) on the basis of MS-DOS with authorization diskette for programming mini PLCs, S5-90U, 95U and 100U, executable on PC, on $3^1/_2$" diskettes in German, English , French, Spanish, Italian Single license Copy license	 **6ES5 864-0MA04** **6ES5 864-0MA04-0KL1**

	Order No.
PC-AG cable (734-1) Connecting cable between SIMATIC S5 (15-pin) and PC (25-pin), 3.2m	**6ES5 734-1BD20**
PG-AG cable (734-2) (included in the scope of supply of the programmer, 3.2m) connecting cable between the programmer and SIMATIC S5,	
5 m	**6ES5 734-2BF00**
10 m	**6ES5 734-2CB00**
25 m	**6ES5 734-2CC50**
Documentation for STEP 5/ST for PG/PC (V7.0) (also for STEP 5/ST basic package and STEP 5/ST for mini controllers)	
German	**6ES5 998-0MA14**
English	**6ES5 998-0MA24**
French	**6ES5 998-0MA34**
Spanish	**6ES5 998-0MA44**
Italian	**6ES5 998-0MA54**

7

TISOFT

Application

TISOFT is a complete software package for programming and documenting all SIMATIC programmable controllers of the series 505.

TISOFT allows the rapid and simple implementation of all automation tasks, as well as straightforward maintenance of the plant placed in operation.

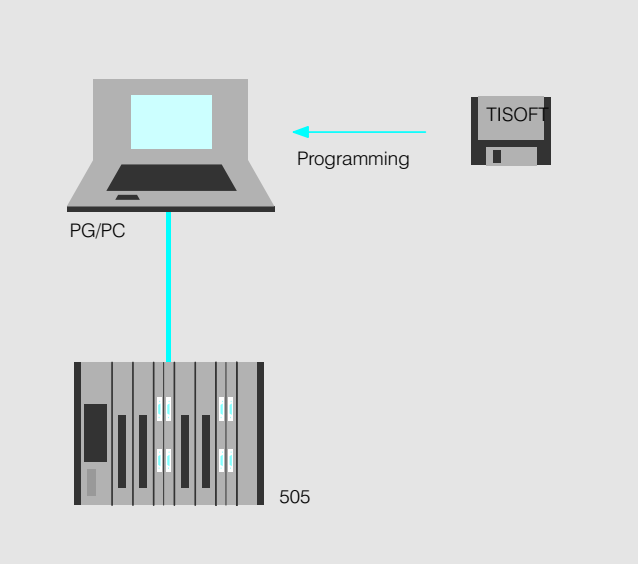

Fig. 7/6 Programming with TISOFT

Design

- Tools for programming, documenting, debugging, developing and maintaining programs
- Menu-driven operation
- Extensive on-line auxiliary functions
- Programmable updating displays
- Sophisticated debugging aids

TISOFT has the same user interface for all programmable controllers. Plant modifications and extensions can thus be implemented by the user with no additional training.

TISOFT runs on:

- SIMATIC PG 720, PG 720C, PG 730, PG 730C, PG 740, PG 750, PG 760 and PG 770 programming devices
- IBM PCs
- IBM-compatible PCs

Additional requirements:

- Floppy disk drive (at least 360 Kbyte) and hard disk drive
- Monochrome or color monitor
- MS-DOS
- Connecting cable for RS 232 C modem (for on-line mode only)

Ordering data	Order No.		Order No.
TISOFT for 505 Version 6.2	**PPX:PC505-6262**	**Manual** for 505 TISOFT	
TISOFT upgrading to Version 6.2	**PPX:PC505-UPG62**	English German French Italian	**PPX:TS505-8101-6** **PPX:TS505-8101D** **PPX:TS505-8101F** **PPX:TS505-8101I**
TISOFT license V6.2 for 505	**PPX:TSSL505-6251**		
TISOFT V6.2 additional copy for 505 PLC	**PPX:TSSL505-6362**		

APT (Application Productivity Tool)

Application

APT is an integrated control system design environment that uses computer-aided software engineering (CASE) technology to provide an object-oriented design environment for the SIMATIC-505 programmable controllers. APT also provides a link between the individual controllers and their logical representation in the data base of the SIMATIC PCS human-machine-interface. The package runs on PCs or on the state-of-the-art Siemens programming devices.

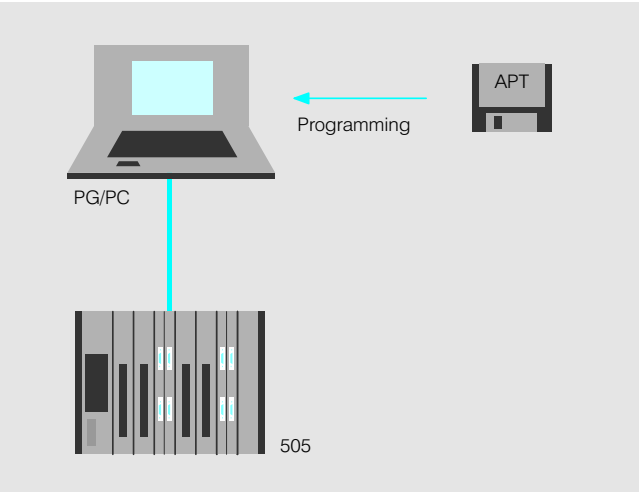

Fig. 7/7 Programming with APT

Functions

APT provides a natural means of mapping the physical process into the control system. It encourages the partition into a hierarchical structure which is easier to understand and implement.

APT uses a graphical approach to design. GRAFCET techniques are used for developing sequential logic. APT also has a graphical representation for continuous control processes based on the SAMA[1] standard. Development of lower-level control actions are simplified by using a library of devices and continuous function blocks that include internal interlocks and comprehensive auxiliary information.

Separate safe-state sequential function charts (SFC) provide alternate control actions for emergency situations. The safe-state SFCs have flexible return-to-normal paths to match the process operating procedures. Extensive validation functions are included to quickly trap invalid and missing configurations. MAITT, a test language interpreter, is included for writing tests and validating control logic.

The principal features of APT are:

- Supports sequential continuous, safe-state, parallel, batch control strategies and process partitioning
- Integrates application design development, testing, documentation, and maintenance
- Windowing, split-screens, pull-down help screens, embedded algorithms, and fill-in-the-blank forms
- Sequential function chart (SFC) and continuous function chart (CFC) graphics-based languages
- State control and math text-based languages
- Multiple main and subordinate safe-state SFCs with priority levels
- Libraries of standard control algorithms

Ordering data	Order No.		Order No.
SIMATIC APT software Upgrade, with manual set (Version 1.7a)	**PPX:APT-6201-T**	**Manuals** System overview for APT software, English	**PPX:APT-8100**
SIMATIC APT software Upgrade to V1.7a, with manual set	**PPX:APT-6202-T**	User manual for APT software, German French	**PPX:APT-8101D** **PPX:APT-8101F**
SIMATIC APT software Version 1.7a , with APT manual set, single license and network card CP 1413, for linking with Industrial Ethernet, compatible with SIMATIC 505 and SIMATIC S5	**PPX:APT-6204-T**	Programming instructions for APT software, German French	**PPX:APT-8102D** **PPX:APT-8102F**
		Manual set for APT software (Version 1.7a)	**PPX:APT-8200-T**

1) Scientific Apparatus Manufacturers Association

GRAPH 5/II

Application

The S5 software package GRAPH 5/II is used for configuring, programming, testing and documenting sequence control systems with a standard method of representation. Graph 5/II contains all functions of the STEP 5 basic package (see page 7/3).
A program package with standard function blocks is required for runnlng the GRAPH 5/II functions in the programmable controllers (see page 7/55).

GRAPH 5/II can be used in the following programmable controllers:

- S5-95U
  (as of 6ES5 095-8M. .2);
  only with FB 72, FB 73, FB 74 and SB5
- S5-100U;
  only with CPU 103
- S5-115U;
  with CPU 941, CPU 942, CPU 943, CPU 944 and CPU 945
- S5-135U:
  with CPU 922, CPU 928 and CPU 928B
- S5-150U;
  no restrictions
- S5-155U;
  with CPU 946, CPU 947 and CPU 948

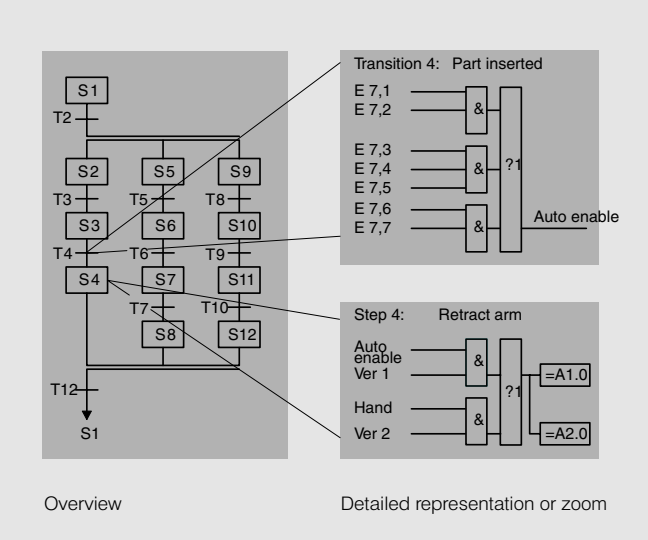

Fig. 7/8 GRAPH 5/II methods of representation

GRAPH 5/II is executable under S5-DOS/ST, S5-DOS/MT (V.6x) on the following programming devices:

PG 710 Plus, PG 720, PG 720C, PG 740, PG 730, PG 730C, PG 740, PG 750, PG 760 and PG 770.

Functions

- Generating the programs in accordance with the standard IEC DIS 1131-3
- Conversion of GRAPH 5 blocks to GRAPH 5/II and vice versa; change of GRAPH 5 blocks;
- Programming of the steps (S) and transitions (T) in STL, CSF or LAD
- Overview and detailed representation or zoom
- Synchronization of system, process and programmable controller. There are 2 methods of synchronization:

  Synchronization with the automatically generated synchronization SB (supports alternative branches);

  Synchronization with the standard function block (FB 70 – 73), which controls the chain (also supports simultaneous branches)
- Diagnostic functions with criteria analysis (via Industrial Ethernet for up to 4 programmable controllers), operating mask on the screen as "HW tableau/PG operating panel" or as "Simple operating panel", indication of fault signals
- User interface and plausibility check when generating step chains
- Step-overlapping magnifying glass: multiple control of the same outputs, similar links and locks are only configured and saved once, step-independent actions are realized (can also be included in chain diagnostic function)
- Search function:
  Operands can be found step- and transition-overlapping
- Preset timer values for easier programming
- Minimum monitoring time for monitoring unpermissible system states
- Optimization of the runtime by shorter operating times of the blocks and immediate activation of the following step at completed transition

Ordering data

	Order No.
GRAPH 5/II software package (S5-DOS/ST, S5-DOS/MT) for configuring and programming sequence control systems, for the S5-95U to S5-155U programmable controllers (for S5-95U only with restrictions) on $3^1/_2$" diskettes German, English, French Single license Copy license	 **6ES5 884-1FA03** **6ES5 884-1FA03-0KL1**
Documentation for GRAPH 5/II V6.6 German English French	 **6ES5 998-1FA13** **6ES5 998-1FA23** **6ES5 998-1FA33**
Software package GRAPH 5/II V7.0[2] **(MS-DOS, FlexOS))**	availble soon

1) Does not run under STEP 5/ST V7.0

2) Adapted to the new architecture and improved user interface of STEP 5/ST V7.0

PRODAVE

Application

PRODAVE is a toolbox which allows process data traffic between the programmable controller and the programming device/PC. PRODAVE builds up the process data traffic between the programmable controller and the programming device/PC via the AS511 protocol or via the 3964R (AK512).

PRODAVE runs under MS-DOS or Windows. All current compilers, such as MS-C, Turbo C and Turbo Pascal can be used as programming language.
Further details about the protocol processing are not required.
The PLC communication is processed by PRODAVE autonomously in the background.

PRODAVE DOS/WIN
PRODAVE DOS/WIN communicates via the serial interface of the programming device/PC with the programming device interface at the CPU, i. e. no special communications processor is needed in the PLC for connection of the programming device/PC. Either the COM 1 or COM2 interface can be used in the programming device or PC. For connection via the COM2 interface of the programming device or COM1 and COM2 interface of the PC, an V.24/TTY converter must be used.

The programming device multplexer PG-MUX can be used as an interface multiplexer for the connection of max. 7 PLCs to a serial interface of the programming device/PC.

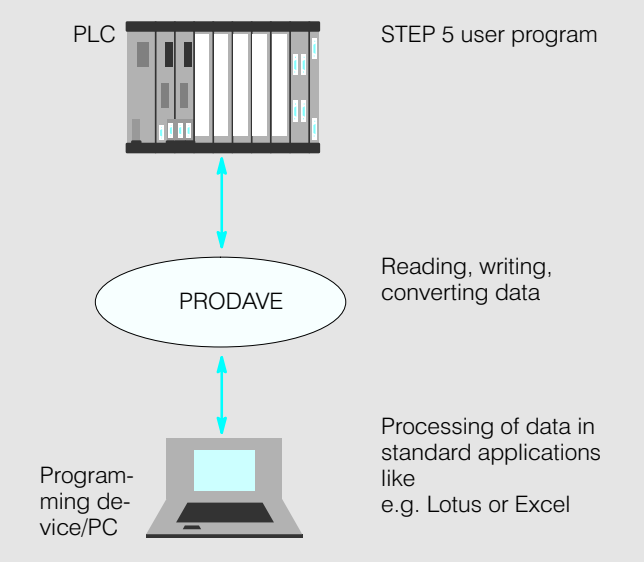

Fig. 7/11 Programming with PRODAVE

PRODAVE DOS 64R, PRODAVE WIN 64R
PRODAVE DOS 64R or WIN 64R communicate with the PLC via the serial interface of the programming device and via the CP 521/ CP 523/CP 524 and CP 525 communications processors. Thus, the interface of the CPU remains free.

PRODAVE NET
PRODAVE NET communicates with the programmable controller via SINEC H1/ PROFIBUS and runs on a programming device/PC under MS-DOS and Windows 3.11.

PRODAVE DDE (for SIMATIC S5)
PRODAVE DDE communicates via the serial interface of the programming device with the programming device interface on the CPU (protocol AS 511).

It also communicates via the serial interface of the programming device/PC with a point-to-point CP slotted into a programmable controller (e.g. CP 524, protocol RK 512).
PRODAVE DDE includes a DDE interface with which standard Windows applications (e.g. Excel) can communicate with the control.

PRODAVE for SIMATIC S7-300/-400
PRODAVE for SIMATIC S7-300/-400 runs under MS-DOS/Windows 3.11/WIndows 95 and communicates with the control via the MPI interface (no operation with TK 858 and modem).

Principle of operation

Once loaded, the PRODAVE toolbox remains resident in memory. It can therefore operate in quasi-background whilst other applications such as statistical evaluations of such process data run in the foreground. The individual tools can be called within the processing program. PRODAVE allows not only the evaluation and monitoring of a process, but also intervention in the process because a number of functions for writing data from the programming device to the programmable controller are available.

Functions

The toolbox contains the following functions:

- Read PLC info (PLC type, CP type, version)
- Read PLC status (RUN, STOP)
- Byte conversion from a byte to 8 logical values and vice versa
- Read data words from block (range from... to...)
- Write data words into block (address range)
- Read/write data words from/in blocks with simultaneous conversion of the data (e.g. KF, KG format)
- Read input bytes from the PLC
- Write output byte to the PLC
- Format conversion of data (e.g. KH to integer)
- Bit memory bit test as status check
- Read bit memory byte or word from the PLC

PRODAVE (continued)

Functions (continued)

- Write bit memory byte or word to the PLC
- Read counter statuses from the PLC
- Set counter statuses in the PLC
- Read timers from the PLC
- Time calls for the user program delay, reset, sync, (e.g. for delay loops for reading data cyclically)
- Output error messages in plaintext
- Load the toolbox in the user memory
- Remove the toolbox from the user memory

Further functions of PRODAVE DOS 511 and WIN 511:

- Common reading of data of different format (MIX-READ function)
- Detection of all data blocks (DB and DX) in the PLC with the book function
- Operation of PRODAVE with TK 858 and modem (not for PRODAVE for SIMATIC S7-300/-400)
- Additional use of the programming device interfaces COM 3 and COM 4 for the data traffic (also for PRODAVE WIN 511 Mini)
- Fast processing of the data traffic without considerable additional memory space requirements

Scope of supply

PRODAVE software on 31/2" diskettes, instructions in German and English.

For that, the receipt of the old software package must be presented, its serial number must be stated and the original diskette must be sent in with the rest of the labels.

Ordering data

	Order No.
PRODAVE DOS 511	
For data link via programming device interface of the PLC under MS-DOS operating system, on $3^1/_2$" diskettes, operating instructions in German and English	
Single license	**6ES5 886-2MP01**
Copy license	**6ES5 886-2MP01-0KL1**
PRODAVE WIN 511	
For data link via programming device interface of the PLC under WINDOWS 3.11 operating system, on $3^1/_2$" diskettes, operating instructions in German and English	
Single license	**6ES5 886-2WQ01**
Copy license	**6ES5 886-2WQ01-0KL1**
PRODAVE WIN 511 Mini	
For data link via programming device interface of the PLC under Windows operating system, (only DB read/write and ask for PLC status), on $3^1/_2$" diskettes, operating instructions in German and English	
Single license	**6ES5 886-2WP01**
Copy license	**6ES5 886-2WP01-0KL1**
PRODAVE DOS 64R	
For data link via CP 524/CP 525 (RK 512) or CP 521-SI/CP 523 (3964R) under MS-DOS operating system, on $3^1/_2$" diskettes, with operating instructions	
Single license	**6ES5 897-2UD ■1**
Copy license	**6ES5 897-2UD ■1-0KL1**
German	**1**
English	**2**
French	**3**
Spanish	**4**

	Order No.
PRODAVE WIN 64R	
For data link via e.g. CP 524/CP 525 (RK 512) or CP 521 SI/CP 523 (3964R) under Windows 3.11 operating system, on $3^1/_2$" diskettes, operating instructions in German and English	
Single license	**6ES5 897-2VD01**
Copy license	**6ES5 897-2VD01-0KL1**
PRODAVE NET	
For data link with SIMATIC S5 via PROFIBUS/Industrial Ethernet under MS-DOS and MS-WINDOWS operating system, on $3^1/_2$" diskettes, manual in German and English	
Single license	**6ES5 886-2MS01**
Copy license	**6ES5 886-2MS01-0KL1**
PRODAVE WIN DDE for SIMATIC S5	
For data link via programming device interface of the PLC under Windows 3.11 (with DDE interface), on $3^1/_2$" diskettes, operating instructions in German and English	
Single license	**6ES5 886-2WS01**
Copy license	**6ES5 886-2WS01-0KL1**

COM 246, COM 247

Application

The COM 246 and COM 247 parameter assignment software enables parameter assignment, programming and control of the IP 246 and IP 247 positioning modules.

COM 246 is required for the following modules:
6ES5 246-4UA31,
6ES5 246-4UB11.

COM 247 is required for the following modules:
6ES5 247-4UA31.

Full functional capability can only be guaranteed with these combinations. See page 7/122 for standard function blocks for the relevant programmable controller.

COM 246 und COM 247 sind ablauffähig unter MS-DOS.

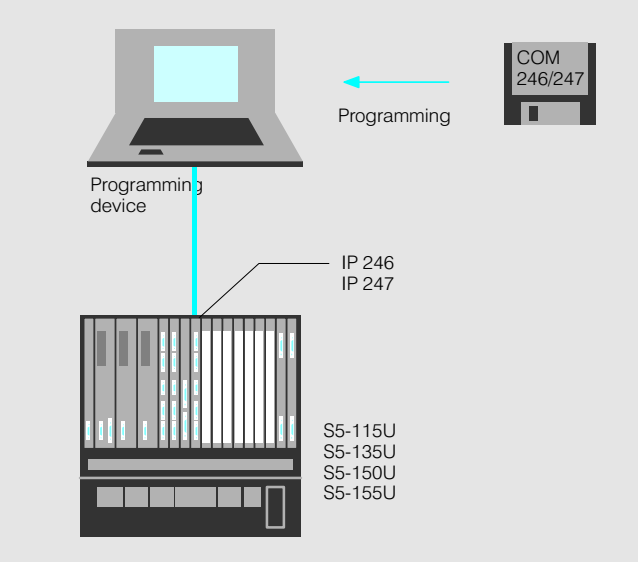

Fig. 7/14 Connection and programming of the IP 246 and IP 247 positioning modules

Functions

The COM 246 and COM 247 parameter assignment software enables operator-prompted interactive dialog with the positioning modules.

There are user-friendly functions available for this purpose:

- Input and output of machine data and traverse programs
- Representation of traverse programs in accordance with DIN 66 025 and in plaintext (you can switch at will between the two representation types)
- Help menus, extensive fault diagnostics

Ordering data

	Order No.
The parameter assignment software COM 246 is part of the: **Configuration package for IP 246I/A** consisting of: Manual, standard FBs and parameter assignment software COM 246 German English French	 **6ES5 246-5AA11** **6ES5 246-5AA21** **6ES5 246-5AA31**
The parameter assignment software COM 247 is part of the: **Configuring package for IP 247** consisting of: Manual, standard FBs and parameter assignment software COM 247 German English French	 **6ES5 247-5AA11** **6ES5 247-5AA21** **6ES5 247-5AA31**

COM PP

Application

The COM PP parameter assignment software is used for creating the parameter blocks which are required for driving the CP 544 and the second interface on the CPU 928B.
The COM PP software is user-friendly with interactive operator prompting.

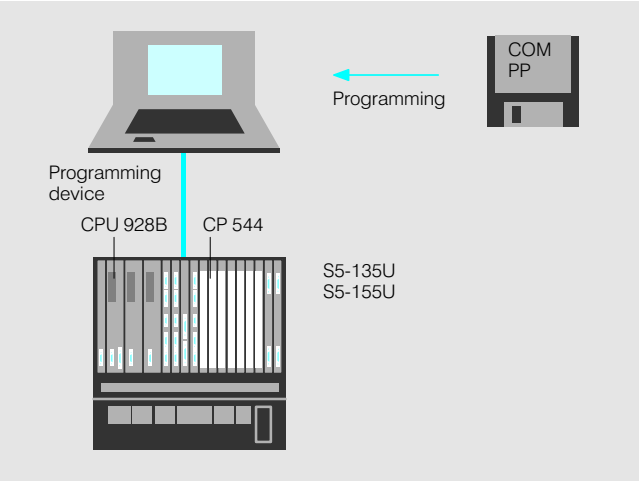

Fig. 7/19 Programming with COM PP

Ordering data	Order No.		Order No.
COM PP **parameter assignment software** for paramerizing the CP 544 and the second interface on the CPU 928 B, on $3^1/_2$" and $5^1/_4$" diskettes German/English/French Single license Copy license	 **6ES5 895-4SP01** **6ES5 895-4SP01-0KL1**	**Operating instructions**	see CP 544 manual or S5-135U/155U manual for CP 928B

7

COM 115H, COM 155H, COM 95F, COM 115F

COM 115H and COM 155H parameter assignment software

The COM 115H and COM 155H software packages assign parameters to the fault-tolerant S5-115H and S5-155H programmable controllers.

They support the user in configuring and fault diagnostics:

- Configuring the H-related data
- Generating the configuration block from the configuration data
- System diagnostics via the error data block and interrupt register
- Documentation of the H-related data via printer
- General system data handling

COM 95F and COM 115F parameter assignment software

The COM 95F and COM 115F software packages assign parameters to the failsafe S5-95F and S5-115F programmable controllers.

They support the user at:

- Configuring the inputs and outputs
- assigning parameter to the operating system of the CPU in dialog with the programming device

The user need not take into account the redundancy of the PLC and the connection diagrams of the various input and output modules during program development.

Ordering data

	Order No.
COM 115H parameter assignment software for programming the S5-115H programmable controller; on $3^1/_2$" and $5^1/_4$" diskettes; German, English, French, Spanish, Italian	
Single license	**6ES5 895-3ST□1**
Copy license	**6ES5 895-3ST□1-0KL1**
COM 155H parameter assignment software for programming the S5-115H programmable controller; on $3^1/_2$" and $5^1/_4$" diskettes; German, English, French	
Single license	**6ES5 895-3SR□3**
Copy license	**6ES5 895-3SR□3-0KL1**
German	**1**
English	**2**
French	**3**
Spanish	**4**
Italian	**5**

	Order No.
COM 115F parameter assignment software for programming the S5-115F programmable controller; on $3^1/_2$" and $5^1/_4$" diskettes German, English, French, Italian	
Single license	**6ES5 895-3SF□5**
Copy license	**6ES5 895-3SF□5-0KL1**
COM 95F parameter assignment software assigns parameters to the S5-95F programmable controller with manual, on $3^1/_2$" and $5^1/_4$" diskettes; German, English, French, Italian	
Single license	**6ES5 895-6MF□2**
Copy license	**6ES5 895-6MF□2-0KL1**
German	**1**
English	**2**
French	**3**
Italian	**5**

COM PROFIBUS

Application

COM PROFIBUS allows the connection of

- distributed I/O devices ET 200U, ET 200M, ET 200B, ET200C, ET 200L, ET 200X,
- the DP/AS interface link, DP/PA link,
- the S5-95U/DP slave,
- S7-200/-300 as the slave and
- other field devices

to the master interface

- IM 308-C,
- S5-95U/DP master
- and other DP master modules.

Compared to COM ET 200 Windows (up to 12/96), COM PROFIBUS has been extended to include FMS configuring of the 5412 (A2) PC module (see page 3/89).

- IM 308-C;
  The set configuration of PROFIBUS DP is stored on a memory card. Burning of the memory card can be implemented directly with the programming device or a PC (with EPROM/EEPROM PG). The data are downloaded via the CP 5411, CP 5511, CP 5611 PC modules or the MPI.

Fig. 7/21 Parameter assignment with COM PROFIBUS

- S5-95U/DP master:
  The set configuration of PROFIBUS-DP is transferred to the programmable controller by downloading via the DP interface.
- FMS configuring
  CP 5412 (A2) PC module

- SOFTNET
  PC modules:
  CP 5411,
  CP 5511,
  CP 5611

COM PROFIBUS runs on the PG 720, PG 740 or PG 760 and AT-compatible PCs, under Windows 3.11 or Windows 95.

Principle of operation

The COM PROFIBUS parameter assignment software is installed on the programming device/PC. It enables simple, user-prompted generation of the address list and parameters for the slave devices. The following must be defined:

- DP address
- Address area in which the I/O modules are to be addressed
- Start addresses of the I/O modules
- Slave-specific parameter assignments, for example, measuring range of an analog input channel

The following must also be defined:

- Setting of the transmission rate
- Setting of the failure response

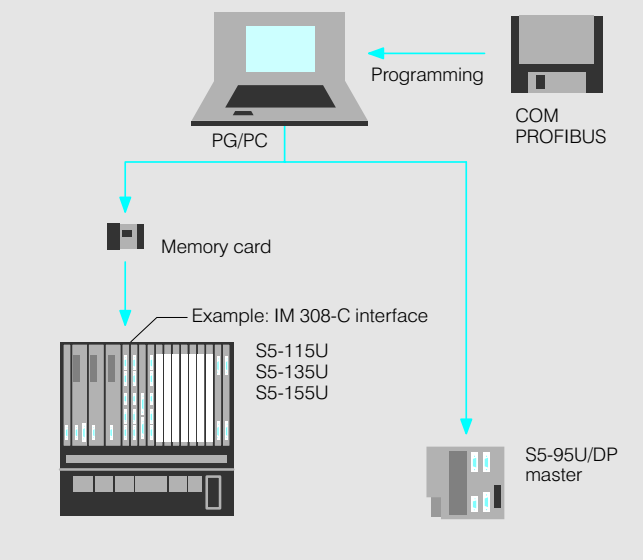

Fig. 7/22 Parameter assignment with COM PROFIBUS

With an online connection between the programming device/PC and PROFIBUS/DP, the COM PROFIBUS parameter assignment software can be used to locate faults in the startup phase or during operation.

COM PROFIBUS (continued)

Ordering data	Order No.		Order No.
COM PROFIBUS parameter assignment software for programming the IM 308-C and other DP master modules, runs on PG 720, 740 and 760 or AT-compatible PCs, with Windows 3.1 or Windows 95, on 3 1/2" diskettes with manual for the distributed ET 200 I/O system,		**Manual for the distributed ET 200 I/O system**	
single license	**6ES5 895-6SE□2**	German	**6ES5 998-3ES12**
copy license	**6ES5 895-6SE□2-0KL1**	English	**6ES5 998-3ES22**
German	**1**	French	**6ES5 998-3ES32**
English	**2**	Spanish	**6ES5 998-3ES42**
French	**3**	Italian	**6ES5 998-3ES52**
Spanish	**4**		
Italian	**5**		

7

COM 525, COM 530, COM 5431 FMS/DP, COM 1430 TF, COM 1473 MAP

Application

The COM 525, COM 530, COM 5431 FMS/DP, COM 1430 TF, COM 1430 TCP and COM 1473 MAP parameter assignment software is needed for programming and parameter input for the relevant communications processors with a programming device.

- COM 525 for CP 524, CP 525
- COM 530 for CP 530 (L1)
- COM 5431 FMS/DP for CP 5431 FMS/DP (PROFIBUS)
- COM 1430 TF for CP 1430 TF (Industrial Ethernet)
- COM 1430 TCP for CP 1430 TCP (Industrial Ethernet)
- COM 1473 MAP for CP 1473 MAP (MAP 3.0-Ethernet)

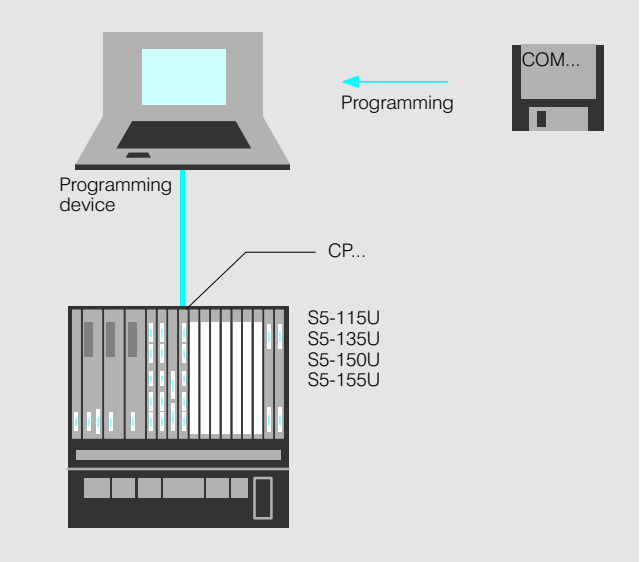

Fig. 7/26 Programming the communications processors

Functions

The programs offer operator prompting and interactive screen forms to facilitate the programming of specific functions of the communications processors. The programs also include extensive testing, diagnostics and documentation functions.

7

COM 525, COM 530, COM 5431 FMS/DP, COM 1430 TF, COM 1473 MAP (continued)

Ordering data	Order No.
COM 525 parameter assignment software	
assigns parameters to the CP 524 and CP 525; German, English, French; on $3^1/_2$" and $5^1/_4$" diskettes	
Single license	**6ES5 895-4SA□1**
Copy license	**6ES5 895-4SA□1-0KL1**
COM 530 parameter assignment software	
assigns parameters to the CP 530; Ger., English, French, Italian;	
on $3^1/_2$" diskettes	
Single license	**6ES5 835-6SC□1**
Copy license	**6ES5 835-6SC□1-0KL1**
on $5^1/_4$" diskettes	
Single license	**6ES5 895-6SC□1**
Copy license	**6ES5 895-6SC□1**
German	**1**
English	**2**
French	**3**
Spanish	**4**
Italian	**5**
COM 5431 FMS/DP parameter assignment software	
assigns parameters to the CP 5431 FMS/DP, with manual CP 5431 FMS/DP; on $3^1/_2$" diskettes,	
German	**6GK1 745-1AD00-0EA0**
English	**6GK1 745-1AD01-0EA0**
French	**6GK1 745-1AD02-0EA0**
Italian	**6GK1 745-1AD04-0EA0**

	Order No.
CP 5431 FMS/DP manual	
German	**6GK1 970-5AB01-0AA0**
English	**6GK1 970-5AB01-0AA1**
French	**6GK1 970-5AB01-0AA2**
Italian	**6GK1 970-5AB01-0AA4**
COM 1430 TF parameter assignment software	
assigns parameters to the CP 1430 TF, with CP 1430 TF manual, on $3^1/_2$" diskettes,	
German	**6GK1 743-0TA00-0EA0**
English	**6GK1 743-0TA01-0EA0**
French	**6GK1 743-0TA02-0EA0**
Italian	**6GK1 743-0TA04-0EA0**
CP 1430 TF/COM 1430 TF manual	
German	**6GK1 970-1TA43-0AA0**
English	**6GK1 970-1TA43-0AA1**
French	**6GK1 970-1TA43-0AA2**
Italian	**6GK1 970-1TA43-0AA4**
Parameter assignment software COM 1430 TCP	**2XV9 450-1AU01**
Configuration software for CP 1430 TCP, on $3^1/_2$" diskettes	
Manual CP 1430 TCP/COM 1430 TCP	
German	**2XV9 450-1AU03**
English	**2XV9 450-1AU02**
COM 1473 MAP parameter assignment software	
assigns parameters to the communications processor, CP 1473 MAP, with manual CP 1473 MAP, on $3^1/_2$" diskettes,	
German	**6GK1 773-0MA10-0EA0**
English	**6GK1 773-0MA11-0EA0**
CP 1430 TF manual	
German	**6GK1 970-1MA73-0AA0**
English	**6GK1 970-1MA73-0AA1**

7

Introduction standard function blocks

Application

Standard function blocks are ready-made software modules which can be linked into programs written by the user for the programmable controllers of the U range. They consist of self-contained complex functional procedures which are often required by the user when programming.

For instance, standard function blocks for mathematical and arithmetic functions, sequence control and closed-loop control are available. The blocks are stored in the user memory of the programmable controller and can be called up by the user as required in his program. They can be called many times during program execution and supplied with the required actual parameters.

Complex functions can be included very simply by the user in his programs through the use of standard function blocks. This makes programming, testing and debugging of user programs very efficient. The user can tap a vast amount of experience by using standard function blocks. The blocks are continuously updated and main-tained.

Design

User program structure

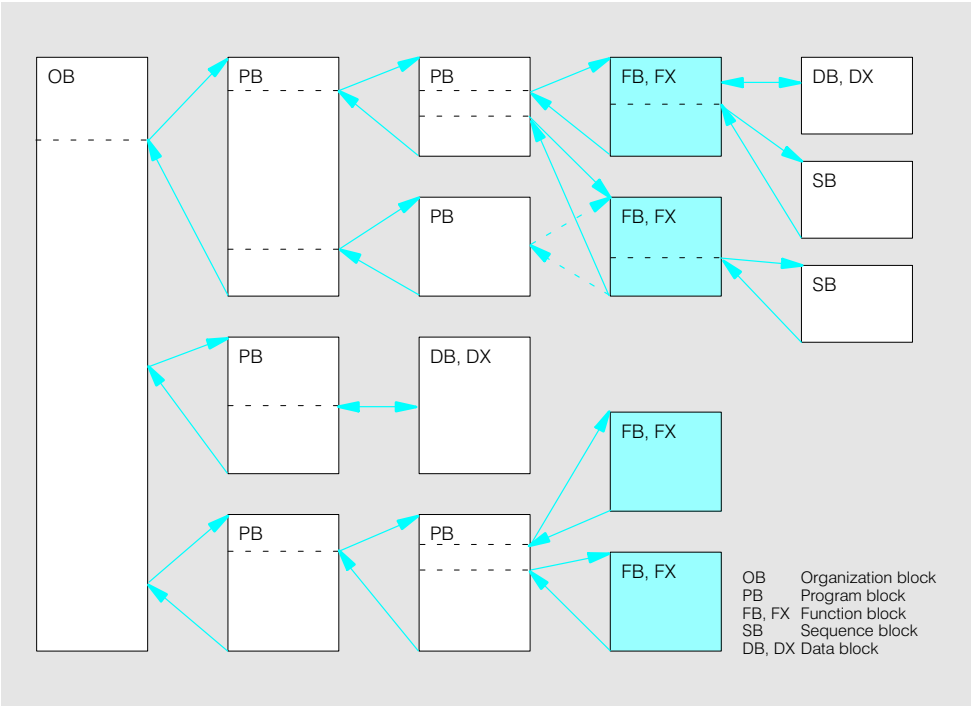

Fig. 7/28 Function blocks within a user program

The user writes his programs for the S5 programmable controllers of the U range in the STEP 5 programming language. The programs are structured, i.e. broken down into self-contained sections. The individual program sections are called "blocks".

The following types of blocks are used for different purposes:

- Organization blocks (OB), for supervising the user program
- Program blocks (PB), for structuring the program according to the technological control task
- Function blocks (FB, FX), for recurring complex functions
- Sequence blocks (SB), for individual technological sequence controls
- Data blocks (DB, DX), these are memory areas in which data for the user program can be stored

The blocks can be nested as required (Fig. 7/28), i.e. blocks from one level can call blocks in a lower level.

Introduction standard function blocks (continued)

Design (continued)
Notes on programming with standard function blocks

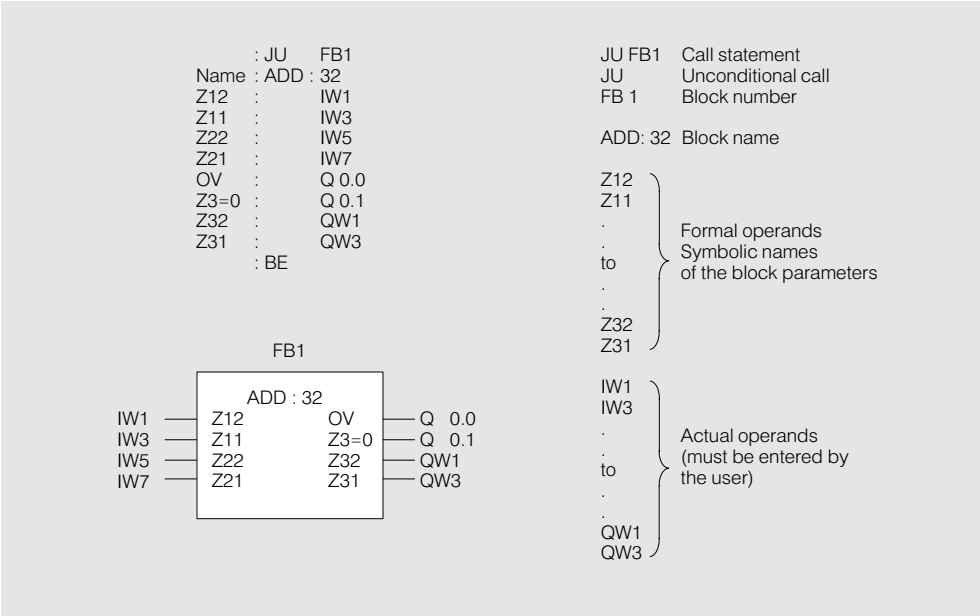

Fig. 7/29 Representation of standard function blocks by the programming device
above: in statement list form (STL)
below: in control system flowchart (CSF) form

A standard function block is designed in such a way that the programming device prompts the user when linking the block into his program. The internal programming of the function block is not important for this.

The function block is called with a call statement (see Fig. 7/29). It is then displayed with its block name and its formal operands (block parameters). Formal operands are mnemonics which represent the type of function of inputs and outputs as well as the data required by the function block.

An actual operand must be entered alongside each formal operand when the corresponding block is called up. The actual operand is chosen by the user according to the requirements of the control task at that particular point.

"A" type parameters (outputs or results) are shown on the right of the function symbol. Basic and supplementary operations in function blocks can only be shown in the statement list. Parameters with "E, D, B, T or Z" types of parameters (inputs or preset data) are shown in the graphic design on the left of the function symbol.

Documentation

A software handbook containing a comprehensive description of the function blocks is provided with each of the program packages (on diskettes).

7

Overview

Program packages Installable in **S5-**	90U	95U	100U CPU 103	**115U** CPU 941 to 944	CPU 945	135U/155U CPU 922	CPU 928	CPU 928B	155U CPU 946/ 947	CPU 948	Page
Basic functions		■	■	■	■	■	■	■	■	■	7/39
Floating-point arithmetic		■	■	■							7/51
Mathematical functions					■	■	■	■	■	■	7/52
GRAPH 5 / II		■	■	■		■	■	■	■		7/55
Closed-loop control											
S5-100U/-115U closed-loop control		■	■	■							7/63
R64 controller structure						■	■	■			7/72
Compact fuzzy control		■	■	■	■		■	■	■	■	7/75
Modular PID and fuzzy control					■	■	■	■	■	■	7/77
Standard software PMC											
PMC/LS-B				■			■	■	■	■	7/91
Message functions											
Message functions for standard CP				■	■	■	■	■	■	■	7/94
Compact message functions				■	■	■	■	■	■	■	7/96
Signalling functions		■	■	■	■	■	■	■	■	■	7/98
Data handling blocks				Internal	Internal	■	■	■	■		7/104
Intelligent I/O modules	■	■	■	■	■	■	■	■	■	■	7/109
CP 516 memory submodule					■	■	■				7/128
Failsafe standard function blocks	Can be used for S5-95F, S5-115F only (CPU 942F)										7/129

7

Basic functions

ADD:32
32-bit binary adder

FB 1 for 95U
FB 1 for 100U
FB 1 for 115U
FB 1 for 135U
FB 3 for 155U

The ADD:32 function block adds two fixed-point binary numbers (31 bit + sign). The result is also a fixed-point binary number (31 bit + sign).

The function block sets the following condition codes if appropriate:
Overflow (result is cancelled), result is 0.

Number range:
– 2 147 483 648 to
+ 2 147 483 647
(-2^{31} to $+2^{31}-1$).

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
95U	108	10	1.8
100U with CPU 103	108	10	2.1
115U with			
CPU 941[1)]	108	10	2.8
CPU 942[1)]	108	10	2.8
CPU 943[1)]	108	10	2.6
CPU 944[1)]	108	10	<0.2
135U/155U with			
CPU 922	100	10	1.6
CPU 928	100	10	0.8
CPU 928B	100	10	0.3
CPU 948	69	10	0.03
155U with CPU 946/947	69	10	0.13

1) As of Order No.: 6ES5 94.-7UB

SUB:32
32-bit binary subtractor

FB 2 for 95U
FB 2 for 100U
FB 2 for 115U
FB 2 for 135U
FB 7 for 155U

The SUB:32 function block subtracts two fixed-point binary numbers (31 bit + sign). The result is also a fixed-point binary number (31 bit + sign).

The function block sets the following condition codes, if appropriate:
Overflow (result is cancelled), result is 0.

Number range:
– 2 147 483 648 to
+ 2 147 483 647
(-2^{31} to $+2^{31}-1$).

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
95U	108	10	1.8
100U with CPU 103	108	10	2.1
115U with			
CPU 941[1)]	108	10	2.5
CPU 942[1)]	108	10	2.5
CPU 943[1)]	108	10	2.3
CPU 944[1)]	108	10	<0.2
135U/155U with			
CPU 922	100	10	1.6
CPU 928	100	10	0.74
CPU 928B	100	10	0.4
CPU 948	69	10	0.03
155U with CPU 946/947	69	10	0.13

1) As of Order No.: 6ES5 94.-7UB

Basic functions (continued)

MUL:32
32-bit binary multiplier

FB 3 for 95U
FB 3 for 100U
FB 3 for 115U
FB 3 for 135U
FB 11 for 155U

The MUL:32 function block multiplies two fixed-point binary numbers (31 bit + sign). The result is also a fixed-point binary number (63 bit + sign).

The function block sets the following condition code, if appropriate:
Result is 0.

Number range:
Multiplicand -2^{31} to $+2^{31}-1$
Multiplier -2^{31} to $+2^{31}-1$
Product -2^{63} to $+2^{63}-1$.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
95U	399	11	8.3 to 31.4
100U with CPU 103	399	11	3.2 to 5.4
115U with			
CPU 941[1)]	399	11	4.0 to 8.2
CPU 942[1)]	399	11	4.0 to 8.2
CPU 943[1)]	399	11	3.5 to 5.6
CPU 944[1)]	209	11	0.01 to 0.035
135U/155U with			
CPU 922	302	11	11.6
CPU 928	302	11	4.32
CPU 928B	302	11	0.5
CPU 948	197	11	0.11
155U with CPU 946/947	197	11	0.7

1) As of Order No.: 6ES5 94.-7UB

7

DIV: 32
32-bit binary multiplier

FB 4 for 95U
FB 4 for 100U
FB 4 for 115U
FB 4 for 135U
FB 15 for 155U

The DIV:32 function block divides two fixed-point binary numbers (31 bit + sign). The result is also a fixed-point binary number (31 bit + sign).

The function block sets the following condition codes, if appropriatie:
Overflow (result is candelled),
quotient equals zero,
remainder equals zero,
error: division by zero.

Number range:
−2 147 483 648 to
+ 2 147 483 647
(-2^{31} to $+2^{31}-1$).

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
95U	395	14	2.1 to 25.8
100U with CPU 103	395	14	2.4 to 4.2
115U with			
CPU 941[1)]	395	14	5.9 to 6.8
CPU 942[1)]	395	14	5.9 to 6.8
CPU 943[1)]	395	14	4.2 to 4.7
CPU 944[1)]	395	14	1.7 to 2.2
CPU 945[1)]	203	14	0.015 to 0.12
135U/155U with			
CPU 922	242	14	1.2 to 37
CPU 928	242	14	0.9 to 13.3
CPU 928B	242	14	1.2
CPU 948	203	14	0.2
155U with CPU 946/947	203	14	0.2 to 2

1) As of Order No.: 6ES5 94.-7UB

Basic functions (continued)

RAD:16
16-bit binary root extractor

FB 5 for 95U
FB 5 for 100U
FB 5 for 115U
FB 5 for 135U
FB 18 for 155U

The RAD:16 function block extracts the sqare root of a fixed-point binary number (15 bit + sign). The result is two fixed-point binary numbers (8-bit root, 16-bit remainder).

The function block sets the following condition code, if appopriate:
Radicand negative.

Number range:
Radicand – 32 768 to + 32 767
Root 0 to + 181
Remainder 0 to + 361.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
95U	126	6	5.3
100U with CPU 103	126	6	1.3
115U with			
CPU 941[1)]	126	6	1.6
CPU 942[1)]	126	6	1.6
CPU 943[1)]	126	6	1.4
CPU 944[1)]	126	6	0.3
CPU 945[1)]	126	6	0.045
135U/155U with			
CPU 922	126	6	0.6 to 9.7
CPU 928	126	6	0.42 to 6.5
CPU 928B	126	6	0.4
CPU 948	128	6	0.12
155U with CPU 946/947	128	6	0.7

1) As of Order No.: 6ES5 94.-7UB

RAD:GP
Floating point root extractor

FB 6 for 115U
FB 6 for 135U
FB 19 for 155U

The RAD: GP function block extracts the square root of a floating-point number (exponent: 7 bit + sign; mantissa: 23 bit + sign). The result is also a floating-point number (exponent: 7 bit + sign; mantisse: 23 bit + sign). The least significant bit of the mantissa is not rounded.

The function block sets the following condition code, if appropriate:
Radicand negative.

Number range:
Radicand
±0.1469368 exp. –39 to
±0.1701412 exp. +39
Root
+ 0.3833234 exp. –19 to
+ 0.1304382 exp. +20.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with CPU 945	127	5	0.04
135U/155U with			
CPU 922	133	8	3.8 to 10.8
CPU 928	133	8	2.2 to 7.1
CPU 928B	133	8	0.4
CPU 948	129	5	0.09
155U with CPU 946/947	129	5	0.3 to 0.4

7

Basic functions (continued)

REG:SCHB
Shift register (bit)

FB 10 for 95U
FB 10 for 100U
FB 10 for 115U
FB 10 for 135U
FB 24 for 155U

The REG:SCHB (bit) function block implements a right-left shift register of variable length. The shift register is located in the bit memory area; the first and last bit memory byte must be specified.

The shift register has inputs for right and left shifting and corresponding outputs for the carry.

The REG:SCHB function block requires a data block which must be called before REG:SCHB itself.

Max. register length: 32 bit

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
95U	250	14	5.3[1] to 77.4[2]
100U with CPU 103	250	14	2.3[1] to 28.8[2]
115U with			
CPU 941[4]	250	14	6.7[1] to 33.4[2]
CPU 942[4]	250	14	6.7[1] to 33.4[2]
CPU 943[4]	250	14	6.4[1] to 31.8[2]
CPU 944[4]	250	14	0.5[1] to 2.5[2]
CPU 945	250	14	0.045[1] to 0.28[2]
135U/155U with			
CPU 922	250	14	1.5[3]
CPU 928	250	14	1.9[3]
CPU 928B	250	14	0.7
CPU 948	252	14	0.04 to 1.49
155U with			
CPU 946/947	252	14	0.2 to 12

1) With 8 bit
2) With 128 bit
3) With 32 bit
4) As of Order No.: 6ES5 94.-7UB..

REG:SCHW
Shift register (word)

FB 11 for 95U
FB 11 for 100U
FB 11 for 115U
FB 11 for 135U
FB 25 for 155U

The REG:SCHW (word) function block implements a right-left shift register of variable length. The shift register is located in the data area; this data area and the number of data words needed must be specified. The shift register has inputs for right and left shifting and corresponding outputs for the carry.

Several "shift register" function blocks can be chained if bit memory words, input words, output words or peripheral words are used for the inputs and outputs "ZER", "TEL", ZAR", and "ZAL".

The "ZER" and "ZEL" inputs of the following function block must then be connected to the "ZAR" and "ZAL" outputs of the preceding block.

Conditions

The data words DW0 and DW1 of the data block selected are not available to the user; this means that, with a single data block, the maximum possible length of the shift register is 254 words.

For K > 254 or K = 0, the function block is not processed.

The shift register can be extended by one data block with each subsequent call of the REG:SCHW function block.

Continued on the next page.

Basic functions (continued)

REG:SCHW (continued)
Shift register (word)

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
95U	125	10	20.1[1] to 31.4[2] 81.0[4] to 122.8[5]
100U with CPU 103	125	10	27.0[1] to 37.0[2] 96.0[4] to 144.0[5]
115U with CPU 941[6]	125	10	31.0[1] to 44.0[2] 117.0[4] to 170.0[5]
CPU 942[6]	125	10	31.0[1] to 44.0[2] 117.0[4] to 170.0[5]
CPU 943[6]	125	10	30.0[1] to 43.0[2] 113.0[4] to 166.0[2]
CPU 944[6]	125	10	1.5[1] to 2.3[2] 5.2[4] to 8.7[5]
CPU 945	120	10	0.045[1] to 0.18[2] 0.525[4] to 0.675[5]
135U/155U with			
CPU 922	125	10	1.0 to 100[3]
CPU 928	125	10	0.8 to 67[3]
CPU 928B	125	10	0.4
CPU 948	117	10	0.36[1] to 0.43[2] 1.37[4] to 1.64[5]
155U with CPU 946/947	117	10	0.4

1) With 64 SR words (1 word = 2 byte)
2) With 64 SL words
3) With 254 words
4) With 254 SR words
5) With 254 SL words
6) As of Order No.: 6ES5 94.-7UB..

REG:FIFO
Buffer

FB 12 for 95U
FB 12 for 100U
FB 12 for 115U
FB 12 for 135U
FB 26 for 155U

The REG:FIFO function block contains a FIFO (first in/first out) register of variable depth.

The FIFO is located in a data area; this data area and the length of the buffer must be specified. 16-bit words can be read in and read out.

The function block has outputs for "Buffer full" and "Buffer empty".

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
95U	160	11	1.4
100U with CPU 103	160	11	1.6
115U with			
CPU 941[4]	160	11	2.3
CPU 942[4]	160	11	2.3
CPU 943[4]	160	11	2.2
CPU 944[4]	160	11	0.3
CPU 945	148	11	0.015
135U/155U with			
CPU 922	160	11	1.2
CPU 928	160	11	0.6
CPU 928B	160	11	0.1
CPU 948	162	11	0.035
155U with CPU 946/947	162	11	0.2

1) As of Order No.: 6ES5 94.-7UB..

Basic functions (continued)

REG:LIFO
Stack

FB 13 for 95U
FB 13 for 100U
FB 13 for 115U
FB 13 for 135U
FB 27 for 155U

The REG:LIFO function block stores the information in a stack (LIFO = last in/first out).

The depth of the stack is variable. The stack is located in a data area; this data area and the depth of the stack must be specified. 16-bit words can be stored.

The function block has outputs for "Stack full" and "Stack empty".

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
95U	117	11	1.4
100U with CPU 103	117	11	1.4
115U with			
CPU 941[1)]	117	11	max. 2.4
CPU 942[1)]	117	11	max. 2.4
CPU 943[1)]	117	11	max. 2.3
CPU 944[1)]	117	11	max. 0.3
CPU 945	110	11	max 0.012
135U/155U with			
CPU 922	117	11	0.9
CPU 928	117	11	0.52
CPU 928B	117	11	0.1
CPU 948	119	11	0.03
155U with CPU 946/947	119	11	0.2

1) As of Order No.: 6ES5 94.-7UB..

COD:B8
Code converter BCD into binary

FB 21 for 115U

The function block "Code converter BCD into binary" converts a BCD number consisting of 8 decades plus sign into a fixed-point binary number (31 + 1 bit).

Permissible range of BCD numbers: -99999999 to +99999999.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	183	7	3.3
CPU 942[1)]	183	7	3.3
CPU 943[1)]	183	7	2.5
CPU 944[1)]	183	7	0.9

1) As of Order No.: 6ES5 94.-7UB..

COD:32
Code converter binary into BCD

FB 23 for 115U

The function block "Code converter binary into BCD" converts a fixed-point binary number (31 + 1 bit) into a BCD number consisting of 10 decades plus sign.

Permissible range of the fixed-point binary numbers: -2^{31} to $+ 2^{31} - 1$

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	302	8	3.5
CPU 942[1)]	320	8	3.5
CPU 943[1)]	302	8	2.5
CPU 944[1)]	302	8	1.2

1) As of Order No.: 6ES5 94.-7UB..

Basic functions (continued)

AE:464
Read in analog value from 6ES5 464 modules

FB 30 for 95U

FB 30 for 100U

FB 30 for CPU 941 to 944

FB 13 for 135U

FB 27 for 155U

The function block "AE:464" is used to read in analog values from the 6ES5 464-8M... analog input modules.

The function block takes into consideration the characteristics of the various analog input modules and produces at its output a standardized value between specified lower and upper limits for a given nominal input signal. The user sets the limits.

The function block for the S5-95U, S5-100U and S5-115U (CPU 941 to 944) produces the standardized value as a 16-bit fixed-point number, for the S5-115U (CPU 945), S5-135U and S5-155U as a 32-bit floating-point number.

Modules to be used:
6ES5 464-8MA11
6ES5 464-8MA21
6ES5 464-8MB11
6ES5 464-8MC11
6ES5 464-8MD11
6ES5 464-8ME11
6ES5 464-8MF11
6ES5 464-8MF21.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
95U	395	9	5.8
100U with CPU 103[2)]	395	9	3.5
115U with			
CPU 941[1)]	418	9	4.5
CPU 942[1)]	418	9	4.5
CPU 943[1)]	418	9	3.9
CPU 944[1)]	418	9	2.7
135U/155U with			
CPU 922	384	11	3.6
CPU 928	384	11	1.9
CPU 928B	384	11	0.6
CPU 948	386	11	0.095
155U with			
CPU 946/947	386	11	0.4

1) As of Order No.: 6ES5 94.-7UB..

2) As of Order No.: 6ES5 103-8MA03

AE:460
Read in analog value from 6ES5 460/465 modules

FB 30 for CPU 941 to 944

FB 250*) for CPU 945

FB 31 for 135U/155U

*) is integrated in the operating system of the CPU 945

The function block "AE:460" is used to read in analog values from the 6ES5 460-4UA/7LA.. or 6ES5 465-4UA/7LA.. analog input modules.

The function block takes into consideration the characteristics of the various analog input modules and produces at its output a standardized value between specified lower and upper limits for a given nominal input signal. The user sets the limits.

The function block for the S5-115U (CPU 941 to 944) produces the standardized value as a 16-bit fixed-point number, for the S5-115U (CPU 945), S5-135U and S5-155U as a 32-bit floating-point number.

Both cyclic and selective sampling are possible.

Modules to be used:
6ES5 460-4UA1.
6ES5 460-4LA1.
6ES5 465-4UA1.
6ES5 465-7LA1.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	315	11	4.9
CPU 942[1)]	315	11	4.9
CPU 943[1)]	315	11	4.6
CPU 944[1)]	315	11	2.8
135U/155U with			
CPU 922	300	13	3.5
CPU 928	300	13	1.6
CPU 928B	300	13	0.6
CPU 948	305	13	0.095
155U with			
CPU 946/947	305	13	0.4

1) As of Order No.: 6ES5 94.-7UB..

7

Basic functions (continued)

AE:463

Read in analog value from 6ES5 463-4U modules

FB 32 for CPU 941 to 944

FB 241*) for CPU 945

FB 32 for 135U/155U

*) is integrated in the operating system of the CPU 945

The function block "AE:463" is used to read in analog values from the 6ES5 463-4UA□□ or 6ES5 463-4UB□□ analog input modules.

The function block takes into consideration the characteristics of the various analog input modules and produces at its output a standardized value between specified lower and upper limits for a given nominal input signal. The user sets the limits.

The function block for the S5-115U (CPU 941 to 944) produces the standardized value as a 16-bit fixed-point number, for the S5-115U (CPU 945), S5-135U and S5-155U as a 32-bit floating-point number.

Modules to be used:
6ES5 463-4UA1.
6ES5 463-4UB1.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	235	9	4.2
CPU 942[1)]	235	9	4.2
CPU 943[1)]	235	9	4.0
CPU 944[1)]	235	9	2.7
135U/155U with			
CPU 922	219	11	3.0
CPU 928	219	11	1.6
CPU 928B	219	11	0.6
CPU 948	221	11	0.08
155U with			
CPU 946/947	221	11	0.5

1) As of Order No.: 6ES5 94.-7UB..

AE:466

Read in analog value from 6ES5 466-3LA modules

FB 33 for CPU 941 to 944

FB 243*) for CPU 945

FB 33 for 135U/155U

*) is integrated in the operating system of the CPU 945

The function block "AE:466" is used to read in analog values from the 6ES5 466-3LA1 □ analog input modules.

The function block takes into consideration the characteristics of the various analog input modules and produces at its output a standardized value between specified lower and upper limits for a given nominal input signal. The user sets the limits.

The function block for the S5-115U (CPU 941 to 944) produces the standardized value as a 16-bit fixed-point number, for the S5-115U (CPU 945), S5-135U and S5-155U as a 32-bit floating-point number.

Modules to be used:
6ES5 466-3LA1.

Technical specifications

For S5-	Block length in word	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	283	9	10.6
CPU 942[1)]	283	9	10.6
CPU 943[1)]	283	9	8.4
CPU 944[1)]	283	9	4.8
135U/155U with			
CPU 922	252	11	3.3
CPU 928	252	11	1.6
CPU 928B	252	11	0.5
CPU 948	254	11	0.09
155U with			
CPU 946/947	254	11	0.7

1) As of Order No.: 6ES5 94.-7UB..

Basic functions (continued)

RLG:AA
Output analog value

FB 251 for 95U*)

FB 251 for 100U*)

FB 251 for 115U*)

FB 41 for 135U/155U

*) is integrated in the operating system

The function block "Output analog value" is used to output analog signals to the process via analog output modules. The function block must be assigned values between a lower and an upper limit.

Modules to be used:
6ES5 470-4UA12
6ES5 470-4UB12
6ES5 470-4UC12
6ES5 470-7LA12
6ES5 470-7LB12
6ES5470-7LC12.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
100U with CPU 103	—	9	max. 6
115U with			
CPU 941[1)]	—	9	max. 6
CPU 942[1)]	—	9	max. 6
CPU 943[1)]	—	9	max. 6
CPU 944[1)]	—	9	max. 6
135U/155U with			
CPU 922	101	12	2.9
CPU 928	101	12	2.4
CPU 928B	101	12	0.2
CPU 948	105	12	0.053
155U with CPU 946/947	105	12	0.27

1) As of Order No.: 6ES5 94.-7UB..

Retten
Laden
Save, load scratch bit memories

FB 38 for 115U

FB 39 for 115U

FB 38 for 135U/155U

FB 38 for 135U/155U

When a cyclic user program is interrupted by a time-controlled or process interrupt-driven program, there is danger of the data stored in the "scratched bit memory area" (FW 200 to FW 254) being over-written by the interrupt-driven program.
The "RETTEN" function block is called at the beginning of the interrupt service routine to save the scratch bit memories in a data block.

The "LADEN" function block is called at the end of the interrupt service routine to reload FW 200 to FW 254 with the scratch bit memories for the cyclic program.

Technical specifications

For S5-	Block length in words		Call length in words		Processing time in ms	
	FB 38	FB 39	FB 38	FB 39	FB 38	FB 439
115U with CPU 945	93	86	3	3	0.133	0.133
135U/155U with CPU 948	105	96	3	3	0.11	0.105
155U with CPU 946/947	105	96	3	3	0.24	0.24

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Basic functions (continued)

SST:UHR
Clock

FB 129 for 155U

The "SST:UHR" function block sets and reads the system clock. The block is not programmable.

It reserves the data words DW 0 to DW 11 in DB 55; the user must initialize these data words.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
155U with CPU 946/947	53	2	0.1 to 0.4

DB-COPY
Copy data words between data blocks DB/DX

FB 44/45 for 115U

FB 44/45 for 135U

FB 44/45 for 155U

The function blocks copy a defined number of data words (0 to 255) between a source DB/DX and a destination DB/DX.

With the CPU 941 to CPU 944 only the normal data area (DB) is permitted.

The FB 44 and FB 45 function blocks have the same function. They differ only in their type of parameter assignment.

The parameters of the FB 44 are specified when they are called (direct parameter assignment) while the FB 45 receives its block parameters by the transfer of a pointer on a parameter field (indirect parameter assignment).

Technical specifications

For S5-	Block length in words		Call length in words		Processing time in ms	
	FB44	FB 45	FB 44	FB 45	FB 44	FB 45
115U with						
CPU 941[1)]	216	273	8	2	2.4 to 24.3	2.6 to 24.7
CPU 942[1)]	216	273	8	2	2.4 to 24.3	2.6 to 24.7
CPU 943[1)]	216	273	8	2	2.0 to 22.2	2.4 to 22.5
CPU 944[1)]	216	273	8	2	1.0 to 1.2	0.9 to 1.5
CPU 945	247	318	8	2	0.025 to 0.115	0.035 to 0.125
135U/155U with						
CPU 922	168	217	8	2	2.3 to 2.8	3.0 to 3.3
CPU 928	168	217	8	2	1.4 to 1.6	1.7 to 2.0
CPU 928B	168	217	8	2	0.3 to 0.6	0.4 to 0.7
CPU 948	233	303	8	2	0.04 to 0.315	0.09 to 0.34
155U with						
CPU 946/947	233	303	8	2	0.3 to 0.7	0.3 to 0.8

1) As of Order No.: 6ES5 94.-7UB..

2) The times are depending on the number of bytes to be transfered.

Basic functions (continued)

PER:ET
Read and write extended I/Os

The function block "Read and write extended I/Os" transfers (depending on the type of parameter assignment) an I/O area via one of the interface modules specified to a CPU-internal area or vice versa.

Input bytes can thus be read from the extended I/Os and output bytes written to the extended I/Os.

FB 196:
Direct parameter assignment
FB 197:
Indirect parameter assignment

The following table contains all source and destination areas which can be addressed.

Areas		S5-115U	S5-135U with CPU 922 928-.UA..	CPU 928 -.UB..	S5-155U
I/O area	P (byte no.)	128-255	128-255	128-255	128-255
	Q (byte no.)	0-255	0-255	0-255	0-255
	IM3 (byte no.)	0-255	0-255	0-255	0-255
	IM4 (byte no.)	0-255	0-255	0-255	0-255
Internal area	DB (DW no.)	10-2042	10-2042	10-2042	10-2042
	DX (DW no.)	-	10-2042	10-2042	10-2042
	Bit memories (byte no.)	0-235	0-235	0-235	0-235
	S-Bit memories (byte no.)	-	-	0-1023	0-4095

The "PER:ET" function block is used with one of the following interface modules:

IM 300-3, IM 300-5 (-5CA11), IM 300-5 (-5LB11), IM 301-3, IM 301-5, IM 304, IM 305, IM 306, IM 307 and IM 308

Note:
The I/O modules addressed with one block call must be addressed continuously. After each gap in the addresses, the PER:ET function block must be called again.

Technical specifications

For S5-	Block length in words		Call length in words		Processing time[2] in ms	
	FB 196	FB 197	FB 196	FB 197	FB 196	FB 197
115U with						
CPU 941[1]	213	272	7	2	2.3 to 10.9	2.1 to 10.7
CPU 942[1]	213	272	7	2	2.3 to 10.9	2.1 to 10.7
CPU 943[1]	213	272	7	2	2.1 to 10.7	1.9 to 10.5
CPU 944[1]	213	272	7	2	0.4 to 0.6	0.7 to 0.9
CPU 945	214	282	7	2	0.025 to 0.115	0.035 to 0.125
135U/155U with						
CPU 922	267	322	7	2	3.2 to 4.7	3.9 to 5.4
CPU 928	267	322	7	2	1.4 to 2.6	1.8 to 3.0
CPU 928B	267	322	7	2	0.9 to 2.1	1.0 to 2.2
CPU 948	301	369	7	2	0.07 to 1.2	0.09 to 1.4
155U with						
CPU 946/947	301	369	7	2	1.1 to 1.3	1.3 to 1.5

1) As of Order No.: 6ES5 94.-7UB..

2) The times are depending on the number of bytes to be transferred.

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Basic functions (continued)

Summary Program package "Basic functions"

Function block	For S5 programmable controllers					
	95U	100U with CPU 103	115U with CPU 941-944	115U with CPU 941-944	135U	155U
ADD : 32	FB 1	FB 1	FB 1	—	FB 1	FB 3
SUB : 32	FB 2	FB 2	FB 2	—	FB 2	FB 7
MUL : 32	FB 3	FB 3	FB 3	FB 3	FB 3	FB 11
DIV : 32	FB 4	FB 4	FB 4	FB 4	FB 4	FB 15
RAD : 16	FB 5	FB 5	FB 5	FB 5	FB 5	FB 18
RAD : GP	—	—	—	FB 6	FB 6	FB 19
REG : SCHB	FB 10	FB 10	FB 10	FB 10	FB 10	FB 24
REG : SCHW	FB 11	FB 11	FB 11	FB 11	FB 11	FB 25
REG : FIFO	FB 12	FB 12	FB 12	FB 12	FB 12	FB 26
REG : LIFO	FB 13	FB 13	FB 13	FB 13	FB 13	FB 27
COD : B8	—	—	FB 21	—	—	—
COD : 32	—	—	FB 23	—	—	—
AE : 464	FB 30	FB 30	FB 30	FB 242[1)]	FB 30	FB 30
AE : 460	—	—	FB 31	FB 250[1)]	FB 31	FB 31
AE : 463	—	—	FB 32	FB 241[1)]	FB 32	FB 32
AE : 466	—	—	FB 33	FB 243[1)]	FB 33	FB 33
RLG : AA	FB 251[1)]	FB 251[1)]	FB 251[1)]	FB 251[1)]	FB 41	FB 41
SON : WS	—	—	—	—	—	—
SST : UHR	—	—	—	—	—	FB 129
Retten	—	—	—	FB 38	—	FB 38
Laden	—	—	—	FB 39	—	FB 39
DB-COPY	—	—	FB 44/45	FB 44/45	FB 44/45	FB 44/45
PER : ET	—	—	FB 196/197	FB 196/197	FB 196/197	FB 196/197

[1)] These function blocks are integrated in the operating system of the CPU.

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Ordering data	Order No.
Program package "Basic functions" for S5-95U, S5-100U with CPU 103, S5-115U with CPU 941-944[2)], CPU 945, S5-135U /155U with CPU 922, 928, 928 B, CPU 948, S5-155U with CPU 946/947, with manual in German, English, French, for MS-DOS, S5-DOS/MT operating system, on $3^1/_2$" diskettes (720 Kbyte) and on $5^1/_4$" diskettes (360 Kbyte)	
Single license	**6ES5 848-7AA02**
Copy license	**6ES5 848-7AA02–0KL1**

[2)] As of Order No.: 6ES594.-7UB..

Floating-point arithmetic

Application

The standard function blocks for floating-point arithmetic enable the S5-115U, S5-100U (with CPU 103) and S5-95U to execute arithmetic operations with

- 32-bit fixed-point numbers (31 bit + sign bit) and
- 32-bit floating-point numbers (exponent: 7 bit + sign bit, mantissa: 23 bit + sign bit)

Functions

The following standard function blocks are available for floating-point arithmetic:

- FB 15: Fixed-point to floating-point conversion
- FB16: Floating-point to fixed-point conversion
- FB 17: Add two floating-point numbers
- FB 18: Subtract two floating-point numbers
- FB 19: Multiply two floating-point numbers
- FB 20: Divide two floating-point numbers
- FB 21: Compare two floating-point numbers

These function blocks set the following bit memories for futher processing:

- Overflow
- Result is 0
- Error

Number range for fixed-point numbers:
2 147 483 648 to + 2 147 483 647 (-2^{31} to $+2^{31} - 1$).

Number range for floating-point numbers:
± 1 469 368 exp.38 to 1 701 412 exp. + 39.

Technical specifications

Block number	Block name	Block length in words	Processing time in ms with						Nesting depth	Blocks called	Bit memories reserved
			S5-95U	S5-100U CPU 103	S5-115U CPU 941	CPU 942	CPU 943	CPU 944			
FB 15	GP:FPGP	72	0.41 - 4.67	0.9 - 1.3	0.85 - 2	0.85 - 2	0.78 - 1.4	0.04 - 0.23	0	—	FW 200 to FW 203
FB 16	GP:GPFP	95	0.54 - 5.63	1.1 - 1.8	1.6 - 2.3	1.6 - 2.3	1.2 - 1.9	0.14 - 0.5	0	—	FW 200 to FW 203
FB 17	GP:ADD	266	1.29 - 2.62	1.4 - 1.9	2.1 - 2.5	2.1 - 2.5	1.6 - 2.25	0.13 - 0.56	0	—	FW 200 to FW 212
FB 18	GP:SUB	267	1.14 - 1.38	1.77 - 2.3	2.1 - 2.5	2.1 - 2.5	1.8 - 2.3	0.13 - 0.56	0	—	FW 200 to FW 212
FB 19	GP:MUL	176	3.63 - 3.97	2.7 - 4.3	2.5 - 4.8	2.5 - 4.8	2.2 - 4.6	1.3 - 4.4	1	FB 242, MUL: 16	FW 200 to FW 220
FB 20	GP:DIV	223	0.56 - 9.3	1.8 - 4.0	1.6 - 4.2	1.6 - 4.2	1.1 - 3.5	0.5 - 2	0	—	FW 200 to FW 214
FB 21	GP:VGL	112	0.67 - 1.01	1.0 - 1.5	1.5 - 1.8	1.5 - 1.8	1.0 - 1.4	0.1 - 0.15	0	—	FW 200 to FW 207

Ordering data

	Order No.
Program package "Floating-point arithmetic" for S5-95U, S5-100U with CPU 103, S5-115U with CPU 941-944 with manual in German, English, French, for MS-DOS, S5-DOS/MT operating system, on 3 1/2" diskettes (720 Kbyte) and on 5 1/4" diskettes (360 Kbyte)	
Single license	**6ES5 845-7GP01**
Copy license	**6ES5 845-7GP01-0KL1**

Mathematical functions

Application

The following standard function blocks are available for executing often-used mathematical functions:

- Trigonometric functions; sine, cosine, tangent, cotangent
- Arc functions; arc sine, arc cosine, arc tangent, arc cotangent
- Logarithmic functions; natural logarithm, common logarithm, logarithm to any base
- Exponential functions; exponent to base e, exponent to base 10, exponent to any base.

The function blocks are available for S5-135U and S5-155U.

Principle of operation

Standard function blocks for mathematical functions are handled in the same way as equivalent STEP 5 statements. When the block is called,

- the contents of accumulator 1 are changed in accordance with the function executed (without altering the contents of the other accumulators or the base address register BR), or
- the contents of accumulators 1 and 2 are combined in accordance with the function executed, with the contents of accumulator 3 being pushed into accumulator 2 and the contents of accumulator 4 into accumulator 3 (like a STEP 5 arithmetical function). The contents of the BR register remain unchanged.

All standard function blocks for mathematical functions process 32-bit floating-point numbers.

SINUS sin (x) **FB 101 for 115U/135U/155U**	The "SINUS" function block calculates the sine of a 24/32-bit floating-point number.	The value must lie within the range 0 (KG = + 0000000 + 00) to 2π (KG = + 6283185 + 01).
COSINUS cos(x) **FB 102 for 115U/135U/155U**	The "COSINUS" function block calculates the cosine of a 24/32-bit floating-point number.	The value must lie within the range 9 (KG = + 0000000 + 00) to 2π (KG = + 6283185 + 01).
TANGENS tan(x) **FB 103 for 115U/135U/155U**	The "TANGENS" function block calculates the tangent of a 24/32-bit floating-point number. The value must lie within the range 0 (KG = + 0000000 + 00) to 2π (KG = + 6283185 + 01).	If the input value is π/2 (KG = + 1570796 + 01) or 3π/2 (KG + 4712389 + 01), the result is infinite and the function block reports an error.
COTANG cotan (x) **FB 104 for 115U/135U/155U**	The "COTANG" function block calculates the cotangent of a 24/32-bit floating-point number. The value must lie within the range (KG = + 2938734 - 34 to KG = + 6283184 + 01).	If the input value is 0π (KG = 3141593 + 01) or 2π (KG = 6283185 + 01), the result is infinite and the function block reports an error.
ARCSIN arcsin (x) **FB 105 for 115U/135U/155U**	The "ARCSIN" function block calculates the arcsine of a 24/32-bit floating-point number.	The value must lie within the range - 1 (KG = - 1000000 + 01) to + 1 (KG = + 1000000 + 01).

Mathematical functions (continued)

ARCCOS arccos (x) **FB 106 for 115U/135U/155U**	The "ARCCOS" function block calculates the arccos of a 24/32-bit floating-point number.	The value must lie within the range – 1 (KG = – 1000000 + 01) to + 1 (KG = + 1000000 + 01).	
ARCTAN arctan (x) **FB 107 for 115U/135U/155U**	The "ARCTAN" function block calculates the arctan of a 24/32-bit floating-point number.	With a value of less than KG = – 5773456 + 07 the result output is – π/2, with a value greater than KG = + 1209486 + 07 the result is + π/2.	
ARCOT arcot (x) **FB 108 for 115U/135U/155U**	The "ARCCOT" function block calculates the arccot of a 24/32-bit floating-point number.	With a value of less than KG = – 5773456 + 07 the result output is π,	with a value greater than KG = + 1209486 + 07 the result is 0.
LN X ln (x) **FB 109 for 115U/135U/155U**	The "LN X" function block calculates the natural log of a 24/32-bit floating-point number.	With a value of less than or equal to 0, accumulator 1 remains unchanged and the function block reports an error.	
LG X lg (x) **FB 110 for 115U/135U/155U**	The "LG X" function block calculates the common log of a 24/32-bit floating-point number.	With a value of less than or equal to 0, accumulator 1 remains unchanged and the function block reports an error.	
B LOG X $\log_b$ (x) **FB 111 for 115U/135U/155U**	The "B LOG X" function block calculates the log to any base. Base b is expected in accumulator 1, the value x in	accumulator 2, both as 24/32-bit floating-point numbers. Both values must be greater than 0, and the base cannot have the value 1.	The result is represented in accumulator 1 as a 24/32-bit floating-point number.
E^X e^x **FB 112 for 115U/135U/155U**	The "E^X function block calculates the exponential value to the base e of a 24/32-bit floating-point number.	The value must lie within the range KG = – 8802962 + 02 to KG = + 8802966 + 02, otherwise an overflow condition is produced.	
ZEHN^X 10^x **FB 113 for 115U/135U/155U**	The "ZEHN^X" function block calculates the exponential value to the base 10 of a 24/32-bit floating-point number.	The value must lie within the range KG = – 3823079 + 02 to KG – 3823079 + 02, otherwise an overflow condition is produced.	
A2^A1 $a2^{a1}$ **FB 114 for 115U/135U/155U**	The "A2^A1" function block calculates the exponential value to any base. Base a2 is expected in accumulator 2,	the exponent a1 in accumulator 1, both as 24/32-bit floating-point numbers. The base value must be positive. The result is represented in accumulator 1 as a 24/32-bit floating-point number.	If the result produces an overflow, the contents of accumulators 1 and 2 remain unchanged and the function block reports an error.

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Mathematical functions (continued)

Technical specifications

Block number	Block name	Block length in words			Processing time in ms with					
		CPU 922, 928	CPU 945	CPU 946/ 947, 948	CPU 922	CPU 928	CPU 928B	CPU 945	CPU 946/947	CPU 948
101	SINUS	242	192	211	3.8	2.4	1.3	0.039	0.4	0.15
102	COSINUS	238	188	207	3.8	2.4	1.4	0.038	0.4	0.14
103	TANGENS	318	268	287	4.0	2.5	1.4	0.043	0.4	0.16
104	COTANG	321	271	290	4.0	2.5	1.3	0.041	0.4	0.15
105	ARCSIN	218	184	203	3.5	2.2	1.3	0.035	0.35	0.14
106	ARCCOS	253	219	238	3.7	2.3	1.3	0.040	0.35	0.15
107	ARCTAN	268	241	260	4.2	2.6	1.4	0.044	0.45	0.17
108	ARCCOT	269	246	265	4.3	2.7	1.4	0.046	0.45	0.17
109	LN X	222	187	206	4.3	2.9	1.5	0.042	0.5	0.17
110	LG X	222	191	210	4.3	2.9	1.5	0.044	0.5	0.17
111	B LOG X	274	227	254	7.6	5.1	1.9	0.079	0.95	0.31
112	E^X	253	217	236	4.5	3.0	1.5	0.046	0.5	0.18
113	ZEHN^X	260	224	243	4.6	3.1	1.5	0.048	0.5	0.19
114	A2^A1	418	364	391	7.4	4.9	1.9	0.077	0.5	0.31

Ordering data

Order No.

Program package "Mathematical functions"
for S5-115U with CPU 945,
S5-135U/155U with
CPU 922, 928, 928B, CPU 948,
S5-155U with CPU 946/947,
with manual
in German, English, French,
for MS-DOS, S5-DOS/MT
operating systems,
on 3 $^1/_2$" diskettes (720 Kbyte)
and
on 5 $^1/_4$" diskettes (360 Kbyte)

Single license — **6ES5 848-7MT01**
Copy license — **6ES5 848-7MT01-0KL1**

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GRAPH 5/II

Application

GRAPH 5/II is an easy-to-use software system for planning and design, programming, documenting and testing sequencers. It consists of the GRAPH 5/II system program for the programming device and the GRAPH 5/II package of standard function blocks (see page 7/10).

Compared with the GRAPH 5 package, the GRAPH 5/II package offers additional diagnostic functions, synchronization and optimized processing times.

The sequence blocks generated with an older version of GRAPH 5 can be matched to the new function blocks with the GRAPH 5/II option package.

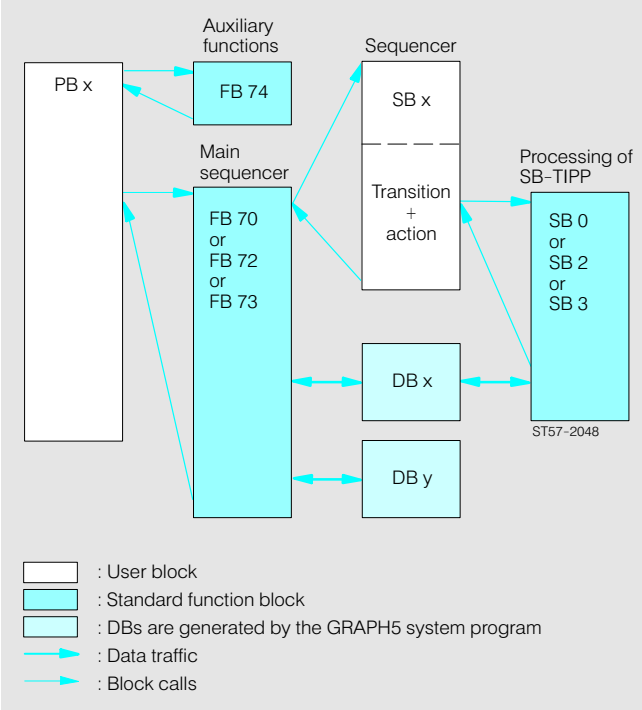

Fig. 7/31 Calling structure

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Processing times

For S5-	Structure linear sequencer FB 70	FB 73	FB 73/74	2 simultaneous sequencers FB 70	FB 72	FB 72/74	4 simultaneous sequencers FB 70	FB 72	FB 72/74	8 simultaneous sequencers FB 70	FB 72	FB 72/74
95U	—	5.9	8.5	—	11	14	—	19	22.5	—	38	41
100U with CPU 103	23	13	19	33	27	29	54	43	47	77	65	71
115U with												
CPU 941	13	7	10	17	12	15	29	19	22	41	29	36
CPU 942	11	6	9	15	11	13	25	17	19	39	30	33
CPU 943	10.1	4	5.5	14.4	10.5	11.8	22.6	18.2	19.6	38	33.6	35.1
CPU 944	1.2	1.0	1.15	1.45	1.3	1.45	3.56	2.0	2.1	3.8	3.2	3.3
CPU 945	0.49	0.43	0.47	0.51	0.48	0.51	0.58	0.51	0.59	0.72	0.58	0.74
135U/155U with												
CPU 922	16.0	10.4	13.9	22.0	18.0	21.6	33.8	29.0	32.6	57.1	51.1	54.6
CPU 928B	1.0	0.7	0.85	1.5	1.1	1.3	1.9	1.6	1.85	24	2.85	3.2
CPU 948	0.59	0.5	0.57	0.73	0.67	0.74	1.01	0.94	1.0	1.53	1.44	1.52
155U with CPU 946/947	1.65	1.2	1.5	2.15	1.85	2.2	3.2	2.8	3.1	5.3	4.75	5.1

1) Processing times for sequencers with 25 steps, 3 assignments per step, 3 scans per transition, switching per cycle (in ms).

GRAPH 5/II (continued)

GPH:HKET
Main sequencer

FB 70 for 100U to 155U

The "GPH:HKET" function block controls the main sequencer of a sequence control system. It controls the conveniently programmable operating modes (e.g. manual, automatic) and calls the secondary sequencers.
A maximum of 255 sequencers can be called; a single sequencer can contain 127 steps.

A maximum of eight columns (simultaneous or alternative branches) can be programmed for each sequencer; one initial step can be selected for each column.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time
100U with CPU 103	1100	24	Depending on the volume of the sequence control system, see table on page 7/55
115U with CPU 941-944, CPU 945	1100 1097	24 24	
135U /155U with CPU 922	1085	24	
CPU 928	1085	24	
CPU 928B	1085	24	
CPU 948	1095	24	
155U with CPU 946/947	1095	24	

7

GPH:UKET
Secondary sequencer

FB 71 for 100U to 155U

The "GPH:UKET" function block controls the secondary sequencer of a sequence control system. Secondary sequencers are called in the main sequencer steps.

The operating modes of the main sequencer are forward-ed automatically to the secondary sequencer. All other functions are the same as in FB 70.

Technical specifications

STEP 5 blocks for S5-	Block length in words	Call length in words	Processing time
100U with CPU 103	1104	16	Depending on the volume of the sequence control system, see table on page 7/55
115U with CPU 941-944	1104	16	
CPU 945	1101	16	
135U/155U with CPU 922	1089	16	
CPU 928	1089	16	
CPU 928B	1089	16	
CPU 948	1099	16	
155U with CPU 946/947	1099	16	

GRAPH 5/II (continued)

GPH:SIM1
High-speed simultaneous sequencer

FB 72 for 95U to 155U

The "GPH:SIM1" function block enables somewhat less convenient but high-speed processing of alternative and simultaneous sequencers. Number of sequencers and steps as for FB 70.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time
95U	731	9	
100U with CPU 103	731	9	
115U with CPU 941-944	731	9	Depending on the volume of the sequence control system, see table on page 7/55
CPU 945	731	9	
135U/155U with CPU 922	731	9	
CPU 928	731	9	
CPU 928B	731	9	
CPU 948	731	9	
155U with CPU 946/947	731	9	

GPH:LIN1
High-speed linear sequencer

FB 73 for 95U to 155U

The "GPH:LIN1" function block enables somewhat less convenient but high-speed processing of linear sequencers. Number of sequencers and steps as for FB 70.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time
95U	333	9	
100U with CPU 103	333	9	
115U with CPU 941-944	333	9	Depending on the volume of the sequence control system, see table on page 7/55
CPU 945	333	9	
135U/155U with CPU 922	333	9	
CPU 928	333	9	
CPU 928B	333	9	
CPU 948	333	9	
155U with CPU 946/947	333	9	

GRAPH 5/II (continued)

GPH:ZFK1
Auxiliary functions

FB 74 for 95U to 155U

The "GPH:ZFK1" function block implements auxiliary functions for FB 72 and FB 73, e.g. step selection and synchronization.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time
95U	370	9	
100U with CPU 103	370	9	
115U with CPU 941-944	370	9	Depending on the volume of the sequence control system, see table on page 7/55
CPU 945	370	9	
135U/155U with CPU 922	369	9	
CPU 928	369	9	
CPU 928B	369	9	
CPU 948	369	9	
155U with CPU 946/947	369	9	

7

PG COPY
Read diagnostic message

FB 67 for 100U to 155U

The "PG COPY" function block provides the programming device with a diagnostic message from the diagnostic buffer for display purposes.

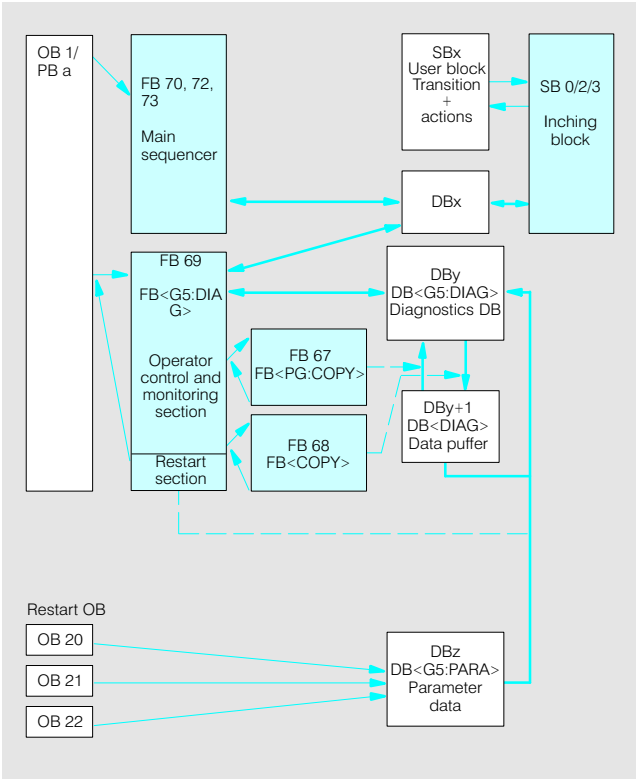

Fig. 7/32 Calling structure for diagnostics

GRAPH 5/II (continued)

COPY
Write diagnostic messages

FB 68 for 100U to 155U

The "COPY" function block enters the diagnostic messages in the diagnostic buffer.

G5 DIAG
Diagnostics

FB 69 for 100U to 155U

The "DIAG" function block organizes and monitors the GRAPH 5/II diagnostics. It calls function blocks FB 67 and FB 68.

Technical specifications

For S5-	Block length in words FB 67	FB 68	FB 69
95U	118	107	1800
100U with CPU 103			
115U with			
CPU 941-944	118	107	1800
CPU 945	120	109	1667
135U/155U with			
CPU 922	103	92	1520
CPU 928	103	92	1520
CPU 928B	103	92	1520
CPU 948	112	101	1530
155U with			
CPU 946/947	112	101	1530

Diagnostic functions

The diagnostic functions monitor all GRAPH 5/II sequencers and transfer the sequencer status information to a programming device or an operator control and monitoring device.

Services:

- Detection of errors in sequencers and preparation of first-up signals
- Updating of status data of the sequencers monitored
- Selection and display of sequencer operating modes
- Recording of diagnostic information in a data buffer

GPH:REAK
Reactivate times

FB 75 for 100U to 155U

The "GPH:REAK" function block saves and reactivates waiting times and monitoring timers in the case of changes of operationg mode and after faults.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time
100U with CPU 103	1144	12	
115U with			
CPU 941-944	1144	12	
CPU 945	1109	12	
135U/155U with			Depending on the volume of the sequence control system
CPU 922	1098	12	
CPU 928	1098	12	
CPU 928B	1098	12	
CPU 948	1098	12	
155U with CPU 946/947	1108	12	

7

GRAPH 5/II (continued)

Sequence blocks
Execution blocks
SB-TIPP

These blocks are needed for executing GRAPH 5 sequencers in the programmable controller. A special SB-TIPP is allocated to each GRAPH 5/II function block:

FB	FB 70	FB 72	FB 73
SB-TIPP	SB0	SB2	SB3

The associated SB-TIPP is called in each transition of sequence block SBx, and executes the operating modes initialized in the corresponding function block.

When a sequencer is generated with the GRAPH 5/II system program, the SB-TIPP call is automatically entered in the user sequence block SBx.

(Ordering data for the GRAPH 5/II system program for programmers: see page 7/10)

Technical specifications

For S5-	Block length in words		
	SB0	SB2	SB3
95U	—	3333	75
100U with			
CPU 103	385	333	75
115U with			
CPU 941-944	385	333	75
CPU 945	385	333	75
135U/155U with			
CPU 922	385	333	75
CPU 928	385	333	75
CPU 928B	385	333	75
CPU 948	385	333	75
155U with			
CPU 946/947	385	333	75

For each sequencer of a sequence control system there is one sequence block SBx, which contains the structure, step enabling or transition conditions and actions.

The user generates sequence blocks SBx using the GRAPH 5/II system program.

7

GRAPH 5/II (continued)

Sequence blocks (cont.)
Synchronization block
SB5

Linear sequencers with alternative branches can be synchronized with the system.

The GRAPH 5/II option package generates a block for the sequencer with the conditions of synchronization.

With the synchronization conditions, the synchronization block SB 5 sets the step which corresponds to the system status.

The SB 5 synchronization block can be run on the following programmable controllers:

- S5-95U
- S5-100U with CPU 103
- S5-115U with CPU 941-944, 945
- S5-135U/155U with CPU 922, 928, 928 B, 948
- S5-155U with CPU 946/947

It has a block length of 318 words.

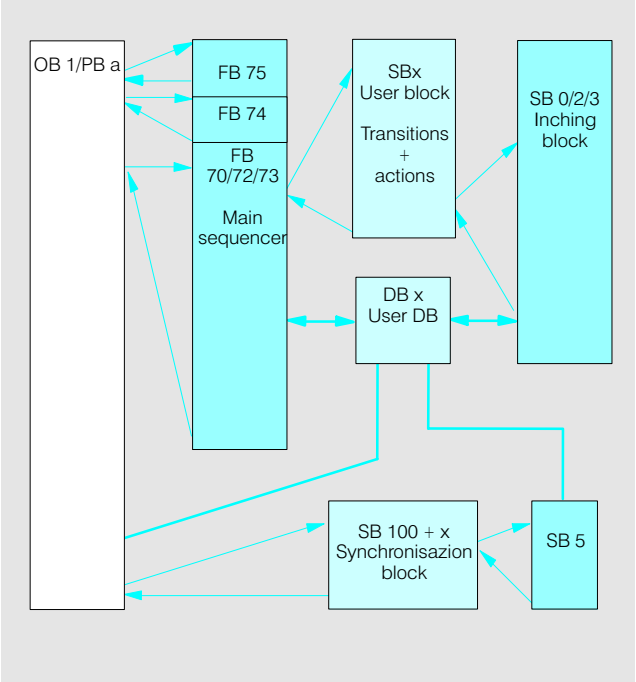

Fig. 7/33 Call structure for synchronization

Data blocks
Work and diagnostic data blocks
DBx, DBy

One DBx work data block is available for each sequencer in sequence control system, and is allocated automatically to the associated SBx sequence block. The DBx work data block maintains the current status of the sequencer.

The error messages for all sequencers in a programmable controller are stored in the DBy diagnostic data block. The GRAPH 5 system program diagnostic function can thus be used to trace group errors over the inidvidual sequencers all the way to the detail level of the faulty sequencer.

The DBx and DBy blocks are generated with the GRAPH 5/II system program.

Summary

The GRAPH 5/II program package contains the following blocks:

- Function blocks FB 67 to FB 75
- Sequence blocks SB 0, SB 2, SB 3, SB 5

Ordering data	Order No.		Order No.
GRAPH 5/II program package for S5-95U, S5-100U with CPU 103, S5-115U with CPU 941-944, 945, S5-135U/155U with CPU 922, 928, 928B, CPU 948, S5-155U with CPU 946/947 MS-DOS, S5-DOS/MT operating systems, on $3^1/_2$″ diskettes (1.44 Mbyte) and on $5^1/_4$″ diskettes (1.2 Mbyte) with manual in German, English, French		**GRAPH 5/II programming software** **Documentation for GRAPH 5/II program package, V 6.6** German Englisch French	See page 7/11 **6ES5 998-1FA13** **6ES5 998-1FA23** **6ES5 998-1FA33**
Single license Copy license	**6ES5 848-7DA03** **6ES5 848-7DA03-0KL1**		

Signalling functions

Application

The processes involved in process and power engineering can only be reliably controlled and monitored if a constant check is kept on operations at a central point. All important events, such as checkback, auxiliary and fault signals and messages, must be monitored and brought to the attention of the operators both visually and audibly.

A set of standard function blocks with the designation "Signalling functions" is available for this purpose.

A distinction is made between first-up and new-value messages (DIN 19 235). In the case of the former, the message (in a group of messages), whose status was the first in the group to change after the last acknowledgement was made, is highlighted. All messages occuring after this first-up message are referred to as new-value messages.

The signalling and acknowledgement states can be indicated by a steady light or flashing light with various frequencies.

A number of individual messages can be combined and displayed as a group message.

MLD:TG
Clock generator

FB 50 for 95U to 155U

The "Clock generator" function block produces flashing frequencies for the lamp outputs of the annunciator blocks.

The positive-going edges of the 0.63 Hz, 1.25 Hz, 2.5 Hz and 5 Hz frequencies are synchronized.

The FR parameter provides these frequencies in bits 4 to 7 of the specified byte (frequency byte).

Bit assignment of the FR frequency byte

Bit 0: Signal 0
Bit 1: Signal 0
Bit 2: Signal 0
Bit 3: Signal 0
Bit 4: F4 flicker frequency 5 Hz
Bit 5: F3 fast flashing light 2.5 Hz (1/2F4)
Bit 6: F2 flashing light 1.25 Hz (1/4F4)
Bit 7: F1 slow flashing light 0.63 Hz (1/8F4)

Conditions

- For the S5-95U, S5-100U (with CPU 103), S5-115U, S5-135U:
  The above frequencies result if called in OB 13, provided the cycle time is < 1 00 ms.
  For cycle times > 100 ms, FB 50 must be called from OB 13 only on each 2nd, 5th or 10th pass; the frequencies are then changed accordingly. FB 50 must not be called more than once in a single cycle.
- For the S5-155U:
  The above frequencies result if called in OB 13, provided the cycle time is < 100 ms.
  For cycle times > 100 ms, FB 50 must be called from OB 14, OB 15 or OB 16; the frequencies are then changed accordingly. FB 50 must not be called more than once in a single cycle.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
95U	23	3	0.4
100U with CPU 103	20	3	0.5
115U with			
CPU 941[1)]	44	3	0.8
CPU 942[1)]	20	3	0.8
CPU 943[1)]	20	3	0.7
CPU 944[1)]	20	3	<0.1
CPU 945	23	3	0.005
135U/155U with			
CPU 922	22	3	0.4
CPU 928	22	3	0.2
CPU 928B	22	3	0.05
CPU 948	19	3	0.01
155U with CPU 946/947	19	3	0.1

1) As of Order No.: 6ES5 94.-7UB.

Signalling functions (continued)

MLD:EZW
MLD:EZWK
First-up signal with single-frequency flashing light (word mode)

FB 51 for 95U to 155U

FB 57 for 95U to 155U

The MLD:EZW and MLD:EZWK function blocks indicate changes in signal status (either with a steady light or flashing light), depending on acknowledgement signals. The sensor signals are processed in word mode either on the open-circuit or closed-circuit principle.

The function block implements the indication of a first-up signal and the output of an audible signal, First-up signals. new-value signals and the audible signal are all acknowledged separately.

In the case of the MLD:EZW function block (FB 51), the signals are routed to outputs.
In the case of the MLD:EZWK function block (FB 57), the signals can be routed either to outputs or to bit memories.

Technical specifications

	Max. number of signal words	signals	Block length in words	Call length in words	Processing time in ms	Block-length in words	Call length in words	Processing time in ms
FB	**FB 51/FB 57**		**FB 51**			**FB 57**		
For S5-95U	16	256	368	18	4.4 to 137	378	19	4.4 to 137
100U with CPU 103	16	256	368	18	5.3 to 162	386	19	5.30 to 162
115U with CPU 941[1)]	16	256	368	18	6.8 to 212	386	19	6.8 to 212
CPU 942[1)]	16	256	368	18	6.8 to 212	386	19	6.8 to 212
CPU 943[1)]	16	256	368	18	6.5 to 207	386	19	6.5 to 207
CPU 944[1)]	16	256	368	18	0.30 to 1.8	386	19	0.3 to 11.8
CPU 945	16	256	326	18	0.40 to 0.925	339	19	0.04 to 0.9
135U/155U with CPU 922	16	256	368	18	4 to 60	392	19	4 to 60
CPU 928	16	256	368	18	4 to 55	392	19	4 to 55
CPU 928B	16	256	368	18	0.2 to 7.7	392	19	0.2 to 7.7
CPU 948	40	640	323	18	0.07 to 1.575	336	19	0.07 to 1.575
155U with CPU 946/947	40	640	323	18	0.2 to 10	336	19	0.2 to 10

1) As of Order No.: 6ES5 94.-7UB.

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Signalling functions (continued)

MLD:EDW
MLD:EDWK
First-up signal with double-frequency flashing light (word mode)

FB 52 for 95U to 155U

FB 58 for 95U to 155U

The MLD:EDW and MLD:EDWK function blocks indicate changes in signal status with a flashing light whose frequency depends on acknowledgement signals. The sensor signals are processed in word mode either on the open-circuit or closed-circuit principle.

The function block implements the indication of a first-up signal and the output of an audible signal. First-up signals, new-value signals and the audible signal are all acknowledged separately.

In the case of the MLD:EDW function block (FB 52), the signals are routed to outputs.
In the case of the MLD:EDWK function block (FB 58), the signals can be routed either to outputs or to flags.

Technical specifications

	Max. number of signal words	signals	Block length in words	Call length in words	Processing time in ms	Block length in words	Call length in words	Processing time in ms
FB	**FB 52/FB 58**		**FB 52**			**FB 58**		
For S5-95U	16	256	449	20	4.8 to 177	463	21	4.8 to 177
100U with CPU 103	16	256	454	20	8.1 to 223	469	21	8.1 to 223
115U with								
CPU 941[1)]	16	256	454	20	1.2 to 266	469	21	10.2 to 266
CPU 942[1)]	16	256	454	20	10.2 to 266	469	21	10.2 to 266
CPU 943[1)]	16	256	454	20	9.8 to 261	469	21	9.8 to 261
CPU 944[1)]	16	256	454	20	0.5 to 14.1	469	21	0.5 to 14.1
CPU 945	16	256	401	20	0.045 to 1.145	417	21	0.045 to 1.145
135U/155U					4 to 88			4 to 88
with CPU 922	16	256	457	20	4 to 63	477	21	4 to 63
CPU 928	16	256	457	20	0.2 to 9.4	477	21	0.2 to 9.4
CPU 928B	16	256	457	20	0.11 to 2.856	477	21	0.11 to 2.856
CPU 948	40	640	401	20		417	21	
155U with					0.2 to 15			0.2 to 15
CPU 946/947	40	640	401	20		417	21	

1) As of Order No.: 6ES5 94.-7UB.

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Signalling functions (continued)

MLD:EZ
MLD:EZK
First-up signal with single-frequency flashing light (bit mode)

FB 55 for 95U to 155U

FB 59 for 95U to 155U

The MLD:EZ and MLD:EZK function blocks indicate changes in signal status (either with a steady light or flashing light), depending on acknowledgement signals. The sensor signals are processed on the open-circuit or closed-circuit principle. Processing is carried out in bit mode.

The function block implements the indication of a first-up signal and the output of an audible signal. First-up signals, new-value signals and the audible signal are acknowledged separately.

In the case of the MLD:EZ function block (FB 55), the signals are routed to outputs.
In the case of the MLD:EZK function block (FB 59), the signals can be routed either to outputs or bit memories.

Technical specifications

Function block	Max. number of signal words **FB 55/ FB 59**	Block length in words **FB 55**	Call length in words	Processing time in ms	Block length in words **FB 59**	Call length in words	Processing time in ms
For S5-95U	30	301	21	3.9 to 100.0	314	22	3.9 to 100.0
100U with CPU 103	30	300	21	5.1 to 100.8	309	22	5.1 to 100.8
115U with							
CPU 941[1)]	30	300	21	5.8 to 120	309	22	5.8 to 120
CPU 942[1)]	30	300	21	5.8 to 120	309	22	5.8 to 120
CPU 943[1)]	30	300	21	5.7 to 115	309	22	5.7 to 115
CPU 944[1)]	30	300	21	0.2 to 7.5	309	22	0.2 to 7.5
CPU 945	30	282	21	0.035 to 0.955	296	22	0.035 to 0.955
135U/155U				6 to 175			6 to 158
with CPU 922	30	281	22	4 to 86	318	22	4 to 85
CPU 928	30	300	22	0.2 to 7	318	22	0.2 to 6.7
CPU 928B	30	300	22	0.09 to 2.585	318	22	0.08 to 2.38
CPU 948	64	282	21		293	22	
155U with				0.2 to 12			0.2 to 12
CPU 946/947	64	282	21		293	22	

1) As of Order No.: 6ES5 94.-7UB

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Signalling functions (continued)

MLD:ED
MLD:EDK
First-up signal with double-frequency flashing light (bit mode)

FB 56 for 95U to 155U

FB 60 for 95U to 155U

The MLD:ED and MLD:EDK function blocks indicate changes in signal status with a flashing light whose frequency depends on acknowledgement signals. The sensor signals are processed on the open-circuit or closed-circuit principle. Processing is carried out in bit mode.

The function block implements the indication of a first-up signal and the output of an audible signal. First-up signals, new-value signals and the audible signal are acknowledged separately.

In the case of the MLD:ED function block (FB 56), the signals are routed to outputs.

In the case of the MLD:EDK function block (FB 60), the signals can be routed either to outputs or bit memories.

Technical specifications

Function block	Max. number of signal words	Block length in words	Call length in words	Processing time in ms	Block length in words	Call length in words	Processing time in ms
	FB 56/ FB 60	**FB 56**			**FB 60**		
For S5-95U	30	334	23	4.3 to 102.0	347	24	4.3 to 102.0
100U with CPU 103	30	332	23	5.7 to 101.2	341	24	5.7 to 101.2
115U with CPU 941[1)]	30	332	23	6.9 to 122	341	24	6.9 to 122
CPU 942[1)]	30	332	23	6.9 to 122	341	24	6.9 to 122
CPU 943[1)]	30	332	23	6.5 to 116	341	24	6.5 to 116
CPU 944[1)]	30	332	23	0.3 to 8.3	341	24	0.3 to 8.3
CPU 945	30	312	23	0.04 to 1.06	326	24	0.04 to 1.06
135U/155U with CPU 922	30	311	22	6 to 175	349	24	6 to 175
CPU 928	30	311	22	4 to 86	349	24	4 to 86
CPU 928B	30	311	22	0.2 to 7	349	24	0.2 to 7.3
CPU 948	64	309	23	0.09 to 2.585	323	24	0.09 to 2.585
155U with CPU 946/947	64	309	23	0.2 to 16	323	24	0.2 to 16

1) As of in Order No.: 6ES5 94.-7UB

Signalling functions (continued)

MLD:SAMW
MLD:SAM
Group signal (word mode)
Group signal (bit mode)

FB 53 for 95U to 155U

FB 54 for 95U to 155U

The MLD:SAMW function block combines individual signals to form a group signal. The smallest group consists of one sensor word (16 signals or messages).

The "Group signal (word mode)" function block works together with the MLD:EZW (FB 51), MLD:EDW (FB 52), MLD:EZWK (FB 57) and MLD:EDWK (FB 58) function blocks. It uses the data block edited by the signalling function blocks.

The "Group signal (bit mode)" function block works together with the MLD:EZ (FB 55), MLD:ED (FB 56), MLD:EZK (FB 59) and MLD:EDK (FB 60) function blocks. It uses the data block edited by the signalling function blocks.

Each new signal is indicated by high-frequency flashing light and an audible signal. After acknowledgement of the signalling function blocks, the group signal and the audible singal can be acknowledged separately if the signal is still present, the flashing light changes to a steady light, otherwise it darkens.

Technical specifications

Function block	Max. number of signal words	Block length in words	Call length in words	Processing time in ms	Block length in words	Call length in words	Processing time in ms
	FB 53/ FB 54	**FB 53**			**FB 54**		
For S5-95U	16	114	12	2.2 to 22.0	107	11	2.0 to 15.0
100U with CPU 103	16	116	12	2.5 to 27.6	106	11	2.2 to 59.6
115U with							
CPU 941[1)]	16	116	12	2.9 to 31.2	106	11	2.9 to 31.2
CPU 942[1)]	16	116	12	2.9 to 31.2	106	11	2.9 to 31.2
CPU 943[1)]	16	116	12	2.8 to 30.5	106	11	2.8 to 30.5
CPU 944[1)]	16	116	12	0.1 to 1.9	106	11	0.1 to 1.90
CPU 945	16	109	12	0.02 to 0.19	103	11	0.015 to 0.465
							2 to 8
135U/155U with CPU 922	16	116	12	3 to 8	106	11	1 to16
CPU 928	16	116	12	1 to 8	106	11	0.1 to 3.6
CPU 928B	16	116	12	0.3 to 1.7	106	11	0.03 to 1.11
CPU 948	40	106	12	0.04 to 0.45	100	11	
155U with CPU 946/947	40	106	12	0.2 to 2	100	11	0.2 to 2

1) As of Order No.: 6ES5 94.-7UB

Ordering data

	Order No.
"Signalling functions" program package for S5-95U S5-100U with CPU 103, S5-115U with CPU 941-944, CPU 945 S5-135U/155U with CPU 922, 928, 928B, CPU 948, S5-155U with CPU 946/947, for S5-DOS/MT operating system on 3 $^1/_2$" diskettes (720 Kbyte) and on 5 $^1/_4$" diskettes (360 Kbyte)	
Single license	**6ES5 848-7EA01**
Copy license	**6ES5 848-7EA01-0KL1**

Data handling blocks

Application

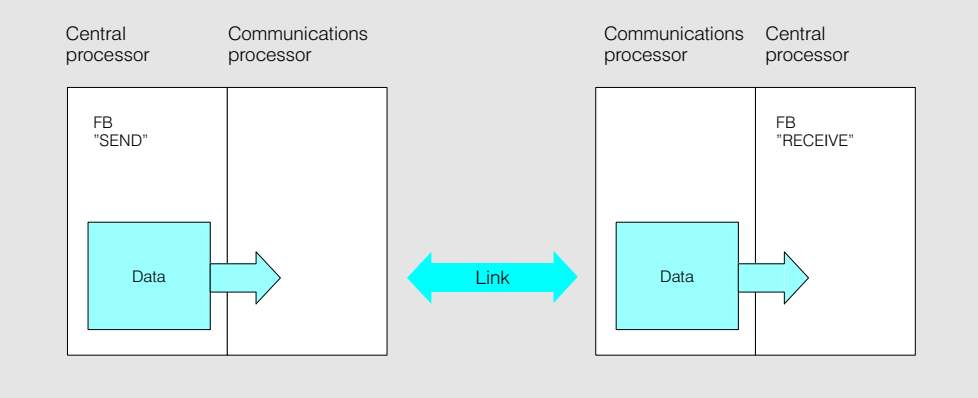

Fig. 7/88 Example of data transmission using data handling blocks

Data traffic between a central processor and

- Communications processors (CPs)
- Intelligent I/O modules IP 246, IP 247 and IP 252
- CP 516 submodule memory

is carried out with the aid of standard function blocks, called "data handling blocks". For example, see Fig. 7/76.

In the case of the S5-115U, the data handling blocks are fully integrated in the operating system.

The functions for the CPU 922, 928, 928B and CPU 948 of the S5-135U are stored in the operating system, the parameters, however, are passed via loadable standard function blocks.

The data handling blocks can handle the central processor data traffic with all communications processors interfaced to the programmable controller, e.g. with two CPs 525 or one CP 528. The structure of the data handling blocks depends on the type of the central processor used, but not on the communications processors.

Standard function blocks for "multiprocessor communication" are integrated in the operating systems of the CPU 922, 928, 928B and CPU 948 for data transfer between CPUs over the page frames of the C coordinator

Note:

The relevant standard function blocks are required for initialization and control of the intelligent I/Os. These standard function blocks call the data handling blocks as required.

SEND
Send

FB 244 for 115U*)

FB 120 for 135U

FB 120 for 155U

*) integrated in the operating system

The SEND standard function block controls data transmission from the central processor to an I/O module memory (dual-port RAM). The two possible operating modes are SEND-All and SEND-Direct.

SEND-Direct can be used, for example, to send a data area specified by the user program in the central processor to the module.

The SEND-All function, on the other hand, sends only data requested by the module, and determines which data are to be transmitted by the central processor.

Technical specifications

For S5-	Block length in words	Processing time
135U/-155U with		
CPU 922	36	See table on
CPU 928	36	page 7/105
CPU 928B	36	
CPU 948	36	

Data handling blocks (continued)

RECEIVE
Receive

FB 245 for 115U*)

FB 121 for 135U

FB 121 for 155U

*) integrated in the operating system

The RECEIVE standard function block transfers data from the I/O module memory (dual-port RAM) to the central processor.

Like the SEND function block, the RECEIVE function block has two operating modes: RECEIVE-Direct and RECEIVE-All.

Technical specifications

For S5-	Block length in words	Processing time
135U/-155U with		
CPU 922	36	See table
CPU 928	36	below
CPU 928B	36	
CPU 948	36	

Processing times for data transmission using the SEND and RECEIVE data handling blocks:

For S5-	Processing time in ms for transmission of			
	16 byte	128 byte	256 byte	512 byte
115U with CPU 941 to 944, CPU 945	1	7.5	15	30
135U/155U with				
CPU 921[1)]	60	65	70	93
CPU 922[1)]	6	7	8	10
M prozessor[2)3)]	6	7	8	10
CPU 928	6	7	7	9
CPU 928B	6	7	7	9
CPU 948	6	7	7	9

1) The S processor data handling blocks differ from the others because of queue processing (see ACTIVE and UP ACTIV function blocks). Four to five ACTIVE calls are necessary for data transfer, depending on the amount of data involved. When these calls are not implemented in one cycle, the user program cycle time must be taken into account when estimating the total data transfer time.

2) The specified times contain the processing times for the function blocks, including the data transfer time and a waiting period of 5 ms for the module response (a maximum of 2 waiting periods of up to 5 ms each may occur).

3) The times given are approximate values for one R processor transferring data with the data handling blocks. When four R processors are used in parallel, it can take up to 11 ms, for example, to transfer 256 bytes. In multiprocessor operation, the properties of the CPs/IPs must be taken into account.

Data handling blocks (continued)

FETCH

FB 246 for 115U*)
FB 122 for 135U
FB 122 for 155U

*) integrated in the operating system

The FETCH standard function block signals the module that it has to make certain specific data available in the memory (dual-port RAM).

The central processor then queries these data with the RECEIVE-All function.

Technical specifications

For S5-	Block length in words	Processing time
135U/155U with		
CPU 922	36	See table on
CPU 928	36	page 7/105
CPU 928B	36	
CPU 948	36	

CONTROL

FB 247 for 115U*)
FB 123 for 135U
FB 123 for 155U

*) integrated in the operating system

The CONTROL standard function block queries the module for status information at any point in the user program. The request might be for the number of the task which the module is currently processing,

or for the information whether a certain task is currently executing or whether that task is free of errors, or whether it has been finished due to a specific error.

Technical specifications

For S5-	Block length in words	Processing time
135U/155U with		
CPU 922	24	See table on
CPU 928	24	page 7/105
CPU 928B	24	
CPU 948	24	

RESET

FB 248 for 115U*)
FB 124 for 135U
FB 124 for 155U

*) integrated in the operating system

The RESET function block can be used to reset individual communications relationships to their initial status.

Technical specifications

For S5-	Block length in words	Processing time
135U/155U with		
CPU 921	76	See table on
CPU 922	21	page 7/105
CPU 928	21	
CPU 928B	21	
CPU 948	21	

Data handling blocks (continued)

SYNCHRON
Synchronize

FB 249 for 115U*)

FB 125 for 135U

FB 125 for 155U

*) integrated in the operating system

The SYNCHRON function block synchronizes the interface between the central processor and the modules (CP, IP, magnetic bubble memory) during system start-up.

The memory (dual-port RAM) is thereby cleared or preset.

Technical specifications

For S5-	Block length in words	Processing time
135U/155U with		
CPU 921	119	See table on
CPU 922	21	page 7/105
CPU 928	21	
CPU 928B	21	
CPU 948	21	

SEND-A
Send

FB 126 for 135U

FB 126 for 155U

The SEND-A is a special version of the SEND function block. The SEND-All function call is shorter, thus making parameter assignment more lucid.

Technical specifications

For S5-	Block length in words	Processing time
135U/155U with		
CPU 922	24	See table on
CPU 928	24	page 7/105
CPU 928B	24	
CPU 948	24	

REC-A
Receive

FB 127 for 135U

FB 127 for 155U

REC-A is a special version of the RECEIVE function block. The RECEIVE-All function call is shorter, thus making parameter assignment more lucid.

Technical specifications

For S5-	Block length in words	Processing time
135U/155U with		
CPU 922	24	see table on
CPU 928	24	page 7/105
CPU 928B	24	
CPU 948	24	

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Data handling blocks (continued)

Summary

The "Data handling blocks" program package contains the following function blocks:

For S5-	S5-115U[1] with CPU 941-944, CPU 945	S5-135U/155U with CPU 922 CPU 928 CPU 928B CPU 948
SEND	FB 244	FB 120
RECEIVE	FB 245	FB 121
FETCH	FB 246	FB 122
CONTROL	FB 247	FB 123
RESET	FB 248	FB 124
SYNCHRON	FB 249	FB 125
ACTIVE	–	–
UP ACTIV	–	–
SEND-A	–	FB 126
REC-A	–	FB 127

*) With the S5-115U the function blocks are contained in the operating system of the central controller module.

Ordering data	Order No.
"Data handling blocks" program package for S5-135U/155U with CPU 922, 928, 928B, 948	
Single license	**6ES5 842-7CB01**
Copy license	**6ES5 842-7CB01-0KL1**

7

Function blocks for IP 240

Application

For the operation of the intelligent I/O modules (see Sections 2 and 4), programs are required in the programmable controller to control the functions of the intelligent I/O modules, to acquire and process the data and to evaluate the signals and interrupts coming from the modules.

These programs are available in the form of standard function blocks, which are briefly described below. A complete description of the function blocks is contained in the programming instructions which are supplied together with the modules.

The following standard function blocks are available for the IP 240:

Positioning
- FB 167 "STRU.POS" for initialization
- FB 168 "STEU.POS" for control

Position decoding
- FB 169 "STRU.WEG" for initialization
- FB 170 "STEU.WEG" for control

Counting
- FB 171 "STRU.DOS" for initialization
- FB 172 "STEU.DOS" for control

Speed measurement
for forewarding to the IP 252 closed-loop control module
- FB 173 "STRU.252" for initialization (for S5-115U only)

STRU.POS
Initialization of function block for positioning mode

FB 167
for 115U, 135U, 155U

The configuring FB first checks the input parameters and the length of the data block to be used for data interchange with the IP 240. It then transfers the general module data (machine readable product designation of the module, FW and HW versions) from the IP to the data block, verifying its own compatibility with the firmware version as it does so. It then enters any errors detected during the start-up test in the data block. Finally, the configuring data (parameters for FB 167) and the following data areas are transferred from the DB to the IP:

- Zero offset
- Final value for the rotary axis
- Distance values for the switching and signalling ranges
- Position numbers and position values for positions 1 to 254.

The function block is normally called in restart organization blocks.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	1159	14	34 to 410
CPU 942[1)]	1159	14	34 to 410
CPU 943[1)]	1159	14	34 to 410
CPU 944[1)]	1159	14	14 to 170
CPU 945	1007	15	11.6 to 135
135U/155U with			
CPU 922	1152	15	23 to 320
CPU 928	1152	15	18 to 264
CPU 928B	1152	15	13 to 161
CPU 948	1059	16	11.6 to 135
155U with			
CPU 946/947	1059	16	10 to 130

1) As of Order No.: 6ES5 94.-7UB..

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Function blocks for IP 240 (continued)

STEU.POS
Control function block for positioning mode

FB 168
for 115U, 135U, 155U

The control function block first checks to make sure that the channel has been configured for "positioning" mode. Then, depending on the parameters with which the FR was initialized, specific data areas are forwarded from the data block to the IP or read out from the IP and updated in the data block.

The following functions are possible:

- Read actual value, final value and status bits
- Write control bits and position number
- Write position data for position 0
- Read interrupt request bytes
- Write new position values for positions 1 to 254
- Write new zero offset
- Write new distance values for positions 1 to 254

Parameter assignment errors and data errors are flagged in the PAFE byte and described in detail in words DW 8 to 10 and DW 13. When an error is detected, the selected function is not executed.

The control FB is normally invoked in the cyclic program. Before it is called, IP 240 must be initialized with the configuring function block FB 167 (STRU.POS, initalize positioning mode).

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	830	5	6.0 to 7.4
CPU 942[1)]	830	5	6.0 to 7.4
CPU 943[1)]	830	5	6.0 to 7.4
CPU 944[1)]	830	5	1.9 to 2.8
CPU 945	801	5	1.1 to 2.0
135U/155U with			
CPU 922	833	5	4.3 to 6.2
CPU 928	833	5	2.5 to 4
CPU 928B	833	5	2.1 to 3.0
CPU 948	795	5	0.8 to 2.4
155U with			
CPU 946/947	795	5	0.9 to 2.1

1) As of Order No.: 6ES5 94.-7UB..

STRU.WEG
Initialize position decoder

FB 169
for 115U, 135U, 155U

The "Initialize position decoder" function block supplies the IP 240 (position decoding mode) with the initial and final setpoint values of the tracks for both channels and the assignments of process interrupts and digital outputs to the tracks.

The data is forwarded in a data block. The user must initialize this DB before calling the function block.

The function block is normally called in restart organization blocks.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	1098	12	76
CPU 942[1)]	1098	12	76
CPU 943[1)]	1098	12	76
CPU 944[1)]	1098	12	20
CPU 945	971	13	14.8
135U/155U with			
CPU 922	1654	13	83
CPU 928	1654	13	56
CPU 928B	1654	13	20
CPU 948	993	14	19.2
155U with			
CPU 946/947	992	14	23

1) As of Order No.: 6ES5 94.-7UB..

Function blocks for IP 240 (continued)

STEU.WEG
Control position decoder

FB 170
for 115U, 135U, 155U

The following functions can be executed with the "Control position decoder" function block in "Position decoding" mode:

- Read actual values and status bits
- Read track identification bits
- Read, delete or modify start and end values of a track
- Write zero offset
- Read interrupt request bytes

The function block is normally called in the cyclic program. Before it is called, the IP 240 must be initialized with FB 169 (STRU.WEG, initialize position decoder).

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	975	5	6 to 54
CPU 942[1)]	975	5	6 to 54
CPU 943[1)]	975	5	6 to 54
CPU 944[1)]	975	5	2 to 17
CPU 945	918	5	0.8 to 17
135U/155U with			
CPU 922	1539	5	6.6 to 68
CPU 928	1539	5	3.5 to 45
CPU 928B	1539	5	1.7 to 4.0
CPU 948	980	5	0.8 to 15.9
155U with			
CPU 946/947	980	5	2.1 to 17

1) As of Order No.: 6ES5 94.-7UB..

STRU.DOS
Initialize counter

FB 171
for 115U, 135U, 155U

The "Initialize counter" function block transfers parameter data from the CPU to the IP 240. These data include the setpoint count and information on the use of digital output, process interrupt and gate control. The function block reports any parameter errors from the IP 240 to the CPU.

The function block is normally called in restart organization blocks.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	814	9	27
CPU 942[1)]	814	9	27
CPU 943[1)]	814	9	27
CPU 944[1)]	814	9	11.5
CPU 945	739	10	9.3
135U/155U with			
CPU 922	1248	10	25
CPU 928	1248	10	18
CPU 928B	1248	10	11
CPU 948	740	11	9.4
155U with			
CPU 946/947	740	11	11

1) As of Order No.: 6ES5 94.-7UB..

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Function blocks for IP 240 (continued)

STEU.DOS
Control counter

FB 172
for 115U, 135U, 155U

The "Control counter" function block can execute the following functions in "Counting" mode:

- Issue commands to the IP 240, such as start, stop, initialize
- Read actual values and status bits
- Process interrupts

The function block is normally called in the cyclic program.

Before it is called, the IP 240 must be initialized with FB 171 (STRU.DOC, initialize position decoder).

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	680	5	6 to 11
CPU 942[1)]	680	5	6 to 11
CPU 943[1)]	680	5	6 to 11
CPU 944[1)]	680	5	1.6 to 2.2
CPU 945	641	5	0.9 to 1.2
135U/155U with			
CPU 922	1110	5	6 to 10
CPU 928	1110	5	3.5 to 6.0
CPU 928B	1110	5	1.9 to 2.2
CPU 948	696	5	0.8 to 1.2
155U with			
CPU 946/947	696	5	1.6 to 2.2

1) As of Order No.: 6ES5 94.-7UB..

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STRU.252
Initialize speed measurement

FB 173
for 115U, 135U, 155U

The "Initialize speed measurement" function block reserves the IP 240 for "IP 252 expansion" mode only. This mode is possible only on the S5-115U.

The user must initialize a data block with the data to be forwarded before calling the function block.

The FB is normally called in organization block OB 20 on a cold restart and in organization block OB 22 on a warm restart.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	562	5	29
CPU 942[1)]	562	5	29
CPU 943[1)]	562	5	29
CPU 944[1)]	562	5	16
CPU 945	789	10	2.6

1) As of Order No.: 6ES5 94.-7UB..

Ordering data

	Order No.	Order No.
The standard function blocks for IP 240 are part of the:		
Configuring package for IP 240 consisting of: Manual and standard FBs for metering, position acquisition and positioning		
German	**6ES5 240-5AA11**	
English	**6ES5 240-5AA21**	
French	**6ES5 240-5AA31**	
Italian	**6ES5 240-5AA51**	

Function blocks for IP 242A

PER:ZSTK
Counter module controller (for page addressing)

FB 178
for 115U, 135U, 155U

The IP 242 A counter module normally uses page addressing. The FB 178 function block supports the following functions:

- Counter initialization
- Issue of commands to the counter module, e.g. start, stop, initialize
- Interrupt processing

The function block can be called both from a restart organization block (for cold restarts) and from a cyclic or interrupt-driven program. Different functions are enabled according to the calling point, e.g. initialization is enabled if it is called in the cold restart OB, interrupt acknowledgement is enabled if called in the interrupt OB and all other functions are enabled if called in the cyclic program.

Counter data (initialization values, counter settings, actual counter readings, etc.) are stored in a data block for processing by the CPU or for transfer to the counter module.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	1359	11	4.8 to 60.2
CPU 942[1)]	1359	11	4.8 to 60.2
CPU 943[1)]	1359	11	4.7 to 59.6
CPU 944[1)]	1359	11	0.8 to 10.7
135U/155U with			
CPU 922[2)]	1281	11	3.6 to 48
CPU 928[3)]	1281	11	2 to 26
CPU 928B	1281	11	1.6 to 19.9
CPU 948	1203	12	0.23 to 2.65
155U with			
CPU 946/947	1203	12	12 to 6.4

1) As of Order No.: 6ES5 94.-7UB..

PER:ZSTL
Counter module controller (for linear addressing)

FB 179
for 115U, 155U

The IP 242A counter module can be used for linear addressing in the S5-115U and S5-155U programmable controllers. This addressing technique uses a special address space in the PLC. As with page addressing, data exchange between the CPU and the IP 242 A can only take place via the function block. Interrupt handling functionality is restricted if the IP 242 A is used with linear addressing.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	1407	11	4.8 to 60.2
CPU 942[1)]	1407	11	4.8 to 60.2
CPU 943[1)]	1407	11	4.7 to 59.6
CPU 944[1)]	1407	11	0.8 to 10.7
155U with			
CPU 946/947	1225	12	1.2 to 6.4
CPU 948	1225	12	0.23 to 2.65

1) As of Order No.: 6ES5 94.-7UB..

Function blocks for IP 242A (continued)

PER:BS
Write to counter module (for page addressing)
PER:BL
Read from counter module (for page addressing)
PER:IN
Acknowledge counter module interrupt (for page addressing)

The IP 242 A counter module is capable of executing command lists as a result of interrupt events. This attribute helps to offload the CPU and enhances the response time of the total system. Certain function blocks have been developed to further accelerate data exchange between the CPU and the IP 242 A. These blocks are "read from module", "write to module" and "acknowledge interrupt".

The FBs are used in conjunction with FB 178.

Module to be used:
6ES5 242-1AA3.

FB 180
for 115U, 135U, 155U

Technical specifications PER:BS

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	466	5	3.9 to 14.3
CPU 942[1)]	466	5	3.9 to 14.3
CPU 943[1)]	466	5	3.7 to 13.8
CPU 944[1)]	466	5	0.7 to 1.7
135U/155U with			
CPU 922	364	5	3.6 to 10.1
CPU 928	364	5	2.1 to 5.4
CPU 928B	364	5	1.5 to 4.8
CPU 948	338	5	0.175 to 0.675
155U with			
CPU 946/947	338	5	0.7 to 1.4

1) As of Order No.: 6ES5 94.-7UB..

FB 181
for 115U, 135U, 155U

Technical specifications PER:BL

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	247	5	2.5 to 4
CPU 942[1)]	247	5	2.5 to 4
CPU 943[1)]	247	5	2.3 to 3.9
CPU 944[1)]	247	5	0.4 to 0.7
135U/155U with			
CPU 922	224	5	2.8 to 4.2
CPU 928	224	5	1.4 to 2.3
CPU 928B	224	5	1.0 to 1.4
CPU 948	194	5	0.115 to 0.175
155U with			
CPU 946/947	194	5	0.6 to 0.7

1) As of Order No.: 6ES5 94.-7UB..

FB 182
for 115U, 135U, 155U

Technical specifications PER:IN

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	203	6	3.3
CPU 942[1)]	203	6	3.3
CPU 943[1)]	203	6	3.1
CPU 944[1)]	203	6	0.6
135U/155U with			
CPU 922	154	6	2.7
CPU 928	154	6	1.3
CPU 928B	154	6	1.1
CPU 948	160	7	0.13
155U with			
CPU 946/947	160	7	0.7

1) As of Order No.: 6ES5 94.-7UB..

Function blocks for IP 242B

ZYK:242B
Counter module controller

FB 183
for 115U, 135U, 155U

The following functions can be executed with the "Counter module controller" function block:

- Counter initialization
- Loading, starting and reading of counter

To initialize the counter module, the function block FB 183 is normally called in the restart organization blocks OB 20, 21 and 22.

Control of the counter module (i.e. starting of counter or reading of actual values) is then carried out in the cyclic program (organization block OB 1).

Counter data (initialization values, counter settings, actual counter readings, etc.) are stored in a data block for processing by the CPU or for transfer to the counter module.

The IP 242 B counter module is capable of executing command lists as a result of interrupt events. This attribute helps to offload the CPU and enhances the response time of the total system.

In contrast to the IP 242 A, the IP 242 B also offers arithmetic functions in connection with load, transfer and comparison operations.

Certain control words tailored to the module functions have been developed to further accelerate data exchange between the CPU and the IP 242 B, besides the use of the command list.

Amongst others, these are the following:

- Process command list
- Write constant register
- Prepare loading
- Read sequence of measured values

The commands are used in conjunction with FB 183.

The module is capable of storing the calculation results (or the counter contents) in measured value sequences on the IP 242 B with a total of 100 x 2 DW.

A second data block is required to read these measured value sequences.

Module to be used:
6ES5 242-1AA4.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	1111	10	9.9 to 41
CPU 942[1)]	1111	10	9.9 to 41
CPU 943[1)]	1111	10	8.5 to 37.78
CPU 944[1)]	1111	10	1.6 to 7.1
CPU 945	1002	10	0.42 to 3.36
135U/155U with			
CPU 922[2)]	1293	10	1.0 to 46.4
CPU 928[3)]	1293	10	4.6 to 25
CPU 928B	1293	10	3.6 to 20.1
CPU 948	1246	10	0.74 to 3.69
155U with			
CPU 946/947	1246	10	1.7 to 6.7

1) As of Order No.: 6ES5 94.-7UB..

Function blocks for IP 242B (continued)

INT:242B
Process interrupt

FB 184
for 115U, 135U, 155U

The FB 184 function block is used to process interrupts and process alarms.

The great advantage is that the access times for the special functions "Write register", "Read register" and "Acknowledge interrupt" are optimized.

To evaluate the process alarms or interrupts, the FB 184 is called in an organization block of the interrupt-driven program (OB 2 to OB 9, depending on the programmable controller).

The FB 184 may only be used in conjunction with FB 183.

The interrupt source can be acquired from parameter IIR.

Further functions are:

- Transfer new parameter assignment data to the module (write data). The counter registers and the global registers can thus be transferred from the data block to the module.
- Read data from the counter module. All counter content registers, the counter status registers and all result registers are read by the module.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	375	10	3.5 to 12.2
CPU 942[1)]	375	10	3.5 to 12.2
CPU 943[1)]	375	10	2.4 to 11.3
CPU 944[1)]	375	10	< 0.5 to 2.5
CPU 945	311	10	0.04 to 2.07
135U/155U with			
CPU 922	394	10	1.8 to 17
CPU 928	394	10	0.9 to 4.7
CPU 928B	394	10	< 0.5 to 3.4
CPU 948	370	11	0.05 to 2.00
155U with			
CPU 946/947	370	11	< 0.5 to 2.3

1) As of Order No.: 6ES5 94.-7UB..

INT:242B
Read counter module

FB 185
für 115U, 135U, 155U

Standard function block FB 185 (ZA:242B) quickly reads the counter module IP 242B (page addressing).

The function block FB 185 matches the functions of FB 183 when called with BEF = ZA in a cyclic, time-controlled program

You can additionally invoke the FB 185, which has shorter running times.

This function block can

- read the counter state register
- read the counter value register
- read the results register

Technical specifications

for S5-	Block length, in words	Call length in words	Processing time in ms
115U with			
CPU 941[1)]	346	5	2.0 to 5.9
CPU 942[1)]	346	5	2.0 to 5.2
CPU 943[1)]	346	5	1.8 to 6.7
CPU 944[1)]	346	5	0.4 to 1.3
CPU 945	303	5	0.03 to 0.6
135U/155U with			
CPU 922	352	5	1.8 to 6.2
CPU 928	352	5	
CPU 928B	352	5	< 0.5 to 2.9
CPU 948	367	6	0.05 to 0.25
155U with			
CPU 946/947	367	6	< 0.4 to 1,2

1) As of Order No.: 6ES5 94.-7UB..

Function blocks for IP 242B (continued)

Ordering data	Order No.	Order No.
The standard function blocks for IP 242A and IP 242B are part of the:		
Configuration package for IP 242A/B		
consisting of		
Manual and standard FBs		
German	**6ES5 242-5AB11**	
English	**6ES5 242-5AB21**	
French	**6ES5 242-5AB31**	
Italian	**6ES5 242-5AB51**	

Function blocks for IP 243-3

PER:ANL
Read analog module

FB 160
für 115U, 135U, 155U

The function block "read analog module" accepts the selected analog value (if the analog module IP 243 is present) and passes on the value either as a bit pattern as it is received from the module or as a 16-bit fixed-point number scaled to the appropriate nominal values.

Moreover, the function block can be used to read the digital inputs and comparator outputs.

Technical specifications

for S5-	Block length, words	Call length, words	Execution time in ms
115U with			
CPU 941[1)]	165	13	4.4 to 5.9
CPU 942[1)]	165	13	4.9 to 5.9
CPU 943[1)]	165	13	4.1 to 5.5
CPU 944[1)]	165	13	0.3 to 1.7
CPU 945	222	14	0.175 to 0.185
135U/155U with			
CPU 922	180	14	1.8 to 2.1
CPU 928	180	14	1.1 to 1.2
CPU 928B	180	14	1.0 to 1.1
CPU 948	222	14	0.48 to 0.49
155U with			
CPU 946/947	222	14	0.69 to 0.74

1) As of Order No.: 6ES5 94.-7UB..

PER:ANS
Write analog module

FB 161
für 115U, 135U, 155U

The function block "write analog module" transfers the either specified bit pattern or a 16-bit fixed-point number scaled to the nominal value to the IP 243-3 analog module.

The function block can be used to control digital outputs (the module must be equipped with a memory for digital output).

Technical specifications

for S5-	Block length, words	Call length, words	Execution time in ms
115U with			
CPU 941[1)]	158	8	3.2 to 3.5
CPU 942[1)]	158	8	3.2 to 3.5
CPU 943[1)]	158	8	2.6 to 2.8
CPU 944[1)]	158	8	0.1 to 1.66
CPU 945	202	9	0.05 to 0.06
135U/155U with			
CPU 922	170	9	1.4 to 1.7
CPU 928	170	9	0.7 to 1
CPU 928B	170	9	0.2 to 0.3
CPU 948	195	9	0.06 to 0.07
155U with			
CPU 946/947	195	9	0.6 to 0.64

1) As of Order No.: 6ES5 94.-7UB..

Function blocks for IP 243-3 (continued)

Ordering data	Order No.		Order No.
The Standard function blocks for IP 243-3 for: S5-115 with CPU 941-944, CPU 945, S5-135U/155U with CPU 922, 928, 928B, 948, S5-155U with CPU 946/947 for operating system MS-DOS, S5-DOS/MT on $3^1/_2$" diskettes or $5^1/_4$" diskettes incl. example program German, English, French	**6ES5 848-7MA01**		

Function blocks for IP 244

PER:TREG
Control temperature controller

FB 162
for 115U, 135U, 155U

The "Control temperature controller" function block transfers the control parameters and setpoint values to the module and reads error messages, actual values and manipulated variables, extreme values or the self-optimizing parameters. The data is stored in three data blocks.

The function block can assign parameters to the entire module or one controller.

The diskette also contains a test program to facilitate installation, with comments in the appropriate language.

Module to be used:
6ES5 244-3AA22 and
6ES5 244-3AB31

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1]	1746	15	6.9 to 74.4
CPU 942[1]	1746	15	6.9 to 74.4
CPU 943[1]	1746	15	6.5 to 72.8
CPU 944[1]	1746	15	0.8 to 5.9
CPU 945	1788	15	0.185 to 3.72
135U/155U with			
CPU 922[2]	1504	15	5.7 to 8.8
CPU 928[3]	1504	15	4.4 to 6.2
CPU 928B	1504	15	1.6 to 12.6
CPU 948	1637	15	0.36 to 3.39
155U with			
CPU 946/947	1637	15	0.8 to 1.7

1) As of Order No.: 6ES5 94.-7UB..
2) As of Order No.: 6ES5 922-3UA11
3) As of Order No.: 6ES5 928-3UA12

Ordering data

	Order No.
The standard function blocks for IP 244 are part of the:	
Configuring package for IP 244 consisting of:	
Manual and standard FBs	
German	**6ES5 244-5AA11**
English	**6ES5 244-5AA21**
French	**6ES5 244-5AA31**
Italian	**6ES5 244-5AA51**

7

Function blocks for IP 246 and 247

Application

The "Control and monitor positioning module" and" Initialize positioning module" function blocks are compatible with both the IP 246 and the IP 247.

PER:POS
Control and monitor positioning module

FB 164 for 115U, 135U, 155U

The "Control and monitor positioning module" function block performs the following functions:

- Starts a job (modes BA 1 ... BA 19) on the IP 246 or IP 247 (modes BA 1 ... BA 17) from an application program. Cyclically reads an actual position value, following error or residual path from the IP 246 or IP 247. These values are output in binary or BCD code, according to the setting of the BCD parameter
- Continually reads the mode setting, current M function, feedback signals and module error from the initialized interface. These are provided as output parameters from the function block or in the axis-specific data block

FB 164 works in conjunction with DB 164. The data block must first be initialized by the user, up to and including data word DW 15. There are no special provisions to be made for the data words.

DB 164 is divided into two areas. Data words DW 1 to DW 7 are set aside for indirect initialization of the function block. Data words DW 8 to DW 15 comprise the fixed working area of FB 164. Work areas may not be changed.

Job-specific parameters are additionally required for some modes of operation. Before a mode is enabled, these must be stored in the appropriate data block as byte, word and double word parameters. The free area of DB 164 can be used for this purpose.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1]	1012	20	5.6 to 11.8
CPU 942[1]	1012	20	5.6 to 11.8
CPU 943[1]	1012	20	4.3 to 10.4
CPU 944[1]	1012	20	0.6 to 5.3
CPU 945	627	19	0.1 to 0.8
135U/155U with			
CPU 922[2]	618	19	3.0 to 11.8
CPU 928[3]	618	19	0.5 to 6.0
CPU 928B	618	19	1.2 to 3.9
CPU 948	682	19	0.6 to 1.2
155U with			
CPU 946/947	682	19	1.0 to 4.4

1) As of Order No.: 6ES5 94.-7UB..
2) As of Order No.: 6ES5 922-3UA11
3) As of Order No.: 6ES5 928-3UA12

PER:PDAT
Positioning module

FB 165 for 115U, 135U, 155U

The "Initialize positioning module" function block handles the transfer of data between the application program and the IP 246 or IP 247. Each valid job number leads to data transfer between the module and the PLC.

Data transfer PLC → IP 246/IP 247

Data awaiting transfer are stored in a data block (source DB) which you must first create. The data block is configured directly using the FB 165 block parameters or indirectly in the axis-specific data block.

Data transfer from IP 246/IP 247 → PLC

Data to be read from the IP 246 or IP 247 are stored in a data block (target DR) in the controllers memory (target DB). The user can configure this data block directly using the FB 165 block parameters or indirectly in the axis-specific data block.

Function blocks for IP 246 and 247 (continued)

Positioning module PER:PDAT FB 165 (continued)

With the aid of FB 165 and the PLC interface, the user can

- Read, delete and transfer machine data and traversing programs on the IP 246 or IP 247
- Read the SYS-ID from the IP 246 or IP 247 and transfer it to the IP 246 or IP 247
- Request an overview of machine data or traversing programs on the IP 246 or IP 247 and simultaneously read actual values (actual position value, residual path)

FB 165 works in conjunction with the DB 165 data block. It requires data words DW 3 to DW 47, inclusive, for its working area.

The user can specify an axis-specific data block through the DBNR parameter. This data block requires a "job block" of 15 data words in length for every axis.

Technical specifications

For S5-	Block length in words	Call length in words	Processing time in ms
115U with			
CPU 941[1]	706	13	5.4 to 11.8
CPU 942[1]	706	13	5.4 to 11.8
CPU 943[1]	706	13	5.1 to 9.3
CPU 944[1]	706	13	3.2 to 8.3
CPU 945	640		
135U/155U with			
CPU 922[2]	573	13	3.0 to 13
CPU 928[3]	573	13	1.0 to 6.6
CPU 928B	573	13	1.2 to 4.0
CPU 948	569		
155U with		13	1.8 to 6.1
CPU 946/947	569		

1) As of Order No.: 6ES5 94.-7UB..
2) As of Order No.: 6ES5 922-3UA11
3) As of Order No.: 6ES5 928-3UA12

The FB 164 and FR 165 function blocks can be initialized directly or indirectly. In the case of direct initialization, the job-specific data and parameters are provided as input parameters to the FB. With indirect initialization, the axis-specific data block is configured from the data block which was valid before the call. The function block supplies the remainder of the parameters from the axis-specific DB.

The "SEND", "RECEIVE", "FETCH" and "SYNCHRON" data handling blocks are required for communication between the positioning module and the CPU (see page 7/97) and are called by FB 164 or FB 165.

The "SYNCHRON" block must be called once (by the user) in the restart organization blocks.

The COM 246 or COM 247 system program (see page 7/21) for the appropriate programming device is required for comfortable installation and programming of the positioning module.

Ordering data

	Order No.		Order No.
The standard function blocks for IP 246/247 are part of the:		The standard function blocks for IP 246/247 are also part of the:	
Configuring package for IP 246I/A consisting of: Manual, standard FBs and parameter asgmt software COM 246		**Configuring package for IP 247** consisting of: Manual, standard FBs and parameter assignment software COM 247	
German	**6ES5 246-5AA11**	German	**6ES5 247-5AA11**
English	**6ES5 246-5AA21**	English	**6ES5 247-5AA21**
French	**6ES5 246-5AA31**	French	**6ES5 247-5AA31**

7

Function blocks for CP 516 memory submodule

Application

FB 199
for 115U, 135U, 155U

Data transfer between the CPU and the CP 516 is carried out with the function block FB 199. The handling blocks (see page 7/104) must also be provided in the CPU. DB 255 is permanently assigned as work area to FB 199.

Functions

- Transfer of a data block from the CPU to the CP 516 or vice versa
- Deletion of a sector or a data block within a sector on the CP 516[1)]
- Transfer of the list of data blocks of a sector to a data block[1)]
- Transfer of the memory card data (type, capacity) to the CPU[1)]
- Transfer contents of card A to card B or vice versa
- Formatting of a memory card

Technical specifications

For S5-	Name	Block length in words	Call length in words	Transfer time CP/CPU or CPU/CP in s
115U with				
CPU 941	EXT-115U	959	20	Approx. 1s
CPU 942	EXT-115U	959	20	for 1 kbyte at
CPU 943	EXT-115U	959	20	100 ms scan
CPU 944	EXT-115U	959	20	time
CPU 945	EXT-945U	988	20	
135U/155U with				
CPU 922	EXT-135R	1168	20	
CPU 928	EXT-135R	1168	20	
CPU 928B	EXT-135R	1168	20	
CPU 948	EXT-155U	1168	20	
155U with				
CPU 946/947	EXT-155U	1168	20	

Ordering data

	Order No.
Standard function blocks for the CP 516 memory submodule for S5-115U with CPU 941-944, 945, S5-135U/155U with CPU 922, 928, 928B, 948, S5-155U with CPU 946/947, with CP 516 manual, for MS-DOS, S5-DOS/MT operating system on 3 1/2" diskettes (720 Kbyte), on 5 1/4" diskettes (360 Kbyte),	
Single license	**6ES5 848-6GC■1**
Copy license	**6ES5 848-6GC■1-0KL1**
with manual in	
German	**1**
English	**2**
French	**3**

1) Not for S5-115U

Failsafe standard FBs

Application

S5-95F

Only the following function blocks can be used in the S5-95F:

- Prototype-tested standard function blocks
- User-created function blocks tested at the system acceptance test

Prototype-tested standard function blocks have been tested by various test institutes and, like the S5-95F, possess a certificate. They enable implementation of frequently required functions without extra overhead.

Non-prototype-tested standard function blocks are rejected by the S5-95F.

S5-115F

Only standard function blocks tested and approved by the German Technical Inspectorate (TÜV) can be used for the S5-115F programmable controller. A check is made at system start-up to ensure that only such standard FBs are used.

The software package with the standard FBs for the S5-115F contains blocks for the following tasks:

- Calculations with 32 bit fixed-point numbers
- Processing of messages
- Control of sequencers
- Safe point-to-point link between two S5-115Fs

Each standard FB for the S5-115F has been prototype-tested by the Bavarian Technical Inspectorate (TÜV). The result of this test is recorded in a certificate supplied together with the software.

The test divides the blocks into the following groups:

- Standard function blocks that can perform safety-related tasks (failsafe standard FBs)
- Standard FBs that cannot influence other blocks of the control program (reaction-free standard FBs)

At the individual acceptance test of your control program, the safety test of the standard FBs is restricted to the following:

- Library number check
- Usage to the intended purpose check
- Block parameter assignment check

Standard function block package "Fuel engineering"

for 95F, 115F

The standard function block "Fuel engineering" contains typical functions for fuel engineering.

The function blocks can be called as often as desired allowing several burners to be operated with one S5-95F or S5-115F.

The blocks are designed for continuous and intermittent operation. They have been TÜV prototype-tested.

Design

Function block	Explanations	Function block	Explanations
Initialization FB 10	• Call in OB 21/22 • Reset data in DB	Solenoid valve oil FB 15	• Control of the oil solenoid valves
Fuel preselection FB 11	• Switching of operating mode oil/gas • Generation of control enable • Indication of operating mode via LEDs	Solenoid valve gas FB16	• Control of the gas solenoid valves • Seal check • Indication of operating states
Safety sequence FB 12	• Scanning of safety sequence • Output of fault signals as first-up signal • Interface to text display	Networked controllers FB 17	• External controller check • Ignition position networked controller ON depending on fuel, closed-loop control enable, open-loop control enable, limit switch • Control of the actuating motor in the OPEN/CLOSED position
Pre-ventilation FB 13	• Start of pre-ventilation time • Valve control and monitor • Display of operating mode	First-up signal FB 18	• Output of the first fault signal of 16 possible signals • Acknowledgment of fault signals one after the other • Lamp test
Ignition FB 14	• Control of ignition valve depending on fuel, networked controllers, pre-ventilation • Manual/automatic ignition • Indication of operating mode		

7

Failsafe standard FBs (continued)

Standard function block package "Emergency off"

for 95F

Emergency off circuits of category 0 to 2 in accordance with DIN EN 60204 Part 1 can be safely controlled with the standard function block package "Emergency off". The blocks have been prototype-tested by the German Trade Association Institute for Safety at Work.

Handling emergency off with on-board I/O

Up to 16 emergency off sequences and 8 shutdown devices can be implemented.

Handling emergency off with external I/O

Up to 56 emergency off sequences and 28 shutdown devices can be implemented.

Design

Function block	Explanations	Function block	Explanations
• Startup initiation FB 21 FB 22 • Start block for OB 1 FB 40	Initialization of the data used at start-up • Management of a shutdown device • Monitoring of the start condition for the sequence • Restart disable after initiation • Actuator readback • Acknowledgment of an initiation • Can be called eight times	• Start block for OB 3 FB 41	• Simultaneous management of 16 emergency off sequences and 8 shutdown devices • Fast shutdown after initiation • Programmable assignment of different sequences to one shutdown device
• Start-up initiation FB 21 FB 22 • Start block for OB 1 (1 FB per DI and DQ module) FB 42, FB 44, FB 46, FB 48, FB 50, FB 52 FB 54, FB 56	Initialization of data used at start-up • Management of a shutdown device • Monitoring of the start condition for the sequence • Restart disable after initiation • Actuator readback • Acknowledgment of an initiation • Can be called four times	• Start block for OB 3 (1 FB per DI and DQ module) FB 43, FB 45, FB 47, FB 49, FB 51, FB 53, FB 55, FB 57	• Simultaneous management of 8 emergency off sequences and 4 shutdown devices • Fast shutdown after initiation • Programmable assignment of different sequences to one shutdown device

Standard function block package "Extended functions"

for 95F

The standard function block package "Extended functions" contains function blocks for processing special functions.

The diskette contains one file with functions for the S5-95F and one file with functions for the S5-115F. The following functions can be used for the S5-95F:

- Arithmetic functions
- Signalling functions
- Sequencer

Design

Function block	Explanations	Function block	Explanations
Arithmetic function • Addition FB 101 • Subtraction FB 102 • Multiplication FB 103 • Division FB 104	Addition of two fixed-point binary numbers (31 bit + sign) Subtraction of two fixed-point binary numbers (31 bit + sign) Multiplication of two fixed-point binary numbers (31 bit + sign) Division of two fixed-point binary numbers (31 bit + sign)	• First-up signal FB 152 • New value signal FB 153	The signals are differentiated between first-up signal and new value. The first signal is output. Every signal change is output as a new value.
Signalling functions • Clock generator FB 150 • Clock generator FB 151	OB 13 call for 8 edge-synchronous blink frequencies. The OB 13 call interval determines the blink frequency. Called in the cyclical program section. The blink frequencies are generated via a timer.	Sequencer FB 170	Sequential control • Linear processing • Branched processing • Alternative branchings The FB 170 function block operates in conjunction with up to 255 sequence blocks (SB 1 to SB 255) and one working data block (DB). One single step of a sequential control is programmed in a step block. The function block requires the working data block for storing the current statuses of the sequencer such as "operating mode" and "current step".

Failsafe standard FBs (continued)

Standard function block package "Extended functions" (continued)

The following functions can be used for the S5-115F:

- Arithmetic functions
- Signalling functions
- Sequencer

for 115F

Design

Function block	Explanations
Arithmetic functions[1])	
• ADD:32 32 bit binary adder FB 1	FB 1 (block name ADD:32) adds two fixed-point binary numbers (31 bit + sign). The result is a fixed-point binary number (31 bit + sign) and lies within the interval -2^{30} ... $+2^{30}$. The function block sets the following identifier for further processing: • Overflow of the number range • Result of the addition is zero
• SUB:32 32 bit binary subtractor FB 2	FB 2 (block name SUB:32) subtracts two fixed-point binary numbers (31 bit + sign). The result is also a fixed-point binary number (31 bit + sign) and lies within the interval -2^{30} to 2^{30}. The function block sets the following identifier for further processing: • Overflow of the number range • Result of the subtraction is zero
• MUL:32 32 bit binary multiplier FB 3	FB 3 (block name MUL:32) multiplies two fixed-point binary numbers (31 bit + sign). The result is a fixed-point binary number (63 bit + sign) and lies within the interval -2^{62} to $+2^{62}$. The function block sets the following identifier for further processing: • Overflow of the number range • Result of the multiplication is zero
• DIV:32 32 bit binary divider FB 4	FB 4 (block name DIV:32) divides two fixed-point binary numbers (31 bit + sign). The result is also a fixed-point binary number. (31 bit + sign) with remainder (31 bit + sign). The function block sets the following identifier for further processing: • Overflow • Error from division by zero • Quotient equals zero • Remainder equals zero
Signalling functions	Continuous monitoring of the process is frequently required for rationalized and safe control in process engineering and power engineering. All significant checkback signals, indicator signals and fault signals must be captured and indicated via LEDs or audible signals. The following blocks are available for this purpose:
• TAKT1 Clock generator via OB 13 call FB 50	FB 50 (block name TAKT1) generates eight edge-synchronous blink frequencies. The block is called in OB 13. The blink frequencies are defined by the OB 13 call interval.
• TAKT2 Clock generator via timer FB 51	FB 51 generates eight edge-synchronous blink frequencies. The block is called in the cyclic program section. The blink frequencies are generated via timer T in the cyclic control program. The basic frequency f1 is defined via the programmable time value.
• MLD:ERST First-up signal FB 52	FB 52 monitors an encoder word (16 signals) • for signal level "0" (quiescent current monitor) or • for signal level "1" (load current monitor). The signals are differentiated according to first-up signal and new value. Indications depends on the acknowledgment signals. The monitor responds with a signal if • one bit of the encoder word and • the bit of the specification parameter have the same signal state. The modified signal states of the encoder word are indicated. First-up indicator The first indication of a signal change is output as the first-up signal. The first-up signal is indicated by setting output bits.

1) As of Order No.: 6ES5 942-7UF12

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Failsafe standard FBs (continued)

Standard function block package "Extended functions" (continued)

for 115F

Design

Function block	Explanations
Signalling functions (continued)	
• MLD:NEUW First-up signal FB 53	FB 53 (block name MLD:NEUW) monitors an encoder word (16 signals) • for signal level "0" (quiescent current monitor) or • for signal level "1" (load current monitor). The monitor responds with a signal if • one bit of the encoder word and • the bit of the specification parameter have the same signal state. Modified signal states of the encoder word EINW are indicated with • Flashing light • Steady light • Horn Indication depends on acknowledgment signals. New value indication The first indication of a signal change is output as the first-up signal. The first-up signal is indicated by setting output bits.
Step sequence control[1)]	Many technical process sequences can be subdivided into individual steps that must be processed chronologically one after the other. Control tasks of this type can be implemented very easily and clearly using step sequence controls. The essential advantages of step sequence controls are: • Easy and time-saving programming • Control program easy to modify • Fast location of errors The smallest unit of a step sequence control is the sequence step or step. Each step is programmed in its own step block. Each step block consists of a statement section and a scan section. • In the statement section, you define actions to be executed in the step (for example, switching of actuators, starting of timers, etc.) • In the scan section, you program the step enabling condition for the next step (for example, by scanning limit switches or waiting times). Several steps executed one after the other constitute a step sequence. As well as linear (unbranched) step sequences, in which the order of the steps is constant, you can also program branched step sequences. Branched step sequences are divided into several parallel program paths. The paths to be followed depend on the status of the step enabling condition. In addition, there are various operating modes available for controlling the step sequence, for example, automatic mode, single-step mode, sequence STOP etc. as well as a fault monitor. Management of the step sequence with its various operating modes and management of the fault monitor independent of the process and can thus be organized by FB 70. Only the step blocks of the step sequence are process-dependent and must be programmed by you. Use of GRAPH 5 software is not possible. The step blocks must be programmed in STEP 5.
• ABL:MAST Step sequence control FB 7	Function block FB 70 ABL:MAST manages step sequence controls for machines or processes. Function block FB 70 operates in conjunction with up to 255 step blocks (SB 1 ... SB 255) and one working data block (DB). In the step blocks, you program the individual steps of the step sequence control. FB 70 requires the working data block for storing the current states of the step sequence, such as operating mode and current step.

1) As of Order No.: 6ES5 942-7UF12

Failsafe standard FBs (continued)

Standard function block package "Extended functions" (continued)

Design

Function block	Explanations
Safety-related point-to-point connection between two S5-115Fs via CP 523[2)]	The point-to-point connection permits safety-related data exchange between two S5-115Fs via CP 523. Up to 124 net data words can be exchanged. One CP 523 is required in each programmable controller. Both CP 523s are linked via a connecting cable up to 10 m in length. The failsafe point-to-point connection has been prototype tested by the Bavarian Technical Inspectorate TÜV and is approved for plants with processes of • Requirement class 6 in accordance with DIN V 19250 • TÜV safety class 2. Both unidirectional and bi-directional data exchange are possible via point-to-point connection. Data blocks function as send and receive mailboxes for the safety-related data. Organization of data exchange is handled by three standard function blocks.
• ANLA-523 Start-up data to CP 523 FB 100	FB 100 is called in the startup OB. It transfers to the CP 523 all the data required to parameterize the CP 523 for safety-related data exchange.
Safety-related point-to-point connection between two S5-115Fs via CP 523[2)]	
• SEND-523 Send data to CP 523 FB 101	FB 101 is processed in the cyclic program (OB 1). It organizes sending of frame data to the connected CP 523. FB 101 starts data transfer by reading the net data from the send data block and calculating data for frame security. Send and security data are then transferred to the CP 523 in several data records. In the case of error-free transfer, the frame data are transferred automatically by the connected CP 523 to the second CP 523. If FB 101 detects a parameter assignment error or a send error, it signals this error in the "PAFE" byte. You must evaluate the "PAFE" byte and branch to an error routine in the event of a send error.
• EMPF-523 Receive CP 523 data FB 102	Function block FB 102 is processed in the cyclic program (OB 1). It handles receiving of the frame data from the connected CP 523. FB 102 reads the frame data in several data records from the CP 523 and checks the received frame for errors using the security information. Only when the frame has been received without errors does FB 102 transfer the net data to the receive data block. If FB 102 detects an error when checking the security information or if the programmed monitoring time runs out, FB 102 deletes the contents of the receive data block.

2) As of Order No.: 6ES5 942-7UF13

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Failsafe standard FBs (continued)

Ordering data	Order No.		Order No.
Standard function block package "Fuel engineering" for S5-95F, S5-115F, incl. German manual, on $3^1/_2$" and $5^1/_4$" diskettes, Single license Copy license	**6ES5 840-8NR11** **6ES5 840-8NR11-0KL1**	**Standard function block package "Extended functions"** for S5-95F, S5-115F, consisting of: Arithmetic functions, signalling functions, step sequence control and safety-related point-to-point connection, incl. German manual, on $3^1/_2$" and $5^1/_4$" diskettes, Single license Copy license	**6ES5 845-8DH12** **6ES5 845-8DH12-0KL1**
Standard function block package "Emergency off" for S5-95F, incl. German manual, on $3^1/_2$" and $5^1/_4$" diskettes, Single license Copy license	**6ES5 840-8NQ12** **6ES5 840-8NQ12-0KL1**		

7

Special driver software

Application

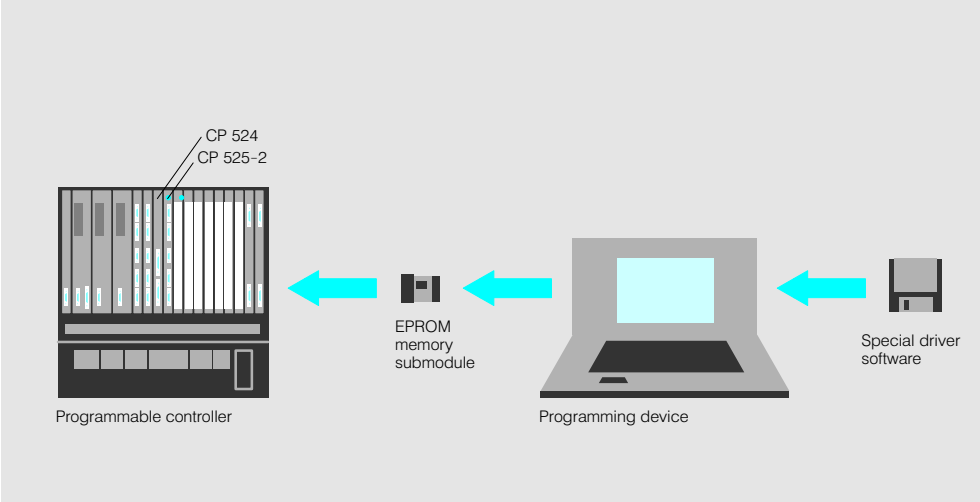

Fig. 7/89 Special driver software on the CP 524/CP 525-2 (driver software on minidiskette, routines are located into EPROM on the CP 524 and into RAM or EPROM on the CP 525) are required for interfacing host systems such as computers or subsystems such as scales or bar code readers.

The ever-increasing extent of the tasks performed by programmable controllers and the hierarchical structure of installations in the process industry often make it necessary to connect SIMATIC S5 systems to host computers and subsystems. These include scanners, barcode readers, automatic labelling machines and identification systems.

The CP 524 and CP 525-2 communications processors support connection to standard Siemens devices, e.g. computers, CRT units and printers. For this purpose the CP 524 communications processor has one interface and the CP 525-2 two interfaces.

Special drivers for CP 524 and CP 525-2 communications processors are available for connection to computers and subsystems of other manufacturers. The special drivers enable asynchronous transmission via:

- The 20 mA current-loop interface (TTY, over a distance of up to 1 km/1.6 miles)
- RS 232C interface (V24/V.28, up to 16 m/52.48 ft)
- RS 422/RS 485 interface (voltage differential transmission, only with CPU 524, up to 1200 m/3936 ft).

The user can choose from the following:

- Character frame;
  ASCII or full-transparent transmission, number of start bits, number of data bits, parity bit
- Procedure;
  Opening character, end character, acknowledgement character, block check character
- Message format;
  Specifications pertaining to the type and amount of data, etc.

These technical capabilities enable optimum adaptation to the interface of the host system.

The special drivers are delivered on diskette ($5^1/_4$" and $3^1/_2$") and are supplied with a manual.

Driver routines have been developed for many common process computers and subsystems such as the process computers and control systems manufactured by AEG, Allen Bradley, ASEA, Data General, FISHER CONTROL, Honeywell, IBM and MODICON as well as for the subsystems manufactured by Datalogic (scanners and barcode readers), SAAB SCANIA Automation (Premid microwave reader system), Philips (weighing equipment), Leuze (barcode readers) and Sick Opto electronic (barcode readers and other systems).

Thanks to their modularity, new special drivers can be easily created on demand.

If required, translations can be made of existing operating instructions for the special drivers.

An additional range of "open drivers" is also available which the user can tailor to his own requirements.

Many manufacturers of subsystems have integrated the Siemens RK 512 standard or 3964 (R) procedure in their systems. This enables these systems to be interfaced via the driver software contained in the COM 525 package. If only the 3964 (R) procedure has been implemented, a special driver (6ES5 897-2AB. 1) is required for the CPU 524/CP 525-2 communications processors.

Special driver software (continued)

Open drivers (continued)

"Open drivers"can be used to send and receive data of any structure (all printable ASCII characters and all other characters from 00H to FFH). The message structure is kept open so that the S5 user can send complete messages to the CP with all control characters intact (including start or end characters), and likewise receive complete messages. The structure of outgoing messages can vary from incoming ones.

Special driver software (continued)

Open drivers (continued)

Because of the wide variety of possible configurations, a thorough knowledge is required of the interface to be connected.

There is a choice of several "open drivers" with different technical specifications for a variety of configurations.

Sending:
All data types are allowed as source data. If the source type "DB" is used, messages can be sent from any data block. The maximum message length is 2048 byte.

Receiving:
A message can begin with any character. The CP recognizes the end of the data string being received from the end parameter. When the CP recognizes the end parameter, the complete message is passed to the CPU. The data are entered with the aid of FB RECEIVE-ALL. The data block for all received messages must have been created beforehand.

S5D004 open driver

The S5D004 "open driver" has the greatest choice of configurations.

The S5D004 "open driver" is configured through a direct SEND job from a STEP 5 program.

The following can be parameterized:

- Baud rate from 50 to 19,200 bauds (with full-duplex and TTY up to 9,600 bauds)
- Character frame
- Receiving data block, data word and CPU number
- Message end parameter: 1 or 2 end codes, timer, fixed length (combination of end codes or timer with fixed partblock length possible)
- Full-duplex mode
- Half-duplex mode optional XON/XOFF protocol for sending and receiving, optional STX hold-off interval, optional echo optional BREAK evaluation in ANZW
- Wordwise or bytewise transmission
- Character delay time: 4 to 65,535 ms in 1 ms raster

Technical specifications

No block check character;
No software handshake (acknowledgement), no hardware handshake (auxiliary signals);
CP 524: 20 mA (current loop), V.24, RS 422, RS 485
CP 525: 20 mA (current loop), V.24;
Maximum sending length from DB: 4096 byte,
unlimited receiving length through blocking,
maximum block length: 1024 byte
Buffering for heavy message traffic

S5D002 open driver

The S5D002 open driver supports the V.24 auxiliary signal (hardware handshake) of the CP 524 as required.

The S5D002 "open driver" is configured through a direct SEND job from a STEP 5 program.

The following can be parameterized:

- Baud rate from 50 to 19,200 baud (with full-duplex and 20 mA (current loop) up to 9,600 baud
- Character frame
- Receiving data block, data word and CPU number
- Message end parameter: 1 or 2 end codes, timer
- Full-duplex mode
- Half-duplex mode Optional XON/XOFF protocol for sending (monitoring time 6 s) and STX hold-off interval, optional echo
- Character delay time: 100 to 25,500 ms in 101 ms raster.

Note
The S5D002 driver is suitable only for use in the CP 524.

Technical specifications

No block check character;
no software handshake (acknowledgement),
programmable hardware handshake
(RTS-CTS handshake;
DTR, STEP 5-compatible PS3, DCD, DSR, RI and PM1 can be evaluated from STEP 5);
CP 524: 20 mA (current loop), V.24 with auxiliary signals, RS 422;
maximum sending length from DB: 4096 byte,
maximum receiving length: 508 byte

Ordering data

	Order No.		Order No.
Program "Open driver" S5D004 for CP 524/CP 525-2 (programmed with PG)		**Program „Open driver" S5D002** for CP 524 (programmed with PG)	
Single license	**6ES5 897-2DC 1**	Single license	**6ES5 897-2NB 1**
Copy license	**6ES5 897-2DC 1-0KL1**	Copy license	**6ES5 897-2NB 1-0KL1**
with description in	↑	with description in	↑
German	**1**	German	**1**
English	**2**	English	**2**
French	**3**		

1) To be used with CP 525 only

Special driver software (continued)

Technical specifications and ordering data for special driver programs

Device	Details	Master/slave relation-ship: S5 is	Protocol	Lan-gua ge	License	Order No.
AEG Logistat CP80 A200-A500	• Does not support control signals of the V.24 interface	Master	SEAB-1	G	Single license Copy license	**6ES5 897-2RB11** **6ES5 897-2RB11-0KL1**
				G	Single license Copy license	**6ES5 897-2RD11** **6ES5 897-2RD11-0KL1**
AEG Logistat CP80 A200-A500	• Only for use with CP 524 • Processes the V.24 RTS control signals • Enables data transmission via modem module e.g. LABK03-frequency telegraphy unit (AEG)	Master	SEAB-1			
				G	Single license Copy license	**6ES5 897-2RE11** **6ES5 897-2RE11-0KL1**
AEG Logistat CP80 A200-A500	• Only for use with CP 524 • Processes the V.24 RTS and DCD control signals • Enables data transmission via modems (e.g. UEB4) or GDÜ from AEG	Slave	SEAB-1			
AEG Logistat CP80 A200-A500	• Does not support control signals of the V.24 interface	Slave	SEAB-1	G	Single license Copy license	**6ES5 897-2UB11** **6ES5 897-2UB11-0KL1**
				G	Single license Copy license	**6ES5 897-2ND11** **6ES5 897-2ND11-0KL1**
AEG Geazent 8006 system	• Connection unit from the Geazent 8006 system with Partyline procedure to SIMATIC S5	Slave	AEG Partyline	G	Single license Copy license	**6ES5 897-2XA11** **6ES5 897-2XA11-0KL1**
AEG MARK IV Turbine control	• Does not support control signals of the V.24 interface	—		G	Single license Copy license	**6ES5 897-2KD11** **6ES5 897-2KD11-0KL1**
ABB (ASEA) Robot control	• Does not support control signals of the V.24 interface • Max. transceiving length 128 byte	—	ADLP-10	G	Single license Copy license	**6ES5 897-2MA11** **6ES5 897-2MA11-0KL1**
ABB (BBC) Procontrol P station automation system	• Does not support control signals of the V.24 interface • The DSCA 114 interface board is required on the ABB side	Slave	(In acc. with DIN 19 244 unbalanced mode)	G	Single license Copy license	**6ES5 897-2BB11** **6ES5 897-2BB11-0KL1**
ABB (ASEA) Master Piece 200/1 Master Piece 800	• V.24 control signals not supported • Note: ABB offers further modules which can also be used for communication with SIMATIC: - e.g. via Modbus protocol with DSCA 180B interface - e.g. via Siemens RK 512 protocol with DSCA 180F interface For details, please contact ABB	Master	EXCOM protocol	G, E F	Single license Copy license	**6ES5 897-2WB ■ 1** **6ES5 897-2WB ■ 1-0KL1**
	• For PLC 2, communication controller 1771 KGM is required			G	Single license Copy license	**6ES5 897-2XD11** **6ES5 897-2XD11-0KL1**
Allen Bradley PLC 2	• Writing to the submodule, max. 252 byte • Reading from the submodule, max 255 byte	Slave				Please consult DEC
ATRON Memory submodule	• RK 512 drivers are available for SIMATIC S5 sister controllers	Master				
DEC Micro VAX, PDP 11				G E F		**1** **2** **3**

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Special driver software (continued)

Technical specifications and ordering data for special driver programs (continued)

Device	Details	Master/ slave relation-ship: S5 is	Protocol	Lan-gua ge	License	Order No.
Datalogic Scanners and barcode readers	• The Siemens RK 512 protocol is implemented in various Datalogic devices. A special driver is then not required. For details, please contact Datalogic			G	Single license Copy license	**6ES5 897-2GE11** **6ES5 897-2GE11-0KL1**
DIN 19 244 (balanced mode)	• Communications software in acc. with DIN 19244 and IEC TC 57, format class FT 1.2, with customer-specific adjustments		In acc with DIN 19 244 and IEC TC 57	G	Single license Copy license	**6ES5 897-2MD11** **6ES5 897-2MD11-0KL1**
DIN 19 244 (unbalanced mode)	• Communications software in acc. with DIN 19 244 and IEC TC 57, format class FT 1.2, with customer-specific adjustments		In acc. with DIN 19 244 and IEC TC 57	G	Single license Copy license	**6ES5 897-2TD11** **6ES5 897-2TD11-0KL1**
Printer	• This driver enables various printers to be interfaced for process status listing with CP 524/525 (as standard, only PT 88/89 and DR 210/21 1/ 230/231 printers with ECM module can be connected)		LAUF	G,E	Single license Copy license	**6ES5 897-2FB** ▯**1** **6ES5 897-2FB** ▯**1-0KL1**
ENRAF NONIUS Microlect System	• Not suitable for E&N ClU 858!	Master		G	Single license Copy license	**6ES5 897-2DB11** **6ES5 897-2DB11-0KL1**
Fisher Controls PROVOX Process control system	• Communication is possible via Modbus protocol if function codes which are not supported by the Fisher PROVOX system are not used	Slave	Modbus protocol (RTU) message frame format	G,E, F	Single license Copy license	**6ES5 897-2QA** ▯**1** **6ES5 897-2QA** ▯**1-0KL1**
Hewlett Packard HP 1000A, Type A600, A700, A900	• RK 512 drivers are available for SIMATIC S5 sister controllers For details, please contact HP					Please consult HP
Hewlett Packard HP 9000, Process computer				G	Single license Copy license	**6ES5 897-2SD11** **6ES5 897-2SD11-0KL1**
Honeywell (Modbus)	• A Generik gateway TDC 200 or TDC 3000, for example, can be used as interface to the bus	Master	Modbus protocol, RTU message frame format	G,E, F	Single license Copy license	**6ES5 897-2KB** ▯**1** **6ES5 897-2KB** ▯**1-0KL1**
Honeywell (Modbus)	• A Generik gateway TDC 200 or TDC 3000, for example, can be used as interface to the bus	Slave	Modbus protocol, RTU message frame format	G,E, F	Single license Copy license	**6ES5 897-2QA** ▯**1** **6ES5 897-2QA** ▯**1-0KL1**
IBM AT Personal computer	• Toolbox, "PRODAVE DOS 64R" for PG/PC (AT and AT-compatible) under MS-DOS operating system		RK 512 or procedure 3964 (R)	G,E, F,S	Single license Copy license	**6ES5 897-2UD** ▯**1** **6ES5 897-2UD** ▯**1-0KL1**
				G E F S		**1** **2** **3** **4**

Special driver programs (continued)

Technical specifications and ordering data for special driver programs (continued)

Device	Details	Master/ slave relation-ship: S5 is	Protocol	Lan-gua ge	License	Order No.
IEEE 488	• Interfacing to the bus is possible via "ICS 4835 Serial EE1E 488 Controller" • Controller can be obtained from: Meilhaus Electronic GmbH 82178 Puchheim Federal Republic of Germany Phone ++49-89-80 70 81			G	Single license Copy license	**6ES5 897-2LA11** **6ES5 897-2LA11-0KL1**
IBM S1 computer			Simliar to RK 512 and procedure 3964	G	Single license Copy license	**6ES5 897-2JE11** **6ES5 897-2JE11-0KL1**
Leuze Barcode reader	• e.g. BLC 10 • Siemens RK 512 is implemented in various devices from Leuze (a special driver is then not required) For details, please contact Leuze		Modbus protocol, RTU message frame format	G	Single license Copy license	**6ES5 897-2GE11** **6ES5 897-2GE11-0KL1**
Modicon (AEG)	• The J478 stand-alone modem, for example, can be used as interface module to the bus	Slave	Modbus protocol, RTU message frame format	G,E, F	Single license Copy license	**6ES5 897-2QA** □**1** **6ES5 897-2QA** □**1-0KL1**
Modicon (AEG)	• The J478 stand-alone modem, for example, can be used as interface module to the bus	Master		G,E, F	Single license Copy license	**6ES5 897-2KB** □**1** **6ES5 897-2KB** □**1-0KL1**
Modicon (AEG)	• Modbus for TELEPERM AS 215 process control system • AS 215 is master	Master	Modbus protocol, RTU message frame format	G	Single license Copy license	**6ES5 897-2PD11** **6ES5 897-2PD11-0KL1**
MTU MCS 4	• Nantos automation system			G	Single license Copy license	**6ES5 897-2LD11** **6ES5 897-2LD11-0KL1**
"Open driver"	• If the CP 524 is used, RS 485 operation is possible with the RS 422/485 module		No protocol	G,E, F,S	Single license Copy license	**6ES5 897-2DC** □**1** **6ES5 897-2DC** □**1-0KL1**
"Open driver"	• Suitable only for CP 524 with V.24 module Support the V24 accompanying signals		No protocol	G,E	Single license Copy license	**6ES5 897-2NB** □**1** **6ES5 897-2NB** □**1-0KL1**
"Open driver"	• This driver enables connection to "simple" RS 485 master/slave networks • The driver acts as master	Master	No protocol	G,E	Single license Copy license	**6ES5 897-2MB** □**1** **6ES5 897-2MB** □**1-0KL1**
"Open driver" (Operation procedure)	• Possible parameters: end/start character, BCC type, character delay time, XON/ XOFF protocol		LAUF	G	Single license Copy license	**6ES5 897-2EA11** **6ES5 897-2EA11-0KL1**
Philips Weighing systems	• PR 159X family PR 1600 family	Master	Philips EW protocol	G,E	Single license Copy license	**6ES5 897-2HD** □**1** **6ES5 897-2HD** □**1-0KL1**
Philips Closed-loop controllers	• KS 4580, KS 4770 via ICS 90	Master		G,E	Single license Copy license	**6ES5 897-2TA** □**1** **6ES5 897-2TA** □**1-0KL1**
				G E F S		**1** **2** **3** **4**

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Special driver programs (continued)

Technical specifications and ordering data for special driver programs (continued)

Device	Details	Master/ slave relation-ship: S5 is	Protocol	Lan-gua ge	License	Order No.
Rotork PAC-SCAN		Master	Rotork PA 14 protocol	G	Single license Copy license	**6ES5 897-2WA11** **6ES5 897-2WA11-0KL1**
SAAB Automation (Philips) Premid Identsystem	• Suitable for microwave ID systems with 20 decimal places, e.g. PC 301 /00;/02;/42 central processing units and PC 3001, PC 3002, PC 3003 data storage units or PC 3040/00/01 compact communications units			G	Single license Copy license	**6ES5 897-2GB11** **6ES5 897-2GB11-0KL1**
SAAB Automation (Philips) Premid Identsystem	• Suitable for microwave ID systems with 8 Kbyte data storage units, e.g. PC 3010/52 CPUs and 2K/8 Kbyte data storage units PC 3004, PC 3005			G G	Single license Copy license	**6ES5 897-2GC11** **6ES5 897-2GC11-0KL1**
Staefa WSE-1 Bus		Master			Single license Copy license	**6ES5 897-2SA11** **6ES5 897-2SA11-0KL1**
SICK Optoeletronic	• Suitable for barcode readers, decoders, terminals, etc.			G	Single license Copy license	**6ES5 897-2GE11** **6ES5 897-2GE11-0KL1**
Siemens Alarm systems	• Interfacing via SIDN interface unit	Master		G	Single license Copy license	**6ES5 897-2CC11** **6ES5 897-2CC11-0KL1**
Siemens 38 Terminals	• Terminals 3805, 3821, ES 005, ES 01 5, ES 021, ES 1 01 B		38xx	G,E	Single license Copy license	**6ES5 897-2DA ▯1** **6ES5 897-2DA ▯1-0KL1**
Siemens SIROTEC RCM			LSV 2	G	Single license Copy license	**6ES5 897-2VB11** **6ES5 897-2VB11-0KL1**
Siemens SICOMP M	• SEB-M			G	Single license Copy license	**6ES5 897-2HC11** **6ES5 897-2HC11-0KL1**
Siemens TELEPERM FM 100	• FM 100 field multiplexer			G	Single license Copy license	**6ES5 897-2LB11** **6ES5 897-2LB11-0KL1**
Siemens 3964 (R)	• 3964(R) procedure with programmable character frames, control characters and times. With/ without S5 header		3964 (R)	G,E	Single license Copy license	**6ES5 897-2AB ▯1** **6ES5 897-2AB ▯1-0KL1**
Siemens RK 512	• Computer link 512; non-standard feature: times, character frames and control charac-ters are programmable. RK 512 always has S5 header		RK 512	G,E	Single license Copy license	**6ES5 897-2CB ▯1** **6ES5 897-2CB ▯1-0KL1**
Siemens PG 7xx	• Toolbox "PRODAVE DOS 64R" for PG/PC (AT and AT-compatible) under MS-DOS operating system		RK 512 or 3964 (R) procedure	G,E F,S	Single license Copy license	**6ES5 897-2UD ▯1** **6ES5 897-2UD ▯1-0KL1**
Tandem Computer			Burroughs Print to Print Connection Protocol	G G E F S	Single license Copy license	**6ES5 897-2TB11** **6ES5 897-2TB11-0KL1** **1** **2** **3** **4**

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Special driver programs for CP 544B

Hard- and software requirements

The special drivers are executable on the CP 544B (6ES5 544-3UB11). A RAM or Flash EPROM memory submodule (..or ..) must be plugged into the CP 544B as the memory.

The two serial interfaces of the CP 544B can be operated independently of each other with different standard protocols and special drivers with the interface modules RS 232C (V.24)/TTY/RS 422/485.

For loading and parameterizing special drivers, the parameter assignment software COM PP Version 3.0 and higher is required.

Technical specifications

Allen Bradley Data Highway	
General notes	Data transmission is performed with the full duplex (DF 1) protocol for the data highway asynchronous link from Allan Bradley. All Allen Bradley modules on which the full duplex protocol can be parameterized on the "asynchronous link" interface can be used as the communication modules. Coupling with the 2nd CPU interface of Allen Bradley CPUs is also possible if the full duplex protocol can be set . The procedure is operated on an RS 232C, V.24 20 mA (TTY) or RS 422 (four-wire full duplex) interface.
Technical specifications	• Allen Bradley Data Highway full duplex (DF1) protocol • Interfaces: 20 mA (TTY), RS 232C (V.24), RS 422/485 (four-wire) • No "embedded responses"
Settable parameters	• Transmission rate of 300 baud to 76800 baud; TTY up to 9600 baud; RS 232 (V.24) up to 19200 baud • Character frame • Receive mailbox DB and data word • Timeout for acknowledgment character 30 ms to 10 s • Number of repetitions on NAK 0 to 5 • Number of ENQ requests 0 to 5 • Duplicate message transmission detection: ON or OFF • Acknowledgment of the CP immediately after receipt or only after transfer to the PLC

Extended open driver	
General notes	Transmission is performed asynchronously, half or full duplex and is run on an RS 232C (V.24), 20 mA (TTY) or RS 422/485 interface. The RS 485 interface of the CP 544B can use the RS 232C (V.24) interface with a modem for multipoint connections. Moreover, RS 232C (V.24) signaling and control lines can be used if the special driver is used.
Settable parameters	• Transmission rate 300 baud to 76800 baud; TTY up to 9600 baud, RS 232C (V.24) up to 19200 baud • Character frame • Mode, i.e. end criterion for receive • CP functions as master of a master-slave link • With/without RS 485 operation for two-wire connections • With/without RS 232C (V.24) accompanying signals • Handling of transmission errors at beginning of message frame • Break evaluation • Character timeout in millisecond timebase • Block assembly (continuous receiving) • BREAK output Data flow control with XON/XOFF or BUSY is not supported by this driver

Special driver programs for CP 544B (continued)

Technical specifications (continued)

MODBUS master

Technical specifications	• MODBUS protocol with RTU format • Master-slave link: SIMATIC S5 is master • Implemented function codes: 01, 02, 03, 04, 05, 06, 07, 08, 11, 12, 15, 16 • No RS 232C (V.24) control and signal lines • CRC polynomial $X^{16} + x^{15} + x^2 + 1$ • Interfaces: 20 mA (TTY), RS 232C (V.24), RS 422/485 (two-wire or four-wire) • Receive mailbox DB and data word are specified on transmission • Character timeout 3.5 characters (baudrate-dependent) • Broadcast message possible
Settable parameters	• Transmission rate of 300 baud to 76800 baud; TTY up to 9600 baud (RS 232C) V.24 up to 19200 baud • Character frame • With/without RS 485 operation for two-wire connections • With/without modem operation (ignore scratch character) • Response timeout 100 ms to 25.5 s in 100 ms timebase • Factor for character timeout 1-9

MODBUS slave

General notes	The communications software consists of a special driver and two function blocks. Data transmission is performed according to the master-slave principle. The master takes the initiative in transmission, the CP 544B functions as a slave and only transmits to the master on request. Message frame exchange from slave to slave is not possible.
Technical specifications	• MODBUS protocol with RTU format • Master-slave link: SIMATIC S5 is the slave • Implemented function codes: 01, 02, 03, 04, 05, 06, 08, 15, 16 • CRC polynomial $X^{16} + x^{15} + x^2 + 1$ • Interfaces: 20 mA (TTY), RS 232C (V.24), RS 422/485 (two-wire or four-wire) • Communications FBs (FB 180 for start-up, FB 181 for cyclic operation with data handling blocks) • MODBUS data address is converted to S5 data areas. Processable data areas: DB or DX, flags, outputs, timers, counters, (extended) I/Os, (extended) system addresses • Character timeout 3.5 characters (baudrate-dependent)
Settable parameters	• Transmission rate of 300 baud to 76800 baud; TTY up to 9600 baud RS 232C (V.24) up to 19200 baud • Character frame • Slave address of the CP • With/without RS 485 operation for two-wire connections • With/without modem operation (ignore scratch character) • Factor for character timeout 1-9 • Number of the working DB (for FB processing) • Release of the memory areas that can be written by the master and the readable (extended) I/Os

Ordering data

	Order No.
Allen Bradley Data Highway	
German	
Single license	**6ES5 897-3WB11**
Copy license	**6ES5 897-3WB11-0KL1**
Extended open driver	
with operation of the RS 232C (V.24) accompanying signals or two-wire operation for RS 485, German	
Single license	**6ES5 897-3DC ■1**
Copy license	**6ES5 897-3DC ■1-0KL1**
↑	**1**
	2

	Order No.
MODBUS master	
RTU message frame format	
German, English, French	
Single license	**6ES5 897-3KB ■1**
Copy license	**6ES5 897-3KB ■1-0KL1**
MODBUS slave	
RTU message frame format	
German, English, French	
Single license	**6ES5 897-3QA ■1**
Copy license	**6ES5 897-3QA ■1-0KL1**
↑	
German	**1**
English	**2**
French	**3**

1) To be used with CP 525 only

Subrack CR 700-0LA for the S5-115U

Component list

Module type		Order No.	General accessories (No., see below)	Adapter casing required (●)	Fan subassembly required (●)		Slot No. PS	CPU	0	1	2	3	IM	Module Qty.	Current consumption at 5 V A	Current consumption at 5 V Sum A	Price each	Price total
							Cross modules required											
CPU	CPU 941, CPU 942	6ES5 94.-7UB11				3									0.16			
	CPU 943, CPU 944 with 1/2 interfaces	6ES5 94.-7UB .1				3									0.2/0,45			
	CPU 945	6ES5 945-7UA .3				3									0.55/1,25[1]			
Digital input module	32 x 24 V DC	6ES5 420-7LA11				5									0.005			
	32 x 24 V DC	6ES5 430-7LA12				5									0.005			
	16 x 24 ... 48 V UC	6ES5 431-7LA11				5									0.005			
	16 x 48 ... 60 V UC	6ES5 432-7LA11				5									0.005			
	8 x 24 V DC	6ES5 434-7LA12				5									0.07			
	16 x 115 V UC	6ES5 435-7LA11				5									0.005			
	16 x 115 V UC	6ES5 435-7LB11				5									0.005			
	8 x 115 V UC	6ES5 435-7LC11				5									0.005			
	16 x 230 V UC	6ES5 436-7LA11				5									0.005			
	16 x 230 V UC	6ES5 436-7LB11				5									0.005			
	8 x 230 V UC	6ES5 436-7LC11				5									0.005			
	32 x 5 ... 15 V DC	6ES5 434-4UA12			●	6									0.08			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-7LA12				5									0.01			
	32 x 24 V DC; 0.5 A	6ES5 451-7LA .1				5									0.1			
	16 x 24 ... 60 V DC; 0.5 A	6ES5 453-7LA11				5									0.05			
	16 x 24 V DC; 2 A	6ES5 454-7LA12				5									0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11				5									0.05			
	16 x 48 ... 115 V AC; 1 A	6ES5 455-7LA11				5									0.175			
	16 x 115 ... 230 V AC; 1 A	6ES5 456-7LA11				5									0.07			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11				5									0.035			
	32 x 5 ... 24 V DC; 0.1 A	6ES5 457-7LA11				5									0.1			
	16 x 30 V AC relay contacts	6ES5 458-7LA11				5									0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11				5									0.05			
	16 x 250 V AC relay contacts	6ES5 458-7LC11				5									0.05			
	16 x 24 V DC; 2 A	6ES5 453-4LA12			●	5									0.12			
Digital input/ output module	24 V DC: 16 inputs; 16 outputs 0.5 A	6ES5 482-7LA11				5									0.05			
	24 V DC: 16 inputs; 16 outputs 0.5 A	6ES5 482-7LF11				5									0.05			
	24 V DC: 16 inputs; 16 outputs 0.5 A	6ES5 482-7LF21				5									0.05			
	24 V DC: 8 inputs; 8 outputs 2.5 A	6ES5 482-7LF31				5									0.15			
	24 V DC: 16 inputs; 24 outputs 1.5 A	6ES5 485-7LA11				5									0.1			
Analog input module	8 inputs	6ES5 460-7LA13				5									0.15			
	8/16 inputs	6ES5 465-7LA13				5									0.15			
	4 inputs	6ES5 463-4U .12			●	6									0.2			
	8/16 inputs	6ES5 466-3LA11			●	4									0.7			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12				5									0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12				5									0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12				5									0.25			
Power output module	(max. 1.25 A)	6ES5 776-7LA13				5									0.09			
	(max. 2.5 A)	6ES5 776-7LA13	●			5									0.09			
Intelligent I/O modules	IP 240 for counting, pos. dec. and pos.	6ES5 240-1AA21			●	7									0.8[2]			
	IP 241 for counting and pos. dec.	6ES5 241-1AA12	●		●	7									1.0[2], [3]			
	IP 242A for counting[6]	6ES5 242-1AA32			●	7									1.1			
	IP 242B for counting	6ES5 242-1AA41			●	7									1.1			
	IP 243 for analog value processing	6ES5 243-1AA13			●	7									0,6			
	IP 244 for temperature control	6ES5 244-3AB31			●	7									0.4			

	IP 260 for high-speed cl.-loop control[5]	6ES5 260-4UA11		•	7									—			
	IP 261 for proportioning[5]	6ES5 261-4UA11		•	7									0.05			
	IP 281 for counting	6ES5 281-4U .12		•	7									0.6			
	IP 288 for positioning	6ES5 288-4UA11		•	7									0.8			
	WF 705 for position decoding	6FM1 705-3AA00		•	7									0.5[2]			
	WF 706 for contr. pos., 3-channel	6FM1 706-3AA20		•	7									0.75[2]			
	WF 706 for contr. pos., 6-channel	6FM1 706-3AB20		•	7									1.5[2]			
	WF 707 for cam controller module	6FM1 707-3AA10		•	7									0.55			
	CPU 523 for point-to-point link	6ES5 523-3UA11		•	3									0.13			
	CPU 530 for SINEC L1, block type	6ES5 530-7LA12			3									1.0			
	CPU 530 for SINEC L1, compact	6ES5 530-3LA12		•	3									1.0			
	CP 2430 (I/O-Betrieb) für AS-Interface	6GK1 243-0SA10		•										0,7			
	IM 305 interface module	6ES5 305-7L .11												0.01/1[4]			
	IM 306 interface module	6ES5 306-7LA11			7									0.05/2[4]			
Total current for central controller																	

1)Depending on the interface module 2) Without sensor supply 3) Allowance must also be made for the respective sensor matching module for each channel used. 4) Power consumption/current supply to the EU 5) Not in conjunction with CPU 945

Total current of the central controller and central expansion units
(carried forward from the configuring sheets for central EUs)

[ ] 1st EU + [ ] 2nd EU + [ ] 3rd EU + [ ] CC = [ ]

PS 951 power supply module	up to 3A: 6ES5 951-7LB21/-7NB21; up to 7 A (PLC without fan) or up to 15 A (PLC with fan): 6ES5 951-7LD21/-7ND51/-7ND41	
Accessories		
1 Adapter casing	6ES5 491-0L .11	
2 Short fan subassembly 24 V DC or 230 V AC	6ES5 981-0HB .1	
3 RAM, EEPROM, EPROM memory submodule	6ES5 37 . -	
4 Front connector K, crimp/screw connection	6XX3 068/6XX3 081	
5 Front connector 490, crimp-/screw/spring-type connection	6ES5 490-7 ... 1	
6 Front connector 497, crimp/screw connection	6ES5 497-4U ...	
7 Other		

Sum [ ]
\+
Total price of expansion units [ ]
=
Total price [ ]

CR 700-0LB subrack for S5-115U and S5-115H

Component list

General accessories (No., see below)
Adapter casing required (●)
Fan subassembly required (●)

Module type		Order No.				Slot No. PS	CPU	0	1	2	3	IM	Module Qty.	Current cons. at 5 V A	Sum A	Price each	total
						Cross modules required											
CPU	CPU 941, CPU 942	6ES5 94.-7UB11			3									0.16			
	CPU 943, CPU 944 with $^1/_2$ interfaces	6ES5 94.-7UB .1			3									0.2/0.45			
	CPU 945	6ES5 945-7UA.3			3									0.55/1.25[1]			
Digital input module	32 x 24 V DC	6ES5 420-7LA11			5									0.005			
	32 x 24 V DC	6ES5 430-7LA12			5									0.005			
	16 x 24 ... 48 V UC	6ES5 431-7LA11			5									0.005			
	16 x 48 ... 60 V UC	6ES5 432-7LA11			5									0.005			
	8 x 24 V DC	6ES5 434-7LA12			5									0.07			
	16 x 115 V UC	6ES5 435-7LA11			5									0.005			
	16 x 115 V UC	6ES5 435-7LB11			5									0.005			
	8 x 115 V UC	6ES5 435-7LC11			5									0.005			
	16 x 230 V UC	6ES5 436-7LA11			5									0.005			
	16 x 230 V UC	6ES5 436-7LB11			5									0.005			
	8 x 230 V UC	6ES5 436-7LC11			5									0.005			
	32 x 5 ... 15 V DC	6ES5 434-4UA12		●	6									0.08			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-7LA12			5									0.01			
	32 x 24 V DC; 0.5 A	6ES5 451-7LA .1			5									0.1			
	16 x 24 ... 60 V DC; 0.5 A	6ES5 453-7LA11			5									0.05			
	16 x 24 V DC; 2 A	6ES5 454-7LA12			5									0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11			5									0.05			
	16 x 48 ... 115 V AC; 1 A	6ES5 455-7LA11			5									0.175			
	16 x 115 ... 230 V AC; 1 A	6ES5 456-7LA11			5									0.07			
	8 x 115 ... 230 V AC; 1 A	6ES5 456-7LB11			5									0.035			
	32 x 5 ... 24 V DC; 0.1 A	6ES5 457-7LA11			5									0.1			
	16 x 30 V AC relay contacts	6ES5 458-7LA11			5									0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11			5									0.05			
	16 x 250 V AC relay contacts	6ES5 458-7LC11			5									0.05			
Digital input/ output module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11			5									0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11			5									0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21			5									0.05			
	24 V DC: 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31			5									0.15			
	24 V DC: 24 inputs, 16 outputs 1.5 A	6ES5 485-7LA11			5									0.1			
Analog input module	8 inputs	6ES5 460-7LA13			5									0.15			
	8/16 inputs	6ES5 465-7LA13			5									0.15			
	4 inputs	6ES5 463-4U .12		●	6									0.2			
	8/16 inputs	6ES5 466-3LA11		●	4									0.7			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12			5									0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12			5									0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12			6									0.25			
Power output module[5]	(max. 1.25 A)	6ES5 776-7LA13			5									0.09			
	(max. 2.5 A)	6ES5 776-7LA13	●		5									0.09			
Intelligent I/O modules	IP 240 for counting, pos. dec. and pos.	6ES5 240-1AA21		●	7									0.8[2]			
	IP 241 for counting and pos. dec.[5]	6ES5 241-1AA12	●	●	7									1.0[2], [3]			
	IP 242A for counting[5], [6]	6ES5 242-1AA32		●	7									1.1			
	IP 242B for counting[5]	6ES5 242-1AA41		●	7									1.1			
	IP 243 für analog value processing	6ES5 243-1AA13		●	7									0,4			
	IP 244 for temperature control	6ES5 244-3AB31		●	7									0.4			
	IP 246 I/O for contr. pos., incremental	6ES5 246-4UA31		●	7									1.3[2]			
	IP 246 I/O for contr. pos., absolute	6ES5 246-4UB11		●	7									1.3[2]			
	IP 247 for contr. pos.	6ES5 247-4UA31		●	7									0.8			
	IP 252 for closed-loop control	6ES5 252-3AA13		●	3/7									2.3			
	IP 260 for high-speed cl.-loop control[5]	6ES5 260-4UA11		●	7									—			
	IP 261 for proportioning[5]	6ES5 261-4UA11		●	7									0.05			
	IP 281 for counting	6ES5 281-4U.12		●	7									0.6			

	WF 705 for position decoding [4]	6FM1 705-3AA00		•	7										0.5[2]			
	WF 706 for contr. pos., 3-channel [4]	6FM1 706-3AA20		•	7										0.75[2]			
	WF 706 for contr. pos., 6-channel [4]	6FM1 706-3AB20		•	7										1.5[2]			
	WF 707 cam controller module [4]	6FM1 707-3AA10		•	7										0.55			
	WF 721 for contr. positioning [4]	6FM1 721-3AA20		•	7										1.0[2]			
	WF 723 for contr. positioning [4]	6FM1 723-3.A.0		•	7										1.3[2]			
Commu-	CP 523 for point-to-point link	6ES5 523-3UA11		•	3										0.13			
nications-	CP 524 for point-to-point link	6ES5 524-3UA13	•	•	3										1.5			
process-	CP 544 for point-to-point link	6ES5 544-3UA11		•	7										>0.9[1]			
sors	CP 527 for HMI	6AV1 242-0AB.0		•	7										1.5			
	CP 526/527 for HMI, exp. module	6ES5 526-3LA22	•	•	7										2.3			
	CP 528 for HMI, digital or analog	6AV4 012-0AA10-0AB0		•	7										1.8			
	CP 530 for SINEC L1, block-type	6ES5 530-7LA12			3										1.0			
	CP 530 for SINEC L1, compact	6ES5 530-3LA12		•	3										1.0			
	CP 2430 (I/O-, Kachelbetr.) f. AS-Interf.	6GK1 243-0SA10		•	7										0,7			
	CP 5431 FMS/DP for PROFIBUS	6GK1 543-1AA00		•	7										0.45			
	CP1430 TF for Industrial Ethernet	6GK1 143-0AA01	•	•	3										2.5			
	CP 1430 TF for Industrial Etnernet	6GK1 143-0AB01	•	•	3										4.5			
	CP 1473 MAP [10]	6GK1 147-3MA00	•	•	7										4.2			
Special	CP 516	6ES5 516-3UA11		•	7										0.8			
applica-	CP 581, SIMATIC PC, modular																	
tions	- Basic module	6ES5581- 1ED13	•	•	7										1.8			
	- Mass storage module [6]	6ES5 581-3LA11		•	7										0.5			
	- Slot module (max. 2) [7]	6ES5 581-0RA12	•	•	7										0.8[10]			
	IM 304 interface module	6ES5 304-3UB11		•											1.5			
	IM 305 interface module	6ES5 305-7L . 11													0.01/1[10]			
	IM 306 interface module	6ES5 306-7LA11			7										0.05/2[10]			
	IM 307 interface module	6ES5 307-3UA11		•											1			
	IM 308 interface module [4]	6ES5 308-3UA12		•											0.5			
	IM 308-C interface module	6ES5 308-3UC11		•											0.6			
only for	CPU 942H	6ES5 942-7UH11			3										0.7			
S5-115H	IM 304, int. module, CC int., 2nd CC	6ES5 304-3UB11		•	7										1.5			
	IM 324R, int. mod., CC int., 1st CC	6ES5 324-3UR11		•	7										1.0			
Total current for central controller																		

1) Depending on the interface module 2) Without sensor supply 3) Allowance must also be made for the respective sensor matching module for each channel used. 4) Not for S5-115H 5) Not in conjunction with CPU 945. 6) The mass storage module can only be plugged in directly on the right next to the basic module 7) Slot modules can be plugged in directly on the right next to the basic, mass storage or slot module. 8) Without plugged-in AT modules 9) For power supply of a transceiver max. 4.2 A 10) Not for S5-115F

Total current of the central controller and central expansion units
(carried forward from the configuring sheets for central EUs)

	+		+		+		=	
1st EU		2nd EU		3rd EU		CC		

PS 951 power supply module	up to 3A: 6ES5 951-7LB21/-7NB21; up to 7 A (PLC without fan) or up to 15 A (PLC with fan): 6ES5 951-7LD21/-7ND51/-7ND41		
Accessories			
1 Adapter casing	6ES5 491-0L . 11		
2 Short fan subassembly 24 V DC or 230 V AC	6ES5 981-0HB . 1		
3 RAM, EEPROM, EPROM memory submodule	6ES5 37 .-		
4 Front connector K, crimp/screw connection	6XX3 068/6XX3 081		
5 Front connector 490, crimp/screw/spring-type connection	6ES5 490-7 ... 1		
6 Front connector 497, crimp/screw connection	6ES5 497-4U ...		
7 Other			

Sum
+
Total price of expansion units
=
Total price

CR 700-1 subrack for the S5-115U

Component list			General accessories (No., see below)	Adapter casing required (●)	Fan subassembly required (●)		Slot No.										Module				
							PS	CPU	0	1	2	3	4	5	6	IM	Qty.	Current cons. at 5 V		Price	
Module type		Order No.					Cross modules required											A	Sum A	each	total
CPU	CPU 941, CPU 942	6ES5 94.-7UB11				3		■										0.16			
	CPU 943, CPU 944 with $^1/_2$ interfaces	6ES5 94.-7UB.1				3		■										0.2/0.45			
	CPU 945	6ES5 945-7UA3				3		■										0.55/1.25[1]			
Digital input module	32 x 24 V DC	6ES5 420-7LA11				5			■	■	■	■	■	■	■			0.005			
	32 x 24 V DC	6ES5 430-7LA12				5			■	■	■	■	■	■	■			0.005			
	16 x 24 ... 48 V UC	6ES5 431-7LA11				5			■	■	■	■	■	■	■			0.005			
	16 x 48 ... 60 V UC	6ES5 432-7LA11				5			■	■	■	■	■	■	■			0.005			
	8 x 24 V DC	6ES5 434-7LA12				5			■	■	■	■	■	■	■			0.07			
	16 x 115 V UC	6ES5 435-7LA11				5			■	■	■	■	■	■	■			0.005			
	16 x 115 V UC	6ES5 435-7LB11				5			■	■	■	■	■	■	■			0.005			
	8 x 115 V UC	6ES5 435-7LC11				5			■	■	■	■	■	■	■			0.005			
	16 x 230 V UC	6ES5 436-7LA11				5			■	■	■	■	■	■	■			0.005			
	16 x 230 V UC	6ES5 436-7LB11				5			■	■	■	■	■	■	■			0.005			
	8 x 230 V UC	6ES5 436-7LC11				5			■	■	■	■	■	■	■			0.005			
	16 x 5 ... 15 V DC	6ES5 434-4UA12			●	6			■									0.08			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-7LA12				5			■	■	■	■	■	■	■			0.01			
	32 x 24 V DC; 0.5 A	6ES5 451-7LA.1				5			■	■	■	■	■	■	■			0.1			
	16 x 24 ... 60 V DC; 0.5 A	6ES5 453-7LA11				5			■	■	■	■	■	■	■			0.05			
	16 x 24 V DC; 2 A	6ES5 454-7LA12				5			■	■	■	■	■	■	■			0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11				5			■	■	■	■	■	■	■			0.05			
	16 x 48 ... 115 V AC; 1 A	6ES5 455-7LA11				5			■	■	■	■	■	■	■			0.175			
	16 x 115 ... 230 V AC; 1 A	6ES5 456-7LA11				5			■	■	■	■	■	■	■			0.07			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11				5			■	■	■	■	■	■	■			0.035			
	32 x 5 ... 24 V DC; 0.1 AV	6ES5 457-7LA11				5			■	■	■	■	■	■	■			0.1			
	16 x 30 V AC relay contacts	6ES5 458-7LA11				5			■	■	■	■	■	■	■			0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11				5			■	■	■	■	■	■	■			0.05			
	16 x 250 V AC relay contacts	6ES5 458-7LC11				5			■	■	■	■	■	■	■			0.05			
Digital input/ output module	24 V DC: 16 Inputs, 16 outputs 0.5 A	6ES5 482-7LA11				5			■	■	■	■	■	■	■			0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11				5			■	■	■	■	■	■	■			0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21				5			■	■	■	■	■	■	■			0.05			
	24 V DC: 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31				5			■	■	■	■	■	■	■			0.15			
	24 V DC: 24 inputs, 16 outputs 1.5 A	6ES5 485-7LA11				5			■	■	■	■	■	■	■			0.1			
Analog input module	8 inputs	6ES5 460-7LA13				5			■	■	■	■	■	■	■			0.15			
	8/16 inputs	6ES5 465-7LA13				5			■	■	■	■	■	■	■			0.15			
	4 inputs	6ES5 463-4U.2			●	6			■									0.2			
	8/16 inputs	6ES5 466-3LA11			●	4			■									0.7			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12				5			■	■	■	■	■	■	■			0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12				5			■	■	■	■	■	■	■			0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC 12				5			■	■	■	■	■	■	■			0.25			
Power output module	(max. 1.25 A)	6ES5 776-7LA13				5			■	■	■	■	■	■	■			0.09			
	(max. 2.5 A)	6ES5 776-7LA13	●			5			■	■	■	■	■	■	■			0.09			

Intelligent I/O module	IP 240 for counting, pos. dec. and pos.	6ES5 240-1AA21		•	7												0.8 [2]		
	IP 241 for counting and pos. dec.	6ES5 241-1AA12	•	•	7												1.0 [2, 3]		
	IP 242A for counting [5]	6ES5 242-1AA32		•	7												1.1		
	IP 242B for counting	6ES5 242-1AA41		•	7												1.1		
	IP 243 für Analogwertverarbeitung	6ES5 243-1AA13		•	4												0.6		
	IP 244 for temperature control	6ES5 244-3AB31		•	7												0.4		
	IP 260 for high speed cl.-loop control	6ES5 260-4UA11		•	7												—		
	IP 261 for proportioning [5]	6ES5 261-4UA11		•	7												0.05		
	IP 281 for counting	6ES5 281-4U.12		•	7												0.6		
	IP 288 for positioning	6ES5 288-4UA11		•	7												0.8		
	WF 705 for position decoding	6FM1 705-3AA00		•	7												0.5 [2]		
	WF 706 for contr. pos., 3-channel	6FM1 706-3AA20		•	7												0.75 [2]		
	WF 706 for contr. pos., 6-channel	6FM1 706-3AB20		•	7												1.5 [2]		
	WF 707 cam controller module	6FM1 707-3AA10		•	7												0.55		
	CP 523 for point-to-point link	6ES5 523-3UA11		•	3												0.13		
	CP 530 for SINEC L1, block type	6ES5 530-7LA12			3												1.0		
	CP 2430 (I/O-Betrieb) für AS-Interface	6GK1 243-0SA10		•													0.7		
	IM 305 interface module	6ES5 305-7L.11															0.01/1 [4]		
	IM 306 interface module	6ES5 306-7LA11			7												0.05/2 [4]		
Total current for central controller																			

1) Depending on the interface module 2) Without sensor supply 3) Allowance must also be made for the respective sensor matching module for each channel used 4) Power consumption/current supply to the EU 5)Not in conjunction with CPU 945

Total current of the central controller and central expansion units
(carried forward from the configuring sheets for central EUs)

	+		+		+		=	
1st EU		2nd EU		3rd EU		CC		

PS 951 power supply module	3/6	up to 3A: 6ES5 951-7LB21/-7NB21; up to 7 A (PLC without fan) or up to 15 A (PLC with fan): 6ES5 951-7LD21/-7ND51/-7ND41	
Accessories			
1 Adapter casing		6ES5 491-0L.11	
2 Long fan subassembly 24 V DC or 230 V AC		6ES5 981-0HA.1	
3 RAM, EEPROM, EPROM memory submodule		6ES5 37 .-	
4 Front connector K, crimp/screw connection		6XX3 068/6XX3 081	
5 Front connector 490, crimp/screw/spring-type connection		6ES5 490-7 ... 1	
6 Front connector 497, crimp/screw connection		6ES5 497-4U ...	
7 Other			

Sum
+
Total price of expansion units
=
Total price

CR 700-2 subrack for S5-115U and S5-115H

Component list			General accessories (No., see below)			Slot No.										Module Qty.	Current cons. at 5 V		Price	
			Adapter casing required (●)			PS	CPU	0	1	2	3	4	5	6	IM					
			Fan subassembly required (●)																	
Module type		Order No.				Cross modules required											A	Sum A	each	total
CPU	CPU 941, CPU 942	6ES5 94.-7UB11			3												0.16			
	CPU 943, CPU 944 with 1/2 interfaces	6ES5 94.-7UB.1			3												0.2/0.45			
	CPU 945	6ES5 945-7UA.3			3												0.2/0.45			
Digital input module	32 x 24 V DC	6ES5 420-7LA11			5									5)			0.5/1.25[1]			
	32 x 24 V DC	6ES5 430-7LA12			5									5)			0.005			
	16 x 24 ... 48 V UC	6ES5 431-7LA11			5									5)			0.005			
	16 x 48 ... 60 V DC	6ES5 432-7LA11			5									5)			0.005			
	8 x 24 V DC	6ES5 434-7LA12			5									5)			0.005			
	16 x 115 V UC	6ES5 435-7LA11			5									5)			0.07			
	16 x 115 V UC	6ES5 435-7LB11			5									5)			0.005			
	8 x 115 V UC	6ES5 435-7LC11			5									5)			0.005			
	16 x 230 V UC	6ES5 436-7LA11			5									5)			0.005			
	16 x 230 V UC	6ES5 436-7LB11			5									5)			0.005			
	8 x 230 V UC	6ES5 436-7LC11			5									5)			0.005			
	32 x 5 ... 15 V DC	6ES5 434-4UA12		●	6												0.005			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-7LA12			5									5)			0.08			
	32 x 24 V DC; 0.5 A	6ES5 451-7LA.1			5									5)			0.01			
	16 x 24 V DC ... 60 V; 0.5 A	6ES5 453-7LA11			5									5)			0.1			
	16 x 24 V DC; 2 A	6ES5 454-7LA12			5									5)			0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11			5									5)			0.05			
	16 x 48 ... 115 V AC; 1 A	6ES5 455-7LA11			5									5)			0.175			
	16 x 115 V ... 230 V AC; 1 A	6ES5 456-7LA11			5									5)			0.07			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11			5									5)			0.035			
	32 x 5 ... 24 V DC; 0.1 A	6ES5 457-7LA11			5									5)			0.1			
	16 x 30 V AC relay contacts	6ES5 458-7LA11			5									5)			0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11			5									5)			0.05			
	16 x 250 V AC relay contacts	6ES5 458-7LC11			5									5)			0.05			
	16 x 24 V DC; 2 A	6ES5 453-4UA12		●	6												0.12			
Digital input/ output module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11			5									5)			0,05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11			5									5)			0.05			
	24 V DC; 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21			5									5)			0.05			
	24 V DC; 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31			5									5)			0.15			
	24 V DC: 24 inputs, 16 outputs 1.5 A	6ES5 485-7LA11			5									5)			0.1			
Analog input module	8 inputs	6ES5 460-7LA13			5									5)			0.15			
	8/16 inputs	6ES5 465-7LA13			5									5)			0.15			
	4 inputs	6ES5 463-4U.12		●	6									5)			0.2			
	8/16 inputs	6ES5 466-3LA11		●	4									5)			0.7			
Analog output mod.	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12			5									5)			0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12			5									5)			0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12			5									5)			0.25			
Power ouput module[5),6)]	(max. 1.25 A)	6ES5 776-7LA13			5									5)			0.09			
	(max. 2.5 A)	6ES5 776-7LA13	●		5									5)			0.09			
Intelli- gent I/O modules	IP 240 for counting, pos. dec. and pos.	6ES5 240-1AA21		●	7												0.8[2)]			
	IP 241 for counting and pos. dec.[5)]	6ES5 241-1AA12	●	●	7												1.0[2),3)]			
	IP 242A for counting[5), 6)]	6ES5 242-1AA32		●	7												1.1			
	IP 242B for counting[5)]	6ES5 242-1AA41		●	7												1.1			
	IP 243 for analog value processing	6ES5 243-1AA13		●	4												0.6			
	IP 244 for temperature control	6ES5 244-3AB31		●	7												0.4			
	IP 246 I/A for contr. pos., incremental	6ES5 246-4U..1	●	●	7												1.3[2)]			
	IP 246 I/A for contr. pos., absolute	6ES5 246-4U.1		●	7												1.3[2)]			
	IP 247 for contr. pos.	6ES5 247-4UA31	●	●	7												0.8[2)]			
	IP 252 for closed-loop control	6ES5 252-3AA13		●	3/7												2.3			
	IP 260 for high-speed cl.-loop control	6ES5 260-4UA11		●	7												—			
	IP 261 for proportioning	6ES5 261-4UA11		●	7												0.05			
	IP 281 for counting	6ES5 281 4U.12		●	7												0.6			
	WF 705 for position decoding[5)]	6FM1 705-3AA00		●	7												0.5[3)]			
	WF 706 for contr. pos. 3-channel[5)]	6FM1 706-3AA20		●	7												0.75[3)]			

	WF 706 for contr. pos. 6-channel[5]	6FM1 706-3AB20		•	7												1,5[3]			
	WF 707 for cam controller module[5]	6FM1 707-3AA10			7												0.55			
	WF 721 for contr. positioning[5]	6FM1 721-3AA20		•	7												1.0[3]			
	WF 723 for contr. positioning[5]	6FM1 723-3.A.0		•	7												1.3[3]			
Commu-	CP 523 for point-to-point link	6ES5 523-3UA11		•	3												0.13			
nications	CP 524 for point-to-point link	6ES5 524-3UA15	•	•	3												1.5			
proces-	CP 544 for point-to-point link	6ES5 544-3U.11		•	7												>0.9[1]			
sors	CP 527 for HMI	6AV1 242-0AB.0		•	7												1.5			
	CP 528 for HMI digital or analog	6AV4 012-0AA10-0AB0		•	7												1.8			
	CP 530 for SINEC L1, block-type	6ES5 530-7LA12			3												1.0			
	CP 530 for SINEC L1, compact	6ES5 530-3LA12		•	3												1.0			
	CP 2430 (I/O, page operation) f. AS interf.	6GK1 243-0SA10		•													0.7			
	CP 5431 FMS/DP for PROFIBUS	6GK1 543-1AA00		•	7												0,45			
	CP 1430 TF for Ind. Ethernet	6GK1 143-0AA01		•	3												2.5			
	CP 1430 FT for Ind. Ethernet	6GK1 143-0AB01		•	3												4.5			
	CP 1473 MAP for Ind. Ethernet[5]	6GK1 147-3MA00	•	•	7												0.45			
Special	CP 516	6ES5 516-3UA11		•	7												0.8			
applica-	IM 304 interface module	6ES5 304-3UB11		•	7												1.5			
tions	IM 305 interface module	6ES5 305-7L.11															0.01/1[4]			
	IM 306 interface module	6ES5 306-7LA11			7												0.05/2[4]			
	IM 307 interface module	6ES5 307-3UA11		•	7												1			
	IM 308 interface module	6ES5 308-3UA12		•	7												0.5			
	IM 308-C interface module	6ES5 308-3UC11		•	7												0.6			
only for	CPU 942H	6ES5 942-7UH11			3												0.7			
S5-115H	IM 304 int. module, CC int., 2nd CC	6ES5 304-3UB11		•	7												1.5			
	IM 324R int. mod., CC int., 1st CC	6ES5 324-3UR11		•	7												1.0			
Total current for central controller																				

1) Depending on the interface module 2) Without sensor supply 3) Allowance must also be made for the respective sensor matching module for each channel used 4) Power consumption/current supply to EU 5) Nor for S5-115H
6) Not in conjunction with CPU 945 7) For power supply of a transceiver max. 4.2 A 8) Not for S5-115F

Total current for the central controller and central expansion units
(carried forward from the configuring sheets for central EUs)

1st EU + 2nd EU + 3rd EU + CC =

PS 951 power supply module		up to 3A: 6ES5 951-7LB21; up to 7 A (PLC without fan) or up to 15 A (PLC with fan): 6ES5 951-7LD21/-7ND51/-7ND41	
Accessories			
1 Adapter casing		6ES5 491-0L.11	
2 Long fan subassembly 24 V DC or 230 V AC		6ES5 981-0HA.1	
3 RAM, EEPROM, EPROM memory submodule		6ES5 37 . -	
4 Front connector K, crimp/screw connection		6XX3 068/6XX3 081	
5 Front connector 490, crimp/screw/spring-type connection		6ES5 490-7 . . . 1	
6 Frontconnector 497, crimp/screw connection		6ES5 497-4U . . .	
7 Other			

Sum
+
Total price of expansion units
=
Total price

CR 700-3 subrack for S5-115U and S5-115H

Component list			General accessories (No., see below)	Adapter casing required (●)	Fan subassembly required (●)	Slot No. PS	CPU	0	1	2	3	4	5	6	IM	Module Qty.	Current cons. at 5 V A	Sum A	Price each	total
Module type		Order No.				Cross modules required														
CPU	CPU 941, CPU 942	6ES5 94.-7UB11			3												0.16			
	CPU 943, CPU 944 with 1/2 interfaces	6ES5 94.-7UB.1			3												0.2/0.45			
	CPU 945	6ES5 945-7UA.3			3												0.55/1.25[1]			
Digital input module	32 x 24 V DC	6ES5 420-7LA11			5												0.005			
	32 x 24 V DC	6ES5 430-7LA12			5												0.005			
	16 x 24 ... 48 V UC	6ES5 431-7LA11			5												0.005			
	16 x 48 ... 60 V UC	6ES5 432-7LA11			5												0.005			
	8 x 24 V DC	6ES5 434-7LA12			5												0.07			
	16 x 115 V UC	6ES5 435-7LA11			5												0.005			
	16 x 115 V UC	6ES5 435-7LB11			5												0.005			
	8 x 115 V UC	6ES5 435-7LC11			5												0.005			
	16 x 230 V UC	6ES5 436-7LA11			5												0.005			
	16 x 230 V UC	6ES5 436-7LB11			5												0.005			
	8 x 230 V UC	6ES5 436-7LC11			5												0.005			
	32 x 5 ... 15 V DC	6ES5 434-4UA12		●	6												0.08			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-7LA12			5												0.01			
	32 x 24 V DC; 0.5 A	6ES5 451-7LA.1			5												0.1			
	16 x 24 V DC ... 60 V; 0.5 A	6ES5 453-7LA11			5												0.05			
	16 x 24 V DC; 2 A	6ES5 454-7LA12			5												0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11			5												0.05			
	16 x 48 ... 115 V AC; 1 A	6ES5 455-7LA11			5												0.175			
	16 x 115 V ... 230 V AC; 1 A	6ES5 456-7LA11			5												0.07			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11			5												0.035			
	32 x 5 ... 24 V DC; 0.1 A	6ES5 457-7LA11			5												0.1			
	16 x 30 V AC relay contacts	6ES5 458-7LA11			5												0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11			5												0.05			
	16 x 250 V AC relay contacts	6ES5 458-7LC11			5												0.05			
	16 x 24 V DC; 2 A	6ES5 453-4UA12		●	6												0.12			
Digital input/ output module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11			5												0.05			
	24 V DC; 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11			5												0.05			
	24 V DC; 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21			5												0.05			
	24 V DC; 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31			5												0.15			
	24 V DC; 24 inputs, 16 outputs 1.5 A	6ES5 485-7LA11			5												0.1			
Analog input module	8 inputs	6ES5 460-7LA13			5												0.15			
	8/16 inputs	6ES5 465-7LA13			5												0.15			
	4 inputs	6ES5 463-4U.12		●	6												0.2			
	8/16 inputs	6ES5 466-3LA11		●	4												0.7			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12			5												0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12			5												0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12			5												0.25			
Power output module[5]	(max. 1.25 A)	6ES5 776-7LA13			5												0.09			
	(max. 2.5 A)	6ES5 776-7LA13	●		5												0.09			
Intelligent I/O modules	IP 240 for counting, pos. dec. and pos.	6ES5 240-1AA21		●	7												0.8[2]			
	IP 241 for counting and pos. dec.[5]	6ES5 241-1AA12	●	●	7												1.0[2),3)]			
	IP 242A for counting[5), 6)]	6ES5 242-1AA32		●	7												1.1			
	IP 242B for counting[5)]	6ES5 242-1AA41		●	7												1.1			
	IP 243 for analog value processing	6ES5 243-1AA13		●	4												0.6			
	IP 244 for temperature control	6ES5 244-3AB31		●	7												0.4			
	IP 246 I/A for contr. pos., incremental	6ES5 246-4U . .1		●	7												1.3[2]			
	IP 246 I/A for contr. pos., absolute	6ES5 246-4U . .1		●	7												1.3[2]			
	IP 247 for contr. pos.	6ES5 247-4UA31		●	7												0.8[2]			
	IP 252 for closed-loop control	6ES5 252-3AA13		●	3/7												2.3			
	IP 260 for high-speed cl.-loop control[6)]	6ES5 260-4UA11		●	7												—			
	IP 261 for proportioning[6)]	6ES5 261-4UA11		●	7												0.05			
	IP 281 for counting	6ES5 281 4U. 12		●	7												0.6			
	WF 705 for position decoding[5)]	6FM1 705-3AA00		●	7												0.5[2]			

Intelli-gent I/O modules	WF 706 for contr. pos., 3-channel[5]	6FM1 706-3AA20		•	7														0.75[2]			
	WF 706 for contr. pos., 6-channel[5]	6FM1 706-3AB20		•	7														1.5[2]			
	WF 707 for cam controller module[5]	6FM1 707-3AA10		•	7														0.55			
	WF 721 for contr. positioning[5]	6FM1 721-3AA20		•	7														1.0[2]			
	WF 723 for contr. positioning[5]	6FM1 723-3.A.0		•	7														1.3[2]			
Commu-nica-tions-proces-sors	CP 523 for point-to-point link	6ES5 523-3UA11		•	3														0.13			
	CP 524 for point-to-point link	6ES5 524-3UA13	•	•	3														1.5			
	CP 544 for point-to-point link	6ES5 544-3U.11		•	7														>0.9[1]			
	CP 527 for HMI	6AV1 242-0AB. 0		•	7														1.5			
	CP526/527 for HMI, exp. module	6ES5 526-3LA22	•	•	7														2.3			
	CP 528 for HMI, digital or analog[7]	6AV4 012-0AA10-0AB0		•	7														1.8			
	CP 530 for SINEC L1, block-type	6ES5 530-7LA12			3														1.0			
	CP 530 for SINEC L1, compact	6ES5 530-3LA12		•	3														1.0			
	CP 2430 (I/O, page operation) f. AS interf.	6GK1 243-0SA10		•															0.7			
Commu-nica-tions-proces-sors	CP 5431 FMS	6GK1 543-1AA00		•	3														0.45			
	CP 1430 TF for Ind. Ethernet	6GK1 143-0AA01		•	3														2.5			
	CP 1430 TF for Ind. Ethernet	6GK1 143-0AB01		•	3														4.5			
	CP 1473 MAP for Ind. Ethernet[12]	6GK1 147-3MA00	•	•	7														4.2			
Special applica-tions	CP 516	6ES5 516-3UA11		•	7														0.8			
	CP 581, SIMATIC PC, modular																					
	- Basic module	6ES5 581- 1ED13		•	7														1.8			
	- Mass storage module[8]	6ES5 581-3LA11		•	7														0.5			
	- Slot module (max. 2)[9]	6ES5 581-0RA12		•	7														0.8[10]			
	IM 304 interface module	6ES5 304-3UB11		•	7														1.5			
	IM 305 interface module	6ES5 305-7L . 11																	0.01/1[4]			
	IM 306 interface module	6ES5 306-7LA11			7														0.05/2[4]			
	IM 307 interface module	6ES5 307-3UA11		•	7														1			
	IM 308 interface module[5]	6ES5 308-3UA12		•	7														0.5			
	IM 308-C interface module	6ES5 308-3UC11		•	7														0.6			
only for S5-115H	CPU 942H	6ES5 942-7UH11			3														0.7			
	IM 304 int. module, CC int. 2nd CC	6ES5 304-3UB11		•	7														1.5			
	IM 324R int. module, CC int. 1st CC	6ES5 324-3UR11		•	7														1.0			
Total current for central controller																						

1) Depending on the interface module 2) Without sensor supply 3) Allowance must also be made for the resprective sensor matching module for each channel used 4) Power consumption/current supply EU 5) Not for S5-115H 6)Not in conjunction with CPU 945 7) Available soon for S5-115H 8) Mass storage module can only be plugged in directly to the right of the basic module 9) Slot modules can be plugged in directly to the right of the basic, mass storage or slot module 10) Without plugged-in AT modules 11) For power supply of a transceiver max. 4.2 A 12) Not for S5-115F

Total current of the central controller and central expansion units
(carried forward from the configuring sheets for central EUs)

1st EU		2nd EU		3rd EU		CC	=	

PS 951 power supply module	up to 3A: 6ES5 951-7LB21-7NB21; up to 7 A (PLC without fan) or up to 15 A (PLC without fan): 6ES5 951-7LD21/-7ND51/-7ND41	

Accessories

1	Adapter casing	6ES5 491-0L.11	
2	Long fan subassembly 24 V DC or 230 V AC	6ES5 981-0HA.1	
3	RAM, EEPROM, EPROM memory submodule	6ES5 37 . -	
4	Front connector K, crimp/screw connection	6XX3 068/6XX3 081	
5	Front conector 490 crimp/screw/spring-type connection	6ES5 490-7 . . . 1	
6	Front connector 497, crimp/screw connection	6ES5 497-4U . . .	
7	Other		

Sum +
Total price of expansion units =
Total price

ER 701-0 subrack for S5-115U and S5-115H

Component list			General accessories (No., see below) / Adapter casing required (●)		Slot No. 0	1	2	3	4	5	IM	Module Qty.	Current consumption at 5 V A	Sum A	Price each	total
Module type		Order No.			Cross modules required											
Digital input module	32 x 24 V DC	6ES5 420-7LA11		5									0.005			
	32 x 24 V DC	6ES5 430-7LA12		5									0.005			
	16 x 24 ... 48 V UC	6ES5 431-7LA11		5									0.005			
	16 x 48 ... 60 V UC	6ES5 432-7LA11		5									0.005			
	16 x 115 V UC	6ES5 435-7LA11		5									0.005			
	16 x 115 V UC	6ES5 435-7LB11		5									0.005			
	8 x 115 V UC	6ES5 435-7LC11		5									0.005			
	16 x 230 V UC	6ES5 436-7LA11		5									0.005			
	16 x 230 V UC	6ES5 436-7LB11		5									0.005			
	8 x 230 V UC	6ES5 436-7LC11		5									0.005			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-7LA12		5									0.01			
	32 x 24 V DC; 0.5 A	6ES5 451-7LA.1		5									0.1			
	16 x 24 V ... 60 V DC; 0.5 A	6ES5 453-7LA11		5									0.05			
	16 x 24 V DC; 2 A	6ES5 454-7LA12		5									0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11		5									0.05			
	16 x 48 ... 115 V AC; 1 A	6ES5 455-7LA11		5									0.175			
	16 x 115 V ... 230 V AC; 1 A	6ES5 456-7LA11		5									0.07			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11		5									0.035			
	32 x 5 ... 24 V DC; 0.1 A	6ES5 457-7LA11		5									0.1			
	16 x 30 V AC relay contacts	6ES5 458-7LA11		5									0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11		5									0.05			
	16 x 250 V UC relay contacts	6ES5 458-7LC11		5									0.05			
Digital I/O module	24 V DC: 16 inputs, 16 outputs 0,5 A	6ES5 482-7LA11		5									0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11		5									0.05			
	24 V DC; 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21		5									0.05			
	24 V DC; 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31		5									0.15			
	24 V DC: 24 inputs, 16 outputs 1.5 A	6ES5 485-7LA11		5									0.1			
Analog input module	8 inputs	6ES5 460-7LA13		5									0.15			
	8/16 inputs	6ES5 465-7LA13		5									0.15			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12		5									0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12		5									0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12		5									0.25			
Power output module[2]	(max. 1.25 A)	6ES5 776-7LA13		5									0.09			
	IM 305 interface module	6ES5 305-7L.11											0.01/1			
	IM 306 interface module	6ES5 306-7LA11		7									0.05/2[1]			
Total current (carried over, where applicable, to the configuring sheets of a central contoller or of a distributed expansion unit)																

1) Power consumption/current supply to EU 2) Not for S5-115H

Accessories			
5 Front connector 490, crimp/screw/spring-type connection	6ES5 490-7 . . . 1		
7 Other			

Total price ER 701-0

ER 701-1 subrack for S5-115U and S5-115H

Component list			General accessories (No., see below) / Adapter casing required (●)		Slot No. 0	1	2	3	4	5	6	7	8	IM	Module Qty.	Current consumption at 5 V A	Sum A	Price each	total
Module type		Order Nr.			Cross modules required														
Digital input module	32 x 24 V DC	6ES5 420-7LA11		5												0.005			
	32 x 24 V DC	6ES5 430-7LA12		5												0.005			
	16 x 24 to 48 V UC	6ES5 431-7LA11		5												0.005			
	16 x 48 to 60 V UC	6ES5 432-7LA11		5												0.005			
	16 x 115 V UC	6ES5 435-7LA11		5												0.005			
	16 x 115 V UC	6ES5 435-7LB11		5												0.005			
	8 x 115 V UC	6ES5 435-7LC11		5												0.005			
	16 x 230 V UC	6ES5 436-7LA11		5												0.005			
	16 x 230 V UC	6ES5 436-7LB11		5												0.005			
	8 x 230 V UC	6ES5 436-7LC11		5												0.005			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-7LA12		5												0.01			
	32 x 24 V DC; 0.5 A	6ES5 451-7LA. 1		5												0.1			
	16 x 24 V DC to 60 V DC; 0.5 A	6ES5 453-7LA11		5												0.05			
	16 x 24 V DC; 2 A	6ES5 454-7LA12		5												0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11		5												0.05			
	16 x 48 to 115 V DC; 1 A	6ES5 455-7LA11		5												0.175			
	16 x 115 to 230 V AC; 1 A	6ES5 456-7LA11		5												0.07			
	8 x 115 to 230 V AC; 1 A	6ES5 456-7LB11		5												0.035			
	32 x 5 to 24 V DC; 0.1 A	6ES5 457-7LA11		5												0.1			
	16 x 30 V AC relay contacts	6ES5 458-7LA11		5												0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11		5												0.05			
	16 x 250 V AC relay contacts	6ES5 458-7LC11		5												0.05			
Digital-I/O module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11		5												0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11		5												0.05			
	24 V DC; 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21		5												0.05			
	24 V DC; 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31		5												0.15			
	24 V DC: 24 inputs, 16 ouputs 1.5 A	6ES5 485-7LA11		5												0.1			
Analog input module	8 inputs	6ES5 460-7LA13		5												0.15			
	8/16 inputs	6ES5 465-7LA13		5												0.15			
Analog output module	8 outputs, ± 10 V; 0 to 20 mA	6ES5 470-7LA12		5												0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12		5												0.25			
	8 outputs, 1 to 5 V; 4 to 20 mA	6ES5 470-7LC12		5												0.25			
Power output modules[2]	(max. 1,25 A)	6ES5 776-7LA13		5												0.09			
	IM 305 interface module	6ES5 305-7L . 11														0,01/1			
	IM 306 interface module	6ES5 306-7LA11		7												0.05/2[1]			
Total current (carried over, where applicable, to the configuring sheets of a central controller or a distributed expansion unit)																			

1) Power consumption/current supply to EU 2) Not for S5-115H

Accessories			
5	Front connector 490, crimp/screw/spring-type connection	6ES5 490-7 . . . 1	
7	Other		

Total price expansion units

ER 701-2 subrack for S5-115U and S5-115H

Component list

General accessories (No., see below)
Adapter casing required (●)
Fan subassembly required (●)

Module type		Order No.	Adapter casing	Fan subassembly	General accessories	Slot No. PS	0	1	2	3	4	5	6	7	IM	Module Qty.	Current consumption at 5 V A	Sum A	Price each	total
						Cross modules required														
Digital input module	32 x 24 V DC	6ES5 420-7LA11			5												0.005			
	32 x 24 V DC	6ES5 430-7LA12			5												0.005			
	16 x 24 ... 48 V UC	6ES5 431-7LA11			5												0.005			
	16 x 48 ... 60 V UC	6ES5 432-7LA11			5												0.005			
	16 x 115 V UC	6ES5 435-7LA11			5												0.005			
	16 x 115 V UC	6ES5 435-7LB11			5												0.005			
	8 x 115 V UC	6ES5 435-7LC11			5												0.005			
	16 x 230 V UC	6ES5 436-7LA11			5												0.005			
	16 x 230 V UC	6ES5 436-7LB11			5												0.005			
	8 x 230 V UC	6ES5 436-7LC11			5												0.005			
	32 x 5 ... 15 V DC	6ES5 434-4UA12		●	6												0.08			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-7LA12			5												0.01			
	32 x 24 V DC; 0.5 A	6ES5 451-7LA.1			5												0.1			
	16 x 24 ... 60 V DC; 0.5 A	6ES5 453-7LA11			5												0.05			
	16 x 24 V DC; 2 A	6ES5 454-7LA12			5												0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11			5												0.05			
	16 x 48 ... 115 V AC; 1 A	6ES5 455-7LA11			5												0.175			
	16 x 115 ... 230 V AC; 1 A	6ES5 456-7LA11			5												0.07			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11			5												0.035			
	32 x 5 ... 24 V DC; 0.1 A	6ES5 457-7LA11			5												0.1			
	16 x 30 V AC relay contacts	6ES5 458-7LA11			5												0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11			5												0.05			
	16 x 250 V AC relay contacts	6ES5 458-7LC11			5												0.05			
Digital I/O module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11			5												0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11			5												0.05			
	24 V DC; 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21			5												0.05			
	24 V DC; 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31			5												0.15			
	24 V DC: 24 inputs, 16 outputs 1.5 A	6ES5 485-7LA11			5												0.1			
Analog input module	8 inputs	6ES5 460-7LA13			5												0.15			
	8/16 inputs	6ES5 465-7LA13			5												0.15			
	4 inputs	6ES5 463-4U.12		●	6												0.2			
	8/16 inputs	6ES5 466-3LA11		●	4												0.7			
Analog output mod.[1,2]	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12			5												0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12			5												0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12			5												0.25			
Power output module[2]	(max. 1.25 A)	6ES5 776-7LA13			5												0.09			
	(max. 2.5 A)	6ES5 776-7LA13	●		5												0.09			
Communication-sproces-sor	CP 523 point-to-point link	6ES5 523-3UA11		●	3												0.13			

IM 306 interface module (always req.)	6ES5 306-7LA11			7												0.05/2[1]			
IM 314 interface module	6ES5 314-3UA11		•	7												1			
IM 317 interface module	6ES5 317-3UA11		•	7												1			
IM 318 interface module[2]	6ES5 318-3UA11		•	7												0.3			
313 monitoring module[2]	6ES5 313-3AA12		•													0.4			
Total current for expansion unit																			

1) Power consumption/current supply to EU 2) Not for S5-115H

Total current for expansion unit and central expansion units connected to ER 701-2
(carried over from the configuring sheets for central EUs)

1st EU + 2nd EU + 3rd EU + CC =

PS 951 power supply module	up to 3A: 6ES5 951-7LB21-7NB21; up to 7 A (PLC without fan) or up to 15 A (PLC without fan): 6ES5 951-7LD21/-7ND51/-7ND41		

Accessories

1	Adapter casing	6ES5 491-0L.11		
2	Long fan subassembly 24 V DC or 230 V AC	6ES5 981-0HA.1		
3	RAM, EEPROM, EPROM memory submodule	6ES5 37. -		
4	Front connector K, crimp/screw connection	6XX3 068/6XX3 081		
5	Front connector 490, crimp/screw/spring-type connection	6ES5 490-7 . . . 1		
6	Front connector 497, crimp/screw connection	6ES5 497-4U . . .		
7	Other			

Sum +

Total price of central expansion units connected to ER 701-2 =

Total price

ER 701-3 subrack for S5-115U and S5-115H

Component list

General accessories (No., see below)
Adapter casing required (●)
Fan subassembly required (●)

Module type		Order No.	Adapter casing required (●)	Fan subassembly required (●)	General accessories (No., see below)	Slot No. PS	0	1	2	3	4	5	6	7	IM	Module Qty.	Current cons. at 5 V A	Sum A	Price each	Price total
		Cross modules required																		
Digital input module	32 x 24 V DC	6ES5 420-7LA11			5												0.005			
	32 x 24 V DC	6ES5 430-7LA12			5												0.005			
	16 x 24 ... 48 V UC	6ES5 431-7LA11			5												0.005			
	16 x 48 ... 60 V UC	6ES5 432-7LA11			5												0.005			
	16 x 115 V UC	6ES5 435-7LA11			5												0.005			
	16 x 115 V UC	6ES5 435-7LB11			5												0.005			
	8 x 115 V UC	6ES5 435-7LC11			5												0.005			
	16 x 230 V UC	6ES5 436-7LA11			5												0.005			
	16 x 230 V UC	6ES5 436-7LB11			5												0.005			
	8 x 230 V UC	6ES5 436-7LC11			5												0.005			
	32 x 5 ... 15 V DC	6ES5 434-4UA12		●	6												0.08			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-7LA12			5												0.01			
	32 x 24 V DC; 0.5 A	6ES5 451-7LA .1			5												0.1			
	16 x 24 ... 60 V DC; 0.5 A	6ES5 453-7LA11			5												0.05			
	16 x 24 V DC; 2 A	6ES5 454-7LA12			5												0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11			5												0.05			
	16 x 48 ... 115 V AC; 1 A	6ES5 455-7LA11			5												0.175			
	16 x 115 ... 230 V AC; 1 A	6ES5 456-7LA11			5												0.07			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11			5												0.035			
	32 x 5 ... 24 V DC; 0.1 A	6ES5 457-7LA11			5												0.1			
	16 x 30 V AC relay contacts	6ES5 458-7LA11			5												0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11			5												0.05			
	16 x 250 V AC relay contacts	6ES5 458-7LC12		●	5												0.05			
Digital input/ output module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11			5												0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11			5												0.05			
	24 V DC: 16 inptus, 16 outputs 0.5 A	6ES5 482-7LF21			5												0.05			
	24 V DC: 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31			5												0.15			
	24 V DC: 24 inputs, 16 outputs 1.5 A	6ES5 485-7LA11			5												0.1			
Analog input module	8 inputs	6ES5 460-7LA13			5												0.15			
	8/16 inputs	6ES5 465-7LA13			5												0.15			
	4 inputs	6ES5 463-4U .12		●	6												0.2			
	8/16 inputs	6ES5 466-3LA11		●	4												0.7			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA13			5												0.25			
	8 outputs, ± 10 V	6ES5 470-7LB13			5												0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC13			5												0.25			
Power output module[5]	(max. 1.25 A)	6ES5 776-7LA13			5												0.09			
	(max. 2.5 A)	6ES5 776-7LA13	●		5												0.09			
Intelli- gent I/O modules	IP 240 for counting, pos. dec. and pos.	6ES5 240-1AA21		●	7												0.8[2]			
	IP 241 for counting and pos. dec.[5]	6ES5 241-1AA12	●	●	7												1.0[2), 3]			
	IP 242A for counting[5), 6]	6ES5 242-1AA32		●	7												1.1			
	IP 242B for counting[5]	6ES5 242-1AA41		●	7												1.1			
	IP 243 for analog value processing	6ES5 243-1AA13		●	4												0.6			
	IP 244 for temperature control	6ES5 244-3AB31		●	7												0.4			
	IP 246 I/A for contr. pos., incremental[7]	6ES5 246-4UB31	●	●	7												1.3[2]			
	IP 246 I/A for contr. pos., absolute[7]	6ES5 246-4UA11		●	7												1.3[2]			
	IP 247 for contr. pos.	6ES5 247-4UA31	●	●	7												0.8[2]			
	IP 252 for closed-loop control[7]	6ES5 252-3AA13		●	3/7												2.3			
	IP 260 for high-speed cl.-loop control[6]	6ES5 260-4UA11		●	7												—			
	IP 261 for proportioning[6]	6ES5 261-4UA11		●	7												0.05			
	IP 281 for counting	6ES5 281-4U.12		●	7												0.6			
	WF 705 for position decoding[5),8]	6FM1 705-3AA00		●	7												0.5[2]			
	WF 706 for contr. pos., 3-channel[5),8]	6FM1 706-3AA20		●	7												0.75[2]			
	WF 706 for contr. pos., 6-channel[5),8]	6FM1 706-3AB20		●	7												1.5[2]			
	WF 707 for cam controller module[5),8]	6FM1 707-3AA10		●	7												0.55			
	WF 721 for contr. positioning[5),8]	6FM1 721-3AA20		●	7												1.0[2]			
	WF 723 for contr. positioning[5),8]	6FM1 723-3.A.0		●	7												1.3[2]			

Commu-	CP 523 for point-to-point link	6ES5 523-3UA11		•	3												0.13			
nications-	CP 524 for point-to-point link[7]	6ES5 524-3UA13	•	•	3												1.5			
proces-	CP 544 for point-to-point link	6ES5 544-3U.11		•	7												>0.9[1]			
sors	CP 526 for HMI, expansion module[7]	6ES5 526-3LA22	•	•	7												2.3			
	CP 527 for HMI[7]	6AV1 242-0AB.0		•	7												1.5			
	CP 528 for HMI analog[7]	6AV4 012-0AA10-0AB0		•	7												1.8			
	CP 530 for SINEC L1, block-type[7]	6ES5 530-7LA12			3												1.0			
	CP 530 for SINEC L1, compact[7]	6ES5 530-3LA12		•	3												1.0			
	CP 5430 TF for PROFIBUS[7]	6GK1 543-0AA01		•	3												0.33			
	CP 2430 (I/O, page operation) f. AS interf.	6GK1 243-0SA10		•													0,7			
	CP 5431 FMS/DP for PROFIBUS	6GK1 543-1AA00		•	7												0.45			
	CP 1430 TF for Ind. Ethernet	6GK1 143-0AA00	•	•	3												2.5			
	CP 1430 TF for Ind. Ethernet	6GK1 143-0AB01	•	•	3												4.5			
	CP 1473 MAP for Ind. Ethernet[10]	6GK1 147-3MA00	•	•	7												4.2			
Special	CP 516	6ES5 516-3UA11		•	7												0.8			
applica-																				
tions																				
	IM 306 interface module	6ES5 306-7LA11			7												0.05/2[4]			
	IM 307 interface module	6ES5 307-3UA11		•	7												1			
	IM 314 interface module	6ES5 314-3UA11		•	7												1			
	IM 317 interface module	6ES5 317-3UA11		•	7												1			
	IM 318 interface module[5]	6ES5 318-3UA11		•	7												0.3			
	313 monitoring module[5]	6ES5 313-3AA12		•													0.4			
Total current for expansion unit																				

1) Depending on the interface module 2) Without sensor supply 3) Allowance must also be made for the respective sensor matching module for each channel used 4) Power consumption/current supply EU 5) Not for S5-115H 6) Not in connection with CPU 945 7) Only for interface module IM 314 or IM 317 8) Only for interface module IM 314 9) For power supply of a transceiver max. 4.2 A 10) Not for S5-115F

Total current for expansion unit and central expansion units
(carried over from configuring sheets for central EUs)

1st EU	+	2nd EU	+	3rd EU	+	CC	=	

PS 951 power supply module	up to 3A: 6ES5 951-7LB21/-7NB21; up to 7 A (PLC without fan) or up to 15 A (PLC with fan): 6ES5 951-7LD21/-7ND51/-7ND41

Accessories

1	Adapter casing	6ES5 491-0L.11
2	Long fan subassembly 24 V DC or 230 V AC	6ES5 981-0HA.1
3	RAM, EEPROM, EPROM memory submodule	6ES5 37 .- .....
4	Front connector K, crimp/screw connection	6XX3 068/6XX3 081
5	Front connector 490, crimp/screw/spring-type connection	6ES5 490-7 ... 1
6	Front connector 497, crimp/screw connection	6ES5 497-4U ...
7	Other	

Sum

\+

Total price of central expansion units connected to ER 701-3

=

Total price

Addressing intelligent I/Os and CPs at S5-115U

Addressing intelligent I/Os and CPs

When configuring, attention must be paid to the address assignment of all modules used. The intelligent I/O modules and communications processors can be addressed in different address areas and therefore require different address widths. Addressing also depends on the CPU. For example, these modules can only be addressed in the page area or P area in the case of the CPU 942H and only in the P area when using the CPU 942F. The following table provides a simple overview.

Module	CPU 941, CPU 942, CPU 943, CPU 944					CPU 945					CPU 942H		CPU 942F
	Address area					Address area					Address area		Addr. area
	Page	P	Q	IM 3	IM 4	Page	P	Q	IM 3	IM 4	Page	P	P
IP 240	—	16	16	—	—	—	16	16	—	—	—	16	—
IP 241	—	8	8	—	—	—	8	8	—	—	—	8	—
IP 242A	1	1)	—	—	—	—	—	—	—	—	1	—	—
IP 242B	2	—	—	—	—	2	—	—	—	—	—	—	—
IP 243	—	8	8	—	—	—	8	8	—	—	—	8	—
IP 244[4]	—	32	—	—	—	—	32	32	—	—	—	32	—
IP 246 I/A	2	—	—	—	—	2	—	—	—	—	2	—	—
IP 247	4	—	—	—	—	4	—	—	—	—	4	—	—
IP 252	1	—	—	—	—	1	—	—	—	—	1	—	—
IP 260	—	2	—	—	—	—	—	—	—	—	—	2	—
IP 261	—	2	2	—	—	—	—	—	—	—	—	2	—
IP 281	—	8	8	—	—	—	8	8	—	—	—	8	—
WF 705, WF 706, WF 707	—	8	8	—	—	—	8	8	—	—	—	—	—
WF 721, WF 723A/B/C	—	32	32	32	32	—	32	32	32	32	—	—	—
CP 523	—	8	—	—	—	—	8	8	—	—	—	8	8
CP 524	1	—	—	—	—	1	—	—	—	—	1	—	—
CP 544	2/4/8[3]	—	—	—	—	2/4/8[3]	—	—	—	—	2/4/8	—	—
CP 527, CP 528, CP 530	1	—	—	—	—	1	—	—	—	—	1	—	—
CP 5430 TF	4[2]	2)	—	—	—	4	1)	1)	—	—	4	1)	—
CP 5431 FMS	4[2]	2)	—	—	—	4	1)	1)	—	—	4	1)	—
CP 143 FMS	4[2]	—	—	—	—	4	—	—	—	—	4	—	—
CP 1473 MAP	4[2]	—	—	—	—	4	—	—	—	—	4	—	—
CP 516	1/4[3]	—	—	—	—	1/4[3]	—	—	—	—	1/4[3]	—	—
CP 581	1/2/4/8[3]	—	—	—	—	1/2/4/8[3]	—	—	—	—	1/2/4/8[3]	—	—

Table 1: Address widths required (in byte) for the individual address areas of intelligent I/O modules and communications processors, depending on the CPU used.

1) Addressing in absolute area with a width of 1 Kbyte
2) Not for CPU 941
3) Parameter-selectable
4) Address width in absolute area: 32 byte

Design, I/O types for S5-115H

Design

In the basic configuration a fault-tolerant S5-115H programmable controller consists of two subunits each comprising

- A CR 700-0LB, CR 700-2, CR 700-2F or CR 700-3 subrack,
- A CPU 942H central processing unit with memory submodule
- A PS 951 power supply module with battery backup.

The two subunits are interconnected via IM 304 and IM 324R interface modules (in adapter casings) and the 721 connecting cable (max. 100 m/330 ft). Both subunits must have the same memory configuration.

There are three possible I/O configurations, depending on the degree of availability required of the I/O area:

- Single-sided configuration
- Switched configuration
- 2-fold redundant configuration

I/O types

I/O			Addresses required including read inputs (R-DI) without locating inputs/outputs			
Type	Designation	Configuration	DI	DQ	AI	AQ
1	Digital	single-sided	1 byte			
2	input	switched	1 byte			
3	(DI)	redundant	1 byte			
8	Digital	single-sided	—	1 byte		
9	output	switched	—	1 byte		
10	(DQ)	redundant	1 byte (R-DI)	1 byte		
13	Analog	single-sided			1 word	
14	input	switched			1 word	
15	(AI)	redundant			1 word	
18	Analog	single-sided				1 word
19	output	switched				1 word
20	(AQ)	redundant				1 word
24	CP/IP	single-sided	Addressing			
25		switched	according to module			

Table 2: Overview of I/O types and addresses required

Example	Allocated addresses	Wiring requirement
10 redundant DIs without error locating (I/O type 3)	2 byte for DIs	10 DE per subunit
5 redundant DIs with error locating (I/O type 3)	1 byte for DIs 1 bit for L-DIs 1 bit L-DQs	5 DIs per subunit 1 L-DIs per subunit 1 L-DQ per subunit
8 redundant DQs with error locating (I/O type 10)	1 byte for DQs 1 bit for L-DIs 1 bit for L-DQs 8 bits for R-DIs	8 DQs per subunit 1 L-DI per subunit 1 L-DQ per subunit 8 R-DI (subunit A, B or switched)

Table 3: Examples of addresses and inputs/outputs required for the redundant I/O configuration

Legend
DI, DQ = Digital input/output or binary input/output
AI, AQ = Analog input/output
L-DI, L-DQ = Locating input/output
R-DI = Readback input

Design, I/O types for S5-115H (continued)

I/O types
(continued)

In order to distinguish between the different configurations of the I/O modules including the CPs and IPs, they have been divided into I/O types. Each configuration has its own response mode:

- Single-sided configuration with types 1, 8, 13, 18 and 24
  The I/O module is permanently assigned to one of the two subunits. When the corresponding subunit is operating, the module is active. Information that has been read-in is also available in the other subunit irrespective of whether it is operating as the master or standby unit. The I/O address used may not be used in the second subunit.
- Switched configuration with types 2, 9, 14, 19 and 25
  Only the master unit addresses the I/O module. Information that has been read-in is automatically passed to the standby unit, so that if required the latter can continue the process without interruption.
- Redundant configuration with types 3, 10, 15 and 20
  The I/O modules are all provided in duplicate. They occupy the same I/O addresses in each subunit. In error-free operation, both I/O modules are active in each case.

The redundant I/O configuration (I/O types 3, 10, 15 and 20) is described on page 11/33.

Table 2 shows the addresses required for the various I/O modules in single-sided, switched and redundant configurations. Since the locating inputs and outputs are assigned in groups, no more than 1 byte for the L-DIs and 1 byte for the L-DQs is normally required per subunit.

Table 3 shows some examples of address requirements. It also shows the necessary wiring. If an input/output byte is occupied by some redundant DI or DQ addresses, it can no longer be used for non-redundant inputs and outputs.

Redundant I/O configuration for S5-115H

I/O types for redundant configuration

I/O type 3 (redundant digital inputs)

- I/O type 3 without fault location.
  If no locating inputs/outputs (L-DI, L-DQ) have been parameterized, the S5-115H continues to operate in the case of a dicrepancy with the value of the master. It is possible that this value is incorrect. If this case cannot be tolerated, the redundant digital inputs (DI) must be operated with fault location.

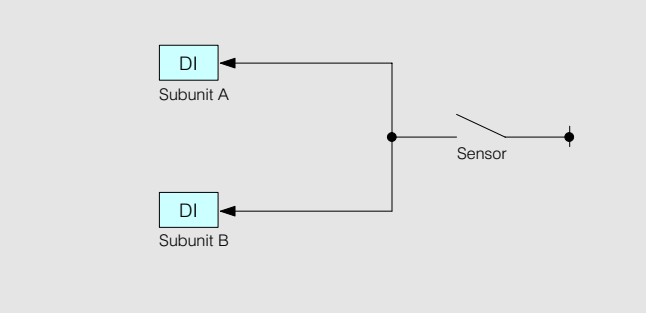

Fig. 11/1 Redundant digital input without fault location

- I/O type 3 with fault location.
  In this case, locating inputs/outputs (L-DI, L-DQ) are used in addition to the redundant digital inputs (DI). As well as recognizing the fault, the operating system can also locate and deactivate the faulty DI module. The S5-115H then continues to operate with the fault-free module only.

The L-DQ and L-DI modules are assigned in groups to the redundant DI modules.
A group consists of all the DIs connected to the same sensor supply

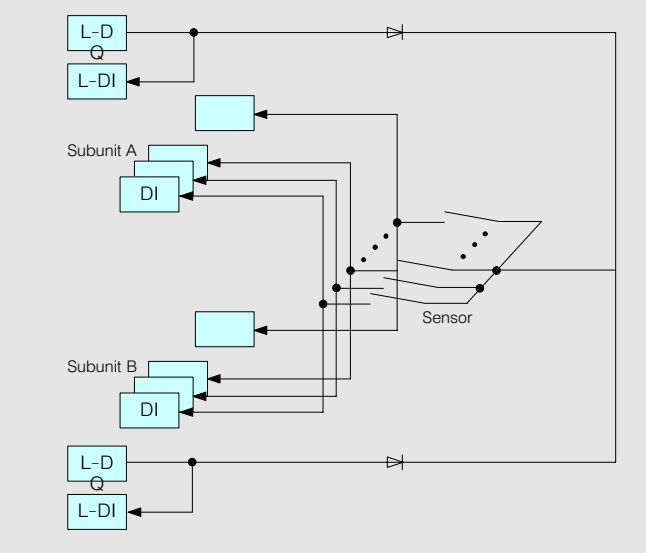

Fig. 11/2 Redundant digital input with fault location

I/O type 10 (redundant, intermittent digtal outputs)

I/O type 10 is designed for fault recognition with restricted or complete fault location (depending on the version) for the intermittent outputs. An output is intermittent if it changes its signal status at least once per hour. Since the R-DI readback digital inputs are permanently assigned to the redundant digital outputs (DQ), just as many R-DIs are required as redundant DQs.

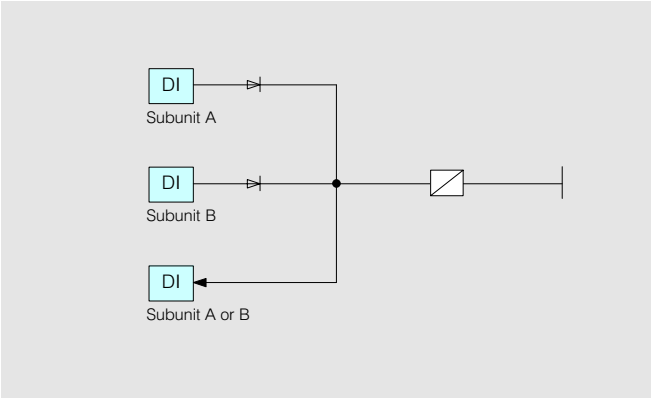

Fig. 11/3 Redundant intermittent digital output with restricted fault location

Redundant I/O configuration for S5-115H (continued)

I/O type 10 (redundant, intermittent digtal outputs) (continued)

- I/O type 10 with restricted fault location.
  If no locating inputs/outputs (L-DI, L-DQ) are parameterized, it is only possible to recognize and locate "permanent 0 faults" (DQ cannot be switched to "1"). If such a case cannot be tolerated, i. e. it must also be possible to handle "permanent 1 faults", the redundant digital outputs must be operated with fault location.
- I/O type 10 with fault location.
  In this case, locating inputs/outputs (L-DI, L-DQ) must be provided in addition to the redundant digital outputs (DQ) and the readback digital inputs (R-DI). The operating system can thus recognize and locate not only "permanent 0 faults", but can also deactivate the faulty DQ modules in the case of "permanent 1 faults". Together with the L-DQs it switches off the load supply of the DQ module briefly and checks the readback signals at the R-DIs. The S5-115H then continues to operate with the fault-free module until the faulty module is repaired.

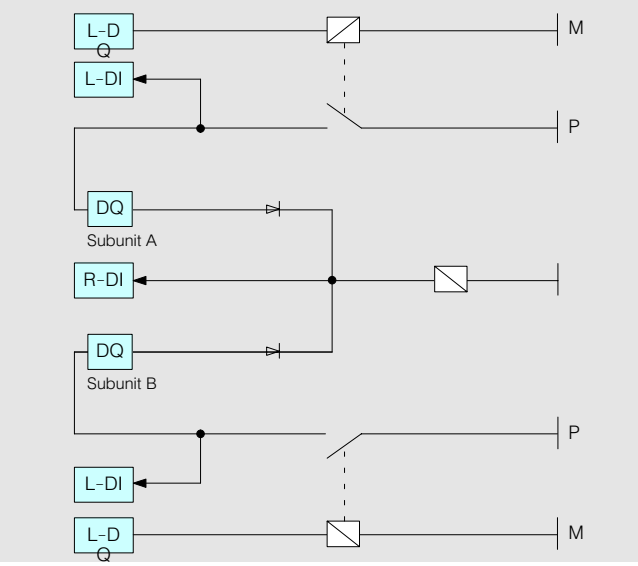

Fig. 11/4 Redundant, intermittent digital output with fault location

Decoupling

The outputs of the redundant digital output modules for 24 V DC connected in parallel must be decoupled with diodes. The same applies to locating outputs.

I/O type 15 (redundant analog inputs)

This I/O type provides fault recognition with restricted fault location in the case of redundant analog inputs (AI). During fault location, the operating system accesses fault information of AI modules via a standard function block. Fault information includes range violation, overrange and wire break. The operating system also reports unacceptable deviations in input values.

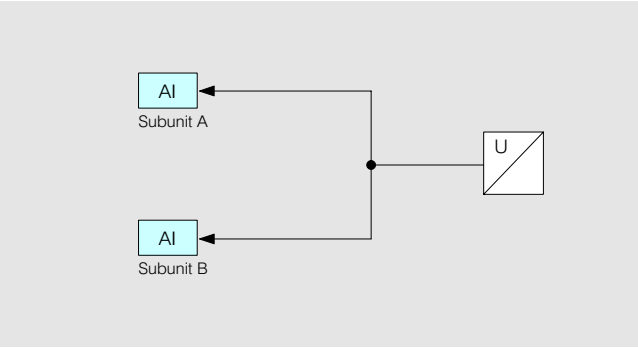

Fig. 11/5 Redundant analog input

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Redundant I/O configuration for S5-115H (continued)

I/O types for redundant configuration (continued)

I/O type 20 (redundant analog outputs)

This I/O type does not receive any operating system support in the recognition and locating of faults. The user must program these himself. The output values are output to both subunits in parallel.

Redundant inputs

Each subunit scans the inputs assigned to it. The user specifies a "discrepancy time" (10 ms to 320 s) for each digital input. This is the maximum permissible time deviation between the signals at two redundant inputs. The operating system monitors this discrepancy time. If the permissible time is exceeded, the operating system locates and reports the error (entry in error data block). In the case of analog input modules, the user specifies the maximum permissible value by which the input signals may deviate.

This "discrepancy window" is monitored by the ANEI function block. The block is supplied on diskette together with the COM 115H parameterization software.

Redundant outputs

In the case of redundant digital outputs, the operating system checks whether an error has occured. If required, the operating system signals the error (entry in error data block).

For redundant analog outputs there is no error detection. If required, this can be programmed by the user (e.g. with readback analog inputs).

Fault recognition and fault locating

In order to ensure non-stop operation, the operating system must not only detect but also locate faults so that the faulty module can be deactivated.

In the case of digital outputs, faults are recognized and located using auxiliary signals.

For redundant digital inputs and outputs fault detection is possible with or without fault locating.

For redundant analog inputs and outputs fault detection without fault locating is possible.

In the case of analog outputs, the operating system does not support fault recognition. If necessary, the user can program fault detection and loating himself.

Readback inputs, locating inputs and outputs

For fault detection of redundant DQs, readback inputs (R-DIs) are necessary; fault location requires locating inputs and outputs (L-DI, L-DQ).

Readback inputs are permanently assigned to their redundant outputs (1 readback input per output pair). Readback inputs can be allocated to subunit A, subunit B or a switched expansion unit. Locating inputs and outputs can be grouped for several inputs or outputs, e. g. together in one L-DI byte and one L-DQ byte per subunit.
As a general rule, a maximum of 1 byte per subunit for L-DIs and 1 byte per subunit for L-DQs is required.

Address assignment

The redundant digital input and output modules can only be operated in the process image area (addresses 0 to 127) and the analog input and output modules in the P area (addresses 128 to 255).

The auxiliary signals L-DI, L-DQ and R-DI required for fault recognition and locating can be operated in the entire P area.

Non-stop operation

For non-stop systems, input and output modules with fault locating functions must be used.

CR 700-2F subrack for S5-115H

Component list			General accessories (No., see below)	Adapter casing required (●)	Fan subassembly required (●)		Slot No.										Module Qty.	Current cons. at 5 V		Price	
							PS	CPU	0	1	2	3	4	5	6	IM					
Module type		Order No.					Cross modules required											A	Sum A	each	total
CPU	CPU 942H	6ES5 942-7UH11			3													0.7			
					3													0.7			
Digital input module	32 x 24 V DC	6ES5 420-7LA11			5													0.005			
	32 x 24 V DC	6ES5 430-7LA12			5													0.005			
	16 x 24 ... 48 V UC	6ES5 431-7LA11			5													0.005			
	16 x 48 ... 60 V UC	6ES5 432-7LA11			5													0.005			
	8 x 24 V DC	6ES5 434-7LA12			5													0.07			
	16 x 115 V UC	6ES5 435-7LA11			5													0.005			
	16 x 115 V UC	6ES5 435-7LB11			5													0.005			
	8 x 115 V UC	6ES5 435-7LC11			5													0.005			
	16 x 230 V UC	6ES5 436-7LA11			5													0.005			
	16 x 230 V UC	6ES5 436-7LB11			5													0.005			
	8 x 230 V UC	6ES5 436-7LC11			5													0.005			
	16 x 5 ... 15 V DC	6ES5 434-4UA12		●	6													0.08			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-7LA12			5													0.01			
	32 x 24 V DC; 0.5 A	6ES5 451-7LA.1			5													0.1			
	16 x 24 ... 60 V DC; 0.5 A	6ES5 453-7LA11			5													0.05			
	16 x 24 V DC; 2 A	6ES5 454-7LA12			5													0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11			5													0.05			
	16 x 48 ... 115 V AC; 1 A	6ES5 455-7LA11			5													0.175			
	16 x 115 ... 230 V AC; 1 A	6ES5 456-7LA11			5													0.07			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11			5													0.035			
	32 x 5 ... 24 V DC; 0.1 AV	6ES5 457-7LA11			5													0.1			
	16 x 30 V AC relay contacts	6ES5 458-7LA11			5													0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11			5													0.05			
	16 x 250 V AC relay contacts	6ES5 458-7LC11			5													0.05			
	16 x 24 V DC; 2 A	6ES5 453-4UA12		●	6													0.12			
Digital input/ output module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11			5													0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11			5													0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21			5													0.05			
	24 V DC: 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31			5													0.15			
	24 V DC: 24 inputs, 16 outputs 1.5 A	6ES5 485-7LA11			5													0.1			
Analog input module[1]	8 inputs	6ES5 460-7LA13			5													0.15			
	8/16 inputs	6ES5 465-7LA13			5													0.15			
	4 inputs	6ES5 463-4U.12		●	6													0.2			
	8/16 inputs	6ES5 466-3LA11		●	4													0.7			
Analog output module[1]	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12			5													0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12			5													0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12			5													0.25			
Intelli-gent I/O modules	IP 240 for counting, pos. dec. and pos.	6ES5 240-1AA21		●	7													0.8[2]			
	IP 243 für Analogwertverarbeitung	6ES5 243-1AA13		●	4													0.6			
	IP 244 for temperature control	6ES5 244-3AB31		●	7													0.4			
	IP 246 I/A for contr. pos., incremental	6ES5 246-4UB11		●	7													1.3[2]			
	IP 246 I/A for contr. pos., absolute	6ES5 246-4UA31		●	7													1.3[2]			
	IP 247 for contr. pos.	6ES5 247-4UA31		●	7													0.8[2]			
	IP 252 for closed-loop control	6ES5 252-3AA13		●	3/7													2.3			
	IP 260 for high-speed cl.-loop control	6ES5 260-4UA11		●	7													—			
	IP 261 for proportioning	6ES5 261-4UA11		●	7													0.05			
	IP 281 for counting	6ES5 281 4U.12		●	7													0.6			

Communications-processors	CP 523 for point-to-point link	6ES5 523-3UA11		•	3												0.13		
	CP 524 for point-to-point link	6ES5 524-3UA13	•	•	3												1.5		
	CP 544 for point-to-point link	6ES5 544-3U.11		•	3/7												>0.9[1]		
	CP 527 for HMI	6AV1 242-0AB.0		•	7												1.5		
	CP 528 for HMI, digital or analog	6AV4 012-0AA10-0AB0		•	7												1.8		
	CP 530 for SINEC L1, block-type	6ES5 530-7LA12			3												1.0		
	CP 530 for SINEC L1, compact	6ES5 530-3LA12		•	3												1.0		
	CP 5430 TF for PROFIBUS	6GK1 543-0AA01		•	3												0.33		
	CP 5431 FMS/DP for PROFIBUS	6GK1 543-1AA00		•	7												0.45		
	CP 1431 TF for Ind. Ethernet	6GK1 143-0AA01		•	3												2.5		
	CP 1431 FT for Ind. Ethernet	6GK1 143-0AB01		•	3												4.5		
Special applications	CP 516	6ES5 516-3UA11		•	7												0.8		
Interface module	IM 304	6ES5 304-3UB11		•	7												1.5		
	IM 305	6ES5 305-7L.11															0.01/1[4]		
	IM 306	6ES5 306-7LA11			7												0.05/2[4]		
	IM 307	6ES5 307-3UA11		•	7												1		
	IM 304, CC int., 1st CC	6ES5 304-3UB11		•	7												1.5		
	IM 324R, CC int., 2nd CC	6ES5 324-3UR11		•	7												1.0		
Total current for central controller																			

1) Depending on the interface module 2) Without sensor supply 3) Power consumption/current supply to EU

Total current of the central controller and central expansion units
(carried forward from the configuring sheets for central EUs)

[ ] 1st EU + [ ] 2nd EU + [ ] 3rd EU + [ ] CC = [ ]

PS 951 power supply module	up to 3A: 6ES5 951-7LB21/-7NB21; up to 7 A (PLC without fan) or up to 15 A (PLC with fan): 6ES5 951-7LD21/-7ND51/-7ND41	

Accessories			
1	Adapter casing	6ES5 491-0L . 11	
2	Long fan subassembly 24 V DC or 230 V AC	6ES5 981-0HA . 1	
3	RAM, EEPROM, EPROM memory submodule	6ES5 37 . -	
4	Front connector K, crimp/screw connection	6XX3 068/6XX3 081	
5	Front connector 490, crimp/screw/spring-type connection	6ES5 490-7 ... 1	
6	Front connector 497, crimp/screw connection	6ES5 497-4U ...	
7	Other		

Sum [ ]
+
Total price of expansion units [ ]
=
Total price [ ]

ER 701-3LH subrack for S5-115H with switched configuration

Component list

General accessories (No., see below)
Adapter casing required (●)
Fan subassembly required (●)

Module type		Order No.				Slot No. PS	0	1	2	3	4	5	6	7	IM	Module Qty.	Current cons. at 5 V A	Sum A	Price each	Price total
						Cross modules required														
Digital input module	32 x 24 V DC	6ES5 420-7LA11			5												0.005			
	32 x 24 V DC	6ES5 430-7LA12			5												0.005			
	16 x 24 ... 48 V UC	6ES5 431-7LA11			5												0.005			
	16 x 48 ... 60 V UC	6ES5 432-7LA11			5												0.005			
	8 x 24 V DC	6ES5 434-7LA12			5												0.07			
	16 x 115 V UC	6ES5 435-7LA11			5												0.005			
	16 x 115 V UC	6ES5 435-7LB11			5												0.005			
	8 x 115 V UC	6ES5 435-7LC11			5												0.005			
	16 x 230 V UC	6ES5 436-7LA11			5												0.005			
	16 x 230 V UC	6ES5 436-7LB11			5												0.005			
	8 x 230 V UC	6ES5 436-7LC11			5												0.005			
	32 x 5 ... 15 V DC	6ES5 434-4UA12		●	6												0.08			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-7LA12			5												0.01			
	32 x 24 V DC; 0.5 A	6ES5 451-7LA .1			5												0.1			
	16 x 24 ... 60 V DC; 0.5 A	6ES5 453-7LA11			5												0.05			
	16 x 24 V DC; 2 A	6ES5 454-7LA12			5												0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11			5												0.05			
	16 x 48 ... 115 V AC; 1 A	6ES5 455-7LA11			5												0.175			
	16 x 115 ... 230 V AC; 1 A	6ES5 456-7LA11			5												0.07			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11			5												0.035			
	32 x 5 ... 24 V DC; 0.1 A	6ES5 457-7LA11			5												0.1			
	16 x 30 V AC relay contacts	6ES5 458-7LA11			5												0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11			5												0.05			
	16 x 250 V AC relay contacts	6ES5 458-7LC11			5												0.05			
	16 x 24 V DC; 2 A	6ES5 453-4UA12		●	6												0.12			
Digital input/ output module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11			5												0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11			5												0.05			
	24 V DC; 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21			5												0.05			
	24 V DC; 8 inputs, 8 ouptuts 2.5 A	6ES5 482-7LF31			5												0.15			
	24 V DC: 24 inputs, 16 outputs 1.5 A	6ES5 485-7LA11			5												0.1			
Analog input module	8 inputs	6ES5 460-7LA13			5												0.15			
	8/16 inputs	6ES5 465-7LA13			5												0.15			
	4 inputs	6ES5 463-4U .12		●	6												0.2			
	8/16 inputs	6ES5 466-3LA11		●	4												0.7			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12			5												0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12			5												0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12			5												0.25			
Intelli-gent I/O modules	IP 240 for counting, pos. dec. and pos.	6ES5 240-1AA21		●	7												0.8 [2]			
	IP 243 for analog value processing	6ES5 243-1AA13		●	4												0,6			
	IP 244 for temperature control	6ES5 244-3AB31		●	7												0.4			
	IP 246 I/A for contr. pos., incremental	6ES5 246-4UA31		●	7												1.3 [2]			
	IP 246 I/A for contr. pos., absolute	6ES5 246-4UB11		●	7												1.3 [2]			
	IP 247 for contr. pos.	6ES5 247-4UA31		●	7												0.8			
	IP 252 for closed-loop control	6ES5 252-3AA13		●	3/7												2.3			

	IP 260 for high-speed cl.-loop control	6ES5 260-4UA11		•	7												—			
	IP 261 for proportioning	6ES5 261-4UA11		•	7												0.05			
	IP 281 for counting	6ES5 281 4U. 12		•	7												0.6			
Commu-nication-sproces-sors	CP 523 for point-to-point link	6ES5 523-3UA11		•	3												0.13			
	CP 524 for point-to-point link	6ES5 524-3UA13	•	•	3/7												1.5			
	CP 544 for point-to-point link	6ES5 544-3U.11		•	3/7												>0.9[1]			
	CP 526 for HMI expansion module	6ES5 526-3LA22	•	•	7												2.3			
	CP 527 for HMI	6AV1 242-0AB. 0		•	7												1.5			
	CP 528 for HMI, digital or analog	6AV4 012-0AA10-0AB0		•	7												1.8			
	CP 530 for SINEC L1, block-type	6ES5 530-7LA12			3												1.0			
	CP 530 for SINEC L1, compact	6ES5 530-3LA12		•	3												1.0			
	CP 2430 (page operation) for AS interface	6GK1 243-0SA10		•													0.7			
	CP 5431 FMS/DP for PROFIBUS	6GK1 543-1AA00		•	7												0.45			
	CP 1430 TF for Ind. Ethernet	6GK1 143-0T.0.		•	3												2.5			
	CP 1430 for Ind. Ethernet	6GK1 143-1AU00		•	3												4.5			
	CP 1473 MAP for Ind. Ethernet[5]	6GK1 147-3MA00	•	•	3												2.6[4]			
Special applica-tions	CP 516	6ES5 516-3UA11		•	3												0.8			
	IM 306 interface module	6ES5 306-7LA11			7												0.05/2[3]			
	IM 314R interface module	6ES5 314-3UR11		•	7												1			
Total current for expansion unit																				

1) Depending on the interface module 2) Without sensor supply 3) Power consumption/current supply to EU
4) For power supply of a transceiver max. 4.2 A 5) Not for S5-115F

Total current for expansion unit and central expansion units connected to ER 701-3
(carried over from the configuration sheets for the central EUs)

[ ] 1st EU + [ ] 2nd EU + [ ] 3rd EU + [ ] CC = [ ]

PS 951 power supply module	up to 3A: 6ES5 951-7LB21/-7NB21; up to 7 A (PLC without fan) or up to 15 A (PLC with fan): 6ES5 951-7LD21/-7ND51/-7ND41		

Accessories				
1	Adapter casing	6ES5 491-0L. 11		
2	Long fan subassembly 24 V DC or 230 V AC	6ES5 981-0HA. 1		
3	RAM, EEPROM, EPROM memory submodule	6ES5 37 . -		
4	Front connector K, crimp/screw connection	6XX3 068/6XX3 081		
5	Front connector 490, crimp/screw/spring-type connection	6ES5 490-7 . . . 1		
6	Front connector 497, crimp/screw connection	6ES5 497-4U . . .		
7	Other			

Sum [ ]
\+
Total price of expansion units [ ]
=
Total price [ ]

Design, I/O types for S5-115F

Design

In the basic configuration, an S5-115F programmable controller consists of 2 subunits each comprising 1

- CR 700-2F or CR 700-0LB subrack,
- CPU 942F with memory submodule,
- PS 951 power supply module with battery backup,
- IM 306 interface module (for address setting).

The two subunits are interconnected via IM 304 and IM 324 interface modules and the 721 connecting cable (max. 10m/33 ft) Both subunits must have the same memory configuration. Safety operation is only possible with EPROM and EEPROM submodules.

The supply voltage is 24 V DC. A transceiver connected to the CPU for interfacing with SINEC L1 or a programming device must have a separate power supply.

Each of the two subunits has 6 or 4 slots for I/O modules. If the number of slots is not sufficient, expansion units with ER 701 subracks can be used. These expansion units with ER 701 subracks can be connected either in centralized configurations using the IM 306 interface module or in distributed configurations using the IM 304 and IM 314 interface module
(see Section 3).

I/O types

All input and output modules specified in Section 3 may be used. The interconnections between modules and the type of connection of the signal leads determine the "I/O type". The table below contains the 11 different I/O types and the address space required.

For block diagrams see pages 11/43 up to 11/46. The main terms used in the diagrams are explained below:

Interrupt evaluation

A 434-7 digital input module for interrupt evaluation can be plugged into each subunit. Interrupt signals always require a two-channel configuration. They can be regarded as being safety-oriented if the falling edge triggers an interrupt.

Direct and indirect driving of actuators

Binary outputs can drive an actuator either directly or indirectly, i.e. via relays. Some actuators cannot be driven directly as their technical specifications do not allow this (see data sheet).

The relays must meet the regulations relating to the technical equipment of the plant in question.

Sensors: Proof against persistent faults, single-two-channel

Sensors are proof against persistent faults if according to their type of construction and certification they cannot initiate a dangerous state of the plant following a default. If sensors are proof against persistent faults, they can be connected in a single-channel configuration.

Otherwise, two sensors must be used, each of them sending signals to one subunit. In both cases, the operating system compensates for any small deviations between the switching instance of the two sensors.

Sensors: Controllable/ non-controllable

A sensor is non-controllable, if it cannot be powered individually via a binary output. Consequently, in the case of I/O type 3, the (test) signal must be routed via a relay module or a transistor module[1].

Intermittent signals

Signals at safety-oriented inputs and outputs are regarded as intermittent if the status changes frequently in response to process events within the second error occurrence period (permissible period of time: e.g. 24 hours):

- Binary signals changing to the other output state;
- Analog signals changing from the non-safety-related range to the safety-related limit value range.

Safety-oriented analog output modules

These analog output modules can only be implemented if the sensors and actuators are connected as in the following example: An analog output signal is read back by a safety analog input on the actuator. In the case of an error, a reset binary output provides an additional shutdown facility for the module.

Non-safety-related I/O types

These types can only be used for input and output modules which cannot cause a dangerous condition in the case of a defect.

I/O type (digital)			I/O type (analog)		
Type	Designation	safety-related	Type	Designation	safety-related
1	Binary	no	13	Analog	no
2	input	yes	14	input	yes
3	(DI)	yes	15	(AI)	yes
			16		yes
8	Binary	no			
9	output	yes	18	Analog output (AQ)	no
10	(DQ)	yes			

Overview of I/O types

1) For new systems DA 6ES5 453-4UA11 only

Characteristics of inputs and outputs, address assignment, scan time for S5-115F

Characteristics of inputs and outputs

Two-channel and safety-related configurations require that some of the inputs and outputs have special characteristics.

Binary inputs

At the beginning of each cycle, both subunits generate a process input image. If the operating system detects any deviations when comparing individual input signals, it will repeatedly read these inputs for a certain period of time (discrepancy time). However, if the input signals still deviate at the end of the permitted discrepancy time, a fault response is triggered.

The discrepancy time can be configured by the user with the support of the COM 115F parameterization software. If this time is not sufficient for some sensors, it is also possible to assign them a specific discrepancy time.

Non-intermittent (changing) signals at binary inputs (type 3) are deactivated and checked once within the selectable test cycle time by means of a test output. This test function need not to be taken into consideration when developing the user program.

Binary outputs

The operating system checks non-intermittent binary outputs (type 10) once every test cycle. If an output is "1" at that moment, it will be switched to "0" for a short instant (and vice versa) until the associated readback input has responded. When checking with the "1" signal, the actuator is at 0 current since the outputs are checked one after another. This test function need not to be taken into account in the user program.

Analog inputs

The user can specify in the COM 115F parameterization software how the S5-115F PLCs are to respond to deviating analog signals in two-channel systems. The deviation tolerances can be entered either absolutely or relative to the average measured value. The operating system unifies the signal values of the two subunits by generating minimum, maximum or average values.

Non-intermittent analog inputs (types 14 and 15) are checked by the operating system once within a test cycle via a test analog output.

No provisions need be made for this test function in the user program.

Analog inputs must be read exclusively by the standard function block FB 250 ANEI. This block is integrated in the operating system and permits safety functions such as range monitoring and wire break detection.

Analog outputs

The safety-related configuration of analog outputs is not possible.

Signal groups

All safety-related inputs and outputs can be combined to form signal groups using the COM 115F parameterization software. Any fault in one module will then result in passivation of all modules in a signal group. Passivated output modules must be deenergized by the user within a specified second fault occurrence period. The formation of signal groups provides a certain degree of independence between function groups, which enhances the availability of the system.

Address assignment

The addresses of the input and output modules plugged into a subrack can be set on the IM 306 interface module based in the same rack. An exception to this is the address of the 463-4 analog input module and 453-4 digital output module, which are set by means of a coding switching on the module itself. The module can therefore only be used in the CR 700-0LB, CR 700-2F and ER 701-3 subracks.

Digital modules

Word addresses (16 bits) are set for digital modules. The following addresses are permissible

- Input modules: 0 to 126
- Output modules: 0 to 124.

Analog modules

Addresses from 128 onwards are available for analog modules. A maximum of 64 word addresses can be assigned. This results in the following maximum number of modules:

- Eight 460-7 analog input modules with 8 word addresses
- Sixteen 463-4 analog input modules with 4 word addresses
- Eight 470-7 analog output modules with 8 word addresses.

If individual coding has not been preset on the 460-7 analog input module, the same addresses may be used by an output module. The addresses used by the 460-7 and 463-4 analog output values must not overlap.

Two-channel input and output modules

For two-channel input and output modules, corresponding modules of the two subunits must be assigned the same addresses.

Additional inputs and outputs for testing and readback are assigned to any vacant addresses with the COM 115 parameterization software.

In the case of analog input types 14 and 15, it is sufficient for inputs with the same measuring range to have identical analog output values.

Single-channel non safety-related input and output modules

Modules may be distributed over any unassigned slots in the two subunits. However, each address must only be assigned once per system.

Characteristics of inputs and outputs, address assignment, scan time for S5-115F (continued)

Scan time

The scan time of a program is defined by the following

- Run-time of the user program
- Run-time of the operating system

In order to determine the run-time of the user program, the execution times of all the statements of the blocks activated in a scan must be summated. On the average, the execution of 1000 statements is 15 ms.

The run-time of the operating system is approx. 60 ms to 250 ms per scan style (average 80 ms). The maximum run-time of the operating system is determined from the following factors

- 55 to 80 ms for operating system functions
- 5 to 10 ms for additional self-tests
- 12 to 140 ms for checking I/O modules
- 0 to 30 ms for processing discrepancy times

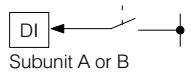
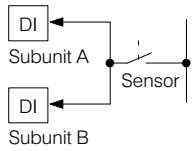
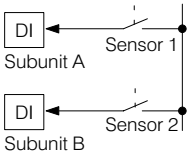
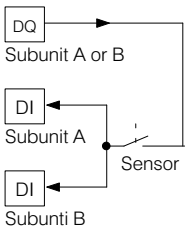
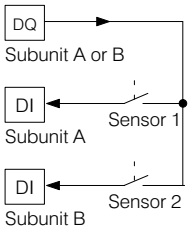
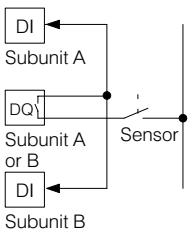
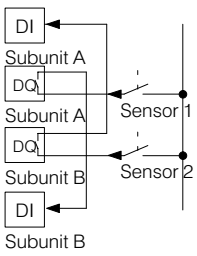
Generally, the last two time factors very rarely occur. The additional self-test is not carried out while checking I/O modules.

The scan time can also be extended by:

- Time-controlled organization blocks
- Interrupt-driven organization blocks
- The SINEC L1 LAN

Block diagrams and module combinations for S5-115F

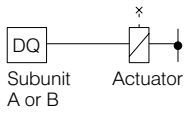
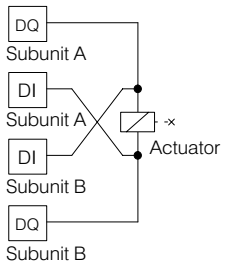
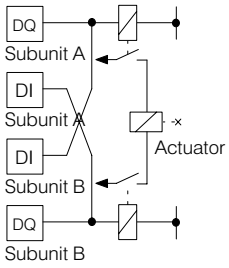
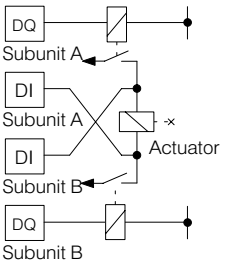
Block diagrams and module combinations

Block diagram	Characteristics	Permissible module combinations	
	I/O type 1; binary input; non safety-related	1 x DI or 1 x DI/DQ or 1 x DI or 1 x DI	**6ES5 430-7LA12** **6ES5 482-7LA11** **6ES5 435-7LC11** **6ES5 436-7LC11**
	I/O type 2; binary input; safety-related; intermittent mode; single-channel sensor	2 x DI or 2 x DI or 2 x DI	**6ES5 430-7LA12** **6ES5 435-7LC11** **6ES5 436-7LC11**
	I/O type 2 binary input; safety-related; intermittent mode; single-channel sensor	2 x DI or 2 x DI or 2 x DI	**6ES5 430-7LA12** **6ES5 435-7LC11** **6ES5 436-7LC11**
	I/O type 3; binary input; safety-related; single-channel sensor; sensor can be controlled	1 x DQ 2 x DI or 1 x DQ 2 x DI or 1 x DQ 2 x DI or 1 x DQ 2 x DI	**6ES5 451-7LA11** **6ES5 430-7LA12** **6ES5 456-7LB11** **6ES5 435-7LC11** **6ES5 456-7LB11** **6ES5 436-7LC11** **6ES5 451-7LA11** **6ES5 434-7LA12**
	I/O type 3; binary input; safety-related; two-channel sensor; sensor can be controlled	1 x DQ 2 x DI or 1 x DQ 2 x DI or 1 x DQ 2 x DI	**6ES5 451-7LA11** **6ES5 430-7LA12** **6ES5 456-7LB11** **6ES5 435-7LC11** **6ES5 456-7LB11** **6ES5 436-7LC11**
	I/O type 3; binary input; safety-related; single-channel sensor; sensor cannot be controlled	1 x DQ 2 x DI or 1 x DQ 2 x DI or 1 x DQ 2 x DI	**6ES5 458-7LA11**[1)] **6ES5 430-7LA12** **6ES5 458-7LB11** **6ES5 430-7LA11** **6ES5 458-7LB11** **6ES5 434-7LA11** **6ES5 458-7LA11**[1)] **6ES5 434-7LA11**
	I/O type 3; binary input; safety-related; two-channel sensor; sensor cannot be controlled	2 x DQ 2 x DI or 2 x DQ 2 x DI	**6ES5 458-7LA11**[1)] **6ES5 430-7LA12** **6ES5 458-7LB11** **6ES5 430-7LA12**

1) For new system 6ES5 453-4UA11 only

Block diagrams and module combinations for S5-115F (continued)

Block diagrams and module combinations (continued)

Block diagram	Characteristics	Permissible module combiantion	
	I/O type 8; binary output; non safety-related	1 x DQ or 1 x DQ or 1 x DQ or 1 x DQ or 1 x DQ or 1 x DI/DQ or 1 x DQ	**6ES5 451-7LA11** **6ES5 454-7LA11** **6ES5 454-7LB11** **6ES5 458-7LA11**[1] **6ES5 458-7LB11** **6ES5 482-7LA11** **6ES5 456-7LB11**
	I/O type 9 with intermittent mode, otherwise I/O type 10; binary output; safety-related; driven directly	1 x DI/DQ 1 x DI/DQ or 2 x DI/DQ or 2 x DQ 2 x DI or 2 x DQ 2 x DI or 2 x DQ 1 x DI/DQ 1 x DI/DQ	**6ES5 482-7LF11** **6ES5 482-7LF21** **6ES5 482-7LF31** **6ES5 456-7LB11** **6ES5 435-7LC11** **6ES5 456-7LB11** **6ES5 436-7LC11** **6ES5 458-7LB11** **6ES5 482-7LF11** **6ES5 482-7LF21**
	I/O type 9 with intermittent mode; otherwise I/O type 10; binary output; safety-related; driven indirectly; coupling relay not tested	1 x DI/DQ 1 x DI/DQ or 2 x DI/DQ or 2 x DQ 2 x DI or 2 x DQ 2 x DI or 2 x DQ 2 x DI/DQ 2 x DI/DQ	**6ES5 482-7LF11** **6ES5 482-7LF21** **6ES5 482-7LF31** **6ES5 456-7LB11** **6ES5 435-7LC11** **6ES5 456-7LB11** **6ES5 436-7LC11** **6ES5 458-7LB11** **6ES5 482-7LF11** **6ES5 482-7LF21**
	I/O type 9 with intermittent mode, otherwise I/O type 10; binary output safety-related; driven indirectly; coupling relay tested	1 x DI/DQ 1 x DI/DQ or 2 x DI/DQ or 2 x DQ 2 x DI or 2 x DQ 2 x DI or 2 x DQ 1 x DI/DQ 1 x DI/DQ or 1 x DI/DQ 1 x DI/DQ 2 x DI or 1 x DI/DQ 1 x DI/DQ 2 x DI	**6ES5 482-7LF11** **6ES5 482-7LF21** **6ES5 482-7LF31** **6ES5 456-7LB11** **6ES5 435-7LC11** **6ES5 456-7LB11** **6ES5 436-7LC11** **6ES5 458-7LB11** **6ES5 482-7LF11** **6ES5 482-7LF21** **6ES5 482-7LF11** **6ES5 482-7LF21** **6ES5 435-7LC11** **6ES5 482-7LF31** **6ES5 482-7LF21** **6ES5 436-7LC11**

1) For new system 6ES5 453-4UA11 only

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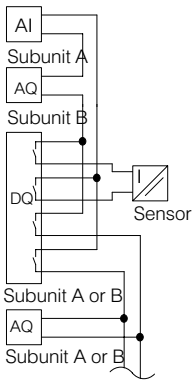
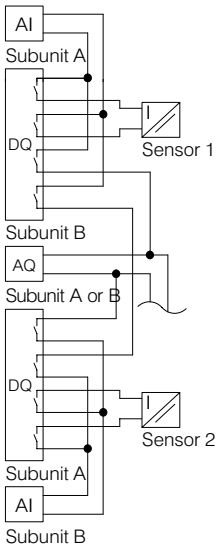
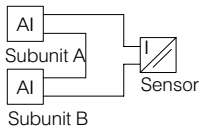
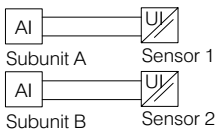
Block diagrams and module combinations for S5-115F (continued)

Block diagrams and module combinations (continued)

Block diagram	Characteristics	Permissible module combinations
	I/O type 14; analog input; safety-related; current sensor; single-channel sensor	2 x AI **6ES5 463-4U.12** 1 x DQ **6ES5 458-7LA11**[1)] 1 x AQ **6ES5 470-7L.12** DQ and AQ must be connected to the same subunit. The current and voltage ranges of the AQs, AIs and sensors must be identical.
	I/O type 15; analog input; safety-related; current sensor; two-channel sensor	2 x AI **6ES5 463-4U.12** 1 x DQ **6ES5 458-7LA11**[1)] 1 x AQ **6ES5 470-7L.12** The current and voltage ranges of the AQs, AIs and sensors must be identical.
	I/O type 16; analog input; safety-related; intermittent mode; current sensor; single-channel sensor	2 x AI **6ES5 463-4U.12**
	I/O type 16; analog input; safety-related; intermittent mode; current or voltage sensor; two-channel sensor	2 x AI **6ES5 463-4U.12**

1) For new system 6ES5 453-4UA11 only

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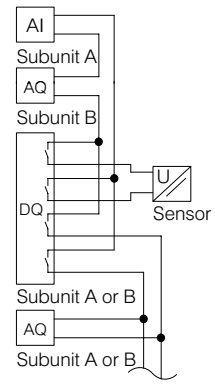
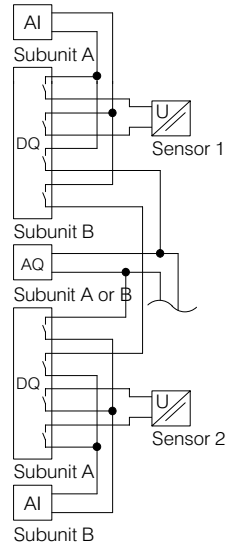
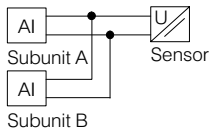
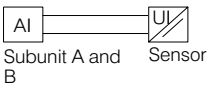
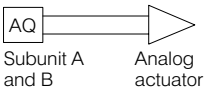
Block diagrams and module combinations for S5-115F (continued)

Block diagrams and module combinations (continued)

Block diagram	Characteristics	Permissible module combinations
	I/O type 14; analog input; safety-related; voltage sensor; single-channel sensor	2 x AI **6ES5 463-4U.12** 1 x DQ **6ES5 458-7LA11**[1)] 1 x AQ **6ES5 470-7L.12** DQ and AQ must be connected to the same subunit. The current and voltage ranges of the AQs, AIs and sensors must be identical.
	I/O type 15; analog input; safety-related; voltage sensor; two-channel sensor	2 x AI **6ES5 463-4U.12** 1 x DQ **6ES5 458-7LA11**[1)] 1 x AQ **6ES5 470-7L.12** The current and voltage ranges of the AQs, AIs and sensors must be identical.
	I/O type 16; analog input; safety-related; intermittent mode; voltage sensor; single-channel sensor	2 x AI **6ES5 463-4U.12**
	I/O type 13; analog input; non safety-related	1 x AI **6ES5 460-7LA11** or 1 x AI **6ES5 463-4U.12**
	I/O type 18; analog output; non safety-related	1 x AQ **6ES5 470-7L.12**

1) For new system 6ES5 453-4UA11 only

Program blocks for S5-115F

Program blocks
Configuration data blocks

The data required for executing the safety-specific functions are stored in the configuration data blocks. These blocks take up extremely little user memory space. For generating the configuration data blocks the COM 115F parameterization software must first be loaded into the programming device. The programming device will then prompt the user when entering the necessary data, i. e. the configuration of the system. The parameterization software is subdivided into the following groups:

- Operating system parameters
- Communications data
- Signal input and output data

For setting the operating system parameters, the user requires certain data, such as monitoring times, test cycle time or time tolerances for input signal deviations between subunits.

For cummunications via the SINEC L1 LAN, the user must specify, for example, the source and destination mailboxes. The mailboxes can be assigned to the flag area or data blocks.

Standard modules are used for signal input and output. The wiring for input and output modules used depends on the characteristics required (pages 11/43 up to 11/46). The COM 115F parameterization software, for example, requires the following data:

- Data block number under which the data is to be stored
- Maximum discrepancy time between binary inputs
- Location (address) of check outputs and readback inputs
- Signal group number for group passivation
- Tolerance range for two-channel analog input modules

The data block numbers are predefined

- DB 1: System configuration data block
- DB 2: Error/fault data block for subunit A
- DB 3: Error/fault data block for subunit B

The numbers of the other configuration data blocks can be defined by the user.

Editing of the configuration data, e.g. correcting, changing or copying, is simple. The configuration data can also be printed out for documentation purposes.

Logic program counter

Each block (except data blocks) must begin with the following sequence of statements to enable the operating system to monitor the correct functional sequence of the blocks:

```
L   FW 0
L   KF+1
+   F
T   FW 0
```

The logic program counter (LPLZ) enables the operating system to perform a number of monitoring functions. The counter must be activated at least every 128 statements. The logic program counter is assigned bit memory word 0. The user can use bit memories only from word 2 onwards.

Organization blocks

The following organization blocks are integrated in the operating system of the S5-115F failsafe programmable controller:

- OB 1
  Cyclic program execution
- OB 2
  Interrrupt-driven program execution
- OB 13
  Time-controlled program execution
- OB 21
  Start-up characteristics for manual power-up
- OB 22
  Start-up characteristics for automatic power-up
- OB 251
  Processing of PID control algorithm

Integrated function blocks

The function blocks listed in the table below are implemented in the operating system of the S5-115F and therefore do not take up any user memory space. The safety-specific function blocks are explained below:

Function block FB 250 ANEI

The FB 250 ANEI processes the analog values entered and converts them into scaled values. This function block also detects errors and issues error messages. A range monitor can be used for detecting wire breaks. The function block executes all functions in connection with the evaluation of two-channel, safety-related analog value sensors. For example, FB 250 ANEI generates from the slightly differing analog values of both subunits a single value, which both subunits can process.

Function block FB 253 MBXT

The FB 253 MBXT permits the implementaiton of a two-channel and thus fault-tolerant SINEC L1 LAN. If a fault occurs on the main channel, the FB 253 copies the data in the mailbox of a second channel into the mailbox of the main channel.

Program blocks, standard function blocks for the S5-115F

Program blocks
Integrated function blocks (continued)

Function block FB 254 SYNC

FB 254 SYNC synchronizes the two subunits irrespective of the times mentioned under "Principle of operation" (page 3/18). Program locations and time intervals for the synchronization of various functions can thus be defined. These are, for example:

- Updating of timers
- Calling of time process and interrupt service routines (organization blocks)
- Updating the mailboxes of the SINEC L1 LAN
- Data transfer to the programming device

Designation			Function	Processing time[1]
Code converter	COD: B4	**FB 240**	Conversion of a 4-decade BCD-coded number into a 16-bit fixed-point binary number	0.8 ms
Code converter	COD: 16	**FB 241**	Conversion of a 16-bit fixed-point binary number into a 6-decade BCD-coded number	1.3 ms
Multiplier	MUL: 16	**FB 242**	Multiplication of two 16-bit fixed point binary numbers	1.1 ms
Divider	DIV: 16	**FB 243**	Division of two 16-bit fixed-point binary numbers	2.6 ms
Read-in analog value	ANEI	**FB 250**	Reading-in analog values via analog input modules	4.0 ms
Output analog value	ANAU	**FB 251**	Output of analog values via analog output modules	6.0 ms
Block transfer CP 523	AGF:BLUE	**FB 252**	Transfer of data to CP 523	2 to 20 ms
Transfer mailbox	MBXT	**FB 253**	Transferring the contents of the redundant SINEC L1 mailbox to the main mailbox	2.0 ms
Synchronization	SYNC	**FB 254**	Synchronization of the two subunits	2.0 ms

1) Approximate average values; greatly dependent on parameters.

Function blocks integrated in the operating system of the S5-115F

Standard-function blocks for the S5-115F (loadable)

Only the following FBs can be used for the S5-115F programmable controller:

- Prototype-tested standard function blocks
- Function blocks created by the user (tested during system acceptance)

No other standard function blocks may be used. A check is made for such standard function blocks on system start-up.

The standard function blocks prototype-tested by the Technical Inspectorate for Bavaria may be used, on the CPU 942F only, as follows:

- Function blocks for arithmetic functions, signalling functions and sequencer on CPU 942F from Order No. 6ES5 942-7UF12 onwards
- Function blocks for interfacing on CPU 942F from Order No. 6ES5 942–7UF13 onwards
- Standard function blocks for fuel engineering

For further information, see Section 7.

CR 700-0LB subrack for S5-115F

Component list

General accessories (No., see below)
Adapter casing required (●)

Module type		Order No.			Slot No. PS	CPU	0	1	2	3	IM	Module Qty.	Current consumption at 5 V A	Sum A	Price each	total
					Cross modules required											
	CPU 942F	6ES5 942-7UF13		3									0.8			
Digital input module	32 x 24 V DC	6ES5 430-7LA12		5									0.005			
	8 x 24 V DC (interrupt module)	6ES5 434-7LA12		5									0.07			
	8 x 115 V UC	6ES5 435-7LC11		5									0.005			
	8 x 230 V UC	6ES5 436-7LC11		5									0.005			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 451-7LA 11		5									0.01			
	16 x 24 V DC; 2 A	6ES5 453-4UA12	●										0.12			
	16 x 24 V DC; 2 A	6ES5 454-7LA11		5									0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11		5									0.05			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11		5									0.035			
	16 x 30 V AC relay contacts	6ES5 458-7LA11		5									0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11		5									0.05			
Digital input/ output module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11		5									0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11		5									0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21		5									0.05			
	24 V DC: 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31		5									0.15			
Analog input	8 inputs	6ES5 460-7LA13		5/7									0.15			
	4 inputs	6ES5 463-4U.12	●	4									0.2			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12		5									0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12		5									0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12		5									0.25			
	CP 523 for point-to-point link	6ES5 523-3UA11	●	3									0.13			
	IM 304 interface module for dist. conf.	6ES5 304-3UB11	●	7									1.5			
	IM 306 interface module for cent. conf.	6ES5 306-7LA11		7									0.05/2[1]			
	IM304 interface mod. for CC int., 1st CC	6ES5 304-3UB11	●	7									1.5			
	IM324 interface mod. for CC int., 2nd CC	6ES5 324-3UA12	●	7									1.0			
Total current for central controller																

1) Power consumption/current supply to EU

Total current for central controller and central expansion units
(carried over from configuring sheets for central EUs)

1st EU + 2nd EU + 3rd EU + CC =

PS 951F power supply module (up to 7 A)	6ES5 951-7ND21	
PS 951F power supply module (up to 7 A)	6ES5 951-7ND31	
PS 951 power supply module (up to 7 A)	6ES5 951-7ND41	

Accessories			
1	Adapter casing	6ES5 491-0L . 11	
3	RAM, EEPROM, EPROM memory submodule	6ES5 37 .-	
4	Front connector K, crimp/screw connection	6XX3 068/6XX3 081	
5	Frontstecker 490, crimp/screw/spring-type connection	6ES5 490-7 ... 1	
7	Other		

Sum +
Total price of expansion units =
Total price

CR 700-2F subrack for S5-115F

Component list			General accessories (No., see below) / Adapter casing required (●)		Slot No.										Module Qty.	Current consumption at 5 V		Price	
					PS	CPU	0	1	2	3	4	5	6	IM					
Module type		Order No.			Cross modules required											A	Sum A	each	total
	CPU 942F	6ES5 942-7UF13		3												0.8			
Digital input module	32 x 24 V DC	6ES5 430-7LA12		5												0.005			
	8 x 24 V DC (interrupt module)	6ES5 434-7LA12		5												0.07			
	8 x 115 V UC	6ES5 435-7LC11		5												0.005			
	8 x 230 V UC	6ES5 436-7LC11		5												0.005			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 451-7LA11		5												0.1			
	16 x 24 V DC; 2 A	6ES5 453-4UA12	●													0.12			
	16 x 24 V DC; 2 A	6ES5 454-7LA11		5												0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11		5												0.05			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11		5												0.035			
	16 x 30 V AC relay contacts	6ES5 458-7LA11		5												0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11		5												0.05			
Digital input/ output module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11		5												0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11		5												0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21		5												0.05			
	24 V DC: 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31		5												0.15			
Analog input	8 inputs	6ES5 460-7LA13		5/7												0.15			
	4 inputs	6ES5 463-4U.12	●	4												0.2			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12		5												0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12		5												0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12		5												0,25			
	CP 523 for point-to-point link	6ES5 523-3UA11	●	3												0.13			
	IM 304 interface module for dist. conf.	6ES5 304-3UB11	●	7												1.5			
	IM 306 interface module for centr. conf.	6ES5 306-7LA11		7												0.05/2[1]			
	IM304 interface mod. for CC int., 1st CC	6ES5 304-3UB11	●	7												1.5			
	IM324 interface mod. for CC int., 2nd CC	6ES5 324-3UA12	●	7												1.0			
Total current for central controller																			

1) Power consumption/current supply to EU

Total current for central controller and central expansion units
(carried over from configuring sheets for central EUs)

[ ] 1st EU + [ ] 2nd EU + [ ] 3rd EU + [ ] CC = [ ]

PS 951F power supply module (up to 7 A)	6ES5 951-7ND21	
PS 951F power supply module (up to 7 A)	6ES5 951-7ND31	
PS 951 power supply module (up to 7 A)	6ES5 951-7ND41	

Accessories			
1	Adapter casing	6ES5 491-0L . 11	
3	RAM, EEPROM, EPROM memory submodule	6ES5 37 .-	
4	Front connector K, crimp/screw connection	6XX3 068/6XX3 081	
5	Front connector 490, crimp/screw/spring-type connection	6ES5 490-7 ... 1	
7	Other		

Sum [ ]
+
Total price of expansion units [ ]
=
Total price [ ]

ER 701-1 subrack for S5-115F

Component list		General list (No., see below) / Adapter casing required (●)			Slot No. 0	1	2	3	4	5	6	7	8	IM	Module Qty.	Current consumption at 5 V A	Sum A	Price each	total
Module type		Bestell-Nr.			Cross modules required														
Digital input module	32 x 24 V DC	6ES5 430-7LA12		5												0.005			
	8 x 115 V UC	6ES5 435-7LC11		5												0.005			
	8 x 230 V UC	6ES5 436-7LC11		5												0.005			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 451-7LA .1		5												0.1			
	16 x 24 V DC; 2 A	6ES5 454-7LA11		5												0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11		5												0.05			
	8 x 115 ... 230 V AC; 1 A	6ES5 456-7LB11		5												0.035			
	16 x 30 V AC relay contacts	6ES5 458-7LA11		5												0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11		5												0.05			
Digital input/ output module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11		5												0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11		5												0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21		5												0.05			
	24 V DC: 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31		5												0.15			
Analog input, 8 inputs		6ES5 460-7LA13		5/7												0.15			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12		5												0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12		5												0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12		5												0.25			
	IM 306 interface module	6ES5 306-7LA11		7												0.05/2[1]			
Total current for expansion unit																			

1) Power consumption/current supply to EU

Accessories			
1	Adapter casing	6ES5 491-0L . 11	
5	Front connector 490, crimp/screw/spring-type connection	6ES5 490-7 ... 1	
7	Other		

Total price ER 701-1

Subrack ER 701-2 for S5-115F

Component list

General accessories (No., see below)
Adapter casing required (●)

Module type		Order No.			Slot Nr. PS	0	1	2	3	4	5	6	7	IM	Module Qty.	Current consumption at 5 V A	Sum A	Price each	Price total
					Cross modules required														
Digital input module	32 x 24 V DC	6ES5 430-7LA12		5												0.005			
	8 x 115 V UC	6ES5 435-7LC11		5												0.005			
	8 x 230 V UC	6ES5 436-7LC11		5												0.005			
Digital-output module	32 x 24 V DC; 0.5 A	6ES5 451-7LA .1		5												0.01			
	16 x 24 V DC; 2 A	6ES5 454-7LA11		5												0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11		5												0.05			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11		5												0.035			
	16 x 30 V AC relay contacts	6ES5 458-7LA11		5												0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11		5												0.05			
Digital input/output module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11		5												0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11		5												0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21		5												0.05			
	24 V DC: 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31		5												0.15			
Analog input, 8 inputs		6ES5 460-7LA13		5/7												0.15			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12		5												0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12		5												0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12		5												0.25			
	IM 306 interface module[2]	6ES5 306-7LA11		7												0.05/2[1]			
	IM 314 interface module	6ES5 314-3UA11	●	7												1.0			
Total current for expansion unit																			

1) Power consumption/current supply to EU
2) The ER 701-2 can also be expanded centrally in the case of the S5-115F; however, this means that no power supply can be installed in ER 701-2

Total current expansion unit and central expansion units connected to the ER 701-2
(carried over from the configuring sheets for central EUs)

[ ] 1st EU + [ ] 2nd EU + [ ] 3rd EU + [ ] CC = [ ]

PS 951F power supply module (up to 7 A)	6ES5 951-7ND21		
PS 951F power supply module (up to 7 A)	6ES5 951-7ND31		
PS 951 power supply module (up to 7 A)	6ES5 951-7ND41		

Accessories

1	Adapter casing	6ES5 491-0L . 11		
5	Front connector 490, crimp/screw/spring-type connection	6ES5 490-7 ... 1		
7	Other			

Total price ER 701-2

ER 701-3 subrack for S5-115F

Component list		General accessories (No., see below) / Adapter casing required (●)		Slot No.										Module				
				PS	0	1	2	3	4	5	6	7	IM	Qty.	Current consumption at 5 V		Price	
Module type		Order No.		Cross modules required											A	Sum A	each	total
Digital input module	32 x 24 V DC	6ES5 430-7LA12		5											0.005			
	8 x 115 V UC	6ES5 435-7LC11		5											0.005			
	8 x 230 V UC	6ES5 436-7LC11		5											0.005			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 451-7LA11		5											0.01			
	16 x 24 V DC; 2 A	6ES5 453-4UA12	●												0.12			
	16 x 24 V DC; 2 A	6ES5 454-7LA11		5											0.05			
	8 x 24 V DC; 2 A	6ES5 454-7LB11		5											0.05			
	8 x 115 ... 230 V AC; 2 A	6ES5 456-7LB11		5											0.035			
	16 x 30 V AC relay contacts	6ES5 458-7LA11		5											0.05			
	8 x 30 V DC/250 V AC relay contacts	6ES5 458-7LB11		5											0.05			
Digital input/ output module	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LA11		5											0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF11		5											0.05			
	24 V DC: 16 inputs, 16 outputs 0.5 A	6ES5 482-7LF21		5											0.05			
	24 V DC: 8 inputs, 8 outputs 2.5 A	6ES5 482-7LF31		5											0.15			
Analog inputs	8 inputs	6ES5 460-7LA13		5/7											0.15			
	4 inputs[2]	6ES5 463-4U.12	●	6											0.2			
Analog output module	8 outputs, ± 10 V; 0 ... 20 mA	6ES5 470-7LA12		5											0.25			
	8 outputs, ± 10 V	6ES5 470-7LB12		5											0.25			
	8 outputs, 1 ... 5 V; 4 ... 20 mA	6ES5 470-7LC12		5											0.25			
	CP 523 for point-to-point link	6ES5 523-3UA11	●	3											0.13			
	IM 306 interface module[3]	6ES5 306-7LA11	●	7											0.05/2[1]			
	IM 314 interface module	6ES5 314-3UA11		7											1.0			
Total current for central controller																		

1) Power consumption/current supply to EU 2) In a centralized configuration of the ER 701-3 with IM 306 the analog input module can be used only in the 1st/2nd expansion unit and only with connection cable 705-0AF00 (0.5 m/1.64 ft) 3) The ER 701-3 can also be expanded centrally in the case of the S5-115F; however, this means that no power supply unit can be installed in the ER 701-3

Total current for expansion unit ER 701-3 and central expansion units connected to the ER 701-3
(carried over from the configuration sheet for central EUs)

1st EU	+	2nd EU	+	3rd EU	+	CC	=	

PS 951F power supply module (up to 7 A)	6ES5 951-7ND21	
PS 951F power supply module (up to 7 A)	6ES5 951-7ND31	
PS 951 power supply module (up to 7 A)	6ES5 951-7ND41	

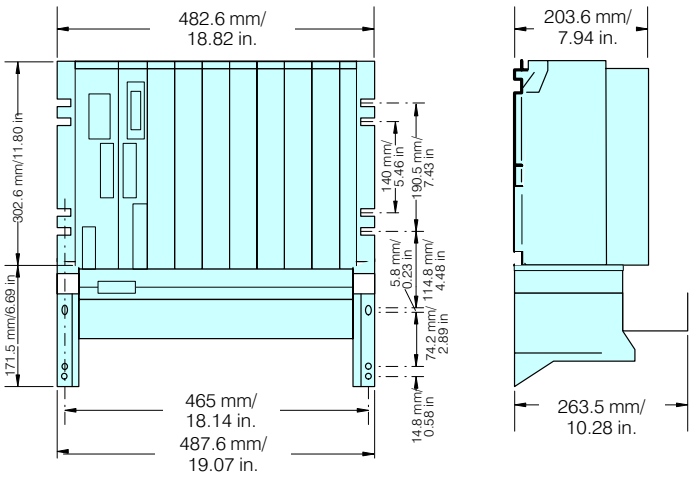
Accessories			
1	Adapter casing	6ES5 491-0L . 11	
3	RAM, EEPROM, EPROM memory submodule	6ES5 37 .-	
5	Front connector 490, crimp/srew/spring-type connection	6ES5 490-7 ... 1	
6	Front connector 497, crimp/screw connection	6ES5 497-4U ...	
7	Other		

Total price ER 701-3

Dimensions

S5-115U/
S5-115H
S5-115F (subunit)

S5-115U with mounting parts and fan subassembly



The central controller with the CR 700-0 subrack and the expansion unit with the ER 701-0 subrack are both 353 mm/13.77 in. wide.

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135U/155U central controller for S5-135U and S5-155U and ZG 135U central controller for S5-135U

Component list

Slots required: 2 / 1

Cross modules required

Module type		Order No.			Slot No. 3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	Module Qty.	Current consumption at 5 V each A	Current consumption at 5 V Sum in [A]	Price each	Price total
Subrack		6ES5 188-3UA..																												
CPUs	CPU 922	6ES5 922-3UA11	•			■		■		■		■															2.2			
	CPU 928	6ES5 928-3UA12	•	•		■	■	■	■	■	■	■															3.0			
	CPU 928B	6ES5 928-3UB12	•	•		■	■	■	■	■	■	■															5.0			
	CPU 948	6ES5 948-3UA .1	•	•		■	■	■	■	■	■	■															3.6			
	923A coordinator	6ES5 923-3UA11	•		■																						0.5			
	923C coordinator	6ES5 923-3UC11	•		■																						1.1			
Digital input modules	32 x 24 V DC	6ES5 420-4UA14	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.08			
	32 x 24 V DC	6ES5 430-4UA14	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.10			
	16 x 24/48/60 V DC	6ES5 431-4UA12	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.09			
	32 x 24 V DC	6ES5 432-4UA12	•					1)		1)		1)																0.2			
	32 x 5/15 V DC	6ES5 434-4UA12	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.08			
	16 x 24/48/60 V AC	6ES5 435-4UA12	•	•			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.10			
	16 x 115/230 V AC	6ES5 436-4UA12	•	•			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.10			
	8 x 115/230 V AC	6ES5 436-4UB12	•	•			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.08			
Digital output modules	32 x 24 V DC; 0.5 A	6ES5 441-4UA14	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.08			
	32 x 24 V DC; 0.5 A	6ES5 451-4UA14	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.12			
	16 x 24 V DC; 2 A	6ES5 453-4UA12	•	•			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.12			
	16 x 24 V DC; 2 A	6ES5 454-4UA14	•				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.10			
	16 x 24/48/60 V AC; 2 A	6ES5 455-4UA12	•	•			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.10			
	16 x 115/230 V AC; 2 A	6ES5 456-4UA12	•	•			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.10			
	8 x 115/230 V AC; 2 A	6ES5 456-4UB12	•	•			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.10			
	16 x 24/48/60 V DC; 0.5 A	6ES5 457-4UA12	•	•			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.12			
	16 x 60 V DC/0.5 A relay contact	6ES5 458-4UA12	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.08			
	16 x 110 V DC/250 V AC; 5A ralay contact	6ES5 458-4UC11	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.12			
Digital I/O modules	16/24 inputs, 24 V DC 8/16 outputs, 24 V DC; 0.5 A	6ES5 482-4UA11	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.09			
Analog input modules	8 inputs	6ES5 460-4UA13	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.15			
	4 inputs (50 Hz)	6ES5 463-4UA13	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.2			
	4 inputs (60 Hz)	6ES5 463-4UB12	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.2			
	8/16 inputs	6ES5 465-4UA12	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.15			
	8/16 inputs	6ES5 466-3LA11	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.7			
Analog output modules	8 outputs; ± 10 V; 0 to 20 mA	6ES5 470-4UA12	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.25			
	8 outputs; ± 10 V	6ES5 470-4UB12	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.25			
	8 outputs; 1 to 5 V; 4 to 20 mA	6ES5 470-4UC12	•		■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		0.25			
Intelligent I/O modules	IP 240 counter and pos. decoder mod.	6ES5 240-1AA21	•					1)		1)		1)															0.8			
	IP 241 digital pos. decoder mod.	6ES5 241-1AA12	•	•				1)		1)		1)															1.0 7)			
	IP 242A counter module	6ES5 242-1AA32	•					1)		1)		1)															1.1			
	IP 242B counter module	6ES5 242-1AA41	•					1)		1)		1)															1.1			
	Analogbaugruppe IP 243	6ES5 243-1AA13	•					1)		1)		1)															0.4			
Intelligent I/O modules	IP 244 temperature control module	6ES5 244-3AB31	•				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						0.4			
	IP 246I positioning module	6ES5 246-4UA 31	•	○8)			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						1.3			
	IP 246A positioning module	6ES5 246-4UB 11	•	○8)			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						1.3			
	IP 247 positioning module	6ES5 247-4UA 31	•	○8)			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						0.8			

	IP 252 closed-loop control module	6ES5 252-3AA13	•	•																				2.3			
	IP 260 closed-loop control module	6ES5 260-4UA11	•																					0.1			
	IP 261 proportioning module[2]	6ES5 261-4UA11	•																					0.05			
	IP 281 counter module	6ES5 281-4U .12	•				1)		1)		1)													0.6			
	WF 705 position decoding module	6FM1 705-3AA00	•																					0.5			
	WF 706 positioning module	6FM1 706-3A.20	•	○[5]																				0.75/1.5			
	WF 707 cam controller module	6FM1 707-3AA10	•																					0.25			
	WF 721/WF 723 A pos. module	6FM1 72 .-3A.00	•																					1.0/1.3			
	WF 723 B/C positioning module	6FM1 723-3 . A00	•																					1.3			
Commu-nica-tions-proces-sors	CP 523	6ES5 523-3UA11	•																					0.13			
	CP 524	6ES5 524-3UA13	•																					1.5			
	CP 544/CP 544B	6ES5 544-3U.11	•																					0.9			
	CP 526 [9] (exp.)	6ES5 526-3LA22	•																					2.3			
	CP 527 [9]	6AV1 242-0AB.0	•																					1.5			
	CP 528 [9]	6AV4 012-0AA10-0AB0	•																					1.8			
	CP 530	6ES5 530-3LA12	•																					1.0			
	CP 2430 (I/O mode) for AS interface	6GK1 243-0SA10	•																					0.7			
	CP 2430[7] (page operation) for AS interf	6GK1 243-0SA10	•																					0.7			
	CP 1430 TF for ind. Ethernet	6GK1 143-0T . 0.	•																					3			
	CP 1430 TCP for ind. Ethernet	2XV9 450-1AU00	•																					3			
	CP 1473 MAP for ind. Ethernet	6GK1 147-3MA00		•																				2.6[8]			
	CP 5431 FMS/DP for ind. Ethernet	6GK1 543-1AA01	•																					0.45			
Special modules	CP 581 integrated PC: basic module	6ES5 581-1ED13																						1.8			
	Mass storage module	6ES5 581-3LA11	1-3																					0.5 [4]			
	Slot module	6ES5 581-0RA11	1-3																					0.8 [4]			
	CP 516 memory submodule	6ES5 516-3UA11																						0.8			
Interface module	from CC to EU IM 300-3	6ES5 300-3AB11	•																					0.6			
	IM 300-5LB	6ES5 300-5LB11	•																					0.6			
	IM 300-5C	6ES5 300-5CA11	•																					0.6			
	IM 301-3	6ES5 301-3AB13	•																					0.8			
	IM 301-5	6ES5 301-5CA12	•																					0.8			
	IM 304	6ES5 304-3UB11	•																					1.2			
	IM 307	6ES5 307-3UA11	•	•													5)	5)	5)	5)				1.0			
	IM 308	6ES5 308-3UA12	•																					0.5			
	IM 308-C	6ES5 308-3UC11	•																					0.7			

Total current for central controller

1) No interrupt lines, thus functionality severely restricted
2) Cannot be used with CPU 948.
3) With IR transmission
4) Depends on components used
5) Depending on version, 1 or 2 slots
6) See Catalog ST 80.1 for detailed description of slot assignment
7) Only slots 19-67 available for page operation in ZG (CC) 135K
8) For power supply of a transceiver max. 4.2 A

Accessories:

Total price

135U/155U central controller for S5-155H

Component list

Slot required: 2 / 1

Slot No. — Cross modules required

Module type		Order No.			3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	Module Qty.	Current consumption at 5 V each A	Current consumption at 5 V Sum in [A]	Price each	Price total
Subrack		6ES5 188-3UA..																												
CPU	CPU 948R	6ES5 948-3UR .2	•	•		▒	▒																				3.6			
	CPU 948RL	6ES5 948-3UR 51	•	•		▒	▒																				3.6			
Digital input module	32 x 24 V DC	6ES5 420-4UA14	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.08			
	32 x 24 V DC	6ES5 430-4UA14	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.10			
	16 x 24/48/60 V DC	6ES5 431-4UA12	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.09			
	32 x 24 V DC[1]	6ES5 432-4UA12	•					1)		1)		1)															0.2			
	32 x 5/15 V DC	6ES5 434-4UA12	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.08			
	16 x 24/48/60 V AC	6ES5 435-4UA12	•	•				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒			0.10			
	16 x 115 V/230 V AC	6ES5 436-4UA12	•	•				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒			0.10			
	8 x 115 V/230 V AC	6ES5 436-4UB12	•	•				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒			0.08			
Digital output module	32 x 24 V DC; 0.5 A	6ES5 441-4UA14	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.08			
	32 x 24 V DC; 0.5 A	6ES5 451-4UA14	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.12			
	16 x 24 V DC; 2 A	6ES5 453-4UA12	•	•				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.12			
	16 x 24 V DC; 2 A	6ES5 454-4UA14	•	•				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.10			
	16 x 24/48/60 V AC; 2 A	6ES5 455-4UA12	•	•				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.10			
	16 x 115/230 V AC; 2 A	6ES5 456-4UA12	•	•				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.10			
	8 x 115/230 V AC; 2 A	6ES5 456-4UB12	•	•				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.10			
	16 x 24/48/60 V DC; 0.5 A	6ES5 457-4UA12	•	•				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.12			
	16 x 60 V DC/0.5 A relay contact	6ES5 458-4UA12	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.08			
	16 x 110 DC/250 V AC; 5 A relay contact	6ES5 458-4UC11	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.12			
Digital I/O modules	16/24 inputs, 24 V DC 8/16 outputs, 24 V DC; 0.5 A	6ES5 482-4UA11	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.09			
Analog input modules	8 inputs	6ES5 460-4UA13	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.15			
	4 inputs (50 Hz)	6ES5 463-4UA12	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.2			
	4 inputs (60 Hz)	6ES5 463-4UB12	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.2			
	8/16 inputs	6ES5 465-4UA12	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.15			
	8/16 inputs	6ES5 466-3LA11	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.7			
Analog output modules	8 outputs, ± 10 V; 0 to 20 mA	6ES5 470-4UA12	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.25			
	8 outputs, ± 10 V	6ES5 470-4UB12	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.25			
	8 ouptuts, 1 to 5 V; 4 to 20 mA	6ES5 470-4UC12	•		▒			▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒		0.25			
Intelli-gent I/O modules	IP 240 counter and pos. dec. module[1]	6ES5 240-1AA21	•					▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒							0.8			
	IP 241 digital pos. decoder module[1]	6ES5 241-1AA12	•				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒							1.0[7]			
	IP 242A counter module[1]	6ES5 242-1AA32	•					▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒							1.1			
	IP 242B counter module[1]	6ES5 242-1AA41	•					▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒							1.1			
	Analog module IP 243[1]	6ES5 243-1AA13	•					▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒							0.6			
	Positioning module IP 246I	6ES5 246-4UA31	•					▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒							1.3			
	IP 246A	6ES5 246-4UB11	•					▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒							1.3			
	IP 247 positioning module	6ES5 247-4UA .1	•	○ 8)				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒							0.8			
	IP 252 closed-loop control module	6ES5 252-3AA13	•	•				▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒							2.3			
	IP 260 closed-loop control module	6ES5 260-4UA11	•					▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		▒	▒	▒			0.1			
	IP 281 counter module[1]	6ES5 281-4U .12	•					▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒							0.6			

Commu-nica-tions-proces-sors	CP 523		6ES5 523-3UA11	•																						0.13			
	CP 524		6ES5 524-3UA15	•																						1.5			
	CP 544/CP 544B		6ES5 544-3U .11	•																						0.9			
	CP 528[3]		6AV4 012-0AA10-0AB0	•																						1.8			
	CP 530		6ES5 530-3LA12	•																						1.0			
	CP 2430 (I/O mode) for AS interface		6GK1 243-2SA10	•																						0,.7			
	CP 2430[4] (page operation) for AS interf.		6GK1 243-2SA10	•																						0.,7			
	CP 5431 FMS/DP for PROFIBUS		6GK1 543-1AA01	•																						0.45			
	CP 1430 TF for ind. Ethernet		6GK1 143-0T .0.	•																						3			
	CP 1430 TCP for ind. Ethernet		2XV9 450-1AU00	•																						3			
	CP 1473 MAP for ind. Ethernet		6GK1 147-3MA00		•																					2.6[5]			
Special tasks	CP 581 integrated PC: basic module		6ES5 581-1ED13	•																						1.8			
	Mass storage module		6ES5 581-3LA11	1-3																						0.5[2]			
	Slot module		6ES5 581-0RA12	1-3																						0.8[2]			
	CP 516 memory submodule		6ES5 516-3UA11																							0.8			
Interface modules	from CC to EU	IM 300-5LB	6ES5 300-5LB11	•																						0.6			
		IM 300-5C	6ES5 300-5CA11	•																						0.6			
		IM 303-3/IM 301-3	6ES5 30 .-3AB1.	•																						0.8			
		IM 301-5	6ES5 301-5CA12	•																						0.8			
		IM 304	6ES5 304-3UB11	•																						1.2			
		IM 307	6ES5 307-3UA11	•	•																					1.0			
		IM 308	6ES5 308-3UA12	•																						0.5			
		IM 308-C	6ES5 308-3UC11	•																						0.7			
	from CC to CC	IM 304	6ES5 304-3UB11	•																						1.2			
		IM 324R	6ES5 324-3UR11	•																						1.0			

1) No interrupt processing possible

2) Depending on components used.

3) See Catalog ST 80.1 for detailed description of slot assignment

4) Only slots 19–67 available for page operation in ZG (CC) 135K

5) For power supply of a transceiver max. 4.2 A

Total current for central controller

Accessories:

Total price

155H central controller for S5-155H

Component list

Slot required: 2 / 1

Cross modules required

Module designation		Order No.	Slot 2	Slot 1	Slot No. 3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	Module Qty.	Current consumption at 5 V each A	Current consumption at 5 V Sum in [A]	Price each	Price total
Subrack		6ES5 188-3UA..																												
Power supply[1]		6ES5 955-7NC11			■	■									■	■														
CPU	CPU 948R	6ES5 948-3UR .2	•	•			■	■									■	■									3.6			
	CPU 948RL	6ES5 948-3UR 51	•	•			■	■									■	■									3.6			
Digital input	32 x 24 V DC	6ES5 420-4UA14	•						■	■	■	■	■						■	■	■	■	■	■	■		0.08			
	32 x 24 V DC	6ES5 430-4UA14	•						■	■	■	■	■						■	■	■	■	■	■	■		0.10			
	16 x 24/48/60 V DC	6ES5 431-4UA12	•						■	■	■	■	■						■	■	■	■	■	■	■		0.09			
	32 x 24 V DC[2]	6ES5 432-4UA12	•						■	■	■	■	■						■	■	■	■	■	■	■		0.2			
	32 x 5/15 V DC	6ES5 434-4UA12	•						■	■	■	■	■						■	■	■	■	■	■	■		0.08			
	16 x 24/48/60 V AC	6ES5 435-4UA12	•	•					■	■	■	■							■	■	■	■	■	■			0.10			
	16 x 115 V/230 V AC	6ES5 436-4UA12	•	•					■	■	■	■							■	■	■	■	■	■			0.10			
	8 x 115 V/230 V AC	6ES5 436-4UB12	•	•					■	■	■	■							■	■	■	■	■	■			0.08			
Digital output	32 x 24 V DC; 0.5 A	6ES5 441-4UA14	•						■	■	■	■	■						■	■	■	■	■	■	■		0.08			
	32 x 24 V DC; 0.5 A	6ES5 451-4UA14	•						■	■	■	■	■						■	■	■	■	■	■	■		0.12			
	16 x 24 V DC; 2 A	6ES5 453-4UA12	•	•					■	■	■	■							■	■	■	■	■	■			0.12			
	16 x 24 V DC; 2 A	6ES5 454-4UA14	•	•					■	■	■	■							■	■	■	■	■	■			0.10			
	16 x 24/48/60 V DC; 2 A	6ES5 455-4UA12	•	•					■	■	■	■							■	■	■	■	■	■			0.10			
	16 x 115/230 V AC; 2 A	6ES5 456-4UA12	•	•					■	■	■	■							■	■	■	■	■	■			0.10			
	8 x 115/230 V AC; 2 A	6ES5 456-4UB12	•	•					■	■	■	■							■	■	■	■	■	■			0.10			
	16 x 24/48/60 V DC; 0.5 A	6ES5 457-4UA12	•	•					■	■	■	■							■	■	■	■	■	■			0.12			
	16 x relay contact 60 V/0.5 A	6ES5 458-4UA12	•						■	■	■	■	■						■	■	■	■	■	■	■		0.08			
	16 x relay contact 110 DC/250 V DC; 5 A	6ES5 458-4UC11	•						■	■	■	■	■						■	■	■	■	■	■	■		0.12			
Digital input output	16/24 inputs. 24 V DC 8/16 outputs. 24 V DC; 0.5 A	6ES5 482-4UA11	•						■	■	■	■	■						■	■	■	■	■	■	■		0.09			
Analog input	8 inputs	6ES5 460-4UA13	•						■	■	■	■	■						■	■	■	■	■	■	■		0.15			
	4 inputs (50 Hz)	6ES5 463-4UA12	•						■	■	■	■	■						■	■	■	■	■	■	■		0.2			
	4 inputs (60 Hz)	6ES5 463-4UB12	•						■	■	■	■	■						■	■	■	■	■	■	■		0.2			
	8/16 inputs	6ES5 465-4UA13	•						■	■	■	■	■						■	■	■	■	■	■	■		0.15			
	8/16 inputs	6ES5 466-3LA11	•						■	■	■	■	■						■	■	■	■	■	■	■		0.7			
Analog output	8 outputs. ± 10 V; 0 to 20 mA	6ES5 470-4UA13	•						■	■	■	■	■						■	■	■	■	■	■	■		0.25			
	8 outputs. ± 10 V	6ES5 470-4UB13	•						■	■	■	■	■						■	■	■	■	■	■	■		0.25			
	8 outputs. 1 to 5 V; 4 to 20 mA	6ES5 470-4UC13	•						■	■	■	■	■						■	■	■	■	■	■	■		0.25			
Intelligent I/O module	Counter and pos. dec. module IP 240[2]	6ES5 240-1AA21	•						■	■	■	■	■						■	■	■	■	■	■	■		0.8			
	Digital position decoder module IP 241[2]	6ES5 241-1AA12	•						■	■	■	■	■						■	■	■	■	■	■	■		1.0[3]			
	Counter module IP 242A[2]	6ES5 242-1AA32	•						■	■	■	■	■						■	■	■	■	■	■	■		1.1			
	Counter module IP 242B[2]	6ES5 242-1AA41	•						■	■	■	■	■						■	■	■	■	■	■	■		1.1			
	Analog module IP 243[2]	6ES5 243-1AA13	•						■	■	■	■	■						■	■	■	■	■	■	■		0.6			
	Positioning module IP 246I	6ES5 246-4UA31	•						■	■	■	■	■						■	■	■	■	■	■	■		1.3			
	IP 246A	6ES5 246-4UB11	•						■	■	■	■	■						■	■	■	■	■	■	■		1.3			
	Positioning module IP 247	6ES5 247-4UA31	•						■	■	■	■	■						■	■	■	■	■	■	■		0.8			
	Closed-loop control module IP 252	6ES5 252-3AA13	•	•					■	■	■	■							■	■	■	■	■	■			2.3			
	Closed-loop control module IP 260	6ES5 260-4UA11	•						■	■	■	■	■						■	■	■	■	■	■	■		0.1			
	Counter module IP 281[2]	6ES5 281-4U .12	•						■	■	■	■	■						■	■	■	■	■	■	■		0.6			

| | | |

183U expansion unit for S5-135U and S5-155U/H

Components list

Slots required: 2 / 1

Module type		Order No.			Slot number: Cross modules required 3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	Module: Qty.	Current consumption at 5 V: each A	Current consumption at 5 V: sum in [A]	Price: each	Price: total
Subrack		6ES5 183-3UA..																											
Digital input modules	32 x 24 V DC	6ES5 420-4UA14	•																								0,08			
	32 x 24 V DC	6ES5 430-4UA14	•																								0,10			
	16 x 24/48/60 V DC	6ES5 431-4UA12	•																								0,09			
	32 x 24 V DC	6ES5 432-4UA12	•					1)		1)		1)															0,2			
	32 x 5/15 V DC	6ES5 434-4UA12	•																								0,08			
	16 x 24/48/60 V AC	6ES5 435-4UA12	•	•																							0,10			
	16 x 115/230 V AC	6ES5 436-4UA12	•	•																							0,10			
	8 x 115/230 V AC	6ES5 436-4UB12	•	•																							0,08			
Digital-output modules	32 x 24 V DC; 0.5 A	6ES5 441-4UA14	•																								0,08			
	32 x 24 V DC; 0.5 A	6ES5 451-4UA14	•																								0,12			
	16 x 24 V DC; 2 A	6ES5 453-4UA12	•	•																							0,12			
	16 x 24 V DC; 2 A	6ES5 454-4UA14	•	•																							0,10			
	16 x 24/48/60 V AC; 2 A	6ES5 455-4UA12	•	•																							0,10			
	16 x 115/230 V AC; 2 A	6ES5 456-4UA12	•	•																							0,10			
	8 x 115/230 V AC; 2 A	6ES5 456-4UB12	•	•																							0,10			
	16 x 24/48/60 V DC; 0.5 A	6ES5 457-4UA12	•	•																							0,12			
	16 x 60 V/0.5 A relay contact	6ES5 458-4UA12	•																								0,08			
	16 x 110V DC/AC 250 V; 5A relay contact	6ES5 458-4UC11	•																								0,12			
Digital-I/O modules	16/24 inputs, 24 V DC 8/16 outputs, 24 V DC; 0.5 A	6ES5 482-4UA11	•																								0,09			
Analog-input modules	8 inputs	6ES5 460-4UA13	•																								0,15			
	4 inputs (50 Hz)	6ES5 463-4UA12	•																								0,2			
	4 inupts (60 Hz)	6ES5 463-4UB12	•																								0,2			
	8/16 inputs	6ES5 465-4UA13	•																								0,15			
	8/16 inputs	6ES5 466-3LA11	•																								0,7			
Analog-output modules	8 outputs, ± 10 V; 0 to 20 mA	6ES5 470-4UA13	•																								0,25			
	8 outputs, ± 10 V	6ES5 470-4UB13	•																								0,25			
	8 outputs, 1 to 5 V; 4 to 20 mA	6ES5 470-4UC13	•																								0,25			
Intelligent I/O modules	IP 240 counter and pos. dec. mod.[2]	6ES5 240-1AA21	•			1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)		0,8			
	IP 241 digital pos. decoder module	6ES5 241-1AA12	•	•		1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)		1,0[3]			
	IP 243 analog module	6ES5 243-1AA13	•			1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)		0,6			
	IP 260 cl loop control module	6ES5 260-4UA11	•																								0,1			
	IP 261 proportioning module[4][6]	6ES5 261-4UA11	•																								0,05			
	IP 281 counter module	6ES5 281-4U .12	•																								0,6			
	Position decoder module WF 705 [6]	6FM1 705-3AA00	•					1)		1)		1)															0,5			
	Positioning module WF 706[2][6]	6FM1 706-3A .20	•	○ [5]				1)		1)		1)															0,75/1,5			
	Cam conditioner WF 707[2][6]	6FM1 707-3AA10	•					1)		1)		1)															0,25			

Inter-face module	from EU to CC/EU	IM 300-3	6ES5 300-3AB11	•																						0.6			
		IM 300-5C	6ES5 300-5CA11	•																						0.6			
		IM 310	6ES5 310-3AB11	•																						0.7			
		IM 317	6ES5 317-3UA11	•	•																					1.0			
		IM 318-3	6ES5 318-3UA11	•																						0.3			
		IM 312	6ES5 312-3AB12	•																						0.2			
		IM 312	6ES5 312-3AB32	•																						0.2			
		IM 314	6ES5 314-3UA11	•																						1.0			
313 monitoring module			6ES5 313-3AA12	•																						0.4			

1) .No interrupt lines, thus functionality severely restricted.
2) No interrupt processing possible.
3) Depending on components used.
4) Not applicable in connection with CPU 948.
5) Depending on version 1 or 2 slots.
6) Not released for CPU 948R/RL.

Total current for CC

Accessories:

184U expansion unit for S5-135U and S5-155U/H

Components list

Slots required: 2 / 1

Module type		Order No.			Slot number: Cross modules required 3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	Module Qty.	Current consumption at 5 V each A	Current consumption at 5 V Sum in [A]	Price each	Price total
Subrack		6ES5 184-3UA..																												
Digital input modules	32 x 24 V DC	6ES5 420-4UA14	•																								0.08			
	32 x 24 V DC	6ES5 430-4UA14	•																								0.10			
	16 x 24/48/60 V DC	6ES5 431-4UA12	•																								0.09			
	32 x 24 V DC	6ES5 432-4UA12	•																								0.2			
	32 x 5/15 V DC	6ES5 434-4UA12	•																								0.08			
	16 x 24/48/60 V AC	6ES5 435-4UA12	•	•																							0.10			
	16 x 115/230 V AC	6ES5 436-4UA12	•	•																							0.10			
	8 x 115/230 V AC	6ES5 436-4UB12	•	•																							0.08			
Digital output modules	32 x 24 V DC; 0.5 A	6ES5 441-4UA14	•																								0.08			
	32 x 24 V DC; 0.5 A	6ES5 451-4UA14	•																								0.12			
	16 x 24 V DC; 2 A	6ES5 453-4UA12	•	•																							0.12			
	16 x 24 V DC; 2 A	6ES5 454-4UA14	•																								0.10			
	16 x 24/48/60 V AC; 2 A	6ES5 455-4UA12	•	•																							0.10			
	16 x 115/230 V AC; 2 A	6ES5 456-4UA12	•	•																							0.10			
	8 x 115/230 V AC; 2 A	6ES5 456-4UB12	•	•																							0.10			
	16 x 24/48/60 V DC; 0.5 A	6ES5 457-4UA12	•	•																							0.12			
	16 x 60 V DC/0.5 A relay contact	6ES5 458-4UA12	•																								0.08			
	16 x 110V DC/250V AC; 5A relay contact	6ES5 458-4UC11	•																								0.12			
Digital I/O modules	16/24 inputs, 24 V DC 8/16 outputs, 24 V DC; 0.5 A	6ES5 482-4UA11	•																								0.09			
Analog input modules	8 inputs	6ES5 460-4UA13	•																								0.15			
	4 inputs (50 Hz)	6ES5 463-4UA12	•																								0.2			
	4 inputs (60 Hz)	6ES5 463-4UB12	•																								0.2			
	8/16 inputs	6ES5 465-4UA12	•																								0.15			
	8/16 inputs	6ES5 466-3LA11	•																								0.7			
Analog output modules	8 outputs, ± 10 V; 0 to 20 mA	6ES5 470-4UA12	•																								0.25			
	8 outputs, ± 10 V	6ES5 470-4UB12	•																								0.25			
	8 outputs, 1 to 5 V; 4 to 20 mA	6ES5 470-4UC12	•																								0.25			
Intelligent I/O modules	IP 240 counter and pos. dec. mod.[2]	6ES5 240-1AA21	•		1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)		0.8			
	IP 241 digital pos. decoder module	6ES5 241-1AA12	•	•	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)			0.6 [3]			
	Analog module IP 243	6ES5 243-1AA13	•		1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)		0.6			
	IP 260 cl. loop control module	6ES5 260-4UA11	•																								0.1			
	IP 261 proportioning module [4]	6ES5 261-4UA11	•																								0.05			
	IP 281 counter module [2]	6ES5 281-4U .12	•		1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)		0.6			

Interface module	from EU to CC/EU IM 312	6ES5 312-5CA12	•																						0.2			
	IM 312	6ES5 312-5CA22	•																						0.2			
	313 monitoring module	6ES5 313-3AA12	•																						0.4			

1) No interrupt lines, thus functionality severely restricted.
2) Only via IM 300-5/IM 312-5 interface module, since there is no power supply in the EU 184.
3) Depending on components used.
4) Not applicable in connection with CPU 948.

Total current for CC

Accessories:

EG 185U expansion unit for S5-135U, S5-155U and S5-155H

Component list

Slots required: 2 / 1

Slot number

Cross modules required

Module type		Order No.			3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	Module Qty.	Current consumption at 5 V each A	Current consumption at 5 V Sum in [A]	Price each	Price total
Subrack		6ES5 185-3UA..																												
Digital input modules	32 x 24 V DC	6ES5 420-4UA14	•																								0.08			
	32 x 24 V DC	6ES5 430-4UA14	•																								0.10			
	16 x 24/48/60 V DC	6ES5 431-4UA12	•																								0.09			
	32 x 24 V DC	6ES5 432-4UA12	•																								0.2			
	32 x 5/15 V DC	6ES5 434-4UA12	•																								0.08			
	16 x 24/48/60 V AC	6ES5 435-4UA12	•	•																							0.10			
	16 x 115/230 V AC	6ES5 436-4UA12	•	•																							0.10			
	8 x 115/230 V AC	6ES5 436-4UB12	•	•																							0.08			
Digital output modules	32 x 24 V DC; 0.5 A	6ES5 441-4UA14	•																								0.08			
	32 x 24 V DC; 0.5 A	6ES5 451-4UA14	•																								0.12			
	16 x 24 V DC; 2 A	6ES5 453-4UA12	•	•																							0.12			
	16 x 24 V DC; 2 A	6ES5 454-4UA14	•																								0.10			
	16 x 24/48/60 V AC; 2 A	6ES5 455-4UA12	•	•																							0.10			
	16 x 115/230 V AC; 2 A	6ES5 456-4UA12	•	•																							0.10			
	8 x 115/230 V AC; 2 A	6ES5 456-4UB12	•	•																							0.10			
	16 x 24/48/60 V DC; 0.5 A	6ES5 457-4UA12	•	•																							0.12			
	16 x 60 V DC/0.5 A relay contact	6ES5 458-4UA12	•																								0.08			
	16 x 110 V DC/250 V AC; 5A relay contact	6ES5 458-4UC11	•																								0.12			
Digital I/O modules	16/24 inputs, 24 V DC 8/16 outputs, 24 V DC; 0.5 A	6ES5 482-4UA11	•																								0.09			
Analog input modules	8 inputs	6ES5 460-4UA13	•																								0.15			
	4 inputs (50 Hz)	6ES5 463-4UA12	•																								0.2			
	4 inputs (60 Hz)	6ES5 463-4UB12	•																								0.2			
	8/16 inputs	6ES5 465-4UA12	•																								0.15			
	8/16 inputs	6ES5 466-3LA11	•																								0.7			
Analog output modules	8 outputs; ± 10 V; 0 to 20 mA	6ES5 470-4UA12	•																								0.25			
	8 outputs; ± 10 V	6ES5 470-4UB12	•																								0.25			
	8 outputs; 1 to 5 V; 4 to 20 mA	6ES5 470-4UC12	•																								0.25			
Intelligent I/O modules	IP 240 counter and pos. dec. module	6ES5 240-1AA21	•			1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)		0,8			
	IP 241 digital pos. dec. module	6ES5 241-1AA12	•	•		1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)					1,0 6)			
	IP 242A counter module	6ES5 242-1AA32	•			1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)					1,1			
	IP 242B counter module	6ES5 242-1AA41	•			1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)					1,1			
	IP 243 analog module	6ES5 243-1AA13	•			1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)			0,6			
	IP 244 temperature control module	6ES5 244-3AB31	•			2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)					0,4			
	IP 246I positioning module	6ES5 246-4UA31	•																								1,3			
	IP 246A positioning module	6ES5 246-4UB11	•																								1,3			
	IP 247 positioning module	6ES5 247-4UA31	•																								0,8			
	IP 252 closed-loop control module	6ES5 252-3AA13	•	•																							2,3			
	IP 260 closed-loop control module	6ES5 260-4UA11	•																								0,1			
	IP 261 proportioning module 7)	6ES5 261-4UA11	•																								0.05			
	IP 281 counter module	6ES5 281-4U.12	•			1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)	1)		0.6			
	IP 288 positioning module	6ES5 288-4UA11	•	•																							0.8			
	WF 705 position decoding module 3)	6FM1 705-3AA00	•																								0.5			

	WF 706 positioning module [3)5)]		6FM1 706-3A.20	•	○[8)]																						0.75/1.5			
	WF 707 cam controller module [3)]		6FM1 707-3AA10	•																							0.25			
	WF 721/WF 723A positioning module [3)]		6FM1 72 .-3AA00	•																							1.0/1.3			
	WF 723 B/C positioning module [3)]		6FM1 723-3.A00	•																							1.4			
Commu-nica-tions-proces-sors	CP 523		6ES5 523-3UA11	•																							0.13			
	CP 524		6ES5 524-3UA13	•																							1.5			
	CP 544/CP 544B		6ES5 544-3U.11	•																							0.9			
	CP 526 (Exp.) [9)]		6ES5 526-3LA22	•																							2.3			
	CP 527 [9)]		6AV1 242-0AB.0	•																							1.5			
	CP 528 [9)]		6AV4 012-0AA10-0AB0	•																							1.8			
	CP 530		6ES5 530-3LA12	•																							1.0			
	CP 2430 (I/O mode) for AS interface		6GK1 243-0SA10	•																							0.7			
	CP 2430[10)] (page operation) for AS int.		6GK1 243-0SA10	•																							0.7			
	CP 5431 FMS/DP for PROFIBUS		6GK1 543-1AA01	•																							0.45			
	CP 1430 TF for ind. Ethernet		6GK1 143-0T.0.	•																							3			
	CP 1430 TCP for ind. Ethernet		2XV9 450-1AU00	•																							3			
	CP 1473 MAP for ind. Ethernet		6GK1 147-3MA00		•																						2.6[11)]			
Special modules	CP 581 integrated PC: basic module		6ES5 581-1ED13																								1.8			
	Mass storage module		6ES5 581-3LA11	1-3																							0.5 [6)]			
	Slot module		6ES5 581-0RA12	1-3																							0.8 [6)]			
	CP 516 memory submodule		6ES5 516-3UA11																								0.8			
Interface module	from CC to EU	IM 300-3	6ES5 300-3AB11	•																							0.6			
		IM 300-5C	6ES5 300-5CA11	•																							0.6			
		IM 310	6ES5 310-3AB11	•																							0.6			
		IM 314	6ES5 314-3UA11	•																							1.0			
		IM 317	6ES5 317-3UA11	•	•																						1.0			
		IM 318-3	6ES5 318-3UA11	•																							0.3			
		IM 308	6ES5 308-3UA12	•																							0.5			
		IM 308-C [12)]	6ES5 308-3UC11	•																							0.7			
	for progr. contr. S5-155H	IM 314R	6ES5 314-UR11	•																							1.0			
	313 monitoring module		6ES5 313-3AA12	•																							0.4			

1) No interrupt lines, thus functionally severely restricted.
2) When IM 307/IM 317 interface modules are used, the IP 244 temperature control module may not be used.
3) Not with S5-155H.
5) No interrupt processing possible.
6) Depending on components used.
7) Cannot be used with CPU 948.
8) 1 or 2 slots depending on the variant.
9) For more information on slot assignment please refer to Catalog ST 80.1.
10) Only slots 19-67 available for page operation in ZG (CC) 135K
11) For power supply of a transceiver max. 4.2 A
12) Operation in EU 185U only in combination with S5-155H

Total current for central controller

Accessories:

Total price

EG 187U expansion unit for S5-135U and S5-155U/H

Component list

Slots required: 2 / 1

Module type		Order No.			Slot No. / Cross modules required: 3	19	35	51	67	83	99	115	131	147	163	Module Qty.	Current consumption at 5 V each A	Current consumption at 5 V Sum in [A]	Price each	Price total
Subrack		6ES5 187-3UA..																		
Digital input modules	32 x 24 V DC	6ES5 420-4UA14	•														0.08			
	32 x 24 V DC	6ES5 430-4UA14	•														0.10			
	16 x 24/48/60 V DC	6ES5 431-4UA12	•														0.09			
	32 x 24 V DC	6ES5 432-4UA12	•														0.2			
	32 x 5/15 V DC	6ES5 434-4UA12	•														0.08			
	16 x 24/48/60 V AC	6ES5 435-4UA12	•	•													0.10			
	16 x 115/230 V AC	6ES5 436-4UA12	•	•													0.10			
	8 x 115/230 V AC	6ES5 436-4UB12	•	•													0.08			
Digital output modules	32 x 24 V DC; 0.5 A	6ES5 441-4UA14	•														0.08			
	32 x 24 V DC; 0.5 A	6ES5 451-4UA14	•														0.12			
	16 x 24 V DC; 2 A	6ES5 453-4UA12	•	•													0.12			
	16 x 24 V DC; 2 A	6ES5 454-4UA14	•	•													0.10			
	16 x 24/48/60 V AC; 2 A	6ES5 455-4UA12	•	•													0.10			
	16 x 115/230 V AC; 2 A	6ES5 456-4UA12	•	•													0.10			
	8 x 115/230 V AC; 2 A	6ES5 456-4UB12	•	•													0.10			
	16 x 24/48/60 V DC; 0.5 A	6ES5 457-4UA12	•	•													0.12			
	16 x 60 V DC/0.5 A relay contact	6ES5 458-4UA12	•														0.08			
	16 x 110V DC/250V AC; 5A relay contact	6ES5 458-4UC11	•														0.12			
	16 x relay contact 110V DC/250V DC;5A	6ES5 458-4UC11	•														0.12			
Digital I/O modules	16/24 inputs, 24 V DC 8/16 outputs, 24 V DC; 0.5 A	6ES5 482-4UA11	•														0.09			
Analog input modules	8 inputs	6ES5 460-4UA13	•														0.15			
	4 inputs (50 Hz)	6ES5 463-4UA12	•														0.2			
	4 inputs (60 Hz)	6ES5 463-4UB12	•														0.2			
	8/16 inputs	6ES5 465-4UA12	•														0.15			
	8/16 inputs	6ES5 466-3LA11	•														0.7			
Analog output modules	8 outputs, ± 10 V; 0 to 20 mA	6ES5 470-4UA12	•														0.25			
	8 outputs, ± 10 V	6ES5 470-4UB12	•														0.25			
	8 outputs, 1 to 5 V; 4 to 20 mA	6ES5 470-4UC12	•														0.25			
Comm.-proc.	CP 2430 for AS interface	6GK1 243-0SA10	•														0.7			
Interface modules	from EU to CC/EU IM 312	6ES5 312-5CA12	•														0.2			
	IM 312	6ES5 312-5CA22	•														0.2			
	313 monitoring module	6ES5 313-3AA12	•														0.4			

Total current for expansion unit

Total price

Accessories:

Design S5-155H and S5-155H Lite

Design

The fault-tolerant programmable controllers S5-155H and S5-155H Lite are available in two versions.

One basic version consists of two separate subunits each with

- One central controller CC 135U/155U with integrated power supply chassis and
- One central controller CPU 948R/RL

The other basic version consists of

- A central controller CC 155H divided into two halves and
- One central controller module CPU 948R/RL and one power supply module for each half.

The two subunits are connected via the IM 304 and IM 324R interface modules and the 721 connecting cable (max. 100m/328 ft). Each subunit/half requires the same amount of memory.

I/O modules are available in 4 different configurations depending on the level of availability required for the I/O area:

- Single-sided configuration
- Switched configuration
- Double-redundancy configuration
- Triple-redundancy configuration

I/O types

In order to distinguish the different configurations available for the I/O modules, they are divided into I/O types. The 4 different configurations are matched by 4 different modes of operation:

- Single-sided configuration with types 1, 8, 13, 18 and 24

The I/O module is permanently assigned to one of the two subunits. The module remains active for as long as the corresponding subunit is in operation. Information read in is also available in the other subunit irrespective of whether it is operating as a master or standby unit. The peripheral address used may not be used in the second subunit.

- Switched configuration with types 2, 9, 14, 19 and 25

The I/O module is only addressed by the master unit. Information read in is automatically passed to the standby unit so that it can take over operation smoothly if required.

- Double-redundancy configuration with types 3, 10, 11, 15, 20 and 21

Each I/O module is available in duplicate. The I/O modules occupy the same I/O addresses in both subunits. Both modules are active in normal, fault-free operation.

- Triple-redundancy configuration of the inputs with types 4 and 16

The I/O modules are available in triplicate. Two inputs reserve the same I/O address in both subunits. The third input can either be of the single-sided or switched type.

1 or 3 sensors can be used per triple-redundant input. The maximum possible availability is achieved when using 3 sensors, since the faulty sensor can be localized and deactivated.

The table on the next page shows an overview of the I/O types for the addresses required.

The table on the next page contains a number of examples. It also describes the amount of wiring required. If an input/output byte is partially reserved with redundant DI or DQ addresses, it can no longer be used for non-redundant inputs and outputs.

Design S5-155H and S5-155H Lite (continued)

Design (continued)

I/O types (continued)

I/O			Required addresses including readback digital inputs (R-DI), without locating inputs/outputs			
Type	Device	Design	DI	DQ	AI	AQ
1	Digital	Single-sided	1 byte			
2	input	Switched	1 byte			
3	(DI)	Double redundancy	1 byte[1]			
4		Triple redundancy	2 byte[2]			
8	Digital	Single-sided	—	1 byte		
9	output	Switched	—	1 byte		
10	(DQ)	Double redundancy	1 byte[1] (R-DI)	1 byte[1]		
11		Double redundancy Non-intermittent	2 byte (R-DI)	1 byte[2]		
13	Analog	Single-sided			1 word	
14	input	Switched			1 word	
15	(AI)	Double redundancy			1 word[1]	
16		Triple redundancy			2 word[2]	
18	Analog	Single-sided				1 word
19	output	Switched				1 word
20	(AQ)	Double redundancy				1 word[1]
21		Double redundancy[4]		1 bit[3]	1 word (R-AI)	1 word[1]
24	CP/IP	Single-sided	Addressing according to module			
25		Switched				

Overview of the I/O types and the required addresses

Example	Reserved addresses	Wiring
10 x 2 redundant DIs without fault location (type 3)	2 byte DI	10 DI per subunit
5 x 2 redundant DIs with fault location (type 3)	1 byte DI 1 byte L-DI 1 byte L-DQ	5 DIs per subunit 1 L-DI per subunit 1 L-DQ per subunit
8 x 2 redundant DIs with fault location (type 10)	1 byte DQ 1 bit L-DI 1 bit L-DQ 1 byte R-DI	8 DQs per subunit 1 L-DI per subunit 1 L-DQ per subunit 8 R-DI (assigned to subunit A, B or switched)
8 x 3 redundant DIs (type 4)	2 byte DI	24 DI
8 x 2 redundant DQs (type 11)	1 byte DQ 1 bit L-DI 1 bit L-DQ 2 byte R-DI	8 DQ per subunit 1 L-DI per subunit 1 L-DQ per subunit 8 R-DQ per subunit 8 R-DI (assigned A, B or switched)

Examples of required addresses and inputs/outputs in the case of redundant I/O configuration

Legend:
DI, DQ = Digital input/output
AI, AQ = Analog input/output
L-DI, L-DQ = Localization input/output
R-DI = Readback digital input

1) Address identical in subunit A and subunit B.
2) As 1); the 2nd address is required for the 3rd channel (either in subunit A, subunit B or switched EU, as required).
3) As 1); 1 byte DQ for 8 AQ channels.
4) With fault localization.

Design S5-155H and S5-155H Lite (continued)

Design (continued) Redundant inputs

Each subunit scans the inputs assigned to it. The user specifies a "discrepancy time" (20 ms to 320 s) for each digital input. This is the maximum permissible time deviation between the signals at 2 redundant inputs. The operating system monitors this discrepancy time. If the permissible time is exceeded, the operating system locates and reports the fault (entry in fault data block).

In the case of analog input modules, the user specifies the maximum permissible value by which the input signals may deviate. This "discrepancy window" is monitored by ANEI function blocks. The function block is supplied on diskette together with the COM 155H parameterization software.

Suitable modules

The redundant operation of digital input modules with an input voltage of 115/230V AC (6ES5 435-4UA1. and 6ES5 436-4U...) is **not** allowed.

Redundant outputs

In the case of redundant digital outputs, the operating system checks by reading back the outputs, whether a fault has occurred. If required, the operating system signals the fault (entry in fault data block).

Fault detection is not available for redundant analog outputs. If required it can be programmed by the user (with readback analog inputs).

Decoupling

In redundant 441, 451 and 454 digital output modules for 24 V DC, the outputs connected in parallel must be decoupled by means of diodes. The same applies to the locating outputs.

Fault recognition and fault locating

In order to ensure non-stop operation, the operating system must not only detect but also locate faults so that the faulty module can be deactivated.

Double-redundancy configuration

In the case of double-redundancy configuration, faults are recognized and located in the case of digital outputs using auxiliary signals. Additional, external wiring is required for this purpose.

The following 2 possibilities exist for double-redundancy digital inputs and outputs:

- Fault recognition without fault locating
- Fault recognition with fault locating

Only the fault recognition without locating alternative is possible for double-redundancy analog inputs. If fault locating is required, the user must install a triple-redundancy configuration.

Analog outputs with (type 21) or without (type 20) fault location can be implemented. A function block is available for fault location (included in the COM 155H scope of delivery).

Readback inputs, locating inputs and outputs

For fault detection of redundant DQ, readback inputs (R-DI) are necessary; fault location requires locating inputs and outputs (L-DI, L-DQ).

Readback inputs are permanently assigned to their redundant outputs (1 readback input per output pair). Readback inputs can be allocated to subunit A, subunit B or a switched expansion unit. Locating inputs and outputs can be grouped for several inputs or outputs.

The user can determine the number of DI or DQ per group (recommended: 1 module per group). In the case of redundant AQ with fault location (type 21), one readback AI (R-AI) and one L-DQ is required per output (recommended: relay module 6ES5 458-4...).

Triple-redundancy configuration

Fault recognition is automatically accompanied by fault location in the case of triple-redundancy inputs. In contrast to the double-redundancy configuration, auxiliary signals are not required.

Addressing

The redundant digital input and output modules can only be operated in the process image area (addresses 0 to 127), and the analog input and output modules in the P area (addresses 128 to 254) and in the Q area (addresses 0 to 254).

Double-redundancy configuration

The auxiliary signals L-DI, L-DQ and R-DI required for fault recognition and locating can be operated in the entire P area; R-DI can also be operated in the Q area.

Triple-redundancy configuration

The third input can be operated in the complete P and Q area.

Design S5-155H and S5-155H Lite (continued)

Design (continued)
I/O types for redundant configuration

I/O type 3 (double-redundancy digital inputs)

I/O type 3 without fault location:

If locating inputs/outputs (L-DI, L-DQ) are not parameterized, the S5-155H continues working in the case of a discrepancy with a value that may be the wrong one. If such a case cannot be tolerated, the redundant digital inputs (DI) must be operated with fault location or implemented with triple redundancy (type 4).

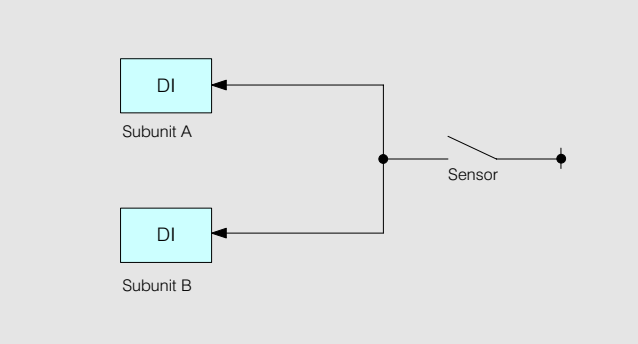

Fig. 11/6 Double-redundancy digital input without fault location

I/O type 3 with fault location:

In this case, locating inputs/outputs (L-DI, L-DQ) are used in addition to the redundant digital inputs (DI). The operating system can thus not only recognize faults, but it can also locate and deactivate the faulty DI module. The S5-155H then only continues working with the fault-free module.

The L-DQ and L-DI are assigned by groups to the redundant digital inputs. A group comprises all DI, which are connected to the same sensor supply.

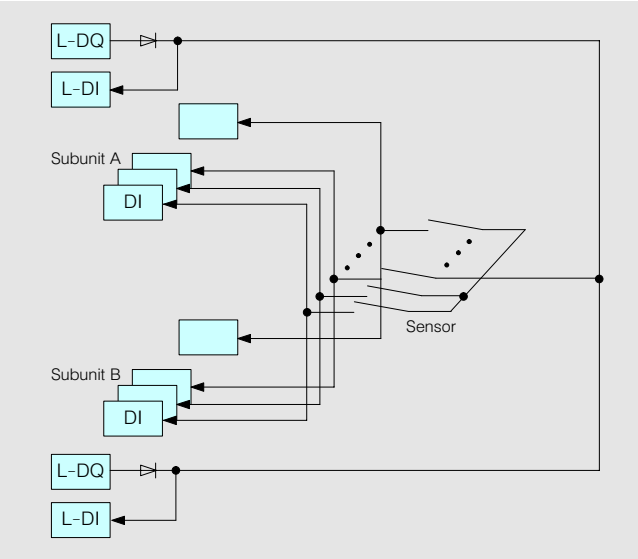

Fig. 11/7 Double-redundancy digital input with fault location

I/O type 4 (triple-redundancy digital inputs)

The operating system performs a cyclic scan to compare whether the signal status of the 3 inputs is identical. If different signal statuses are found to exist after expiry of the discrepancy time, a fault is signalled. A valid signal status is one derived from the 2-out-of-3 decision result.

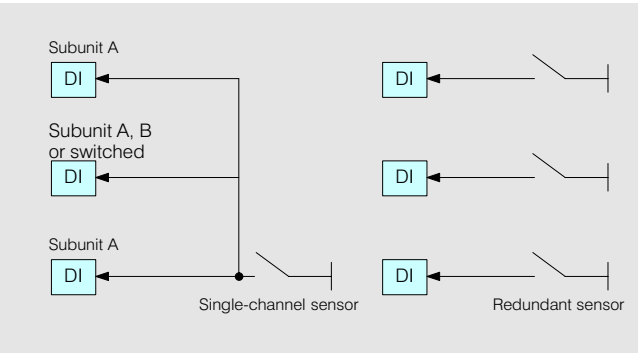

Fig. 11/8 Triple-redundancy digital input

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Design S5-155H and S5-155H Lite (continued)

Design (contined)
I/O types for redundant configuration

I/O type 10 (double-redundancy digital outputs)

I/O type 10 is designed for fault recognition with restricted or complete fault location (depending on version) for intermittent outputs. An output is intermittent if it changes its signal status at least once per hour. Since the R-DI readback digital inputs are permanently assigned to the redundant digital outputs (DQ), just as many R-DIs are required as redundant DQs.

I/O type 10 with restricted fault location

If locating inputs/outputs (L-DQ, L-DI) are not parameterized, it is only possible to recognize and locate "permanent 0 faults" (DQ cannot be switched to "1"). If such a case cannot be tolerated, i.e. it must also be possible to handle "permanent 1 fault", the redundant digital outputs must be operated with fault location.

I/O type 10 with fault location

In this case, location inputs/outputs (L-DI, L-DQ) must be provided in addition to the redundant digital outputs (DQ) and the readback digital input (R-DI). The operating system can thus recognize and locate not only "permanent 0 faults" but it can also deactivate the faulty DQ modules in case of "permanent 1 faults".

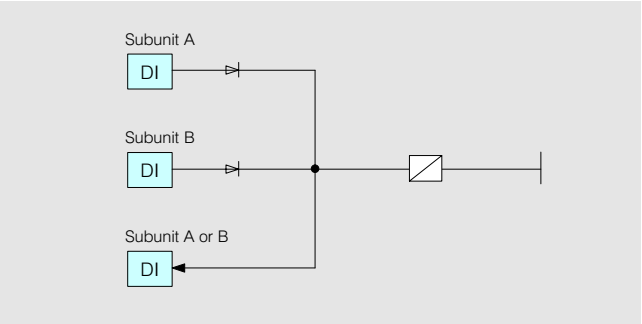


Fig. 11/9 Double-redundancy intermittent digital output with restricted fault location

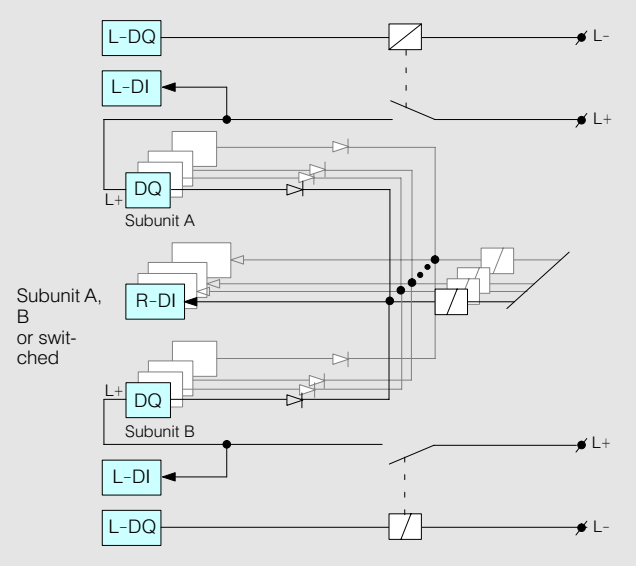


Fig. 11/10 Double-redundancy intermittent digital output with fault location

Design S5-155H and S5-155H Lite (continued)

Design (continued)
I/O types for
redundant configuration

I/O type 11 (double-redundancy non-intermittent digital outputs)

I/O type 11 is capable of fault recognition and location involving non-intermittent outputs. Three R-DIs are required per redundant DQ. An R-DI is assigned to each subunit. The third R-DI ist either assigned to a subunit or is in switched configuration.

The operating system can recognize, locate and deactivate "permanent 0 faults" and "permanent 1 faults.

The circuit is stuctured as for I/O type 10. Two DIs must be provided for each DQ pair.

I/O type 15 (double-redundancy analog inputs)

This I/O type provides fault recognition with restricted fault location in the case of redundant analog inputs (AI). During fault location, the operating system accesses fault information of AI modules via a standard function block. Fault information includes range violation, overrange and wire break.

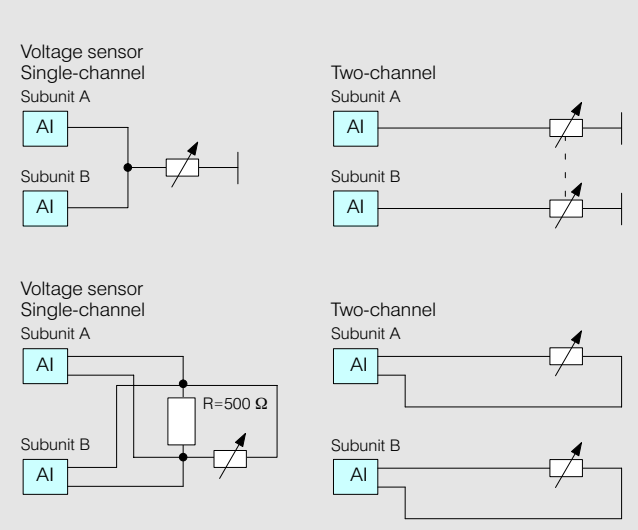


Fig. 11/11 Double-redundancy analog inputs

I/O type 16 (triple-redundancy analog inputs)

This I/O type provides fault recognition with fault location for redundant analog inputs (AI). In order to recognize faults, the 3 analog values are checked for discrepancy. If a single-sided locatable fault occurs (QVZ acknowledgment delay, wire break), the module is deactivated. If the operating system locates a discrepancy fault, the operating system waits until the discrepancy time has elapsed and then deactivates the module the analog value of which deviates most from the other two values.

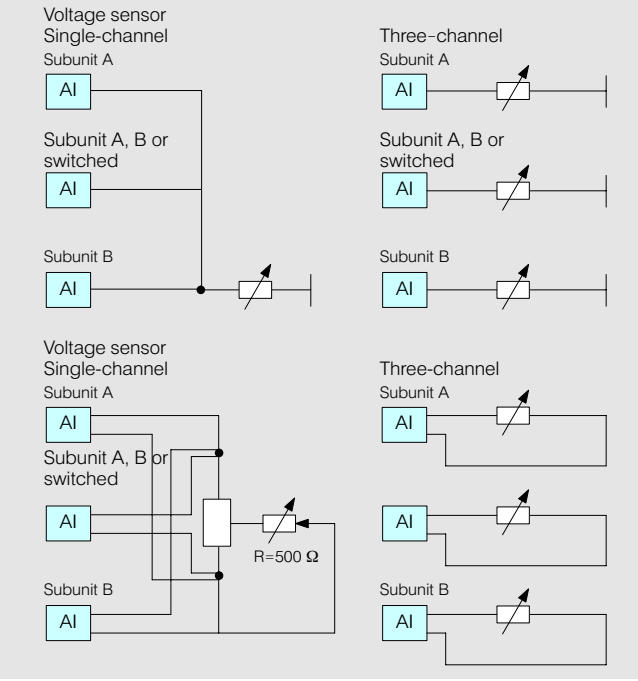


Fig. 11/12 Triple-redundancy analog module

Design S5-155H and S5-155H Lite (continued)

Design (contined)
I/O types for
redundant configuration

I/O type 20 (redundant analog outputs)

This I/O type does not receive any operating system support in the recognition and locating of faults. They must be programmed by the user. The output values are output to both subunits in parallel.

I/O type 21

The analog output is available under the same address in both subunits. One AI and one L-DQ (e.g. DQ 458) are also necessary. Only one side is active. It is checked whether the passive AQ channel is intact by changing over the active side.

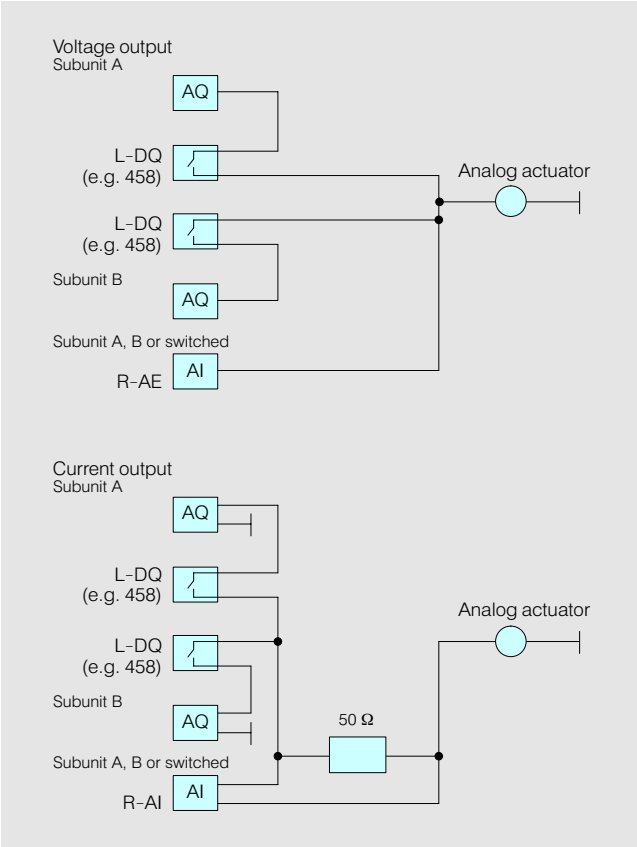


Fig. 11/13 Redundant analog outputs

11

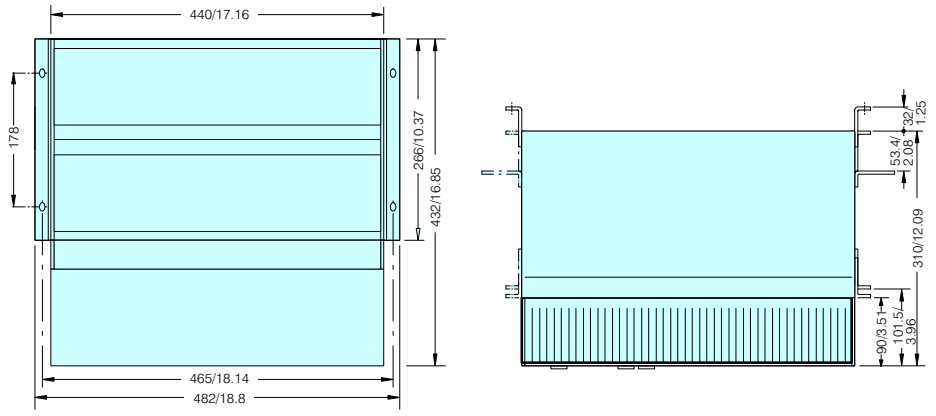
Technical specifications and dimensions

Technical specifications

Insulation group		C in acc. with VDE 0110 (line side), Part 13 Group 2 (for 48 V, 24 V and 5 V inputs/outputs)
Degree of protection		IP 20 for power supply modules or modules with screw terminals, otherwise IP 00
Ambient temperature		0 to + 55 °C (air inlet temperature, below)
Transport and storage temperature		– 40 to + 70 °C
Humidity rating		F in acc. with DIN 40040 (15 % to 95 %, no condensation)
Altitude rating		S in acc. with DIN 40040 (860 to 1060hPa; 660 to 1060 hPa for transport and storage)
Mechanical stress		Installation in stationary equipment, free from vibration; Installation on ships and in vehicles, provided that special installation rules are observed, but not on the engine assembly
Power supply chassis		see page 4/134
Weight	approx.	ZG 135U/155: 14 kg (30.8 lb) ZG 135U: 16 kg (35.2 lb) EG 183U, EG 185U: 14 kg (30.8 lb) EG 184U: 13 kg (28.6 lb) EG 187U: 11 kg (24.2 lb)

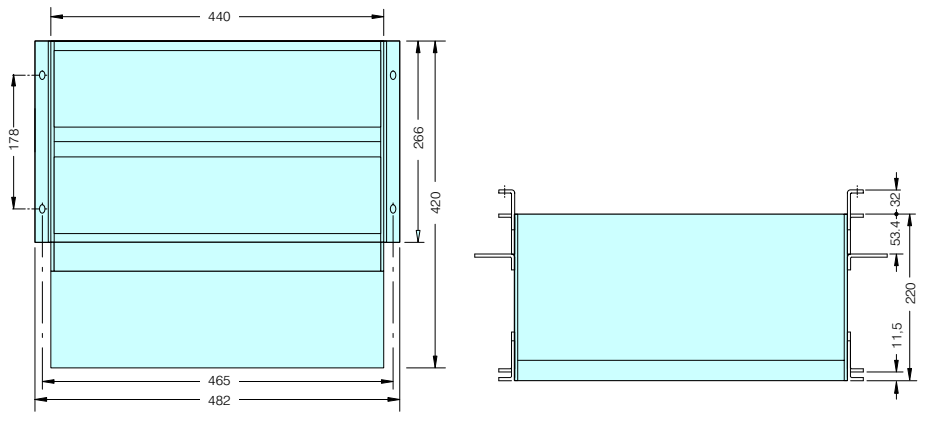
CC 135U/155U central controllers EU 183U, EG 184U and EU 185U expansion units

ZG 135U/155U central controllers
EG 183U, EG 184U and EG 185U expansion units



CC 155H central controller

CC 155H central controller



Technical specifications and dimensions (continued)

EU 187U expansion unit